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MINERALS YEARBOOK

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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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FOREWORD

MINERALS YEARBOOK, 1957, 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.

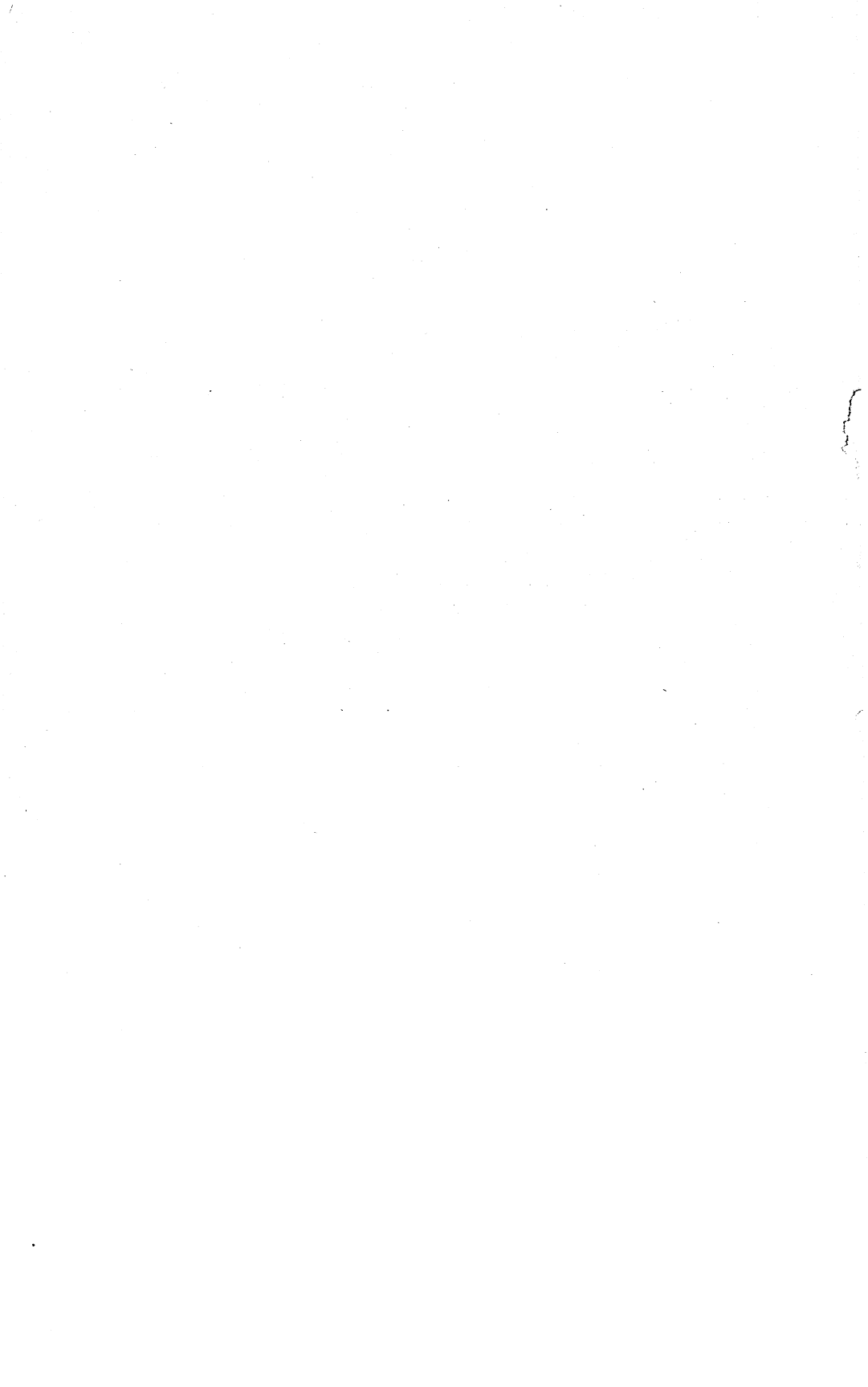
Volume I includes chapters on metal and nonmetal mineral commodities, with the exception of the mineral fuels. Included also are a chapter reviewing these mineral industries, a statistical summary, and chapters on mining technology, metallurgical technology, and employment and injuries.

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 each of the 48 States plus chapters on the Territory of Alaska, the Territory of Hawaii and 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. ANKENY, *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 and Territorial 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 State and Territorial 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: 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; R. B. Maurer, chief, Division of Mineral Industries, 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, Ruth Robothan, and Clara M. Hutcheson; in Region II, Leo Giorgetti and Betty Tong; 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, Ruby J. Phillips, Helen E. Tice, Anita C. Going, and Anne C. Rogers.

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.

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Statistical Summary of Mineral Production

By Kathleen J. D'Amico¹



THIS SUMMARY is identical to that in volume III 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 United States 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, 1954-57, 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.

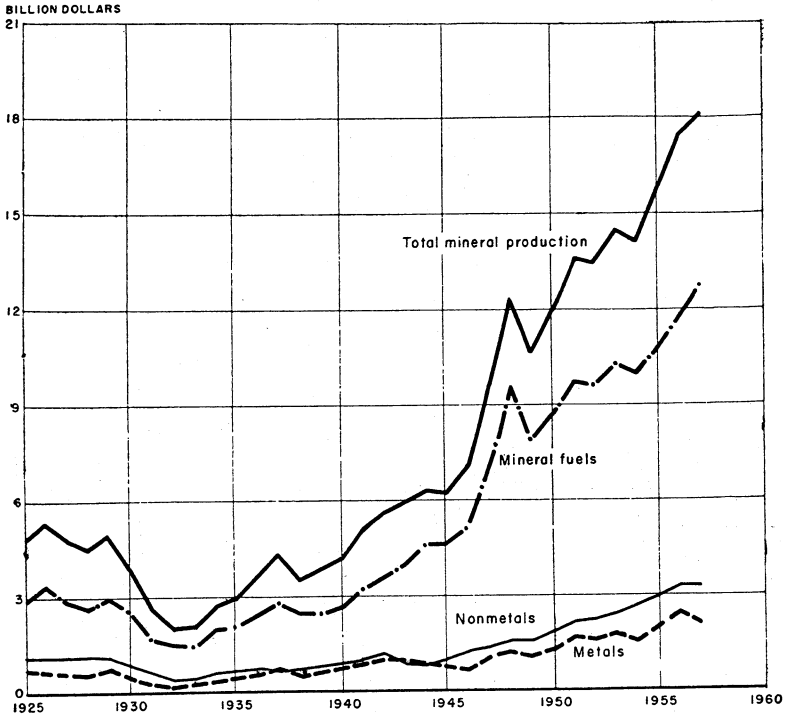


FIGURE 1.—Value of mineral production in the United States, 1925-57.

TABLE 1.—Value of mineral production in continental United States, 1925-57, by mineral groups¹

(Millions)

Year	Min- er- al fuels	N - m- e- t- als (ex- c- e- p- t fuels)	Metals	T o- t- al	Year	Min- er- al fuels	N - m- e- t- als (ex- c- e- p- t fuels)	Metals	Total
1925.....	\$2,910	\$1,187	\$715	\$4,812	1942.....	\$3,568	\$1,056	\$999	\$5,623
1926.....	3,371	1,219	721	5,311	1943.....	4,028	916	987	5,931
1927.....	2,875	1,201	622	4,678	1944.....	4,574	836	900	6,310
1928.....	2,666	1,103	655	4,484	1945.....	4,569	888	774	6,231
1929.....	2,940	1,166	802	4,908	1946.....	5,070	1,243	729	7,062
1930.....	2,500	973	507	3,980	1947.....	7,188	1,338	1,054	9,610
1931.....	1,620	671	287	2,578	1948.....	9,502	1,552	1,219	12,273
1932.....	1,460	412	128	2,000	1949.....	7,920	1,559	1,101	10,078
1933.....	1,413	432	205	2,050	1950.....	8,683	1,822	1,351	11,862
1934.....	1,947	520	277	2,744	1951.....	9,773	2,079	1,671	13,529
1935.....	2,013	594	365	2,942	1952.....	9,676	2,163	1,617	13,396
1936.....	2,405	685	516	3,606	1953 ²	10,257	2,350	1,811	14,418
1937.....	2,798	711	756	4,265	1954 ²	9,919	3,230	1,518	14,667
1938.....	2,436	622	460	3,518	1955 ²	10,780	3,292	2,055	15,807
1939.....	2,423	754	631	3,808	1956 ²	11,741	3,284	2,338	17,383
1940.....	2,662	784	752	4,198	1957 ²	12,720	3,277	2,129	18,126
1941.....	3,228	681	830	5,107					

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.

TABLE 2.—Mineral production¹ in the United States,² 1954-57

Mineral	1954		1955		1956		1957	
	Short tons (unless other- wise stated)	Value (thou- sands)	Short tons (unless other- wise stated)	Value (thou- sands)	Short tons (unless other- wise stated)	Value (thou- sands)	Short tons (unless other- wise stated)	Value (thou- sands)
MINERAL FUELS								
Asphalt and related bitumens (native):								
Bituminous limestone and sandstone.....		\$3,696		\$4,111		\$4,114		\$3,221
Gilsonite.....	1,337,822	2,724	82,822	3,117	89,003	3,822	1,168,507	4,269
Carbon dioxide, natural (estimated).....	688,900	211	702,417	234	713,030	285	704,270	188
Coal:								
Bituminous and lignite ¹	391,705	1,769,620	464,633	2,092,383	500,874	2,412,004	492,704	2,504,406
Pennsylvania anthracite.....	29,033	247,870	26,205	206,097	28,900	236,785	25,338	227,754
do.....	189,873	3,202	235,888	3,881	266,937	4,413	310,365	5,112
Natural-gas liquids:								
Natural gasoline and cycle products.....	8,742,546	882,601	9,405,351	978,857	10,081,923	1,083,812	10,694,139	1,212,408
LP-gases.....	5,385,282	402,418	5,844,904	423,775	6,807,100	481,958	5,734,307	415,791
do.....	5,204,304	178,994	5,972,698	195,231	6,467,413	265,185	6,655,282	263,665
do.....	244,163	2,258	273,660	2,282	327,972	3,220	316,217	3,458
Peat.....	2,314,988	6,424,930	2,464,428	6,870,380	2,617,283	7,296,760	2,616,778	8,079,504
Petroleum (crude).....								
Total mineral fuels.....		9,919,000		10,780,000		11,741,000		12,720,000
NONMETALS (EXCEPT FUELS)								
Abrasive stone: ⁴								
Grindstones and pulpetones.....	2,218	164	2,769	196			1,505	132
Millstones.....	(⁵)	(⁷)	(⁵)	(⁷)			(⁵)	5
Pebbles (grinding).....	3,070	99	2,130	68			2,902	86
Tube-mill liners (natural).....	50						1,440	108
Asbestos.....	47,621	4,698	44,568	4,487			43,653	4,917
Barite.....	883,283	8,508	1,108,103	10,809			1,592,892	11,756
Boron minerals.....	790,449	26,714	924,496	33,816			597,857	40,817
Bromine.....	187,869	41,313	184,454	39,856			191,971	48,038
Cement.....	274,703	763,413	306,128	884,391			299,233	961,499
Clays.....	42,367	123,165	48,106	139,540			50,182	150,721
thousand short tons.....	9,758	132	10,735	151			11,893	184
Emerald.....	(⁷)	(⁷)	100	5			(⁷)	(⁷)
Epsom salts from epsomite.....	411,018	3,490	465,378	3,801			611,801	5,439
Fluorspar.....	245,628	12,333	279,540	12,590			328,872	16,777
long tons.....	14,183	971	11,835	1,191			9,776	1,080
Garnet (abrasive).....	(⁵)	(⁵)	(⁵)	(⁵)			(⁵)	882
Gem stones (estimated).....	8,966	27,884	10,684	33,938			9,195	29,871
Gypsum.....	16,259	129	16,190	157			18,366	183
thousand short tons.....								

See footnotes at end of table.

TABLE 2.—Mineral production¹ in the United States,² 1954-57—Continued

Mineral	1954		1955		1956		1957	
	Short tons (unless otherwise stated)	Value (thou- ands)	Short tons (unless otherwise stated)	Value (thou- ands)	Short tons (unless otherwise stated)	Value (thou- ands)	Short tons (unless otherwise stated)	Value (thou- ands)
NONMETALS (EXCEPT FUELS)—continued								
Lime.....	8,621	\$101,525	10,470	\$126,890	10,567	\$135,532	10,266	\$135,143
Magnesite.....	284,015	1,391	486,088	2,713	686,569	2,502	678,489	3,268
Magnesium compounds from sea water and brines (except for metals)								
MgO equivalent.....	113,774	9,469	155,779	12,704	169,019	13,668	184,499	16,235
Mari.....	206,257	152	183,044	128	285,653	215	(⁹)	(⁹)
Greasand.....	2,838	199	5,704	218	(⁷)	(⁷)	(⁹)	(⁷)
Mica.....	81,073	1,734	95,432	2,058	86,309	1,850	11 92,438	11 2,110
Scrap.....	663,788	2,393	642,113	3,370	887,871	2,757	690,052	2,452
Sheet.....	219,703	1,762	286,157	2,282	310,800	2,550	301,605	2,562
Phosphate rock.....	13,821	86,669	12,265	75,379	15,747	97,922	13,976	87,689
Potassium salts ^a	1,948,721	72,950	2,066,706	78,602	2,171,584	82,107	2,296,481	84,612
K ₂ O equivalent.....	1,647	2,974	1,804	3,369	1,482	4,749	1,827	4,625
Pumice.....	909	7,159	1,007	8,391	1,070	9,743	1,067	9,087
Pyrites.....	20,660	105,487	22,093	123,276	24,206	136,139	23,844	147,291
Salt (common).....	556,160	503,293	591,633	535,610	561,495	\$ 602,412	630,097	\$ 607,372
Sand and gravel.....	761	12,961	760	12,914	615	11,668	632	11,029
Sodium carbonate (natural).....	527,282	13,536	613,494	15,001	652,891	17,400	632,717	17,792
Sodium sulfate (natural).....	284,701	3,890	284,549	5,351	\$ 332,990	6,437	\$ 331,382	6,762
Stone ^b	409,196	699,445	467,272	702,142	\$ 504,031	\$ 765,313	\$ 531,488	\$ 812,198
Strontium minerals (crude).....	12	(⁴)	177	4	4,040	77	(⁷)	(⁷)
Sulfur.....	5,328	142,014	5,839	163,156	5,676	150,356	5,085	132,915
Frasch-process mines.....	185,035	(⁷)	199,869	(⁷)	185,592	(⁷)	(⁷)	(⁷)
Other mines.....	399,960	11,209	458,021	12,585	563,344	14,241	472,686	12,962
Sulfur, recovered elemental.....	618,994	3,493	728,708	4,917	799,039	4,869	684,453	4,796
Talc, pyrophyllite, and soapstone.....	(⁷)	(⁷)	1,500	913	45,009	203	50,717	195
Titanium-iron concentrate (non-titanium use).....	1,459	2,538	49,062	2,702	192,628	2,543	183,987	2,603
Tri-poli.....	195,538		204,040					
Vermiculite.....								
Value of items that cannot be disclosed: Aplite, brucite, calcium-magnesium chlorite, certain clays, diatomite, gravelite, lo-lyne, kyanite, lithium minerals, nitrogen compounds (1957), olivine, staurolite (1957), sharpening stones, wollastonite, and values indicated by footnote 7.....								
Total nonmetallic minerals ^b	22,580	\$ 2,639,000	30,805	\$ 2,972,000		\$ 3,284,000		\$ 3,277,000

STATISTICAL SUMMARY OF MINERAL PRODUCTION

METALS

Antimony ore and concentrate.....	766	633	(9)	590	710	(9)
Bauxite.....antimony content.....	1,094,886	1,788,841	14,543	1,743,344	1,416,172	12,154
Beryllium concentrate.....long tons, dried equivalent.....	304	304	298	460	521	276
Chromite.....gross weight.....	669	153,253	6,644	17,207,592	106,157	7,816
Cobalt.....do.....	163,365	2,439	(9)	216,606	370,453	(9)
Cobalt (content of concentrate).....thousand pounds.....	2,219	17,954	22	11,104,156	11,086,532	11,634,239
Columbium-tantalum concentrates.....	32,829	998,570	744,933	11,827,159	1,785,397	11,086,532
Copper (recoverable content of ores, etc.).....	492,929	1,880,142	65,805	11,687,159	1,785,397	11,634,239
Gold (recoverable content of ores, etc.).....	1,837,310	64,306	64,306	11,827,159	1,785,397	11,634,239
Iron ore, usable (excluding byproduct iron sinter).....	76,126	525,818	748,602	96,944	104,157	865,703
Lead (recoverable content of ores, etc.).....thousand long tons, gross weight.....	325,419	338,025	100,731	352,826	338,216	36,730
Manganese ore (35 percent or more Mn).....gross weight.....	206,128	15,176	21,651	344,735	366,334	29,363
Manganiferous ore (5 to 35 percent Mn).....	588,332	3,079	680,651	865,127	865,127	(9)
Manganiferous residuum.....do.....	214,931	213,370	(9)	130,129	(9)	(9)
Mercury.....do.....	18,543	18,955	5,504	24,177	6,284	11,8,552
Nickel (content of concentrate).....76-pound flasks.....	64,021	64,709	65,919	57,126	57,143	67,805
Nickel concentrates.....thousand pounds.....	14	4,411	(9)	7,302	12,901	(9)
Rare-earth concentrates.....	(9)	37,198	33,666	(9)	2,907	649
Silver (recoverable content of ores, etc.).....thousand troy ounces.....	36,941	37,198	33,666	11,38,722	11,35,044	34,541
Titanium concentrates.....	581,895	7,376	10,268	735,388	782,975	17,362
Ullmannite.....gross weight.....	17,305	9,182	1,122	12,065	10,644	1,544
Tungsten ore and concentrate.....do.....	15,091	16,412	60,941	14,737	51,201	8,186
Uranium ore.....60-percent WO ₃ basis.....	(9)	51,453	(9)	\$ 3,003,690	\$ 70,601	3,682,543
Vanadium.....thousand pounds.....	6,022	(9)	(9)	(9)	(9)	78,454
Zinc (recoverable content of ores, etc.).....	475,471	6,572	126,009	642,340	591,735	123,235
Zirconium concentrate.....	17,959	54,671	1,426	(9)	(9)	(9)
Value of items that cannot be disclosed: Magnesium chloride for magnesium metal, platinum-group metals (crude), tin (1954-55), and values indicated by footnote 16.....		23,913				
Total metals.....	38,880	40,866	40,866	\$ 48,704	59,558	59,558
Grand total mineral production.....	1,518,000	2,055,000	2,055,000	\$ 2,388,000	2,129,000	2,129,000
	\$14,067,000	\$15,807,000	\$15,807,000	\$17,383,000	18,126,000	18,126,000

1 Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
 2 Includes Alaska and Hawaii.
 3 Includes small quantity of anthracite mined in States other than Pennsylvania.
 4 Preliminary figure.
 5 Revised figure.
 6 Excludes sharpening stones, value for which is included with "Nonmetal items that cannot be disclosed."
 7 Figure withheld to avoid disclosing individual company confidential data, value included with "Nonmetal items that cannot be disclosed."
 8 Weight not recorded.
 9 Excludes certain clays; value included with "Nonmetal items that cannot be disclosed."
 10 Beginning with 1957 calcareous marl included with stone.
 11 Final figure. Supersedes preliminary figure given in commodity chapter.
 12 Marketable production. Supersedes figures for "Sold or used" as reported previously.
 13 Excludes abrasive stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table.
 14 Less than \$1,000.
 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 Data not available.

TABLE 3.—Minerals produced in the United States,¹ by States, and principal producing States in 1957

State	Anti- mony	Apilte	Asbes- tos	Asphalt	Barite	Bauxite	Beryl- lum	Boron	Bromine	Brucite	Calcium magne- sium chlo- ride	Carbon dioxide	Cement	Chro- mite	Clays	Coal
Alabama				3		2							✓	4		✓
Alaska	3						✓									✓
Arizona			2										✓			✓
Arkansas			3		✓	1	2	1	4	3	2		✓	2	4	✓
California							2						✓			✓
Colorado							4						✓			✓
Connecticut																✓
Delaware						3							✓			✓
Florida							✓						✓			✓
Georgia													✓			✓
Hawaii													✓			✓
Idaho	1				✓		✓						✓			4
Illinois													✓			✓
Indiana													✓			✓
Iowa													✓			✓
Kansas													✓			✓
Kentucky								✓					✓			3
Louisiana													✓			✓
Maine													✓			✓
Maryland							✓						✓			✓
Massachusetts													4			✓
Michigan									2		1		✓			✓
Minnesota													✓			✓
Missouri													✓			✓
Mississippi													✓	1		✓
Missouri													✓			✓
Montana													✓			✓
Nebraska										1			✓			✓
Nevada													✓			✓
New Hampshire	2						✓						✓			✓
New Jersey								3					✓			✓
New Mexico													✓			✓
New York							✓						✓			✓
North Carolina			4										✓			✓
North Dakota													✓			✓
Ohio													✓			✓
Oklahoma													✓			✓
Oregon													✓			2
Pennsylvania													✓			✓
Rhode Island													✓			✓
South Carolina													✓			✓
South Dakota								1					✓			✓
Tennessee													✓			✓
Texas												3	✓			✓
Utah										1			✓			✓
Vermont				1									✓			✓
Virginia													✓			✓
Washington													✓			✓
West Virginia													✓			✓
Wisconsin													✓			✓
Wyoming													✓			✓

¹ Includes Alaska and Hawaii.

TABLE 3.—Minerals produced in the United States,¹ by States, and principal producing States in 1957—Continued

State	Cobalt	Columbitum-tantalum	Copper	Diatomite	Emery	Epsomite	Feldspar	Fluor-spar	Garnet	Gem stones	Gold	Graphite	Gypsum	Helium	Iodine
Alabama															
Alaska			✓												
Arizona			1												
Arkansas		2					✓	✓					✓		
California				1			2	✓					✓		
Colorado			✓				3	3					2		1
Connecticut							✓						✓		
Delaware															
Florida															
Georgia							✓								
Hawaii															
Idaho	1	1	✓					1	2				✓		
Illinois															
Indiana															
Iowa															
Kansas															
Kentucky								4					3		
Louisiana													✓		
Maine															
Maryland															
Massachusetts															
Michigan			✓										1		
Minnesota															
Mississippi															
Missouri	2		✓												
Montana			3					2					✓		
Nebraska															
Nevada			4	2				✓					✓		
New Hampshire															
New Jersey															
New Mexico															
New York		4	✓		1				1				✓		2
North Carolina			✓				1								
North Dakota															
Ohio															
Oklahoma															
Oregon			✓												
Pennsylvania	3		✓	3											
Rhode Island															
South Carolina															
South Dakota		3					4						✓		
Tennessee			✓												
Texas							✓								
Utah			2										4		1
Vermont															
Virginia															
Washington			✓												
West Virginia				4		1									
Wisconsin															
Wyoming			✓												

¹ Includes Alaska and Hawaii.

TABLE 3.—Minerals produced in the United States,¹ by States, and principal producing States in 1957—Continued

State	Iron ore	Iron oxide pigments	Kyanite	Lead	Lime	Mang- sife	Magnesium chloride	Magnesium compounds	Manga- nese	Mer- cury	Mica	Molyb- denum	Natural gas	Natural-gas liquids	Nickel
Alabama													✓		
Alaska	3				✓				2	3	3				
Arizona				✓	✓				✓	✓	✓	3	✓		
Arkansas	✓			✓	✓				✓	✓	✓			✓	
California	✓			✓	✓		1		✓	✓	✓	4	✓	2	
Colorado	✓			✓	✓				✓	✓	✓	1	✓	✓	
Connecticut					✓										
Delaware					✓										
Florida	✓				✓				✓		2		✓		
Georgia					✓										
Hawaii	✓				✓					✓	✓		✓		3
Idaho					✓								✓		
Illinois					✓								✓		
Indiana					✓								✓		
Iowa					✓								✓		
Kansas					✓								✓		
Kentucky					✓								✓		
Louisiana					✓						✓		2	3	
Maine					✓						✓				
Maryland					✓								✓		
Massachusetts					✓										
Michigan	2	1			✓		2		✓				✓		
Minnesota	1	✓			✓								✓		
Mississippi					✓				✓		✓		✓		
Missouri	✓				✓				✓		✓		✓		2
Montana	✓				✓				✓		✓		✓		
Nebraska	✓				✓				✓		✓		✓		
Nevada					✓				1	2	✓				
New Hampshire					✓										
New Jersey	✓				✓				4		✓		✓		
New Mexico	✓				✓								✓		
New York	✓				✓				3		✓		3		
North Carolina	✓				✓						1		✓		
North Dakota					✓								✓		
Ohio					✓								✓		
Oklahoma					✓				✓				✓		
Oregon	✓				✓								✓		
Pennsylvania	✓				✓								✓		
Rhode Island					✓								✓		
South Carolina					✓								✓		
South Dakota					✓								✓		
Tennessee	✓				✓				✓				✓		
Texas	✓				✓								✓		
Utah	✓				✓				✓				✓		
Vermont					✓								✓		
Virginia					✓								✓		
Washington	✓				✓				✓		✓		✓		
West Virginia	✓				✓				✓				✓		
Wisconsin	✓				✓				✓				✓		
Wyoming	✓				✓				✓				✓		

¹ Includes Alaska and Hawaii.

TABLE 3.—Minerals produced in the United States,¹ by States, and principal producing States in 1957—Continued

State	Olivine	Peat	Pelite	Petroleum	Phosphate rock	Platinum-group metals	Potassium salts	Pumice	Pyrites	Rare-earth metals	Salt	Sand and gravel	Silver	State	Sodium carbonate
Alabama				✓							✓				
Alaska						1							✓		
Arizona			4					2							
Arkansas				✓											
California		4	✓	2		2		1	3	✓	✓			✓	
Colorado		✓	2	✓				✓	4	4					2
Connecticut		✓													
Delaware		✓													
Florida		3		✓	1			4		3				1	
Georgia		✓						4							
Hawaii		✓								4	✓		1		
Idaho		✓			3										
Illinois		✓		✓											
Indiana		✓		✓											
Iowa		✓													
Kansas		✓		✓				✓							
Kentucky		✓		✓											
Louisiana		✓		3							4				
Maine		✓													
Maryland		✓						✓							
Massachusetts		✓													
Michigan		✓						4							
Minnesota		✓		✓							1				
Mississippi		✓													
Missouri		✓		✓											
Montana		✓		✓	4										
Nebraska		✓		✓											
Nevada		✓		✓				✓							
New Hampshire		✓		✓											
New Jersey		✓		✓											
New Mexico		✓		✓			1	3							
New York		✓		✓							✓				
North Carolina		✓		✓							✓				
North Dakota	1			✓							3				
Ohio		✓		✓											
Oklahoma		✓		4											
Oregon		✓		✓											
Pennsylvania		✓		✓											
Rhode Island		✓		✓											
South Carolina		✓		✓											
South Dakota		✓		✓						1					
Tennessee		✓		✓	2										
Texas		✓		✓							2				
Utah		✓		✓	✓						✓				
Vermont		✓		✓											
Virginia		✓		✓											
Washington		2		✓											
West Virginia		✓		✓											
Wisconsin		✓		✓											
Wyoming		✓		✓	✓										

¹ Includes Alaska and Hawaii.

TABLE 3.—Minerals produced in the United States,¹ by States, and principal producing States in 1957—Continued

State	Sodium sulfate	Stone	Strontium	Sulfur	Talc, pyrophyllite, and soapstone	Titanium	Tripoli	Tungsten	Uranium	Vanadium	Vermiculite	Wollastonite	Zinc	Zirconium
Alabama		✓			✓				✓					
Alaska		✓						✓	4	3			✓	
Arizona				4	✓									
Arkansas		2	1		2			2	✓			2	✓	
California	1	✓						✓	3	1			✓	
Colorado		✓												
Connecticut		✓												
Delaware		✓												
Florida		✓			4	2								1
Georgia		✓												
Hawaii		✓				4	1	✓	✓				3	
Idaho		✓											✓	
Illinois		✓												
Indiana		✓												
Iowa		✓												
Kansas		✓												
Kentucky		✓												
Louisiana		✓												
Maine		✓												
Maryland		✓												
Massachusetts		✓												
Michigan		4												
Minnesota		✓												
Mississippi		✓												
Missouri		✓						4	✓	✓	1		✓	4
Montana		✓						3	✓				✓	
Nebraska		✓												
Nevada		✓												
New Hampshire		✓												
New Jersey		✓												
New Mexico		✓												
New York		✓			1	1			1	4			✓	✓
North Carolina		✓			3			1				1	✓	✓
North Dakota		✓												
Ohio		✓												
Oklahoma		3					2							
Oregon		✓						✓	✓					
Pennsylvania		✓												
Rhode Island		✓					3							
South Carolina		✓												
South Dakota		✓				✓			✓					
Tennessee		✓												
Texas	2	✓		2					✓	2			2	2
Utah		✓							✓	2			✓	
Vermont		✓												
Virginia		✓												
Washington		✓												
West Virginia		✓	1					✓	✓				✓	
Wisconsin		✓		✓										
Wyoming	3	✓		3					✓	✓			✓	

¹ Includes Alaska and Hawaii.

TABLE 4.—Value of mineral production in the United States, 1954-57, by States, in thousand dollars, and principal minerals produced in 1957

State	1957			
	1954	1955	1956	1957
	Value	Rank	Percent of U. S. total	Principal minerals in order of value
Alabama.....	154,639	20	1.16	Coal, iron ore, cement, stone.
Alaska.....	24,408	41	0.16	Sand and gravel, gold, coal, stone.
Arizona.....	254,479	14	2.06	Copper, sand and gravel, cement, zinc.
Arkansas.....	131,745	25	1.78	Petroleum, bauxite, stone, sand and gravel.
California.....	1,429,539	2	9.11	Petroleum, cement, natural gas, natural-gas liquids.
Colorado.....	255,852	17	1.88	Petroleum, molybdenum, coal, uranium ore.
Connecticut.....	9,581	45	0.09	Stone, sand and gravel, lime, clays.
Delaware.....	947	50	(1)	Sand and gravel, stone, clays.
Florida.....	106,510	26	0.75	Phosphate rock, stone, cement, titanium concentrate.
Georgia.....	55,828	31	0.38	Clays, stone, cement, barite.
Hawaii.....	3,506	47	0.03	Stone, sand and gravel, pumice, lime.
Idaho.....	69,689	30	0.40	Lead, silver, zinc, phosphate rock.
Illinois.....	473,077	8	3.20	Petroleum, coal, stone, sand and gravel.
Indiana.....	165,369	21	1.10	Coal, cement, petroleum, stone.
Iowa.....	58,798	32	0.38	Cement, stone, sand and gravel, coal.
Kansas.....	449,587	10	2.79	Petroleum, natural gas, cement, stone.
Kentucky.....	327,503	11	2.48	Coal, petroleum, natural gas, stone.
Louisiana.....	998,057	3	8.41	Petroleum, natural gas, natural-gas liquids, sulfur.
Maine.....	10,716	46	0.07	Cement, stone, sand and gravel, slate.
Maryland.....	30,741	39	0.22	Stone, sand and gravel, cement, coal.
Massachusetts.....	18,851	42	0.14	Stone, sand and gravel, lime, clays.
Michigan.....	279,935	12	2.23	Iron ore, cement, salt, copper.
Minnesota.....	351,474	7	3.22	Iron ore, sand and gravel, stone, cement.
Mississippi.....	110,563	24	0.82	Petroleum, natural gas, sand and gravel, cement.
Missouri.....	151,280	23	0.84	Lead, cement, stone, lime.
Montana.....	126,412	22	1.06	Petroleum, copper, zinc, sand and gravel.
Nebraska.....	42,303	20	0.46	Petroleum, cement, sand and gravel, stone.
Nevada.....	39,138	28	0.32	Copper, silver, iron ore, sand and gravel.
New York.....	9,112	48	0.02	Sand and gravel, mica, feldspar, stone.
New Hampshire.....	47,044	34	0.36	Stone, sand and gravel, iron ore, magnesium compounds.
New Jersey.....	47,044	34	0.36	Stone, sand and gravel, iron ore, magnesium compounds.
New Mexico.....	374,600	9	3.05	Petroleum, potassium salts, natural gas, copper.
New York.....	102,738	18	1.35	Cement, iron ore, stone, salt.
North Carolina.....	41,631	40	0.31	Stone, sand and gravel, mica, feldspar.
North Dakota.....	22,223	36	0.32	Petroleum, coal, sand and gravel, natural-gas liquids.
Ohio.....	283,659	13	2.13	Coal, stone, cement, lime.

Okahoma.....	711,089	757,120	803,037	6	4.44	Petroleum, natural gas, natural-gas liquids, coal.
Oregon.....	31,736	34,021	42,480	37	.23	Sand and gravel, stone, cement, nickel.
Pennsylvania.....	969,910	1,088,867	1,082,093	4	5.97	Coal, cement, stone, petroleum.
Rhode Island.....	1,864	1,627	1,369	49	.01	Sand and gravel, stone, graphite.
South Carolina.....	20,197	21,342	22,168	43	.12	Cement, stone, clays, sand and gravel.
South Dakota.....	37,874	42,231	39,990	38	.22	G-ld, sand and gravel, stone, cement.
Tennessee.....	105,666	119,316	125,738	27	.71	Coal, stone, cement, zinc.
Texas.....	3,730,705	4,247,723	4,857,244	1	24.81	Petroleum, natural gas, natural-gas liquids, sulfur.
Utah.....	255,550	309,759	356,215	15	1.97	Copper, coal, iron ore, uranium.
Vermont.....	20,483	23,131	21,885	44	.12	Stone, asbestos, slate, copper.
Virginia.....	129,603	172,541	224,531	19	1.24	Coal, stone, cement, sand and gravel.
Washington.....	53,300	61,723	58,090	35	.52	Sand and gravel, cement, stone, zinc.
West Virginia.....	636,311	935,074	985,710	5	5.52	Coal, natural gas, stone, cement.
Wisconsin.....	54,286	65,813	68,644	33	.38	Stone, sand and gravel, iron ore, cement.
Wyoming.....	281,306	317,594	345,804	16	1.91	Petroleum, clays, sodium carbonate, natural gas.
Total.....	14,067,000	17,381,000	18,128,000	-----	100.00	Petroleum, coal, natural gas, cement.

¹ Less than 1 percent.

TABLE 5.—Mineral production in the United States,² 1954-57, by States

ALABAMA

Mineral	1954		1955		1956		1957	
	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 ¹ thousand 376-pound barrels.....	11,122	\$98,583	13,721	\$38,850	14,065	\$41,840	13,000	\$40,279
Clays..... thousand short tons.....	1,321	2,258	(¹)	(¹)	1,594	2,147	1,316	1,504
Coal..... thousand long tons, gross weight.....	10,283	67,338	13,088	79,337	12,663	79,322	13,260	86,114
Iron ore (usable)..... thousand long tons, gross weight.....	5,912	33,327	6,814	44,657	5,633	34,824	6,223	40,518
Lime..... thousand short tons.....	422	4,488	(¹)	(¹)	4,466	5,089	564	6,271
Mica (sheet)..... million cubic feet.....	(¹)	(¹)	(¹)	(¹)	1,122	7	(¹)	(¹)
Natural gas..... million cubic feet.....	87	5	282	20	42	3	650	64
Petroleum (crude)..... thousand 42-gallon barrels.....	1,584	3,690	1,411	2,910	3,069	7,335	(¹)	(¹)
Sand and gravel..... thousand short tons.....	3,966	3,451	3,660	4,999	4,621	4,621	5,065	4,883
Stone..... thousand short tons.....	7,394	11,609	8,269	11,867	7,12,343	7,14,702	7,9,519	7,11,972
Total.....			1,500	8	2,200	5	1,600	3
Total Alabama ¹		4,856		4,325		4,083		23,225
		154,639		186,453		189,186		209,422

ALASKA

Antimony ore and concentrate..... antimony content.....	2,963	208	7,082	625	28	(¹)	17	(¹)
Chromite..... gross weight.....	(¹)	(¹)	640	5,769	727	711	4,297	
Clays..... thousand short tons.....	667	6,442	249,294	8,725	209,296	6,374	842	7,296
Coal..... do.....	4	2	1	1	1		(¹)	(¹⁰)
Copper (recoverable content of ores, etc.)..... troy ounces.....	248,511	8,998	(¹)	(¹⁰)	1	(¹⁰)	216,467	7,541
Gold (recoverable content of ores, etc.)..... troy ounces.....	1,046	277	9,793	8,242	3,280	853	5,401	9
Lead (recoverable content of ores, etc.)..... 76-pound flasks.....	6,640	6,302	34	31	5,285	5,890	6,096	1,349
Mercury..... thousand short tons.....	284	466	266	280	195	26	29	8,799
Sand and gravel..... thousand short tons.....	190	410	86	183	183	595	528	1,953
Silver (recoverable content of ores, etc.)..... long tons.....								
Stone (content of concentrate)..... long tons.....								
Total.....		1,572		1,552		1,644		1,394
Total Alaska ¹		24,408		25,412		23,408		28,792

ARIZONA

Beryllium concentrate..... gross weight.....	(¹)	(¹)	(¹)	(¹)	6	3	5	2
Clays..... thousand short tons.....	254	814	254	869	112	168	118	177
Columbium-tantalum concentrate..... pounds.....			(¹)	(¹)			2,433	7

	11	68	9	59	10	66	9	62
Coal.....	377,927	222,977	454,105	338,762	505,908	430,022	515,854	310,544
Copper (recoverable content of ores, etc.).....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Germ stones.....	114,809	4,018	127,616	4,467	146,110	5,114	152,449	5,336
Gold (recoverable content of ores, etc.).....	8	385	9,817	(4)	11,999	3,768	(4)	(5)
Gypsum.....	8,890	1,131	1,112	1,438	1,277	1,756	12,441	3,558
Lead (recoverable content of ores, etc.).....	163	43	1,444	(1)	42,088	3,468	70,505	6,626
Lime.....	1,682	18	1,353	9	2,392	2,670	1,650	17
Manganese ore (35 percent or more Mn).....	1,538	1,325	1,497	1,511	2,392	2,385	3,071	3,071
Mercury.....	1,296	7	(1)	(1)	21	3	2,222	6
Mica (separ).....	3,761	126	10,568	84	15,928	108	15,646	114
Molybdenum (content of concentrate).....	81	3,067	7,785	6,519	7,932	366	307	640
Natural gas.....	4,289	3,891	4,634	4,194	5,179	6,167	10,287	9,222
Oil.....	1,205	1,914	1,601	2,329	1,623	2,474	2,101	4,778
Pumice.....	132	457	181	676	186	5	2,101	2,982
Sand and gravel.....	21,461	4,636	22,684	5,580	274,505	5,408	286,037	6,277
Silver (recoverable content of ores, etc.).....					25,580	7,009	33,905	7,865
Stone.....								
Tungsten concentrate.....								
Uranium ore.....								
Zinc (recoverable content of ores, etc.).....								
Value of items that cannot be disclosed: Asbestos, barite (1954-55), cement, clays (bentonite, 1955-56), diatomite (1954-55), feldspar, fluorspar (1954-1957), nitrogen compounds (1957), pyrites (1957), rare-earth metals concentrates (1955), vanadium, vermiculite (1954), and values indicated by footnote 4.....								
Total Arizona.....	8,172	254,479	9,201	378,277	12,484,959	12,111,701	10,441	372,644

ARKANSAS

	(1)	(4)	(1)	(1)	(1)	(1)	(1)	(1)
Abrasive stones (whetstones).....	370,621	3,489	462,986	3,755	486,254	4,256	477,327	3,404
Barite.....	1,949,368	15,994	1,721,243	14,028	1,668,432	13,307	1,556,808	11,600
Bauxite.....	617	2,556	739	2,376	719	1,636	617	1,586
Clays.....	477	3,589	578	4,319	590	4,601	508	3,976
Coal.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones.....	13,728	1,021	23,744	1,727	29,485	2,066	23,251	7
Iron ore (usable).....	33,471	1,841	32,123	1,799	30,162	1,810	36,200	1,726
Manganese ore (35 percent or more Mn).....	50,778	3,234	47,483	3,239	41,529	2,541	39,869	2,313
Natural gas.....	58,506	2,521	57,088	2,169	56,146	2,293	54,034	2,097
Natural-gas liquids.....	29,130	79,520	28,369	76,880	29,355	78,965	30,597	80,343
Natural gasoline and cycle products.....	6,612	6,567	9,003	7,663	10,200	8,730	8,507	6,949
LP-gases.....	42	379	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum (crude).....	4,604	5,930	6,176	8,026	6,325	8,113	7,278	8,378
Petroleum (refined).....								
Sand and gravel.....								
Shale.....								
Stone.....								
Value of items that cannot be disclosed: Abrasive stones (oldestones), bromine (1957), cement, gypsum, lime, soapstone, recovered elemental sulfur, and values indicated by footnote 4.....								
Total Arkansas.....	131,745	5,742	182,822	7,616	135,210	8,182	8,014	140,939

See footnotes at end of table.

iodine, lithium minerals (1954), magnesite (1954-56), mica, molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate, sodium carbonate and sulfate, titanium iron concentrate (nontitanium use, 1954-55), uranium ore (1956-57), and values indicated by footnote 4.	12 43, 650	12 55, 858	12 68, 030	62, 188
Total California 5.	12 1, 429, 539	12 1, 456, 682	12 1, 551, 413	1, 650, 855

COLORADO

Beryllium concentrate.....	60	27	46	179	94	182	91
Clays.....	855	1, 003	1, 118	523	1, 215	403	978
Coal.....	2, 900	16, 079	20, 100	3, 562	19, 832	3, 594	21, 831
Columnium-tantalum concentrate.....	4, 967	10	7	52	(9)	103	(9)
Copper (recoverable content of ores, etc.).....	4, 523	2, 669	3, 225	4, 228	3, 594	5, 115	3, 079
Feldspar.....	(1)	(1)	46, 114	47, 014	(1)	43, 818	(1)
Fluorspar.....	59, 197	3, 197	(1)	(1)	(1)	(1)	35
Gem stones.....	(1)	(1)	48	(1)	30	(1)	(1)
Gold (recoverable content of ores, etc.).....	96, 146	3, 365	88, 577	97, 668	3, 418	87, 928	3, 078
Gypsum.....	65	253	77	329	353	(1)	(1)
Iron ore (usable).....	6	(1)	4	(1)	(1)	(1)	(1)
Lead (recoverable content of ores, etc.).....	17, 823	4, 883	15, 805	19, 856	(1)	21, 003	6, 007
Lime.....	(1)	(1)	689	517	7	2	45
Manganese ore (35 percent or more Mn).....	(1)	(1)	(1)	8	(10)	175	14
Mica. Sheet.....	42, 545	(1)	45, 827	(1)	(1)	(1)	(1)
Molybdenum.....	46, 729	3, 976	45, 122	(1)	(1)	119, 500	(1)
Neutral gas.....	46, 206	(1)	52, 653	58, 516	5, 312	54, 897	(1)
Petroleum (crude).....	(1)	(1)	71	(1)	162, 874	(1)	(1)
Pumice.....	(1)	(1)	(1)	50	162, 874	54, 897	165, 698
Pyrites.....	(1)	(1)	(1)	(1)	109	25	53
Rare-earth metals concentrates.....	(1)	(1)	(1)	(1)	(1)	62	(1)
Salt.....	(1)	(1)	(1)	16	(1)	577	(1)
Sand and gravel.....	13, 552	9, 027	12, 912	15, 152	18	16, 400	13, 994
Silver (recoverable content of ores, etc.).....	3, 417	3, 083	2, 772	2, 285	31, 082	2, 788	2, 523
Slime.....	1, 804	2, 112	2, 149	2, 250	2, 068	2, 438	4, 168
Tungsten concentrate.....	1, 927	3, 421	1, 152	873	3, 010	45	55
Uranium ore.....	(1)	(1)	(1)	12, 496, 517	12, 12, 410	740, 055	15, 605
Vanadium.....	35, 150	7, 592	4, 595	5, 582	(1)	6, 284	(1)
Zinc (recoverable content of ores, etc.).....	(1)	(1)	35, 350	40, 246	11, 027	47, 000	10, 904
Value of items that cannot be disclosed: Carbon dioxide, cement, iron-oxide pigments (1957), lithium minerals (1954), natural-gas liquids, perlite, tin (1954-55), vermiculite (1954), and values indicated by footnote 4.							
Total Colorado 5.	255, 852	67, 874	76, 969	286, 219	12 75, 632		81, 918
							340, 638

See footnotes at end of table.

TABLE 5.—Mineral production¹ in the United States,² 1954-57, by States—Continued
CONNECTICUT

Mineral	1954		1955		1956		1957	
	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.....	13	8	5	3	(¹) 338	(¹) 390	(¹) 308	(¹) 409
Clays.....	289	285	325	315	(¹) 40	(¹) 609	(¹) 30	(¹) 503
Feldspar.....	9,280	60	35	503	14 310	12 13	(¹) 2,004	(¹) 11
Iron.....	(¹)	(¹)	3	13	12 3,190	4,369	4,777	5,042
Mica (sheet and scrap).....	5,856	24	(¹) 4,345	(¹) 4,080	7 4,428	7 6,590	6,199	10,040
Pest.....	4,846	4,315	3,042	5,451				
Sand and gravel.....	2,829	4,269						
Stone.....		725		123		124		119
Value of items that cannot be disclosed: Columbian-tantalum concentrate (1954-55), gem stones (1957), stone (crushed granite and dimension limestone 1955, dimension limestone, 1956) and values indicated by footnote 4.....		9,581		10,428		12 11,737		16,055
Total Connecticut ³								

DELAWARE	
Sand and gravel.....	972
Stone.....	752
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4.....	(¹) 2,297
Total Delaware.....	1,407

FLORIDA	
Clays.....	372
Lime.....	(¹) 33,337
Natural gas.....	35
Peat.....	37,438
Petroleum (crude).....	108
Phosphate rock.....	10,493
Sand and gravel.....	3,860
Stone.....	1 14,235

.....thousand short tons.....	413	\$4,816	432	422	\$5,826	\$6,067
.....million cubic feet.....	(¹) 36	(¹) 4	40	(¹) 40	3	(¹) 3
.....thousand 42-gallon barrels.....	61,098	232	58,496	37,844	203	195
.....thousand long tons.....	8,747	53,640	11,822	10,191	74,290	64,789
.....thousand short tons.....	5,066	4,349	3,851	6,753	5,094	6,148
.....do.....	1 17,028	1 22,966	18,779	21,786	25,183	30,467

Titanium concentrate:									
Ilmenite.....-gross weight.....do.....do.....	157,157	2,412	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Rutile.....do.....do.....do.....	7,305	869	12	62	122	1,122	1,122	1,122	(4)
Zirconium concentrate.....do.....do.....do.....	17,959	820	28,913	28,913	1,425	1,425	43,794	2,160	56,802
Value of items that cannot be disclosed: Cement, abrasive garnet (1954-56), gem stones (1956), rare-earth metals concentrates (1956-57), staurolite (1957), stone (dimension limestone, (1954-55)), and values indicated by footnote 4.....									
Total Florida.....		15,956			22,787			28,452	
		106,510			108,987			140,490	
									28,718
									136,026

GEORGIA

Clays.....-thousand short tons.....do.....do.....do.....	2,711	24,107	2,953	26,145	3,047	29,501	2,707	30,120
Coal.....do.....do.....do.....do.....	8	41	12	62	8	42	13	63
Iron ore (usable).....-thousand long tons, gross weight.....do.....do.....do.....	222	872	257	994	357	1,609	443	2,109
Iron oxide pigments.....do.....do.....do.....do.....	(4)	(4)	6,139	36	(4)	(4)	(4)	(4)
Manganiferous ore (5 to 35 percent Mn).....do.....do.....do.....do.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Mica (sheet).....-gross weight.....do.....do.....do.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Peat.....-pounds.....do.....do.....do.....do.....	5,150	61	2,988	2,199	20,149	150	16,933	153
Sand and gravel.....-thousand short tons.....do.....do.....do.....do.....	2,703	2,466	7,488	14,225	6,226	48	4,690	45
Stone.....do.....do.....do.....do.....do.....	8,058	21,384	7,488	14,225	2,426	2,183	2,127	2,096
Value of items that cannot be disclosed: Asbestos (1964), barite, bauxite (1956-57), beryllium concentrate, cement, feldspar, gem stones (1956-57), lime (1964), manganese ore, scrap mica, slate, stone (dimension and crushed marble and crushed sandstone, 1956; crushed marble and crushed sandstone, 1956; dimension and crushed marble and crushed sandstone, 1957), and minerals indicated by footnote 4.....	50,536	177	53,828	118	57,916	122	49,372	106
Total Georgia.....		7,481		17,495		14,558		20,081
		55,828		60,417		67,912		69,799

HAWAII

Clays.....-thousand short tons.....do.....do.....do.....do.....	(4)	8	(4)	(4)	(4)	(4)	(4)	(4)
Lime.....do.....do.....do.....do.....do.....	(4)	251	6	202	2	306	2	3
Pumice.....do.....do.....do.....do.....do.....	(4)	(4)	130	76	10	492	266	271
Salt.....do.....do.....do.....do.....do.....	(4)	(4)	(4)	(4)	59	18	(4)	492
Sand and gravel.....do.....do.....do.....do.....do.....	(4)	319	(4)	425	(4)	503	298	538
Stone.....do.....do.....do.....do.....do.....	1,485	2,993	1,414	2,884	3,494	6,076	2,585	4,632
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 4.....		59		22				
Total Hawaii.....		3,595		3,592		6,972		5,930

See footnotes at end of table.

Lime.....	532	7,421	644	9,416	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Natural gas.....	9,475	1,345	8,033	1,036	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Peat.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Petroleum (crude).....	66,798	196,060	81,423	236,040	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Sand and gravel.....	24,443	26,164	26,362	28,139	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Silver (recoverable content of ores, etc.).....	1	1	3	3	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Stone.....	26,407	31,134	28,866	35,621	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Zinc (recoverable content of ores, etc.).....	14,427	3,116	21,700	5,338	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Value of items that cannot be disclosed: Iron oxide pigments (1954), natural-gas liquids, recovered elemental sulfur, tripoli, and values indicated by footnote 4.....										
Total Illinois ²		13,061		12,666				26,048		27,925
		473,077		533,052				572,321		579,584

INDIANA

Abrasive stones.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Clays.....	1,946	2,991	1,729	2,938	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Coal.....	13,400	46,913	16,149	58,000	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Lime.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Marl, calcareous (except for cement).....	28,536	19	17,080	10	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Natural gas.....	735	44	1,226	132	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Peat.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Petroleum (crude).....	11,204	33,160	10,988	31,980	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Sand and gravel.....	14,405	11,879	17,082	14,900	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Stone.....	11,182	27,460	14,124	34,680	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Value of items that cannot be disclosed: Cement, gypsum (1955-57), recovered elemental sulfur, and values indicated by footnote 4.....		42,448		43,888				50,598		48,716
Total Indiana ²		165,369		183,479				12,196,753		198,942

IOWA

Cement.....	9,859	27,044	10,430	29,539	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Clays.....	883	921	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Coal.....	1,197	4,503	1,258	4,402	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Gypsum.....	1,107	3,036	1,337	4,177	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Lead (recoverable content of ores, etc.).....	4	1	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Peat.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Sand and gravel.....	12,200	9,276	11,771	8,345	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Stone.....	13,240	16,388	15,705	18,558	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Value of items that cannot be disclosed: Nonmetals and minerals indicated by footnote 4.....		251		1,252				467		614
Total Iowa ²		88,798		63,555				66,529		68,985

See footnotes at end of table.

TABLE 5.—Mineral production in the United States, 1954-57, by States—Continued

KANSAS

Mineral	1954		1955		1956		1957	
	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 17	9,076	\$23,874	9,454	\$25,854	10,698	\$30,696	8,178	\$24,814
Clays	(1)	768	3,873	3,873	977	1,169	969	1,240
Coal	1,372	5,603	742	3,166	884	3,856	749	3,351
Helium	37,530	42,583	42,742	1,663	46,035	698	36,743	3,570
Lead (recoverable content of ores, etc.)	4,033	1,105	5,498	1,638	7,653	2,398	4,237	1,217
Natural gas	412,369	43,711	471,041	52,286	526,091	59,448	580,700	66,200
Natural-gas liquids:								
Natural gasoline	(1)	(1)	118,599	6,318	105,482	5,928	119,247	6,569
LP-gases	119,317	335,280	92,586	2,643	120,287	8,843	103,494	4,042
Petroleum (crude)	23	93	121,669	340,670	124,204	346,629	127,705	366,332
Pumice	877	7,779	2	8,432	(1)	(1)	(1)	(1)
Salt (common)	10,422	7,194	10,663	6,432	12,515	9,622	9,345	6,175
Sand and gravel	10,377	12,942	22,483	15,340	13,431	15,703	7,10,412	11,626
Stone	19,110	4,128	27,011	6,792	28,665	7,854	15,869	3,879
Zinc (recoverable content of ores, etc.)								
Value of items that cannot be disclosed: Natural cement, fire clay (1955), gypsum, stone (dimension and crushed sandstone, 1957), and values indicated by footnote 4		9,721		1,616		1,465		1,191
Total Kansas †		449,587		470,830		493,770		505,084

KENTUCKY

Clays	571	2,995	876	4,416	905	4,079	864	3,915
Coal	56,964	265,737	69,020	298,308	74,555	331,358	74,667	338,109
Fluorspar	35,831	1,510	8,899	308	14,865	608	20,626	979
Lead (recoverable content of ores, etc.)	80	22				72	411	118
Natural gas	72,713	16,579	73,214	17,352	73,687	17,022	77,300	18,100
Natural-gas liquids:								
Natural gasoline	28,224	1,552	34,991	2,492	35,275	2,414	34,956	1,935
LP-gases	189,966	5,066	189,247	6,451	248,992	8,709	176,033	7,403
Petroleum (crude)	13,791	40,270	15,518	44,850	17,628	61,297	16,879	52,831
Sand and gravel	4,730	4,402	4,899	5,298	5,684	6,974	4,482	4,556
Stone	10,130	13,286	11,934	15,579	11,553	15,324	12,718	16,714
Zinc (recoverable content of ores, etc.)	468	99			417	114	837	
Value of items that cannot be disclosed: Native asphalt, cement, iron ore (1956), silver (1956-57)		5,626		6,446		7,079		6,211
Total Kentucky †		327,503		391,068		443,168		450,354

LOUISIANA

Clays ^a	714	941	651	785	785	642	642
Gypsum.....	(1)	(1)	587	276	598	(1)	(1)
Natural gas.....	1,399,222	124,531	1,690,032	1,996,302	215,038	1,943,900	1,943,900
Natural-gas liquids: Natural gasoline and cycle products.....	665,070	54,330	782,328	773,949	62,394	775,009	63,866
LP-gases.....	292,226	11,620	291,138	305,222	14,727	335,142	14,888
Petroleum (crude).....	246,558	722,370	271,010	793,290	299,421	877,951	1,072,101
Salt (common).....	3,089	11,101	3,563	15,407	3,704	17,695	15,941
Sand and gravel.....	7,910	9,687	8,574	10,942	12,579	14,730	14,730
Stone.....	2,044	3,127	3,253	4,961	6,674	4,353	7,132
Sulfur (Frasch-process).....	1,854	49,222	2,072	58,028	2,239	59,330	52,090
Value of items that cannot be disclosed: Cement, bentonite, lime, re- covered elemental sulfur, and values indicated by footnote 4.....	13,334	13,334	18,309	16,563	19,110	19,110	19,110
Total Louisiana ^a	998,037	1,156,037	1,568,837	1,288,331	1,524,928	1,524,928	1,524,928

MAINE

Beryllium concentrate.....	(1)	(1)	22	13	12	7	4	2
Cement.....	1,973	3,425	2,349	6,873	(1)	(1)	(1)	(1)
Clays.....	27	27	33	33	26	23	30	28
Geldspar.....	(1)	(1)	98,282	199	22,219	144	14,330	92
Gem stones.....	(1)	(1)	(1)	5	(1)	(1)	(1)	1
Lime.....	(1)	(1)	(1)	(1)	(1)	179	(1)	(1)
Mica.....	(1)	(1)	71	2	114	3	6	(1)
Peat.....	(1)	37	21,121	129	19,913	146	25,453	202
Sheet.....	(1)	(1)	(1)	(1)	(1)	(1)	8,037	3,037
Sand and gravel.....	7,461	2,538	7,529	2,855	7,196	3,085	8,037	3,076
Stone and gravel.....	1,024	2,356	1,192	2,542	1,947	12,787	899	6,617
Value of items that cannot be disclosed: Columbitum-tantalum con- centrate (1954-56), slate, and values indicated by footnote 4.....	865	865	857	857	6,912	6,912	6,617	6,617
Total Maine ^a	10,716	12,991	12,991	12,991	12,728	12,728	12,711	12,711

MARYLAND

Clays.....	627	1,166	698	1,265	1,046	1,046	1,963
Lime.....	422	1,879	512	2,002	669	2,985	2,985
Natural gas.....	67	685	74	53	581	(1)	(1)
Sand and gravel.....	1,394	282	3,116	626	4,610	4,300	6,120
Stone.....	10,098	12,171	9,695	12,211	10,147	8,679	11,594
Value of items that cannot be disclosed: Beryllium concentrate (1954- 57), cement, ball clay (1956-57), gem stones (1956-57), greensand marl, mica (1954, 1957), potassium salts, slate (1954-55), stone (oystershell 1955), talc and soapstone, and values indicated by footnote 4.....	5,065	8,266	7,533	7,800	6,229	6,140	13,392
Total Maryland ^a	17,287	17,125	17,125	17,125	17,729	17,729	10,664
See footnotes at end of table.	30,741	35,488	35,488	35,488	40,534	40,534	39,607

TABLE 5.—Mineral production¹ in the United States,¹ 1954-57, by States—Continued
MASSACHUSETTS

Mineral	1954		1955		1956		1957	
	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.....	129	\$121	125	\$142	128	\$213	78	\$97
Lime.....	128	1,709	135	1,957	134	2,093	137	2,233
Sand and gravel.....	(4)	(4)	(4)	(4)	300	(4)	600	(4)
Stone.....	9,640	8,366	9,581	8,926	10,189	9,520	9,900	9,691
Value of items that cannot be disclosed: Mineral fuels and nonmetals.....	2,942	9,040	4,128	11,381	5,442	13,753	4,877	13,165
Value of items that cannot be disclosed: Mineral fuels and nonmetals.....	12	12	6	6	3	3	6	6
Total Massachusetts ¹⁴		18,851		22,109		25,085		24,789

MICHIGAN

Cement.....	16,712	45,692	19,738	53,048	21,880	67,798	22,045	71,606
Clays.....	1,871	1,919	1,938	2,019	2,110	2,401	1,842	1,982
Copper (recoverable content of ores, etc.).....	23,593	13,920	50,066	37,349	61,526	52,297	58,400	85,157
Gypsum.....	1,693	5,036	1,762	5,661	1,716	5,861	1,386	4,823
Iron ore (usable).....	9,709	70,004	14,144	104,253	12,536	98,111	13,123	111,484
Magnesium compounds from well brines (partly estimated), MgO equivalent.....	37,093	4,104	46,336	5,064	(4)	(4)	(4)	(4)
Manganiferous ore (5 to 35 percent Mn).....	15,361	(4)	119,313	57	157,246	95	123,547	(4)
Marl, calcareous (except for cement).....	106,668	1,239	8,300	830	10,911	1,451	9,900	9,300
Natural gas.....	6,662	38	(4)	(4)	31,111	475	80,271	1,406
Petroleum (crude).....	(4)	35,600	11,266	32,900	10,740	30,824	10,169	31,117
Salt (and brine).....	5,064	29,397	4,975	31,668	5,548	35,644	5,225	41,073
Silver (recoverable content of ores, etc.).....	32,041	25,516	37,214	29,491	42,150	35,146	41,838	35,144
Stone.....	27,758	21,904	33,636	28,909	33,999	31,010	34,495	34,176
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones (1955-57), lime, magnesium chloride for metal (1954-55), natural-gas liquids, potassium salts, and values indicated by footnote 4.....		11,293,267		12,931,841		12,383,737		40,441
Total Michigan ⁸		13,279,935		13,363,778		12,394,556		404,377

MINNESOTA

Clays.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Iron ore (usable).....	48,613	319,633	69,419	465,170	62,637	461,904	67,656	541,474

Manganiferous ore (5 to 35 percent Mn).....do.....	504,057	(4)	683,919	(4)	692,295	(4)
Iron, calcareous (except for cement).....do.....	(4)	(4)	875	(4)	1,300	(4)
Lead.....do.....	23,849	(4)	28,187	(4)	28,493	(4)
Sand and gravel.....do.....	2,629	(4)	17,429	(4)	7,552	(4)
Stone 1.....do.....			3,005		2,963	
Value of items that cannot be disclosed:						
Abrasive stones, cement, fire clay (1955-57), gem stones (1955-57), lime, manganese ore (1955-57), stone (crushed limestone, 1954-57, calcareous iron 1957), recovered elemental sulfur (1957), and values indicated by footnote 4.....do.....	8,204		11,739		13,443	
Total Minnesota 11.....	351,474		501,151		501,027	
Total Mississippi 11.....						15,571
Total Mississippi 11.....						584,501

MISSISSIPPI

Clays.....do.....	559	3,103	701	613	3,590	616	3,635
Iron ore.....do.....	140,448	11,657	163,167	185,137	18,143	182,411	21,047
Natural gas.....do.....							1
Natural-gas liquids:.....do.....							
Natural gasoline and cycle products.....do.....	27,804	1,944	22,382	24,829	1,751	25,152	1,469
LP-gases.....do.....	15,288	528	12,242	396	580	10,044	472
Petroleum (crude).....do.....	34,240	85,600	37,741	40,824	100,019	39,202	114,078
Sand and gravel.....do.....	5,442	4,287	5,625	5,315	4,701	5,172	4,344
Stone.....do.....	181	181	5,573	656	656	760	754
Value of items that cannot be disclosed:							
Certain metals and nonmetals.....do.....	3,353	3,353			4,174		4,694
Total Mississippi 11.....	110,563		122,620		133,098		149,305

MISSOURI

Barite.....do.....	312,791	3,047	363,692	381,642	4,462	317,350	3,938
Cement.....do.....	11,379	31,425	12,255	12,012	36,868	10,794	34,307
Clays.....do.....	1,927	5,859	2,402	2,658	8,016	2,648	7,648
Coal.....do.....	2,514	10,028	3,232	3,283	13,223	2,976	12,891
Copper (recoverable content of ores, etc.).....do.....	1,925	1,136	1,722	1,285	1,606	1,604	1,966
Iron ore (usable).....do.....	173	(4)	261	(4)	365	(4)	(4)
Lead (recoverable content of ores, etc.).....do.....	125,250	34,319	125,412	123,783	38,868	126,345	36,135
Lime.....do.....	1,126	11,165	1,465	1,492	16,814	1,393	16,475
Natural gas.....do.....	16	(4)	15	12	2	(4)	(4)
Petroleum (crude).....do.....	9,891	10,204	9,984	9,585	10,117	8,480	8,942
Sand and gravel.....do.....	18,353	320	269	243	207	184	166
Silver (recoverable content of ores, etc.).....do.....	18,672	24,752	122,369	24,578	33,577	22,098	29,896
Stone.....do.....	5,210	1,125	4,476	4,380	1,200	2,951	685
Zinc (recoverable content of ores, etc.).....do.....							
Value of items that cannot be disclosed:							
Native asphalt, masonry cement (1955-57), copal (1955-57), gem stones (1957), iron oxide pigment materials (1955-56), manganese ore (1954, 1957), nickel (content of ore, 1955-57), stone (dimension marble 1955), tripoli (1954), and values indicated by footnote 4.....do.....	2,908	4,833			5,897		7,385
Total Missouri 11.....	131,280		151,626		163,693		152,879

See footnotes at end of table.

TABLE 5.—Mineral production¹ in the United States,² 1954-57, by States—Continued
MONTANA

Mineral	1954		1955		1956		1957	
	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.....	123,096 (⁴)	\$4,133 (⁴)	118,703 (⁴)	\$3,719 (⁴)	118,780 (⁴)	\$3,807 (⁴)	119,149 (⁴)	\$3,921 (⁴)
Clays.....	.....	.....	.....	.....	.....	.....	.....	.....
Coal: Bituminous and lignite.....	.....	.....	.....	.....	.....	.....	.....	.....
Copper (recoverable content of ores, etc.).....	1,491	4,157	1,247	3,782	846	3,468	413	2,160
Fluorspar.....	59,349	35,016	81,542	60,830	98,426	81,962	91,512	55,990
Gem stones.....	15,102	(⁴)	25,223	(⁴)	59,775	(⁴)	64,339	(⁴)
Gem stones (recoverable content of ores, etc.).....	23,660	828	28,123	984	38,121	35	32,766	35
Iron ore (usable).....	6	(⁴)	7	(⁴)	12	(⁴)	36	(⁴)
Lead (recoverable content of ores, etc.).....	14,820	4,061	17,028	5,075	18,642	5,853	13,300	3,804
Manganese ore (35 percent or more Mn).....	58,661	(⁴)	106,026	(⁴)	80,552	(⁴)	68,298	(⁴)
Manganiferous ore (5 to 35 percent Mn).....	5,266	(⁴)	6,341	(⁴)	4,752	(⁴)	4,547	(⁴)
Mica, sheet.....	(⁴)	(⁴)	(⁴)	(⁴)	56	(⁴)	13	(⁴)
Natural gas.....	30,252	2,057	28,255	1,724	25,847	1,758	* 30,200	* 2,200
Petroleum (crude).....	14,195	31,230	15,654	35,380	21,760	56,141	* 27,215	* 73,481
Phosphate rock.....	(⁴)	(⁴)	(⁴)	(⁴)	558	(⁴)	534	3,825
Pumice.....	175	1	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Sand and gravel.....	13,341	7,460	13,772	6,515	10,024	7,174	11,108	8,150
Silver (recoverable content of ores, etc.).....	5,178	4,886	6,090	5,003	7,366	6,685	5,593	5,030
Stone.....	1,320	1,385	1,274	1,200	1,816	1,816	2,567	3,654
Talc.....	(⁴)	(⁴)	(⁴)	(⁴)	22,197	(⁴)	(⁴)	(⁴)
Tungsten ore and concentrate.....	678	(⁴)	1,211	(⁴)	1,230	(⁴)	661	(⁴)
Zinc (recoverable content of ores, etc.).....	60,952	13,166	68,588	16,873	70,520	19,322	50,520	11,721
Value of items that cannot be disclosed: Barite, cement, clay (bentonite, 1956; bentonite and fire clay, 1957), gypsum, lime, natural-gas liquids, pyrites, recovered elemental sulfur (1956-57), vanadium (1957), vermiculite, uranium ore (1956-57), and values indicated by footnote 4.....								
Total Montana.....		126,412		166,993		192,781		191,728

NEBRASKA

Clays.....	164	164	151	151	153	154	134	135
Gem stones.....	.....	.....	(⁴)	(⁴)	(⁴)	3	(⁴)	2
Natural gas.....	9,901	706	10,515	2,553	13,541	2,845	* 12,600	* 2,700
Petroleum (crude).....	7,793	21,490	11,203	30,310	16,204	45,209	* 19,586	* 58,983
Sand and gravel.....	5,548	6,992	6,408	6,103	10,569	7,401	7,944	5,889
Stone.....	2,660	3,512	3,081	4,177	3,063	4,142	3,065	3,749

Value of items that cannot be disclosed: Cement, natural-gas liquids, and pumice.....	10,637	11,144	12,771	13,670
Total Nebraska ¹	42,393	54,237	17,311	83,280

NEVADA

Antimony ore and concentrate.....	4	113,694	709	13	1,087	20	9
Barite.....	83,893	6	13	14	32	109,663	721
Clays.....	5	78,925	58,878	19	68,700	12	46,906
Copper (recoverable content of ores, etc.).....	70,217	(11)	(4)	(11)	50	77,760	2,886
Gem stones.....	79,067	72,913	2,652	19	2,801	76,762	(1)
Gold (recoverable content of ores, etc.).....	664	837	2,836	2	70	674	(1)
Gypsum.....	351	3,291	1,667	917	5,021	904	(1)
Iron ore (usable).....	3,041	883	981	2	2,004	5,879	1,710
Lead (recoverable content of ores, etc.).....	(1)	101,469	(4)	121,452	(4)	129,046	(1)
Manganese ore (35 percent or more Mn).....	12,870	165	1,669	5,359	1,523	6,313	1,559
Manganeseiferous ore (5 to 35 percent Mn).....	4,974	1,315	110	64	34	644	676
Mercury.....	33	40	(4)	12	34	(4)	(4)
Pumice.....	3,531	3,580	3,762	4,857	4,569	233	5,190
Sand and gravel.....	1,839	846	765	19,994	19,999	5,969	868
Silver (recoverable content of ores, etc.).....	1,896	1,612	2,699	1,401	2,281	925	1,585
Stone.....	5,331	10,732	17,791	10,540	98	7,467	57
Talc and soapstone.....	1,035	6,155	22,751	5,400	19,263	1,196	1,676
Tungsten concentrate.....	20,043	2,670	657	7,488	2,052	5,292	1,228
Zinc (recoverable content of ores, etc.).....	20,224	2,670	657	7,488	2,052	5,292	1,228
Value of items that cannot be disclosed: Brucite (1954-1956-57), diatomite, fluor spar, lime, magnesite, calcareous marl (1954-56), molybdenum, perlite, salt, sulfur ore (1955-57), uranium (1956-57), and values indicated by footnote 4.....	12,435	13,752	13,752	13,752	13,752	16,756	16,756
Total Nevada ^{1,2}	89,138	113,220	113,220	113,220	126,681	86,023	86,023

NEW HAMPSHIRE

Beryllium concentrate.....	12	7	12	4	2	4	2
Clays.....	36	36	35	(4)	47	37	51
Columbium-tantalum concentrate.....	255	(11)	5	(1)	1	(1)	(1)
Gem stones.....	42,466	234	(4)	50,873	178	53,554	460
Iron.....	825	12	(4)	305	10	422	17
Peat.....	(4)	(4)	(4)	320	(4)	85	(4)
Sand and gravel.....	2,241	1,095	1,593	3,862	1,822	4,300	1,970
Stone.....	2,72	473	(4)	(4)	(4)	(4)	(4)
Value of items that cannot be disclosed: Abrasive stones, feldspar, and values indicated by footnote 4.....	255	255	960	1,378	1,378	881	881
Total New Hampshire.....	2,112	2,112	2,905	3,436	3,436	3,331	3,331

See footnotes at end of table.

TABLE 5.—Mineral production¹ in the United States,² 1954-57, by States—Continued
NEW JERSEY

Mineral	1954		1955		1956		1957	
	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.....	578	\$1,246	644	\$1,552	651	\$2,214	653	\$1,872
Iron ore (usable).....	476	6,622	760	13,653	102	16,842	877	16,668
.....thousand long tons, gross weight.....	214,931	(4)	213,370	(3)	130,129	(4)	(4)	(4)
Manganiferous residuum.....	2,101	185	(1)	(1)	(1)	(1)	(1)	(1)
Marl (greensand).....	10,005	14,705	11,153	16,495	194	18,239	10,323	17,619
Sand and gravel.....	8,772	12,110	7,858	17,244	8,972	20,825	8,792	21,222
.....thousand short tons.....	(4)	(4)	7,404	(4)	4,667	(4)	(4)	(4)
Stone.....	37,416	7,992	11,643	2,864		1,260	12,530	2,357
Sulfur, recovered elemental.....								
Zinc (recoverable content of ores, etc.) ³⁰								
Value of items that cannot be disclosed: Ball clay (1956-57), gem stones (1955-57), lime, magnesium compounds, pear, stone (crushed marble, 1955), and values indicated by footnote 4. Excludes limestone used in manufacturing lime.....		4,184		5,239		4,608		4,699
Total New Jersey.....		47,044		57,495		64,279		64,937

NEW MEXICO

Barite.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Beryllium concentrate.....	117	44	106	56	4,059	81	4,441	98	15
.....gross weight.....	48	83	45	31	31	29	29	33	83
Clays.....	123	727	202	1,236	109	153	137	829	829
.....thousand short tons.....	2,093	4	76	(10)	95	923	866	1	1
Coal.....	66,558	35,729	66,417	49,547	74,345	63,193	67,472	40,618	40,618
.....pounds.....	8,876	(4)	(4)	(4)	(11)	30	(11)	30	30
Columbium-tantalum concentrate.....	(15)	(4)	1,917	67	3,275	115	3,212	112	112
Copper (recoverable content of ores, etc.).....	3,539	124	1,917	25					
.....troy ounces.....	3,887	3	53,721	946	76,072	1,350	69,336	1,189	1,189
Fluorspar.....	41,755	735	3,296	982	6,042	1,897	5,294	1,514	1,514
.....thousand cubic feet.....	887	(4)	1,380	(4)	22,011	31	24	290	290
Gold (recoverable content of ores, etc.).....	20,546	82	40,320	(4)	38,782	1,834	25,499	2,114	2,114
.....thousand long tons, gross weight.....							42,636	152	152
Hellum.....									
Iron ore (usable).....									
.....thousand cubic feet.....									
Lead (recoverable content of ores, etc.).....									
.....thousand short tons.....									
Lime.....									
.....gross weight.....									
Manganese ore (65 percent or more Mn).....									
.....million cubic feet.....									
Manganiferous ore (5 to 35 percent Mn).....									
.....pounds.....									
Mica.....									
.....million cubic feet.....									
Natural gas.....									
.....million cubic feet.....									
Strap.....									
Sheet.....									
.....pounds.....									
Total New Mexico.....		35,049		48,119		55,118		69,890	69,890

Natural-gas liquids:	10,941
Natural gasoline and cycle products..... thousand gallons.....	309,010
L.P. gases..... do.....	16,560
Petroleum (crude)..... thousand 42-gallon barrels.....	1,065
Petroleum (refined)..... do.....	275,930
Potassium salts ¹ K ₂ O equivalent.....	1,971
Pumice..... thousand short tons.....	187,950
Salt (common)..... do.....	241,705
Sand and gravel..... thousand short tons.....	75,122
Silver (recoverable content of ores, etc.)..... thousand troy ounces.....	2,080,475
Sulfur..... thousand short tons.....	667
Tungsten ore and concentrate..... 60-percent WO ₃ basis.....	501
Uranium ore.....	59
Zinc (recoverable content of ores, etc.).....	7,901
Value of items that cannot be disclosed: Carbon dioxide, diatomite (1954-55), molybdenum, magnesium compounds (1954, 1956-57), rare-earth metals concentrates (1956), recovered elemental sulfur, vanadium, and values indicated by footnote 4.....	7,803
.....	7,909
.....	1,348
.....	1,175,742
.....	32,660
Total New Mexico.....	11,583,034

NEW YORK

Cement ¹⁷ thousand 376-pound barrels.....	14,497	38,861	52,150	1,508	1,270
Clays..... thousand short tons.....	1,199	1,494	1,676	174	1,893
Emery..... thousand short tons.....	9,758	1,132	151	(¹¹)	2
Gem stones..... thousand short tons.....	1,134	4,005	4,404	4,817	864
Gypsum..... thousand long tons, gross weight.....	2,803	31,707	38,019	41,094	3,329
Iron ore (usable)..... thousand long tons, gross weight.....	1,187	3,325	1,366	1,030	1,667
Lead (recoverable content of ores, etc.)..... thousand short tons.....	(⁴)	(⁴)	83	505	(⁴)
Lime..... million cubic feet.....	2,598	3,637	1,073	1,160	3,300
Natural gas.....	(⁴)	(⁴)	4,098	1,160	(⁴)
Peat.....	3,257	11,140	2,900	23	(⁴)
Petroleum (crude)..... thousand 42-gallon barrels.....	3,413	22,754	10,310	12,091	6,277
Salt (common)..... thousand short tons.....	30,052	29,756	25,214	27,545	3,691
Sand and gravel..... do.....	35	31	60	28,722	25,640
Silver (recoverable content of ores, etc.)..... thousand troy ounces.....	115	1,742	91	84	64
Slate..... thousand short tons.....	19,410	31,426	1,345	944	39
Stone..... do.....	53,199	11,491	37,919	36,135	24,265
Zinc (recoverable content of ores, etc.).....			13,042	16,196	64,659
Value of items that cannot be disclosed:					
Abrasive stone (1964), beryllium concentrate (1964), natural cement (1954-59), abrasive garnet, iron oxide pigments (1955-57), calcareous marl (1954), recovered elemental sulfur (1964), talc, titanium concentrate, wollastonite, and values indicated by footnote 4.....					
Total New York ⁴	192,738	9,883	8,773	68,969	70,699
.....	216,907	237,016			244,349

See footnotes at end of table.

TABLE 5.—Mineral production in the United States,² 1954-57, by States—Continued
NORTH CAROLINA

Mineral	1954		1955		1956		1957	
	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.....	587	\$12	23 227	\$12	23 454	\$16	1	\$4 85
Beryllium concentrate.....	(1)	(1)	(1)	(1)	(1)	(1)	1	1
Clays.....	1 873	2 590	2 375	1 792	2 663	2 027	2	\$1 407
Feldspar.....	230 744	2 221	242 724	2 188	255 637	3 192	233 439	2 728
Gem stones.....	214	8	190	(6)	(1)	31	(1)	(10)
Lead (recoverable content of ores, etc.).....	4	1	2	7	882	3	1 373	48
Lead (recoverable content of ores, etc.).....	214	1	2	7	882	3	1 373	48
Mica.....	4	1	2	7	882	3	1 373	48
Scrap.....	61 049	1 457	60 887	1 377	47 125	1 065	53 452	1 173
Sheet.....	479 221	1 787	553 444	2 745	770 803	2 135	577 607	1 575
Sand and gravel.....	7 441	5 508	7 786	5 911	7 581	6 264	6 829	5 724
Silver (recoverable content of ores, etc.).....	(3)	(3)	(2)	(1)	1	1	12	11
Stone.....	10 134	15 625	10 903	16 533	7 8352	7 11 472	7 9 455	7 12 839
Talc and pyrophyllite.....	112 704	389	124 206	16 572	125 487	(4)	120 905	(1)
Tungsten concentrate.....	2 538	(4)	2 609	(4)	2 732	(4)	1 828	(10)
Zinc.....								
Value of items that cannot be disclosed: Abrasive stone (millstones, 1954; grinding pebbles and tube-mill liners, 1957), asbestos (1954-55, 1957), clay (benfontle, 1957), copper, lithium minerals, olivine, slate (1957), stone (crushed and dimension granite, crushed limestone, crushed mica, cellanous, and dimension sandstone, 1956); dimension granite, crushed basalt, dimension and crushed marble, crushed limestone, and crushed sandstone (1957), vermiculite (1954-55), and values indicated by footnote 4.								
Total North Carolina.....		12 123		10 075		13 14 135		11 498
		41 651		41 210		13 40 873		37 570

NORTH DAKOTA

Clays.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Coal (lignite).....	1 083	69	3 102	7 261	2 815	6 578	2 561	5 947
Natural gas.....	6 025	12 890	5 256	405	11 725	6 950	12 400	1 100
Petroleum (crude).....	7 105	2 219	11 143	32 200	13 495	39 136	13 642	42 899
Pumice.....	1	4	4	10	5	5	2	2
Sand and gravel.....	1	4	11 169	2 638	5 946	4 259	7 048	4 967
Stone.....			77	80	83	87	29	52
Sulfur, recovered elemental.....					1 735	46	10 314	264

Value of items that cannot be disclosed: Certain minerals and values indicated by footnote 4.....	7,041	1,529	2,423	2,698
Total North Dakota.....	22,223	44,123	53,555	57,796

OHIO

Abrasive stones, grindstones and pulpstones.....	(1)	(1)	(1)	(1)	1,505	\$132
Cement.....	13,077	\$35,929	14,914	\$49,794	16,238	52,184
Clays.....	3,061	11,137	6,297	15,677	6,136	16,073
Coal.....	32,469	117,520	37,870	133,814	38,934	148,650
Lime.....	2,849	31,444	3,039	39,394	2,995	38,383
Natural gas.....	28,824	6,111	33,766	7,895	25,368	29,300
Peat.....	29,840	10,357	22,484	249	15,509	102
Petroleum (crude).....	2,860	10,110	4,353	12,680	4,785	17,694
Salt (common).....	5,787	12,399	2,905	14,769	2,972	16,923
Sand and gravel.....	25,837	27,373	27,905	30,200	36,146	16,936
Stone.....	32,627	41,802	33,273	49,841	1,90,947	7,37,451
Value of items that cannot be disclosed: Calcium-magnesium chloride (1954-59), gypsum, natural gasline, stone (crushed sandstone), 1958-dimension limestone and calcareous marl, 1957, recovered elemental sulfur (1954-56), and values indicated by footnote 4.....	2,084	2,865	5,394	5,394	375,488	2,452
Total Ohio.....	283,659	340,457	375,488	375,488	385,858	385,858

OKLAHOMA

Clays.....	452	1,283	724	727	705	701	641	642
Coal.....	1,915	11,268	2,164	12,668	2,007	12,341	2,195	14,195
Lead (recoverable content of ores, etc.).....	14,204	3,892	14,126	4,200	12,350	3,878	7,163	2,094
Natural gas.....	616,355	43,145	614,976	49,503	678,603	54,288	685,000	663,500
Natural-gas liquids.....								
Natural gasoline and cycle products.....	478,590	24,332	504,692	28,770	489,983	26,543	460,644	25,329
LP-gases.....	453,810	13,506	512,320	14,297	579,101	23,427	587,140	21,824
Petroleum (crude).....	185,851	518,520	202,817	563,830	215,862	600,066	216,111	651,786
Pumice.....	(1)	(1)	(1)	(1)	(1)	3	(1)	(1)
Salt (common).....	5,424	4,265	6,294	4,786	5,947	4,842	7	63
Sand and gravel.....	9,239	9,147	10,933	12,295	10,547	12,417	22,016	14,064
Stone.....	43,171	9,325	41,543	10,220	27,515	7,539	22,236	3,469
Tripoli.....								
Zinc (recoverable content of ores, etc.).....								
Value of items that cannot be disclosed: Native asphalt, clay (bentonite, 1955-57), cement, gypsum, lime, manganese ore (1957), stone (dimension limestone 1954), recovered elemental sulfur, uranium ore (1956), and values indicated by footnote 4.....								
Total Oklahoma.....	12,584	15,525	12,989	12,989	14,866	12,989	14,866	14,866
Total Oklahoma.....	650,205	711,089	12,757,120	803,937	803,937	803,937	803,937	803,937

See footnotes at end of table.

Petroleum (crude).....	thousand 42-gallon barrels.....	9, 107	31, 150	8, 531	30, 200	8, 230	35, 718	\$ 8, 179	\$ 38, 987
Pyrophyllite (sericite schist).....	.....	1, 898	9	13, 313	(¹)	(¹)	(¹)	(¹)	(¹)
Sand and gravel.....	thousand short tons.....	14, 218	20, 596	10	20, 512	14, 047	21, 321	12, 406	19, 570
Silver (recoverable content of ores, etc.).....	thousand troy ounces.....	8	8	10	9	(¹)	(¹)	(¹)	(¹)
Slate.....	thousand short tons.....	194	4, 419	186	4, 421	154	4, 194	139	4, 005
Stone.....	do.....	40, 522	61, 193	44, 438	17 68, 918	7 44, 913	7 73, 831	43, 258	73, 090
Sulfur, recovered elemental.....	long tons.....	(¹)	(¹)	7, 738	263	11, 350	7 386	(¹)	(¹)
Trippol.....	.....	(¹)	(¹)	1, 090	6	1, 030	7	(¹)	(¹)
Value of items that cannot be disclosed: Clays (kaolin 1956), copper, gem stones (1955-57), mica, pyrites, stone (dimension basalt 1956, shell 1956), and values indicated by footnote 4.									
Total Pennsylvania ¹.....	.....	12, 549	925, 545	.....	969, 910	.....	16, 202	.....	16, 911

RHODE ISLAND

Sand and gravel.....	thousand short tons.....	1, 013	980	1, 941	1, 498	1, 308	1, 283	1, 058	1, 060
Stone.....	do.....	(¹)	(¹)	(¹)	(¹)	42	221	7 4	7 14
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4.									
Total Rhode Island.....	.....	481	481	.....	336	.....	143	.....	285
Total South Carolina.....									

SOUTH CAROLINA

Clays.....	thousand short tons.....	1, 136	4, 702	1, 066	5, 463	1, 087	5, 450	937	6, 161
Mica (sheet).....	pounds.....	(¹)	(¹)	(¹)	(¹)	5, 400	14	2, 278	12
Sand and gravel.....	thousand short tons.....	2, 814	2, 550	3, 127	2, 677	3, 239	2, 926	2, 647	2, 871
Stone.....	do.....	2, 862	4, 233	3, 455	4, 921	3, 804	4, 285	7 3, 413	7 4, 581
Value of items that cannot be disclosed: Barite, cement, kyanite, serap mica, rare-earth metals concentrates (1956-57), staurolite (1957), stone (dimension granite, 1953-54; dimension granite and crushed limestone, 1956-57; calcareous mar, 1957), titanium (1956-57), vermiculite, zirconium concentrate (1957), and values indicated by footnote 4.									
Total South Carolina ¹¹.....	.....	6, 374	17, 744	.....	20, 197	.....	9, 277	.....	10, 491
Total Pennsylvania.....									

SOUTH DAKOTA

Beryllium concentrate.....	gross weight.....	337	140	294	157	195	95	263	145
Clays.....	thousand short tons.....	(¹)	(¹)	(¹)	(¹)	201	201	176	176
Coal (lignite).....	do.....	26, 447	43	26	90	25	90	21	79
Columbium-tantalum concentrate.....	pounds.....	26, 447	43	5, 638	10	237	(¹⁰)	2, 311	6
Feldspar.....	long tons.....	(¹¹)	(¹)	42 164	267	45, 226	289	41, 316	267
Gem stones.....	.....	(¹¹)	5	(¹¹)	7	(¹¹)	10	(¹¹)	15

See footnotes at end of table.

TABLE 5.—Mineral production ¹ in the United States, 1954-57, by States—Continued
SOUTH DAKOTA—Continued

Mineral	1954		1955		1956		1957	
	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)
Gold (recoverable content of ores, etc.)..... troy ounces.....	541, 445	\$18, 951	529, 965	\$18, 545	568, 523	\$19, 868	568, 130	\$19, 885
Gypsum..... thousand short tons.....	6	11	13	16	16	63	13	53
Iron ore (usable)..... thousand long tons, gross weight.....	2	(¹)		(¹)	22	100	(¹)	(¹)
Lead.....								
Scrap.....								
Sheet.....	1, 510	27	1, 322	27	1, 288	31	1, 626	43
Neat..... million pounds.....	16, 299	65	4, 854	21	12, 494	167	9, 083	46
Sand and gravel..... thousand short tons.....	7							
Silver (recoverable content of ores, etc.)..... thousand short tons.....	14, 819	7, 840	13, 533	10, 097	12, 539	8, 423	14, 753	8, 101
Sulfur..... thousand short tons.....	151	137	140	140	136	123	135	122
Uranium ore..... thousand short tons.....	1, 615	4, 929	2, 262	5, 660	2, 200	5, 725	1, 718	5, 068
Uranium concentrate..... 60-percent U ₃ O ₈ basis.....	(²)	1						
Value of items that cannot be disclosed: Cement, clays (bentonite, 1956-57), lime, lithium minerals (1954), petroleum, vanadium (1954), and values indicated by footnote 4.....		6, 121		6, 115		7, 547		6, 084
Total South Dakota ¹		37, 874		40, 826		12, 42, 281		39, 990

TENNESSEE

Cement..... thousand 376-pound barrels.....	7, 569	19, 724	8, 812	23, 673	8, 755	25, 435	7, 415	22, 806
Clays..... thousand short tons.....	1, 015	3, 781	1, 208	4, 170	1, 379	4, 888	1, 154	4, 228
Coal..... do.....	6, 429	25, 477	7, 053	28, 747	8, 848	35, 609	7, 955	31, 147
Copper (recoverable content of ores, etc.).....	9, 087	5, 362	9, 911	7, 394	10, 449	8, 882	9, 790	5, 894
Gold (recoverable content of ores, etc.)..... troy ounces.....	218	8	221	8	189	7	172	6
Lead (recoverable content of ores, etc.).....								
Lime..... thousand short tons.....	80	968	103	1, 102	125	1, 436	94	1, 134
Manganese ore (35 percent or more Mn)..... gross weight.....	11, 823	920	15, 395	1, 280	17, 821	1, 417	12, 938	1, 007
Natural gas..... million cubic feet.....	89	10	39	5	45	6	35	5
Phosphate rock..... thousand short tons.....	1, 633	11, 743	1, 463	10, 626	1, 685	11, 643	1, 812	12, 514
Sand and gravel..... thousand short tons.....	5, 155	6, 141	5, 137	6, 629	5, 629	6, 480	5, 617	6, 641
Silver (recoverable content of ores, etc.)..... thousand short tons.....	61	55	67	60	65	59	54	49
Stone (recoverable content of ores, etc.)..... thousand short tons.....	14, 040	22, 046	14, 381	22, 276	15, 556	23, 796	15, 354	24, 155
Zinc (recoverable content of ores, etc.).....	30, 328	6, 550	40, 216	9, 893	46, 023	12, 610	53, 063	13, 470
Value of items that cannot be disclosed: Barite, fluorspar (1956-57), iron ore, manganese ore (1954), scrap mica (1956-57), petroleum, pyrites, stone (crushed sandstone, 1956; crushed granite and crushed sandstone, 1957), and minerals indicated by footnote 4.....		5, 480		6, 994		8, 772		8, 029
Total Tennessee ¹		105, 086		119, 316		137, 846		123, 738

TEXAS

Cement.....	21,923	56,674	24,856	67,549	25,966	75,665	22,144	68,541
Clays.....	2,401	7,002	(1)	5,100	3,146	4,765	2,992	4,934
Copper (recoverable content of ores, etc.).....				1				
Gen. stones.....				115		115	(1)	100
Gypsum.....	1,818	3,773	1,349	4,220	1,157	3,623	1,043	3,343
Helium.....	110,983	1,874	139,397	2,272	145,880	2,364	204,286	3,353
Iron ore (usable).....	415	(2)	875	(3)	(4)	(5)	(6)	(7)
Lime.....	3,422	3,422	3,583	3,549	(1)	6,988	798	(9)
Natural gas.....	4,551,232	386,555	4,730,798	378,404	4,909,859	484,990	5,256,000	478,489
Natural-gas liquids.....								
Natural gasoline and cycle products.....	2,732,100	200,559	2,987,808	206,506	2,984,609	216,378	2,944,381	201,423
L.P.-gases.....	2,982,929	40,913	3,453,430	10,114	3,731,047	144,745	3,831,694	187,618
Petroleum (crude).....	2,973,273	2,765,400	1,053,207	2,982,300	1,107,808	131,225	1,083,812	3,369,317
Salt (common).....	2,563	2,310	3,583	3,897	3,963	14,370	4,012	17,104
Sand and gravel.....	28,310	24,841	31,518	25,490	29,386	27,213	23,085	32,427
Sodium sulfate.....	(1)	(1)	45,718	28,090	(2)	(3)	(4)	(5)
Stone.....	23,840	29,344	27,321	33,544	52,773	36,350	30,960	35,358
Sulfur (Frasch-process).....	3,474	92,792	3,767	105,128	2,437	3,596	2,219	70,256
Sulfur, recovered elemental.....	107,232	2,880	114,989	3,144	140,164	3,865	162,761	4,022
Talc and soapstone.....	19,862	2,128	35,064	3,213	41,332	244	47,780	1,199
Value of items that cannot be disclosed: Abrasive stones, native asphalt, bromine, clay, (tuller's earth 1955-57), coal (lignite), Feldspar (1957), graphite, magnesium chloride (for metal), magnesium compounds (except for metal), mercury (1955-57), peat (1954), pumice, silver (1954-55), stone (dimensional sandstone, 1954), uranium ore (1956-57), and values indicated by footnote 4.....								
Total Texas.....	52,527	3,730,705	50,069	3,993,310	12,245,123	11,623,354		71,510

UTAH

Asphalt and related bitumens, native: Gilsomite.....	75,943	2,724	82,822	3,117	(1)	(2)	206,041	4,259
Clays.....	(3)	(4)	(5)	(6)	(7)	(8)	(9)	4,473
Coal.....	5,908	20,761	6,296	40,005	6,522	34,436	6,858	40,263
Copper (recoverable content of ores, etc.).....	211,835	124,983	232,049	173,780	250,604	213,013	237,887	143,190
Fluorspar.....	4,403	82	7,328	151	10,581	10,265	11,087	387
Gen. stones.....				6	(1)	10	(2)	12
Gold (recoverable content of ores, etc.).....	403,401	14,119	441,206	15,442	416,031	14,561	378,438	13,245
Iron ore (usable).....	3,941	19,277	3,847	24,688	4,002	27,508	4,156	30,383
Lead (recoverable content of ores, etc.).....	44,972	12,322	50,452	15,035	49,555	15,560	44,471	12,719
Lime.....	30	432	39	583	55	830	43	821
Manganese ore (35 percent or more Mn).....	25	(1)					142	12
Manganiferous ore (5 to 35 percent Mn).....	97	(2)						
Natural gas.....	16,024	2,259	17,163	2,386	17,268	2,435	19,009	2,700
Petroleum (crude).....	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Phosphate rock.....	1,905	4,480	2,227	5,140	2,466	5,302	4,093	9,291
Pumice.....	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Salt (common).....	4	4	196	20	45	330	38	148
Sand and gravel.....	167	1,020	1,339	1,471	1,471	221	221	2,013
See footnotes at end of table.	5,328	3,592	5,158	3,309	5,836	4,476	26,968	15,485

Manganese ore (35 percent or more Mn).....	22,678	1,781	22,654	2,779	20,231	1,902	12,655	1,058
Mari, calcareous (except for cement).....	33,174	21	(1)	(1)	10,522	12	(1)	(1)
Mica, sheet.....	1,401	380	(1)	968	2,396	6	529	6
Natural gas.....	7,115	8,658	6,461	8,076	2,926	810	* 2,500	* 700
Petroleum (crude).....	17	469	32	820	7,783	(1)	6,298	(1)
Sand and gravel.....	10,884	18,138	11,966	19,870	14,082	23,076	17,944	121,003
Silver (recoverable content of ores, etc.).....	16,738	3,615	18,329	4,509	19,196	5,181	23,080	5,277
Stone.....								
Talc (recoverable content of ores, etc.).....								
Value of items that cannot be disclosed: Apilite, cement, feldspar, gem stones (1957-58), Ely iron ore (1964), iron oxide pigments, kyanite, manganese (1956-57), mica (scrap 1954-55), pyrites, salt, stone (dimension miscellanea), titanium sandstone and calcareous marl (1957), talc and soapstone, titanium concentrate, and values indicated by footnote 4.								
Total Virginia ¹	19,403	129,603	24,046	172,541	24,931	208,805	28,154	324,331

WASHINGTON

Abrasive stone: Pebbles (grinding).....	(1)	(1)	(1)	(1)	25	(1)	25	(1)
Barite.....	(1)	(1)	22	22	30	3	(1)	(1)
Chromite.....	261	318	365	412	329	440	298	488
Clays.....	619	4,478	610	4,263	473	3,432	390	2,761
Coal.....	3,636	2,145	3,958	2,993	2,926	2,487	1,700	1,023
Copper (recoverable content of ores, etc.).....	(1)	(1)	(1)	5	(1)	(1)	(1)	(1)
Epsumite.....	(1)	(1)	(1)	(1)	(1)	75	(1)	75
Gem stones.....	96,740	2,336	74,360	2,602	70,669	2,473	(1)	(1)
Gold (recoverable content of ores, etc.).....	(1)	(1)	4	4	(1)	(1)	(1)	(1)
Iron.....	9,998	2,723	10,340	3,081	11,657	3,660	12,734	3,642
Lead (recoverable content of ores, etc.).....	43,134	153	37,640	113	37,043	3,129	39,364	155
Peat.....	16,045	(1)	21,645	19,351	16,842	15	19,924	(1)
Sand and gravel.....	314	13,595	436	19,351	16,842	15	19,924	(1)
Silver (recoverable content of ores, etc.).....	5,367	9,527	6,593	10,580	8,057	11,660	8,454	10,600
Stone.....	(1)	(1)	(1)	46	(1)	(1)	4,065	24
Talc and soapstone.....	18	66	12	7,296	25,609	7,017	24,000	5,568
Tungsten concentrate.....	22,304	4,818	29,536	19,765	13,736	13,736	18,950	18,950
Zinc (recoverable content of ores, etc.).....				67,334	61,723	61,723	58,690	58,690
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, lime, magnesite, mercury (1957), olivine, petroleum (1957), strontium minerals (1956-57), uranium ore (1956-57), and values indicated by footnote 4.								
Total Washington ²	53,300	16,924	72,536	19,765	61,723	61,723	58,690	58,690

See footnotes at end of table.

TABLE 5.—Mineral production in the United States, 1954-57, by States—Continued
WEST VIRGINIA

Mineral	1954		1955		1956		1957	
	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.....	587	\$1,451	707	\$2,563	770	\$2,449	708	\$2,091
Coal.....	115,996	541,370	139,168	653,388	155,890	824,043	156,842	875,587
Natural gas.....	(¹)	(¹)	(¹)	(¹)	1,685	1	(^{1b})	(^{1b})
Natural gas liquids:	191,601	45,601	212,403	49,915	204,717	48,518	204,900	49,200
LP-gases.....	41,076	2,593	35,756	2,352	35,728	2,094	30,435	2,185
LP-liquids.....	142,884	5,035	286,871	6,376	240,989	12,031	235,851	6,143
Petroleum (crude).....	2,902	8,500	2,320	7,080	2,179	8,411	2,215	6,436
Salt (common).....	472	2,886	638	3,477	681	3,453	648	2,642
Sand and gravel.....	4,074	8,351	5,171	9,779	5,110	10,711	5,354	9,893
Stone.....	7,315	11,743	5,899	9,714	6,579	10,765	6,989	11,894
Value of items that cannot be disclosed: Abrasive stone, (1955), bromine, calcium-magnesium chloride, cement, lime, manganese ore (1957), recovered elemental sulfur, and values indicated by footnote 4.		10,504		12,930		14,590		14,984
Total West Virginia ¹		636,311		755,512		935,074		982,719
WISCONSIN								
Abrasive stones: Pebbles (grinding).....	(¹) 180	(¹) 174	(¹) 165	(¹) 166	1,093	31	1,790	43
Clays.....	1,429	(¹) 436	1,886	(¹) 581	1,488	172	1,131	136
Iron ore (usable).....	1,261	346	1,948	581	2,552	(¹) 811	1,576	(¹) 543
Lead (recoverable content of ores, etc.).....	1,115	1,135	1,768	1,768	(¹) 6	(¹) 6	(¹) 1,900	(¹) 543
Lime.....	19,607	10	14,087	7	11,074	(¹) 6	(^{1b}) 400	(¹) 543
Meat, calcareous (except for cement).....	23,979	(¹) 396	27,978	19,958	27,115	19,097	29,394	18,094
Peat.....	8,289	16,188	12,180	18,843	11,126	20,402	12,434	22,455
Sand and gravel.....	15,534	3,355	18,326	4,508	23,990	6,546	21,575	5,006
Stone.....								
Zone (recoverable content of ores, etc.).....								
Value of items that cannot be disclosed: Abrasive stone (tube-mill liners, 1954-56), cement, gem stones (1957), stone (crushed basalt, 1955), and values indicated by footnote 4.								
Total Wisconsin ¹		15,840		20,528		19,451		22,590
		54,286		65,813		65,860		68,644

WYOMING

Beryllium concentrate..... gross weight.	9,534	10,036	10,974	(¹) 1,086	(¹) 1,084	1,069	83
Clays..... thousand short tons.	2,831	2,927	11,845	2,553	9,920	2,117	11,973
Cool..... do.	1			3	8	4	7,777
Copper (recoverable content of ores, etc.)..... long tons.				1,201			2
Feldspar.....				(¹¹) 762	75	(¹¹) 573	(¹) 55
Gold (recoverable content of ores, etc.)..... Troy ounces.	407	52	2	11	27		20
Gypsum..... thousand short tons.	7	22	89		46		
Iron ore (usable)..... thousand long tons, gross weight.	458	749	(¹) 89	650			(¹) 736
Natural gas..... million cubic feet.	71,068	77,819	6,615	84,398	7,283	90,000	8,400
Natural gas liquids.....							
Oil..... thousand gallons.	47,082	40,200	2,775	48,859	3,160	47,709	2,966
L.P. gas..... do.	46,084	46,108	1,961	48,053	2,337	57,805	2,566
Petroleum (crude)..... thousand 42-gallon barrels.	93,533	99,483	239,750	104,830	265,785	106,616	283,599
Phosphate rock..... thousand long tons.	(¹)	55	345	119	721	121	18
Pumice..... thousand short tons.	(¹)	(¹)	(¹)	46	38	49	41
Rare-earth metals concentrates.....							
Sand and gravel..... thousand short tons.	4,164	3,952	3,978	3,904	2,935	2,426	1,905
Sodium carbonate (natural).....	(¹) 616	(¹)	(¹)	337,851	8,345	(¹)	(¹)
Stone..... thousand short tons.	113,101	1,303	2,034	1,353	2,076	1,291	2,296
Sulfur, recovered elemental..... long tons.		120,997	3,206	121,161	3,214	107,366	2,767
Tungsten ore and concentrate .60-percent WO ₃ basis							
Uranium ore.....				156,509	156,509		
Value of items that cannot be disclosed: Cement, fire clay (1957), silver, sodium sulfate, vanadium, and values indicated by footnote 4.			14,983		2,765	274,699	4,669
Total Wyoming ²	281,306	297,752	14,983	7,894	7,894	17,527	345,604

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
² Includes Alaska and Hawaii.
³ Excludes pozzolan cement and slag, 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 Total adjusted to eliminate duplication in the value of clays and stone.
⁹ Less than 1,000 short tons.
¹⁰ Weight not recorded.
¹¹ Revised figure.
¹² Excludes masonry cement, value for which is included with "Items that cannot be disclosed."
¹³ Sheet mica only.

¹⁴ Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and/or lime.
¹⁵ Beginning with 1957 calcareous marl included with stone.
¹⁶ Excludes natural cement, value for which is included with "Items that cannot be disclosed."
¹⁷ Less than 1,000 long tons.
¹⁸ Final figure. Supersedes preliminary figure given in commodity chapter.
¹⁹ 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.
²⁰ Marketable production. Supersedes figures for "sold or used" as previously reported.
²¹ Less than 1 ton.
²² Grinding pebbles and tube-mill liners, weight of millstones not recorded.
²³ Millstones only.
²⁴ Less than 1,000 Troy ounces.
²⁵ Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low-grade ore and concentrate stockpiled near Coquille, Oregon during World War II.

TABLE 6.—Mineral production ¹ in the Canal Zone and islands administered by the United States, ² 1954-57

Mineral	1954		1955		1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)
American Samoa:								
Sand and gravel.....	2	\$1	1	\$1				
Stone.....	58	15	9	4	2	\$6	34	\$37
Total American Samoa.....		16		5		6		37
Canal Zone:								
Sand and gravel.....								
Stone (crushed).....	187	245	36	47	40	48	59	99
Total Canal Zone.....		245	1	287	2	278		99
Canton: Stone (crushed).....	3	5	1	2	2	5		
Guam:								
Sand and gravel.....	843	2,275			19	24	1	1
Stone.....			1,241	3,852	341	311	1,034	1,132
Total Guam.....		2,275		3,852		335		1,133
Johnston: Stone.....	(³)	(⁴)	12	33	203	304	3,875	6,700
Midway: Stone (crushed).....	(³)	2			5	12	11	31
Virgin Islands: Stone (crushed).....	4	17	1	3	22	22	5	6
Wake: Stone (crushed).....	1	1						

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.

³ Less than 1,000 short tons.

⁴ Less than \$1,000.

TABLE 7.—Mineral production¹ in the Commonwealth of Puerto Rico, 1954-57

Mineral	1954		1955		1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sand) (s)	Short tons (unless otherwise stated)	Value (thou- sand) (s)	Short tons (unless otherwise stated)	Value (thou- sand) (s)	Short tons (unless otherwise stated)	Value (thou- sand) (s)
Cement.....	3,682	\$9,663	4,117	\$12,507	4,255	\$14,065	5,552	\$17,232
Clays.....	(*) 8	(*) 199	137	122	143	129	159	140
Lime.....	254	10	10	10	(*) 101	(*) 101	(*) 10	104
Salt (common).....	9	98	10	112	183	192	497	754
Sand and gravel.....	375	834	433	679	2,076	2,556	2,452	3,595
Stone.....	1,752	2,493	1,784	2,516				
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 2.....		154				195		180
Total Puerto Rico ⁴		12,381		14,917		16,395		20,265

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 stone, value for which is included with "Items that cannot be disclosed."

⁴ Total has been adjusted to eliminate duplication in the value of stone.

TABLE 8.—Principal minerals imported for consumption in the United States, 1956-57

[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	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Metal.....	216,401	\$100,137	222,158	¹ \$107,336
Scrap.....	25,992	¹ 10,770	16,271	¹ 5,396
Plates, sheets, bars, etc.....	22,582	¹ 16,480	19,633	¹ 15,099
Antimony:				
Ore (antimony content).....	6,572	1,762	8,198	1,973
Needle or liquated.....	46	23	38	17
Metal.....	4,321	2,245	5,412	2,587
Oxide.....	1,479	636	1,893	790
Arsenic: White.....	6,422	745	10,135	794
Bauxite:				
Crude.....	² 5,669,833	44,414	² 7,100,998	60,951
Calcined:				
When imported for manufacture of fire brick..... long tons.....	138,716	3,198	67,172	1,522
Other..... do.....	9,960	221	50	⁽³⁾
Beryllium ore.....	12,371	4,459	7,290	2,526
Bismuth..... pounds.....	924,614	1,830	837,603	¹ 1,598
Boron carbide..... do.....	93,675	172	74,162	123
Cadmium:				
Metal..... do.....	3,115,638	4,640	1,585,547	2,424
Flue dust (cadmium content)..... do.....	1,451,889	876	1,399,851	837
Calcium:				
Metal..... do.....	8,387	10	24,204	¹ 39
Chloride.....	1,855	60	1,989	77
Chromate:				
Ore and concentrates (Cr ₂ O ₃ content).....	919,255	49,350	982,889	55,661
Ferrochrome (chromium content).....	⁴ 25,973	⁴ 11,403	30,910	14,460
Metal.....	409	¹ 687	1,354	¹ 2,748
Cobalt:				
Alloy (cobalt content)..... pounds.....	2,013,463	⁽⁵⁾	816,501	⁽⁵⁾
Ore (cobalt content)..... do.....	5,839	3	15,179	20
Metal..... do.....	12,974,393	32,910	⁶ 16,240,327	⁶ 32,559
Oxide (gross weight)..... do.....	828,450	¹ 1,413	646,750	853
Salts and compounds (gross weight)..... do.....	397,711	247	364,381	179
Columbium ore..... do.....	5,699,553	8,387	3,348,706	3,038
Copper (copper content):				
Ore.....	6,089	4,049	20,940	12,212
Concentrates.....	74,651	54,514	62,398	34,275
Regulus, black, coarse.....	5,198	4,395	5,324	3,196
Unrefined, black, blister.....	276,085	¹ 225,932	301,182	179,440
Refined in ingots, etc.....	191,812	157,944	162,309	97,025
Old and scrap.....	5,410	¹ 3,463	5,801	¹ 3,039
Old brass and clippings.....	4,310	¹ 3,003	4,643	¹ 2,393
Ferrous alloys: Ferrosilicon (silicon content).....	5,005	1,737	3,813	1,679
Gold:				
Ore and base bullion..... troy ounces.....	1,197,136	41,785	1,185,917	41,474
Bullion..... do.....	2,532,611	90,882	6,515,253	231,167
Iron ore:				
Ore..... long tons.....	³ 40,410,652	² 450,490	33,653,048	285,060
Pyrites cinder..... do.....	1,430	6	567	¹ 2
Iron and steel:				
Pig iron.....	326,700	17,842	225,387	13,528
Iron and steel products (major):				
Semimanufactures.....	⁴ 382,754	¹ 44,005	282,830	33,624
Manufactures.....	⁴ 1,096,077	¹ 416,233	1,011,392	170,866
Scrap.....	222,936	¹ 10,381	203,407	9,078
Tin-plate scrap.....	32,633	¹ 932	35,203	1,072
Lead:				
Ore, flue dust, matte (lead content).....	191,302	50,621	228,783	60,459
Base bullion (lead content).....	31	11	25	8
Pigs and bars (lead content).....	262,204	¹ 77,719	327,236	86,937
Reclaimed, scrap, etc (lead content).....	20,464	¹ 5,283	7,610	¹ 1,646
Sheets, pipe, and shot.....	7,654	12,017	5,917	¹ 1,377
Babbit metal and solder (lead content).....	2,626	¹ 3,381	2,100	¹ 3,049
Type metal and antimonial lead (lead content).....	8,500	2,763	4,858	¹ 5,527
Manufactures.....	235	¹ 184	659	¹ 360

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Magnesium:				
Metallic and scrap.....	630	\$304	982	\$480
Alloys (magnesium content).....	24	203	35	283
Sheets, tubing, ribbons, wire and other forms (magnesium content).....	2	49	8	17
Manganese:				
(Ore (35 percent or more manganese) (manganese content).....)	1,007,240	69,726	1,167,112	96,699
Ferromanganese (manganese content).....	123,953	28,500	257,821	60,232
Spiegeleisen, less than 30 percent manganese, more than 1 percent carbon.....	234	18		
Mercury:				
Compounds..... pounds.....	27,985	100	19,221	68
Metal..... 76 pound flasks.....	47,316	11,010	42,005	9,333
Minor metals: Selenium and salts..... pounds.....	234,969	3,452	172,678	1,904
Molybdenum: Ore and concentrates (molybdenum content)..... do.....			27,461	55
Nickel:				
Ore and matte.....	12,820	4,592	13,177	5,202
Pigs, ingots, shot, cathodes.....	106,534	152,409	99,676	155,213
Scrap.....	1,078	1,479	410	573
Oxide.....	32,955	31,776	37,080	42,925
Platinum group:				
Unrefined materials:				
Ore and concentrates..... troy ounces.....			1,572	119
Grains and nuggets, including crude, dust, and residues..... troy ounces.....	34,016	2,854	26,628	1,960
Sponge and scrap..... do.....	6,234	551	2,129	160
Osmiridium..... do.....	971	56	2,851	163
Refined metal:				
Platinum..... do.....	436,757	40,982	306,195	25,141
Palladium..... do.....	530,686	10,958	327,558	6,303
Iridium..... do.....	2,323	203	1,431	109
Osmium..... do.....	347	25	1,126	9
Rhodium..... do.....	20,323	2,039	16,629	1,688
Ruthenium..... do.....	2,220	87	1,864	75
Radium:				
Radium salts..... milligrams.....	43,221	633	76,206	1,061
Radioactive substitutes.....	(7)	514	(7)	844
Rare earths: Ferrocerium and other cerium alloy..... pounds.....	12,536	40	7,948	126
Silver:				
Ore and base bullion..... troy ounces.....	63,125,065	52,900	99,925,905	78,260
Bullion..... do.....	99,706,716	75,209	106,192,994	79,400
Tantalum: Ore..... pounds.....	1,312,865	1,180	828,265	949
Tin:				
Ore (tin content)..... long tons.....	16,688	32,317	94	118
Blocks, pigs, grains, etc..... do.....	62,590	136,412	56,183	121,311
Dross, skimmings, scrap, residues, and tin alloys n.s.p.f..... pounds.....	11,364,288	9,430	11,382,988	9,488
Tin foil, powder, flitters, etc.....	(7)	605	(7)	561
Titanium:				
Ilmenite.....	359,281	9,198	460,353	10,317
Rutile.....	48,906	7,143	84,837	11,843
Metal..... pounds.....	4,095,621	9,509	7,064,672	16,722
Ferrotitanium..... do.....	225,967	92	256,000	100
Compounds and mixtures..... do.....	1,387,548	354	135,116	179
Tungsten (tungsten content):				
Ore and concentrates..... do.....	20,860,153	58,011	14,018,140	34,525
Metal..... do.....	37,456	119	82,617	1239
Ferrotungsten..... do.....	870,621	1,945	414,877	674
Other..... do.....	146,663	328	66,955	112
Zinc:				
Ores (zinc content).....	462,379	49,231	679,322	88,491
Blocks, pigs, and slabs.....	244,726	65,034	268,852	64,057
Sheets.....	454	172	732	245

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless other- wise stated)	Value (thou- sands)	Short tons (unless other- wise stated)	Value (thou- sands)
METALS—continued				
Zinc—Continued				
Old, dross, and skimmings.....	602	\$97	590	\$89
Dust.....	72	118	112	128
Manufactures.....	(?)	1287	(?)	1264
Zirconium: Ore, including zirconium sand.....	31,140	792	41,692	1,142
NONMETALS				
Abrasives: Diamonds (industrial)..... carats..	4 16,413,281	1474,322	12,570,343	1 51,145
Asbestos.....	4 689,910	14 61,939	682,732	1 60,140
Barite:				
Crude and ground.....	589,421	14 3,615	833,049	1 5,875
Witherite.....	2,934	110	3,029	138
Chemicals.....	4,956	1467	5,369	1 502
Bromine..... pounds.....	2,918	135	1,512	38
Cement..... 376-pound barrels.....	4,456,120	114,189	4,426,297	1 14,819
Clays:				
Raw.....	172,244	12,873	159,866	1 2,859
Manufactured.....	3,617	198	2,987	79
Cryolite.....	23,122	2,901	32,712	4,022
Feldspar: Crude..... long tons.....	258	9	72	7
Fluorspar.....	485,552	111,225	631,367	1 16,031
Gem stones:				
Diamonds..... carats.....	4 1,869,974	14 162,012	1,612,471	1 142,560
Emeralds..... do.....	50,931	1 1,688	37,245	1 1,595
Other.....	(?)	124,009	(?)	1 24,417
Graphite.....	47,888	12,594	41,530	2,107
Gypsum:				
Crude, ground, calcined.....	4 4,347,281	17,853	4,335,337	17,604
Manufactures.....	(?)	1 693	(?)	1 911
Iodine, crude..... pounds.....	1,704,868	2,180	2,685,489	2,769
Jewel bearings..... number, thousands.....	54,800	12,456	70,127	12,780
Kyanite.....	6,951	306	5,999	263
Lime:				
Hydrated.....	757	12	245	5
Other.....	31,903	549	39,002	687
Dead-burned dolomite.....	9,031	587	10,419	640
Magnesium:				
Magnesite.....	102,765	6,446	80,638	4,298
Compounds.....	13,423	1497	12,582	510
Mica:				
Uncut sheet and punch..... pounds.....	1,958,907	13,748	1,841,840	13,359
Scrap.....	7,218	79	5,187	57
Manufactures.....	5,411	17,926	5,766	18,032
Mineral-earth pigments: Iron oxide pigments:				
Natural.....	3,168	138	3,079	1125
Synthetic.....	5,997	1879	7,033	11,046
Ocher, crude and refined.....	206	12	203	12
Siennas, crude and refined.....	722	171	676	56
Umber, crude and refined.....	2,762	89	1,944	165
Vandyke brown.....	200	12	139	10
Nitrogen compounds (major).....	1,473,260	167,431	1,402,427	1 58,308
Phosphate, crude..... long tons.....	109,891	2,626	109,546	3,090
Phosphatic fertilizers..... do.....	32,251	1,906	29,175	12,246
Pigments and salts:				
Lead pigments and salts.....	5,851	11,530	8,565	1,912
Zinc pigments and salts.....	5,793	11,146	6,967	1,336
Potash.....	4 333,951	12,018	338,690	1 11,823
Pumice:				
Crude or unmanufactured.....	19,487	111	35,182	291
Whole or partly manufactured.....	1,315	51	2,124	170
Manufactures, n. s. p. f.....	(?)	1 8	(?)	1 14
Quartz crystal (Brazilian pebble)..... pounds.....	1,166,460	1,249	1,546,236	729
Salt.....	368,212	12,354	654,149	13,546
Sand and gravel:				
Glass sand.....	478	393	683	621
Other sand.....	332,031	1454	290,280	1437
Gravel.....	179	(?)	14,877	122

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS—continued				
Sodium sulfate.....	103,249	\$2,174	74,111	\$1,511
Stone.....	(¹)	7,609	(⁷)	¹ 8,504
Strontium: Mineral.....	9,439	192	6,525	131
Sulfur and pyrites:				
Sulfur:				
Ore..... long tons.....	14,750	359	14,454	350
Other forms, n. e. s..... do.....	⁴ 197,479	4,975	481,214	¹ 11,882
Pyrites..... do.....	⁸ 73,286	¹ 480	⁸ 70,682	¹ 408
Talc: Unmanufactured.....	23,351	1,749	20,395	1,701
COAL, PETROLEUM, AND RELATED PRODUCTS				
Asphalt and related bitumen.....	4,116	99	3,972	104
Carbon black:				
Acetylene black..... pounds.....	8,373,224	1,383	7,571,116	1,342
Gas black and carbon black..... do.....	69,890	18	20	(²)
Coal:				
Anthracite.....	46	(³)	1,138	9
Bituminous, slack, culm, and lignite.....	355,701	¹ 2,885	366,506	¹ 3,146
Briquets.....	318	4	850	10
Coke.....	130,955	¹ 1,471	117,951	¹ 1,544
Peat:				
Fertilizer grade.....	233,394	¹ 9,764	236,370	¹ 10,700
Poultry and stable grade.....	14,295	¹ 766	10,389	¹ 587
Petroleum:				
Crude..... thousand barrels.....	354,727	¹ 837,626	386,209	¹ 980,893
Gasoline ⁹ do.....	9,311	¹ 40,506	11,483	48,202
Kerosine..... do.....	231	¹ 896	125	537
Distillate oil ¹⁰ do.....	5,572	¹ 17,908	9,148	¹ 31,277
Residual oil ¹¹ do.....	⁴ 165,756	⁴ 366,448	176,021	464,960
Unfinished oils..... do.....	4,561	12,499	1,588	4,578
Asphalt (liquid and solid)..... do.....	3,602	8,768	6,419	16,749
Miscellaneous..... do.....	(⁵)	134	(⁵)	144

¹ Owing to changes in tabulating procedures by the Bureau of the Census data known to be not comparable to years before 1954.
² Adjusted by the Bureau of Mines.
³ Less than 1,000.
⁴ Revised figure.
⁵ Data not available.
⁶ Includes 4,903 pounds of scrap (\$1,698).
⁷ Weight not recorded.
⁸ In addition to data shown an estimated 292,520 long tons (\$865,020) was imported in 1956 and 282,400 long tons (\$889,100) in 1957.
⁹ Includes naphtha but excludes benzol, 1956—1,656,000 barrels (\$17,813,000); 1957—1,317,212 barrels (\$14,516,000).
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, 1956-57

[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	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Ingots, slabs, crude.....	1 34, 618	1 \$19, 109	27, 982	\$14, 051
Scrap.....	19, 329	8, 127	18, 166	6, 435
Plates, sheets, bars, etc.....	12, 493	13, 093	13, 767	13, 179
Castings and forgings.....	1, 247	3, 094	1, 333	3, 064
Antimony: Metals and alloys, crude.....	33	24	4	3
Arsenic: Calcium arsenate..... pounds..	628, 020	52	2, 779, 954	201
Bauxite, including bauxite concentrates long tons..	14, 921	834	60, 993	4, 847
Aluminum sulfate.....	16, 130	583	19, 689	834
Other aluminum compounds.....	22, 452	3, 183	48, 390	5, 251
Beryllium..... pounds..	89, 558	260	208, 771	260
Bismuth:				
Metals and alloys..... do.....	287, 092	559	158, 393	213
Salts and compounds..... do.....	51, 251	182	31, 703	144
Cadmium..... do.....	1, 284, 248	1, 932	692, 758	1, 060
Calcium chloride..... do.....	32, 523	1, 057	47, 965	1, 628
Chrome:				
Ore and concentrates:				
Exports.....	1, 727	99	837	53
Reexports.....	12, 990	502	4, 872	194
Chromic acid.....	637	351	19, 674	388
Ferrochrome.....	5, 538	2, 891	4, 535	2, 419
Cobalt..... pounds..	3, 025, 142	1, 820	1, 068, 731	947
Columbium metals, alloys, and other forms.. do.....	10, 500	9	59, 241	47
Copper:				
Ores, concentrates, composition metal, and unrefined copper (copper content).....	13, 717	11, 648	15, 656	9, 964
Refined copper and semimanufactures.....	280, 575	253, 615	430, 446	288, 936
Other copper manufactures.....	185	291	238	321
Copper sulfate or blue vitriol.....	30, 177	8, 036	33, 644	6, 534
Copper base alloys.....	(?)	54, 847	(?)	56, 371
Ferroalloys:				
Ferrosilicon..... pounds..	4, 229, 074	483	5, 297, 681	502
Ferrophosphorus..... do.....	150, 821, 010	2, 339	100, 635, 032	1, 901
Gold:				
Ore and base bullion..... troy ounces..	19, 962	710	23, 953	834
Bullion, refined..... do.....	713, 900	25, 851	4, 781, 780	167, 498
Iron ore..... long tons..	1 5, 508, 296	1 48, 805	5, 002, 153	49, 302
Iron and steel:				
Pig iron.....	1 269, 477	1 15, 084	882, 342	57, 202
Iron and steel products (major):				
Semimanufactures.....	1 3, 026, 901	1 496, 688	3, 395, 118	574, 548
Manufactured steel mill products.....	1 1, 721, 854	1 395, 393	2, 521, 622	579, 236
Advanced products.....	(?)	1 167, 011	(?)	169, 140
Iron and steel scrap: Ferrous scrap, including re-rolling materials.....	1 6, 446, 463	1 300, 620	6, 746, 314	328, 703
Lead:				
Ore, matte, base bullion (lead content).....	1, 055	340	906	257
Pigs, bars, anodes.....	4, 628	1, 300	4, 339	1, 345
Scrap.....	2, 136	578	885	215
Magnesium:				
Metal and alloys.....	3, 388	2, 240	1, 208	1, 114
Semifabricated forms, n. e. c.....	487	902	355	768
Powder.....	56	99	22	39
Manganese:				
Ore and concentrates.....	6, 133	664	5, 270	724
Ferromanganese.....	2, 248	682	7, 395	1, 866
Mercury:				
Exports..... 76-pound flasks..	1, 080	284	1, 919	484
Reexports..... do.....	2, 025	476	3, 275	763
Molybdenum:				
Ores and concentrates..... pounds..	17, 981, 007	21, 296	25, 465, 515	32, 428
Metals and alloys, crude and scrap..... do.....	35, 240	21	98, 513	182
Wire..... do.....	11, 440	202	13, 750	231
Semifabricated forms, n. e. c..... do.....	4, 853	28	4, 289	49
Powder..... do.....	20, 735	44	28, 222	43
Ferromolybdenum..... do.....	944, 671	1, 052	383, 271	447

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Nickel:				
Ore.....	27,331	\$556		
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc.....	16,361	18,019	12,756	\$14,089
Nickel-chrome electric resistance wire.....	208	836	151	632
Semifabricated forms, n. e. c.....	626	1,878	508	1,797
Platinum:				
Bars, ingots, sheets, wire, sponge, and other forms including scrap..... troy ounces.....	23,823	2,383	17,199	1,329
Palladium, rhodium, iridium, osmiridium, ruthenium and osmium metals and alloys, including scrap..... troy ounces.....	18,249	634	23,155	874
Platinum group manufactures except jewelry.....	(¹)	2,489	(²)	1,960
Radium metal (radium content)..... milligrams.....			750	7
Rare earths:				
Cerium ores, metal and alloy..... pounds.....	23,784	79	13,270	33
Lighter flints..... do.....	16,303	110	3,372	24
Silver:				
Ore and base bullion..... troy ounces.....	2,058,401	1,868	1,372,682	1,246
Bullion, refined..... do.....	3,442,479	3,154	8,926,674	8,238
Tantalum:				
Ore, metal, and other forms..... pounds.....	3,647	115	4,877	252
Powder..... do.....	6,080	245	5,997	228
Tin:				
Ingots, pigs, bars, etc.:				
Exports..... long tons.....	1,439	1,821	1,112	1,526
Reexports..... do.....	451	1,018	419	919
Tin scrap and other tin bearing material except tinplate scrap..... long tons.....	1,4,604	12,324	9,545	3,911
Tin cans finished or unfinished..... do.....	30,502	13,245	30,166	14,309
Tin compounds..... pounds.....	375,021	672	489,227	867
Titanium:				
Ores and concentrates.....	1,838	312	2,019	276
Sponge (including iodide titanium) and scrap.....	14	60	71	78
Intermediate mill shapes.....	469	5,509	698	7,174
Mill products n. e. c.....	90	2,796	81	2,230
Ferrotitanium.....	364	148	367	130
Dioxide and pigments.....	64,766	25,137	52,960	19,687
Tungsten: Ore and concentrates:				
Exports.....	117	225	164	227
Reexports.....	349	778	572	724
Vanadium ore and concentrates (vanadium content)..... pounds.....	1,856,594	1,4,046	1,000,340	2,115
Zinc:				
Ores and concentrates (zinc content).....	854	162	7	(³)
Slabs, pigs, or blocks.....	8,813	2,465	10,785	2,553
Sheets, plates, strips or other forms, n. e. c.....	4,444	3,031	4,056	2,950
Scrap (zinc content).....	14,921	1,540	5,469	822
Dust.....	372	136	595	195
Semifabricated forms, n. e. c.....	582	301	485	247
Zirconium:				
Ores and concentrates.....	1,048	90	3,160	315
Metals and alloys and other forms..... pounds.....	18,987	200	66,784	384
NONMETALS				
Abrasives:				
Grindstones..... pounds.....	850,231	64	660,057	54
Diamond dust and powder..... carats.....	210,841	616	199,282	622
Diamond grinding wheels..... do.....	187,438	948	194,934	1,135
Other natural and artificial metallic abrasives and products.....	(⁴)	25,217	(⁵)	25,777
Asbestos: Unmanufactured:				
Exports.....	2,797	338	2,775	340
Reexports.....	153	37	118	10
Boron: Boric acid, borates, crude and refined				
..... pounds.....	487,470,563	16,596	428,994,042	15,975
..... do.....	6,111,373	2,557	10,510,719	3,053
Cement..... 376-pound barrels.....	1,980,804	17,292	1,330,520	5,322

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS—continued				
Clay:				
Kaolin or china clay.....	59,138	\$1,298	54,879	\$1,327
Fire clay.....	1 152,109	1 1,573	136,819	1,794
Other clays.....	1 299,687	1 9,722	292,921	10,407
Cryolite.....	213	58	165	55
Fluorspar.....	197	31	754	81
Graphite:				
Amorphous.....	790	90	902	93
Crystalline flake, lump, or chip.....	147	47	167	57
Natural, n. e. c.....	125	24	280	75
Gypsum:				
Crude, calcined, crushed.....	20,757	711	24,447	763
Plasterboard, wallboard, and tile..... square feet.....	7,026,932	364	8,866,572	520
Manufactures, n. e. c.....	(?)	141	(?)	62
Iodine, iodide, iodates..... pounds.....	505,274	750	232,973	335
Kyanite and allied minerals.....	1,331	63	2,588	130
Lime.....	82,737	1,546	65,195	1,329
Mica:				
Unmanufactured..... pounds.....	546,673	92	911,006	46
Manufactured:				
Ground and pulverized..... do.....	8,901,497	486	9,256,170	521
Other..... do.....	343,159	1,139	541,432	983
Mineral-earth pigments: Iron oxide, natural and manufactured.....	5,071	909	3,675	1,038
Nitrogen compounds (major).....	1,038,307	53,090	1,126,789	52,926
Phosphate rock..... long tons.....	2,880,484	25,704	3,126,215	28,189
Phosphatic fertilizers..... do.....	504,612	1 17,921	575,387	24,705
Pigments and salts (lead and zinc):				
Lead pigments.....	13,034	1 1,129	3,953	1,422
Zinc pigments.....	4,135	1,087	4,135	1,163
Lead salts.....	1,282	576	608	231
Potash:				
Fertilizer.....	390,716	13,705	459,699	16,096
Chemical.....	6,839	1,232	7,796	1,410
Quartz crystal (raw).....	(?)	65	(?)	153
Radioactive isotopes, etc.....	(?)	906	(?)	1,367
Salt:				
Crude and refined.....	336,320	2,464	390,707	2,591
Shipments to noncontiguous Territories.....	11,649	881	10,975	857
Sodium and sodium compounds:				
Sodium sulfate.....	1 29,933	1 1,037	23,667	859
Sodium carbonate.....	1 241,948	1 8,219	173,756	6,282
Stone:				
Limestone, crushed, ground, broken.....	1,060,560	1,359	1,080,460	1,640
Marble and other building and monumental cubic feet.....	344,210	976	415,903	1,158
Stone, crushed, ground, broken.....	175,364	2,890	129,559 ¹	2,699
Manufactures of stone.....	(?)	377	(?)	506
Sulfur:				
Crude..... long tons.....	1 1,651,307	1 48,305	1,562,301	43,438
Crushed, ground, flowers of..... do.....	1 24,024	1 1,777	17,420	1,528
Talc:				
Crude and ground.....	42,333	1,009	39,985	1,127
Manufactures, n. e. c.....	69	74	291	138
Powders-talcum (face and compact).....	(?)	1,371	(?)	1,322
COAL, PETROLEUM, AND RELATED PRODUCTS				
Asphalt and bitumen, natural:				
Unmanufactured.....	30,844	1,845	30,792	1,878
Manufactures, n. e. c.....	(?)	937	(?)	885
Carbon black..... thousand pounds.....	425,328	36,105	459,671	40,468
Coal:				
Anthracite.....	5,244,349	73,535	4,331,785	65,012
Bituminous.....	1 68,552,629	1 658,537	76,342,312	763,672
Briquets.....	107,452	1,716	86,464	1,383
Coke.....	655,717	11,468	822,244	14,356

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States, 1956-57—Continued

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
COAL, PETROLEUM, AND RELATED PRODUCTS—con.				
Petroleum:				
Crude..... thousand barrels	1 28, 624	1 \$90, 336	50, 203	\$173, 206
Gasoline ¹ do	28, 202	191, 233	30, 792	206, 914
Kerosine..... do	2, 876	12, 323	4, 914	21, 780
Distillate oil ¹ do	1 31, 926	1 122, 149	45, 071	182, 163
Residual oil..... do	22, 147	1 52, 812	32, 875	95, 951
Lubricating oil..... do	13, 217	193, 579	13, 193	194, 830
Asphalt..... do	1, 294	7, 478	1, 545	9, 992
Liquefied petroleum gases..... do	4, 274	16, 214	4, 538	21, 100
Wax..... do	920	20, 851	1, 023	22, 741
Coke..... do	6, 376	20, 323	5, 176	20, 970
Petrolatum..... do	307	6, 195	270	5, 962
Miscellaneous products..... do	851	16, 967	1, 032	18, 480

¹ Revised figure.

² Weight not recorded.

³ Less than \$1,000.

⁴ Includes naphtha but excludes benzol: 1956—64,740 barrels (\$1,114,968); 1957—64,158 barrels (\$1,154,633).

TABLE 10.—Comparison of world and United States¹ production of principal metals and minerals, 1956-57

[Compiled under the supervision of Berenice B. Mitchell, Division of Foreign Activities, Bureau of Mines]

Mineral	1956			1957		
	World	United States	Per cent of world	World	United States	Per cent of world
	Thousand short tons			Thousand short tons		
Coal:						
Bituminous.....	1,701,042	497,997	29	1,751,809	492,704	28
Lignite.....	621,868	2,878	(²)	657,596	2,638	(²)
Pennsylvania anthracite.....	156,200	28,900	19	157,700	25,338	16
Coke (excluding breeze):						
Gashouse ³	52,812	182	(²)	51,645	(⁴)	(⁴)
Oven and beehive.....	282,556	74,483	26	294,475	75,951	26
Fuel briquets and packaged fuel.....	119,400	1,584	1	121,800	1,152	(²)
Natural gas..... million cubic feet.....	(⁴)	10,081,923	(²)	(⁴)	(²)	(²)
Peat.....	58,990	292	(²)	70,300	316	(²)
Petroleum (crude)..... thousand barrels.....	6,124,171	2,617,283	43	6,440,350	2,616,778	41
Nonmetals:						
Asbestos.....	1,970	41	2	2,050	44	2
Barite.....	3,100	1,352	44	3,300	1,305	40
Cement..... thousand barrels.....	1,377,428	333,472	24	1,443,993	313,756	22
Corundum.....	11			10		
Diamonds..... thousand carats.....	18,300			20,800		
Diatomite.....	760	368	48	750	368	49
Feldspar ⁴ thousand long tons.....	1,230	693	56	1,160	612	53
Fluorspar.....	1,790	330	18	1,775	329	19
Graphite.....	270	(⁴)	(¹)	320	(⁴)	(⁴)
Gypsum.....	35,520	10,316	29	33,900	9,195	27
Magnesite.....	5,100	687	13	5,300	678	13
Mica (including scrap).....						
Nitrogen, agricultural ⁴ thousand pounds.....	310,000	173,506	56	350,000	185,646	53
Phosphate rock..... thousand long tons.....	7,385	2,178	29	7,826	2,230	28
Potash..... K ₂ O equivalent.....	33,750	15,747	47	32,350	13,976	43
	8,300	2,172	26	8,700	2,266	26

See footnotes at end of table.

TABLE 10.—Comparison of world and United States¹ production of principal metals and minerals, 1956-57—Continued

Mineral	1956			1957		
	World	United States	Per- cent of world	World	United States	Per- cent of world
	Thousand short tons			Thousand short tons		
Nonmetals—Continued						
Pumice	8, 700	1, 482	17	8, 400	1, 827	22
Pyrites	17, 300	1, 070	6	17, 000	1, 067	6
Salt	74, 000	24, 216	33	77, 400	23, 854	31
Strontium ²	18	4	22	11	(³)	(⁴)
Sulfur, native,	8, 000	6, 484	81	7, 300	5, 579	76
Talc, pyrophyllite, and soapstone	1, 935	739	38	1, 875	684	36
Vermiculite ⁵	255	193	76	249	184	74
Metals:						
Mine basis:						
Antimony (content of ore and concentrate) ⁶	55	(⁷)	1	53	(⁸)	1
Arsenic ⁹	47	12	26	47	10	21.
Bauxite	17, 200	1, 743	10	18, 700	1, 416	8
Beryllium concentrates	13	(⁹)	4	11	(⁹)	5
Bismuth	5, 300	(⁴)	(⁴)	4, 800	(⁴)	(⁴)
Cadmium	19, 950	10, 604	53	20, 430	10, 549	52
Chormite	4, 400	208	5	4, 500	166	4
Cobalt (contained)	16, 000	1, 269	8	15, 500	1, 649	11
Columbian-tantalum concentrates thousand pounds	9, 150	217	2	7, 760	368	5
Copper (content of ore and concentrates)	3, 780	1, 106	29	3, 870	1, 086	28
Gold	38, 400	1, 865	5	39, 620	1, 800	5
Iron ore	390, 367	97, 849	25	422, 135	106, 148	25
Lead (content of ore and concentrate)	2, 440	353	14	2, 540	338	13
Manganese ore (35 percent or more Mn)	12, 319	345	3	13, 000	366	3
Mercury thousand 76-pound flasks	215	24	11	235	33	14
Molybdenum (content of ore and concentrate)	63, 500	57, 462	91	66, 800	60, 753	91
Nickel (content of ore and concentrate)	283	7	2	314	10	3
Platinum groups (Pt, Pd, etc.)	980	21	2	1, 190	19	2
Silver	224, 200	38, 739	17	228, 700	38, 720	17
Tin (content of ore and concentrate)	192			192		
Titanium concentrates:						
Ilmenite	1, 792	685	38	1, 925	757	39
Rutile	122	12	10	158	11	7
Tungsten concentrate, 60 percent WO ₃	82, 500	14, 737	18	72, 700	5, 520	8
Vanadium (content of ore and concentrate) ⁶	4, 230	3, 868	91	4, 312	3, 691	86
Zinc (content of ore and concentrate)	3, 360	542	16	3, 420	532	16
Smelter basis:						
Aluminum	3, 720	1, 679	45	3, 730	1, 648	44
Copper	3, 990	1, 231	31	4, 040	1, 178	29
Iron, pig (incl. ferroalloys)	222, 200	77, 667	35	232, 900	81, 144	35
Lead	2, 370	542	23	2, 490	533	21
Magnesium	157	68	43	168	81	48
Steel ingots and castings	312, 600	115, 216	37	322, 300	112, 715	35
Tin	193	18	9	185	2	1
Zinc	3, 120	984	32	3, 230	986	31

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 United States 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).⁸ In 1957 United States production of antimony was 630 short tons and in 1957, 709 short tons.⁹ In 1956 United States production of beryl was 460 short tons and in 1957, 521 short tons.

Employment and Injuries in the Mineral Industries

By John C. Machisak¹



THIS CHAPTER of the Minerals Yearbook (volume III) contains the overall injury experience and related employment data at coal mines, metal mines and their metallurgical plants, nonmetal mines (except stone quarries) and nonmetal mills, stone quarries and their related plants, and coke plants in the United States for the calendar year 1957. Volume I of the yearbook contains injury experience and employment data in the metal, nonmetal, and quarrying industries, as well as their milling related plants. Volume II contains the injury experience and related employment data for coal mines and coke plants and for the oil and gas industries.

Federal law requires operators of coal mines to furnish the information requested; however, the Bureau of Mines collects injury and employment data for all other mineral industries on a purely voluntary basis.

Every effort has been made to obtain complete coverage for all mineral industries of the Nation, and the data presented are believed to present a true picture of the hazards to which workers in these industries are exposed.

A 3-percent decline was noted in the number of men employed during 1957; estimated figures for 1957 show employment of 507,085, compared with 524,941 in 1956. The number of days worked averaged 3 less than in the preceding year; both man-days and man-hours decreased 5 percent. A 7.95-hour shift was worked in 1957 compared with 7.97 in 1956. The hours worked by the average employee during the year dropped 1 percent—from 2,001 in 1956 to 1,973 in 1957.

The overall injury experience in the mineral industries for 1957 was more favorable than in 1956; the combined (fatal and nonfatal) injury-frequency rates declined 8 percent. The fatal injuries were 16 less than in the preceding year, and the nonfatal injuries decreased 12 percent—from 33,702 in 1956 to 29,511 in 1957.

A slight decline in the number of man-hours worked in 1957 caused the fatal rate (0.61) for 1956 to be about the same (0.62) as for 1957. The nonfatal injury-frequency rate per million man-hours of worktime dropped to 29.50 from the rate of 32.08 reported for 1956.

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

Five major disasters (a disaster is a single accident in which 5 or more men are killed) occurred in the bituminous-coal-mining industry during 1957. In Alaska on January 18, 5 men were killed; in Pennsylvania in September, 6 men lost their lives; and in West Virginia on February 4, December 9, and December 27, there were 37, 5, and 11 men, respectively, killed in disasters.

TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, 1953–57, by industry groups

	1953	1954	1955	1956	1957 ¹
Average number of men working daily: ²					
Coal mines.....	351, 126	283, 705	260, 161	260, 368	249, 425
Metal mines.....	72, 529	66, 610	65, 143	67, 788	63, 700
Nonmetal mines (except stone quarries) ³	12, 765	12, 810	14, 504	15, 595	16, 000
Stone quarries.....	83, 641	78, 910	78, 238	80, 093	77, 900
Coke plants.....	23, 440	19, 209	20, 681	20, 473	20, 280
Metallurgical plants.....	55, 283	54, 396	57, 741	63, 039	60, 900
Nonmetal mills ⁴			8, 723	17, 585	18, 900
Total.....	598, 784	515, 640	505, 191	524, 941	507, 085
Average number of active mine days:					
Coal mines.....	187	175	206	212	208
Metal mines.....	270	245	263	264	266
Nonmetal mines (except stone quarries) ³	292	284	264	268	253
Stone quarries.....	278	273	274	272	272
Coke plants.....	345	342	352	346	355
Metallurgical plants.....	318	307	314	325	319
Nonmetal mills ⁴			283	288	279
Total.....	230	222	245	251	248
Man-days worked, in thousands:					
Coal mines.....	65, 688	49, 598	53, 612	55, 285	51, 772
Metal mines.....	19, 559	16, 294	17, 113	17, 891	16, 929
Nonmetal mines (except stone quarries) ³	3, 727	3, 637	3, 836	4, 179	4, 041
Stone quarries.....	23, 248	21, 506	21, 470	21, 777	21, 152
Coke plants.....	8, 086	6, 567	7, 279	7, 082	7, 186
Metallurgical plants.....	17, 603	16, 713	18, 150	20, 508	19, 442
Nonmetal mills ⁴			2, 467	5, 056	5, 275
Total.....	137, 911	114, 315	123, 927	131, 778	125, 797
Man-hours worked, in thousands:					
Coal mines.....	513, 594	387, 950	419, 627	433, 657	405, 781
Metal mines.....	156, 605	130, 489	136, 950	143, 398	135, 119
Nonmetal mines (except stone quarries) ³	30, 488	29, 564	31, 093	33, 964	32, 718
Stone quarries.....	189, 776	175, 817	175, 775	178, 281	172, 387
Coke plants.....	64, 677	52, 482	58, 164	56, 557	57, 330
Metallurgical plants.....	138, 811	133, 675	145, 841	164, 072	154, 951
Nonmetal mills ⁴			19, 843	40, 675	42, 021
Total.....	1, 093, 951	909, 977	987, 293	1, 050, 604	1, 000, 307
Number of injuries:					
Fatal:					
Coal mines.....	461	396	420	448	477
Metal mines.....	92	86	79	89	60
Nonmetal mines (except stone quarries) ³	22	9	19	17	7
Stone quarries.....	43	34	53	50	44
Coke plants.....	8	8	9	10	12
Metallurgical plants.....	12	16	11	20	13
Nonmetal mills ⁴			3	7	12
Total.....	638	549	594	641	625

See footnotes at end of table.

EMPLOYMENT AND INJURIES IN THE MINERAL INDUSTRIES 53

TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, 1953-57, by industry groups—Continued

	1953	1954	1955	1956	1957 ¹
Number of injuries					
Nonfatal:					
Coal mines.....	24,258	17,718	18,890	19,819	17,442
Metal mines.....	6,164	4,994	5,837	5,287	3,835
Nonmetal mines (except stone quarries) ²	1,419	956	1,156	1,036	950
Stone quarries.....	4,450	3,834	3,811	3,754	3,740
Coke plants.....	425	254	325	301	239
Metallurgical plants.....	2,824	2,578	2,694	2,348	2,405
Nonmetal mills ⁴			451	1,157	900
Total.....	39,540	30,334	33,164	33,702	29,511
Injury rates per million man-hours:					
Fatal:					
Coal mines.....	0.90	1.02	1.00	1.03	1.18
Metal mines.....	.59	.66	.58	.62	.44
Nonmetal mines (except stone quarries) ².....	.72	.30	.61	.50	.21
Stone quarries.....	.23	.19	.30	.28	.26
Coke plants.....	.12	.15	.15	.18	.21
Metallurgical plants.....	.09	.12	.08	.12	.08
Nonmetal mills ⁴.....			.15	.17	.29
Total.....	.58	.60	.60	.61	.62
Nonfatal:					
Coal mines.....	47.23	45.67	45.02	45.70	42.98
Metal mines.....	39.36	38.27	42.62	36.87	28.38
Nonmetal mines (except stone quarries) ²	46.54	32.34	37.18	30.50	29.04
Stone quarries.....	23.45	21.81	21.68	21.06	21.70
Coke plants.....	6.57	4.84	5.59	5.32	4.17
Metallurgical plants.....	20.34	19.29	18.47	14.31	15.52
Nonmetal mills ⁴			22.73	28.44	21.42
Total.....	36.14	33.33	33.59	32.08	29.50

¹ Estimate.

² Men at work each day mine was active.

³ Clay mines included beginning with 1955.

⁴ Not previously shown separately—clay included beginning with 1956.

Work Stoppages.—According to the Bureau of Labor Statistics, there were 213 work stoppages in the mineral industries effecting a work loss of 893,000 man-days. Most of the work stoppages occurred in the bituminous-coal industry (161); however, most of the man-days lost were charged to the cement industry (436,000) resulting from 6 work stoppages in 1957. The anthracite-mining industry had 3 stoppages and lost 3,000 man-days. There were 13 stoppages in the metal-mining industry; 59,000 man-days were lost. The non-metal-mining and quarrying industry had 16 stoppages and lost 34,000 man-days. The 5 stoppages in the coke and its byproducts industry, and 9 in the petroleum refining accounted for the remaining 14 stoppages and totaled 225,000 additional man-days of work lost.

Average Earnings.—The weekly earnings in each of the mineral industries for which data are published by the United States Department of Labor, Bureau of Labor Statistics, increased, except for slight declines in the copper and lead-zinc groups. Hourly earnings increased in each of the mineral industries during the year.

Labor Turnover.—Accession rates in the mineral industries, as reported by the Bureau of Labor Statistics, declined, except that the petroleum-industry rate was identical with that reported for 1956. Separation rates increased in virtually all groups, for which data are available, except iron.

TABLE 2.—Work stoppages, average earnings, and labor turnover in certain mineral industries in the United States, 1953-57

[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:						
1953.....	24	108	‡ 69.34	‡ 2.45	1.4	3.1
1954.....	19	76	‡ 73.68	‡ 2.40	1.3	5.2
1955.....	17	9	‡ 78.73	‡ 2.35	1.8	4.5
1956.....	18	56	‡ 78.96	‡ 2.40	‡ 1.4	‡ 1.5
1957.....	3	3	81.79	2.63	1.3	2.4
Bituminous:						
1953.....	392	418	85.31	2.48	1.3	2.6
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	‡ 106.22	2.81	‡ 1.2	‡ 1.2
1957.....	161	136	110.53	3.02	.9	1.6
Metal mining:						
1953.....	15	255	88.54	2.04	4.3	4.7
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	‡ 96.83	2.30	‡ 3.8	‡ 3.6
1957.....	13	59	98.74	2.42	2.5	3.7
Iron:						
1953.....	(4)	(4)	90.74	2.14	1.9	2.1
1954.....	(4)	(4)	82.03	2.17	1.6	4.3
1955.....	(4)	(4)	‡ 92.86	‡ 2.31	2.8	1.7
1956.....	(4)	(4)	‡ 96.71	2.43	‡ 1.9	‡ 1.6
1957.....	(4)	(4)	103.49	2.62	.8	1.6
Copper:						
1953.....	(4)	(4)	91.60	2.00	4.8	4.8
1954.....	(4)	(4)	‡ 87.13	2.05	3.6	3.9
1955.....	(4)	(4)	95.70	2.17	5.2	4.5
1956.....	(4)	(4)	‡ 100.28	‡ 2.30	‡ 4.1	‡ 4.1
1957.....	(4)	(4)	97.75	2.39	2.5	4.6
Lead-zinc:						
1953.....	(4)	(4)	80.06	1.92	2.7	4.9
1954.....	(4)	(4)	‡ 76.92	1.89	2.1	2.2
1955.....	(4)	(4)	83.82	2.01	2.5	2.1
1956.....	(4)	(4)	‡ 89.24	‡ 2.14	‡ 3.0	‡ 2.9
1957.....	(4)	(4)	88.97	2.17	2.0	3.8
Nonmetal mining and quarrying:						
1953.....	26	63	75.99	1.70	(4)	(4)
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)
Cement:						
1953.....	5	20	73.39	1.76	2.5	2.6
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	‡ 83.54	2.03	‡ 1.9	‡ 1.9
1957.....	6	436	87.91	2.16	1.8	2.1
Coke and byproducts:						
1953.....	2	1	78.81	1.89	(4)	(4)
1954.....	1	7	‡ 80.93	1.95	(4)	(4)
1955.....	1	(4)	86.31	2.06	(4)	(4)
1956.....	3	56	‡ 91.32	‡ 2.19	(4)	(4)
1957.....	5	25	96.00	2.33	(4)	(4)
Petroleum refining:						
1953.....	9	50	94.19	2.32	.8	.9
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	‡ .8	‡ .8
1957.....	9	200	112.88	2.76	.8	1.1

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.

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 (827) enrolled in the National Safety Competition, and the National Sand and Gravel Competition reported outstanding safety records in 1957. Of the establishments enrolled in these 2 contests, 377 (46 percent) attained injury-free records, with an aggregate worktime for these injury-free records of almost 28 million man-hours. The 27,509,897 injury-free man-hours was 20 percent of the total man-hours worked (136,900,783) at all participating operations in these two national competitions. In addition, the Bureau of Mines conducted three other competitions, sponsored annually by national associations connected with the mineral industries. These associations were: National Crushed Stone, National Lime, and National Slag. Of the 203 plants enrolled in these 3 contests, during 1957, 80 (39.4 percent) had injury-free records during an aggregate worktime of almost 24 million man-hours.

Trophy awards for the best safety record in each of the six groups in the 1957 National Safety Competition were made to the following:

Anthracite Underground Mines.—Pine Knot Colliery, Republic Steel Corporation, Minersville, Pa.

Bituminous-Coal Underground Mines.—Republic mine, Republic Steel Corporation, Elkhorn City, Ky.

Metal Underground Mines.—Calloway-Mary mine, Tennessee Copper Company Division, Tennessee Corporation, Copperhill, Tenn.

Nonmetal Underground Mines.—Bellefonte mine, National Gypsum Company, Bellefonte, Pa.

Open-Pit Mines.—Mississippi Group mine, The M. A. Hanna Company (Hanna Ore Mining Company), Keewatin, Minn.

Quarries.—Calcite quarry, Michigan Limestone Division, United States Steel Corporation, Rogers City, Mich.

TABLE 3.—Employment and injury experience of the United States mineral industries, 1931-57

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.....	524,941	251	131,778,156	1,050,603,577	641	33,702	.61	32.08
1957 ¹	507,085	248	125,797,050	1,000,307,205	625	29,511	.62	29.50

¹ 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. Jones²



RECORD production of crude petroleum, sand and gravel, lime, scrap mica and increased production of bituminous coal and iron ore highlighted the mineral industry of the State in 1957. Among the States, Alabama ranked second in production of native asphalt, bauxite, and slag cement and third in production of iron ore and mica.

Alabama's mineral industry was dominated by the mining and processing of coal and iron ore, which furnished 60 percent of the total value of production. Leading companies were Tennessee Coal & Iron Division of United States Steel Corp. (coal, iron ore, lime, and stone), Woodward Iron Co. (coal and iron ore), Alabama Power Co. (coal), Alabama By-Products Corp. (coal), and Southern Cement Division of American Marietta Co. (cement, clay, lime, and stone).

The total value of production established a new annual record, surpassing \$200 million for the first time. Total value increased 11 percent over 1956, the previous record year.

TABLE 1.—Mineral production in Alabama, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry..... thousand 376-pound barrels..	1, 753	\$6, 585	1, 618	\$6, 041
Portland..... do	12, 312	35, 256	11, 382	34, 238
Clays ²	1, 594	2, 147	1, 516	1, 504
Coal.....	12, 663	79, 322	13, 260	86, 114
Iron ore (usable)..... thousand long tons, gross weight.....	5, 633	34, 824	6, 223	40, 515
Lime.....	466	5, 089	554	6, 271
Mica (sheet)..... pounds.....	1, 122	7	(3)	(3)
Natural gas..... million cubic feet.....	42	3	450	44
Petroleum (crude)..... thousand 42-gallon barrels.....	3, 069	7, 335	4, 366	(3)
Sand and gravel.....	4, 939	4, 621	5, 065	4, 883
Stone ³	12, 343	14, 702	9, 519	11, 972
Talc.....	2	4	2	3
Value of items that cannot be disclosed: Asphalt (native), bauxite, slag cement, clay (kaolin) mica (scrap), salt, stone (dimension limestone, dimension marble, and oystershells, 1957), and values indicated by footnote 3.....		4, 083		23, 225
Total⁴.....		189, 186		209, 422

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Excludes kaolin.

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Preliminary figure.

⁵ Incomplete figures; excludes dimension limestone and dimension marble and oystershells, 1957.

⁶ The total has been adjusted to eliminate duplications in the values of clays and stone.

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TABLE 2.—Average unit value of mineral commodities produced in Alabama 1948-52 (average) and 1953-57

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Asphalt (native).....short ton.....	(¹)	(¹)	(¹)	\$6.64	\$6.17	\$5.70
Bauxite.....long dry ton.....	\$5.93	\$7.31	\$7.99	6.31	10.51	10.59
Cement:						
Masonry.....376-pound barrel.....	(¹)	(¹)	(¹)	3.52	3.76	3.73
Portland.....do.....	2.21	2.46	2.57	2.68	2.86	3.01
Slag.....do.....	3.00	3.16	3.30	2.90	3.16	3.18
Clays:						
Fire.....short ton.....	2.55	2.88	4.18	5.10	3.26	2.77
Kaolin.....do.....	7.70	9.67	9.94	10.45	10.49	12.00
Miscellaneous.....do.....	.83	.99	1.04	.90	.90	.89
Coal.....do.....	6.14	6.33	6.23	6.06	6.26	6.49
Iron ore:						
Hematite.....long ton.....	4.04	7.70	5.74	6.86	6.49	6.84
Limonite.....do.....	3.81	5.35	5.12	4.70	5.23	5.40
Lime.....short ton.....	9.34	10.66	10.64	11.22	10.91	11.33
Mica:						
Scrap.....do.....	16.55	-----	20.00	21.10	27.00	32.38
Sheet.....pound.....	1.41	6.09	2.75	14.44	6.07	5.68
Natural gas.....million cubic feet.....	46.67	48.78	60.00	70.92	71.43	80.00
Petroleum.....42-gallon barrel.....	(¹)	1.94	2.33	2.06	2.39	2.98
Salt.....short ton.....	1.08	1.08	1.08	3.11	3.11	3.11
Sand and gravel:						
Sand.....do.....	.73	.76	.87	.84	.81	.90
Gravel.....do.....	.74	.84	.87	1.05	1.04	1.01
Stone:						
Limestone:						
Crushed.....do.....	1.53	1.51	1.28	1.12	1.07	1.14
Dimension.....do.....	46.87	145.14	43.75	38.96	44.03	43.19
Marble:						
Crushed.....do.....	8.02	9.02	4.83	6.34	5.72	6.88
Dimension.....do.....	143.10	98.14	124.09	97.53	177.47	134.16
Oystershell, crushed.....do.....	(¹)	(¹)	(¹)	(¹)	1.27	1.42
Sandstone:						
Crushed.....do.....	6.55	9.09	5.64	1.90	1.46	2.03
Dimension.....do.....	15.85	13.46	17.43	15.52	16.93	13.91
Talc.....do.....	-----	-----	-----	5.33	2.05	2.00

¹ Data not available.

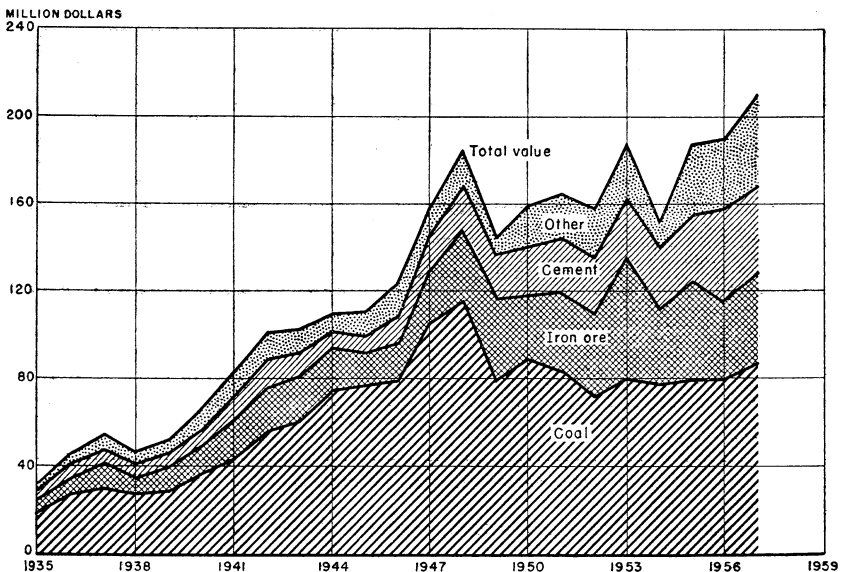


FIGURE 1.—Value of coal, iron ore, cement and total value of mineral production in Alabama, 1935-57.

EMPLOYMENT AND INJURIES

Total employment in the mineral industries increased 5 percent over 1956. The increase was distributed among all industries except quarries and mills, which decreased 2 percent. Increases were: Coal mines, 7 percent; metal mines, 1 percent; coke ovens and smelters, 7 percent; sand and gravel mines, 28 percent; and nonmetal mines, 15 percent. Most companies operated a regular 5-day week, although cement mills and coke ovens were operated continuously. The only serious strike was in the cement industry.

Injury experience was better than in 1956, as the frequency rate decreased 3 percent. The frequency rate decreased for all industries except quarries and mills, which increased 2 percent, and nonmetal mines, which increased 36 percent. Decreases were: Coke ovens and smelters, 23 percent; metal mines, 16 percent; and coal mines, 10 percent. Eleven fatal injuries occurred, compared with 20 in 1956.

TRENDS AND DEVELOPMENTS

Although the iron-ore industry has been fairly stable for many years at about 7 million tons per year, since 1955 imports of foreign ore into Birmingham have displaced about one-third of the normal production. During the year the R-N Corp., jointly owned by Republic Steel Corp. and National Lead Co., announced successful use of a direct-reduction process for treating low-grade red iron ore at Birmingham.

TABLE 3.—Employment in the mineral industries, 1956-57

Industry	1956			1957 ¹		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Coal mines.....	7,978	208	1,655,974	8,697	203	1,765,239
Metal mines.....	3,836	186	713,134	3,259	222	723,140
Quarries and mills.....	2,823	279	787,603	2,706	285	768,674
Coke ovens and smelters.....	1,535	366	561,693	1,659	365	601,198
Oil and gas.....	781	247	193,190	(²)	(²)	(²)
Sand and gravel mines.....	* 419	* 259	* 108,502	550	253	139,359
Nonmetal mines.....	374	233	87,125	416	240	100,035
Total.....	17,746	231	4,107,221	17,281	237	4,097,645

¹ Preliminary figures.² Data not available.³ Excluding Government-and-contractor operations.

The cement industry has expanded steadily for several years, by expansions of existing plants. During 1957 the Southern Cement Division increased the capacity of its Roberta mill by the addition of another kiln.

The stone industry has followed closely the increase in construction and roadbuilding of recent years. During the year Vulcan Materials Co. acquired as subsidiary companies Kennesaw Stone Co., Montgomery-Roquemore Gravel Co., Southern Cen-Vi-Ro Pipe Corp., Stockbridge Stone Co., Drummond Trucking Co., Ireland Investment Co., Atlanta Aggregate Co., Birmingham Slag Co., Vulcan De-tinning Co., Union Chemical & Materials Corp., Lambert Bros. Inc., Rockwood Slag Co., Chattanooga Rock Products Co., Wesco Paving Co., Ralph E. Mills Co., Camp Concrete Co., and Brooks Sand & Gravel Co. and became the leading aggregate company in the Southeast.

TABLE 4.—Injuries in the mineral industries, 1956–57

Industry	1956					1957 ¹			
	Fatal	Non-fatal	Total	Injuries per million man-days	Days lost per million man-hours	Fatal	Non-fatal	Total	Injuries per million man-days
Oil and gas.....	1	5	6	31	3,929	(?)	(?)	(?)	(?)
Coke ovens and smelters.....	2	22	24	43	(?)	3	17	20	33
Metal mines.....	2	43	45	63	2,961	1	37	38	53
Coal mines.....	15	175	190	115	8,912	5	179	184	104
Quarries and mills.....		114	114	145	(?)	2	112	114	148
Sand and gravel mines.....	(?)	(?)	(?)	(?)	(?)		26	26	186
Nonmetal mines.....		16	16	184	(?)		25	25	250
Total.....	20	375	395	99	(?)	11	396	407	99

¹ Preliminary figures.² Data not available.

Lime production has gradually increased for several years. This was the first year's operation for the new plant of United Cement Co.

Natco Corp., the Nation's leading producer of structural clay products, began construction on a new plant at Bessemer to manufacture clay conduit for telephone and powerlines.

Thompson-Weinman & Co. completed a new marble grinding plant at Sylacauga.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Coal was mined at 171 mines in 11 counties, compared with 225 mines in 12 counties in 1956. Leading counties were Jefferson, Walker, and Tuscaloosa. The leading coal producer was Tennessee Coal & Iron Division of United States Steel Corp., with mines in Jefferson County. Production increased 5 percent over 1956 and 1 percent over 1955 but was still 30 percent below 1947, the record year. Average production per mine increased from 56,000 tons in 1956 to 78,000 tons in 1957.

Coke.—Six companies produced byproduct metallurgical coke at 7 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.—One new gasfield was brought in during 1957—the Whitehouse gasfield in Marion County. There were 3 producing gas wells in the Hamilton field and 1 in the new Whitehouse field, all in Marion County. Production came from beds of Mississippian age at comparatively shallow depths. Allowable production was 1 million cubic feet per day for the Whitehouse field and 500,000 cubic feet per day for the Hamilton field.

TABLE 5.—Coal production, 1948–52 (average) and 1953–57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948–52 (average).....	14,227	\$37,258	1956.....	12,663	\$79,322
1953.....	12,532	79,370	1957.....	13,260	83,114
1954.....	10,283	64,030			
1955.....	13,088	79,337	Earliest record to date....	923,506	(¹)

¹ Data not available.

TABLE 6.—Marketed production of natural gas, 1950-52 (average) and 1953-57

Year	Thousand cubic feet	Value	Year	Thousand cubic feet	Value
1950-52 (average).....	2,333	\$103	1955.....	282,000	\$20,000
1953.....	41,000	2,000	1956.....	42,000	3,000
1954.....	87,000	5,000	1957.....	150,000	14,000

¹ Preliminary figure.

Petroleum.—Production of crude petroleum increased over 1956 to a new annual record. Allowable production for the Citronelle field was 200 barrels per day from the Upper Donovan zone and 150 barrels per day from the Lower Donovan zone. Allowable daily production from the Gilbertown, Pollard, and South Carlton fields was 100 barrels. The number of producing wells in 1957, by counties, was as follows:

County:	Field	Number of wells
Mobile.....	Citronelle.....	106
Choctaw.....	Gilbertown.....	66
Escambia.....	Pollard.....	36
Clarke.....	South Carlton.....	8
Baldwin.....	do.....	5
Total.....		221

TABLE 7.—Production of crude petroleum, 1948-52 (average) and 1953-57

Year	Thousand 42-gallon barrels	Value (thousands)	Year	Thousand 42-gallon barrels	Value (thousands)
1948-52 (average).....	792	(¹)	1956.....	3,069	\$7,335
1953.....	1,694	\$3,290	1957.....	* 5,366	(¹)
1954.....	1,584	3,690			
1955.....	1,411	2,910	1944-57 (total to date).....	15,019	(¹)

¹ Figure withheld to avoid disclosing individual company confidential data.

* Preliminary figure.

NONMETALS

Cement.—Seven companies produced masonry cement at 7 plants in Blount, Jefferson, and St. Clair Counties. Leading producers were Southern Cement Division of American Marietta Co. (North Birmingham plant) and National Cement Co. (Ragland plant). Shipments decreased 8 percent below 1956 and 17 percent below 1955, the record year.

Seven companies produced portland cement at 9 plants in 5 counties. Leading producers were Ideal Cement Co. (Mobile plant) and Lone Star Cement Corp. (Birmingham and Demopolis plants). Shipments decreased 8 percent below 1956, the record year, and were 3 percent below 1955.

Southern Cement Division of American Marietta Co. (North Birmingham plant) and Cheney Lime & Cement Co. (Algood plant) produced slag cement. Shipments declined 23 percent below 1956 and were 90 percent below 1952—the record year.

Alabama cement industry was based upon calcining local stone materials, which are plentiful throughout the State. Raw materials consumed during the year in portland cement included limestone and oystershells (48 percent), cement rock (36 percent), clay and shale (11 percent), and other materials (5 percent).

TABLE 8.—Shipments of portland cement, 1948-52 (average) and 1953-57

Year	Thousand barrels	Value (thousands)	Year	Thousand barrels	Value (thousands)
1948-52 (average).....	10, 229	\$22, 649	1955.....	11, 782	\$31, 517
1953.....	10, 428	25, 701	1956.....	12, 312	35, 256
1954.....	11, 122	28, 583	1957.....	11, 382	34, 238

Clays.—Ten companies mined fire clay at 10 mines in 8 counties. Leading producers were Natco Corp., the Nation's leading producer of structural clay products, and Donoho Foundry Co. Production declined 42 percent below 1956, the record year, and 19 percent below 1955.

Thomas Alabama Kaolin Co., the State's only kaolin producer, mined kaolin at the Hackleburg mine for firebrick and block, rubber, fertilizers, and insecticides.

Eighteen companies mined miscellaneous clay at 19 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. Production decreased 12 percent below 1956, the record year, and 9 percent below 1955.

TABLE 9.—Fire clay sold or used by producers, 1948-52 (average) and 1953-57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948-52 (average).....	177	\$471	1955.....	216	\$1, 103
1953.....	253	727	1956.....	303	990
1954.....	236	986	1957.....	175	484

TABLE 10.—Fire clay sold or used by producers, 1956-57, by uses

Use	1956	1957	Use	1956	1957
	Short tons	Short tons		Short tons	Short tons
Heavy clay products.....	92, 387	(1)	Stoneware.....	20	-----
Foundries and steelworks.....	55, 405	71, 602	Other.....	-----	103, 215
Firebrick and block.....	149, 890	(1)	Total.....	303, 329	174, 817
Fire-clay mortar.....	5, 627	(1)			

¹ Figure withheld to avoid disclosing individual company confidential data.

Lime.—Eight companies produced quick and hydrated lime at nine plants in Jefferson, Mobile, and Shelby Counties. Leading producers were Southern Cement Division of American Marietta Co. (Keystone and Roberta limekilns), and Tennessee Coal & Iron Division of United States Steel Corp. (Ensley works). Production increased 19 percent over 1956 and 18 percent over 1953, the previous record year.

Mica.—Dixie Mines, Inc., mined scrap mica, at the Micaville mine, which was shipped to Texas for grinding; production expanded 49 percent over 1956 and established a new record for the State. Four companies or individuals mined a small quantity of sheet mica in Chilton, Cleburne, and Coosa Counties; leading producers were Dixie Mines, Inc. (Indian mine), and Ellis Inlow (Inlow No. 2 mine).

Salt.—Mathieson Chemical Corp., the State's only salt producer,

TABLE 11.—Miscellaneous clay sold or used by producers, 1953-57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1953.....	928	\$922	1956.....	1,291	\$1,156
1954.....	1,080	1,126	1957.....	1,141	1,020
1955.....	1,258	1,131			

TABLE 12.—Lime sold or used by producers, 1948-52 (average) and 1953-57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948-52 (average).....	403	\$3,782	1955.....	462	\$5,186
1953.....	471	5,018	1956.....	466	5,089
1954.....	422	4,488	1957.....	554	6,271

TABLE 13.—Lime sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Chemical and industrial.....	372,738	\$4,094,340	469,047	\$5,315,266
Other.....	93,661	994,355	84,505	956,229
Total.....	466,399	5,088,695	553,552	6,271,495

has increased production each year since drilling the brine wells near McIntosh in 1952. Production expanded 79 percent over 1956 (the previous record year) and 84 percent over 1955.

Sand and Gravel.—Twenty-six companies mined sand and gravel at 35 mines in 25 counties. Leading producers were Montgomery-Roquemore Gravel Co. and Alabama Gravel Co., both operating in Elmore and Montgomery Counties. Production increased 1 percent over 1956 (the previous record year) and was 38 percent above 1955.

Stone.—Alabama Asphaltic Limestone Co. mined native asphalt (bituminous limestone) in Colbert County for roads.

Twenty-seven companies produced crushed limestone at 33 quarries in 15 counties. Leading producers were Lone Star Cement Corp. (Birmingham, Demopolis, and St. Stephens quarries), Stockbridge Stone Co., and Tennessee Coal & Iron Division of United States Steel Corp (Delonah quarry). Production decreased 2 percent below 1956 (the record year) but was 17 percent above 1955.

TABLE 14.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Sand		Gravel		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948-52 (average).....	(1)	(1)	(1)	(1)	3,578	\$2,580
1953.....	1,571	\$1,197	2,140	\$1,806	3,711	3,003
1954.....	1,517	1,317	2,449	2,134	3,966	3,451
1955.....	1,652	1,384	2,028	2,139	3,680	3,523
1956.....	2,436	1,964	2,563	2,657	4,999	4,621
1957.....	2,172	1,964	2,893	2,919	5,065	4,883

1 Figure withheld to avoid disclosing individual company confidential data.

TABLE 15.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956						1957					
	Sand		Gravel		Total		Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	872,358	\$761,940	1,312,203	\$1,414,966	2,184,541	\$2,176,906	1,158,652	\$1,079,321	1,322,912	\$1,390,557	2,481,564	\$2,469,908
Paving.....	1,283,831	969,801	779,949	800,677	2,054,780	1,761,478	603,894	1,489,192	815,928	879,159	1,419,822	1,865,851
Railroad ballast.....	77,154	65,581	171,917	102,439	240,071	168,020	(1)	(1)	135,863	103,148	212,239	103,148
Molding.....	(1)	(1)	(1)	(1)	(1)	(1)	132,433	212,239	(1)	(1)	132,433	212,239
Engine.....	(1)	(1)	(1)	(1)	(1)	(1)	86,423	64,422	(1)	(1)	86,423	64,422
Blast.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other.....	202,262	176,136	308,234	338,929	510,496	515,065	190,227	119,219	618,513	546,149	808,740	665,368
Total.....	2,435,585	1,994,458	2,563,303	2,657,011	4,998,888	4,621,469	2,171,629	1,964,393	2,893,216	2,919,043	5,064,845	4,853,436

¹ Figure withheld to avoid disclosing individual company confidential data. ² Excludes railroad ballast sand.

Alabama Limestone Co. (Rockwood and Aday quarries) quarried dimension limestone for rubble, rough architectural, and dressed building stone.

Three companies crushed marble for terrazzo, whiting, and other uses at 4 quarries in Talladega County. The leading producer was Moretti-Harrah Marble Co. Production increased 3 percent over 1956 and 24 percent over 1955.

Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for interior, cut, dressed building stone; and for rough and cut, dressed monumental stone. Production increased 23 percent over 1956 but was 25 percent below 1955.

Bay Towing & Dredging Co. dredged oystershell from Mobile Bay for cement, lime, concrete and roads, agstone, and poultry grit.

Three companies crushed 34,500 tons of sandstone for refractory stone, concrete and roads, foundries, and cement at 3 quarries in Jefferson County. The leading producer was Universal Atlas Cement Co. (Leeds quarry).

De Kalb Stone Co., Inc., and A. O. Brown quarried 1,700 tons of dimension sandstone for rough architectural building stone, and for flagging at 2 quarries in De Kalb and Blount Counties.

TABLE 16.—Crushed limestone sold or used by producers, 1948-52 (average) and 1953-57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948-52 (average) ¹	2,549	\$3,927	1955.....	7,943	\$8,889
1953 ¹	3,815	5,780	1956.....	9,517	10,214
1954.....	7,196	9,238	1957.....	9,292	10,567

¹ Except for cement and lime.

TABLE 17.—Crushed limestone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Cement manufacture.....	3,784,284	\$2,610,098	3,255,272	\$2,381,537
Concrete and roads.....	2,818,013	3,441,290	2,625,195	3,298,696
Fluxing stone.....	1,661,590	2,228,118	1,992,420	2,711,752
Lime manufacture.....	521,356	619,744	728,059	897,993
Agstone.....	409,255	531,587	420,643	620,908
Asphalt filler.....	(1)	(1)	97,407	191,782
Riprap.....	90,138	130,088	(1)	(1)
Rayon filler.....	(1)	(1)	17,000	43,000
Other.....	232,302	652,896	156,279	421,157
Total.....	9,516,938	10,213,821	9,292,275	10,566,825

¹ Figure withheld to avoid disclosing individual company confidential data.

Talc.—American Talc Co., the State's only talc producer, mined and ground 1,600 tons of talc for ceramics and insecticides at the Winterboro talc mine in Talladega County.

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

METALS

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 24 percent below 1956 and 19 percent below 1955.

Ferroalloys.—Shipments of ferromanganese, silicomanganese, ferro-silicon, and ferrophosphorus totaled 147,000 tons valued at \$32,436,000.

Iron Ore.—Shipments of iron ore increased 10 percent over 1956 but were 9 percent below 1955. Of the total shipments, 57 percent was direct-shipping ore, 31 percent was concentrate, and 12 percent was sinter, compared with 50, 40, and 10 percent in 1956. The number of active mines increased from 46 to 50, and average usable production per mine increased from 122,000 to 124,000 tons.

Eleven companies mined red iron ore (hematite) at 14 mines in 4 counties. Leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Wenonah mines) and Woodward Iron Co. (Songo and Pyne mines). Shipments increased 13 percent over 1956 but were 18 percent below 1955.

Twenty-eight producers mined brown iron ore (limonite) for iron and steel at 36 mines in 11 counties. Leading producers were Shook & Fletcher Supply Co. (Adkins, Taits Gap, Warner, and Blackburn mines) and Glenwood Mining Co., Inc. (Louisville, Spring Hill, and Glenwood mines). Shipments increased 2 percent over 1956 and 47 percent over 1955.

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 and North Birmingham plants), and Woodward Iron Co. (Woodward plant) produced 4,904,000 tons of foundry, basic, low-phosphorus, intermediate-phosphorus, and direct-casting pig iron. Value of shipments was \$253,161,000. Iron ore consumed was 77 percent domestic and 23 percent imported. Foreign imports, mainly from Venezuela, Labrador, and Liberia, decreased 7 percent below 1956, the record year.

REVIEW BY COUNTIES

Mineral production was reported from 47 of the State's 67 counties. Leading counties were Jefferson (which supplied 58 percent of the total value), Walker, and Shelby.

Production of natural gas and petroleum was of undetermined county origin.

Baldwin.—Fairhope Clay Products Co. mined 4,400 tons of miscellaneous clay for heavy clay products.

Barbour.—Three companies mined brown iron ore for sale to iron and steel plants; leading producers were Glenwood Mining Co. Inc., and C. B. Hewitt Mining Co. R. E. Wilson, and D. M. Wilson Bauxite Co. mined bauxite for chemicals and refractories.

Bibb.—Shook & Fletcher Supply Co. (Adkins mine) mined brown iron ore for sale to iron and steel plants. Eight mines produced 75,000 tons of coal; leading producers were the Belle Ellen No. 9 mine (H. E. Hicks Coal Co.) and the No. 14 mine (Moore Coal Co.). The Forest Service mined 2,400 tons of paving sand.

TABLE 18.—Mine production and shipments of crude iron ore, 1956-57

	1956		1957	
	Number of mines	Long tons	Number of mines	Long tons
Mine production:				
By varieties:				
Hematite	9	4,506,076	14	4,916,430
Limonite	37	5,164,863	36	5,447,849
By mining methods:				
Open-pit	41	5,274,327	45	5,548,782
Underground	5	4,396,612	5	4,815,497
Shipments from mines:				
Direct to consumers	11	2,825,867	14	3,564,447
To beneficiation plants	35	6,817,750	36	6,769,937

TABLE 19.—Shipments of usable iron ore, 1948-52 (average) and 1953-57

Year	Thousand long tons	Value (thousands)	Year	Thousand long tons	Value (thousands)
1948-52 (average)	7,633	\$32,354	1955	6,814	\$44,657
1953	7,446	55,640	1956	5,633	34,824
1954	5,913	33,327	1957	6,223	40,518

TABLE 20.—Production and shipments of usable iron ore, 1956-57

	1956		1957	
	Long tons	Iron content, natural (percent)	Long tons	Iron content, natural (percent)
Production:				
Hematite	4,279,157	38	4,850,651	36
Limonite	1,347,435	46	1,440,312	44
Shipments:				
Direct shipping ore	2,825,867	38	3,564,447	38
Concentrates	2,255,841	39	1,933,437	39
Sinter	551,000	43	725,000	44

Blount.—Four mines produced 230,000 tons of coal; leading producers were the Southview strip mine (Robbins Coal Co. Inc.) and the 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. Stockbridge Stone Co. (No. 609 quarry) crushed limestone for concrete and roads. Lehigh Coal Co. (Trafford mine) mined 13,800 tons of fire clay for firebrick and block and for heavy clay products. A. O. Brown quarried 700 tons of dimension sandstone for rough architectural building stone.

Butler.—Eleven mines produced 247,000 tons of brown iron ore for iron and steel; leading producers were Smith Mining Co. and Butler Mining Co.

TABLE 21.—Value of mineral production in Alabama, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Baldwin.....	\$11,920	\$4,000	Miscellaneous clay.
Barbour.....	(?)	(?)	Iron ore, bauxite, sand and gravel.
Bibb.....	(?)	(?)	Coal, iron ore, sand and gravel.
Blount.....	2,430,768	2,455,757	Coal, iron ore, cement, limestone, fire clay, sandstone.
Butler.....	253,677	1,370,310	Iron ore.
Calhoun.....	320,720	408,210	Sand and gravel, fire clay, iron ore, miscellaneous clay.
Cherokee.....	(?)	2,981	Sand and gravel.
Chilton.....	100	(?)	Sand and gravel, mica.
Clarke.....	16,982	267,018	Sand and gravel.
Clay.....	2,065	-----	-----
Clayburne.....	(?)	(?)	Mica, sand and gravel.
Colbert.....	(?)	1,409,795	Asphalt (native), limestone, sand and gravel.
Conecuh.....	-----	(?)	Iron ore.
Cosa.....	(?)	(?)	Mica.
Covington.....	67,500	5,500	Sand and gravel.
Crenshaw.....	(?)	(?)	Iron ore.
Cullman.....	564,870	(?)	Coal, limestone.
Dallas.....	607,124	(?)	Sand and gravel.
De Kalb.....	405,138	(?)	Limestone, sandstone.
Elmore.....	(?)	(?)	Sand and gravel.
Escambia.....	(?)	63,500	Sand and gravel, miscellaneous clay.
Etowah.....	566,971	(?)	Limestone, sand and gravel, iron ore.
Fayette.....	30,930	-----	-----
Franklin.....	4,777,804	2,362,295	Iron ore, limestone, sand and gravel, fire clay.
Greene.....	(?)	(?)	Sand and gravel.
Hale.....	-----	80,000	Do.
Henry.....	63,024	-----	-----
Houston.....	52,891	(?)	Sand and gravel.
Jackson.....	580,257	261,599	Limestone, coal.
Jefferson.....	111,865,272	121,652,301	Coal, iron ore, cement, limestone, lime, miscellaneous clay, sandstone, fire clay.
Limestone.....	44,800	63,000	Limestone.
Macon.....	56,348	59,601	Sand and gravel.
Madison.....	(?)	(?)	Limestone, miscellaneous clay.
Marengo.....	(?)	(?)	Cement, limestone.
Marion.....	(?)	(?)	Coal, kaolin.
Mobile.....	(?)	(?)	Cement, oystershell, lime, sand and gravel, miscellaneous clay.
Monroe.....	4,930	13,145	Sand and gravel.
Montgomery.....	(?)	(?)	Sand and gravel, miscellaneous clay.
Morgan.....	985,840	725,084	Limestone, sand and gravel.
Pike.....	552,041	749,341	Iron ore.
Randolph.....	(?)	(?)	Mica.
Russell.....	581,460	387,849	Sand and gravel, miscellaneous clay.
St. Clair.....	(?)	(?)	Cement, limestone, miscellaneous clay, fire clay, iron ore, sand and gravel, coal.
Shelby.....	8,731,359	10,825,311	Lime, limestone, cement, coal, miscellaneous clay, iron ore, fire clay.
Sumter.....	75,000	32,000	Sand and gravel.
Talladega.....	1,924,731	2,053,019	Marble, iron ore, talc.
Tuscaloosa.....	3,203,744	2,879,372	Coal, iron ore, sand and gravel.
Walker.....	18,014,235	18,929,315	Coal, fire clay.
Washington.....	(?)	(?)	Limestone, salt, miscellaneous clay.
Winston.....	92,618	17,068	Coal.
Undistributed ²	32,300,881	42,343,629	-----
Total Alabama.....	189,186,000	209,422,000	-----

¹ Individual county figures exclude petroleum and natural gas. The following counties are not listed because no production was reported: Autauga, Bull Creek, Chambers, Choctaw, Coffee, Dale, Geneva, Lamar, Lauderdale, Lawrence, Lee, Lowndes, Marshall, Perry, Pickens, Tallapoosa, and Wilcox.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

³ Includes petroleum, natural gas, and values indicated by footnote 2.

TABLE 22.—Shipments of brown iron ore in Butler County, 1948–52 (average) and 1953–57

Year	Long tons	Value	Year		
			Year	Long tons	Value
1948–52 (average).....	550	\$3,013	1955.....	(?)	(?)
1953.....	71,732	404,011	1956.....	41,861	\$253,677
1954.....	66,530	409,006	1957.....	246,811	1,370,310

¹ Figure withheld to avoid disclosing individual company confidential data.

Calhoun.—John B. Lagarde, Inc., and Wade & Co. mined 198,000 tons of structural sand and gravel. Donoho Foundry Co. and J. D. Woodham mined 43,000 tons of fire clay for foundries and steelworks. Four mines produced brown iron ore for sale to iron and steel plants. Agricola Brick Co. mined miscellaneous clay for use in making brick.

Cherokee.—Wolf Creek Sand Co. mined 1,500 tons of molding sand.

Chilton.—Southeastern Sand-Gravel Co. mined structural, paving, and engine sand and structural and paving gravel. Ellis Inlow (No. 2 mine) and Hazel Buchanan (Mountain Creek mine) produced a small quantity of sheet mica.

Clarke.—Radcliff Gravel Co. Inc., mined 410,000 tons of sand and gravel.

Cleburne.—Dixie Mines, Inc., (Indian mine), produced sheet mica. The Forest Service mined 1,900 tons of paving sand.

Colbert.—Alabama Asphaltic Limestone Co. (Margerum quarry) mined native asphalt for roadstone. Tri-State Limestone Co. and Alabama Asphaltic Limestone Co. crushed limestone for riprap, concrete and roads, and agstone. Tennessee Valley Sand & Gravel Co. (Sheffield mine) mined structural and paving sand and gravel.

Conecuh.—Birmingham Contracting Co. mined brown iron ore for the iron and steel industry.

Coosa.—N. T. Carter, Jr. (Patricia Ruth mine) produced a small quantity of sheet mica.

Covington.—The Forest Service mined 11,000 tons of paving sand.

Crenshaw.—Glenwood Mining Co., Inc., and Davis Bros. Mining Co. mined brown iron ore for iron and steel.

Cullman.—Seven mines produced 30,000 tons of coal; leading producers were the Arkadelphia No. 2 strip mine (H. E. Drummond Coal Co.), and the Trimble strip mine (Trimble Coal Co.). Stockbridge Stone Co. (No. 610 quarry) crushed limestone for concrete and roads.

Dallas.—Dallas Sand & Gravel Co., Inc., and C. Pierson Cosby mined molding, structural, paving, engine, 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. (Skirum quarry) quarried 980 tons of dimension sandstone for rough architectural building stone and for flagging.

Elmore.—Alabama Gravel Co. and Montgomery-Roquemore Gravel Co. (No. 3 mine) mined structural, paving, blast, and engine sand and structural, paving, railroad ballast, and other gravel.

Escambia.—Flomaton Gravel Co. mined 55,000 tons of structural and paving sand and structural, paving, and other gravel. Keego Clay Products Co. mined 11,500 tons of miscellaneous clay for heavy clay products.

Etowah.—Alabama Aggregate Co. (Cobb City quarry) and Gadsden Stone Co. crushed limestone for riprap, fluxing stone, concrete and roads, agstone, and asphalt filler. Milner Sand Co. mined molding, structural, and paving sand and structural and paving gravel. Harris & Reed and G & S Mining Co. mined a small quantity of red iron ore for the iron and steel industry.

Franklin.—Five mines produced brown iron ore for use in the iron and steel industry; the leading producer was Shook & Fletcher Supply

Co. (Warner and Blackburn mines). Alabama Limestone Co. (Rockwood quarry) quarried dimension limestone for rubble, rough architectural stone, and dressed building stone and crushed limestone for concrete and roads, agstone, asphalt filler, rock dust for coal mines, filter beds, mineral food, and other uses. Tennessee Valley Sand & Gravel Co. (Spruce Pine mine) mined structural and paving sand and gravel and a small quantity of fire clay for fire-clay mortar.

Greene.—Akron Sand Co. mined structural and paving sand and gravel.

Hale.—The Alabama State Highway Department mined 80,000 tons of paving gravel.

Houston.—L. C. Smith Sand & Gravel Co. mined structural sand.

Jackson.—Jackson County Highway Department crushed 113,000 tons of limestone for concrete and roads. Three mines produced 18,900 tons of coal; the leading producer was the Armstrong mine (Widows Creek Coal Co.).

Jefferson.—Forty-nine mines produced 9,311,000 tons of coal; leading producers were the Concord No. 1 mine (Tennessee Coal & Iron Division of United States Steel Corp.), the Maxine mine (Alabama By-Products Corp.), and the Edgewater mine (Tennessee Coal & Iron Division of United States Steel Corp.).

Nine mines produced 4,751,000 tons of red iron ore; leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Wenonah mines) and Woodward Iron Co. (Pyne mine).

Five companies produced portland cement; leading producers were Lehigh Portland Cement Co. (Birmingham mill) and Universal Atlas Cement Co. (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. (Birmingham mill). Tennessee Coal & Iron Division of United States Steel Corp. (Ensley works) produced quicklime.

Seven quarries produced crushed limestone for fluxing stone, concrete and roads, railroad ballast, agstone, rock dust for coal mines, cement, and lime; leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Dolohah quarry) and Universal Atlas Cement Co. (Leeds quarry).

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

Three companies crushed 35,000 tons of sandstone for refractories, concrete and roads, foundries, and cement; leading producers were Universal Atlas Cement Co. (Leeds quarry) and Sam P. Acton. Dixie Fire Brick Co. Inc., and Bibby Coal, Shale & Clay Co. mined fire clay for firebrick and block and fire-clay mortar.

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

Limestone.—Limestone County Board of Revenue crushed 45,000 tons of limestone for concrete and roads.

Macon.—Sharpe Sand & Gravel Co. mined 47,000 tons of structural and paving sand and gravel.

Madison.—Madison Limestone Co. crushed limestone for concrete and roads, agstone, and asphalt filler. Alabama Brick & Tile Co. 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.—Thirty-one mines produced 218,000 tons of coal; leading producers were the No. 1 mine (Miles & Harbin Coal Co.) and the Miles mine (Jack Miles Coal Co.). Thomas Alabama Kaolin Co., the State's only kaolin producer, operated the Hackelburg mine during the year and mined kaolin for firebrick and block, rubber, fertilizers, and insecticides and fungicides.

TABLE 23.—Portland cement shipments in Jefferson County, 1948-52 (average) and 1953-57

Year	Barrels	Value	Year	Barrels	Value
1948-52 (average).....	6, 112, 563	\$13, 617, 436	1955.....	6, 784, 814	\$18, 155, 302
1953.....	6, 090, 801	15, 255, 438	1956.....	6, 796, 991	19, 706, 508
1954.....	6, 577, 320	16, 865, 621	1957.....	5, 678, 526	17, 512, 062

TABLE 24.—Crushed limestone sold or used by producers in Jefferson County, 1954-57

Year	Short tons	Value	Year	Short tons	Value
1954.....	3, 859, 097	\$5, 147, 303	1956.....	3, 338, 615	\$2, 775, 183
1955.....	3, 650, 689	4, 228, 343	1957.....	3, 186, 937	2, 980, 277

TABLE 25.—Miscellaneous clay sold or used by producers in Jefferson County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average) ¹	144, 215	\$146, 838	1955.....	299, 004	\$259, 685
1953 ¹	87, 508	87, 508	1956.....	257, 531	195, 920
1954.....	285, 255	(²)	1957.....	238, 088	205, 188

¹ Except clay for cement.

² Figure withheld to avoid disclosing individual company confidential data.

Mobile.—Ideal Cement Co. produced portland cement at the Mobile mill, using oystershell dredged from Mobile Bay, produced lime at the Mobile limekiln from oystershell, and mined 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. Radcliff Gravel Co. recovered sand and gravel from dredging operations in Mobile Bay for structural, paving, and other uses.

Monroe.—Mannings Sand & Gravel Co. mined 14,200 tons of structural sand and gravel.

Montgomery.—Six mines produced structural, paving, blast, engine, and railroad-ballast sand and structural, paving, railroad-ballast, and other gravel; leading producers were Montgomery-Roquemore Gravel Co. (No. 2 mine) and Alabama Gravel Co. Jenkins Brick Co. and Excelsior Brick Co. mined miscellaneous clay for heavy clay products.

Morgan.—Three companies crushed 354,000 tons of limestone for riprap, concrete and roads, and agstone; leading producers were Trinity Stone Co. and the State highway department. Decatur Sand & Gravel Co. mined structural and paving sand and gravel.

Pike.—Six mines produced brown iron ore for sale to iron and steel plants; leading producers were Dunbar & Layton and Luverne Mining Co.

TABLE 26.—Shipments of brown iron ore in Pike County, 1953-57

Year	Long tons (gross weight)	Value	Year	Long tons (gross weight)	Value
1953.....	10, 652	\$51, 969	1956.....	103, 754	\$522, 041
1954.....	117, 836	574, 826	1957.....	147, 288	749, 341
1955.....	96, 214	402, 725			

Randolph.—Dixie Mines, Inc. (Dixie mine), shipped scrap mica to Texas for grinding.

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

St. Clair.—National Cement Co. produced masonry and portland cement at the Ragland mill and produced crushed limestone for asphalt filler and cement. National Cement Co. and Ragland Brick Co. mined miscellaneous clay for cement and heavy clay products. Riverside Clay Co. mined 19,500 tons of fire clay for foundries and steelworks. Bowen Construction Co and E. C. Bookout Construction Co. mined a small quantity of red iron ore for the iron and steel industry. Wolf Creek Sand Co. mined 3,800 tons of molding sand. Armstrong & Armstrong Coal Co. (A. & A. strip mine) mined 2,000 tons of coal.

Shelby.—Five companies produced lime at 7 limekilns; leading producers were the Roberta Limekiln (Southern Cement Division of American Marietta Co.), and the Saginaw Limekiln (Longview Lime Corp.). Nine quarries produced crushed limestone for riprap, fluxing stone, concrete and roads, agstone, rock dust for coal mines, paper, cement, lime and other uses; leading producers were Stockbridge Stone Co. (Calera quarry) and Southern Cement Division of American Marietta Co. Southern Cement Division of American Marietta Co. produced portland cement at the Calera mill. Sixteen mines produced 79,000 tons of coal; the leading producer was River Valley Coal Co. (River Valley No. 8 mine). Southern Cement Division of American Marietta Co. mined miscellaneous clay for use in cement. Shelby Sand & Ore Co. mined brown iron ore for sale to iron and steel plants. Montevallo Clay Co. mined a small quantity of fire clay for foundries and steelworks.

Sumter.—The State highway department mined 32,000 tons of paving gravel.

Talladega.—Moretti-Harrah Marble Co., Alabama Marble Co., and Thompson-Weinman & Co. crushed marble for terrazzo, whiting, and other uses. Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for interior, cut, dressed building stone;

rough monumental stone; and cut, dressed monumental stone. Rucker Mining Co. (Munford mine) mined brown iron ore for iron and steel. American Talc Co. (Winterboro mine), Alabama's only talc producer, mined 1,600 tons of talc.

Tuscaloosa.—Eleven mines produced 495,000 tons of coal; leading producers were Twin Seam Mining Co. (Kellerman No. 4 strip mine) and Mitchell Bros. Construction Co. (Mitchell No. 2 and No. 3 strip mines). Southern Coal & Iron Co. reopened the old Dudley mine and shipped red iron ore for the iron and steel industry. Yazoo Gravel Co. Inc. and Tuscaloosa Sand & Gravel Co. mined molding, structural, and other sand and structural and other gravel.

Walker.—Thirty-nine mines produced 2,797,000 tons of coal; leading producers were the Gorgas mine (Alabama Power Co.) and the Empire No. 3 mine (DeBardeleben Coal Corp.). Natco Corp. and Russell Coal & Clay Co. mined fire clay for firebrick and block; and heavy clay products.

TABLE 27.—Crushed limestone sold or used by producers in Shelby County, 1954-57

Year	Short tons	Value	Year	Short tons	Value
1954.....	1,202,048	\$1,617,460	1956.....	2,001,294	\$2,829,496
1955.....	1,437,923	1,861,243	1957.....	2,404,387	3,443,908

Washington.—Lone Star Cement Corp. crushed limestone and miscellaneous clay which were shipped to Louisiana for use in making cement. Mathieson Chemical Corp., the State's only salt producer, recovered salt from brine at its plant near McIntosh.

Winston.—Twin Arrows Coal Co. (No. 1 mine) and Charles Wheeler Coal Co. (No. 1 strip mine) mined 3,400 tons of coal.

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, United States Department of the Interior, and the Department of Mines, Territory of Alaska.

By Alvin Kaufman,¹ Anthony Evans,² Phil R. Holdsworth,³ and May G. Downey⁴



THE OUTSTANDING event in Alaska's mineral industry in 1957 was the discovery of oil on the Kenai-Moose Range, Kenai Peninsula, by the Richfield Oil Corp. Production tests indicated that the well could flow at the rate of 900 barrels of petroleum per day. Additional drilling will be required to determine the full extent of the oilfield. The discovery of petroleum resulted in increased exploration activity by other oil companies; virtually every major American company was active in Alaska. Compared with 1956, in 1957 estimated expenditures for exploration and prospecting virtually tripled. Oil-drilling activity was centered on the Kenai and Alaska Peninsulas and in the Willow Creek district, Cook Inlet-Susitna region. Exploration activity for metals and minerals also increased compared with 1956.

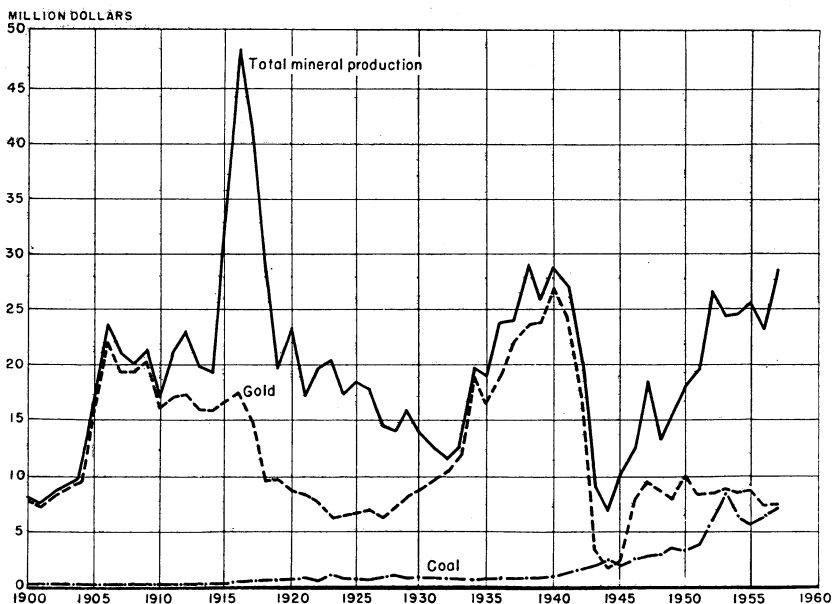


FIGURE 1.—Value of total mineral production, gold, and coal in Alaska, 1900-57. From 1911-31 copper production accounted for most of the value of minerals other than gold and coal.

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TABLE 1.—Mineral production in Alaska, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony.....	(²)	(²)	17	\$4
Chromite..... gross weight	7, 193	\$711	4, 207	431
Coal, bituminous..... thousand short tons	727	6, 374	842	7, 296
Gold (recoverable content of ores, etc.)... troy ounces	209, 296	7, 325	215, 467	7, 541
Lead (recoverable content of ores, etc.).....	1	(³)	9	3
Mercury..... 76-pound flasks	3, 280	853	5, 461	1, 349
Sand and gravel..... thousand short tons	5, 955	5, 880	6, 096	8, 799
Silver (recoverable content of ores, etc.)... troy ounces	28, 360	26	28, 862	26
Stone..... thousand short tons	195	595	528	1, 953
Value of items that cannot be disclosed: Copper, gem stones, platinum-group metals, uranium (1957), and values indicated by footnotes 2 and 3.....		1, 644		1, 390
Total Alaska.....		23, 408		28, 792

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 \$1,000.

TABLE 2.—Expenditures for exploration and prospecting by major companies in Alaska, 1956-57¹

Type and region	Expenditures (thousand dollars)	
	1956	1957
Metals exploration:		
Southeastern.....	\$656	\$690
Copper River and Prince William Sound.....	245	175
Kuskokwim and Yukon River.....	95	70
Northwestern.....		205
Oil and gas exploration:		
All areas.....	2, 980	10, 500
Total.....	3, 976	11, 640

¹ Compiled by Phil R. Holdsworth, Commissioner of Mines, Territory of Alaska.

During 1957 the first commercial shipment of Alaska uranium ore was made from Prince of Wales Island, Southeastern Alaska region.

The value of Alaskan mineral production rose 23 percent in 1957 compared with 1956. The rise resulted primarily from the increased value of sand and gravel production although the output of this commodity rose only moderately. The rise in value of sand and gravel was largely due to activity in isolated areas, with resultant high labor and other costs. Coal, gold, mercury, and stone also increased in output and value.

In value of output, sand and gravel (third in 1956), ranked first, gold (first in 1956) second, and coal (second in 1956) third. The production of these 3 commodities comprised 82 percent of the total value of the minerals produced in 1957, compared with 84 percent in 1956. Mercury output was more than 1½ times that in 1956 because of full-scale operation of the Red Devil mine. Chromite shipments declined primarily because of depleted direct shipping-grade reserves, although total production of direct shipping- and milling-grade ore

remained constant. Platinum-group metals and small quantities of antimony, copper, gem stones, lead, silver, and stone were produced during the year.

TABLE 3.—Employment and injuries in Alaska mines, 1957, by types of mines ¹

Type of mine	Number of men working (average)	Average number of days worked ²	Man days	Injuries (number)	
				Fatal	Nonfatal
Metal mines:					
Lode.....	118	180	21,209	1	16
Mills.....	21	201	4,224		11
Placer:					
Dredges.....	783	216	168,957		92
Nonfloat.....	264	110	29,124		9
Hydraulic.....	12	71	855		
Small-scale hand.....	6	51	305		1
Drift.....	1	50	50		
Nonmetal mines.....	92	100	9,182		2
Quarries and mills.....	62	59	3,660		
Coal mines.....	317	235	74,558	6	80
Total.....	1,676	186	312,124	7	211

¹ Excludes prospecting and purely investigational work but includes assessment and development work. Coverage of sand and gravel operations (nonmetal mines) approximately 9 percent; all others 100 percent.

² Calculated.

Employment.—During 1957, 164 mines and 2 ore-dressing plants were active and employed 1,676 men. These figures are not comparable with data published by the Bureau of Mines in 1956 because of inclusion of commercial sand and gravel fixed plants. Excluding sand and gravel operations, 152 active mines and 2 ore-dressing plants employed 1,584 men in 1957, compared with 170 mines and 2 ore-dressing plants employing 1,591 men in 1956. The relatively stable employment, despite the 12-percent decline in the number of active mines, resulted from operation of 2 new large dredges, each operating 3 shifts and from the fact that most of the mines ceasing activity were 1-man operations.

Wages and Hours.—The mines operated on an average of 186 days during the year. The short working period resulted from climatic conditions and necessitated working men as many or more overtime hours at premium pay as at regular pay. The average workweek in the coal industry was approximately 48 hours; some companies worked 50- and 63-hour weeks. Metal mines employed their personnel from 48 hours in one instance to 63 hours in the majority of cases.

In mineral industries covered by the Employment Security Act (companies having 4 or more employees working at least 20 weeks during the year), the average weekly earnings rose to \$142.82 in 1957, compared with \$126.66 in 1956. The rise in wages resulted from an attempt to compete with the construction industry for some types of skilled labor, as well as negotiated wage increases included in union contracts, necessitated by the constantly rising cost of living.

Average wage rates are shown in table 4. These are not comparable with those in 1956, which were excerpted from the Alaska General Contractors (AGC) AFL-CIO Construction Contract. Investigation has disclosed, however, that in today's surplus labor market very few mining companies pay the AGC rate, although those rates do exercise

considerable weight upon mine wages in Alaska. Therefore, an average of the wages actually paid by major companies has been compiled to indicate the general level of earnings in the Alaskan mining industry.

Wages were generally higher than in the United States because of the higher cost of living in Alaska. The annual cost-of-living survey conducted by the Department of State for the Civil Service Commission indicated that, compared to Washington, D. C., Anchorage was 57 percent, Fairbanks 67 percent, and Juneau 42 percent higher. Comparable data for 1956 were 49, 56, and 35 percent, respectively.

TABLE 4.—Average wage rates paid by coal and metal mining companies, by occupation, 1957

Occupation	Coal companies	Metal mines	Occupation	Coal companies	Metal mines
Cook.....	\$2.70	\$2.50	Shovel and dragline operator.....	\$4.00	-----
Laborer.....	-----	2.80	Tractor operator.....	3.70	\$3.80
Miner.....	4.20	3.30	Truck driver.....	3.50	3.60

Injuries.—With 7 deaths, the 1957 fatality record was considerably worse than that in 1956, when there was 1 fatal accident; 6 occurred in coal mines and the other in a lode mine. A major disaster occurred on January 18 at Evan Jones Slope mine of Evan Jones Coal Co., Jonesville, Cook Inlet-Susitna region, when a gas and dust explosion killed 5 men underground on the first shift. The explosion originated in a pocket in the top pillar, which was being extracted when the men were blasting with permissible-type explosives in a nonpermissible manner. There was considerable destruction of the main fanhouse and various underground workings. The mine subsequently was abandoned; the slope portal and fanshaft were sealed on January 25, 1957.

A roof fall killed a miner on December 11, 1957, at Suntrana mine, Suntrana Mining Co., Inc., Bonnifield district, Yukon River region. Inadequate roof support and failure of the miner to heed his supervisor's warning not to travel underneath that section were responsible for the fatality.

On April 18 a man was killed by a rockfall at the Admiralty-Alaska Gold Mining Co. nickel-copper prospect, Funter Bay, Admiralty Island, Southeastern Alaska region. The victim failed to follow instructions to remove an overhanging rock; he was killed while cleaning up around a mucking machine.

Legislation and Government Programs.—Defense Minerals Exploration Administration (DMEA) contracts for exploration programs in Alaska totaled \$413,000 in 1957. This represented a 46-percent decline from 1956. Contracts terminated or completed during the year amounted to \$320,000; new or increased contracts totaled \$88,000. Only 4 contracts were active in 1957 compared with 7 in 1956.

In November 1957 the Secretary of the Interior announced the opening of approximately 20 million acres in Northern Alaska for mineral leasing and mining claims. This land had been withdrawn from public entry in 1943. The action was of particular interest because it will permit competitive leasing of approximately 16,000

TABLE 5.—Defense Minerals Exploration Administration activities in Alaska, 1957

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	Apr. 2, 1954	\$49,251	50
KUSKOKWIM RIVER DeCoursey Mountain Mining Co.	Aniak	West of Sleitnute	Red Devil	Mercury	June 2, 1953	287,920	75
SOUTHEASTERN ALASKA Southeastern Mining & Exploration Co.	Juneau	Northwest of William Henry Bay.	Lucky Six	Uranium	May 27, 1957	² 24,000	75
YUKON RIVER Alaska Metals Mining Co., Inc.	Fairbanks	Gilmore Dome	Yellow Pup	Tungsten	Sept. 28, 1954	52,308	75

¹ All contracts were for lode deposits.

² Contract terminated.

acres in the Gubic gas field as well as release 4 million acres of adjacent land to noncompetitive leasing. It was also proposed to set aside an additional 9 million acres for a wildlife preserve (to extend roughly from the Canada-Alaska border to the Canning River in the west and from the Arctic Ocean to the south slopes of the Brooks Range, with a maximum north-south dimension of 140 miles). The release order does not permit entry on the 23-million acre Naval Petroleum Reserve No. 4 or on a 2-mile buffer zone surrounding the reserve.

The Twenty-third Territorial Legislature met in 1957 and passed several laws affecting the mining industry. The employment security taxable wage base was increased from \$3,600 per employee to \$4,200, and the minimum qualifying wage for employment security benefits was increased from \$450 to \$500. The Territorial corporate income tax rate was increased from 12½ to 18 percent.

The legislature also set up an assistance plan for prospectors. The new law provides round-trip fare, not to exceed \$200, to the prospecting area; food, clothing, and equipment up to \$100 per month for a maximum of 3 months; and monthly delivery of supplies to the prospector. Assistance will not be given to the same prospector more than once a year. The program will be administered by the Territorial Department of Mines.

A compulsory assessment-work affidavit law also was passed. This requires annual filing of an assessment-work affidavit. The new law states that the affidavit when filed by noon on September 29 of each year will be prima facie evidence that the work has been done. Failure to file within 6 months after the close of the assessment work-year (July 1 at noon) will be considered an abandonment of the claim; the claim will then become subject to relocation by another person. Compliance with the provisions of the act before relocation by someone else, however, will save the rights of the last locator. If the claim has not been relocated by another person within 1 year after forfeiture, the last locator may return and relocate the claim.

An Industrial Incentives Act also was passed by the Legislature. By this act, those businesses that produce or expect to produce a product not commercially produced in Alaska at present are exempt from all Territorial and local taxes, upon application to and approval by the board of administration. The law applies to processed or refined ores; mine production will not be considered unless the product is beneficiated or substantially processed in the Territory. Qualifying businesses also may be exempted by the board from real or personal property taxes for a maximum period of 10 years from the start of operation. Exempt businesses will not be required to pay the various licensing fees and excise or other taxes levied by the Territory. Exemptions granted do not apply to any Federal taxes.

Transportation.—There was no general increase in transportation rates in 1957; however, the major ocean carriers applied to the Maritime Commission for a 15-percent raise in December. Commodity rates on shipments of machinery and explosives from Seattle to various points in the Territory rose 2 and 31 cents per hundred pounds, respectively. The cost of transporting diesel oil remained the same as in 1956. Tariffs charged by the Alaska Railroad for transportation over its track remained relatively stable. Increases in the combina-

tion ocean-rail rates for transporting machinery and explosives reflected the rise in water-transport rates. The railroad began a program of upgrading its freight equipment in its own shops and, in addition, ordered 50 roller-bearing hopper cars. The latter will be used to haul coal from the Matanuska and Nenana coalfields to the various military installations.

TABLE 6.—Freight rates of selected commodities, Seattle to selected Alaskan cities, 1956-57, per hundred pounds

Commodity	Seattle to—							
	Seward		Anchorage		Fairbanks via Valdez		Fairbanks via Seward	
	1956	1957	1956	1957	1956	1957	1956	1957
Machinery.....	\$1.24	\$1.26	\$2.18	\$2.20	\$3.43	\$3.45	\$2.61	\$2.63
Explosives.....	3.10	3.41	4.82	5.13	6.66	6.99	6.23	6.54
Diesel oil.....	1.18	1.18	1.73	1.73	3.51	3.51	2.71	2.71
Ores and concentrates (southbound only) ¹.....	.68	.68	1.08	1.08	-----	-----	1.43	1.43

¹ Value not to exceed \$60 per ton. Rate increases 25 percent for each additional \$60 (or fraction) valuation.

Air-transportation rates remained stable in 1957 compared with 1956. Northern Consolidated Airlines, which services several of the larger mines in Alaska, began a modernization program. The company solicited funds by the sale of bonds and stock to finance the purchase of Fairchild turboprop planes. These will replace the present DC-3 and DC-4 fleet.

In February Alaska began participating in the Federal Highway Program. Under the Federal Highway Act, the appropriation for the fiscal year ending June 30, 1958, including the 1957 construction season, was \$13.2 million. These funds were matched by the Territory at the rate of 10 percent. In addition, some \$2 million was available from Forest Service funds for constructing roads within national forests. This will cover virtually all of Southeastern Alaska.

In 1957 there was approximately 2,000 miles of primary road (95 percent paved) and over 3,000 miles of secondary road (gravel-surfaced). The primary system connected Anchorage and Fairbanks with each other and with the ports of Haines, Valdez, and Seward. Fifty percent of the secondary system was connected to the primary system and 50 percent connected isolated communities with rail-, water-, and air-transportation facilities. Roadbuilding activities continued to connect these isolated roads with the primary system.

The Bureau of Public Roads continued work on U. S. 97, the Fairbanks-Nome Highway. It is anticipated that the Livengood-Eureka section will be completed during the summer of 1958. The 102-mile Denali Highway between Mount McKinley Park and Paxson on the Richardson Highway was opened to traffic in the fall of 1957. This will provide the Kathleen-Margaret mine with highway transportation. Paving of the last section of Richardson Highway was completed, and part of Sterling Highway (on the Kenai Peninsula) also was paved. Taylor Highway from Tetlin Junction on the Alaska High-

way to Dawson in Yukon Territory, which had been under construction in 1956, was in full operation in 1957.

The Territory of Alaska prepared to assume the roadbuilding and maintenance burden through creation of a Highway and Public Works Department in 1957. The department purchased a new ferryboat for operation between Juneau and Haines; this provided Juneau, the capital, with access to the Alaska Highway during summer.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—No antimony ore was mined in Alaska in 1957. Earl R. Pilgrim, however, shipped a small quantity of material from stocks at the Stampede mine, Kantishna district, Yukon River region, to Kobe, Japan. Pilgrim did not anticipate reopening the mine until a road connecting the Stampede mine to Mount McKinley Park Highway is built. This would allow easy access to the Alaska Railroad or to Denali Highway.

There was virtually no prospecting activity for antimony during the year. Assessment work was reported by Kloss and Davis at Sunset Cove and by Tillicum Mining Co. near Ketchikan, both in Southeastern Alaska.

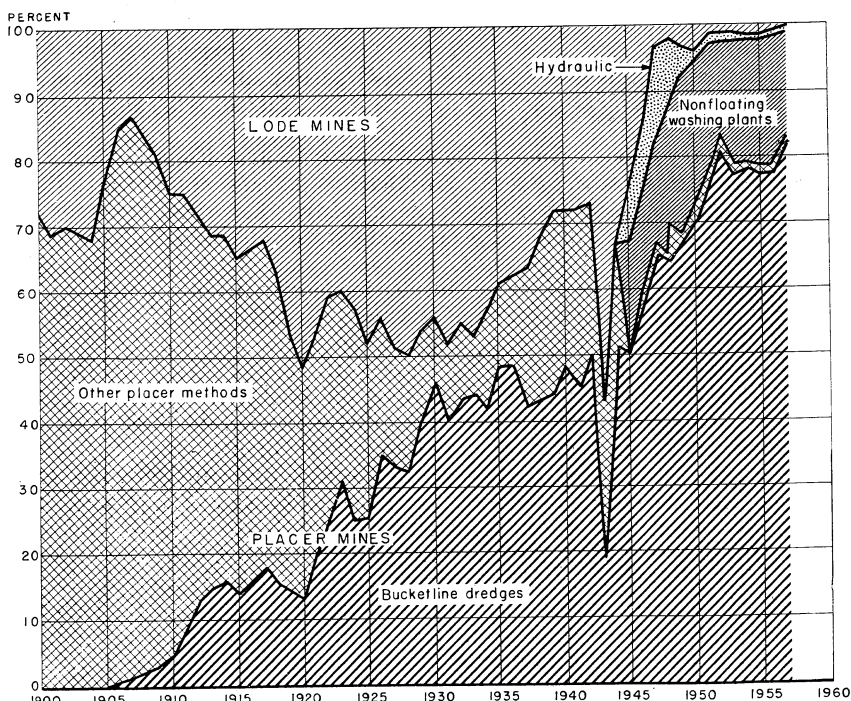


FIGURE 2.—Percentage of total Alaska gold produced at lode and placer mines and by various methods of placer mining, 1900–57; “Other placer methods” includes hydraulic and nonfloating washing plants, for which separate data are not available before 1943.

Chromium.—In 1957, shipments of chromite ore from Alaska declined sharply compared with 1956 because of a drop in the grade of ore mined by the Kenai Chrome Co. near Jakolof Bay, Kenai Peninsula region. Approximately one-half of the company mine output was shipped to the General Services Administration (GSA) Ore Purchase Depot at Grants Pass, Oreg. The rest of the ore was stockpiled at the newly constructed company mill. It was anticipated that the ore would be beneficiated during the winter. Sourdough Mining Co., Seldovia, began producing in 1957. Output was relatively minor.

Copper.—Less than 1 ton of copper (recovered as a secondary metal from a shipment of gold concentrate produced in previous years) was marketed from Alaska during 1957. Several mining companies continued their prospecting or development activities in the Territory during the year. Among these were the Bear Creek Mining Co. (Kennecott Copper Corp., subsidiary) Northwestern Alaska region; MacLaren River Copper Corp., Cook Inlet-Susitna region; and Totem Exploration Co., Southeastern Alaska region.

Gold.—Gold output from Alaska mines increased 3 percent in 1957 compared with 1956, primarily because of yield from two new dredges. Production from these more than balanced the net loss of 1 dredge—22 dredges in 1956, 21 in 1957. During the year, 7 dredges ceased activity, 2 new dredges began producing, and 4 old dredges started producing again. The effect of these new dredges is best indicated by the 16-percent rise in gravel washed and the 10-percent increase in gold recovered by dredges, compared with 1956.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, 1948–52 (average), 1953–57, and total 1948–1957, 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		Fine ounces	Value	Fine ounces	Value
1948–52 (average).....	13	194	33, 770	249, 455	\$8, 730, 939	44, 378	\$40, 165
1953.....	3	148	475	253, 783	8, 882, 405	35, 387	32, 027
1954.....	5	146	19, 747	248, 511	8, 697, 885	33, 697	30, 497
1955.....	4	142	3, 884	249, 294	8, 725, 290	33, 693	30, 494
1956.....	3	120	265	209, 296	7, 325, 360	28, 360	25, 697
1957.....	4	87	11, 626	215, 467	7, 541, 345	28, 862	26, 122
1948–1957.....			(³)	28, 859, 718	722, 122, 186	20, 217, 441	14, 483, 547

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948–52 (average).....	5	\$2, 300	110	\$36, 343	6	\$1, 683	\$8, 811, 430
1953.....			9	2, 358			8, 916, 790
1954.....	4	2, 360					8, 730, 742
1955.....	1	746	1	298			8, 756, 828
1956.....	(⁴)	(⁴)	1	314			7, 351, 341
1957.....	(⁴)	(⁴)	9	2, 574			7, 570, 041
1948–1957.....	685, 910	226, 889, 964	25, 762	3, 031, 940	56	14, 466	966, 542, 103

¹ Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes retreated, and ore shipped to smelters during calendar year indicated.

² Does not include gravel washed.

³ Figure not available.

⁴ Less than 1 ton; quantity and value not included in total.

TABLE 8.—Fifteen leading gold-producing mines in 1957, in order of output

Rank	Mine	District	Region	Rank in 1956	Operator	Source of gold
1	Fairbanks Unit.....	Fairbanks.....	Yukon River.....	1	United States Smelting, Refining & Mining Co.	Dredges (7).
2	Nome Unit.....	Nome.....	Seward Peninsula.....	2	do.	Do. (3).
3	Nyac.....	Aniak.....	Kuskokwim River.....	3	New York-Alaska Gold Dredging Corp.	Do. (2).
4	Hogaza River.....	Hughes.....	Yukon River.....	(1)	United States Smelting, Refining & Mining Co.	Do. (1).
5	Colorado Creek.....	Innoko.....	do.....	7	Strandberg & Sons	Nonfloat.
6	Coal Creek.....	Circle.....	do.....	4	Gold Placers, Inc.	Dredge (1).
7	Older Creek.....	Aktarod.....	do.....	11	Older Dredging Co.	Do. (1).
8	Flat Creek.....	do.....	do.....	15	North American Dredging Co.	Do. (1).
9	Slate Creek.....	Chisana.....	do.....	(1)	Hobbs Enterprises	Nonfloat.
10	Fairbanks Creek.....	Fairbanks.....	do.....	12	Alder Creek Mining Co.	Do.
11	Eureka Creek.....	Hot Springs.....	do.....	6	Strandberg & Sons	Do.
12	Blf Creek.....	Chandalar.....	do.....	(1)	Chandalar Mining Co.	Do.
13	Poorman Creek.....	Ruby.....	do.....	10	Miscovitch Bros.	Do.
14	Indian River.....	Hughes.....	do.....	(1)	Strandberg & Sons	Do.
15	Ophir Creek.....	Innoko.....	do.....	(1)	Gus Uotila.....	Do.

¹ Not among the 15 highest in 1956.

Despite the comparatively favorable dredge picture in 1957, the value of ground washed by these units continued to drop. In 1957 each cubic yard was worth an average of 44 cents, compared with 46 cents in 1956 and 62 cents in 1955.

TABLE 9.—Gold produced at placer mines, 1948–52 (average), 1953–57, and total, 1880–1957, by classes of mines and methods of recovery

Class and method	Mines producing ¹	Washing plants	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1948–52 (average)	19	26	13,310,000	183,970	\$6,438,950	\$0.484
1953	14	23	14,080,000	197,701	6,919,535	.491
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
Nonfloating washing plants: ²						
1948–52 (average)	100	100	3,454,900	53,832	1,884,120	.545
1953	87	87	3,591,000	53,991	1,889,685	.526
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
Gravel hydraulically handled:						
1948–52 (average)	33	-----	362,660	5,027	175,945	.485
1953	14	-----	36,000	820	28,700	.797
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
Small-scale hand methods (wet):						
1948–52 (average)	39	-----	32,060	806	28,210	.880
1953	33	-----	17,000	604	21,140	1.244
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
Underground placers (drift):						
1948–52 (average)	3	-----	830	129	4,515	5.440
1953	-----	-----	-----	-----	-----	-----
1954	1	-----	200	14	490	2.450
1955	2	-----	400	42	1,470	3.675
1956–57	-----	-----	-----	-----	-----	-----
Grand total placers:						
1948–52 (average)	194	-----	17,160,450	243,764	8,531,740	.497
1953	148	-----	17,724,000	253,116	8,859,060	.500
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
1880–1957	-----	-----	(³)	(³)	⁴ 504,076,577	(³)

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

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

³ Complete data not available.

⁴ Data for 1880–1936 from published records of the Federal Geological Survey.

TABLE 10.—Mine production of gold, silver, copper, and lead in 1957, by months, in terms of recoverable metals ¹

Month	Gold (fine ounces)	Silver (fine ounces)	Lead (short tons)	Month	Gold (fine ounces)	Silver (fine ounces)	Lead (short tons)
January.....				August.....	40,711	5,009	
February.....				September.....	42,720	5,815	
March.....	1,076	198		October.....	40,941	5,160	
April.....	1,653	673		November.....	27,472	3,881	
May.....	4,839	1,056		December.....	5,147	630	² 9
June.....	16,457	2,425		Total.....	215,467	28,862	9
July.....	34,451	4,015					

¹ Derived mostly from mint and smelter receipts; data are adjusted to exclude receipts during the first part of 1957 previously credited to 1956 production, and to include expected receipts in 1958 which are part of actual output in 1957. No zinc produced in 1957; data for copper (less than 1 ton) not included in totals.

² Includes all smelter receipts of lead produced in 1957.

The number of nonfloating placer plants (an operation in which the gravel is delivered to sluiceboxes on bedrock or to elevated sluice boxes with bulldozer or dragline excavation equipment) continued to decline. There were 70 active operations in 1957, compared with 76 in 1956 and 90 in 1955. Most operators who remained active reworked old tailings and in many instances were highly inventive. The trend was to use elevated sluiceboxes mounted on rubber tires, allowing complete flexibility of operation by the use of various mechanisms. In most instances, boxes could be raised, lowered, or pointed in any direction to aid disposal of tailings. In addition, several operators were investigating the use of rubber-tired bulldozers in place of crawler-type tractors for the disposal of tailings. Many thought that the rubber-tired type would have much lower maintenance cost.

In all, 87 placer mines and 4 lode mines were active in 1957 compared with 120 and 3, respectively, in 1956. Placer mines continued to be the major source of gold in Alaska. The 70 mines utilizing nonfloating washing plants produced 17 percent (21 percent in 1956) of the gold output, dredge operations yielded 82 percent (77 percent in 1956), and hydraulic, small-scale hand, and lode mines contributed the remaining 1 percent. The greatest decrease occurred among the small-scale hand and hydraulic operations. In 1956 there were 17 small-scale hand and 14 hydraulic producers. In 1957 these dropped to 2 small-scale hand and 3 hydraulic producers. Output from lode mines included small quantities of gold from Yellowband mine of Yelinore, Inc., Nizina district, Copper River region; Flume Creek mine of Fred M. Wackwitz and Moosehunter mine of Wilson & Drake Mining Co., Fairbanks district, Yukon River region; and Gastineau Contractors, Inc., Juneau district, Southeastern Alaska region (Alaska Juneau mill cleanup).

The Fairbanks district, Yukon River region, continued to be the major gold-producing area in Alaska. It was followed in value of output by the Nome district, Seward Peninsula region. United States Smelting, Refining & Mining Co. continued to be the leading gold producer in Alaska, operating 7 dredges in Fairbanks district, 3 at Nome, and 1 on the Hogatza River. The company completed its preparatory stripping and thawing activities on Chicken Creek, Fortymile district, Yukon River region.

TABLE 11.—Mine production of gold, silver, copper, and lead in 1957, by regions and districts, in terms of recoverable metals ¹

Region and district ²	Mines producing ³		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total			
Cook Inlet-Susitna region:												
Valdez Creek.....				19	19				3			\$608
Yentna.....		4		703	703				113			24,707
Copper River region:												
Nelchina.....		1		127	127				28			4,470
Nikina.....	1		36	652	709		10		77			24,885
Kuskokwim River region:												
Aniak.....		3		20,637	20,637				2,162			724,252
Bethel.....		1		121	121				17			4,280
Seward Peninsula region:												
Council.....		1		418	418				42			14,668
Pathaven.....		4		1,716	1,716				255			60,291
Kougarok.....		4		1,177	1,177				101			41,286
Koyuk.....		1		258	258				19			9,047
Nome.....		5		43,654	43,654				4,870			1,532,298
Port Clarence.....		(⁴)		11	11				1			386
Southeastern Alaska region:												
Juneau.....	1	(⁴)	11,535	24	326	302	62	9	71	(⁶)	(⁶)	11,474
Petersburg.....		(⁴)		2	2							70
Yukon River region:												
Circle.....		4		5,111	5,111				651			179,474
Bagle.....		1		346	346				35			12,142
Fairbanks.....		2		98,127	98,173	46	1,704		13,539	18,000		3,452,479
Fortymile.....		7	55	951	951				189			33,456
Hot Springs.....		4		2,341	2,341				611			82,488
Iditarod.....		5		8,434	8,434				1,252			296,323
Innoko.....		8		8,342	8,342				1,070			292,988
Kanishma.....		1		76	76				13			2,672
Koyukuk.....		3		288	288				22			10,100
Marshall.....		1		7	7				1			246
Melozitna.....		1		194	194				17			6,805
Rampart.....		3		317	317				30			11,122
Ruby.....		4		3,306	3,306				561			116,218
Tulovana.....		1		799	799				80			28,037
Other districts ⁴		11		16,904	16,904				1,268			592,789
Total ⁵	4	87	11,626	215,062	215,467	405	1,836	27,026	28,862	(⁶)	18,000	7,570,041

¹ No zinc produced in 1957; quantity and value of copper and lead in Juneau district, Southeastern Alaska region, not included in district or Alaska totals (see footnote 5).
² Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; others producing are listed in footnotes 6 and their output included with "Other districts."
³ Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
⁴ No producing mines; production was before but not reported until 1957.
⁵ Less than 1 ton (see footnote 1).
⁶ Includes the following districts for which quantities and values cannot be shown separately (number of operations in parentheses): Chistochina (2), Copper River region; Hope (1), Kenai Peninsula region; Goodnews Bay (2) and McGrath (1), Kuskokwim River region; Shumagak (1), Northwestern Alaska region; Chandalar (1), Chisana (1), and Hughes (2), Yukon River region.
⁷ Includes quantities and values of gold and silver recovered from properties that were inactive in 1957, as indicated in footnote 4.
⁸ Includes 3 mines, active in 1957, from which no recovered gold or silver was sold, except as natural gold; 1 each in Hope district, Kenai Peninsula region, and in Fortymile and Marshall districts, Yukon River region.

TABLE 12.—Mine production of gold, silver, and lead in 1957, by regions, in terms of recoverable metals ¹

Region	Mines producing		Gold (lode and placer)		Silver (lode and placer)		Lead		Total value
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Pounds	Value	
Cook Inlet-Susitna.....		4	722	\$25,270	116	\$105			\$25,375
Copper River.....	1	4	1,596	55,860	185	167			56,027
Kenai Peninsula ²		1							
Kuskokwim River.....		7	21,475	751,625	2,216	2,006			753,631
Northwestern Alaska and Seward Peninsula.....		16	47,378	1,658,230	5,322	4,817			1,663,047
Southeastern Alaska.....	1		328	11,480	71	64	(³)	(³)	11,544
Yukon River.....	2	55	143,968	5,038,880	20,952	18,963	18,000	\$2,574	5,060,417
Total.....	4	87	215,467	7,541,345	28,862	26,122	18,000	2,574	7,570,041

¹ No zinc produced in 1957; quantity (less than 1 ton) and value of copper and lead produced in Southeastern Alaska not included in region or Alaska totals.

² Gold and silver recovered in 1957; none sold.

³ Less than 1 ton (see footnote 1).

TABLE 13.—Equipment used at placer-gold mines ¹ in Alaska, 1957, by regions

Region	Number of operations	Gravel washed (cubic yards) ²	Equipment used (number)				
			Bull-dozers	Drag-lines	Hydraulic giants	Dredges	Other ³
Cook Inlet-Susitna.....	4	74,700	5		1		
Copper River.....	4	114,980	2				1
Kenai Peninsula.....	1	1,580	1		1		
Kuskokwim River.....	7	1,847,810	14	7	9	3	
Northwestern Alaska.....	1	3,000	1				
Seward Peninsula.....	15	4,217,430	27	4	17	6	5
Yukon River.....	55	10,385,400	82	25	203	12	8
Total.....	87	16,644,900	132	36	231	21	14

¹ Includes equipment used at 1 operation from which gold is a byproduct of platinum-group metals recovery.

² Partly estimated.

³ Includes hydraulic elevators, power shovels, pumping units, scrapers, screen stackers, talling hoists, and dry-land dredges.

Placer-mine operators reported that 601 ounces of natural gold (nuggets, grains, and dust that had not been melted or amalgamated) was sold to buyers and jewelers. Prices were \$3 to \$5 an ounce above the mint price of \$35 per fine ounce. The major nugget-producing areas were the Yukon River, Seward Peninsula, and Copper River regions.

Iron Ore.—No iron ore was shipped from Alaska in 1957, but the tempo of exploration remained high. Six companies were active during the year. Almost all of them confined their activities to the southeastern part of the Territory.

Lead.—Lead was recovered from a sulfide concentrate produced in previous years and from a shipment of lead-silver ore mined in Fairbanks district, Yukon River region. There was little prospecting or exploration for lead deposits during the year.

Mercury.—Production of mercury was more than 1½ times that in 1956, largely a result of development of additional ore reserves at the Red Devil mine, Kuskokwim River region, as well as operation

of the mine for a full 12 months during the year; the Red Devil mine was active for 10 months in 1956.

The only other mercury producer in Alaska was Russel R. Schaefer, operator of the Schaefer mine (formerly the Broken Shovel mine), in the Aniak district, Kuskokwim River region. Output of both mines was sold to buyers in the United States and to local gold-placer operators. Exploration for mercury was at a high level during the year. The DeCoursey Mountain Mining Co., operator of the Red Devil mine, took over development of the Red Top mine, Bristol Bay region, formerly owned by the Moneta Porcupine Mines, Ltd. The Cordero Mining Co. and the Sunshine Mining Co. were active in the Kuskokwim River region.

TABLE 14.—Production of mercury, 1948-52 (average) and 1953-57

Year	Pro- ducing mines	76-pound flasks	Price ¹ (per flask)	Value
1948-52 (average) ²	1	46	\$129.29	\$5,947
1953.....	2	40	193.03	7,721
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

¹ Value calculated at average New York price.

² No production in 1950-51.

³ Figure withheld to avoid disclosing individual company confidential data.

Nickel.—Admiralty-Alaska Gold Mining Co. continued development work at a nickel-copper deposit on Funter Bay, Admiralty Island, Southeastern Alaska region.

Platinum.—The Goodnews Bay Mining Co., only producer of platinum as a primary product in the United States or its Territories, continued operating a dredge and sluice 10 miles south of Platinum, Kuskokwim River region.

Scrap Metals.—Approximately 6,200 tons of scrap metal (principally ferrous metals) was shipped to markets in Japan and Washington State. Much of the metal was salvaged from abandoned mines and obsolete military installations.

Silver.—As in previous years, most of the silver produced in Alaska in 1957 was a byproduct of gold output; 94 percent of the silver came from placer-gold operations and the remainder from lode mines. Output rose 2 percent in 1957 compared with 1956, because of increased gold recovery. The leading gold producers also were the major silver producers. The United States Smelting, Refining & 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.

Tungsten.—No tungsten ore or concentrate was shipped by Alaska mines in 1957. Alaska Metals Mining Co., Inc., however, continued exploration at Gilmore Dome, Fairbanks district, Yukon River region, with DMEA assistance.

Uranium.—The first shipments of uranium ore from Alaska were made in 1957; the ore was shipped from the Ross-Adams property,

Prince of Wales Island, Southeastern Alaska region, to the Dawn Mining Co. mill at Ford, Wash. Kendrick Bay Mining Co., a jointly owned operation of Climax Molybdenum Co. and a group of Ketchikan prospectors, produced the ore. The company completed its diamond-drilling program on the Ross-Adams property in 1956 and began mining in July 1957 at the rate of 400 tons per day. In early September the first shipment was made. Ore shipments were barged to Seattle and transhipped by train and truck to Ford. There was little prospecting for uranium during the year.

NONMETALS

Clays.—Basic Building Products Co. did not operate either its brick plant near Anchorage, Cook Inlet-Susitna region, or its Eagle River and Sheep Mountain clay mines. The shutdown resulted from operational difficulties with the scove kiln.

Gem Stones.—Shungnak Jade Project, Shungnak, Northwestern Alaska region, continued to purchase jade from Eskimo claim owners in 1957. The project, Eskimo-operated but sponsored by the Alaska Native Service, continued to cut, polish, and shape jade for souvenirs and jewelry. The organization's entire output was marketed through the Alaska Native Arts and Crafts Association.

The Empire Jade Co., Kotzebue, Northwestern Alaska region, continued to send part of its raw material to Germany for cutting and polishing. The company hauled a jade boulder, estimated to weigh 20 tons, from the mine at Jade Mountain to Kotzebue; at the end of 1957 the boulder was stored in a meadow.

Small quantities of agate and petrified wood were collected, cut, and polished for jewelry by the Alaska Lapidary Service, Baranof, Southeastern Alaska region. Frank H. Waskey, Kuskokwim River region, offered beach pebbles and leaf imprints from Nelson Island Beach for sale.

Norton's Gem Shop, Seward, and the Alaska Jade Co., Fairbanks, were inactive during 1957.

Sand and Gravel.—Construction of an early warning radar system and greater use of paving material resulted in a moderate increase in sand and gravel output in 1957 compared with 1956. The value of production rose 50 percent compared with 1956 because of high labor costs at isolated construction sites on the Alaska Peninsula and Aleutian Islands. The average value rose from \$0.99 per ton in 1956 to \$1.44 in 1957.

Nine commercial and six Government agencies or their contractors produced sand and gravel in 1957. When compared with stateside data, the Alaska Railroad is considered a commercial producer, although it is an Agency of the United States Department of the Interior. Major producers of sand and gravel were the United States Army Corps of Engineers and the Bureau of Public Roads, United States Department of Commerce.

The percentage of sand and gravel produced by Government agencies or their contractors rose from 87 percent in 1956 to 92 percent in 1957 and resulted primarily from increased output by the United States Army Corps of Engineers.

TABLE 15.—Sand and gravel sold or used by producers, 1956-57, by uses

	1956		1957	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
Sand:				
Structural.....	104	\$298	159	\$552
Paving.....	188	345	198	682
Other.....	5	44	(¹)	(¹)
Gravel:				
Structural.....	149	407	330	720
Paving.....	5,012	4,268	5,108	6,589
Railroad ballast.....	131	118	277	241
Other.....	366	400	(¹)	(¹)
Undistributed.....			2 24	2 15
Total.....	5,955	5,880	6,096	8,799

¹ Included with "Undistributed" in 1957 to avoid disclosing individual company confidential data.

² Includes blast, filter, and "Other sand" and "Other gravel."

TABLE 16.—Stone sold or used by producers, 1956-57, by uses

	1956		1957	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
Crushed and broken:				
Riprap.....	148	\$351	98	\$326
Concrete and road stone.....	37	215	350	1,544
Other ¹	10	29	80	83
Total.....	195	595	528	1,953

¹ Includes: 1956—railroad ballast and asphalt aggregate; 1957—acid neutralization, building, and chips for seal coating and fill material.

Stone.—Basalt, granite, marble, miscellaneous stone, and sandstone were produced in 1957 with granite representing 50 percent of the total production. The entire stone output except marble came from quarries operated by Government agencies or their contractors; most of it came from quarries operated by the United States Army Corps of Engineers and by the 17th Naval District. Approximately one-third of the stone was used in producing concrete at Elmendorf Air Force Base and Fort Richardson.

Production of stone more than doubled that in 1956; however, this increase is not significant, because stone is used only when suitable sand and gravel deposits are not available. Production generally fluctuates widely from year to year.

White Marble quarry, Fairbanks district, Yukon River region, was the only commercial stone producer in Alaska in 1957.

MINERAL FUELS

Coal.—Coal production in 1957 almost equaled that in the record year 1953. Output was 16 percent higher than in 1956, primarily because of increased use by military installations despite an extremely warm winter. The annual average monthly temperature was 37° F. compared with 31° F. in 1956. Almost 90 percent of the coal was sold for use as heat and power to Ladd and Eielson Air Force bases

near Fairbanks, Fort Richardson, and Elmendorf Air Force Base near Anchorage, and other military bases in the Territory. The continued rise in production of Alaskan bituminous coal reflected the Territory's strategic position with consequent continued expansion of its military bases. Coal not used by military establishments was sold to local utilities for producing heat and power and for domestic heating and cooking. As in 1956, retail prices in Anchorage and Fairbanks were approximately \$24 per ton.

Four underground and six strip mines were operated by seven companies in 1957. The Pioneer Mining Co. was inactive during the year; Cripple Creek Coal Co. began production. Output continued to come from the Matanuska field, Cook Inlet-Susitna region; the Nenana field, Yukon River region; and Point Barrow, Northern Alaska region. Most of the underground production was shot from the solid or cut by hand.

TABLE 17.—Production of coal, 1956-57, by fields

Field	Thousand short tons	
	1956	1957
Matanuska.....	269	237
Nenana.....	457	604
Barrow.....	1	1
Total.....	727	842

TABLE 18.—Production of coal, 1948-52 (average), 1953-57, and total 1880-1957¹

Year	Thousand short tons	Value (thousands)
1948-52 (average).....	487	\$3, 736
1953.....	861	8, 452
1954.....	667	6, 442
1955.....	640	5, 759
1956.....	727	6, 374
1957.....	842	7, 286
1880-1957.....	10, 947	79, 334

¹ Production data for 1880-1940 from published records of the Federal Geological Survey.

In 1957, the only continuous miner in use belonged to Usibelli mine, of Usibelli Coal Mines, Inc.; in 1956, 2 continuous miners were in use. These machines are not efficient under Alaskan mining conditions. Use of mechanized coal-loading equipment also decreased. In 1957, 4 mobile loaders, 1 scraper loader, and 8 duckbills were used, compared with 6 mobile loaders, 13 scraper loaders, 5 duckbills, and 6 hand-loaded conveyors in 1956. This decline is not indicative of a trend; it merely reflects mining conditions during the year.

The average value at the tippie of coal mined underground dropped from \$9 per ton in 1956 to \$8.41 in 1957, primarily because of the influence of competition. For the first time, underground coal sold for less than strip-mined coal. Continuing its upward march in value, strip-mined coal sold for \$8.80 per ton, compared with \$8.64 per ton in

1956. Its increased value resulted from higher costs, particularly for removing overburden.

In 1957, 65 percent of the total coal production came from the Territory's strip mines compared with 64 percent in 1956. Of the total coal output, 37 percent was cleaned, compared with 47 percent in 1956. The decline in cleaned coal resulted because the Pioneer Mining Co. mine and cleaning plant shut down. Evan Jones Coal Co. and Mrak Coal Co., in the Matanuska field and Usibelli Coal Mines, Inc., in the Nenana field operated cleaning plants.

A suit against Usibelli Coal Mines, Inc., and Cripple Creek Coal Co. was filed by Suntrana Mining Co., Inc., in 1957. The suit involved a demand for \$80,000 damages and a restraining order preventing the 2 defendants from dumping overburden from hydraulic-mining operations into the Healy River. Suntrana Mining Co., Inc., contended that overburden from the other two coal companies, both located upstream, was filling in the river near its operation, making its mines increasingly vulnerable to floods. The court had reached no decision at the end of the year.

Natural Gas.—There was no commercial production of crude petroleum or natural gas in 1957. The naval base at Point Barrow, however, continued to use a small quantity of natural gas from one of the wells drilled during the United States Navy exploration program on Naval Petroleum Reserve No. 4, Northern Alaska region.

The outstanding development in the petroleum industry in 1957 was the discovery of oil on the Kenai-Moose Range, Kenai Peninsula, by the Richfield Oil Corp. in July. The Swanson River No. 1 well was originally reported to have a flow of 200 barrels per day, but subsequent reports indicated that the well could flow at the rate of 900 barrels per day plus 122,000 cubic feet of gas. The discovery of oil caused a full-fledged oil boom, indicated by the rise in acreage under lease. At the beginning of 1957 approximately 5 million acres was under lease for oil exploration or prospecting; by the end of the year over 10 million acres was under lease, and applications had been filed for 14 million acres more. This area under lease or application for lease in size roughly equivalent to Maine and Connecticut combined, comprises only 6 percent of the total area of Alaska.

Other companies drilling wells in Alaska were Colorado Oil & Gas Corp. in the Yakutat area; Humble Oil & Refining Co., with the cooperation of the Shell Oil Co., on the Alaska Peninsula; Anchorage Gas & Oil Development Co., Inc., in the Willow Creek area; and Phillips Petroleum Co. at Yakutat.

Companies active in geophysical work in 1957 were Benedum Interests in the Kateel River-Koyukuk River area, Richfield Oil Corp. in the Matanuska Valley, and Standard Oil Co. of California on the Kenai Peninsula.

Major companies having landholdings of considerable size comprised the Alaska Oil & Mineral Co., Colorado Oil & Gas Corp., Humble Oil & Refining Co., Ohio Oil Co., Phillips Petroleum Co., Shell Oil Co., and Standard Oil Co. of California.

In 1957, the Secretary of the Interior issued regulations restricting oil and gas development on wildlife lands except when oil might be drained away from them by wells on adjacent land. Alaskan wildlife

lands were specifically exempted from the regulations with a provision that before leases are issued, the Fish and Wildlife Service must make a protective plan for wildlife for each refuge.

The Alaska Oil and Gas Conservation Commission in mid-November issued a preliminary draft of the rules and regulations setting technical standards for exploring and developing Alaska's oil and gas resources. The regulations will become effective in 1958. They will require filing complete data on oil and gas production and exploration work in the Territory. Information will be considered confidential for 2 years. Hearings on these preliminary regulations will be held in the spring of 1958.

REVIEW BY REGIONS

Regions and districts used in this report conform to a pattern previously established, boundaries are defined in a report published in 1954.⁵

In 1957, as in previous years, the Yukon River region led all other areas in Alaska in the total value of mineral production. The area was followed by the Cook Inlet-Susitna, the Aleutian Islands, and Kuskokwim River regions. In 1956, the leading mineral-producing areas were the Yukon River, Cook Inlet-Susitna, Kuskokwim River, and Copper River regions. The rise in prominence of the Aleutian Islands region resulted primarily from increased construction activity, with a consequent increase in sand and gravel and stone production in that area. The decline in the importance of gold to the Alaska's mineral economy was well illustrated by the fact that the regions ranking second, third, and fourth owed their prominence to commodities other than gold.

TABLE 19.—Value of mineral production in Alaska, 1956-57, by regions¹

Region	1956 (thousands)	1957 (thousands)	Minerals produced in 1957 in order of value
Alaska Peninsula.....		\$818	Sand and gravel.
Aleutian Islands.....	\$152	4,242	Sand and gravel, stone.
Bristol Bay.....	89		
Cook Inlet-Susitna.....	5,229	5,048	Coal, sand and gravel, stone, gold, silver.
Copper River.....	1,586	113	Gold, sand and gravel, stone, silver.
Kenai Peninsula.....	977	1,027	Sand and gravel, chromite.
Kodiak.....	248	192	Stone, sand and gravel.
Kuskokwim River.....	3,079	3,370	Mercury, platinum-group metals, gold, sand and gravel, silver, gem stones.
Northern Alaska.....	46	12	Coal.
Northwestern Alaska.....	153	21	Gem stones, sand and gravel, gold, silver.
Seward Peninsula.....	983	1,780	Gold, sand and gravel, silver.
Southeastern Alaska.....	580	698	Sand and gravel, uranium, stone, gold, gem stones, silver.
Yukon River.....	10,286	11,471	Gold, coal, sand and gravel, stone, silver, antimony, lead.
Total Alaska.....	23,408	28,792	

¹ No mineral production from Bering Sea region.

No mineral production was reported from the Bering Sea region.

Alaska Peninsula.—Sand and gravel for use in military construction was produced. Humble Oil & Refining Co. and Shell Oil Co., operating under a cooperative agreement, began oil-exploration activ-

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.

ities at Jute Bay, 350 miles southwest of Anchorage. The first well, Bear Creek unit No. 1, was spudded September 23 and at the end of the year was 6,585 feet deep. Preparatory work included building a road from the beach to the drill site, 5 miles inland.

Aleutian Islands.—General Metals of the Aleutians shipped ferrous and nonferrous scrap metal to Japan and the United States. The scrap metal was recovered from World War II military equipment abandoned on the islands by American and Japanese armed forces. Large quantities of stone and sand and gravel for use in Government construction were mined.

Bristol Bay.—DeCoursey Mountain Mining Co. continued development of the Red Top mine (formerly under lease to Moneta Porcupine Mines, Ltd.). Completed underground work included 900 feet of drifts. No mineral commodities were marketed from the region.

Cook Inlet-Susitna.—Coal continued to be the leading commodity, in terms of value, produced in the Cook Inlet-Susitna region. Production and value of coal, compared with 1956, declined approximately 12 and 10 percent, respectively. The 237,117 tons of coal mined was sold at an average value of \$12.43 per ton. Stone, sand and gravel (used mostly for military construction), gold, and silver were also produced. Gold and silver came from small placer-mining operations in Valdez Creek and Yentna districts. No gold was reported from lode-gold deposits in the Willow Creek district for the second consecutive year since production started in 1909. The Alaska Railroad shipped scrap metal to the United States.

MacLaren River Copper Corp. acquired the Kathleen-Margaret mine of the Alaska Copper Mining Co., 12 miles north of Mile 42 on the Denali Highway (Valdez Creek district). During the year 410 feet of diamond drilling was completed under a DMEA contract. The company was seeking additional capital to complete exploration and development and build a mill at the mine site.

Anchorage Gas & Oil Development Co., Inc., continued drilling its Rosetta No. 3 well in the Willow Creek district. The well, spudded in 1955, reached a depth of 3,490 feet at the end of 1957. The company completed negotiations with Union Oil Co. of California for the latter to acquire nearly 25,000 of the 86,000 acres under lease to it.

Havenstrite Oil Co. continued casing its Iniskin unit No. 1 well in the Redoubt district. Drilling activity at the Iniskin No. 1 well began in 1953 and was halted in 1954. At the end of 1957, the company had cased 9,375 feet of the 9,745-foot well. Good "shows" of oil were reported from the well, but recovery in 1957 was not believed to be of commercial quantity.

Coal mined in the region came from underground and strip mines of the Evan Jones Coal Co. and strip mines of the Mrak Coal Co., both in the Willow Creek district. The Evan Jones Coal Co. shut down from mid-April until July after completing its military contract. An explosion in January killed five men in Evan Jones Slope mine. After recovery of the bodies, the portal of the slope mine was sealed; other extensive underground workings were not involved in the explosion.

The Bureau of Mines issued a report⁶ on an investigation in the Matanuska coalfield. Over 2,000 feet of diamond drilling was completed. During the project 10 coal beds were cut; of these, 2 appeared to be persistent and minable over an area of $\frac{1}{2}$ square mile. This area was said to contain nearly 5 million tons of coal. Two other beds east of the $\frac{1}{2}$ -square-mile area may be minable. Deeper beds apparently lie beneath a zone of gas and brackish water.

Basic Building Products Co., Anchorage, did not operate its scove brickkiln. The company was trying to arrange financing to replace this kiln with a more efficient downdraft unit. Clay from the company Sheep Mountain deposits will be used to manufacture refractory brick for the kiln construction.

Copper River.—Value of mineral production in the Copper River region continued the sharp decline that began in 1956. Production dropped \$1,473,000 because of lower requirements for sand and gravel caused by completion of roadbuilding contracts. One lode and four placer mines recovered a small quantity of gold and silver. Stone was also produced.

Oil exploration continued in the Yakataga area. Phillips Petroleum Co. abandoned drilling operations at its No. 2 well at the 12,000-foot level after recovery tests did not indicate oil in commercial quantities. The company was prospecting in the same area to determine future drill sites.

Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., prospected and explored Prince William Sound district. The company also investigated prospects near the site of the famous "Kennecott Bonanza" (idle since 1938) in Nizina district, using a helicopter for transportation and reconnaissance.

The Bureau of Mines issued a report⁷ on copper investigations in Prince William Sound district. Deposits examined assayed to over 8 percent copper; zinc, gold, and silver were present in small amounts. Flotation tests indicated 81 percent of the values could be recovered in a product assaying 28 percent copper.

Kenai Peninsula.—The Kenai Chrome Co. Star Four mine was active from June to October. The mine, 10 miles northeast of Seldovia, is 2,500 feet above sea level on Red Mountain. A 13-mile road with grades up to 21 percent connects the mine with a millsite and with loading facilities near Jakolof Bay. During 1957 the company completed constructing its new mill. This plant consists of a vibrator, a picking table for removing high-grade ore, crusher, storage bin, ballmill, classifier, tables, and heated storage space for concentrate; it will be powered by a 150-kilowatt generator driven by a diesel engine on which has been mounted a heat exchanger. The latter will provide heat for the concentrate storage unit.

Kenai Chrome Co. also completed arrangements for lease of Chrome Queen mine, between Star Four mine and Jacklof Bay. Part of 1957 was spent cleaning up the mine and building a compressor shack. The lower grade ore mined at Chrome Queen mine will be treated in the mill at Jacklof Bay. The company production was purchased

⁶ May, R. R., and Warfield, R. S., Investigation of Subbituminous Coal Beds Near Houston, Westward Extremity of Matanuska Coalfield, Alaska: Bureau of Mines Rept. of Investigations 5350, 1957, 20 pp.

⁷ Mihelich, Miro, and Wells, R. R., Copper Mines and Prospects Adjacent to Landlocked Bay, Prince William Sound, Alaska: Bureau of Mines Rept. of Investigations 5320, 1957, 21 pp.

by the GSA and shipped to the Grants Pass (Oreg.) depot. William Lyons, operating as the Sourdough Mining Co., Seldovia, also shipped a small quantity of chromite ore to the GSA depot.

Other mineral commodities produced in the region were sand and gravel used for road construction and a small quantity of coal sold to local users. The coal was mined from a deposit 2 miles west of Homer.

Oil exploration in Alaska received encouragement when the Richfield Oil Corp. Swanson River No. 1 well, spudded in April, was reported to have an oil flow of 900 barrels per day with 122,000 cubic feet of gas. The oil-bearing stratum was reached at the 11,150–11,215-foot depth. The 71,600-acre Swanson unit was owned jointly by Richfield Oil Corp., Union Oil Co. of California, and Ohio Oil Co.

Following this oil discovery, Standard Oil Co. of California and Richfield Oil Corp. announced a joint exploration program on the Kenai Peninsula in which Standard Oil Co. will supervise and pay for the drilling in return for a share in Richfield Oil Corp. holdings. Nearly 450,000 acres will be explored under the agreement. In November the combine began to drill Swanson River unit No. 2 approximately 2 miles south of the unit No. 1 well.

Kodiak.—Stone and sand and gravel used in naval-construction projects were the only mineral commodities produced in the Kodiak region.

Kuskokwim River.—The value of minerals recovered in the Kuskokwim River region increased \$291,024 over 1956. Minerals produced ranked, in order of value, mercury, platinum-group metals, gold, sand and gravel, silver, and gem stones.

Although the number of active gold placer mines decreased from 9 in 1956 to 7 in 1957, the value of gold increased \$149,100. The leading gold producer in the region, which ranked fourth in the Territory, was New York-Alaska Gold Dredging Corp. in the Aniak district. This company utilized hydroelectric power and, like most Alaskan operations, experienced a water shortage. On the basis of long-range forecasts by a weather-forecasting service, in 1956 the company dug extra water-storage ditches that enabled it to maintain operations.

Goodnews Bay Mining Co. continued to produce platinum-group metals, gold, and silver. Recovery was made by a nonfloat operation on the smaller creeks and a dredge in the main river valley. Mining operations were occasionally hampered by ice, which slowed stripping activity, and by repairs required when the center pin broke on the dragline.

Mercury produced in the region came from the DeCoursey Mountain Mining Co. Red Devil mine and the Russell Schaefer mine (formerly the Broken Shovel mine), both in the Aniak district. The Red Devil mine operated the entire year and recovered the largest quantity of mercury ever produced in Alaska in 1 year.

Development at the Red Devil mine extended the main shaft to the 500-foot level, connected the 450- and 300-foot levels by a winze, and uncovered new veins by hydraulic placering on Barometer Mountain, north of the mine. A shaft being sunk on the latter deposit will connect by a drift with a main shaft on the 300-foot level. The company was affected by a sharp decline in the average price of mercury from \$260 to almost \$225 per flask during the year.

Cordero Mining Co. examined mercury deposits across the Kuskokwim River from the Red Devil Mine. Other mercury investigations were made by the Sunshine Mining Co. near Kagati Lake.

Frank H. Waskey, Bethel, offered amber beach pebbles and leaf imprints for sale. These items were purchased or collected on Nelson Island.

Northern Alaska.—Meade River coal mine, operated by Ed Bunnell, sold a small quantity of coal to residents of Barrow for heating and cooking purposes. The coal was mined from underneath the ice and transported to town by "cat train." Natural gas from one of the exploration wells on Naval Petroleum Reserve No. 4 also was used.

Northwestern Alaska.—Small quantities of gem stones, sand and gravel, gold, and silver were produced in the Northwestern Alaska region during 1957.

The Empire Jade Co. continued mining and cutting jade boulders; cut pieces are sold to retailers in the United States or sent to Germany for carving and finishing. The company was engaged also in a campaign to sell jade to the Eskimo ivory carvers of Kotzebue (mostly from Little Diomedea) for use in ivory and jade bracelets. A 20-ton jade boulder discovered in 1952 was hauled from Jade Mountain to Kotzebue. The exact quality of the jade in the boulder is unknown.

Shungnak Jade Project used Eskimo workmen to manufacture jade jewelry from gem-quality materials purchased from native claimholders. A Territorial loan was made to the project for modernization of its lapidary equipment.

Bear Creek Mining Co. continued exploration and development work on copper deposits in the Kobuk district. A road from the river bank to the copper prospects was being constructed for the company by Dahl Creek Mines.

Seward Peninsula.—Total value of mineral production in the Seward Peninsula region in 1957 was approximately \$1.8 million. Commodities produced, in order of value, were gold, sand and gravel, and silver. Value of production increased 81 percent compared with 1956 because United States Smelting, Refining & Mining Co. operated a new gold dredge in the Nome district. The number of active placer mines dropped from 22 in 1956 to 15 in 1957. Many mines were forced to close because of a season-long water shortage which plagued most placer-mining areas in Alaska during 1957, as well as adverse economic mining conditions.

The United States Smelting, Refining & Mining Co. Nome unit was the second leading gold producer in Alaska in 1957. The company operated 3 dredges (including a new one) in its Nome unit for the first time since 1953; at that time a company dredge overturned. The new dredge encountered operational difficulties in its initial starts. Several shutdowns were made to repair leaks and to correct faulty wiring in electrical circuits. Thawing operations were severely handicapped by an inadequate water supply.

Jack Neubauer worked the Council Dredging Co. and Northern Mining Co. claims on Niukluk River, near Nome. The latter company's dredge was used. Last Chance Mining Co., Council district,

closed its dredge early in the season. William Munz, the owner, returned to his flying service.

Placer mines able to operate despite the water shortage included those of Herbert Engstrom, H. W. Edwards, and Lee Brothers Dredging Co.—all in the Nome district; Havenstrite Oil Co., Paul L. Beshore & Associates, and Otto F. Weinard—all in the Fairhaven district; and N. B. Tweet & Sons and Lucky Syndicate in the Kougarok district. Most placer operations had to save and recycle water used in washing or stripping operations. The Rocky Mountain Mining Co., Nome district, abandoned its claims on Rocky Mountain Creek at the end of 1957. The company left a small stockpile of sacked tungsten concentrates acquired as a byproduct from several years' gold-placer mining.

Southeastern Alaska.—Minerals produced in Southeastern Alaska region, ranked in order of value, were sand and gravel, uranium, stone, gold, gem stones, and silver. Value of production increased 20 percent compared with 1956. Highlights of the mineral industry were uranium and iron exploration.

Kendrick Bay Mining Co., Ketchikan district, from May until August built a dock and a road to the Ross-Adams uranium deposit at Moira Sound. Actual mining began late in July; ore was shipped to Ford, Wash. The I & L group of claims explored by Union Carbide Nuclear Co. in 1956 remained idle throughout the year.

In the Juneau district, Southeastern Alaska Mining & Exploration Co. investigated a radioactive deposit at William Henry Bay.

Tillicum Mining Co. continued assessment work at Klemme mine, 18 miles southeast of Ketchikan. In 1957 the company diamond drilled the antimony deposit in an attempt to outline the ore body. Kloss and Davis did assessment work on the K & D lode mine, also an antimony deposit.

Exploration of iron deposits continued at a high level. Klukwan Iron Ore Corp. optioned 160 claims adjoining the Klukwan Indian Reservation to Columbia Iron Ore Mining Co., which has an option to lease the property for 75 years or to purchase it for \$10 million. The Klukwan Iron Ore Corp. also completed a contract with the Chilkat Indians for lease of a 320-acre site on their reservation. A congressional bill was needed before the latter, a former administrative site, could be leased. Klukwan Iron Ore Corp. churn drilled the ore deposit to outline reserves and operated a concentrating plant to obtain samples for metallurgical testing.

Prince of Wales Mining Co., a subsidiary of Utah Company of the Americas, investigated iron deposits near Kasaan village. Diamond-drill holes and prospecting shafts were put down at the Poorman mine. The company also examined the Sunrise group of claims on Revilagedo Island and Mount Andrew mine on Prince of Wales Island. Columbia Iron Mining Co. investigated iron deposits on Duke, Kelp, and Percy Islands and at Union Bay in the Cleveland Peninsula area.

Results of the Federal Bureau of Mines laboratory testing of copper-magnetite ores from Poorman, Rush and Brown, and Copper Center deposits on Kasaan Peninsula were published. This report⁸ indicates ores from the three mines are amenable to flotation-and-magnetite

⁸ Wells, R. R., Erspamer, E. G., and Sterling, F. T., Beneficiation of Iron-Copper Ores From Kasaan Peninsula, Prince of Wales Island, Alaska: Bureau of Mines Rept. of Investigations, 1957, 5312, 15 pp.

separation treatment, which results in a high-grade magnetite concentrate with a low copper content. Nearly complete sulfur removal was made from samples of the Poorman and Copper Center deposits.

Colorado Oil & Gas Co. abandoned the Yakutat No. 1 well after drilling to a depth of 9,314 feet. The well, spudded in March, was abandoned after drill collars and fishing tools were lost in the hole. Drilling equipment was moved to a new site 3 miles northeast from No. 1 well; Yakutat No. 1A well was spudded July 17, and at the year's end drilling had reached a depth of 9,842 feet.

Admiralty-Alaska Gold Mining Co. drove 1,700 feet of crosscut and diamond drilled to explore a nickel-copper deposit at Funter Bay, Admiralty Island; the work was continuing at the year end. On April 18, a fatality was caused by a rockfall from the back of the crosscut.

Yukon River.—Gold, coal, sand and gravel, stone, silver, antimony, and lead (in order of value of output) were produced in the Yukon River region, comprising 40 percent of the value of total mineral production in Alaska. Because of increased gold and coal output, value of mineral production rose 12 percent over 1956. Gold recovered comprised 44 percent of the value of regional mineral output and 67 percent of the value of Alaskan gold output. Coal production was 38 percent of the value of minerals produced in the region.

United States Smelting, Refining & Mining Co., leading gold producer in the region and Alaska, operated eight dredges in the Yukon River region. Seven were active in the Fairbanks district. Dredge 6, however, in midseason completed washing of available reserves at its site and was partially dismantled in preparation for an overland move to Sheep Creek in the spring of 1958. Operation of an additional dredge was started on Chatinika Creek in midseason. In the early spring, operation of the eighth dredge was begun at Bear Creek near Hog River, Hughes district. It took 2 years to move the unit from Livengood to the Hogatza River dredging ground.

The company reported that 1 season of stripping in 1 area and 1 season of thawing in 2 areas would complete the life of the Fairbanks operations. During the year, stripping at Chicken in the Fortymile district also was completed; a dredge will be moved to this area in 1959.

The board of directors of the United States Smelting, Refining & Mining Co. voted, effective January 1, 1958, to carry all credits from Alaska operations to reserves. This action will permit the Alaska investment and its related deferred charges to be completely written off in a few years.

Of the 15 leading gold-producing mines in Alaska, 13 were in the Yukon River region.

The number of active placer mines dropped from 77 in 1956 to 55 in 1957. Gold recovered by dredges in the region accounted for 79 percent of the region's total and 53 percent of the gold recovered in Alaska. An average of nearly 80 cubic yards of gravel was processed by dredge to recover an ounce of gold.

Leading gold-producing mines in both the region and Alaska included: United States Smelting, Refining & Mining Co., Fairbanks and Hogatza units; Strandberg & Sons, Colorado Creek, Indian River and Eureka Creek units; Gold Placers, Inc., Coal Creek; and Otter Dredging Co., Iditarod district.

Fullerton Bros., operating as Colorado Creek Mining Co. and 1 of the 15 leading gold producers in 1956, spent most of 1957 moving equipment from Colorado Creek, Innoko district, to Flat Creek, Iditarod district, where it was assembled. Fullerton Bros. anticipated operating on Flat Creek in 1958 using Flat Creek Placers as their company name.

Exploration and prospecting for oil in the Kateel River area continued at a high level. Oil-lease applications for over 2 million acres had been filed by the end of 1957.

The only active commercial stone quarry in Alaska in 1957 was James F. Donovan's White Marble quarry at Mile 10 on the Steese Highway, Fairbanks district. Most of the quarry's production was sold to the Government.

Nearly 17 percent of the region's mineral value came from sand and gravel, mined primarily in the Fairbanks area. Part of the material produced was used by the Alaska Railroad and the United States Army Corps of Engineers. Roadbuilding by the Bureau of Public Roads also used a substantial quantity of sand and gravel.

Alaska Metals Mining Co., Inc., operated its mill for a few weeks to recover tungsten concentrates from ore mined in previous years. With DMEA assistance the company continued exploration on its Gilmore Dome tungsten deposit.

Coal produced in the region was strip-mined by Usibelli Coal Mining Co., Arctic Coal Co., and Cripple Creek Coal Co. in the Healy River coalfield, Bonnifield district; Usibelli Coal Mining Co. and Suntrana Mining Co., Inc., operated underground mines. Suntrana Mining Co., Inc., was the successful bidder to supply the Alaska Railroad with 10,000 tons of stoker coal during 1957.

Earl R. Pilgrim, owner of Stampede mine, Kantishna district, shipped antimony ore from material mined in previous years. Underground activity was suspended indefinitely in 1957. Stampede mine is believed to be the oldest antimony mine in Alaska. Production was first reported in 1915 when 150 tons of high-grade ore was mined and stockpiled. The property was again inactive until 1936, when Pilgrim assumed management of the mine for Morris P. Kirk & Sons, a division of National Lead Co. A 40-ton mill was built in 1939 and operated until the spring of 1940, when high-grade ore was discovered in the mine. Pilgrim acquired control of the property in 1942 and operated it until 1943; mining was discontinued at that time because supplies and equipment were difficult to obtain. In 1946 the stibnite vein was traced nearly 1,200 feet north of the mine. A new adit opened a high-grade antimony vein 3 to 15 inches wide. Mining after 1946 was sporadic because of an unstable antimony market and higher costs of mining in Alaska, compared with the United States. Pilgrim has reported that the mine will remain inactive until completion of a road to his property.

The Mineral Industry of Arizona

By William H. Kerns,¹ Frank J. Kelly,¹ and D. H. Mullen¹



THE VALUE of mineral production in Arizona fell 23 percent (\$112.4 million) from the alltime high of \$485.0 million set in 1956 to \$372.6 million in 1957. The marked decline resulted mainly from a drop of \$119.5 million in the value of copper output because of lower prices; copper production in 1957 actually was greater by 10,000 short tons than in 1956.

Some of the major copper-producing companies reduced overtime by cutting the regular 6-day workweek to 5 days to cut costs, as well as to curtail production and thereby equalize supply and demand and bolster the price; however, reductions by these companies were more than counterbalanced by increased production by others and by output from new mining operations. In 1957 the San Manuel mine had its first full year of operation, and the Pima and the Old Dick mines were new copper producers.

As it has since 1910, Arizona led the United States in copper output in 1957, and copper composed 83 percent of the total value of mineral production in the State. Several new or improved processing facilities and mining developments for the copper industry were begun or completed during 1957. Inspiration Consolidated Copper Co. completed converting its milling process from ferric sulfate leaching to the "dual-metallurgical process" of acid-leaching the oxide and flotation of the sulfide fraction of the ore. Ray Mines Division continued its \$40 million program of expansion and modification of the mill and pit and construction of a smelter. Miami Copper Co. completed and placed in operation its new "L-P-F" (leaching, precipitation, and flotation) circuit of its mill at Miami. Preparation of copper and molybdenum mining and milling facilities of Duval Sulphur & Potash Co. properties was begun. Bagdad Copper Corp. conducted pilot-plant tests to develop an economical method of recovering electrolytic copper from its copper concentrate and produce a byproduct sulfuric acid for use in heap-leaching a large body of subgrade copper oxide material capping the copper sulfide ore body.

Metals other than copper, including gold, lead, manganese ore, molybdenum, silver, uranium ore, and zinc, supplied 10 percent of the total value of mineral yield in Arizona in 1957. Some lead-zinc mining operations were suspended and others curtailed because of the lower market price for lead and zinc. At the Old Dick mine—a new copper-zinc producer in May—preparations were made in December for a closedown. Operations were suspended at the Flux lead-zinc mine in October, the mine was leased, and the mill was sold. The

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

TABLE 1.—Mineral production in Arizona, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate..... gross weight.....	6	\$3	5	\$2
Clays ² thousand short tons.....	112	168	118	177
Coal..... do.....	10	66	9	63
Columbian-tantalum-concentrate..... pounds.....			2,435	7
Copper (recoverable content of ores, etc.).....	505,908	430,022	515,854	310,544
Gem stones.....	(³)	104	(³)	75
Gold (recoverable content of ores, etc.)..... troy ounces.....	146,110	5,114	152,449	5,336
Gypsum (crude)..... thousand short tons.....	96	366	(⁴)	(⁴)
Lead (recoverable content of ores, etc.).....	11,999	3,768	12,441	3,558
Lime..... thousand short tons.....	127	1,756	138	2,127
Manganese ore and concentrate (35-percent or more Mn)..... gross weight.....	⁵ 42,008	⁵ 3,468	79,505	6,626
Mercury..... 76-pound flasks.....	(⁴)	(⁴)	28	7
Mica (scrap).....			1,650	17
Molybdenum (content of ore and concentrate)..... thousand pounds.....	2,392	2,670	2,385	3,071
Natural gas..... million cubic feet.....	21	3	⁶ 22	⁶ 3
Perlite (crude).....	15,928	108	15,646	114
Pumice..... thousand short tons.....	115	366	397	640
Rare-earth minerals..... pounds.....	150	(⁷)		
Sand and gravel..... thousand short tons.....	7,932	6,167	10,287	9,222
Silver (recoverable content of ores, etc.)..... thousand troy ounces.....	5,179	4,687	5,279	4,778
Stone..... thousand short tons.....	1,623	2,475	2,101	2,982
Tungsten concentrate..... 60-percent WO ₃ basis.....	186	637	5	8
Uranium ore.....	⁸ 274,505	⁸ 5,408	286,037	6,277
Zinc (recoverable content of ores, etc.).....	25,580	7,009	33,905	7,866
Value of items that cannot be disclosed: Asbestos, bentonite, cement, feldspar, fluor spar (1957), nitrogen compounds (1957), pyrites (1957), vanadium, and values indicated by footnote 5.....		11,701		10,441
Total Arizona ⁹		⁸ 484,959		372,644

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 Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

⁵ Excludes shipments to the Government purchase depot under the "low-grade" program; quantity and value for this manganese ore and concentrate in 1956 were: 56 short tons, \$4,269.

⁶ Preliminary figure.

⁷ Less than \$1,000.

⁸ Revised figure.

⁹ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

TABLE 2.—Average unit value of selected mineral commodities produced in Arizona, 1948-52 (average) and 1953-57¹

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Clays..... dollars per short ton.....	2.18	3.62	3.21	3.41	3.43	2.97
Copper..... cents per pound.....	22.1	28.7	29.5	37.3	42.5	30.1
Lead..... do.....	16.1	13.1	13.7	14.9	15.7	14.3
Lime..... dollars per short ton.....	14.09	12.84	12.72	12.83	13.84	15.39
Manganese ore and concentrate (35 percent or more Mn)..... dollars per short ton.....	(²)	(²)		(²)	82.56	83.34
Molybdenum..... dollars per pound.....	(²)	.98	.99	1.01	1.12	1.29
Perlite..... dollars per short ton.....	5.98	(²)	5.39	7.94	6.81	7.29
Pumice..... do.....	(²)	3.44	1.56	4.05	3.19	1.61
Sand and gravel..... do.....	.78	.78	.82	.84	.78	.90
Stone..... do.....	.94	1.40	1.59	1.46	1.53	1.42
Tungsten..... dollars per short-ton unit.....	36.16	58.21	57.92	62.30	57.14	26.70
Uranium..... dollars per short ton.....					19.70	21.94
Zinc..... cents per pound.....	14.9	11.5	10.8	12.3	13.7	11.6

¹ Prices are discussed in detail in the commodity chapter of vol. 1, Minerals Yearbook.

² Figure withheld to avoid disclosing individual company confidential data.

Johnson Camp copper-zinc mine was closed in August. Operations at the San Xavier lead-zinc mine and mill were suspended in June.

Nonmetals, including lime, sand and gravel, stone, asbestos, and cement, composed 6 percent, and miscellaneous metals, nonmetals, and mineral fuels (coal) the remaining 1 percent of the total of all minerals produced.

EMPLOYMENT AND INJURIES

Detailed data on employment in Arizona, procured from the Bureau of Labor Statistics, United States Department of Labor, and the Unemployment Compensation Division, Employment Security Commission of Arizona, are given in the following tables. The annual average employment in the Arizona copper-mining industry represented 5 percent of the total in the nonagricultural category. The average weekly earnings and average weekly hours for copper mining and copper smelting dropped sharply during the latter half of the year, because a number of the major copper producers cut the workweek from 6 to 5 days to reduce costs and curtail production. Average employment also was down for December compared with the high for June.

According to the State mine inspectors report² for the year beginning December 1, 1956, there were 7 fatal accidents in underground and 1 in open-pit mines in Arizona. In addition, 235 serious accidents (resulting in loss of 14 days or more) occurred in underground mines and 36 in open-pit mines. Three of the fatal accidents in underground and the 1 in open-pit mines were caused by the fall of rock and 1 each by blasting, electricity, carbon monoxide, and haulage.

TABLE 3.—Annual average employment in mining and other nonagricultural industries in Arizona, 1956-57

[United States Department of Labor, Bureau of Labor Statistics and Unemployment Compensation Division, Employment Security Commission of Arizona]

Industry	Annual average employment		Percent of total nonagricultural	
	1956	1957	1956	1957
Mining ¹	15,700	16,600	6.5	6.2
Copper mining.....	(2)	14,100	(2)	5.3
Other mining and quarrying.....	(2)	2,500	(2)	0.9
Manufacturing.....	35,700	39,500	14.7	14.8
Copper smelting.....	(2)	2,000	(2)	0.8
Other manufacturing.....	(2)	37,500	(2)	14.0
Contract construction ²	20,100	22,400	8.3	8.4
Transportation and public utilities.....	21,000	21,700	8.6	8.1
Wholesale and retail trade.....	59,900	67,400	24.6	25.2
Finance, insurance, and real estate.....	9,500	10,600	3.9	4.0
Service and miscellaneous.....	30,800	34,300	12.7	12.9
Government and education.....	50,400	54,600	20.7	20.4
Total nonagricultural.....	243,100	267,100	100.0	100.0

¹ Includes extraction of minerals occurring naturally, quarrying, well operation, milling, exploration and development of mineral properties, and removal of overburden.

² Breakdown not available.

³ Includes some employees engaged in mining, quarrying, and removing 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.

² Hersey, R. V. (Roy), Forty-Sixth Annual Report of the State Mine Inspector for Year Ending November 30, 1957: 1958, 26 pp.

TABLE 4.—Average hourly earnings, average weekly hours, average weekly earnings in copper mining and other industries related to mining in Arizona, 1956-57¹

[United States Department of Labor, Bureau of Labor Statistics and Unemployment Compensation Division, Employment Security Commission of Arizona]

Industry	Average hourly earnings		Average weekly hours		Average weekly earnings	
	1956	1957	1956	1957	1956	1957
Copper mining	\$2.38	\$2.43	47.2	43.9	\$112.07	\$106.68
Manufacturing (total) ²	2.14	2.23	42.3	40.6	90.63	90.54
Copper smelting	(³)	2.31	(³)	47.1	(³)	108.78
Contract construction ⁴	2.81	2.97	37.4	36.6	105.09	108.70

¹ Excludes administrative and nonworking supervisory personnel.² Includes smelting and refining ferrous and nonferrous metals from ore, which was a part of the mineral industry.³ Breakdown not available.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.

LEGISLATION AND GOVERNMENT PROGRAMS

The Federal Government continued its participation in financing exploration projects in search of strategic and critical minerals with the program administered by the Defense Minerals Exploration Administration (DMEA). During 1957 no DMEA contracts were executed for work in Arizona. Some work authorized in years before 1957 was completed and some was continued.

Government assistance to the San Manuel Copper Corp. was very important to development of the property, the copper-mining industry, and the overall economy of the State. The Magma Copper Co., sole owner of the corporation, stated (in its annual report for 1957) that the United States Treasury Department had loaned \$70,751,638 to the San Manuel Copper Corp. by December 31, 1957. The Federal Government also gave this company financial assistance in the form of a copper-purchasing contract. The first copper was sold to the Government under this contract in 1957. A report on this, quoted from the company annual report to the stockholders, follows:

* * * Commencing in the third quarter of 1957, all of San Manuel's copper has been sold to the United States Government under its 1952 contract at 27.05¢ per pound, the "put" price of 24¢ having increased 3.05¢ by operation of the contract's escalation clause. It is to be noted that while the escalation clause (based on United States Department of Labor indices) increased the contract price about 12.7% since 1952, the production costs of the industry as published by the Arizona Department of Mineral Resources increased approximately 33.1% in about the same period of time, and that the contract price escalation therefore does not fully compensate for the increased production costs being experienced. Such sales to the Government will continue unless the copper can be sold on the market at or above such price. The Government contract is expected to be applicable to all of San Manuel's copper production for about three more years. It has been amended to remove any obligation or right to sell molybdenum concentrates to the Government. All of San Manuel's production of such concentrates through December 31, 1959, has been sold.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—A small quantity of beryllium concentrate (beryl) was recovered by hand-sorting pegmatite from two mines in Arizona in 1957 and sold to Beryl Ores Co., Arvada, Colo. It was processed by Beryl Ores and shipped to buyers for specialized industrial uses.

Copper.—Arizona continued to be the leading copper-producing State in the United States in 1957, a position held since 1910. In 1957 the lead over Utah (the second-ranking copper producer) was 117 percent, compared with 102 percent in 1956. The 1957 output—516,000 tons—was a new record production and 2 percent above the old one of 506,000 tons set in 1956. Despite increased output, the value of the copper produced declined from \$430 million in 1956 to \$311 million in 1957—a 28-percent decrease—as a result of a drop in the annual average unit price for copper. The value of the copper output accounted for 83 percent of the total value of mineral production in Arizona in 1957; therefore, the \$119.5 million drop in value of copper output was responsible for most of the decline in value of mineral production for the State.

The 15 leading copper-producing mines in Arizona in 1957 contributed 97 percent of the total copper output in the State; the first 5 mines supplied 70 percent. The Morenci Branch operation of the Phelps Dodge Corp. continued as Arizona's largest copper producer. The Copper Queen Branch and New Cornelia Branch operations of the Phelps Dodge Corp. were the second and third highest copper producers, followed by the San Manuel Copper Corp. (owned by the Magma Copper Co.) operation, a new large-scale producer in 1956, and the Ray Mines Division operation of the Kennecott Copper Corp. Copper output from the Pima Mining Co. operation at the Pima mine and the Cyprus Mines Corp. operation at the Old Dick mine, both new producers in 1957, added substantially to the State total.

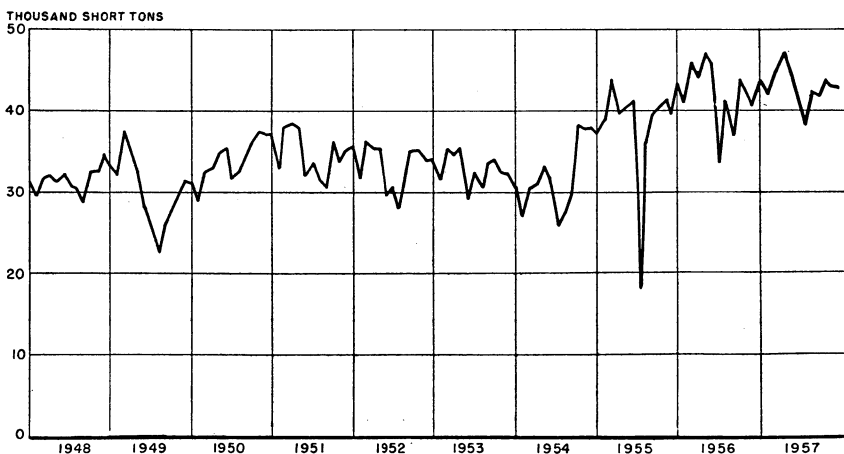


FIGURE 1.—Mine production of copper in Arizona, 1948-57, by months, in terms of recoverable metal.

TABLE 5.—15 leading copper-producing mines in 1957, in order of output

Rank in 1957	Rank in 1956	Mine	District	County	Operator	Source of copper in 1957
1	1	Morenci.....	Copper Mountain.	Greenlee.....	Phelps Dodge Corp....	Gold-silver, copper ores, copper precipitates.
2	2	Copper Queen-Lavender pit.	Warren.....	Cochise.....	.....do.....	Copper ore, copper precipitates.
3	3	New Cornelia.....	Ajo.....	Pima.....	.....do.....	Gold-silver, copper ores.
4	5	San Manuel....	Old Hat.....	Pinal.....	San Manuel Copper Corp.	Copper ore.
5	4	Ray pit.....	Mineral Creek.	.....do.....	Kennecott Copper Corp.	Copper ore, copper precipitates.
6	6	Inspiration....	Globe-Miami.	Gila.....	Inspiration Consolidated Copper Co.	Do.
7	8	Magma.....	Pioneer.....	Pinal.....	Magma Copper Co.	Copper ore.
8	7	Copper Cities..	Globe-Miami.	Gila.....	Miami Copper Co., Copper Cities Division.	Do.
9	10	Miami.....	.....do.....	.....do.....	Miami Copper Co....	Copper ore, copper precipitates.
10	9	Silver Bell Unit.	Silver Bell....	Pima.....	American Smelting and Refining Co.	Copper ore.
11	(¹)	Pima.....	Pima.....	.....do.....	Pima Mining Co.	Do.
12	11	Bagdad.....	Eureka.....	Yavapai.....	Bagdad Copper Corp.	Do.
13	12	Copper Glance, Mineral Hill-Daisy.	Pima.....	Pima.....	Banner Mining Co.	Do.
14	13	Castle Dome dump.	Globe-Miami	Gila.....	Miami Copper Co., Castle-Dome Division.	Copper precipitates.
15	(¹)	Old Dick.....	Eureka.....	Yavapai.....	Cyprus Mines Corp....	Copper-zinc ore.

¹ Did not produce in 1956.

TABLE 6.—Ore mined, waste and leach material removed, and total copper production at principal copper open-pit and underground mines, 1956-57 ¹

Mine	Ore mined (short tons)		Waste and leach material removed (short tons)		Total copper produced from all sources ² (short tons)	
	1956	1957	1956	1957	1956	1957
Open pit:						
Morenci.....	16,794,287	14,767,611	37,788,263	32,608,512	127,156	106,793
New Cornelia.....	10,112,434	8,813,134	14,504,201	14,014,755	66,432	62,459
Ray.....	5,852,742	4,751,463	(³)	(³)	53,248	56,879
Lavender.....	5,069,049	4,440,768	6,544,497	6,025,455	40,153	38,789
Inspiration.....	3,709,789	4,456,378	11,456,577	8,151,872	37,083	35,728
Copper Cities.....	4,167,147	3,482,482	3,869,132	3,037,708	27,826	20,746
Pima.....	.....	1,094,559	⁴ 8,849,000	⁴ 3,119,907	.....	(⁶)
Bagdad.....	1,363,505	1,487,994	12,765,358	⁴ 4,584,861	6,734	9,813
Castle Dome dump.....	.....	.....	.....	.....	⁷ 2,617	⁷ 2,495
Underground:						
San Manuel.....	5,539,581	8,825,130	.....	.....	39,076	59,899
Copper Queen.....	632,088	630,068	.....	.....	31,927	34,601
Magma.....	453,683	442,134	.....	.....	23,885	21,776
Miami.....	3,812,165	3,455,120	.....	.....	19,282	20,448

¹ Source: Company published annual reports.

² Includes copper recovered from leaching of material in place or on dumps.

³ Data not available.

⁴ Source: Mining World Catalog, Survey and Directory Number, Apr. 15, 1958, p. 222.

⁵ Cubic yards.

⁶ Figure withheld to avoid disclosing individual company confidential data.

⁷ Recovered from water leaching of mine dumps only.

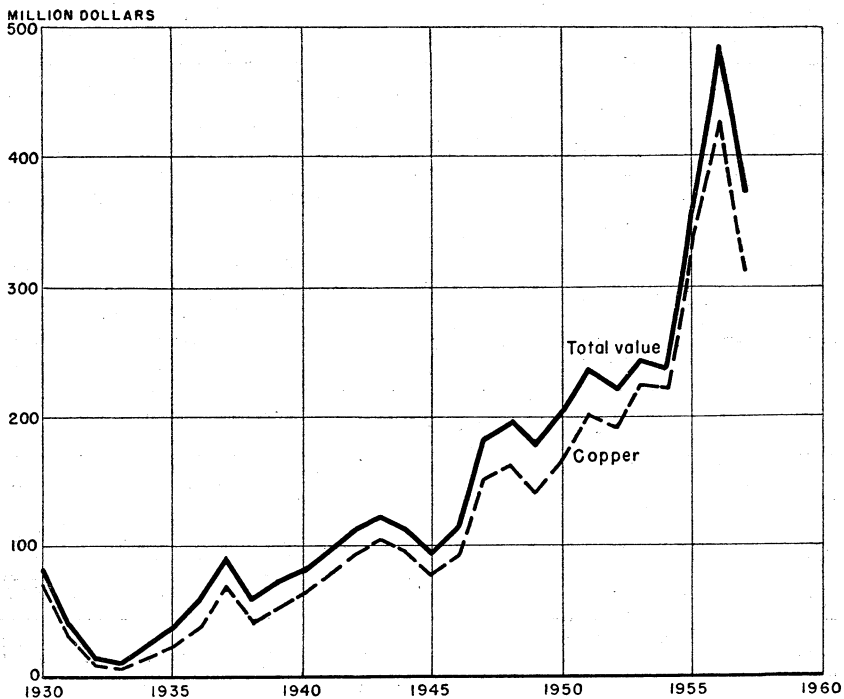


FIGURE 2.—Value of mine production of copper and total value of mineral production in Arizona, 1930-1957.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total, 1860-1957, 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		Fine ounces	Value	Fine ounces	Value
1948-52 (average).....	292	24	42,042,704	113,048	\$3,956,687	4,991,246	\$4,517,330
1953.....	163	6	45,700,618	112,824	3,948,840	4,351,429	3,938,263
1954.....	164	5	43,460,477	114,809	4,018,315	4,298,811	3,890,641
1955.....	173	7	52,710,060	127,616	4,466,560	4,634,179	4,194,166
1956.....	194	5	61,044,282	146,110	5,113,850	5,179,185	4,687,424
1957.....	141	8	60,166,168	152,449	5,335,715	5,279,323	4,778,054
1860-1957.....			(³)	12,183,068	313,902,535	345,955,657	265,474,918

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average).....	389,804	\$172,966,949	24,753	\$7,954,501	57,152	\$16,826,753	\$206,222,220
1953.....	393,525	225,883,350	9,428	2,470,136	27,530	6,331,900	242,572,489
1954.....	377,927	222,976,930	8,385	2,297,490	21,461	4,635,576	237,818,952
1955.....	454,105	338,762,330	9,817	2,925,466	22,684	5,580,264	355,928,786
1956.....	505,908	430,021,800	11,999	3,767,686	25,580	7,008,920	450,589,680
1957.....	515,854	310,544,108	12,441	3,558,126	33,905	7,865,960	332,081,963
1860-1957.....	15,740,650	5,856,111,626	578,457	111,379,548	749,032	182,154,153	6,729,022,780

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 Figure not available.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	13,475	451,131	43,782	957	2,466
February.....	12,752	437,542	43,254	1,093	2,597
March.....	13,109	428,345	45,212	1,079	2,350
April.....	13,059	454,632	47,101	990	2,601
May.....	13,857	481,483	44,222	1,176	3,127
June.....	12,746	447,797	40,713	1,203	3,500
July.....	11,858	387,503	38,043	1,130	3,235
August.....	13,104	460,836	42,311	1,096	2,880
September.....	12,901	446,984	41,730	1,142	2,924
October.....	13,339	453,447	43,759	1,124	2,910
November.....	11,243	420,524	43,000	735	2,697
December.....	11,006	409,099	42,727	716	2,618
Total.....	152,449	5,279,323	515,854	12,441	33,905

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1937, by counties and districts, in terms of recoverable metals

County and district	Mines producing (lode and placer)	Lode material sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Zinc		Total value
			Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Apache County													
Cochise County	1	456					14,700	\$4,425					\$4,425
Cochise County													
Cochise (Dragon)	2	44,716			22,926	\$20,749	2,208,900	664,879			5,019,500	\$582,262	1,267,890
Golden Rule	1	33	21	\$735	106	96	100	30	4,900	\$701			1,562
Rucker Basin	1		1	35									35
Smelter and Turquoise													
Warren (Bishop)	5	6,419	406	14,210	10,294	9,317	583,000	175,483	297,100	42,485	1,600	186	241,681
Whetstone (Benson)	3	5,071,569	49,140	1,719,900	1,184,825	1,072,328	146,783,500	44,181,833					46,974,059
	1	26	3	105	9	8							113
Total	12	5,122,793	49,571	1,734,985	1,218,160	1,102,496	149,575,500	45,022,225	302,000	43,186	5,021,100	582,448	48,485,340
Coconino County													
Hualapai Indian Reservation													
Gila County	1	39			4	4	2,500	752					756
Gila County													
Banner (Christmas)	3	14,455	2	70	522	472	365,200	108,925	34,300	4,905			115,372
Globe-Miami	14	11,414,081	1,398	48,930	171,673	155,373	159,212,800	47,923,053	3,800	543			48,127,899
Green Valley	1	80			14	13	4,400	1,324					1,337
Total	18	11,428,616	1,400	49,000	172,209	155,858	159,582,400	48,034,302	38,100	5,448			48,244,608
Grham County													
Arivupa													
Greenlee County	4	9,725			5,884	5,325	87,800	26,428	595,900	85,214	1,392,900	161,576	278,543
Copper Mountain													
Mariopca County	2	14,771,488	8,773	307,055	738,640	668,507	213,953,600	64,400,084					65,375,596
Ariva Fris													
Cave Creek & Camp	1	43			2	2	1,500	452					454
Creek and Vulture	3	84	26	910	136	114	2,500	752					1,776
Goldfield	1	25	14	490	137	124							614
Total	5	152	40	1,400	265	240	4,000	1,204					2,844

See footnotes at end of table.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals—
Continued

County and district	Mines producing ¹ (lode and placer)	Lode material sold or treated ² (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Zinc		Total value
			Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Mohave County:													
Bentley.....	1	28			\$39	\$35	9,400	\$2,829	100	\$14			\$2,878
Cedar Valley.....	1				218	197	8,900	2,679					2,876
Hualapai Indian Reservation ³ and Walsapai ⁴	4	5,014	1,440	\$50,400	7,546	6,830	4,600	1,385	123,000	17,589	85,400	\$9,907	86,111
Lost Basin ⁵	1	539	19	665	5,601	4,979	8,200	2,468	227,600	32,547	20,700	2,401	43,060
Owens.....	1												
Total.....	8	5,581	1,463	51,205	13,305	12,042	31,100	9,361	350,700	50,150	106,100	12,308	135,066
Pima County:													
Ajo.....	1	8,815,840	35,027	1,225,945	467,060	422,713	124,917,100	37,600,047		86			39,248,705
Arivaca ³	2	1,055	1	35	560	584	22,600	6,803	600				7,458
Baboquivari.....	1	953			4,874	4,411	26,300	7,910					12,327
Empire.....	1	736			7,001	7,001	21,300	6,411					6,892
Fresnal.....	1	3,902	512	17,920	7,736	7,001	21,300	6,411					24,921
Helvetia (Rosemont).....	4	22,785	5	175	5,213	5,213	1,124,900	338,995					343,983
Old Hat ⁷	1	34			44	40	40,312,900	12,134,483	5,900	744			784
Pima.....	5	1,264,000			366,962	382,119	40,312,900	12,134,483	1,409,500	214,428	2,575,000	298,700	12,979,430
Silver Bell.....	3	2,808,130	23	805	154,569	139,893	38,517,800	11,983,858	8,500	788	2,908,000	337,397	12,072,739
Total.....	22	12,918,035	35,569	1,244,915	1,008,126	912,405	204,942,900	61,987,813	1,510,800	216,044	5,483,600	636,097	64,937,274
Pinal County:													
Bunker Hill.....	2	7,351	46	1,610	1,152	1,043	241,700	72,752					75,405
Crozier Peak.....	5	17			81	81	1,200	391					442
Mineral Creek (Ray).....	2	4,771,115	1,964	68,740	219,817	198,945	113,773,000	34,946,215	284,400	40,669	10,700	2,285	34,556,914
Old Hat ⁷	1	8,759,904	13,594	475,790	201,369	182,249	119,803,800	36,060,844	78,500	11,226			36,750,209
Plecho.....	2	38			7	6	2,800	845					849
Pioneer (Superior).....	1	440,395	12,771	446,985	549,902	497,689	43,551,100	13,108,881					14,053,555
Riverside.....	2	543			19	17	16,100	4,846					4,863
Total.....	15	13,979,363	23,375	993,125	972,355	880,030	277,391,700	83,494,902	362,900	51,895	19,700	2,285	85,422,237

Santa Cruz County:												
6	53,278	166	5,810	175,594	158,921	211,200	63,571	7,471,700	1,068,454	7,916,100	918,288	2,215,024
13	4,948			32,021	28,981	304,900	91,775	494,900	60,760	729,700	84,645	268,161
2	110	1	35	755	683	3,700	1,114	3,300	472			2,304
21	58,336	167	5,945	208,370	188,585	519,800	156,460	7,899,900	1,129,686	8,645,800	1,002,913	2,483,489
Yavapai County:												
2	449	20	700	231	209	51,700	15,562					16,471
7	1,832,710	26,277	919,695	919,700	832,376	22,743,300	6,847,238	13,785,200	1,971,284	47,140,500	5,468,298	16,038,991
2	29	7	245	2	2	2,100	632					879
4	22,301	1	35	6	5	912,900	274,783					274,823
4	4	4	140									140
4	4	4	140									140
1	4		140	2	2							142
1		7	245	396	338	1,700	512					35
1	25	7	245	231	209	200	60					1,115
1	43	21	735	17,441	15,785	1,799,000	541,499					1,004
3	13,834	411	14,385	28	25	300	90					571,699
2	51	6	210	38	34							325
2	114	79	2,765	38	34							2,799
28	1,869,570	26,838	939,330	938,075	849,005	25,516,200	7,680,376	13,785,200	1,971,284	47,140,500	5,468,298	16,908,293
Yuma County:												
2	250			442	400			36,500	5,219	300	35	5,654
3	1,184	180	6,300	70	63	49,900	15,020					21,353
1	42	11	385	25	23	200	60					1,468
1	87	8	290	19	17	5,400	1,626					1,923
1	50					1,300	391					381
2	119	5	175	3,360	3,041	2,800	843					4,069
1	282			11	10	26,200	7,886					7,896
1		49	1,715	3	3							1,718
12	2,014	253	8,855	3,980	3,557	85,800	25,826	36,500	5,219	300	35	43,492
149	60,166,168	152,449	5,335,715	5,279,323	4,778,064	1,031,708,000	310,544,108	24,832,000	3,558,128	67,810,000	7,865,900	332,081,933
199	61,044,282	146,110	5,113,850	5,179,185	4,687,424	1,011,616,000	430,021,800	23,993,000	3,767,686	51,160,000	7,008,920	460,599,680

1 All lode mines, except for 8 placer mines as indicated in footnote reference
 2 Operations at miscellaneous cleanups not counted as a producing mine.
 3 Does not include precipitates shipped.
 4 Includes placer production by districts as follows: Rucker Basin—1 fine ounce gold (value, \$36); Lost Basin—4 fine ounces gold (value, \$140) and 1 fine ounce silver (value, \$1); Arivaca—1 fine ounce gold (value, \$35); Hassayampa—3 fine ounces gold (value, \$105); Kirkland—1 fine ounce gold (value, \$36); Walker—1 fine ounce gold (value, \$36); Trigo—49 fine ounces gold (value, \$1,715) and 3 fine ounces silver (value, \$3).
 5 Combined to avoid disclosing individual company confidential data.
 6 Hualpai Indian Reservation district lies in both Coconino and Mohave Counties.
 7 Byproduct of tungsten ore.
 7 Old Hat district lies in both Pima and Pinal Counties.

TABLE 10.—Gold and silver produced at placer mines, 1948-52 (average) and 1953-57, in fine ounces, in terms of recoverable metals

Year	Small-scale hand methods ¹			Gravel mechanically handled						Underground placers			Total	
	Nonfloating washing plants ²			Bucketline and drag-line dredges			Drift			Number of operations		Gold	Silver	
	Number of operations	Gold	Silver	Number of operations	Gold	Silver	Number of operations	Gold	Silver	Number of operations	Gold			
1948-52 (average)	18	93	3	2	251	41	1	49	7	4	10	24	354	44
1953	5	60	0	—	—	—	—	—	—	—	—	0	60	7
1954	5	78	0	—	—	—	—	—	—	—	—	0	78	0
1955	6	79	5	1	4	—	—	—	—	—	—	7	83	5
1956	4	92	8	1	2	—	—	—	—	—	—	5	94	8
1957	8	60	4	—	—	—	—	—	—	—	—	8	60	4

¹ Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
² Includes all placer operations using power excavator and washing plant, both on dry land, when washing plant is movable, outfit is termed "dry-land dredge."
³ Less than 1 ounce.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	15	5,059	1,718	5,368	45,900	8,700	
Dry gold-silver.....	6	74,520	637	12,970	1,243,800		
Dry silver.....	20	33,919		13,824	1,199,500	3,800	
Total.....	41	113,498	2,355	32,162	2,489,200	12,500	
Copper.....	67	59,571,834	123,375	4,088,618	947,840,100	5,500	25,200
Copper-lead-zinc.....	6	2,888		27,215	135,500	364,200	598,300
Copper-zinc.....	4	88,171	66	41,596	4,674,100	25,900	16,910,000
Lead.....	21	9,762	153	38,779	29,500	3,444,100	264,500
Lead-zinc.....	8	371,412	26,300	1,044,073	1,059,400	20,993,900	47,084,000
Zinc.....	2	7,072	23	1,405	88,300	600	2,928,000
Total.....	103	60,051,139	149,917	5,241,686	953,826,900	24,833,600	67,810,000
Other "lode" material:							
Gold-silver tailings.....	1	350	3	200			
Copper precipitates.....	7	48,175			75,180,700		
Copper mill and smelter cleanings and cleanings.....		1,023	88	3,137	200,900		
Lead cleanings.....		158	26	1,816	1,200	35,900	
Tungsten ore.....	1			218	8,900		
Total.....	9	49,706	117	5,471	75,391,900	35,900	
Total "lode" material.....							
	141	60,214,343	152,389	5,279,319	1,031,708,000	24,882,000	
Gravel (placer operations)							
	8		60	4			
Total, all sources.....	149	60,214,343	152,449	5,279,323	1,031,708,000	24,882,000	67,810,000

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

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore.....	12	17			
Cyanidation: Ore.....	3,971	41,960			
Total recoverable in bullion.....	3,983	41,977			
Concentration, and smelting of concentrates:					
Ore.....	110,546	4,183,232	855,614,500	21,532,100	67,509,200
Old tailings.....	3	200	200		
Total.....	110,549	4,183,432	855,614,700	21,532,100	67,509,200
Direct-smelting:					
Ore.....	37,743	1,048,857	65,399,700	3,314,000	300,800
Smelter cleanings, etc.....	114	5,053	202,100	35,900	
Copper precipitates.....			75,180,700		
Total.....	37,857	1,053,910	140,782,500	3,349,900	300,800
Other: Straight leaching of copper ore.....					
			35,310,800		
Placer.....					
	60	4			
Grand total.....	152,449	5,279,323	1,031,708,000	24,882,000	67,810,000

¹ Includes tungsten-ore concentrate.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Cochise.....	4,625,499			335,003	13,943	274,847	80,817,100		5,019,500
Gila.....	7,277,308			159,574	1,392	169,240	103,043,100	34,300	
Graham.....	9,404			1,999		5,558	80,400	549,300	1,392,900
Greenlee.....	14,721,624			404,351	8,725	735,260	207,255,500		
Mohave.....	5,013			401	1,440	7,759	13,500	122,700	85,400
Pima.....	12,863,656			359,824	34,980	985,718	203,156,000	1,499,500	5,481,800
Pinal.....	13,925,094			518,086	27,680	950,665	238,232,700		
Santa Cruz.....	51,013			12,552	99	176,872	351,100	5,504,600	8,404,200
Yavapai.....	1,832,186	3,983	41,977	114,835	22,290	877,071	22,665,300	13,785,200	47,125,100
Yuma.....	250			36		442		36,500	300
Total:									
1957.....	55,311,047	3,983	41,977	1,906,661	110,549	4,183,432	855,614,700	21,532,100	67,509,200
1956.....	56,760,218	3,875	46,492	1,806,359	108,695	3,978,131	820,489,500	21,807,100	50,974,900
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore.....	3,690	22	35	167	1,411	4,697	3,200	8,700	
Dry gold-silver:									
Crude ore.....	400			13	6	267	200		
Old tailings.....	350			10	3	200	200		
Copper:									
Crude ore.....	54,835,773			1,800,191	86,696	3,103,920	849,648,900		
Copper-lead zinc: Crude ore.....	2,888			1,130		27,215	135,500	364,200	598,300
Copper-zinc: Crude ore.....	88,112			25,431	66	41,525	4,669,800	25,300	16,898,600
Lead: Crude ore.....	1,350			127	5	1,854	300	139,400	300
Lead-zinc: Crude ore.....	371,412	3,961	41,942	76,645	22,339	1,002,131	1,059,400	20,993,900	47,084,000
Tungsten: Crude ore.....				34		218	8,900		
Zinc: Crude ore.....	7,072			2,913	23	1,405	88,300	600	2,928,000
Total:									
1957.....	55,311,047	3,983	41,977	1,906,661	110,549	4,183,432	855,614,700	21,532,100	67,509,200
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS									
Dry gold.....				167	1,411	4,697	3,200	8,700	
Dry gold-silver.....				23	9	467	400		
Copper.....				1,808,557	86,770	3,134,250	853,919,400		5,000
Copper-lead.....				403		19,598	73,900	270,300	30,700
Copper-lead-zinc.....				1,737		53,586	230,300	1,531,000	344,500
Copper-zinc.....				39		101	3,600	400	39,900
Lead.....				4,482	113	148,259	136,400	5,772,000	368,400
Lead-zinc.....				25,420	20,099	642,403	368,000	13,089,100	3,716,300
Zinc.....				65,833	2,147	180,071	879,500	860,600	63,004,400
Total: 1957.....				1,906,661	110,549	4,183,432	855,614,700	21,532,100	67,509,200

See footnotes at end of table.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For copper ore treated by leaching

	Ore treated (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Gila.....	4,112,282	-----	-----	35,310,800	-----	-----
Total: 1957.....	4,112,282	-----	-----	35,310,800	-----	-----
1956.....	3,480,652	-----	-----	58,984,000	-----	-----

C. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Apache.....	456	-----	-----	14,700	-----	-----
Cochise.....	506,105	35,627	943,313	68,758,400	302,000	1,600
Coconino.....	39	-----	4	2,500	-----	-----
Gila.....	52,755	8	2,969	21,228,500	3,800	-----
Graham.....	321	-----	326	7,400	46,600	-----
Greenlee.....	53,979	48	3,380	6,698,100	-----	-----
Maricopa.....	152	40	265	4,000	-----	-----
Mohave.....	568	19	5,545	17,600	228,000	20,700
Pima.....	54,379	588	22,408	1,786,900	11,300	1,800
Pinal.....	75,757	695	21,690	39,159,000	362,900	19,700
Santa Cruz.....	7,323	68	31,498	168,700	2,395,300	241,600
Yavapai.....	37,416	560	19,027	2,850,900	-----	15,400
Yuma.....	1,764	204	3,485	85,800	-----	-----
Total: 1957.....	791,014	37,857	1,053,910	140,782,500	3,349,900	300,800
1956.....	856,917	33,446	1,154,554	132,342,500	2,190,900	185,100

BY CLASSES OF MATERIAL

Dry gold: Crude ore.....	1,369	285	636	42,700	-----	-----
Dry gold-silver: Crude ore.....	74,120	631	12,703	1,243,600	-----	-----
Dry silver: Crude ore.....	33,919	-----	13,824	1,199,500	3,800	-----
Copper:						
Crude ore.....	623,779	36,679	984,698	62,880,400	5,500	25,200
Cleanings and mill and smelter cleanings ¹	1,023	88	3,137	200,900	-----	-----
Precipitates.....	48,175	-----	-----	75,180,700	-----	-----
Copper-zinc: Crude ore.....	59	-----	71	4,300	-----	11,400
Lead:						
Crude ore.....	8,412	148	36,925	29,200	3,304,700	264,200
Cleanings.....	158	26	1,916	1,200	35,900	-----
Total: 1957.....	791,014	37,857	1,053,910	140,782,500	3,349,900	300,800

¹ Includes concentrate and contained recoverable metal from tungsten ore.² Combined to avoid disclosing individual company confidential data.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Material shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATES SHIPPED TO SMELTERS						
Dry gold.....	187	1,411	4,697	3,414	12,583	-----
Dry gold-silver.....	23	9	467	489	-----	-----
Copper.....	1,808,557	91,054	13,246,713	1874,184,791	-----	1,913,673
Copper-lead.....	403	-----	19,698	92,807	275,778	39,294
Copper-lead-zinc.....	1,737	-----	53,586	286,676	1,562,107	441,708
Copper-zinc.....	39	-----	108	4,187	485	44,281
Lead.....	4,482	113	148,259	170,358	5,890,004	472,456
Lead-zinc.....	25,420	20,099	642,403	459,949	13,356,242	4,764,506
Zinc.....	65,833	3,250	271,952	1,076,130	1,508,341	70,970,880
Total: 1957.....	1,906,661	115,936	4,387,783	876,278,361	22,605,540	78,646,798
1956.....	1,806,359	111,535	4,051,863	846,743,915	23,077,619	59,635,770
ORE TO LEACHING PLANTS						
Copper.....	4,112,282	-----	-----	70,760,945	-----	-----
Total: 1957.....	4,112,282	-----	-----	70,760,945	-----	-----
1956.....	3,480,652	-----	-----	66,624,771	-----	-----
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold: Crude ore.....	1,369	285	636	43,893	83	-----
Dry gold-silver: Crude ore.....	74,120	636	13,046	1,297,320	-----	-----
Dry silver: Crude ore.....	33,919	-----	13,824	1,225,140	3,831	-----
Copper:						
Crude ore.....	623,779	36,679	984,727	67,120,317	9,225	194,050
Cleanings, and mill and smelter cleanings ²	1,023	88	3,137	207,611	23	-----
Precipitates.....	48,175	-----	-----	76,077,645	-----	-----
Copper-zinc: Crude ore.....	59	-----	71	5,337	-----	14,586
Lead:						
Crude ore.....	8,412	148	36,925	36,624	3,383,755	339,341
Cleanings.....	158	26	1,916	1,553	36,612	-----
Total: 1957.....	791,014	37,862	1,054,282	146,015,440	3,433,529	547,977
1956.....	856,917	33,453	1,155,018	141,922,208	2,243,354	461,919

¹ Includes concentrate and contained metal from tungsten ore.

² Combined to avoid disclosing individual company confidential data.

To equalize copper supply and demand, most of the major producers in the State cut production during the year. In March, Phelps Dodge Corp. placed in effect a schedule of 23 operating days instead of 24 in each 4-week period at most of its operations. Then in September it announced an additional 5-percent cutback. Morenci and New Cornelia Branches were operated 11 days, followed by a 3-day shutdown in each 2-week period. At the Copper Queen Branch the working schedule was cut from a 6-day week to an alternate 6- and 5-day week. In July the Miami Copper Co. cut the workweek at its Copper Cities and Miami mines from 6 days to 5. A similar cut was made by Pima Mining Co. at Pima in October. In April operations at the Ray Mines Division of Kennecott Copper Corp. were reduced from 7 days a week to 6 days. In addition, the entire division was shut down from October 7 to October 20 for major maintenance work. Lowering the number of working days per man per

week cut labor costs, because it reduced the number of overtime hours at premium pay.

During the year several new developments had significant effects on Arizona's copper industry. Pima Mining Co. (50 percent owned by Cyprus Mines Corp. and 25 percent each by Utah Construction Co. and Union Oil Co.) put its mill at the Pima mine in operation early in January. This culminated an extensive exploration, development, and construction program lasting several years and put in production a mine that will undoubtedly be a major source of copper. Output from this mine added substantially to Arizona's total copper output and was a factor in establishing a record copper production in 1957, despite a planned reduction in output at many major producing mines.

Inspiration Consolidated Copper Co. completed rehabilitation and conversion of its milling facilities from ferric sulfate leaching of the ore to a sulfuric acid leaching of the oxide fraction and flotation of the sulfide fraction of the ore (tailing from the leaching operation). This new milling method is termed the "dual metallurgical process" and has been described by Dayton.³ The new 15,000-ton-per-day flotation concentrator went into operation on January 7. The change to the dual process eliminated the need to mine ore selectively to maintain the oxide-sulfide ratio formerly required by the ferric sulfate leaching process and made it possible to mine a greater tonnage of ore, despite a shortened workweek during the year. It permitted profitable treatment of lower grade ore and thus increased the ore reserves. The changed process released part of the capacity of the electrolytic tankhouse where refined metal is produced in the form of cathodes by plating copper out of leaching solutions onto copper starting sheets. This excess tank capacity was used to refine anode copper produced by smelting concentrate and copper precipitates.

According to Inspiration Consolidated Copper Co. officials, because of the poor copper market no date was set for starting the as planned major shaft-sinking and plant-construction program at the Christmas mine; however, mine development was continued throughout the year, on a 6-day workweek to July and on a 5-day workweek thereafter. A small mill on the property was renovated and operated on a limited basis to gain metallurgical information for the final design and flow-sheet of the new concentrator. A new hoist and headframe were installed at the development shaft.

Under a \$40 million program to increase productive capacity of the Ray Mines Division of Kennecott Copper Corp. 20,000 tons annually, construction of the new smelter at Hayden was well advanced by the end of the year, with completion expected by the middle of 1958. Relocation of surface facilities to permit enlargement of the pit was well advanced and was to be completed by early 1959. Expansion of the mill progressed. The modification of the mill for treatment of ores by leach-precipitation-flotation (L-P-F), costing \$5 million and increasing the copper recovery by an additional 2 pounds per ton of ore, was described.⁴ Completion of the program will mean a sub-

³ Dayton, Stanley, *Dual Process Metallurgy Stretches Inspiration Ore Reserves*: Min. World, vol. 19, No. 10, September 1957, pp. 50-59.

⁴ Last, A. W., Stevens, J. L., and Eaton, L., Jr., *L-P-F Treatment of Ray Ore*: Min. Eng., vol. 9, No. 11, November 1957, pp. 1236-1238.

stantial addition in personnel. To accommodate them 600 new houses were being erected by the company.

Cyprus Mines Corp. began milling copper-zinc ore from its Old Dick mine early in May; but, because of the drop in copper and zinc prices preparations were made at the close of the year for suspending operations early in 1958. According to the company, shutdown expenses are not great, and the property can be readily reopened if and when economic conditions relative to the base metals change. A subsidiary company (Coronado Copper & Zinc Co.) closed its Johnson Camp Unit copper-zinc operation in August. The company annual report stated that the remaining ore reserve was not large and the property can only be reopened if metal prices are substantially higher.

A new mill circuit installed to treat the high-oxide portion of the ore from the Miami underground mine operated by the Miami Copper Division of the Miami Copper Co. was put in service in April. The new circuit used the "L-P-F" (leaching, precipitation, and flotation) process, in which acid leaching of the ore is followed by precipitation of the copper on shredded iron and flotation of the precipitates (cement copper) to recover the copper. According to the company annual report, the unit was operated successfully for the balance of the year, treated 4,333 tons of ore per operating day, and recovered 2,723 tons of copper that otherwise would have been lost.

In-place leaching of caved and worked-out areas of the Miami mine supplied 16 percent of the division's production. After underground mining is ended, recovery of copper by in-place leaching is expected to increase the present rate of 6 million pounds per year about 3 times. The first section of a new precipitation plant to be used in this in-place leaching program was placed in operation in March. Construction of a second and final section of this plant along with increased facilities for pumping the copper solution out of the mine, was begun in 1957 and about half finished by the close of the year.

The construction of copper and molybdenum mining and milling facilities of the Duval Sulphur & Potash Co. properties in Pima County was begun during the year and proceeded on schedule; \$6.2 million of an estimated total cost of \$21 million had been expended by the close of the year, according to the company annual report for 1957. Development of the open-cut mine was under contract to Isbell Construction Co. of Reno, Nev., and the design and construction of the mill were under contract to the Stearns-Roger Manufacturing Co. of Denver, Colo. The company expected to put the mine and mill in operation during the first half of 1959.

In its annual report for 1957 the Bagdad Copper Corp. stated that a fifth ball mill was added to the mill at a cost of \$178,000, a pilot plant was purchased and installed at a cost of \$60,000, and company store and office buildings at Bagdad were completed at a cost of \$294,000 during the year. The purpose of the pilot plant was to develop an economical method of recovering electrolytic copper from its copper concentrate and produce byproduct sulfuric acid for use in heap-leaching the subgrade copper oxide material capping the copper sulfide ore body. A description of the process reporting results of the tests was published.⁵

⁵ Mining World, Electrolytic Copper Production is Goal of Bagdad Pilot Plant Study: Vol. 19, No. 9, August 1957, pp. 50-53.

Gold.—A 4-percent increase in gold output in Arizona in 1957 reflected directly the increased production of copper, because 81 percent of the gold was recovered from copper ore alone. Of the remainder, 17 percent came from ores of lead and zinc and 2 percent from ores of gold and silver.

Six mining operations—Copper Queen and New Cornelia Branches of Phelps Dodge Corp., Iron King of Shattuck Denn Mining Corp., San Manuel of San Manuel Copper Corp., Magma of Magma Copper Corp., and Morenci Branch of Phelps Dodge Corp. (in order of gold output)—furnished 95 percent of the State's total gold production in 1957.

Iron.—Large-scale sampling and metallurgical testing of an iron deposit north of Oracle Junction, was done by the Omega Mining Co. The company drilled fifty 3-foot-diameter holes to a depth of 28 feet in the loosely consolidated conglomerate. Slotted culvert pipe was set in the holes and channel samples were taken through the slot. Magnetic-separation tests were made on the samples and it was reported that the results were encouraging.

Lead.—Lead output in Arizona in 1957 was virtually the same as in 1956. The State's principal producer—Iron King mine operated by the Shattuck Denn Mining Corp.—was active throughout the year. Operations were suspended by the American Smelting and Refining Co. at the Flux mine (the second largest lead producer in Arizona in 1957) and at the Trench mill on October 23. The surface plant was sold, and certain mining claims were leased to James P. Nash & E. W. McFarland on December 30. The Glove mine, ranking third in lead output, was operated throughout the year by the Sunrise Mining Co. In March the San Xavier mine, the fourth largest lead producer in Arizona in 1957, and the Sahuarita mill, where the ore from this mine was treated, were sold to the McFarland & Hullinger partnership (former leasers) by The Eagle-Picher Co. Operations at the mine and mill were suspended at the end of June. These mines—Iron King, Flux, Glove, and San Xavier—supplied 92 percent of the total lead output in Arizona in 1957.

Manganese Ore and Concentrate.—The output of manganese ore and concentrate almost doubled—from 42,000 short tons (gross weight) valued at \$3.5 million in 1956 to 80,000 tons valued at \$6.6 million in 1957. All ore and concentrate produced in 1957 was marketed under the "carlot" program administered for the Government by the General Services Administration (GSA). Under this program, the minimum acceptable manganese content of the ore or concentrate was 40 percent.

The ore and concentrate shipped from Arizona in 1957 were produced from 40 mines by 45 mining operations in 9 counties. Maricopa County, with 11 producing mines, had the largest output, followed by Yuma, with 10 mines. Other counties, in order of value of output, included Mohave, Gila, Pima, Pinal, Yavapai, Cochise, and Coconino. The four leading producers, in order of output, were: Herald Mining Corp. (Purple Pansy), Big Horn Mining Co. (Black Rock), Mohave Mining & Milling Co. (Little Horn), and Twentieth Century Fuels, Inc. (Georgann); all were in Maricopa County.

Mohave Mining & Milling Co. operated a 300-ton-per-day custom manganese mill and sintering plant near Wickenburg, Ariz., throughout the year. Dasco Mines Corp. completed a 200-ton-per-day

flotation mill and sintering plant near Wenden, Ariz., in October. The Herald Mining Corp. operated the Purple Pansy mill near Aquila, Ariz., for the first 5 months of the year on ore from its mine.

Mercury.—A small quantity of mercury was produced in Arizona in 1957 by 5 individual operators, 1 in Gila and 4 in Maricopa Counties, and sold to either the Quicksilver Products, Inc., or Chemical Manufacturing Co., Inc. Output was from an area near Sunflower, 50 miles northeast of Phoenix, where a substantial quantity of mercury had been produced, especially during periods of high prices. The largest producer of mercury from this area in 1957 was Acme Mines, followed by Oneida Mining Co.

Molybdenum.—The output of molybdenum in Arizona in 1957—all recovered as a byproduct of copper ore from five mines, Miami, Morenci, Silver Bell, San Manuel, and Bagdad—was virtually the same as in 1956. An article was published⁶ describing how American Smelting and Refining Co. improved the molybdenite recovery at its Silver Bell concentrator by installing a Morenci-process molybdenite-recovery plant.

Inspiration Consolidated Copper Co. completed metallurgical testwork, and designs were ready for installing a circuit in the mill to recover molybdenite from the copper concentrate recovered from copper ore from the Inspiration mine. Pima Mining Co. conducted tests to determine the feasibility of installing a molybdenite-recovery circuit in the Pima mill, where the copper ore from the Pima mine is treated. The mill under construction by Duval Sulphur & Potash Co. at the Esperanza copper mine will have a molybdenum circuit, because it is reported that the mill feed at times will be up to 3 or 4 pounds of molybdenite per ton.

Silver.—Like gold, the slight increase in silver output in Arizona in 1957 directly reflected the gain in copper production because 77 percent was recovered from copper ore alone. Of the remainder, 22 percent came from ores of copper, lead, and zinc and 1 percent from ores of gold and silver. The Copper Queen Branch operation at the Copper Queen underground mine and the Lavender open-pit mine was again by far the largest silver producer in the State, followed (in order of output) by the Iron King underground lead-zinc mine, Morenci open-pit copper mine, Magma underground copper mine, and New Cornelia Branch operation at the Ajo open-pit copper mine. These 5 operations supplied 72 percent of Arizona's total silver output in 1957.

Tungsten.—The drop in the output of tungsten concentrate (60-percent WO_3 equivalent) in Arizona from 186 short tons in 1956 to 5 tons in 1957 resulted from exhaustion of funds in December 1956 for the Government domestic purchase program. The Arizona operators found that they could not produce tungsten for the United States market price, which was about one-half that paid by the Government under the purchase program.

A total of 1,279 units of tungsten was produced in Arizona in 1957, of which 316 units was sold and shipped (recorded as produced). The average selling price for the tungsten sold was \$26.70 per unit. A total of 2,346 units was reported by the operators as stocks on

⁶ Engineering and Mining Journal, How AS&R Raised Molybdenite Recovery on Copper Concentrate; Vol. 158, No. 8, August 1957, pp. 104-106.

TABLE 15.—Mine production of uranium ore, July 1955–December 1957¹

County	July 1–Dec. 31, 1955						1957					
	Number of properties	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²	Number of properties	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²	Number of properties	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²
Apache.....	59	81,645	424,489	\$1,775,086	60	163,427	775,385	\$3,097,246	39	139,503	643,873	\$2,619,495
Cochise.....	3	(3)	(3)	(3)	1	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Cocouino.....	14	3,809	11,461	36,370	64	87,291	382,032	1,645,836	58	86,226	480,506	2,018,642
Gila.....	1	(3)	(3)	(3)	17	6,823	25,653	98,677	10	10,282	51,996	207,644
Graham.....	3	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Maricopa.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Mohave.....	1	(3)	(3)	(3)	12	16,721	149,069	668,004	9	(3)	(3)	(3)
Navajo.....	3	(3)	(3)	(3)	2	(3)	(3)	(3)	1	(3)	(3)	(3)
Pima.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Pima.....	1	(3)	(3)	(3)	2	(3)	(3)	(3)	2	(3)	(3)	(3)
Santa Cruz.....	2	7,111	33,798	139,921	2	243	882	2,767	(3)	(3)	(3)	(3)
Yavapai.....	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Undistributed.....	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total.....	88	92,565	469,748	1,951,327	161	274,505	1,331,021	5,407,530	121	286,037	1,510,644	6,276,970

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."

hand at the close of the year. Activity was reported at 13 mines—6 in Yuma County, 3 each in Pima and Cochise Counties, and 1 in Mohave County.

Uranium.—Uranium ore produced in 8 counties in 1957 totaled 286,037 tons having an average grade of 0.26 percent U_3O_8 and was a 4-percent tonnage increase compared with 1956. Major production was from Apache and Coconino Counties, followed by Navajo and Gila Counties. The Rare Metals Corp. processing mill at Tuba City operated the entire year and processed all the ore produced in Coconino County. Ores from other counties were processed at Tuba City and at various mills in Colorado, New Mexico, and Utah. The buying station at Cutter in the Globe area operated by Lucius Pitkin, Inc., for the Atomic Energy Commission (AEC) was closed on June 30 because of limited ore receipts and difficulty in processing the ore at existing mills. Also the ore reserve in the area did not warrant consideration of a separate milling facility.

Exploration and development continued throughout the year. Operators reported 783,000 feet of drilling and removal of 547,000 cubic yards of waste material by stripping. Development included 18,400 linear feet of drifts, crosscuts, adits, shafts, raises, and winzes.

At the close of the year the Arizona uranium-ore reserve, as determined by the AEC, was 1.4 million tons having an average grade of 0.32 percent U_3O_8 and was 1.8 percent of the United States reserve (78 million tons).⁷

The Arizona State mine inspector reported that 440 men were employed in Arizona uranium mines, exclusive of those at the Rare Metals Corp. mill at Tuba City.

Vanadium.—Vanadium was recovered from some uranium ores originating in Apache County and processed at Colorado mills. Ores processed at mills in Arizona, New Mexico, and Utah were not treated to recover vanadium.

Zinc.—Zinc production in Arizona in 1957 increased 31 percent in quantity but only 12 percent in value above the 1956 output. The difference in the two percentage increases reflected the drop in price for zinc during 1957. The Iron King mine was by far the principal producer of zinc (as with lead) in the State. Following the Iron King mine and in order of output were the Old Dick, Flux, Johnson Camp Unit, and Atlas. These 5 mines supplied 91 percent of Arizona's zinc output.

The Iron King mine was operated throughout the year. The Cyprus Mines Corp. began operations at the Old Dick mine in May, then at the close of the year began preparing for a shutdown early in 1958, because of a drop in the price for zinc and copper. American Smelting and Refining Co. at the Flux mine suspended operation in October, and the claims were leased to Nash & McFarland. The Johnson Camp mine was closed in August by Coronado Copper & Zinc Co., wholly owned subsidiary of Cyprus Mines Corp. The Atlas mine operated by B. S. & K. Mining Co. was active from January through May, and November and December.

⁷ AEC, Additional Domestic Uranium Production Statistics for 1957: Press Release 208 (Grand Junction, Colo., office), Mar. 7, 1958, 4 pp.

NONMETALS

Asbestos.—The asbestos producers of Arizona, despite temporary curtailment of Government purchases of asbestos, shipped 15 percent more fiber in 1957 than in 1956. A 3-month work stoppage at the mines in the spring of 1957 was due to lack of funds for continued purchases by the General Services Administration (GSA) at the Government depot in Globe. However, \$2.5 million was included in the Interior Department appropriation bill for 1958 for the purchase of Arizona asbestos, and the purchase program was reactivated after July 1, 1957.

A breakdown of shipments reveals that, although total output was greater in 1957, sales of Grades 1, 2, and 3 fiber dropped 16, 3, and 11 percent, respectively. On the other hand, sales of filter fiber rose 28 percent above 1956 and were responsible for the increase in total shipments. In order of importance relative to tonnages shipped, the major producers were American Fiber Corp. (El Dorado, Victory, Rock House, May, Montezuma, and Asbestos Nos. 3 and 4 mines), Metate Asbestos Corp. (Apache, Blue Mule, and Lucky 7 mines), Jaquays Mining Corp. (Regal mine), and Phillips Asbestos Mines Phillips mines).

Cement.—Although shipments of Types I and II (general use and moderate heat) portland cement continued to increase (7 percent) in 1957, this overall gain was not as high as in 1956. Arizona Portland Cement Co., a subsidiary of the California Portland Cement Co., with a plant at Rillito, continued to be the only producer in the State. Limestone for the cement plant was quarried near the mine, and gypsum and smelter slag were purchased from Arizona sources. During the last quarter of 1957 the company reduced its cement price 15 cents per barrel in what company officials termed "an anti-inflation move." Arizona Portland Cement Co. also announced plans to build a new cement plant with an annual capacity of 2 million barrels near Ash Fork. Reportedly, the company will build the new plant in northern Arizona rather than further expand its Rillito plant, a 3-kiln, 2.7-million-barrel facility. Construction of a plant will depend upon securing a contract to supply cement for the Glen Canyon Dam. Bids for supplying the cement are expected to be opened during the second quarter of 1958.

Clays.—The total output of clays in Arizona in 1957 continued to decline, dropping 15 percent below 1956. Again, the reduced production of nonswelling bentonite from the Cheto mines near Sanders was the principal reason for the decrease. In contrast, the output of miscellaneous clay rose 5 percent above 1956, owing to increased output by the Wallapai Brick & Clay Products, Inc., and Western Clay Products Co., Inc., in Maricopa County, and Tucson Pressed Brick Co. in Pima County. Fifteen tons of fire clay was mined by the Gila Pottery Co. at Globe for use in manufacturing art pottery and flowerpots. All the miscellaneous clay produced was used in manufacturing heavy clay products.

Feldspar.—Feldspar, mined by Paul A. Hodges, Stewart Mining Co., and Sena Mining Co. and shipped to the International Minerals & Chemical Corp. mill at Kingman, decreased 24 percent in 1957.

The ground feldspar was used for flux and in the manufacture of glass, pottery, enamel, and soap and abrasives by consumers in California, Colorado, Louisiana, Ohio, and Washington.

Gem Stones.—The value of gem and ornamental stones collected in Arizona during 1957 dropped to \$75,000 compared with \$104,000 in 1956. Reportedly, the decline resulted from a loss in popularity of baroque or free-form gem stones, coupled with the fact that the better mineral specimens used as gems and ornamental stones have become increasingly difficult to find. Navajo County was the most important gem-stone-producing area, followed by Gila, Mohave, and Greenlee Counties. In terms of value, turquoise was the most important stone collected, followed by petrified wood and agate.

Gypsum.—Decreased construction activity, particularly during the latter half of 1957, adversely affected the output of crude gypsum in Arizona. The consumption of gypsum at the plant of Union Gypsum Co. at Phoenix dropped considerably below 1956. Arizona Gypsum Corp. was the only other operator in the State. Sales of gypsum for portland-cement retarder and agricultural use increased slightly in 1957.

During 1957 the Union Gypsum Co. put into operation a new calcining mill and thereby doubled its previous production capacity. A 20,000-square-foot addition to its warehousing facilities was also constructed during the year. The Union Gypsum mine is 11 miles south of Winkelman. The ore, mined with a 1½-yard shovel, is trucked to a plant 1 mile from the mine, where the mine-run material is screened and the fines are discarded. The screened gypsum is then crushed to ¾- to 1-inch size and hauled by truck to Winkelman for rail shipment to Phoenix. According to published reports, daily shipments to Phoenix amounted to 250 to 300 tons of crushed gypsum. Late in 1957 a new gypsum pit was opened by Union Gypsum Co. 13 miles north of Mammoth, Pinal County, to supply crude material to its Phoenix wallboard plant.

Completion in 1957 of mine installations at a gypsum deposit near Camp Verde by the Verde Gypsum Co. introduced a new producer of agricultural gypsum in Arizona. The crude material will be trucked to Phoenix for sale to agricultural chemical companies and replaces gypsum formerly received from California mines.

Lime.—The output of quicklime and hydrated lime in 1957 continued to climb, reaching 138,221 tons, 9 percent more than in 1956. Limekilns were operated by Paul Lime Plant, Hoopes & Co., Phelps Dodge Corp., San Manuel Copper Corp., and United States Lime Products Corp. As in 1956, quicklime used in treating base-metal ores consumed the bulk of the lime produced. Phelps Dodge Corp. and San Manuel Copper Corp. utilized the entire output of their kilns, whereas the other three operators reported sales for use in processing metal ores, steel blast and open-hearth furnaces, water purification, paper, and insecticides, fungicides, and disinfectants.

Mica.—The grinding plant of Buckeye Mica Co. at Buckeye was reactivated in 1957, and its mines at Buckeye and Quartzite were reopened. Dry-ground mica totaling 1,650 tons was shipped to manufacturers of roofing material and paint.

Nitrogen Compounds.—A deposit of bat guano mined by Randall Mills Corp. from caves on the south rim of the Grand Canyon 60

miles north of Kingman became available as a soil conditioner in 1957. A single-span tramway, longest of its type in the world, was constructed to transport the guano from the 60-million-year-old Bat Cave 600 feet above the Colorado River in Grand Canyon to the top of the rim, where packaging and warehouse facilities were under construction. The entire procedure of mining and processing the guano was described.⁸ All of the output was sold to the United States Guano Corp. of Kingman which, in turn, packaged and distributed the product.

Perlite.—Output of crude perlite in Arizona in 1957 became stabilized; material sold or used remained at relatively the same level as that reported in 1956. Perlite Industries of Arizona, Inc., was again the dominant producer. The company mined perlite for the Sil-Flo Corp. of Fort Worth, Tex., as well as for use at its Phoenix expanding plant. The latter facility produced expanded perlite for use as a building plaster and concrete aggregate. Lee's Perlite Industries, Inc., was idle throughout 1957, and by the end of the year Superior Industries, Inc., at Superior, discontinued operations. Tucson Perlite, Inc., reported the production of 180 tons of crude ore and 83 tons of expanded perlite used as a plaster aggregate.

Pumice.—The output of pumice in Arizona in 1957 included the production of volcanic cinder (scoria) used as railroad ballast, it therefore climbed to 397,000 tons in 1957 compared with 115,000 tons in 1956. The Atchison, Topeka & Santa Fe Railroad was the leading producer and operated the Winona mine (Coconino County). The bulk of the material was used for railroad ballast, and some crude material was sold to local cinder-block manufacturers. Superlite Builders Supply Co. of Phoenix discontinued mining at its Yavapai County operation on June 30. Crude material was purchased from the Atchison, Topeka & Santa Fe Railroad between June 30 and November 1, when the company began mining at the Winona deposit. Scoria was shipped by rail to the company Phoenix plant for the production of building blocks. Christensen Construction Co., contract miner for Arizona Precast Concrete Co., discontinued mining during 1957 and Arizona Precast took over active operation of its tuff deposit. The crude material was shipped to the company's block plant at Mesa. The Gila Valley Block Co. continued to operate its block plant at Safford on crude material mined from the Pumice & Cinder No. 2 deposit.

Pyrites.—Pyrite concentrate was recovered by the Ray Mines Division of Kennecott Copper Corp. Roasting of the concentrate produced sulfur dioxide gas, which was used to produce sulfuric acid.

Sand and Gravel.—In terms of value, sand and gravel produced in Arizona ranked second among all minerals produced compared with fourth place in 1956. Sand and gravel sold or used in 1957 reached 10.3 million tons valued at \$9.2 million—30 percent more tonnage than 1956. Highway construction in connection with the Federal highway program, as well as normal State roadwork, was mainly responsible for the increase. The December 31, 1957, report of the Federal Bureau of Public Roads showed that Arizona ranked 10th in the Nation in mileage of all construction underway on the system,

⁸ Deco Trefoil (Denver Equipment Co.), Mining the Grand Canyon: Vol. 22, No. 2, March-April 1958, p. 3.

with 61.9 miles. In all mileage completed on the 41,000-mile super-highway network Arizona ranked 9th, with 46.6 miles. For total work programmed—in all stages of planning and construction since the Federal aid effort began on July 1, 1956—Arizona was fifth with 187.9 miles.

TABLE 16.—Production of sand and gravel in 1957, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Coconino.....	(¹)	(¹)	Pinal.....	108	\$135
Gila.....	109	\$97	Yavapai.....	90	135
Greenlee.....	(¹)	(¹)	Yuma.....	4	7
Maricopa.....	2,495	2,341	Undistributed.....	6,547	5,301
Navajo.....	42	67	Total.....	10,287	9,222
Pima.....	892	1,139			

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

TABLE 17.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	791	\$764	\$0.97	731	\$754	\$1.03
Paving.....	227	251	1.11	291	313	1.08
Engine.....	1	1	1.00	(¹)	(¹)	-----
Filter.....				(¹)	(¹)	-----
Railroad ballast.....	(¹)	(¹)	-----	1	1	.80
Other.....	189	212	1.12	167	187	1.11
Gravel:						
Building.....	1,242	1,168	.94	1,162	1,344	1.16
Paving.....	912	842	.92	594	647	1.09
Railroad ballast.....	(¹)	(¹)	-----	20	23	1.14
Other.....	277	254	.92	441	377	.86
Total sand and gravel.....	3,639	3,492	.96	3,407	3,646	1.07
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Paving.....	2,629	1,469	.56	647	540	.83
Gravel:						
Building.....				1	1	1.62
Paving.....	1,664	1,206	.72	6,232	5,035	.81
Total sand and gravel.....	4,293	2,675	.62	6,880	5,576	.81
Grand total.....	7,932	6,167	.78	10,287	9,222	.90

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

Maricopa County was the leading producing area, supplying 24 percent of the total output. Pima County was second, followed by Gila, Pinal, and Yavapai Counties. The five leading commercial producers were Superior Sand & Gravel Division of Fisher Contracting Co., Arizona Sand & Rock Co., Inc., San Xavier Rock & Sand Co., Acme Materials Co., and Valley Redi-Mix Co. Commercial producers employed an average of 540 men, and the average length of employment was 260 days.

Stone.—Stone production in Arizona increased from 1.6 million tons in 1956 to 2.1 million tons in 1957, a 29-percent increase. The gain was reported in the crushed-limestone and sandstone classification as a result of increased consumption of limestone for cement and sandstone for highway use.

The uses that consumed 98 percent of the total stone production were cement, flux, lime, and concrete aggregate. Additional stone was used as terrazzo, roof granules, riprap, and abrasives and in the manufacture of pottery, porcelain, and household cleansers. Dimension sandstone was used for rough construction, dressed building stone, and flagging. The principal counties reporting production were Pima, Coconino, Cochise, Greenlee, Yavapai, and Pinal.

TABLE 18.—Production of stone in 1957, by counties

County	Short tons	Value	County	Short tons	Value
Apache.....	40, 400	\$13, 000	Pima.....	736, 400	\$767, 800
Cochise.....	475, 100	1, 027, 600	Pinal.....	57, 800	129, 400
Coconino.....	531, 457	356, 394	Yavapai.....	58, 896	286, 293
Gila.....	30, 006	37, 596	Total.....	2, 100, 559	2, 981, 683
Greenlee, Maricopa, and Mohave.....	1 170, 500	1 363, 600			

¹ Combined to avoid disclosing individual company confidential data.

TABLE 19.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	17, 382	\$22, 062	140	\$300	930	\$19, 800	1 110, 439	1 \$169, 287
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.....	(²)	(²)	800	800	1, 700	29, 500	1, 138, 200	1, 504, 000

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	266, 656	\$332, 376	46, 811	\$74, 923	442, 358	\$618, 748
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

¹ Excludes limestone for cement and lime.

² Figure withheld to avoid disclosing individual company confidential data; included with "Other."

Vermiculite.—Ari-Zonolite Co. operated its Glendale exfoliated-vermiculite plant on crude ore from out-of-State sources. The exfoliated product was used for loose-fill insulation and as a light-weight aggregate.

MINERAL FUELS

Coal.—Coal was produced at 2 mines—1 each in Coconino and Navajo Counties. Total production was 8,901 tons, a 12-percent decrease compared with 1956. Only the coal produced in Coconino County was sold on the open market.

TABLE 20.—Stone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction..... short tons..	(¹)	(¹)	206	\$146
Rubble..... do.....	3, 808	\$17, 820		
Architectural:				
Rough..... cubic feet..	67	97		
Approximate equivalent in short tons.....	5			
Dressed..... cubic feet..	(¹)	(¹)	38, 800	65, 081
Approximate equivalent in short tons.....	(¹)		2, 910	
Flagging..... cubic feet..	190, 524	177, 465	162, 380	144, 756
Approximate equivalent in short tons.....	14, 289		12, 343	
Other (quantity approximate in short tons).....	3, 404	61, 737		
Total dimension stone (quantities approximate in short tons).....	21, 506	257, 119	15, 459	209, 983
Crushed and broken stone:				
Riprap..... short tons..	5, 295	3, 495	900	1, 500
Metallurgical..... do.....	449, 847	578, 877	459, 000	903, 600
Concrete and roadstone..... do.....	220, 054	256, 097	598, 500	382, 200
Other ² do.....	926, 327	1, 378, 931	1, 026, 700	1, 484, 400
Total crushed and broken stone.....	1, 601, 523	2, 217, 400	2, 085, 100	2, 771, 700
Grand total (quantities approximate in short tons).....	1, 623, 029	2, 474, 519	2, 100, 559	2, 981, 683

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

² Includes cement, lime, ferrosilicon, enamel, pottery, porcelain, tile, terrazzo, roof granules, plaster, food filler, cleansers, and abrasives.

Petroleum and Natural Gas.—Eight wells were drilled for oil and gas in Apache and Mohave Counties in 1957. In Apache County two wells drilled northeast of the Bita Peak gasfield were completed. No data were released. Three gas wells were completed in the southeastern portion of the Black Mesa basin. Wells drilled in Mohave County were dry and were abandoned. Drilling in the State totaled 21,309 feet.

The El Paso Natural Gas Co. proposed building additional gathering and processing facilities in the Four Corners area that would include natural gas from the East Boundary Butte and Bita Peak fields in Apache County. East Boundary Butte field was discovered in 1954 and the Bita Peak field in 1956. The Bita Peak field was considered one of the best gas wells ever completed in the Four Corners area. Both produce from the Paradox and have been shut in because of the lack of transmission facilities.

REVIEW BY COUNTIES

Apache.—The value of uranium ore produced in Apache County represented 87 percent of the total value of mineral production in 1957. This county was the leading producer of uranium ore in the State, with shipments from 39 mines, all in the Carrizo Mountains. Vanadium Corp. of America operated the Monument No. 2 mine and was the leading shipper of uranium ore, followed by Kerr-McGee Oil Industries, Inc., operator of the Mesa group of mines. Shipments from Apache County were processed at mills in Colorado, New Mexico, and Utah.

The mining of bentonite from the Cheto mine by the Alba Mining Corp. continued to be the principal activity of the nonmetal-mineral industry of the county. Wylie Bros. produced 40,000 tons of crushed miscellaneous stone in connection with a contract with the Federal Bureau of Indian Affairs.

TABLE 21.—Value of mineral production in Arizona, 1956–57, by counties

County	1956 ¹	1957	Minerals produced in 1957 in order of value
Apache.....	\$3,601,829	\$3,020,320	Uranium ore, clays, stone, copper.
Cochise.....	68,344,376	50,474,007	Copper, gold, silver, stone, lime, zinc, manganese ore and concentrate, lead, tungsten concentrate, gem stones.
Coconino.....	1,884,705	2,864,384	Uranium ore, pumice, stone, sand and gravel, coal, manganese ore and concentrate, copper, silver.
Gila.....	76,785,677	50,935,723	Copper, asbestos, manganese ore and concentrate, molybdenum, lime, uranium ore, silver, sand and gravel, gold, stone, gem stones, lead, mercury, clays.
Graham.....	531,609	290,079	Zinc, lead, copper, pumice, silver, gem stones.
Greenlee.....	111,374,672	67,052,744	Copper, molybdenum, silver, lime, gold, stone, gem stones, sand and gravel.
Maricopa.....	3,959,377	6,206,000	Manganese ore and concentrate, sand and gravel, clays, pumice, stone, mica (scrap), mercury, gem stones, gold, fluorspar, copper, silver, uranium ore.
Mohave.....	1,873,189	911,628	Manganese ore and concentrate, stone, gold, lead, feldspar, zinc, silver, gem stones, copper, nitrogen compounds, tungsten concentrate.
Navajo.....	793,823	1,495,443	Uranium ore, sand and gravel, coal, gem stones.
Pima.....	91,431,712	75,739,870	Copper, cement, gold, sand and gravel, silver, stone, zinc, manganese ore and concentrate, molybdenum, lead, clays, gem stones, perlite, tungsten concentrate, uranium ore.
Pinal.....	101,723,680	87,710,021	Copper molybdenum, gold, silver, gypsum, lime, manganese ore and concentrate, sand and gravel, stone, perlite, pyrites, lead, zinc, gem stones.
Santa Cruz.....	2,929,900	2,491,068	Lead, zinc, silver, copper, uranium ore, gold.
Yavapai.....	16,064,018	18,254,158	Copper, zinc, lead, gold, silver, lime, stone, manganese ore and concentrate, pumice, sand and gravel, molybdenum, uranium ore, columbium-tantalum concentrate, beryllium concentrate, gem stones.
Yuma.....	2,331,363	1,117,509	Manganese ore and concentrate, copper, gold, sand and gravel, lead, gem stones, silver, tungsten concentrate, mica (scrap), zinc.
Undistributed.....	4,344,641	3,537,576	
Total ⁴	484,959,000	372,644,000	

¹ Revised to include final value of uranium production.

² Excludes value of manganese ore sold and blended at Government low-grade stockpiles for future beneficiation.

³ Includes value of sand and gravel, vanadium, gem stones, natural gas, and beryllium concentrate that cannot be assigned to specific counties.

⁴ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

A small quantity of copper was recovered from ore mined by Trent Exploration Co. and shipped directly to a smelter.

Superior Oil Co. drilled 2 wells northeast of the Bita Peak gas-field; no data were released. Kerr-McGee Oil Industries, Inc., completed 3 helium wells in the southeast portion of the Black Mesa basin.

Cochise.—The value of copper output comprised 89 percent of the total value of mineral production in Cochise County in 1957; the county ranked fifth in Arizona in value of copper production. It was the largest gold- and silver-producing county, fourth largest zinc, and sixth largest lead producer. Other metals produced in the county included manganese ore and tungsten. The value of produc-

tion of all of the metals except gold and manganese ore dropped sharply in 1957.

The Copper Queen Branch operation of the Phelps Dodge Corp. continued to rank first among mineral producers in value of output in the county; it held first place in the State in gold and silver production and second in copper output. Gold output from this mine increased 9 percent and copper 2 percent, whereas silver output declined 7 percent compared with 1956. According to the company annual report, the concentrator treated 4,580,920 tons of ore, consisting of 4,441,328 tons from the open pit and 139,592 tons from the underground mine. This ore yielded 326,391 tons of concentrate, which was shipped to the company Douglas Reduction Works for smelting. The precipitating plant produced 8,811 tons of copper precipitates for smelting. The proved ore reserve will suffice for 6 to 7 years; however, drilling in 1957 gave hope that additional ore may be developed.

The Johnson Camp mine was the second largest copper producer in the county and the fourth largest zinc producer in the State in 1957. The Cyprus Mines Corp. stated, in its annual report for 1957, that the Johnson Camp mine was closed in August because of the drop in copper and zinc prices. During the 8 months of operation 44,579 dry short tons of ore was milled, resulting in the production of 3,636 tons of copper concentrate and 4,976 tons of zinc concentrate.

In addition to the larger quantities of gold, silver, copper, lead, and zinc recovered from the two major mining operations—Copper Queen Branch and Johnson Camp—smaller quantities of these metals came from nine other active mines in the county in 1957. Of these, the Shannon mine (operated by the Shannon Mining Co.) had the greatest value of metal output.

Nonmetal production in Cochise County in 1957 was valued at \$1.9 million compared with \$1.4 million in 1956. The gain again resulted from increased output of stone and lime. Paul Lime Plant was the only one operated in the county, whereas stone production was reported by a number of individual operators.

Coconino.—In 1957 Coconino County ranked second in the State in value of uranium-ore production. This value constituted 70 percent of the total value of mineral output in the county in 1957. Uranium ore from 58 mines in the Cameron district was processed at the Rare Metals Corp. mill at Tuba City. Rare Metals Corp., Marcy Exploration & Mining Co., and Uteco Uranium Corp. were the principal producers.

Pumice, stone, and sand and gravel produced in the county had a value of \$803,000 and supplied 28 percent of the total value of mineral production in the county. Pumice (scoria) quarried by the Atchison, Topeka & Santa Fe Railroad from the Winona deposit boosted the county total \$369,000. Substantial gains over 1956 were reported for stone and sand and gravel output.

Manganese ore was mined from the Denison mine in Coconino County by Alvis F. Denison and was milled and shipped under the Government "carlot" program administered by the GSA. The Uteco Uranium Corp. made a shipment of ore to the smelter from the Laguna group; a small quantity of silver and copper was recovered

from it. Lawrence Isaac Coal Co. produced coal at the Cow Spring No. 3 mine; all was sold in the open market.

Gila.—The value of mineral production from Gila County in 1957 dropped \$25.8 million (34 percent) below 1956. Most of this decline resulted from a \$26 million (35 percent) fall in the value of copper production in the county; copper represented 94 percent of the total value of mineral production in the county in 1957. Four leading copper producers in Arizona (rank in parentheses)—Inspiration (6th), Copper Cities (8th), Miami (9th), and Castle Dome Dump (14th)—were in Gila County.

Inspiration Consolidated Copper Co. in January began to operate its newly converted mill employing the "dual metallurgical process" of acid leaching, followed by flotation concentration. According to the company, the plant was soon ready for full operation, but market conditions precluded capacity production. By July 15 conditions were such that the 6-day workweek was cut to 5 days; this schedule remained in effect throughout the balance of the year. Adoption of the dual metallurgical process made it possible to mine and treat lower grade ores profitably and thus increased the ore reserve. The drop in grade of ore mined in 1957, brought about by this change in milling practice and the resultant lower average ratio of waste removed to ore mined, is shown by the following data from the company published annual report:

Summary of data on overburden stripped and ore mined at Inspiration Consolidated Copper Co. mine, 1956-57

Year	Overburden stripped (short tons)	Ratio overburden stripped to ore mined	Ore mined (short tons)	Total copper content (percent)	Oxide copper content (percent)	Sulfide copper content (percent)
1956.....	11,456,577	3.09	3,709,789	0.976	0.496	0.480
1957.....	8,151,872	1.83	4,456,378	.892	.476	.416

The cost of breaking ground at the Inspiration mine was lowered considerably by the use of ammonium nitrate mixed with carbonaceous material in place of conventional explosives.

The Copper Cities mine, operated by the Copper Cities Division of Miami Copper Co., was the second largest copper producer in Gila County in 1957. According to the company printed annual report, 20,746 tons of copper was produced from 3,482,482 tons of ore containing 0.714 percent copper, mined from the Copper Cities open-pit mine in 1957. The ratio of overburden stripped to ore mined was 0.87 to 1.00. The ore reserve, as of January 1, 1958, according to this report, was estimated at 31.7 million tons.

The Miami Copper Division of the Miami Copper Co. produced 20,448 tons of copper (17,191 tons from ore and 3,257 tons from in-place leaching) from the Miami mine in 1957, according to the company annual report. Re-treatment of the copper concentrate resulted in the recovery of molybdenum concentrate containing 322,463 pounds of molybdenum marketed in the form of molybdic trioxide. A new mill circuit to treat high oxide copper ore by the L-P-F process

(leaching, precipitation, and flotation of the precipitates) was placed in service in April. It operated successfully throughout the remainder of the year, treated an average of 4,333 tons of ore per day, and recovered 2,723 tons of copper that otherwise would have been lost. According to the company, the ore reserve as of January 1, 1958, at the Miami mine was estimated at 3.47 million tons.

Water leaching of the old mine dumps at the worked-out Castle Dome mine by the Castle Dome Division of the Miami Copper Co. continued in 1957. The company reported in its annual report that 2,495 tons of copper was produced. The facilities used to collect and pump the solutions drained from the mine dumps were improved, and some additions were made to the system used for distributing the water to the dumps.

In addition to these 4 major operations, 14 other mines were reported active in the county in 1957 producing ores of gold, silver, copper, and lead. Most were small producers; over 500 tons of ore was produced from only 4 mines—Chillito and "79" in the Banner mining district and Carlota and Copper Hill & Keystone in the Globe-Miami district.

Nonmetal-mineral commodities produced in Gila County in 1957 composed 3 percent of the total value of mineral output. That asbestos was the principal constituent of this group was due largely to the availability of a market at the Government purchase depot at Globe. Significant gains in the sale of shorts and harsh fibers placed local producers on a sounder basis with regard to marketing their mine output. Operation of the only limekiln in the county by Hoopes & Co. filled the local demand for this product. Quicklime was employed in treating base-metal ores; this was the only use reported in 1957. A shift in construction activities of the State highway department resulted in a decline in the output of sand and gravel, and a slight drop in lime consumption was followed by a reduced output of limestone. The remainder of the county nonmetal production consisted of clay produced and used by the Gila Pottery Co. and gem stones collected by a large number of individual hobbyists and dealers.

Uranium ore was produced from 10 mines in the county in 1957. Except for a small tonnage that was shipped to Grants, N. Mex., all ore was delivered to the buying station at Globe. Because of the small quantity of ore developed in the area, limited deliveries to the buying station, and the refractory character of the ore, the station was closed on June 30.

The Globe Manganese mine in Gila County was operated by Jolyn Associates and was the fifth largest manganese-ore shipper in the State in 1957. The ore was shipped to the Mohave Mining & Milling Co. custom mill at Wickenburg, Ariz., where it was processed, sintered, and shipped to GSA under the "carlot" program.

Graham.—The value of mineral output in Graham County in 1957 declined 45 percent below 1956. Except for the value of a small quantity of pumice (scoria) produced by the Gila Valley Block Co. for use in manufacturing concrete block and a small value for gem stones collected by the Desert Rose Gift Shop, the entire amount came from the silver, copper, lead, and zinc output. Production of these metals was reported from four mines; as in past years, the major producer was the Head Center mine operated by the Athletic Mining

Co. The value of output in 1957 was about half that of 1956, because the last production in 1957 was reported in July. This explained most of the overall decline in total value of output for Graham County in 1957.

Greenlee.—The value of copper output in Greenlee County decreased 40 percent—from \$108.2 million in 1956 to \$64.4 million in 1957—mainly as a result of the drop in the price for copper; output declined only 16 percent. Copper represented 96 percent of the total value of Greenlee County mineral production in 1957. Substantial quantities of gold, silver, and molybdenum were recovered entirely as byproducts of copper mining. Other minerals produced in the county in 1957 included lime, stone, sand and gravel, and gem stones.

The Morenci mine of the Morenci Branch of the Phelps Dodge Corp. supplied most of the metal output in the county and was first in copper and molybdenum, sixth in gold, and third in silver production in the State in 1957. The Phelps Dodge Corp. published annual report for 1957 showed 14,721,209 tons of ore all told (an average of 52,018 tons per working day) was treated in the concentrator and 405,044 tons of concentrate was smelted. The molybdenum plant produced 840 tons of molybdenite concentrate as a byproduct. The company reported production of limestone used as smelter flux and in the manufacture of lime used in treating the copper ore. Sandstone also was quarried by the company for use as smelter flux.

Maricopa.—Manganese ore and concentrate produced from 11 mines in Maricopa County and shipped or processed and shipped under the Government "carlot" program were valued at \$3.6 million and composed 58 percent of the total value of mineral production in the county in 1957. The five leading shippers (in order of value of shipments, with name of mine in parentheses) were Herald Mining Corp. (Purple Pansy), Big Horn Mining Co. (Black Rock), Mohave Mining & Milling Co. (Little Horn), Twentieth Century Fuels, Inc. (Georgann), and U. S. Consolidated Mines, Inc. (U. S. Consolidated).

Mohave Mining & Milling Co. operated a 300-ton-per-day custom mill and sintering plant near Wickenburg, Ariz., throughout the year. Ore reported to average 20 percent manganese was treated by a combination of dense medium concentration, tabling, and flotation to yield a product assaying about 45 percent manganese. Ores from the various mines were run separately by mine, and the resulting concentrates along with ores from some mines, were blended and sintered to meet the GSA specifications for grade and size under the Government "carlot" manganese-ore purchase program. In May it was reported that 55 carloads of the product was being shipped monthly.

The value of sand and gravel output (\$2.3 million) represented 37 percent of the total value of mineral production in the county in 1957. The output dropped 10 percent in quantity; but an increase in the average price more than offset the decline in tonnage, so that the value of output increased 5 percent. Of the 14 commercial producers, the Superior Sand and Gravel Division of Fisher Contracting Co., Arizona Sand & Rock Co., Inc., and Acme Materials Co. were the major producing firms. The county highway department was the only Government-and-contractor producer reporting in 1957.

Miscellaneous clay was the second-ranking nonmetal, and output rose to 71,000 tons in 1957 compared with 63,000 tons in 1956.

Crushed decomposed-granite sales continued to decline, but the production of pumice (tuff) by the Arizona Precast Concrete Co. increased to 30,000 tons (9,200 tons in 1956). The tuff was used in manufacturing building block.

The mines and grinding plant of Buckeye Mica Co. were reactivated in 1957; as a result, 1,650 tons of ground mica was made available to local and west coast markets. Gem stones valued at \$3,550 and consisting of jasper, agate, serpentine, and chalcedony were collected, and a small quantity of fluorspar was mined, as a result of exploration by Monolith Portland Cement Co.

A total of 27 flasks of mercury valued at \$6,700 was produced from 4 operations in Maricopa County in 1957. The principal producer was Acme Mines. Five mines, each producing less than 100 tons of ore, yielded the small output of gold, silver, and copper in the county.

Mohave.—The value of manganese ore and concentrate produced by 11 operations in Mohave County and shipped under the Government "carlot" purchase program composed \$593,000 (65 percent) of the \$912,000 total value of mineral output in the county in 1957. Floyd Brown (American mine) and C. F. Heise (Priceless mine) were the two major manganese-ore producers.

Other metals—gold, silver, copper, lead, and zinc—produced from 7 lode mines and 1 placer mine, supplied \$135,000 of the remaining value of mineral production in the county. The Golden Gem, Rawhide, Champion, and Grand Gulch mines were the major contributors to this total. Dye & Bathrick mined and milled tungsten ore from the Borianna mine in 1957 and shipped some tungsten concentrate to the Union Carbide Nuclear Co. The partnership had a large stockpile of tungsten concentrate on hand at the close of the year. A small quantity of copper concentrate containing some silver was recovered as a byproduct of the milling of the tungsten ore and was marketed during the year.

Crushed sandstone (silica sand) valued at \$140,000 was quarried in Mohave County in 1957, and the finished product was reported to have been sold to manufacturers of pottery, porcelain, abrasives, and cleansers. International Mineral & Chemical Corp. continued to operate its feldspar mill at Kingman; shipments of ground feldspar went to consumers in California, Colorado, Louisiana, Ohio, and Washington and were also exported to Mexico. A nitrogen compound in the form of guano was reported for the first time by the United States Guano Corp. Gem or ornamental stones worth \$10,000 were collected by hobbyists and gem dealers.

Navajo.—Uranium ore from nine mines in Navajo County was the most valuable mineral commodity produced in the county in 1957. The largest producer—Industrial Uranium Co.—operating the Moonlight mine, shipped its entire output to mills at Mexican Hat and Monticello, Utah. Foutz & Thomas, operating the Fern mine, and Gibraltar Minerals, operating the Bootjack mine, were other major producers. Ore from these mines was processed at the same Utah mills. Coal valued at \$40,000 was produced from the Keams Canyon No. 4 mine by the Hopi Indian Agency for its own use. Navajo County continued to be an important area for the collection of pertified wood. Sand and gravel produced by Ray Despain, Sheldon Hatch, Kirby Trucking Co., Winslow Sand & Gravel Co., and

the Navajo County Highway Department totaled 42,000 tons of structural, paving, and fill sand, structural and paving gravel, and railroad ballast.

Pima.—The value of mineral production in Pima County dropped from \$91.4 million in 1956 to \$75.7 million in 1957, mainly as a result of the declining value of copper output from \$77.8 million in 1956 to \$61.7 million in 1957. This decrease was brought about entirely by a drop in the price of copper, because copper output actually increased from 91,500 tons in 1956 to 102,500 in 1957. The value of the copper output in 1957 accounted for 82 percent of the total value of all minerals produced in the county. Four mines—Ajo (3d-ranking copper producer in the State), Silver Bell Unit (10th), Pima (11th), and Mineral Hill-Daisy-Copper Glance group (13th)—supplied 99 percent of the total copper output in the county and 20 percent in the State in 1957.

In its annual report the Phelps Dodge Corp. published the following data for the New Cornelia Branch operation in 1957. In all, 8,813,134 tons of ore was mined from the Ajo open-pit mine. The concentrator treated 8,792,045 tons of ore during the year—an average of 31,067 tons per working day—and the smelter treated 202,261 tons of concentrates. Major items of equipment purchased during the year included 2 eight-cubic yard electric shovels, 3 rotary drills, and 2 bulldozers.

The Silver Bell Unit (Oxide and El Tiro open-pit mines), second largest copper producer in the county, operated by the American Smelting and Refining Co., was active throughout the year. In its annual report to stockholders, the company reported that a sizable copper ore body suitable for open-pit mining had been outlined at its East Pima project, adjacent to the Pima Mining Co. mine near Tucson. It also reported that it was the successful bidder for exploration concessions on the San Xavier Indian Reservation adjacent to the East Pima project and that initial drilling on the reservation near the northern boundaries of the East Pima deposit had established extensions of the mineralized area.

Cyprus Mines Corp., which owns a half interest in the Pima Mining Co., stated, in its published annual report for 1957, that operations were begun early in January at the Pima property and that operating costs and metallurgical results confirmed the estimates and test data. The capacity of the mining and milling plant exceeded expectations. During the year, 1,094,559 dry short tons of ore was mined and milled, and 67,288 tons of copper concentrate was produced. The ore reserve at the end of the year exceeded 7.5 million tons, containing approximately 2 percent copper. A much larger tonnage of lower grade material could not be mined profitably at the 1957 copper price, according to the company.

Reporting on its group of mines near Tucson, Ariz., Banner Mining Co. stated (in its report for 1957) that the decreased copper price forced closing of its Twin Buttes mine in June and Mineral Hill mine in July. Production throughout the remainder of the year came entirely from the Daisy mine. Exploration drilling near the Daisy mine revealed more low-grade ore in the deposits discovered in 1956, which may be minable by open-pit methods. The drilling also led to discovery of a substantial tonnage of higher grade ore. The

property explored adjoins the Pima and East Pima properties on the west.

Other metals produced in the county included gold, silver, lead, zinc, manganese, tungsten, molybdenum, and uranium. The gold and silver were recovered mostly as byproducts of copper ore. The lead and zinc came mainly from the San Xavier mine operated by McFarland & Hullinger, and Ironwood mine operated by David C. Hartley, and zinc from the Atlas mine operated by the B. S. & K. Mining Co. Manganese ore, tungsten concentrate, molybdenum, and uranium ore were shipped from one mine each, respectively.

Cement, clays, gem stones, perlite, sand and gravel, and stone valued at \$10.2 million were the nonmetals produced in Pima County during 1957. Shipments of portland cement by the Arizona Portland Cement Co. composed the major share of the value of nonmetals. Pima County continued to rank second in the State as a producer of sand and gravel. Seven commercial operators reported total sales of 809,000 tons and the county highway department, 82,600 tons—a 6-percent decline in total output compared with 1956. Stone ranked second to sand and gravel in terms of value, and 736,000 tons of all types of stone was quarried. Limestone provided the bulk of the quantity and was used in manufacturing cement. Crushed sandstone (silica sand) was produced by Richard Ballestros and Jack C. Gilbert. Production of clay resulted from the local demand for building materials and Grabe Brick Co., Louis DeVry & Son, and Tucson Pressed Brick Co. reported raw-clay production for use at their brick and structural-clay-products plants. Tucson Perlite, Inc., mined crude perlite and shipped expanded material from its Tucson plant. In addition, ornamental stone valued at \$1,700 was reported collected.

Pinal.—Pinal was another “copper county” in 1957; the value of copper output was 27 percent of the total for copper in the State and accounted for 95 percent of the total value of mineral production in the county in 1957. Most of this copper came from three mines—San Manuel, Ray, and Magma, the State’s fourth, fifth, and seventh ranking copper producers in 1957, respectively. Other metals—gold and silver (recovered mainly as a byproduct from treating copper ore), molybdenum (recovered entirely as a byproduct from copper ore), lead from 3 mines, zinc from 1 mine, and manganese ore from 2 mines—accounted for 4 percent of total value of Pinal County’s mineral production in 1957. The remaining 1 percent came from nonmetals, including gypsum, perlite, sand and gravel, stone, pyrite, lime, and gem stones.

The San Manuel mine was the leading copper producer in the county in 1957. Magma Copper Co. (sole owner of the San Manuel Copper Corp., operator of the San Manuel mine) reported in its 1957 annual report to its stockholders that 8,825,130 tons of ore averaging 0.755 percent sulphide copper was produced from the mine in 1957, compared with 5,539,581 tons averaging 0.754 percent in 1956. The average total copper content of the ore mined in 1957 was 0.818 percent, but the excess over the sulfide content was oxide copper, which was not recovered by the flotation process used in San Manuel’s mill. Production of copper was 59,899 tons in 1957 compared with 39,076 tons in 1956. The company reported that it expected to

increase production to 70,000 tons in 1958. The causes of a series of failures of the electrical equipment on the two ore hoists, which started in 1956 and last occurred in October 1957, were determined and corrected. However, the hoist shutdowns, which aggregated 101 lost days for one or the other of the 2 hoists during 1957, seriously delayed attainment and maintenance of full production. In mining, ground weight in some of the areas was found to be heavier than expected, causing additional expense for maintaining openings and in some instances interrupting production in those areas. The use of unreinforced concrete to support the heavy ground proved successful. The ore transportation, crushing, milling, and smelting facilities operated satisfactorily and demonstrated a capacity for handling and treating 32,000 tons of ore per day. Recovery was 91.5 percent of the copper in sulfides at the mill and 98.5 percent of the copper at the smelter.

According to the Kennecott Copper Corp. published annual report for 1957, the Ray Mines Division operation at the Ray mine, the second ranking copper producer in Pinal County, had a larger copper output in 1957 than in 1956, despite the reduction in number of days operated and a smaller quantity of ore mined. This resulted from increased production of low-cost precipitate copper obtained by leaching the caved areas of the old underground mine; production of copper from this source increased from 14,934 tons in 1956 to 17,712 tons in 1957. The total copper output from all sources was 56,879 tons in 1957, compared with 53,248 tons in 1956, according to the company report.

The Magma Copper Co. stated, in its annual report for 1957, that 442,134 tons of ore averaging 5.36 percent copper, 1.37 ounces silver, and 0.03 ounce gold per ton was mined from the Magma mine in 1957. In addition, 2,874 tons of ore was purchased from other producers and smelted in 1957. A total of 21,776 tons of copper was produced from the Magma mine ore, and 118 tons was produced from the purchased ore by the company. Development in 1957 at the Magma mine including 12,015 feet of drifts and crosscuts, 7,323 feet of raises, 342 feet of shaft, and 16,083 feet of diamond drilling. Additions to ore reserves about equaled the ore mined during the year, according to the company.

Except for captive lime production reported by San Manuel Copper Corp., captive pyrite recovered by Kennecott Copper Corp. at Ray, and ornamental stone collected by individuals and dealers, nonmetal output in Pinal County in 1957 centered around the construction materials—gypsum, perlite, sand and gravel, and stone. Gypsum-mining operations were conducted by Arizona Gypsum Corp. and Union Gypsum Co. The latter company consumed its mine production at its Phoenix wallboard plant, whereas Arizona Gypsum Corp. sold gypsum for portland-cement retarder and agricultural use. Perlite was mined and expanded by Perlite Industries of Arizona, Inc., with a plant at Phoenix, and by Superior Industries, Inc., with a grinding plant at Superior. Crushed limestone used as a smelter flux and in manufacturing lime and crushed sandstone used as flux were quarried by San Manuel Copper Corp., and 5 producers reported output of 108,000 tons of sand and gravel. There were 2 commercial operations and 3 Government-and-contractor operators.

Santa Cruz.—Lead and zinc output together composed \$2.2 million (88 percent) of the \$2.5 million value of mineral production in Santa Cruz County in 1957. Although 21 mines active in the county produced ores of lead, zinc, gold, silver, or copper, most of the lead and zinc came from the 2 major producers, Flux and Glove, which ranked second and third, respectively, in lead output in the State. The Flux mine was closed down, and the last ore was milled at the Trench mill from this mine on October 23, 1957. Subsequently, the surface plant and equipment were sold and certain mining claims leased to James P. Nash & E. W. McFarland. The Glove mine was operated throughout the year by the Sunrise Mining Co. Uranium ore, the only other mineral commodity produced in the county in 1957, was shipped from one mine.

Yavapai.—In 1957 Yavapai County was the leading producer of lead and zinc in Arizona and ranked fourth in gold and silver and sixth in copper output. The combined value of output of these metals comprised \$16.9 million (92 percent) of the total value of mineral production in the county. Other metals produced included columbium-tantalum concentrate and molybdenum (byproduct of copper ore) each from 1 operation, and beryllium concentrate, manganese ore, and uranium ore, each from 2 operations, respectively.

The Iron King mine operated by the Iron King Branch of Shattuck Denn Mining Corp.—the leading lead and zinc, third-ranking gold, and second silver producer in the State—was one of the major contributors to the value of mineral production in the county. Lead and zinc concentrates produced by flotation from the ore mined were shipped to the American Smelting and Refining Co., El Paso and Amarillo, Tex., smelters, respectively, and a precipitate produced by cyanidation was shipped to the United States Smelting Refining and Mining Co., Midvale, Utah, smelter.

Bagdad Copper Corp. mine at Bagdad was the principal producer of copper in the county and the twelfth largest copper producer in the State in 1957. During the year, a fifth ball mill was added to increase the capacity of the mill, a pilot plant was built to test the possible recovery of copper from the oxide-copper material capping the sulfide-copper ore being mined and treated, and an office and store building were constructed.

The Old Dick mine was put in operation in May by the Old Dick Division of Cyprus Mines Corp. According to the published annual report of the corporation, 43,273 dry short tons of ore was mined and milled, yielding 4,582 tons of copper concentrate and 12,151 tons of zinc concentrate. Because of the drop in copper and zinc prices, preparations were made at the end of the year to suspend operations. According to the corporation, the ore body contains approximately 214,000 tons of high-grade ore, and the property can be readily reopened—given higher metal prices.

Other important metal producers in Yavapai County included 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. The Big Hole Mining Co. produced copper ore from the United Verde open-pit mine formerly operated by Phelps Dodge Corp.

United States Lime Products Corp. continued to produce quicklime and hydrated lime for the building and chemical industries. Stone production consisted of 48,000 tons of crushed limestone used for manufacturing lime and 11,000 tons of dimension sandstone used as a building stone and for flagging. All sand and gravel output in 1957 was commercial production employed for structural and paving purposes. Operation of the Cruice scoria pit by Superlite Builders Supply Co. until July 1 supplied the entire output of pumice.

Yuma.—The value of manganese-ore and concentrate output constituted 95 percent of the total value of mineral production in Yuma County in 1957. The ore was mined by 14 individual operators at 10 mines. The operations with the largest output included John P. Stewart, Frank Greene, Jesus Daniels, G. H. Seebold, John D. Todd & L. W. Smith, and J. F. Power. All of the ore and concentrate was shipped under the Government "carlot" purchase program.

One placer mine produced gold and silver and 11 lode mines produced ores of gold, silver, copper, lead, and zinc in the county. The aggregate value of the minerals recovered from these mines was \$43,000. The Mineral Hills mine, operated by R. A. De Lano Co., and the Empire mine, operated by Baker & King Copper Mining Co. and L. A. Cornejo, were the major producers of these metals. Shipments of tungsten concentrate were made from five mines in the county.

The value of nonmetals—sand and gravel, gem stones, and mica—continued to decline and was only \$12,000 in 1957 compared with \$19,000 in 1956. Four thousand tons of structural sand and gravel was quarried by the Valley Sand & Gravel Co. Gem and ornamental stones, valued at \$4,000, were collected, including agate, chalcedony, geodes, jasper, and travertine. The Buckeye Mica Co. produced 140 tons of scrap mica at the Quartzite mine for shipment to the company grinding plant at Buckeye.



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, United States Department of the Interior, and the Arkansas Geological and Conservation Commission, Norman F. Williams, Director and State Geologist, Little Rock, Ark.

By Robert S. Sanford¹ and Rosalie M. Miller²



ARKANSAS mineral production in 1957 continued to trend upward for the fifth consecutive year and set a new value record of \$141 million—an increase of \$5.7 million (4 percent) over 1956. Declines in total value of bauxite, coal, manganese, natural-gas liquids, sand and gravel, cement, clays, soapstone, sulfur, lime, and iron ore were more than offset by increases in abrasive stone, barite, natural gas, crude petroleum, stone, gypsum, and slate. The major factors that contributed to the new value record for the State's mineral production were the increased average unit value (23 cents) and increased production (1.2 million barrels) of crude petroleum. The average price of Arkansas crude petroleum per barrel was \$2.69 in 1956. During the Suez crisis the price of oil increased and averaged \$2.92 in 1957.

The value of output of liquid, gaseous, and solid fuels, which comprised 71 percent of the State total, increased 11 percent from 1956.

As a group, nonmetals, were valued at \$27.3 million. This value represented 20 percent of the State total in 1957 and a decline of \$1.2 million from 1956. Unusually heavy rains in both spring and fall hampered construction, and especially highway construction, and were a major factor in the decreased production of sand and gravel. Byproduct sulfur declined slightly in yield and value, paralleling the decline in natural-gas liquids extracted from natural gas.

The production value of the metals group (bauxite, manganese ore, and iron ore) was \$13.4 million—9 percent of the State total in 1957 and a decrease of \$2.1 million from 1956.

Arkansas expanded mineral industry by constructing new plants, also by modernizing and expanding existing facilities as follows:

Bromine was added to the list of minerals produced in Arkansas, with a new bromine-recovery plant near El Dorado completed at a cost exceeding \$1 million by Michigan Chemical Corp. and Murphy Corp.

A new cement plant, with an estimated annual capacity of 1.4 million barrels of portland and masonry cement, was being constructed at an estimated cost of \$15 million by Arkansas Cement Corp. near Foreman.

American Cyanamid Co. completed new facilities, based on Federal Bureau of Mines research, for bauxite calcining and magnetic separation at Bauxite. Further plans include constructing office and laboratory buildings.

Planned expansion of the El Dorado gasoline refinery by Lion Oil Co. includes a catalytic reformer, a hydrosulfurization unit, and a

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TABLE 1.—Mineral production in Arkansas, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stone (whetstones).....	35	\$11		
Barite.....	486,254	4,256	477,327	\$3,494
Bauxite..... long tons, dried equivalent..	1,668,432	13,307	1,356,898	11,600
Clays.....	719,251	1,636	616,519	1,586
Coal.....	590,091	4,601	507,731	3,976
Gem stones.....	(²)	25	(²)	20
Iron ore (usable)..... long tons, gross weight..	(²)	(²)	6,973	35
Manganese ore (35 percent or more Mn)..... gross weight..	29,485	2,066	23,261	1,726
Natural gas..... million cubic feet..	30,162	1,810	436,200	4,250
Natural-gas liquids:				
Natural gasoline and cycle products				
thousand gallons..	41,529	2,541	39,869	2,313
LP-gases..... do.....	56,146	2,293	54,034	2,097
Petroleum (crude)..... thousand 42-gallon barrels..	29,355	78,965	430,597	489,343
Sand and gravel.....	10,199,515	8,729	8,569,518	6,949
Stone.....	6,324,819	8,113	7,278,152	8,378
Value of items that cannot be disclosed: A abrasive stone (oilstones), bromine, portland and masonry cement, gypsum, iron ore (1956), lime, slate, soapstone, re- covered elemental sulfur, and values indicated by footnote 3.....		8,182		7,994
Total Arkansas ³		135,210		140,940

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Quantity not recorded.

³ Figures withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Preliminary figure.

⁵ Value has been adjusted to eliminate duplicating the value of clays and stone.

TABLE 2.—Average unit value of mineral commodities produced in Arkansas, 1953-57

Commodity	1953	1954	1955	1956	1957
Abrasive stone..... short ton..	\$109.70	\$301.54	\$269.01	\$245.57	\$163.00
Barite (crude) ¹ do.....	10.36	9.41	8.11	8.75	7.32
Bauxite..... long ton, dried equivalent..	8.48	8.20	8.15	7.98	8.55
Cement:					
Portland ¹ 376-pound barrel..	2.58	2.61	2.73	2.89	3.07
Masonry ¹ do.....			3.70	3.68	3.93
Clays: ¹					
Fire clay..... short ton..	4.60	4.99	2.61	4.33	3.48
Kaolin..... do.....	(²)	10.00	10.00	10.00	
Miscellaneous clay..... do.....	1.06	2.18	1.36	1.00	1.00
Coal..... do.....	7.93	7.52	7.48	7.80	7.83
Gypsum..... do.....	3.27	3.27	2.89	2.89	2.91
Manganese ore (35 percent or more) ¹ do.....	86.01	74.36	72.75	70.07	74.21
Natural gas..... thousand cubic feet..	.053	.055	.056	.060	.069
Natural-gas liquids:					
Natural gas and cycle products..... gallon..	.071	.064	.068	.061	.058
LP-gases..... do.....	.046	.043	.038	.041	.039
Petroleum (crude)..... 42-gallon barrel..	2.60	2.73	2.71	2.69	2.92
Sand and gravel..... short ton..	1.01	.99	.85	.86	.81
Slate..... do.....	9.15	9.06	9.07	9.25	8.43
Stone:					
Crushed limestone..... do.....	1.71	1.34	1.68	1.16	1.18
Crushed sandstone..... do.....	1.17	2.77	2.06	1.70	1.20
Dimension sandstone..... do.....	(²)		15.42	12.36	13.02
Crushed granite..... do.....		.99	1.00	1.33	
Miscellaneous stone..... do.....	1.25	1.26	1.39	1.10	.96
Soapstone..... do.....	2.47	2.68	4.00	4.00	4.00
Sulfur, recovered elemental ¹ long ton..	23.08	26.75	26.49	29.34	29.16

¹ Value of shipments.

² Data not available.

100,000-pound-per-hour steam boiler. The new 6,200-barrel Ultra-former at the El Dorado refinery operated by American Oil Co. boosted plant production.

An important addition to the fertilizer industry will be the urea plant being constructed by Monsanto Chemical Co.

A new plant for manufacturing aluminum sulfate was being built at Pine Bluff. The aluminum sulfate will be used in the two paper mills under construction near Pine Bluff.

Jeffrey Stone Co. completed a stone-crushing plant north of North Little Rock at an estimated cost of \$1 million.

Arkansas Lightweight Aggregate Corp. was building a lightweight-aggregate plant north of England. Plans for a similar plant near Poyen were announced by Southwest Concrete Material Corp.

EMPLOYMENT AND INJURIES

Employment.—Annual employment of workers covered by the Arkansas Employment Security law has increased an average of 1,300 per year for the past 5 years; however, in 1957 the increase was only 437 employees. Over 50 percent of this gain was reported by the crude-petroleum, natural-gas, metal-mining, and bituminous-coal-mining industries. Nonmetal mining and quarrying showed a loss in annual employment resulting, in part, from decreased construction activity.

Injuries.—There were 5 fatal accidents in coal mines, 2 fatal and 1 permanent total disability accidents in metal and nonmetal mines, and none in quarries. Injury data on the petroleum industry were not available.

Wages.—The average weekly wage in the metal-mining industry was \$89.05, a gain of 5 percent; in the nonmetallic industry, \$72.90, a gain of 3 percent; in the coal industry, \$79.83, an increase of 2 percent; and in the crude-petroleum industry, \$88.99, a gain of 6 percent from 1956.

TABLE 3.—Average annual employment of mining industries, 1953–57¹

Industry	1953 ² Employment	1954 Employment	1955 Employment	1956		1957	
				Employing units	Employment	Employing units	Employment
Metal mining.....	920	905	910	45	868	42	962
Bituminous-coal mining.....	860	464	536	37	561	34	602
Crude petroleum and natural gas.....	2,940	2,967	2,909	305	3,061	333	3,230
Nonmetallic mining and quarrying.....	1,920	1,845	2,089	99	2,159	103	2,128
Total.....	6,640	6,181	6,444	486	6,649	512	6,922

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

² Revised figures.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Production of coal in Arkansas reversed a 2-year upward trend and was 507,700 tons, a 14-percent decline in quantity and in total value. Of the 25 mines operated (3 more than in 1956), 17 were underground, and 8 were open pits. The 17 underground mines produced 286,875 tons of coal (57 percent); cutting machines were used in mining 86 percent of the coal. At the 8 strip mines, 3.3

TABLE 4.—Coal production, 1948-52 (average) and 1953-57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948-52 (average)	1, 154, 512	\$8, 964, 442	\$7. 76	1955	577, 726	\$4, 319, 146	\$7. 48
1953	775, 207	6, 143, 757	7. 93	1956	590, 091	4, 601, 264	7. 80
1954	477, 268	3, 589, 217	7. 52	1957	507, 731	3, 975, 984	7. 83

million cubic yards of overburden was excavated, and 220,856 tons of coal was loaded (43 percent)—15 cubic yards of overburden per ton of coal mined.

Petroleum and Natural-Gas Exploration and Development.—Arkansas had the best drilling year since 1925. The petroleum industry drilled 1,117 wells during 1957, compared with 1,002 wells in 1956, 786 in 1955, and 617 in 1954. Furthermore, prospecting by geophysical and core-drilling methods increased during the year. Twelve oil or gas fields were discovered, and 2 of these—Kress City and Plainfield—were deep fields of possible major importance. Many extensions to fields and many new oil and gas pays also were discovered. There were three noteworthy extensions: An eastern extension to the Nick Springs-East field, a new pay and west extension and rediscovery of the Lisbon-Northwest field, and a deep pay and north extension to the Calion field. Increased production obtained by sand fracturing led to drilling many wells in shallow areas.

In north Arkansas, dry natural gas from relatively shallow sands of Pennsylvanian age continued to be produced. Thirteen explora-

TABLE 5.—Oil- and gas-well drilling in Arkansas in 1957¹

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Bradley						2				2
Calhoun						3				3
Clay						1				1
Columbia	103		14	1		14	104			28
Conway		3				2		3		2
Crawford					1			1		1
Crittenden						1				1
Desha						1				1
Franklin		10				1		10		11
Hempstead						2				2
Jackson						1				1
Johnson						1				1
Lafayette	30		40	4		25	34			65
Little River						2				2
Logan						2				2
Madison					1	3		1		3
Miller	27		28	4		31	31			59
Nevada	26		16	1		29	27			45
Ouachita	324		23			24	324			47
Pike						1				1
Pope		3						3		3
Sebastian		6	2					6		2
Union	214		45	2		43	216			88
Total:										
1957	724	22	168	12	2	189	736	24	357	1, 117
1956	672	9	167	1	4	149	673	13	316	1, 002

¹ Arkansas Oil and Gas Commission, Arkansas Oil and Gas Statistical Monthly Bulletins: Vol. 26 Nos. 1-12, January-December 1957.

tory gas wells which resulted in the discovery of 1 gas field, were drilled in 1957 as compared with 19 wells in 1956 and 20 wells in 1955. Development drilling of 24 wells adjacent to natural-gas fields resulted in 22 gas producers and 2 dry holes.

In south Arkansas, most crude petroleum and gas-condensate production came from Upper and Lower Cretaceous and Jurassic formations at depths of 6,000 to 8,000 feet. The entire drilling increase took place in south Arkansas where 1,080 holes were drilled compared with 983 holes in 1956. Of the 1,117 completions in the State in 1957, 914 were in proved fields (848 in 1956), including 724 oil wells (672 in 1956), 22 gas wells (9 in 1956), and 168 dry holes (167 in 1956); of the 203 exploratory tests (154 in 1956), 12 produced oil (1 in 1956), 2 gas (4 in 1956), and 189 were dry (149 in 1956).

Arkansas oil exploration was encouraged by passage of an important new law. The act provides a reduction in the State severance tax of 75 percent for 5 years if the newly discovered oil pool is above the base of the deepest producing oil formation in the county of discovery. Additional incentive offers a reduction for 10 years if the pool is in a county where there is no oil production or if the new production is below the base of the deepest oil-producing formation in the county.³

TABLE 6.—Crew-weeks spent in geophysical and core-drill oil and gas prospecting in 1957¹

NORTH ARKANSAS						
County	1956 Total crew-weeks	1957				
		Method				
		Total crew- weeks	Reflection seismo- graph	Gravity meter	Magnetom- eter	Core drill
Franklin.....		6				6
Johnson.....	19	32				32
Logan.....	11	7				7
Pope.....		7				7
Prairie.....		4	4			
Total north Arkansas.....	30	56	4			52
SOUTH ARKANSAS						
Ashley.....		16	10		6	
Bradley.....	24	2	2			
Calhoun.....	12	3	3			
Clark.....		1	1			
Columbia.....	73	57	49	8		
Hempstead.....		13	13			
Howard.....		1	1			
Lafayette.....	46	55	55			
Miller.....	6	23	23			
Nevada.....	24	11	11			
Ouachita.....	5	4	4			
Prairie.....		21	4	17		
Union.....	65	28	28			
Total south Arkansas.....	255	235	204	25	6	
Total Arkansas.....	285	291	208	25	6	52

¹ National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 27, 1956, pp. 25, 38; vol. 28, 1957, pp. 26, 32.

³ Petroleum Engineer, vol. 29, No. 5, May 1957, p. a-11.

TABLE 7.—Estimated proved reserves of crude oil, natural-gas liquids, and natural gas, 1956-57¹

	Proved reserves, Dec. 31, 1956	Changes in proved reserves, due to extensions and new discoveries in 1957	Proved reserves, Dec. 31, 1957 (production was deducted)	Percent change from 1956
Crude oil.....thousand barrels..	317,726	16,864	304,959	-4
Natural-gas liquids ².....do.....	42,467	2,412	37,140	-13
Natural gas.....million cubic feet..	1,171,527	151,812	1,283,022	+10

¹ American Gas Association, and American Petroleum Institute, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vol. 12, Dec. 31, 1957, pp. 9, 10, 19.

² Includes condensate, natural gasoline, and LP-gases.

Natural Gas.—Marketed production of natural gas in Arkansas reversed an 8-year downward trend and increased 20 percent to 36,200 million cubic feet valued at \$2.5 million in 1957. Of the 12 producing counties, the first five, in order of production, were Franklin, Columbia, Lafayette, Union, and Pope.

TABLE 8.—Marketed production of natural gas, 1948-52 (average) and 1953-57¹

Year	Million cubic feet	Value		Year	Million cubic feet	Value	
		Thousands	Per thousand cubic feet			Thousands	Per thousand cubic feet
1948-52 (average).....	47,352	\$1,907	\$0.040	1955.....	32,123	\$1,799	\$0.056
1953.....	41,510	2,200	.053	1956.....	30,162	1,810	.060
1954.....	33,471	1,841	.055	1957 ²	36,200	2,500	.069

¹ Comprises gas either sold or consumed by producers including losses in transmission, quantities added to storage, and increases in gas pipelines.

² Preliminary figures.

TABLE 9.—Gross withdrawals and disposition of natural gas, 1953-57

(Million cubic feet)

Year	Gross withdrawals ¹			Disposition		
	From gas wells	From oil wells	Total	Marketed production ²	Repressuring	Vented and wasted ³
1953.....	38,100	27,000	65,100	41,510	20,003	3,587
1954.....	36,000	20,000	56,000	33,471	18,568	3,961
1955.....	19,000	36,000	55,000	32,123	16,649	6,228
1956.....	16,000	37,000	53,000	30,162	16,269	6,569
1957.....	† 15,600	† 36,400	† 52,000	† 36,200	† 13,406	† 2,394

¹ Marketed production plus quantities used in repressuring, vented, and wasted.

² Comprises gas sold or consumed by producers, including 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.

⁴ The Arkansas Oil and Gas Commission, Arkansas Oil and Gas Statistical Bulletins: Vol. 26, Nos. 1-12, January-December 1957.

⁵ Preliminary figures.

Natural-Gas Liquids.—Production of natural-gas liquids in Arkansas (93.9 million gallons valued at \$4.4 million) was 4 percent less in quantity and 9 percent less in value than in 1956. Of the total, 42 percent was natural gasoline and cycle products, and 58 percent was

TABLE 10.—Natural-gas liquids produced, 1948-52 (average) and 1953-57

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1948-52 (average).....	59,359	\$4,457	40,258	\$1,679	99,617	\$6,136
1953.....	58,422	4,123	55,188	2,562	113,610	6,685
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

LP-gases. The five producing counties (in order of importance) were Columbia, Lafayette, Union, Miller, and Hempstead.

Petroleum.—Petroleum production in Arkansas in 1957 was 30.6 million barrels valued at \$89.3 million—an increase of 4 percent in quantity and 13 percent in value compared with 1956. During the Suez crisis, when oil tankers were routed from the Middle East around the Cape of Good Hope to Europe, it was necessary for the United States to supply a considerable quantity of crude oil to the European markets. The price of Arkansas crude petroleum was increased an average of 23 cents per barrel and with moderate variations continued high throughout 1957. Petroleum is the leading mineral resource of Arkansas, and in 1957 the State ranked 11th in the United States in the value of this fuel. Production came from 7 counties (8 in 1956), in the following order: Columbia, Union, Ouachita, Lafayette, Miller, Nevada, and Calhoun.

Nearly 83 percent of the crude petroleum produced was refined in the State. Refinery runs to stills in 1957 amounted to 25.2 million barrels, a 1-percent decline from 1956.

Lion Oil Co., Division of Monsanto Chemical Co., announced plans for constructing a catalytic reformer with a throughput of 5,000 barrels of charging stock per day, a hydrosulfurization unit, and a 100,000-pound-per-hour steam boiler at the El Dorado refinery. Construction was scheduled for completion in the latter part of 1958.

The American Oil Co. new 6,200-barrel Ultraformer went on stream at the El Dorado refinery. This second Ultraformer for the 43,000-barrel plant boosted ultraforming capacity to 11,800 barrels. The first such unit, rated at 5,600 barrels, went on stream in 1954.⁴

TABLE 11.—Production of crude petroleum, 1948-52 (average) and 1953-57

Year	Thousand barrels	Value		Year	Thousand barrels	Value	
		Total (thousands)	Average per barrel			Total (thousands)	Average per barrel
1948-52 (average).....	30,403	\$75,156	\$2.47	1955.....	28,369	\$76,880	\$2.71
1953.....	29,681	77,170	2.60	1956.....	29,355	73,965	2.69
1954.....	29,130	79,520	2.73	1957.....	130,597	189,343	2.92

¹ Preliminary figure.

⁴ Oil and Gas Journal, vol. 55, No. 43, Oct. 23, 1957, p. 73.

TABLE 12.—Production of crude petroleum, 1953–57, by fields

(Thousand barrels)

Field	1953	1954	1955	1956	1957 ¹
Atlantic.....	649	554	483	438	399
Bradley West.....				499	(²)
Buckner.....	645	529	478	444	415
Dorcheat-Macedonia.....	841	624	617	632	721
El Dorado.....	711	838	857	923	990
Fouke.....	1,429	1,210	1,241	1,431	1,468
Horsehead.....	194	706	816	403	188
Magnolia.....	4,029	3,289	2,890	3,609	4,521
McKamie.....	1,369	1,480	1,331	1,349	1,337
Midway.....	2,642	2,262	2,048	2,238	2,299
Shuler.....	2,318	2,599	2,593	2,353	2,119
Smackover.....	3,892	4,370	4,678	4,466	4,206
Stephens.....	1,223	1,077	1,014	1,157	1,745
Village.....	840	850	846	811	776
Wesson.....	3,296	2,699	1,840	1,591	2,491
Other fields ²	5,603	6,043	6,637	7,011	6,922
Total.....	29,681	29,130	28,369	29,355	30,597

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

TABLE 13.—Indicated demand, production, and stocks of crude petroleum in 1957, by months

(Thousand barrels)

Month	Demand	Production	Stocks (end of month)	Month	Demand	Production	Stocks (end of month)
January.....	2,734	2,606	3,076	September.....	2,838	2,521	2,827
February.....	2,900	2,496	2,672	October.....	2,424	2,564	2,967
March.....	2,753	2,667	2,586	November.....	2,633	2,530	2,864
April.....	2,376	2,547	2,757	December.....	2,389	2,560	3,035
May.....	2,608	2,593	2,742	Total: 1957.....	30,866	30,597	
June.....	2,669	2,483	2,656	1956.....	28,164	29,355	
July.....	2,585	2,520	2,591				
August.....	1,957	2,510	3,144				

“Phase two” of one of the world’s most intensively engineered waterflood projects was underway in the prolific Magnolia field of south Arkansas. It was anticipated that the final part of the program would net the Magnolia producers an extra 31 million barrels of oil or an estimated 60-percent recovery of the oil in place. The Magnolia field, a 19-year-old Smackover limestone pool of about 4,000 acres, had already produced about 85 million barrels of oil. Producers hoped to more than double the ultimate recovery through the present two-phase secondary-recovery program.⁵

NONMETALS

Abrasive Stone.—Novaculite was quarried in Hot Spring County and classified as “Soft Arkansas”, “Washita”, and “Hard Arkansas”. The rough novaculite was shipped to the Norton Pike Co. plant in New Hampshire and processed into oilstones.

Barite.—Arkansas barite sold or used by producers was 477,327 tons in 1957—a decline of 2 percent. Inventories of barite increased substantially during 1957. About 95 percent of the barite was

⁵ Oil and Gas Journal, vol. 55, No. 20, May 20, 1957, p. 118.

processed and used in oil-well drilling muds. Hence, the decline in barite production can be attributed to a 7-percent decline in oil-well drilling in the United States during 1957. Arkansas barite mines furnished 41 percent of the United States total.

Magnet Cove Barium Corp. used an unusual method in sinking a new 12- by 12-foot shaft at its mine near Malvern. A 20-inch drill hole was completed to the required depth, and the mine level was extended to connect with the drill hole. During shaft sinking the rock was blasted into the large-diameter hole and broken rock drawn from the drill hole through a timber chute into mine cars.

Shielding for atomic reactors and heavy aggregate for gas-pipeline coating will doubtless consume increasing quantities of barite. Atomic requirements were not expected to be large, but pipeline aggregate could consume a large tonnage for coating offshore gas-gathering pipelines.

TABLE 14.—Primary barite sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value		Year	Short tons	Value	
		Total (thousands)	Average per ton			Total (thousands)	Average per ton
1948-52 (average)---	380,925	\$3,325	\$8.73	1955-----	462,986	\$3,755	\$8.11
1953-----	380,763	3,946	10.36	1956-----	486,254	4,256	8.75
1954-----	370,621	3,488	9.41	1957-----	477,327	3,494	7.32

Bromine.—Michigan Chemical Corp. and Murphy Corp. completed constructing a bromine-recovery plant just south of El Dorado, Union County, in April 1957. The plant cost over \$1 million and has a rated capacity of 5 million pounds of bromine per year. Brine from the Reynolds limestone zone in the Smackover oilfield was used in the new plant to produce both elemental bromine and ethylene dibromide. The brine contains 4,200 parts per million of bromine, twice the bromine content of brines usually used for recovery and 65 to 70 times as much as sea water. The proportion was 1 barrel of oil to 25 barrels of brine. The brine was collected through a network of cement-asbestos pipes into a central tank battery, where residual oil floats off the brine. The brine from the separator tanks discharges into an 800,000-gallon storage pond lined with asphalt to prevent seepage. Brine from the storage pond is pumped through brush-packed wooden towers to remove small quantities of hydrogen sulfide and other dissolved gases.⁶ Leaving the towers through Haveg lines, brine picks up heat in exchangers and from counterflowing tail brine, then passes to an overhead Monel gravity feed tank for the four Kubierschky extraction towers. Flowing down through the ceramic- and porcelain-plate packing in these granite towers, brine contacts upflowing steam and chlorine that liberate bromine vapor from the brine. In order to condense, separate, and purify, the bromine and water vapor, with traces of chlorine, go through glass lines to tantalum condensers and then into glass gravity separators

⁶ Chemical Engineering, vol. 65, No. 11, June 2, 1958, pp. 51-52.

for removing water. Then, the bromine is fractionated in small ceramic towers to remove all traces of chlorine. Chlorine-free bromine goes through a glass-lined distillation column for separating non-volatile materials. Condensed bromine vapor from the distillation column contacts sulfuric acid in a packed, glass lined column to remove the last traces of moisture. The moisture-free product is held in batch tanks until the sample analysis is complete, then it is transferred to storage tanks with a capacity of 200,000 pounds. Bromine is shipped in 30- or 50-ton lead-lined tank cars, 7½-ton tank trucks, 225-pound drums, or 6½-pound bottles. Following extraction, spent brine is limed, cooled, treated with chemicals, and settled before injection into the Wilcox formation. Bromine was converted to ethylene dibromide, which is used principally as a gasoline additive.

Cement.—Shipments of portland and masonry cement from the Ideal Cement Co. plant near Okay in Howard County decreased slightly during the year.

Arkansas Cement Corp. was constructing, at an estimated cost of \$15 million, a new cement plant 2½ miles southwest of Foreman, Little River County. The wet process will be used, and a 12- by 450-foot kiln was being installed. The plant will have an estimated annual capacity of 1.4 million barrels of portland cement. Natural gas will be used as fuel, and the limestone will be quarried one-half mile southeast of the new cement plant. The new plant, designed and constructed by Kaiser Engineers, a division of Henry J. Kaiser Co., Oakland, Calif., was scheduled to begin production during October 1958.

Arkansas Louisiana Gas Co. announced plans to build a power station next to the cement plant that its subsidiary, Arkansas Cement Corp., was building at Foreman. The plant was to have a generating capacity of nearly 8,000 kilowatts, will cost about \$1 million, and will furnish electricity for the new cement plant.⁷

Clays.—Production of all types of clays in Arkansas was 616,519 short tons valued at \$1.6 million—a decrease of 14 percent in quantity and 3 percent in value from 1956. The major uses for clays remained unchanged during the past several years, but it is anticipated that the uses will change when the two new lightweight-aggregate plants are completed.

TABLE 15.—Clays sold or used by producers, 1948–52 (average) and 1953–57, by kinds

Year	Miscellaneous clay		Fire clay		Total clay	
	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	185,354	\$189,545	302,376	\$991,407	487,730	\$1,180,952
1953.....	197,874	209,549	331,252	1,524,865	529,126	1,734,414
1954.....	¹ 254,490	¹ 555,891	362,960	2,000,476	617,450	2,556,367
1955.....	(²)	(²)	(²)	(²)	738,637	2,375,882
1956.....	¹ 444,553	¹ 447,469	274,698	1,188,843	719,251	1,636,312
1957.....	³ 226,068	³ 226,068	390,451	1,360,047	616,519	1,586,115

¹ Kaolin and clay used for cement combined with miscellaneous clay to avoid disclosing individual company confidential data.

² Quantity and value included in total clay.

³ Includes clay used for cement.

⁷ Rock Products, vol. 60, No. 11, November 1957, p. 86.

Arkansas Lightweight Aggregate Corp. was constructing a lightweight-aggregate plant 1.6 miles northwest of England, Lonoke County, on State Highway 30. A rotary kiln (8 by 125 feet) and auxiliary facilities were being installed. The plant will have an anticipated output of 15 cubic yards per hour. The auxiliary equipment was large enough to accommodate two more rotary kilns as business increases. Clay was to be mined in a nearby open pit. The plant was scheduled for completion in April 1958.

Southwest Concrete Material Corp. announced plans to build a new plant near Poyen in Grant County for producing lightweight aggregate from clay.

Gem Stones.—A member of the Dallas Gem and Mineral Society found a 3.11-carat diamond in the "Crater of Diamonds" near Murfreesboro in Pike County.

Quartz crystals, valued at over \$5,000, were found and sold by 3 producers.

Gypsum.—Gypsum production, all from Pike County, increased 2 percent in quantity and 3 percent in value over 1956.

Lime.—Production of lime declined slightly. Lime was used in a modification of the soda-lime-sinter process for producing alumina; hence, the slightly decreased quantity of lime consumed in this process paralleled a slight reduction in alumina production. Lime also was used for water purification and by the paper, petroleum, sugar-refining, and other industries.

Sand and Gravel.—Sand and gravel was produced in 47 (43 in 1956) of the State's 75 counties; in order of value the leading counties were Pulaski, Miller, Izard, Crawford, and St. Francis. Production of sand and gravel amounted to 8.6 million short tons valued at \$6.9 million. This decline of 16 percent in quantity and 20 percent in value from 1956 was attributed to prolonged heavy rains during the spring and fall months, virtually stopping highway and building construction.

Arkansas Glass Container Corp., Jonesboro, Craighead County, completed constructing a new plant and shipped the first carload of glass during September 1957.

Slate.—Slate production in Arkansas increased 22 percent in quantity and 11 percent in value over the preceding year.

Soapstone.—Output and value of soapstone declined approximately 6 percent in quantity and in value during 1957.

Stone.—Production and sale of stone continued to gain for the sixth successive year and attained a record high of 7.3 million short tons valued at \$8.4 million, a gain of 15 percent in quantity and 3 percent in total value over 1956. Over 53 percent (98 percent in 1956) of the dimension sandstone was dressed and used for construction; the remainder was employed for rough construction and rubble. Limestone for use as soil conditioner decreased 2 percent to 103,000 short tons during the year. Miscellaneous stone used for concrete aggregate and roadstone was 41 percent (67 percent in 1956); for railroad ballast, 21 percent (26 percent in 1956); for riprap, 7 percent; and for roofing granules, 31 percent.

Jeffrey Stone Co. completed constructing a \$1 million (estimated) crushing plant north of North Little Rock. The plant will produce concrete aggregate, aggregate for asphalt-road surfacing, sealing

TABLE 16.—Sand and gravel sold or used by producers, 1956-57, by class of operations and uses

	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand:						
Building.....	1,398,942	\$1,122,097	\$0.80	1,167,491	\$987,025	\$0.85
Paving.....	1,205,435	881,866	.73	905,385	750,515	.83
Gravel:						
Building.....	1,453,913	1,507,585	1.04	1,198,077	1,247,092	1.04
Paving.....	2,575,178	2,308,671	.90	1,678,191	1,582,169	.94
Other.....	193,875	196,880	1.02	202,668	121,831	.60
Undistributed.....	1,385,695	716,380	1.86	1,342,194	655,845	1.92
Total sand and gravel.....	7,213,038	6,733,479	.93	5,494,006	5,344,477	.97
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Paving.....				1,064,973	398,115	.37
Building.....	53,151	10,630	.20			
Gravel:						
Paving.....	2,709,326	1,865,293	.69	2,040,539	1,206,719	.59
Building.....	224,000	120,000	.54			
Total sand and gravel.....	2,986,477	1,995,923	.67	3,105,512	1,604,834	.52
Grand total.....	10,199,515	8,729,402	.86	8,599,518	6,949,311	.81

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

TABLE 17.—Stone sold and used by producers, 1953-57

Year	Thousand short tons	Value		Year	Thousand short tons	Value	
		Total (thousands)	Average per ton			Total (thousands)	Average per ton
1953.....	3,545	\$5,070	\$1.43	1956.....	6,325	\$8,113	\$1.28
1954.....	4,604	5,930	1.29	1957.....	7,278	8,378	1.15
1955.....	6,176	8,026	1.30				

chips, roadstone filter rock, railroad ballast, and riprap. Company officials estimated a 25-year supply of quartzitic sandstone in the 400 acres under lease for quarrying. The sandstone ranges from 50 to 100 feet in thickness.

Sulfur (Recovered Elemental).—Recovery of byproduct sulfur from gas cycle plants in Columbia and Lafayette Counties continued from 1956 with only a slight decrease in quantity and value.

METALS

Aluminum.—Arkansas ranked fifth in the Nation in aluminum output. Production and shipments by the aluminum industry declined slightly in 1957 from the record of 1956. Following a 7-year upward trend, primary production decreased about 2 percent, and shipments of wrought and cast products decreased about 7 percent. To supply the needs of its two reduction plants, Reynolds Metals Co. acquired additional gas wells in Arkansas.

Bauxite.—Production of bauxite from Arkansas mines—96 percent of the United States total—declined 19 percent in quantity and 13 percent in value, but shipments from mines and processing plants to consumers gained 8 percent in quantity and 9 percent in value from the previous year. Eighty-five percent of the bauxite was mined in Saline County and the remainder in Pulaski County.

Aluminum Company of America with mines in Saline County was the largest producer in Arkansas during 1957. Reynolds Mining Corp., a subsidiary of Reynolds Metals Co., operating open pit and underground mines in Saline County, was the second largest producer. Dulin Bauxite Co., third largest producer, operated the 400 B.C. and Bryant underground mines in Saline County: The Dixon pit from January to July, the McClain-Nelson open pit from October through December, Wilson-Riley underground mine from February through December, and the Confederate Home open-pit mine from January until the ore body was exhausted in November, in Pulaski County. Part of the ore was dried, and the remainder was shipped crude.

Dickinson-McGeorge, Inc., resumed mining in 1957 after being idle in 1956 and was the fourth largest producer—at 3 mines in Pulaski County and 2 mines in Saline County.

Consolidated Chemical Industries, Inc., shipped crude ore from stocks to its own plant in Pulaski County; the products were sold as dried and activated bauxite. Activated bauxite was also produced by Porocel Corp. and Campbell Bauxite Co., both in Pulaski County.

The American Cyanamid Co. produced from the Quapaw mine in Saline County and also shipped mine stocks from the idle Berry-Mayhan and Lewis mines to the company plant for drying before consumption by the chemical industry. Much Quapaw ore is too high in iron content to meet specifications for alum manufacture, but it can be beneficiated by roasting followed by magnetic separation, a process developed by the Federal Bureau of Mines.⁸ New calcining and magnetic facilities using this process were installed at Bauxite. By treating bauxite not previously considered usable, company production in the area will be prolonged for 20 years.

The Norton Co. bauxite mine and plant were idle during 1957.

Allied Chemical and Dye Corp. was building a \$300,000 plant at Pine Bluff, Ark., to manufacture aluminum sulfate to be used locally

TABLE 18.—Mine production of bauxite and shipments from mines and processing plants to consumer, 1948-52 (average) and 1953-57, in long tons

Year	Mine production			Shipments from mines and processing plants to consumers		
	Crude	Dried-bauxite equivalent	Value	As shipped	Dried-bauxite equivalent	Value
1948-52 (average).....	1,709,244	1,443,341	\$8,951,996	1,546,171	1,418,123	\$10,586,856
1953.....	1,802,797	1,529,976	12,975,992	1,889,206	1,689,207	15,042,236
1954.....	2,296,528	1,949,368	15,993,887	1,978,216	1,711,386	15,239,244
1955.....	2,049,623	1,721,243	14,026,190	1,938,811	1,660,263	14,844,798
1956.....	1,966,320	1,668,432	13,307,341	1,827,832	1,576,028	13,724,443
1957.....	1,625,098	1,356,898	11,600,216	2,004,289	1,693,992	14,948,537

⁸ Calhoun, W. A. and Powell, H. E. Jr., Laboratory Investigation of Bauxite Ore From the Quapaw Deposit, Saline County, Ark.: Bureau of Mines Rept. of Investigations 5366, 1957, 11 pp.

in the paper mills. Also near Pine Bluff, International Paper Mill was completing a \$58-million plant, and the Dierks Paper Mill was building a \$20-million plant.

Iron Ore.—One company mined brown iron ore in 1957 in Fulton County.

Manganese.—Arkansas ranked sixth in the Nation in the value of manganese production. Manganese production declined 21 percent in quantity and 16 percent in total value from 1956. In 1956, 9 producers made shipments from Independence County and 1 from Polk County. These were points of railroad shipment, and considerable tonnage was trucked across county lines. In 1957 about 20 producers in Independence County shipped a total of 16,681 long tons; shipments were also reported from Izard, Polk, Searcy, and Sharp Counties.

Several mining companies continued active manganese exploration through the year. The Federal Bureau of Mines continued to sample, map, and correlate data on manganese-ore deposits and manganeseiferous limestone deposits in Arkansas and to obtain samples for mineral-dressing tests.

TABLE 19.—Manganese ores shipped from mines, 1948–52 (average) and 1953–57, in short tons

Year	Manganese ore ¹		Value	
	Gross weight	Mn content	Total	Average per ton
1948-52 (average).....	2,050	862	(²)	-----
1953.....	6,123	2,812	\$526,647	\$86.01
1954.....	13,728	5,407	1,020,752	74.36
1955.....	23,744	11,685	1,727,286	72.75
1956.....	29,485	12,525	2,066,116	70.07
1957.....	23,261	10,000	1,726,164	74.21

¹ Containing 35 percent or more manganese (natural).

² Data not available.

Zinc.—Athletic Mining and Smelting Co., subsidiary of American Zinc, Lead and Smelting Co., operated the Fort Smith zinc smelter at capacity during the first 5 months. In June production was reduced 40 percent, and the smelter continued to operate on a 60-percent basis during the remainder of the year.

United Industries was rehabilitating five old lead-zinc mines near Ponca, Newton County.

REVIEW BY COUNTIES

Mineral production was reported in 59 of the 75 counties in Arkansas. Fifteen of these counties reported production of over \$1 million. Petroleum was produced in 7 counties (8 in 1956); natural gas in 12; natural-gas liquids in 5; clay in 12 (11 in 1956); coal in 5; manganese in 5 (2 in 1956); sand and gravel in 47 (43 in 1956); stone in 18; barite, bauxite, sulfur, slate, and lime in 2; and bromine, gypsum, abrasive stone, cement, and soapstone each in 1 county.

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

TABLE 20.—Value of mineral production in Arkansas, 1956-57, by counties ¹

County	1956	1957	Percent change	Minerals produced in 1957 in order of value
Ashley	(2)	\$97,903	-----	Sand and gravel.
Baxter	(2)	(2)	-----	Do.
Benton	\$52,903	38,060	-28	Stone, sand and gravel.
Bradley	50,873	6,128	-83	Sand and gravel.
Calhoun	525,816	366,586	-30	Sand and gravel, petroleum.
Carroll	972	4,528	+366	Sand and gravel.
Chicot	(2)	16,298	-----	Do.
Clark	321,397	141,639	-56	Sand and gravel, stone, clays.
Clay	28,263	16,502	-42	Sand and gravel.
Cleveland		4,610	-----	Do.
Columbia	21,827,491	27,516,890	+26	Petroleum, natural-gas liquids, natural gas, sulfur, sand and gravel.
Conway		1,520	-----	Sand and gravel.
Craighead	20,338	14,890	-27	Sand and gravel, clays.
Crawford	29,879	(2)	-----	Sand and gravel, natural gas.
Crittenden	(2)	(2)	-----	Sand and gravel.
Cross	321,209	219,240	-32	Do.
Drew	116,864	21,860	-81	Do.
Drew	(2)	35,176	-----	Do.
Faulkner		49,066	-----	Stone, sand and gravel.
Franklin	699,264	1,024,601	+47	Natural gas, coal, stone.
Garlon	15,858	34,560	+118	Iron ore.
Garland	90,570	(2)	-----	Oilstones, sand and gravel.
Grant	(2)	(2)	-----	Do.
Greene	230,363	103,112	-55	Sand and gravel.
Hempstead	271,352	220,549	-19	Natural-gas liquids, clays, sand and gravel.
Hot Spring	5,814,046	4,482,444	-23	Barite, clays, stone, sand and gravel.
Howard	(2)	(2)	-----	Cement, sand and gravel.
Independence	3,047,340	2,669,317	-12	Manganese, lime, stone, sand and gravel.
Izard	1,261,368	1,379,907	+9	Stone, sand and gravel, manganese.
Jackson	(2)	(2)	-----	Sand and gravel.
Jefferson	(2)	(2)	-----	Do.
Johnson	2,016,025	1,512,604	-25	Coal, natural gas, clays, stone.
Lafayette	15,274,565	16,849,467	+10	Petroleum, sulfur, natural-gas liquids, natural gas, sand and gravel.
Lawrence	(2)	(2)	-----	Stone, sand and gravel.
Lincoln	73,996	64,797	-12	Sand and gravel.
Little River	(2)	(2)	-----	Sand and gravel, stone.
Logan	437,672	475,453	+9	Coal, stone.
Lonoke	15,952		-----	
Madison	(2)	(2)	-----	Stone.
Marion	(2)	2,200	-----	Sand and gravel.
Miller	6,924,015	7,186,665	+4	Petroleum, sand and gravel, natural-gas liquids, clays, natural gas.
Mississippi	(2)	129,780	-----	Sand and gravel.
Montgomery	(2)	552,884	-----	Slate, barite, gem stones.
Nevada	3,241,619	2,798,580	-14	Petroleum, sand and gravel, natural gas.
Ouachita	15,468,557	17,976,919	+16	Petroleum, sand and gravel, natural gas, clays.
Perry	(2)	(2)	-----	Sand and gravel.
Phillips	(2)	(2)	-----	Do.
Pike	(2)	156,090	-----	Gypsum, gem stones, sand and gravel.
Poinsett	(2)	45,600	-----	Sand and gravel.
Polk	122,336	301,726	+147	Manganese, clays.
Pope	(2)	294,269	-----	Sand and gravel, natural gas, stone, coal.
Pulaski	9,322,838	7,995,450	-14	Stone, bauxite, sand and gravel, clays.
Randolph	34,196		-----	
St. Francis	(2)	333,946	-----	Sand and gravel.
Saline	12,076,860	10,870,548	-10	Bauxite, lime, clays, sand and gravel, soapstone, slate.
Searcy		8,616	-----	Manganese.
Sebastian	3,065,611	2,711,531	-12	Coal, stone, natural gas, clays, sand and gravel.
Sharp		5,392	-----	Manganese.
Stone		2,500	-----	Stone.
Union	24,069,594	25,179,979	+5	Petroleum, natural-gas liquids, bromine, natural gas, clays.
Washington	(2)	132,621	-----	Stone, sand and gravel, natural gas.
White	(2)	(2)	-----	Stone.
Undistributed	8,339,998	6,886,697	-----	
Total	135,210,000	140,940,000		

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

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

Baxter.—C. E. Sharp produced structural sand, and Independent Gravel Co. crushed limestone for agricultural use.

Benton.—Paul Davis, Ellis & Koonce, and White River Sand and Gravel Co. produced paving sand and gravel for fill. Independent Gravel Co. quarried and crushed limestone for use as a soil conditioner.

Bradley.—Carter Lyon produced a small quantity of paving gravel. Earl Reynolds produced structural and paving sand. Exploratory drilling resulted in two dry holes.

Calhoun.—W. W. Grant produced paving gravel. Ouachita Aggregate Co. fixed plant produced structural sand and gravel and paving gravel. Pine Bluff Sand & Gravel Co. produced structural sand and gravel and railroad ballast sand. St. Francis Material Co. produced structural and paving sand and gravel at its fixed plant. Petroleum also was produced in the county. Three dry exploratory wells were drilled.

Carroll.—James W. Garrett produced building sand and gravel at a fixed plant near Berryville.

Chicot.—O. F. Townsend Estate dredged building and paving sand and gravel near Lake Virginia.

Clark.—Arkadelphia Sand & Gravel Co. produced molding, paving, and other sands and structural, paving, and other gravels. R. & P. Barringer produced paving gravel at a fixed plant near Whelen Springs. E. D. Cook Estate produced gravel from a pit at Friendship. Nowlin & Sons Co. produced clay gravel for miscellaneous uses. Chas. McMillan produced pit-run building and paving gravel. Arlington Waggoner dredged paving gravel from the Caddo River near Amity. West Lake Quarry & Material Co. quarried and crushed limestone for riprap. Hope Brick Works mined miscellaneous clay for manufacturing heavy clay products. Reynolds Metals Co. continued operating its aluminum-reduction plant at Arkadelphia.

Clay.—The Buckskull Gravel Co. fixed plant on the Current River produced paving sand and gravel. Ezra Montgomery produced sand and gravel for structural use. James McKinney produced pit-run gravel near Corning. One dry exploratory well was drilled.

Columbia.—Columbia County led the State with a total mineral production of nearly \$28 million (a gain of 26 percent over 1956). The county also led in producing crude petroleum and natural-gas liquids and ranked second in natural gas. Three natural-gasoline and cycle plants at Magnolia produced natural-gas liquids valued at \$2.7 million by the absorption process. Much of the natural gas from Columbia County contained objectionable hydrogen sulfide. Lion Oil Co. recovered sulfur from natural gas by the "modified Claus" process; Olin Mathieson Chemical Corp. used the "Mathieson" process to recover sulfur.

The county ranked third in the State in total oil wells drilled. Exploratory drilling discovered the Plainfield oilfield that produces from the Cotton Valley sand between 9,164–9,184 feet; also 14 exploratory holes were dry. Of the 117 field-development wells drilled, 103 were completed as oil producers, and 14 were dry.

Drew County Highway Department produced pit-run gravel for paving. Columbia Sand and Gravel Co. and W. B. Ferguson produced building sand and gravel. Lambert & Barr used a dragline near Waldo to mine gravel for use in road construction.

Conway.—A small quantity of sand and gravel was produced. Two dry exploratory wells were drilled, and 3 development wells were completed as gas producers.

Craighead.—The first carload of glass was shipped during September from the recently completed plant of Arkansas Glass Container Corp. Wheeler Brick Co., Inc., mined red clay for manufacturing face brick at a plant near Jonesboro. Cox Gravel Co., Cottonville Gravel Co., and Mississippi Valley Construction Co. produced structural and paving sand and structural gravel.

Crawford.—Sand and gravel and natural gas were produced in the county. Exploratory drilling resulted in discovery of the Kibler-Williams Deep gasfield that produced from the Atoka formation. Arkhola Sand and Gravel Co. dredged sand and gravel near Van Buren for paving, structural, and miscellaneous uses.

Crittenden.—A small quantity of sand and gravel was produced. One dry exploratory well was drilled.

Cross.—Near Wynne, Cross County Gravel Co. produced structural and paving gravel, also a special gravel with a clay binder for constructing secondary roads. Humphries and Kail produced structural and paving sand and gravel. McGeorge Construction Co. produced structural and paving gravel. Each of the above-mentioned companies operated washing plants.

Desha.—Sam Finley, Inc., produced structural sand and gravel. Linwood Smith, contractor, operated a dredge to produce sand and gravel for use in highway construction and drainage work. Exploratory drilling resulted in one dry hole.

Drew.—Mrs. R. F. Hyatt, Sr., trustee, produced gravel for public roads at a portable plant near Monticello. O'Neill Bros. Sand & Gravel Co., Clyde Rogers, and L. P. Long produced structural and paving sand and gravel. Drew County Highway Department produced pit-run gravel for paving purposes.

Franklin.—The county continued to lead the State in producing natural gas. Exploratory drilling resulted in 1 dry hole, and all 10 development wells drilled proved gas-productive. Coal was strip-mined by Arnold Coal Co. and Dixie Construction Co. and was used

chiefly for steam generation. Arnold Stone Co. quarried a small quantity of sandstone for use as rubble.

Fulton.—Johnel Mining Co. assumed ownership of the Mammoth Springs open-pit mine, formerly the property of the Double E Mining Co. Shipments of brown iron ore continued.

Garland.—Novaculite, quarried at five open-pit mines, was purchased by Norton Pike Co. and shipped to its New Hampshire plant, where the stone was processed into high-quality oilstone. L. C. Eddy & Sons Construction Co. produced paving gravel. Smith Bros. Construction & Materials Co. produced sand and gravel for general use at a fixed plant near Hot Springs.

Grant.—Plans were announced by the Southwest Concrete Material Corp. to construct a lightweight-aggregate plant near Poyen.

Greene.—Structural and paving sand and gravel were produced by Arkansas Gravel Co., B. & S. Gravel Co., Ted Kline, and Mississippi Valley Construction Co.

Hempstead.—Natural-gas liquids were recovered by the natural-gasoline and cycle plant operated by Sunray Oil Corp. at Patmos. Two dry exploratory wells were drilled. Hope Brick Works mined clay for manufacturing heavy clay products. Paving gravel also was produced.

Hot Spring.—Barite valued at about \$3.5 million was mined by the Baroid Division of the National Lead Co. and by Magnet Cove Barium Corp.; both crude and ground barite were produced. The county ranked second in production of clay and third in output of stone in the State. Acme Brick Co. and Malvern Brick & Tile Co. mined fire clay for use in refractories and miscellaneous clay for manufacturing heavy clay products. Coogan Gravel Co. and W. M. Fowler produced sand and gravel for structural and paving uses. Malvern Gravel Co. produced paving sand and gravel at a fixed plant near Malvern. Sandstone was crushed and used as refractory stone ganister by Harbison-Walker Refractories Co. and Coogan Gravel Co. Quartz crystal was quarried by Chas. Coleman from deposits near Hot Springs. Reynolds Metals Co. continued operating its aluminum-reduction plant at Jones Mill.

Howard.—The only cement plant in Arkansas was that of Ideal Cement Co. near Okay, Ark. The company mined chalk, marl, and limestone for use in manufacturing cement. Structural and paving sand and gravel and railroad-ballast gravel were produced by the Mississippi Valley Construction Co., John Watson, and Mrs. Nina Dilly.

Independence.—Manganese, valued at about \$1.3 million and mined by about 20 producers, was the most important mineral product from Independence County. Lime for industrial, chemicals, and construction uses, was produced by Batesville White Lime Co. Galloway Sand and Gravel Co. operated a fixed plant near Batesville to mine structural and railroad ballast sand. Limestone was quarried and crushed by the Batesville White Lime Co. for use in concrete, as a metallurgical flux, as roadstone, as a soil conditioner, and for lime. Dimension sandstone for rough construction was quarried by Bristow Stone Co. and Salado Stone Co.

Izard.—The county continued to rank second in production value of stone and third in sand and gravel in the State. Glass sand was

mined and processed by the Silica Products Co., Inc., plant near Guion. Crushed limestone, for use as a metallurgical flux, for concrete aggregate, roadstone, soil conditioner, and poultry grit and for lime, was produced by the Aluminum Company of America and the Arkansas Limestone Co. U. S. Manganese Corp. mined manganese ore.

Jackson.—Sand and gravel for structural and paving was quarried by Allbright Bros. Contractors, Inc., and dredged by Mobley Construction Co., Inc., from deposits in the White River near Newport. Exploratory drilling resulted in one dry hole.

Jefferson.—Structural sand and gravel was dredged from the Arkansas River by Pine Bluff Sand & Gravel Co. Allied Chemical and Dye Corp. was building a \$300,000 plant at Pine Bluff for producing aluminum sulfate for paper manufacture. Near Pine Bluff, 2 large paper plants were under construction, 1 by the International Paper Mill and the other by Dierks Paper Mill.

Johnson.—The county again ranked second in producing coal—valued at over \$1 million. Coal mined in the western part of the county was sold almost exclusively to steel mills because of its coking qualities. Coal was produced from eight mines in the eastern part of the county chiefly for domestic consumption. Eureka Brick & Tile Co. mined clay for manufacturing heavy clay products. Dimension sandstone was quarried near Lamar by the Texas Ledge Stone Co. for dressed stone and by Clarksville Ledge Stone Co. for use as rubble. Natural gas also was produced. One dry exploratory well was drilled.

Lafayette.—The county led in producing byproduct elemental sulfur, ranked second in natural-gas liquids, third in natural gas, fourth in output of petroleum, and fourth in the value of total minerals produced in the State—valued at \$16.5 million.

Exploratory drilling resulted in the discovery of four oilfields, as follows: Kress City field, producing from a limestone stringer just above the main body of the Smackover limestone at a depth of 8,304–8,311 feet (5 additional oil wells and 2 dry holes were drilled during the year); Lewisville "Old Town" field, producing from Tuscaloosa sand at 3,030–3,033 feet (a west offset to the discovery well brought in a new Paluxy sand pay at 3,180–3,182 feet, and an east offset and a south-east offset to the discovery well were dry and abandoned during the year); Meriwether Lake field producing from Tuscaloosa sand at 2,713–2,717 feet (1 additional Tuscaloosa well and 4 dry holes were drilled during the year); Walnut Hill field producing from the Mitchell sand of the Rodessa formation at 5,834–5,838 feet (3 additional Mitchell sand wells and 2 dry holes were completed during the year). Development drilling of 70 wells adjacent to proved fields resulted in 30 completions as oil producers and 40 dry holes.

Paving and structural sand and gravel were mined with a dragline and processed in fixed and portable plants by Meriwether Gravel Co., Inc., Lambert & Barr, and International Paper Co. Olin Mathieson Chemical Corp. recovered elemental sulfur from natural gas by the Mathieson process.

Lawrence.—Black Rock Sand & Gravel Co. operated a fixed plant to produce structural sand and gravel, and L. F. Parker produced paving gravel from a pit near Black Rock. Ben M. Hogan & Co.

crushed limestone for use in concrete aggregate, roadstone, and screenings.

Lincoln.—Structural and paving sand and gravel were produced by Glover Bros. at a fixed plant near Star City. Linwood Smith, contractor, mined sand and gravel from several pits in the county for structural and paving purposes.

Little River.—Arkansas Cement Corp. was constructing a new wet-process portland and masonry cement plant at an estimated cost of \$15 million near Foreman. Production was scheduled to start during October 1958. Electricity for the plant will be furnished by a power station to be constructed by the Arkansas Louisiana Gas Co. Ark-La Lime Co. quarried, crushed, and ground limestone for use as a soil conditioner. Structural and paving sand and gravel were produced by Braswell Sand & Gravel Co., Inc., at a fixed plant near Wilton. Two dry exploratory wells were drilled.

Logan.—The county continued to rank third in producing bituminous coal. One mine used manual methods, and 2 used machines to mine coal. Sandstone was quarried and dressed to dimension stone by Logan County Building Stone Co. and by Schwartz Bros. Other sandstone was quarried and used for rough construction by the Arkansas Ledge Stone Co., Wurst & Vassaur. Exploratory drilling resulted in two dry holes.

Lonoke.—Arkansas Lightweight Aggregate Corp. was building a new lightweight-aggregate plant north of England. The plant was scheduled for completion in April 1958.

Madison.—Limestone was crushed and used as soil conditioner by War Eagle Lime Co. Of 4 exploratory wells drilled, 1 proved oil productive, and 3 were dry.

Marion.—A small quantity of gravel for paving use was mined from the Jefferson Pit near Yellville. Guy King produced some structural sand near Mountain Home.

Miller.—The county was the second-ranking producer of sand and gravel, fourth in natural-gas liquids and clay, and fifth in petroleum in the State. Natural gas also was produced.

Exploratory drilling resulted in the discovery of four oilfields as follows: Jonesville, producing from Mooringsport formation at a depth of 5,052–5,057 feet; Central Schools field, producing from Tuscaloosa sand at 2,979–2,986 feet; Christmas field, producing from Paluxy sand at 3,221–3,223 feet (3 additional Paluxy wells and 6 dry holes were completed during the year); and Genoa field producing from the Paluxy sand at 3,388–3,391 feet (6 additional Paluxy sand wells and 4 dry holes were completed during the year).

Gifford Hill Co., Inc., Graves Bros. Construction Co., General Construction Co., and Lambert & Barr produced sand and gravel for structural, paving, railroad-ballast, and other uses. W. S. Dickey Clay Manufacturing Co. mined fire clay and miscellaneous clay for heavy clay products at its plant near Texarkana, Tex. Ark-La Oil Co. operated its natural-gasoline and cycle plant.

Mississippi.—Structural and paving sand and gravel were produced by the Mississippi Valley Construction Co. and Mississippi River Sand Co. Elliott Sartain & Co. dredged gravel for paving use from the Mississippi River near Osceola.

Montgomery.—Slate, barite, gemstones (quartz crystal) and roofing granules were produced in the county. Slate was quarried, crushed, and ground to form slate flour and roofing granules by Bird & Sons, Inc. Baroid Division of National Lead Co. opened a new barite mine.

Nevada.—The county ranked sixth in producing petroleum. Sand and gravel and natural gas also were produced. Exploratory drilling resulted in 9 oil discoveries and 29 dry holes. Development drilling adjacent to proved fields resulted in 26 oil producers and 16 dry holes.

Newton.—United Industries was rehabilitating five old lead-zinc mines near Ponca.

Ouachita.—The county ranked third in the value of total mineral production (\$18 million) and third in petroleum produced (\$17.8 million) in the State. The total of 371 wells drilled was the highest in the State. During the year 24 dry exploratory wells were drilled; and, of 347 development wells drilled, 324 were completed as oil producers, and 23 were dry holes. Berry Asphalt Co. continued to operate its petroleum refinery at Stephens.

Structural and paving sand and gravel were produced by Morgan Pate, Pine Bluff Sand & Gravel Co., and Standard Gravel Co. Ouachita County Highway Department mined pit-run gravel for paving purposes. Hope Brick Works mined clays for manufacturing brick and heavy clay products, including structural tile.

Pike.—All gypsum mined in Arkansas came from Pike County. It was produced by Arkansas Gypsum Co. and was used as a cement retarder.

Diamonds having an estimated value of \$14,500 were found by gem collectors in "The Crater of Diamonds" near Murfreesboro. A small quantity of sand and gravel was produced. Exploratory drilling resulted in one dry hole.

Poinsett.—Pit-run paving gravel was produced by Nelson Crowder at a fixed plant near Harrisburg.

Polk.—Will H. Hargus purchased manganese ore from several small-scale miners and beneficiated the ore in a mill. W. S. Dickey Clay Manufacturing Co. mined shale for manufacturing heavy clay products.

Pope.—Sand and gravel, natural gas, stone, and coal were produced in the county. Structural and paving sand and gravel were produced by Mobley Construction Co., Inc., and Pope County Highway Department. United States Army Corps of Engineers quarried sandstone for use as riprap. Sandstone was quarried and dressed to dimension stone by Eureka Stone Co. and Pope County Stone Co. Three development wells were drilled; all proved gas productive. Natural gas also was produced.

Pulaski.—The county led the State in value of sand and gravel, stone, and high-alumina clays produced. Bauxite was mined or shipped from stocks by American Cyanamid Co., Consolidated Chemical Industries, Inc., Dickinson-McGeorge, Inc., and Dulin Bauxite Co. Several calcining, chemical, and activating plants processed bauxite for abrasives, chemicals, and other industrial uses. Jeffrey Stone Co. completed constructing a new crushing plant—at an estimated cost of \$1 million—at North Little Rock and quarried

and crushed sandstone for riprap, concrete aggregate, roadstone, and screenings. Big Rock Stone & Materials Co. quarried and processed sandstone and nepheline syenite for use as roofing granules, riprap, concrete aggregate, roadstone, and railroad ballast. Limestone was quarried and crushed for use as concrete aggregate and as roadstone by Ben M. Hogan & Co., D. F. Jones, and Reynolds & Williams. State of Arkansas Highway Department quarried and processed limestone for use as concrete aggregate and roadstone. Artificially colored roofing granules were manufactured by the Minnesota Mining & Manufacturing Co. from nepheline syenite quarried by Big Rock Stone & Material Co.

Consolidated Chemical Industries, Inc., and A. P. Green Fire Brick Co. mined high-alumina bauxitic kaolinitic clay from large residual deposits south and southwest of Little Rock. Sand and gravel was quarried by Big Rock Stone & Material Co., Arkansas State Highway Department, Donna Fill Co., North Little Rock Sand Co., John D. Ott, and Horace A. Illing for structural, paving, and bank-stabilization uses.

Vermiculite was exfoliated by Zonolite Co. from crude vermiculite mined in Montana.

Saline.—Bauxite mining (81 percent of the Nation's production) and alumina production were the most important industries in the county. Bauxite was mined by open-pit or underground methods by Aluminum Company of America, American Cyanamid Co., Dickinson-McGeorge, Inc., Dulin Bauxite Co., and Reynolds Mining Corp. Approximately 85 percent of the bauxite from Saline County, was used for producing alumina in the plants of Reynolds Mining Co. and Aluminum Company of America. The remainder was processed by calcining and activating and by chemical plants. American Cyanamid Co. constructed new calcining and magnetic-separation facilities for treating bauxite ore. Lime for use in a modified soda-lime-sinter process to produce alumina and for chemical and industrial purposes was produced by Aluminum Company of America and by Reynolds Metals Co.

Milwhite Co., Inc., quarried and processed soapstone for use in insecticides and roofings. Structural and paving sand and gravel were produced by East Arkansas Material Co., Newcomb & West Construction Co., Mrs. Kenneth Pelton, and Mike Richards Equipment Co. Slate was quarried and ground to produce slate flour by Milwhite Co., Inc.

The county ranked fifth in the total value of minerals produced in the State and third in the value of clay production. A. P. Green Fire Brick Co. mined kaolinitic clay for refractory use.

Searcy.—A small quantity of manganese ore was mined and shipped from Searcy County.

Sebastian.—The county led in producing coal (shipped mostly to coking plants at steel mills) and ranked fourth in the value of stone produced. Natural gas, clay, and sand and gravel were also produced. Sand and gravel for construction and paving use was mined and processed by Forsgren Bros. Construction Co. Acme Brick Co. mined clay for manufacturing brick and heavy clay products. Roscolite Co. mined clay and manufactured lightweight aggregates. Sandstone was quarried for rough construction by Dixie Stone

Co. Limestone was quarried and crushed for concrete aggregate and roadstone by Bob Dills and for railroad ballast by Arkhola Sand and Gravel Co. Athletic Mining and Smelting Co. (subsidiary of American Zinc, Lead and Smelting Co.) operated a horizontal-retort zinc smelter at Fort Smith. Of 8 development wells drilled, 6 were completed as gas producers, and 2 were dry holes.

Sharp.—A small quantity of manganese ore was mined in and shipped from Sharp County during the year.

Union.—The county was the oldest and one of the most prolific producers of liquid gaseous fuels in Arkansas. Union County ranked second in the value of minerals produced (\$25 million), second in producing petroleum, third in natural-gas liquids, and fourth in natural gas. The total wells drilled (304) was second highest in the State. Exploratory drilling resulted in discovery and rediscovery of two oilfields, as follows: Lick Creek field, producing from the Meakin sand at a depth of 2,545–2,550 feet. Lisbon N. W. field was producing from the Blossom sand at 2,592–2,594 feet and 2,596–2,598 feet. This well was not only a rediscovery but also extended the abandoned field 1 mile west and discovered a new pay. Development drilling of 259 wells adjacent to proved fields resulted in 214 oil producers and 45 dry holes. Four petroleum refineries and 3 natural-gasoline and cycle plants were operating in the county during the year.

In April 1957 Michigan Chemical Corp. and Murphy Corp. completed constructing a bromine-recovery plant south of El Dorado. The rated capacity of the plant is 5 million pounds of bromine per year.

Monsanto Chemical Co. was constructing a new urea plant at El Dorado; its capacity will be 100 tons per day. Operations were scheduled to begin by early fall of 1958.

Production at El Dorado Brick Works was suspended for a short time during its modernization program. New clay sheds, new brick machinery, a new drier, and brick packaging equipment were being added. A new front-end loader was purchased for the pit where clay is mined for common and face brick.

Washington.—Stone, sand and gravel, and a small quantity of natural gas were produced in the county. Limestone was quarried and crushed for use as concrete aggregate and roadstone by McClinton Bros. Ozark Construction Co. processed sand and gravel for use in construction and paving.

White.—Acme Materials Co. quarried and crushed sandstone for use in manufacturing high-silica refractories.

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, United States Department of the Interior, and the California Department of Natural Resources, Division of Mines.

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CALIFORNIA crude-petroleum production rose in value in 1957 more than \$116 million or about 13 percent. The increased value of petroleum output largely furnished the record-breaking \$1.7-billion mineral yield, \$100 million more than the previous high of 1956. The volume produced was 3 percent below that of 1956, but the evident price inflation was not so pronounced in the other mineral fuels, which contributed a fuels output valued at 75 percent of the State's total mineral yield for the year compared with 73 percent in 1956.

Nonmetals output generally reflected the business slump of the second half of 1957. For example, both quantity and value of portland cement, barite, calcium chloride, pumice, sand and gravel, gypsum, bromine, iodine, mica, slate, sodium sulfate, and strontium minerals declined. The clays, feldspar and sulfur ore that were shipped also decreased in quantity and value. Less salt, talc, and sodium carbonate were produced in 1957, but the values of each exceeded the corresponding 1956 figures. There was virtually no change in the quantities of crude perlite, potassium salts, and pyrites produced, but the value of the crude perlite declined and those of the potassium salts and pyrites increased compared with the preceding year. The quantity and value of boron, lime, magnesium compounds, stone (including that for nonconstruction use), masonry cement, and asbestos increased; the quantity of diatomite and elemental sulfur rose, but their values were less.

The yield of metals furnished 3 percent of the State total mineral value in 1957 compared with 4 percent in 1956. Chromite, manganese ore, and mercury mining prospered under the stabilizing influence of guaranteed prices and market through Government purchasing. The output of molybdenum concentrates (coproducts of tungsten milling) and that of iron ore, both in demand at good prices, increased during 1957. Gold mining continued to decline, and the production of lead, zinc and the associated metal, silver, dropped sharply following declining base-metal prices. Tungsten-concentrate output declined sharply when it became necessary to compete in the open market at prices considerably lower than that of Government purchases which were terminated early in the year. Platinum production was small and virtually unchanged in 1957. The yield of rare-earth-

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metals concentrate was much lower than in 1956, as the producer sought an expanded market. Copper-ore production rose in quantity, despite the declining price, largely because it was a coproduct of tungsten milling.

TABLE 1.—Mineral production in California, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Boron minerals ²	3 568, 087	3 335, 722	597, 857	\$40, 817
Cement..... 376-pound barrels.....	39, 239, 586	120, 511	37, 731, 340	117, 852
Chromite..... gross weight.....	27, 082	2, 192	34, 901	2, 789
Clays.....	2, 981, 595	6, 138	4 2, 729, 000	4 5, 764
Coal (lignite).....	12, 000	120	(³)	(³)
Copper (recoverable content of ores, etc.).....	859	730	945	569
Feldspar..... long tons.....	3 241, 160	3 1, 265	181, 613	1, 086
Gem stones.....	(⁴)	90	(⁴)	100
Gold (recoverable content of ores, etc.)-troy ounces.....	193, 816	6, 784	170, 885	5, 981
Gypsum.....	1, 399, 390	3, 402	1, 268, 000	2, 995
Iron ore (usable)..... long tons, gross weight.....	2, 414, 277	(⁵)	(⁵)	(⁵)
Lead (recoverable content of ores, etc.).....	9, 296	2, 919	3, 458	989
Lime.....	302, 479	5, 078	325, 000	5, 408
Magnesium compounds from sea water and bit- terns (partly estimated) MgO equivalent.....	66, 007	4, 532	74, 558	5, 315
Manganese ore (35 percent or more Mn) gross weight ⁷	6, 595	595	9, 009	802
Mercury..... 76-pound flasks.....	9, 017	2, 344	3 16, 511	3 4, 078
Natural gas..... million cubic feet.....	504, 458	113, 503	502, 572	9 114, 416
Natural-gas liquids: Natural gasoline and cycle products thousand gallons.....	876, 902	84, 615	843, 378	81, 355
LP-gases..... thousand do.....	410, 232	21, 332	390, 743	20, 421
Peat.....	18, 918	215	35, 916	424
Perlite.....	15, 119	135	15, 109	113
Petroleum (crude) thousand 42-gallon barrels.....	350, 754	918, 975	339, 646	9 1, 035, 920
Pumice.....	634, 356	2, 334	459, 000	1, 510
Salt (common).....	1, 444, 211	7, 606	1, 330, 000	8, 721
Sand and gravel.....	3 86, 447, 000	3 96, 526	79, 024, 000	87, 030
Silver (recoverable content of ores, etc.) troy ounces.....	938, 139	849	522, 000	473
Stone.....	32, 583, 370	46, 109	41, 351, 000	53, 591
Sulfur, recovered elemental..... long tons.....	(⁶)	(⁶)	80, 906	2, 709
Talc, pyrophyllite and soapstone.....	153, 710	1, 419	133, 915	1, 526
Tungsten concentrate. 60-percent WO ₃ basis.....	3, 719	13, 449	1, 750	2, 735
Uranium ore (U ₃ O ₈ content)..... pounds.....	10 1, 903	10 5	(⁸)	(⁸)
Zinc (recoverable content of ores, etc.).....	8, 049	2, 205	2, 969	689
Value of items that cannot be disclosed: Asbes- tos, barite, bromine, calcium-magnesium chloride, carbon dioxide, masonry cement, clay (kaolin 1957), diatomite, fluorspar (1957), abrasive garnet (1956), iodine, magnesite (1956), mica, molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare- earth-metals concentrates, slate, sodium car- bonate and sulfate, strontium, sulfur ore, and values indicated by footnote ⁵		3 68, 025		62, 188
Total California ¹¹		3 1, 551, 413		1, 650, 855

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Beginning with 1956, all figures are based on finished products.

³ Revised figure.

⁴ Excludes kaolin, which is included with "Undistributed" to avoid disclosing company confidential data.

⁵ Figure withheld to avoid disclosing company confidential data.

⁶ Weight not recorded.

⁷ Excludes shipments to Government low-grade depots and custom mills, but quantity and value for this material is as follows: 1956—manganese ore, 293 short tons, \$19,630; 1957—manganese ore, 112 short tons, \$4,000, and low-grade manganese ore, 43 short tons, \$1,814.

⁸ Final figure. Supersedes preliminary figure given in commodity chapter.

⁹ Preliminary figure.

¹⁰ Revised to include uranium shipments for the calendar year 1956.

¹¹ The total has been adjusted to eliminate duplicating the value of clays and stone included in cement and lime.

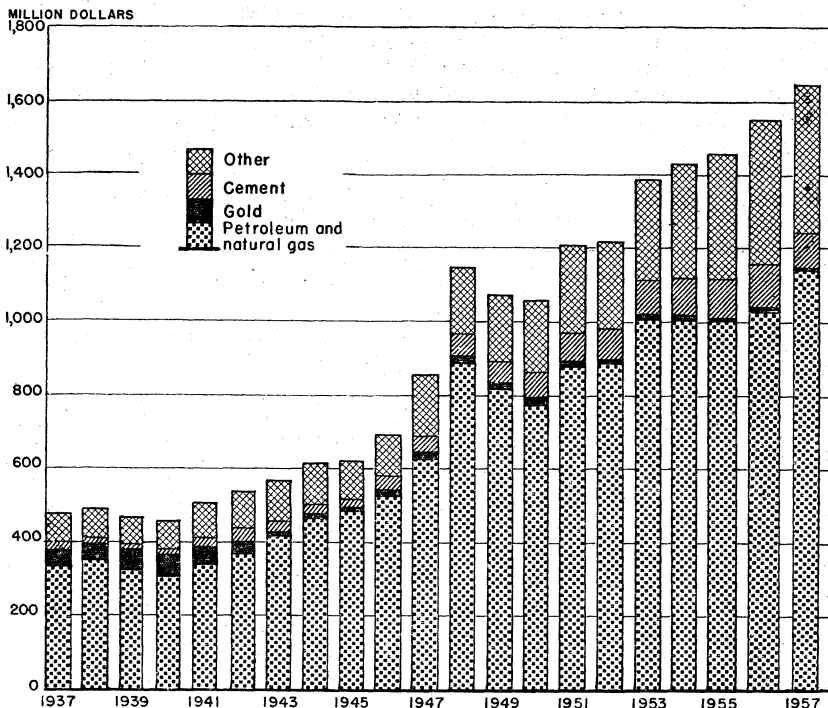


FIGURE 1.—Value of petroleum and natural gas, gold, cement, and total value of mineral production in California, 1937-57.

The State mineral-fuels production in 1957 was marketed generally as in the past several years. Because consumption of both petroleum and natural gas in the State exceeded production, most of the output was sold within the State; some petroleum was shipped out of the State. As California was the refining center of the Western States, some petroleum and natural-gas products were marketed in other States. The coal was mined for nonfuel purposes locally; all coal consumed in the State as fuel came from out of State. The peat production was used largely in local agriculture in competition with imported peat; some output was marketed in neighboring States.

Boron minerals and iodine (California was the sole producer in the United States) and other commodities were not produced widely but were consumed throughout the country and the world. These commodities included: Diatomite, lithium minerals, magnesium compounds, potash, talc, calcium chloride, bromine, perlite, salt and sodium compounds, were produced in enough quantity for marketing both within and outside the State. There was rather widespread output of lime, cement, feldspar, and gypsum but some California production of each was marketed outside the State largely because of the State's geographical position in maritime commerce. Gypsum was imported into California from Mexico in rather large quantities; and most of California crude-sulfur-ore output was used in Nevada for special application. California consumed rather large tonnages

of Frasch sulfur from the Gulf States. Some California semiprecious gem stones were marketed throughout the world. The other non-metallic mineral production was used within the State. The small output of asbestos and mica fell far short of State requirements of these minerals, and special clays were brought in to supplement local production.

TABLE 2.—Principal custom mills, commercial grinding plants, and primary smelters in California in 1957

Name	County	Nearest city or town	Minerals processed	Remarks
Industrial Minerals & Chemical Co.	Alameda.....	Berkeley.....	Nonmetals.....	Contract grinding—minerals purchased.
Metals Disintegrating Co., Inc.	.....do.....	Emeryville.....	.....do.....	Do.
American Smelting and Refining Co.	Contra Costa...	Selby.....	Gold, silver, lead, zinc.	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.
Hill Bros. Chemical Co...	.....do.....	.....do.....	.....do.....	Custom mill.
Kennedy Minerals Co...	.....do.....	.....do.....	.....do.....	Commercial grinding.
Los Angeles Chemical Co.	.....do.....	.....do.....	.....do.....	Contract grinding—minerals purchased.
Western Talc Co.....	.....do.....	.....do.....	.....do.....	Contract grinding.
Kaiser Co., Inc.....	San Bernardino.	Fontana.....	Iron ore.....	Blast furnaces, steel plant, fabricating plants.
Commercial Minerals Co.	San Francisco...	San Francisco.	Nonmetals.....	Contract grinding—minerals purchased.
Wildberg Bros. Smelting & Refining Co.	.....do.....	.....do.....	Gold, silver, platinum.	Smelting, refining, manufacturing.

Marketing metals and metal ores generally followed variable procedures. The entire chromite and manganese ore output was sold to the General Services Administration (GSA) for stockpiling. Mercury was sold largely to local brokers, but some went to buyers in the Middle Western and Eastern States. Copper ores and concentrates were marketed at copper smelters in Washington, Utah, Nevada, and Arizona, while lead and lead-zinc ores and concentrates were sold to lead smelters in California and Utah. Zinc concentrates were consigned to a Montana zinc smelter. Gold and silver ores went to California and Nevada smelters, and gold and silver in dore bullion was sold to the United States Mint and to California smelters. The latter also received the small platinum output. Molybdenum concentrates were sold to buyers in the Eastern United States. All but a small part of the iron-ore production was consumed within the State; a moderate tonnage was shipped to Japan. Tungsten concentrates were marketed locally as to GSA and to buyers in the Eastern United States. Uranium ore, under direction of the Atomic Energy Commission (AEC), was consigned to Utah processing mills. Rare-earth-metal concentrate was marketed in the Eastern United States. Most of the nonferrous-metal scrap and a considerable part of the ferrous metal produced in California was sold within the State. Japanese requirements for ferrous scrap were partly filled by shipments from California during the year.

TABLE 3.—Sand and gravel, crushed stone, and portland cement sold or used in 1957, by method of transportation

Material	Tonnage transported, by method				
	Railroad	Motor-truck	Waterway	Not stated ¹	Total
Sand and gravel (commercial).....	3,553,642	56,935,978	-----	445,991	60,935,611
Crushed stone (commercial).....	671,658	26,533,354	1,333,973	209,473	28,748,458
Portland cement.....	1,713,809	5,314,398	61,407	3,873	7,093,492
Total.....	5,939,109	88,742,127	1,395,380	659,342	96,735,958

¹ Includes interplant transfers to batching units, etc.

Government Programs.—Exploration activity under the Defense Minerals Exploration Administration (DMEA) program in 1957 compared favorably with the 23 active projects of 1956. The 23 contracts for projects in 17 counties totaled nearly \$2 million and were in effect during all or part of the year; 9 projects—3 for tungsten, 2 for mercury and 1 each for lead-zinc, chromite, manganese and uranium—were terminated by December 31, 1957; 2 contracts, 1 each for tungsten and mercury were canceled before work was begun. Only 4 new contracts were executed during the calendar year, 2 each for mercury and tungsten.

The Government carlot purchase program for chromite, manganese ore, and mercury was in effect throughout 1957. Purchases of tungsten concentrates by the Government ceased in January 1957. Shipments of California chromite and manganese ores and concentrates and tungsten concentrates were accepted for payment and stockpiled out of State by General Services Administration (GSA). Over 1,500 flasks of California mercury was purchased by GSA during 1957.

The Bureau of Mines maintained the following facilities in California during 1957: The Regional Office and Mineral Industries Office, in San Francisco, for the area comprising California, Nevada, and Hawaii and the Pacific Island Possessions; the Minerals Thermodynamics Experiment Station, at Berkeley; and the Pacific Petroleum Experiment Station, at San Francisco. The Mineral Industries Office added the canvass of iron and steel scrap in California and Nevada to its statistical functions in 1957.

Employment and Injuries.—According to the Division of Labor Statistics and Research, California Department of Industrial Relations, in cooperation with the Bureau of Labor Statistics, United States Department of Labor, employment in all phases of the mineral industries declined during 1957, except in metal mining. Wage increases were reported throughout all parts of the industry during the year. Nonmetal mining and quarrying employees received the largest hourly increases; workers in mineral-fuel production gained more because of a slightly longer workweek. The trend toward a smaller number of disabling work injuries continued for the mineral industries as a whole but was reversed in 1957 in the mineral-fuel-production group. The safety-conscious mineral industries and their employees, assisted by improved safety programs and various State agencies, have supplied this overall increasingly better safety record.

TABLE 4.—Defense Minerals Exploration Administration contracts active during 1957

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
ALPINE					
Wm. C. Morrison & Sons.....	Valpine.....	Tungsten.....	Sept. 22, 1954	\$16,000	75
BUTTE					
Helmke, Thomas & Janssen.....	Lambert.....	Chromite.....	Dec. 17, 1954	51,474	50
FRESNO					
Vance H. Hongola.....	Obelisk.....	Tungsten.....	Dec. 8, 1955	12,000	75
HUMBOLDT					
Providence Tuolumne Gold Mines, Inc.	Copper Bluff...	Copper-zinc...	June 18, 1953	58,820	50
INYO					
Coso Uranium, Inc.....	White Swan.....	Uranium.....	Aug. 21, 1956	30,725	75
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					
California Quicksilver Mines, Inc.	Abbott.....	Mercury.....	Sept. 15, 1951	163,540	75
MADEIRA					
Climax Molybdenum Co.....	Shadow Creek..	Lead-zinc.....	May 28, 1956	100,040	50
NAPA					
Murray A. Schutz.....	Harrison.....	Mercury.....	May 2, 1956	28,540	75
NEVADA					
Idaho-Maryland Mines Corp.....	Brunswick.....	Tungsten.....	Dec. 28, 1954	118,966	75
SAN BENITO					
New Idria Mining & Chemical Co.	West Idria.....	Mercury.....	July 18, 1952	365,126	75
Do.....	do.....	do.....	Apr. 4, 1955	129,331	75
Do.....	do.....	do.....	Nov. 12, 1957	96,980	75
SAN BERNARDINO					
Owl Springs Co., Inc.....	Owl's Head.....	Manganese.....	Jan. 17, 1956	22,800	75
SAN DIEGO					
Julian Nickel Mines (MacAfee & Co.).	Friday.....	Copper-nickel-cobalt.	Mar. 12, 1956	28,800	75
SAN LUIS OBISPO					
Smith & Biaggini.....	Buena Vista.....	Mercury.....	Oct. 18, 1956	11,060	75
Frank Vollmer.....	Oceanic.....	do.....	Feb. 28, 1955	6,639	75
SANTA CLARA					
Palo Alto Mining Corp.....	Guadalupe.....	do.....	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					
The Castella Corp. (Smith & Austin).	Altoona.....	do.....	June 27, 1955	95,260	75

TABLE 5.—Estimated number of nonsupervisory personnel in the mineral industry, 1948-52 (average) and 1953-57¹

Year	Metal mining	Mineral-fuel production	Nonmetallic mining and quarrying	Total
1948-52 (average).....	3,300	25,400	5,900	34,600
1953.....	3,200	27,400	6,600	37,200
1954.....	3,000	26,800	6,400	36,200
1955.....	3,300	27,400	6,600	37,300
1956.....	2,900	26,300	7,600	36,800
1957.....	2,300	26,500	7,300	36,100

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.

TABLE 6.—Average wages and hours worked in the mineral industries, 1956-57¹

Industry	1956			1957		
	Average hourly rate	Average weekly earnings	Average hours worked per week	Average hourly rate	Average weekly earnings	Average hours worked per week
Metal mining.....	\$2.25	\$97.70	43.4	\$2.32	\$99.93	43.1
Mineral-fuel production.....	2.60	102.96	39.6	2.72	108.15	39.8
Nonmetallic mining and quarrying.....	2.49	105.24	42.4	2.61	107.33	41.1

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.

TABLE 7.—Fatal and nonfatal disabling work injuries, mineral industries, 1956-57¹

Industry	1956			1957			Disabling work injuries per thousand workers ²	
	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	1956	1957
Metal mining.....	7	443	450	9	306	315	155	137
Mineral-fuel production.....	7	1,696	1,703	7	1,803	1,810	65	68
Nonmetallic mining and quarrying.....	5	447	452	9	377	386	59	53
Total.....	19	2,586	2,605	25	2,486	2,511	71	70

¹ California Department of Industrial Relations, Division of Labor Statistics and Research: California work injuries, 1957.

² A disabling work injury is defined as one that causes disability beyond the day of the accident.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—Lignite was mined near Ione, Amador County, for nonfuel use. Production dropped substantially below 1956. The entire output was processed nearby to extract montan wax and other constituents.

Natural Gas.—Marketed production of natural gas in California during 1957 dropped very slightly under that in 1956. Of the 502,572 million cubic feet produced, 30 percent originated in dry-gas fields

and 70 percent from oil wells. Receipts of natural gas from West Texas and New Mexico increased to 641,772 million cubic feet and thus constituted 56 percent of the total consumption in the State in 1957. These receipts totaled 15 percent more than in 1956 and 80 percent more than in 1953. Additional pipeline construction was underway during the year; it has been predicted that, by the end of 1958, daily receipts from out of State may approach 120 percent of the 1957 average. The increase in demand during the past 5 years, broken down by principal consumers, is shown as follows: By gas companies, domestic and consumer sales up 30 percent, industrial sales up 25 percent; by steam-electric generating plants, up 60 percent; and by oil and gas producers (own requirements), up 9 percent.

TABLE 8.—Natural gas, natural-gas liquids, and petroleum produced in 1957, by counties

County	Marketed natural gas		Natural-gas liquids				Petroleum	
			Natural gasoline and cycle products		LP-gases from plants			
	Million cubic feet ¹	Value (thousand dollars) ²	Thousand gallons	Value (thousand dollars)	Thousand gallons	Value (thousand dollars)	Thousand 42-gallon barrels	Value (thousand dollars)
Butte.....	8, 807	2, 228						
Colusa.....	614	155						
Contra Costa.....	1, 664	421						
Fresno.....	33, 329	7, 245	78, 486	7, 571	36, 363	1, 901	34, 459	111, 089
Glenn.....	17, 964	4, 545						
Humboldt.....	2, 087	528						
Kern.....	86, 022	18, 854	192, 348	18, 554	89, 116	4, 657	91, 508	273, 746
Kings.....	9, 187	2, 069	16, 905	1, 631	7, 833	409	2, 103	7, 171
Los Angeles.....	84, 086	18, 307	196, 140	18, 920	90, 873	4, 749	81, 573	251, 984
Madera.....	2, 760	698						
Monterey.....	4, 229	918					11, 845	23, 659
Orange.....	33, 339	7, 234	79, 332	7, 653	36, 755	1, 921	39, 812	120, 353
Riverside.....							3	(³)
Sacramento.....	42, 325	10, 708						
San Benito.....	427	92					521	(³)
San Bernardino.....	63	14					171	(³)
San Joaquin.....	13, 104	3, 315						
San Luis Obispo.....	1, 442	313	3, 427	331	1, 588	83	2, 331	7, 952
San Mateo.....	35	8					189	(³)
Santa Barbara.....	25, 568	5, 716	49, 760	4, 800	23, 054	1, 205	27, 895	84, 313
Solano.....	32, 612	8, 251						
Sonoma.....	99	25					(⁴)	(⁵)
Sutter.....	1, 388	351						
Tehama.....	835	211						
Tulare.....	6, 880	1, 741					60	(⁵)
Ventura.....	96, 810	21, 059	226, 980	21, 895	105, 161	5, 496	46, 530	150, 128
Yolo.....	2, 316	586						
Undistributed.....							646	5, 525
Total.....	⁴ 502, 572	⁵ 114, 416	843, 378	81, 355	390, 743	20, 421	339, 646	1, 035, 920

¹ California Department of Natural Resources, Division of Oil and Gas figures instead of Federal Bureau of Mines figures, which are incomplete.

² Preliminary figures.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Less than a thousand 42-gallon barrels.

⁵ Does not include volume and value of gas blown to air for which the distribution by county is unknown.

The Rio Vista field, largely in Sacramento County, was by far the leading gas producer in the State and yielded about 3.5 times the volume that was obtained from the Beehive Bend-Willows area in Glenn County. The Beehive Bend area was the most active in develop-

ment; 17 new wells brought the total in this field to 49. Only three new gasfields were discovered in 1957, in Butte, Colusa, and San Benito Counties. The Arbuckle field appeared to be the most significant of the 3, and 11 wells had been completed by the end of the year.

At the end of the year 569 wells were producing at dry-gasfields, including 58 wells completed in 1957. According to the American Gas Associations report, natural-gas reserves in the State gained 2.3 percent during the year. When corrected to the standard California measurement base of 14.73 pounds per square inch, the reserve volume was 8,904,279 million cubic feet. In natural-gas reserves California ranked sixth in the United States yet had less than 4 percent of the total national reserve. To meet peak demands, four large storage reservoirs were in use in southern California—La Goleta, Montebello, Playa Del Rey, and Brea Olinda. Studies were underway during the year for such storage facilities in the San Joaquin and Sacramento Valley areas.

Natural-Gas Liquids.—The production of natural-gas liquids dropped 5 percent in 1957 to a daily average of 3,380,000 gallons. The total value of the liquids production was also less than in 1956 by almost 4 percent. Natural gasoline constituted 68 percent of the total production of liquids in 1957.

Sales of liquefied-petroleum gas dropped 3 percent below the 1956 figure to 375 million gallons in California. This was the first drop in sales in several years and resulted from wider availability of the cheaper natural gas. This decrease was roughly equivalent to the drop in sales to domestic household customers.

The comparatively new crude-oil secondary-recovery technique known as the "miscible slug" used almost 12 million gallons of LP-gas in California in 1957. Three such miscible-gas tests were in progress after the first test in Kern County in 1956. At the end of the year LP-gas inventory was about 47 million gallons, a 42-percent increase from December 1956. Natural-gasoline stocks reached 33 million gallons—3 percent higher than a year earlier. An underground liquefied-gas-storage experiment proved its feasibility; and this technique, in use at several points in the United States, was expected to become more popular in California. The natural-gas liquid reserve dropped about 2 percent during the year to 305 million barrels.

Peat.—The quantity of California 1957 peat produced for use as a soil conditioner rose 90 percent above 1956. Most of the output came from the San Joaquin River Delta near Brentwood, Contra Costa County, but some production was also reported from Jess Valley, Modoc County, and the Huntington Beach area, Orange County.

Petroleum.—California crude-oil production has fallen far short of its refinery requirements every year since World War II. For the fourth consecutive year petroleum production dropped. In 1957 the drop was 3 percent or 30,000 barrels a day. Daily production averaged 930,000 barrels, but refinery throughput was 1,149,000 barrels. Crude-oil production declined despite continued exploration. By virtue of sizable increases in crude-oil prices late in 1956 and early 1957, the value of the year's output rose 13 percent to exceed \$1 billion for the first time. Although 12 California counties yielded significant volumes of crude petroleum, Kern and Los Angeles Counties,

furnished more than half of the 1957 output. Three of the 231 producing fields in the State—Wilmington, Ventura, and Huntington Beach—yielded 208,000 barrels a day, 22 percent of the total.

Because of the shortage of domestic crude, most California wells were producing at the maximum efficient rate during most of 1957 except for Elk Hills, where the Navy had a reserve production of about 57,000 barrels per day shut in. There was a large increase in crude-oil shipments—45 percent over 1956—into the Pacific Coast area, where California has 92 percent of the refining capacity. Concurrently there was an unexpected drop in demand for petroleum products during the latter half of the year—7 percent under the same period in 1956, contrasted with the expected rise of 3 to 5 percent. A large part of the decline was supplied by residual fuel-oil sales. Gasoline demand approximated the predicted increase of 2.5 percent over 1956. Part of the drop in fuel-oil sales was attributed to wider use of natural gas, which cut into former liquid-fuel markets of the Northwest to the extent of 20,000 barrels of fuel oil per day.

By the end of 1957 the combined effect of the great increase in receipts from out of State and the drop in demand caused the highest inventory of petroleum products on the Pacific coast since the war (148 million barrels contrasted with 112 million on December 31, 1956). Because of this glut of petroleum products, some small refiners faced at least a temporary shutdown until the inventory situation improved. Concurrently, high stocks forced some producers to shut in crude-oil production and caused a serious threat to the crude-oil price structure.

Exploratory wells drilled during the year totaled 584—4 percent less than the last 5-year average. These resulted in 76 productive oil wells and 15 gas wells for a successful completion record of 16 percent (compared with 19 percent successful completions during 1956). The above exploratory wells included 239 wildcats drilled in virgin areas. This drilling program discovered 3 new gasfields and 6 new oilfields—apparently none of major importance—a discovery rate of a new field for every 26 dry holes drilled as “new-field” wildcats; in this respect, the California record was only about 31 percent as good as the national average of a new oil discovery for every 8 dry holes.

These discoveries added 15 million barrels to the reserve; however, this volume, along with extensions and revisions of existing fields, was so much less than production that total crude-oil reserves dropped 11.6 million barrels during the year to 3,760 million barrels. At the end of 1957 the State had 37,018 producing wells, with an average daily output of 25.1 barrels per well, compared with 35,990 wells producing 26.6 barrels per day a year earlier.

In California (as in other oil-producing States) the continuing rise in costs of finding and producing crude oil has encouraged the use of supplemental recovery methods to increase the ultimate yield from producing fields. During 1957 the number of active secondary-recovery projects was increased by 11, to a total of 105. Of these, 57 used waterflood techniques, 40 were gas-injection projects, and 8 used a combination of gas and water. Three companies experimented with “miscible-gas” or liquefied-petroleum-gas injection. During recent years there have been three “fire-flood” thermal-recovery tests, using in-place combustion controlled by pumping superheated air into

the oil formation. These trials have been in the South Belridge and Midway-Sunset fields, Kern County, and the Ojai field, Ventura County. One test has been described as very successful, but, at the end of the year, one had been abandoned and another shut in temporarily.

Surface subsidence in the harbor area of Los Angeles and Long Beach continues to threaten oil production. Wilmington (its oil production has been exceeded by only three other fields in the United States) has long been troubled with subsidence; in 1 area this has exceeded 20 feet. Producers in the field planned a multimillion-dollar repressuring project, and the State passed special legislation providing for necessary remedial measures. The leasing of State-owned tidelands was discontinued early in 1957, pending revision of the tidelands-leasing act by the California legislature. Resumption of offshore leasing under the new act was expected in 1958. There was particular interest in the area between Concepcion and Elwood, offshore from the old Capitan and Elwood oilfields, a few miles west of Santa Barbara.

There was no major refinery construction, but, the crude-oil capacity of the 44 plants increased about 5 percent during 1957 to 1,334,000 barrels a day. About 7 percent of available capacity was shut down at the year end. Several California firms have announced refinery-expansion plans totaling 19,000 barrels of crude oil a day. Projected plans for new plants in Washington and Oregon are roughly six times this figure. Refined products from these new refineries will compete to some extent with California refinery output.

NONMETALS

Asbestos.—The tonnages of crude asbestos mined and shipped were 50 and 47 percent greater, respectively, than in 1956. However, the total output was small, and only two properties were active. One producer mined amphibole asbestos from an open pit in Inyo County and shipped a small tonnage of shorts to a local buyer. Chrysotile asbestos was mined from an open pit in Napa County and conditioned for use as a cement additive. The Federal Bureau of Mines initiated exploration at a Shasta County chrysotile-asbestos deposit under a program to determine the potential of the State's principal asbestos occurrences.

Barite.—California mine output of crude barite in 1957 was more than 500 percent above that in the preceding year. The major output was derived from deposits in Tulare County; smaller tonnages came from San Bernardino and Nevada Counties. The quantities sold or used dropped about 50 percent, and mine stocks of crude barite rose slightly. The tonnage of crude material received and ground at California grinding plants decreased nearly 35 percent, and the stock of crude barite, at plants was higher by about 5 percent, compared with 1956. The end stock of ground barite at plants increased nearly 63 percent. In Alameda, 3 grinding plants were operated, 2 in Los Angeles, and 1 each in Fresno, Kern, Merced, Sacramento, and Stanislaus Counties. Some producers ground their own crude barite; others purchased it for grinding; and a few ground the material on a

custom basis. Approximately 83 percent of the total ground barite in 1957 was used as a constituent in well-drilling fluids; the tonnage was 18 percent less than in 1956. A modest quantity of ground barite was used in glass, ceramics, and glazes and as a filler in paint and asphalt emulsions. Appreciable quantities of crude barite were consumed in producing various barium chemicals.

Boron Minerals and Compounds.—The bedded deposits of kernite and borax (tincal) in Kern County, of colemanite in Inyo County, and the brines of Searles Lake in San Bernardino County were the sources in 1957 of the entire United States supply (and a high percentage of the world supply) of boron compounds. Although the 1957 output was only slightly more than in 1956, that in 1958 was expected to increase substantially. Of the various compounds produced, only the output of sodium tetraborate declined compared with the preceding year. The quantity and value of the combined production in 1957 exceeded 1956 by 5 and 14 percent, respectively. The Pacific Coast Borax Division, United States Borax & Chemical Corp., the major producer, worked open-pit and underground mines in Inyo and Kern Counties and treated the mined boron material at refineries in Kern and Los Angeles Counties. The Boron open pit and refinery produced for the first time in 1957. Mining at the Boron pit was begun in May. It was 137 feet deep upon completion of stripping the more than 7 million tons of overburden. The refinery was officially opened November 13. At Searles Lake, San Bernardino County, American Potash & Chemical Corp. and West End Chemical Division, Stauffer Chemical Co., recovered boron compounds from the lake brines. The Stauffer Chemical Co., in San Francisco County, recovered boric acid (commercial and anhydrous grades) from purchased crude borates produced in Kern County. The company completed a 50-percent increase in capacity of its San Francisco facilities in November. The California Borate Co. closed down its Western Borax mine near Boron, Kern County, after 2½ years of development work. As a part of its investigations of saline deposits, the Federal Geological Survey completed five deep coreholes in the Kramer area east of Boron, Kern County. The test holes augmented the 4½-year Government program to pinpoint surface and underground deposits yielding boron minerals. Cores were logged from 41 holes drilled during the latter half of 1954 in saline deposits near Searles Lake, San Bernardino County.

Bromine and Bromine Compounds.—Elemental bromine was recovered from Searles Lake brines, San Bernardino County. Production increased about 9 percent; the unit price remained substantially the same. The liquid bromine was shipped to chemical plants and processed into various bromine compounds. Nearly the entire production was used in making antiknock gasoline. Small quantities were used in making space (methyl bromide) and soil (dibromochloropropane) fumigants. Small quantities were consumed in pharmaceuticals and photography. Ethylene dibromide was manufactured from bromides recovered in processing salt-works bitterns at Newark, Alameda County.

Calcium Chloride.—California's entire production of calcium chloride in 1957 was recovered from Bristol Lake brines, San Bernardino County. One plant near Saltus and another near Amboy produced liquid calcium chloride. A third plant (also near Amboy)

purchased the liquid chloride and prepared the flake product. The output of both liquid and flake material was about 22 percent less than in 1956; the average value per ton was higher by nearly 7 percent. Most of the 1957 production was sold in southern California, Nevada, and Arizona and used in treating seaweed and metal ores, and by the cement industry. It was also used for dust control and in refrigeration.

Cement.—Despite a 17-percent increase in the annual capacity of California cement plants in 1957, production decreased 3 percent, and shipments decreased about 4 percent from the alltime high of 1956. The decline was attributed to a depressed building industry that was responsible for a 7-percent reduction in construction employment in the Los Angeles–Long Beach area in 1957. However, increased labor costs brought about a 2-percent rise in the unit value of cement. Eight of the 13 cement plants in operation during the year were in southern California. The southern plants provided 56 percent of the State output, but their production was down 6 percent from 1956. By comparison, output from the 5 northern plants increased 1 percent.

A new wet-process plant near Lucerne Valley, San Bernardino County, began producing and marketing in the southern California area in May. The Riverside Cement Co. (plants at Crestmore, Riverside County, and Oro Grande, San Bernardino County) merged with Hercules Cement Corp. in Pennsylvania and Peerless Cement Corp. in Michigan to form the American Cement Corp., and became a division of that corporation. The grinding capacity of the Oro Grande plant was expanded during the year. One cement producer established a distribution facility at Broderick on the Sacramento River, Yolo County. Bulk cement was barged from the company plant at Redwood City, San Mateo County, to the new terminal for distribution to central and northern California consumers. The numbers of kilns at a Kern County cement plant, near Mojave, was increased from 2 to 5. Another producer at Davenport, Santa Cruz County, increased the number of its kilns from 7 to 9.

TABLE 9.—Finished portland cement produced, shipped, and in stock, and estimated consumption, 1948–52 (average) and 1953–57

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	Average per barrel		
1948–52 (average).....	11	31,530	26,720	26,558	\$67,535,000	\$2.54	22,915	1,270
1953.....	11	35,220	32,145	32,002	90,873,000	2.84	27,733	1,726
1954.....	11	35,845	32,599	32,762	98,251,000	3.00	29,761	1,563
1955.....	11	37,173	35,450	35,084	103,794,000	2.96	31,643	1,929
1956.....	12	42,882	39,547	39,290	120,511,000	3.07	35,872	2,180
1957.....	13	50,150	38,371	37,731	117,852,000	3.12	33,388	2,812

Clays.—Producers of clays in California consumed about 77 percent of the total output, which declined moderately below 1956. The heavy-clay-products industry used 50 percent of the total; cement manufacturing consumed 25 percent; and 13 percent was bloated for

lightweight aggregate. The remaining 12 percent was used in other industrial processes. Despite the overall production decline in 1957, the output of fire and stoneware clays increased 9 percent and china clay, 5 percent. Producers of bentonite increased their output over 400 percent owing to the local demand for its use in preparing drilling muds. Compared with the 1956 output, the major production decreases were: Ball-type clay, 23 percent; miscellaneous clays and shale, 13 percent; fuller's earth, 11 percent; and clay for use in cement, 10 percent.

Deposits in Los Angeles, Placer, and Riverside Counties were the source of 67 percent of the clays produced for use in heavy clay products, although 17 other counties yielded clay of this type. Producers in 7 counties supplied clays used in cement; however, 67 percent of the total was obtained in Calaveras, Riverside, and San Mateo Counties. Solano, Marin, and Ventura Counties yielded all the clays bloated for lightweight aggregate. Clays used in the refractories industry were mined in 5 counties; Amador and Riverside Counties, together yielded 86 percent. Approximately 90 percent of the clays (chiefly bentonitic clays) used in preparing drilling muds came from Kern County—the remainder from San Benito and Ventura. Wall- and floor-tile manufacturers obtained 60 percent of their clays from San Bernardino County; however, Alameda, Amador, and Riverside Counties contributed to the total. Deposits in 7 counties were the source of clays used for pottery and stoneware; 77 percent came from Kern and Riverside Counties. All clays used for filtering and clarifying purposes were mined in Inyo and San Bernardino Counties. Producers in Amador, Inyo, and Mono Counties supplied 86 percent of the clays used for various filler purposes; the remainder came from Kern and Los Angeles Counties.

TABLE 10.—Clays produced in 1956–57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Amador.....	235, 830	\$764, 963	(1)	(1)
Calaveras.....	173, 643	228, 580	(1)	(1)
Contra Costa.....	76, 621	116, 100	(1)	(1)
Inyo.....	9, 894	57, 499	(1)	(1)
Kern.....	130, 986	309, 754	102, 575	\$341, 281
Los Angeles.....	475, 528	593, 144	518, 657	650, 225
Orange.....	49, 210	197, 180	‡ 42, 465	‡ 108, 121
Riverside.....	461, 275	1, 164, 210	423, 406	1, 185, 557
San Bernardino.....	46, 541	218, 803	‡ 36, 087	‡ 197, 613
San Diego.....	40, 885	40, 885	42, 072	42, 072
San Joaquin.....	35, 331	44, 164	(1)	(1)
San Luis Obispo.....	(1)	(1)	9, 200	11, 500
Santa Barbara.....	9, 982	9, 982	6, 844	6, 844
Stanislaus.....	3, 937	12, 795	1, 143	4, 000
Tulare.....	7, 600	9, 500	6, 750	5, 000
Undistributed ¹	1, 225, 332	2, 369, 958	1, 538, 981	3, 211, 787
Total.....	2, 981, 595	6, 137, 517	‡ 2, 728, 180	‡ 5, 764, 000

¹ Alameda, Amador (1957), Calaveras (1957), Contra Costa (1957), Fresno, Inyo (1957), Marin, Mono (1956), Placer, Sacramento, San Benito, San Joaquin (1957), San Luis Obispo (1956), San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Sutter, Ventura, and Yuba Counties included with "Undistributed" to avoid disclosing individual company confidential data.

² Excludes kaolin that cannot be revealed.

Diatomite.—Most of California's 1957 diatomite production was obtained from open pits in Santa Barbara County, but substantial tonnages were mined at pits in Los Angeles and Napa Counties. Nearly all of the Napa County output was used in pozzolanic cement. More than half of the State yield was consumed in preparing filter aids; however, large quantities of the processed material were used as filler in paper and rubber products, as lightweight aggregate, for insulation, as an extender in paints and fumigants, and in desiccants. Despite a greater diatomite output compared with 1956, the total value of the production declined, owing to the relatively higher percentage of lower quality products sold in 1957.

Feldspar.—California feldspar production in 1957 declined below 1956 in both quantity and value. Feldspar concentrate recovered by flotation from dune sands in Monterey County decreased compared with 1956, but sales of the ground material increased. The ground product was used principally in glass and ceramics. The quantity of crude feldspar mined by open pit near Kramer Junction in San Bernardino County and ground for refractory use in Los Angeles County was virtually the same as in 1956.

Fluorspar.—The only fluorspar production in California during the year came from a deposit in the Clark Mountain area, San Bernardino County. A small tonnage of crude fluorspar was mined and milled, and a few tons of Acid-grade spar was obtained. California metallurgical fluorspar requirements in 1957 were met by shipments from Nevada mines and from Mexico.

Gem Stones.—The activities of many gem clubs and societies in California increased during 1957, and San Bernardino County continued to be the popular source of a variety of materials for members of these organized groups. Substantial quantities of agate, jasper, obsidian, onyx, rhodonite, and jadeite were gathered in the State for private collections or for sale through commercial outlets. Creek beds in Mendocino and San Benito Counties and a beach cove in Monterey County were sources for collectors seeking jadeite. Other gem materials found in California counties included idocrase (californite) from Butte, Del Norte, and Siskiyou; opalized wood from El Dorado; geodes from Riverside and Santa Clara; turquoise and malachite from San Bernardino; and petrified whalebone from Santa Cruz County. The Pala and Ramona areas of San Diego County were sources of small but valuable quantities of tourmaline, kunzite, beryl, lepidolite, smoky quartz, topaz, and spessartite.

Gypsum.—The 1957 production of crude gypsum and gypsite declined from the 1956 alltime high by 9 percent in tonnage and 12 percent in value. Twelve mines were active. Imperial County continued to be the chief producer, and Kern County ranked second. Other producing counties were Riverside, Kings, Ventura, San Luis Obispo, and Merced. Imports for consumption originated at San Marcos Island in the Gulf of California, Mexico, and gypsum was shipped into California for consumption from a quarry near Henderson, Nev. Of the total tonnage produced (including byproduct gypsum) 46 percent (703,353 tons) was sold uncalcined. The calcined tonnage was estimated at 807,000 tons. Ninety percent of the uncalcined product was sold for agricultural use and 10 percent as

cement retarder. The calcined product went into plasters, wall-board, sheathing, and lath at six California plants.

The United States Gypsum Co. continued as by far the leading producer at quarries in the Fish Creek Mountains, Imperial County, and near Midland, Riverside County. Other producers were H. M. Holloway, Lost Hills, Kern County; C. L. Fannin Agricultural Gypsum Co., Wasco, Kern County; The Temblor Gypsum Co., McKittrick, Kern County; the Monolith Portland Cement Co., Cuyama, Ventura County, and the Superior Gypsum Co., Simmler, San Luis Obispo County. The Westvaco Mineral Products Division continued to recover byproduct synthetic gypsum at its bitterns-magnesia plant in Newark, Alameda County.

Iodine.—A chemical plant near Compton, Los Angeles County, and another in Seal Beach, Orange County, recovered crude iodine and produced potassium iodide from waste oil-well brines of the Los Angeles Basin. The Compton plant also produced sodium iodide and potassium and calcium iodate. A large quantity of the crude iodine was converted to these various salts but the production was sold mostly in the crude form to manufacturers of chemicals and pharmaceuticals. The 1957 output declined in both quantity and value below 1956, owing chiefly to competition from imports.

Iron Oxide Pigments.—The C. K. Williams Co. continued during the year as the only manufacturer of iron oxide pigments in California at its plant in Alameda County. About two-thirds of the production was synthetic and was derived from treating scrap steel with sulfuric acid and caustic soda. The remaining third was produced by calcining limonite from the company mine in northwestern Oregon. The tonnage sold was slightly less than in 1956; the value was slightly higher.

Lime.—The production of lime in California during 1957 rose nearly 8 percent above 1956. The major increases were in the quantities consumed for chemical and industrial uses, including plants producing magnesium compounds from sea water. A slight increase was noted in the tonnage of hydrated lime produced for agricultural use. The production of both quick and hydrated lime sold to manufacturers of refractories and to the building trades declined. Rotary kilns and continuous hydrators were operated by producers in El Dorado, Monterey, San Bernardino, and Tuolumne Counties. The Tuolumne County plant also had shaft-type kilns in operation. The average value of California's total lime output dropped a few cents per ton below that of 1956.

Lithium Compounds.—Crude dilithium-sodium phosphate was recovered from the brines of Searles Lake, San Bernardino County, for the 20th consecutive year. The crude phosphate was converted to finished lithium carbonate and marketed as such.

Magnesium Compounds.—The output of magnesium compounds in California (the major source of the domestic supply) rose 13 percent in quantity and 17 percent in value compared with 1956. The production of caustic-calcined magnesia was substantially the same as in the preceding year, but the output of refractory magnesia was appreciably higher. Sales of the chloride and trisilicate of magnesium carbonate increased; but the quantities of magnesium hydroxide and U. S. P. and Technical-grade magnesia sold declined slightly. A

plant in Monterey County and a San Mateo County producer obtained magnesium compounds from sea water using a calcined limestone-dolomite mixture. One company used dolomite to extract magnesium compounds from sea-water bitterns, purchased from a salt company, at a plant in Alameda County. It produced magnesium chloride directly from sea water at another plant in San Diego County. In Alameda County, one producer used magnesite and brucite produced in Nevada to make hydrous magnesium sulfate, and another made magnesium carbonate from magnesium hydroxide purchased locally. No magnesite was produced in California in 1957.

Mica.—Imperial County was the source of the entire State mica (sericite schist) production during 1957; a test shipment was made from a deposit near Quincy, Plumas County, to a grinder in Fresno County to determine possible use. One Imperial County producer prepared mica schist for use in manufacturing roofing paper; another producer wet-ground the material for an extender in paint. A Los Angeles County processing plant prepared scrap mica imported from India and mica purchased in Arizona for roofing materials.

Perlite.—Deposits in Inyo, Napa, and San Bernardino Counties were the source of the State 1957 output of crude perlite. The tonnage of crude perlite produced was virtually the same as in 1956, but the average value dropped over \$1 per ton. Inyo County crude material was expanded at plants in Los Angeles County. Most of the perlite produced at the Napa County deposit was expanded at a plant operated by the producer at the quarry site; however, a modest tonnage was shipped to a wallboard plant in Los Angeles County. Crude perlite from San Bernardino County was shipped to various expanding plants in California and one in southwestern Nevada. Expansion plants were also operated in Contra Costa, Fresno, Marin, and Riverside Counties; however, nearly 75 percent of the total crude perlite processed in California was treated at plants in the Los Angeles area. Nevada mines were the source of more than 50 percent of the crude mineral expanded at these plants. Approximately 64 percent of the expanded material was used in plaster aggregate; smaller quantities were consumed as filter aids, concrete aggregate, soil conditioners, insulation, and for various filler uses.

Potassium Salts.—One plant in San Bernardino County was the source of the entire State production of potassium compounds recovered from dry-lake brines. In December the company completed an expansion program that doubled the plant's granular potash capacity. The plant products were muriate of potash (potassium chloride) and potassium sulfate, which was converted from the muriate. Only the Chemical-grade muriate was produced because of the demand for a product comparatively free of calcium and magnesium salts for use in manufacturing other potassium compounds, particularly potassium hydroxide. The year-to-year demand by the chemical industry for muriate of potash is quite stable, and the 1957 output and average market value were but slightly higher than in 1956.

A moderate tonnage of flue-dust accumulations from a cement plant in Santa Cruz County was used by the fruit industry to improve soil, because it contained potassium sulfate.

Pumice, Pumicite, and Volcanic Cinder.—The limited yield of volcanic cinder in San Bernardino and Siskiyou Counties, for use as railroad ballast, was the principal reason for the decline in the total output of pumice, pumicite, and volcanic cinder. The ballast material from these counties and from Modoc County comprised 61 percent of the total output in 1957. About 27 percent was used as concrete aggregate; 6 percent, in road paving and fill; 5 percent, for scouring blocks, pesticide diluent, insulation and acoustic plaster; and less than 1 percent, for all other purposes. Split-stone pumice blocks were produced in Fresno County for fireplace facings, planters, and wall veneer, and a producer in Inyo County prepared colored pumice granules for landscaping.

TABLE 11.—Pumice ¹ sold or used in 1957, by counties

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Fresno.....	482	\$3,171			482	\$3,171
Inyo.....	3,758	7,516	78,963	\$337,593	82,721	345,109
Madera.....	493	1,108	(2)	(2)	(2)	(2)
Modoc.....	45,980	84,603	(2)	(2)	(2)	(2)
Mono.....	(2)	(2)	19,299	(2)	21,499	(2)
San Bernardino.....	(2)	(2)	500	5,000	(2)	(2)
Shasta.....	7,332	14,437			7,332	14,437
Siskiyou.....	226,866	417,860	16,394	52,623	243,260	470,483
Other counties ²	30,139	39,397	28,883	546,823	103,795	676,931
Total.....	315,050	568,092	144,039	942,039	459,089	1,510,131

¹ Includes pumicite and volcanic cinder.

² Imperial, Kern, Lake, Lassen Counties and parts of Madera, Modoc, Mono, and San Bernardino Counties are included with "Other counties" to avoid disclosing individual company confidential data.

Pyrite.—The Mountain Copper Co. of California continued through 1957 to be the only producer of pyrite in the State from its Hornet mine in Shasta County. The production was slightly higher than in 1956, but the shipments of this output which went to two sulfuric acid plants in Contra Costa County were substantially less. The pyrite cinder produced at these plants was used as an additive in portland cement.

Salt.—Despite an 8-percent decline in the quantity of salt produced in California during 1957, the value of the production rose about 15 percent above that in 1956. More than 80 percent of the total output was obtained from sea water by evaporation; a high percentage was extracted at plants in the San Francisco Bay area. More than 70 percent of the State salt yield is normally produced by solar evaporation on a 3-year cycle; the 1957 output was retarded by the very wet weather during the fall and winter of 1954-55. The increase in total value in 1957 was due to the relatively larger quantities of higher purity products compared with 1956. Although slightly greater tonnages were used by dairies, bakeries, and groceries in domestic consumption, the major increases were in the quantities of these grades sold for export. California produced and shipped salt to eight States, Alaska, and the Pacific Islands possessions and exported to consumers in Canada, Mexico, Central America, the Philippine Islands, Thailand, and Japan. Operators in Kern and San Bernardino Counties produced salt from dry-lake brines, and the State's only producer of rock salt mined halite at its open pits in

San Bernardino County. While much of the rock salt was shipped to Nevada for chlorine manufacture and to Arizona, some of it and the salt from dry-lake brines were consumed in the State, primarily at chemical, ice, cold storage and water-softening plants.

Sand and Gravel.—The production of sand and gravel for commercial sale in 1957 declined nearly 10 percent below 1956 figures owing to the moderate recession in building during the year. However, the rise in Government-and-contractor output of these materials was due to the activity in flood-control projects by the United States Army Corps of Engineers, construction of dams by the Federal Bureau of Reclamation, and continued progress on the roadbuilding program of the California Division of Highways. The State road projects received additional aid under the new Federal Highway Program, but the actual work was limited to advanced planning and the acquisition of land necessary to complete the program. In 1957 large tonnages of sand were produced and used in sections of the connecting freeways for Madera, Tulare, Ventura, and Orange Counties. The demand for industrial sands, including molding, blast, and engine sands, was greater than in 1956. The quantity of glass sand credited to the State's total sand and gravel output was appreciably lower, due to a change by the Bureau of Mines in the method of classifying marketable feldspathic sands produced in Monterey County, the State output of feldspar was correspondingly higher.

TABLE 12.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	17,466,618	\$15,102,500	24,921,199	\$21,147,981	42,387,817	\$36,250,481
1953.....	22,129,931	21,232,885	36,299,597	31,991,318	58,429,528	53,224,203
1954.....	25,094,671	25,655,359	45,429,941	42,483,219	70,524,612	68,138,578
1955.....	25,506,919	26,856,865	39,371,729	39,963,495	64,878,648	66,820,360
1956.....	¹ 30,564,122	¹ 35,492,384	55,882,484	61,033,878	¹ 86,446,606	¹ 96,526,262
1957.....	32,830,673	34,134,241	46,193,764	52,895,888	79,024,437	87,030,129

¹ Revised figure.

Slate.—Only two slate quarries were active in 1957. Dimension slate for flagging was produced in Mariposa County. Quantity output exceeded the 1956 figures by more than 15 percent at a slightly lower unit value. The Chili Bar operation, El Dorado County, was sold to Placerville Slate Products Co. The entire 1957 production from this quarry was crushed and sold for use as roofing granules. Reduced demand for the granules by the building industry supplied the substantially lower tonnage as compared with the output of recent years.

Sodium Compounds.—A high percentage of the State's 1957 production of sodium compounds was recovered from Searles Lake brines at Trona and West End, San Bernardino County. An important tonnage of soda ash and trona was obtained from dry-lake brines at Bartlett, Inyo County, and a smaller quantity of salt cake was produced in the processing of borate minerals mined from the Kramer deposit, Kern County. The output of trona and salt cake increased

TABLE 13.—Sand and gravel sold or used by producers 1956-57, by commercial and Government-and-contractor operations and by uses

	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Glass.....	¹ 613, 649	\$1,790, 470	\$2.92	409, 391	\$1, 693, 564	\$4.14
Molding.....	(?)	(?)	(?)	121, 534	187, 171	1.54
Building.....	16, 912, 937	19, 088, 591	1.13	15, 393, 932	17, 585, 135	1.14
Paving.....	7, 247, 940	7, 614, 506	1.05	6, 573, 041	6, 666, 490	1.01
Blast.....	145, 170	480, 245	3.31	200, 759	699, 531	3.48
Engine.....	50, 575	98, 838	1.95	101, 181	208, 526	2.06
Filter.....	¹ 69, 496	105, 315	1.52	61, 933	58, 421	.94
Other ²	3, 453, 208	4, 366, 865	1.26	3, 699, 091	3, 217, 961	.87
Total.....	¹ 28, 492, 975	¹ 33, 544, 830	1.18	26, 560, 862	30, 316, 799	1.14
Gravel:						
Building.....	17, 030, 375	21, 337, 879	1.25	16, 061, 984	20, 607, 123	1.28
Paving.....	18, 633, 827	22, 543, 075	1.21	14, 235, 511	16, 955, 746	1.19
Railroad ballast.....	343, 495	304, 369	.89	(?)	(?)	(?)
Other ²	9, 388, 547	7, 651, 486	.81	4, 077, 254	4, 404, 461	1.08
Total.....	45, 396, 244	51, 836, 809	1.14	34, 374, 749	41, 967, 330	1.22
Total sand and gravel.....	¹ 73, 889, 219	¹ 85, 381, 639	1.16	60, 935, 611	72, 284, 129	1.19
GOVERNMENT-AND-CONTRACTOR OPERATIONS ³						
Sand:						
Building.....	810, 971	951, 811	1.17	1, 113, 970	758, 536	.68
Paving.....	1, 260, 176	995, 743	.79	5, 155, 841	3, 058, 906	.59
Total.....	2, 071, 147	1, 947, 554	.94	6, 269, 811	3, 817, 442	.61
Gravel:						
Building.....	824, 508	1, 332, 287	1.62	1, 963, 823	1, 809, 161	.92
Paving.....	9, 661, 732	7, 864, 782	.81	9, 855, 192	9, 119, 397	.93
Total.....	10, 486, 240	9, 197, 069	.88	11, 819, 015	10, 928, 558	.92
Total sand and gravel.....	12, 557, 387	11, 144, 623	.89	18, 088, 826	14, 746, 000	.82
ALL OPERATIONS						
Sand.....	¹ 30, 564, 122	¹ 35, 492, 384	1.16	32, 830, 673	34, 134, 241	1.04
Gravel.....	55, 882, 484	61, 033, 873	1.09	46, 193, 764	52, 895, 888	1.14
Grand total.....	¹ 86, 446, 606	¹ 96, 526, 262	1.12	79, 024, 437	87, 030, 129	1.10

¹ Revised figure.² Figure withheld to avoid disclosing individual company confidential data; included with "Other."³ Includes figures for State, counties, municipalities and other Government agencies.

compared with 1956 figures, but the production of soda ash and glauber salt declined. The overall unit value of sodium compounds rose very slightly owing to higher operational costs in 1957.

Stone.—The large number of heavy-construction projects in progress during 1957 were the chief reasons for the 27-percent increase in output above the 1956 figure. Much of this increase was credited to the quantities of crushed and broken granite produced and used as fill at the Courtright and Wishon Dams, Fresno County, by contractors for Pacific Gas & Electric Co., and at the Trinity Dam, Trinity County, by contractors for the Federal Bureau of Reclamation. An appreciable tonnage of dimension granite was produced in San Diego County and used in the construction of the Los Angeles County Court House.

TABLE 14.—Production of sand and gravel in 1957, by counties

County	Short tons	Total value
Alameda.....	6,881,916	\$8,382,005
Alpine.....	13,000	17,560
Amador.....	218,412	651,984
Butte.....	533,212	588,652
Calaveras.....	96,524	335,557
Colusa.....	246,399	193,814
Contra Costa.....	435,479	379,834
Del Norte.....	479,639	429,995
El Dorado.....	277,231	289,059
Fresno.....	1,433,981	1,633,781
Glenn.....	433,251	351,052
Humboldt.....	1,595,312	1,530,941
Imperial.....	618,689	438,654
Inyo.....	163,855	134,304
Kern.....	895,669	1,282,914
Kings.....	588,027	300,856
Lake.....	149,888	126,479
Lassen.....	58,725	65,688
Los Angeles.....	19,536,601	21,996,249
Madera.....	1,159,920	818,618
Marin.....	37,238	45,670
Mariposa.....	59,112	96,652
Mendocino.....	1,108,268	1,528,826
Merced.....	1,465,287	1,116,102
Modoc.....	508,188	503,126
Mono.....	179,639	132,244
Monterey.....	887,770	1,538,859
Napa.....	66,724	47,613
Nevada.....	61,837	56,568
Orange.....	5,007,988	4,571,099
Placer.....	283,880	384,864
Plumas.....	389,494	441,843
Riverside.....	2,578,043	2,835,492
Sacramento.....	3,562,138	4,384,330
San Benito.....	437,160	363,882
San Bernardino.....	4,458,056	4,519,418
San Diego.....	3,392,126	5,472,388
San Francisco.....	243,729	90,026
San Joaquin.....	1,928,668	2,016,510
San Luis Obispo.....	471,466	737,859
San Mateo.....	220,146	146,718
Santa Barbara.....	462,384	558,333
Santa Clara.....	1,252,989	1,355,470
Santa Cruz.....	752,472	813,561
Shasta.....	1,022,124	1,263,505
Sierra.....	48,694	57,419
Siskiyou.....	369,768	480,540
Solano.....	714,700	883,160
Stanislaus.....	877,863	908,995
Sutter.....	138,965	111,960
Tehama.....	268,587	387,168
Trinity.....	1,180,123	925,032
Tulare.....	1,530,650	1,022,818
Ventura.....	3,109,905	3,129,115
Yolo.....	737,678	754,951
Yuba.....	663,524	692,749
Other counties ¹	2,731,014	2,684,268
Total.....	79,024,437	87,030,129

¹ Includes Sonoma and Tuolumne Counties, combined to avoid disclosing individual company confidential data.

The production of basalt and miscellaneous stone, used chiefly as fill and for concrete and roadstone, was less than in 1956, but the decline was offset by the output of crushed sandstone that was available near the major road projects in 1957. The requirements by steel companies for Metallurgical-grade limestone at blast and open-hearth furnaces caused a rise in total value of the limestone despite a slight drop in the tonnage quarried during the year. The tonnage of natural and artificially colored roofing granules produced (from basalt, granite, and limestone) declined about 4 percent, although the value of the production was nearly 9 percent above the 1956 figure.

TABLE 15.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble..... short tons.....	40,468	\$731,991	42,212	\$769,620
Rough architectural..... cubic feet.....	145,015	1,303,800	52,986	513,930
Approximate equivalent in short tons.....	3,884		4,655	
Monuments and mausoleums..... cubic feet.....	52,320	569,296	66,394	612,019
Approximate equivalent in short tons.....	4,510		5,725	
Flagging..... cubic feet.....	6,784	13,751	9,381	20,762
Approximate equivalent in short tons.....	584		796	
Total dimension stone (quantities approximate, in short tons).....	49,446	1,618,838	53,388	1,916,331
Crushed and broken stone:				
Riprap..... short tons.....	1,369,152	2,322,133	1,499,225	2,683,401
Metallurgical..... do.....	52,240	171,561	288,294	898,458
Concrete and roadstone..... do.....	11,829,859	15,466,048	15,467,253	17,786,122
Railroad ballast..... do.....	144,771	167,318	172,409	184,870
Agricultural..... do.....	1,720	8,336	1,301	5,638
Chemical..... do.....	28,284	81,454	17,200	57,877
Miscellaneous ³ do.....	4,107,898	426,272,964	23,842,180	30,057,392
Total crushed and broken stone..... do.....	32,533,924	44,489,814	41,297,871	51,674,758
Grand total (quantities approximate, in short tons).....	32,583,370	46,108,652	41,351,259	53,591,089

¹ Includes 13,005 cubic feet valued at \$62,400 of dressed architectural stone.

² Includes dressed architectural stone.

³ Includes whitening substitute, filler, mineral food, poultry grit, stucco, roofing granules, filter beds, terrazzo, and miscellaneous uses.

⁴ Includes 11,583,084 short tons of limestone and oystershell used in cement valued at \$16,119,212 and 676,456 tons of limestone used in lime valued at \$1,235,988.

⁵ 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.

TABLE 16.—Production of stone,¹ in 1957, by counties

County	Short tons	Value	County	Short tons	Value
Alameda.....	1,004,739	\$721,943	San Diego.....	600,401	\$1,502,262
Amador.....	10,493	82,339	San Francisco.....	161,672	104,864
Butte.....	446,484	346,676	San Luis Obispo.....	213,548	474,693
Contra Costa.....	1,935,323	2,542,389	San Mateo.....	2,533,785	2,749,490
Del Norte.....	164,950	204,505	Santa Barbara.....	172,672	420,680
El Dorado.....	312,572	912,518	Santa Clara.....	4,405,439	4,547,328
Fresno.....	7,886,667	4,596,479	Santa Cruz.....	781,809	1,254,141
Humboldt.....	217,269	440,401	Shasta.....	63,460	49,647
Imperial.....	33,606	43,258	Sierra.....	5,600	28,875
Kings.....	26,336	52,059	Siskiyou.....	76,160	119,283
Lake.....	1,997	3,994	Solano.....	279,487	386,136
Lassen.....	34,825	39,164	Sonoma.....	2,373,390	2,401,235
Los Angeles.....	2,605,323	3,953,876	Tehama.....	30,826	42,571
Madera.....	79,199	190,291	Trinity.....	802,189	587,258
Marin.....	1,191,135	2,037,668	Tulare.....	64,332	132,026
Mendocino.....	181,971	268,066	Tuolumne.....	216,064	784,144
Napa.....	749,127	1,076,833	Ventura.....	232,717	613,026
Riverside.....	1,088,972	2,905,600	Yolo.....	8,300	17,000
Sacramento.....	1,051	2,029	Yuba.....	818,302	533,278
San Benito.....	1,129,759	1,786,136	Other counties ²	3,723,967	7,089,958
San Bernardino.....	4,685,411	7,546,970			
			Total.....	41,351,259	53,591,089

¹ Includes stone used in cement and lime.

² Includes Calaveras, Inyo, Kern, Monterey, Placer, and Plumas combined to avoid disclosing individual company confidential data.

TABLE 17.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Basalt and related rocks (traprock)		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	3,565,847	\$3,214,767	2,664,009	\$2,800,346	1,993,217	\$4,940,034
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	² 12,472,285	² 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	10,664,922	1,952,417	2,431,926	⁴ 14,102,264	⁴ 22,511,933

Year	Sandstone		Other stone ¹		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	2,093,219	\$2,835,693	4,188,796	\$4,903,511	14,505,083	\$18,694,351
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

¹ Includes light-colored volcanics, schist, serpentinite, river boulders, and such other stone as cannot properly be classed in any main group, and marble (1953-57).

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.

Strontium Minerals.—The celestite deposit at the northwest end of the Fish Creek Mountains, San Diego County, was the source of the entire California production of this commodity in 1957. The output was used by a Los Angeles chemical plant in making various strontium compounds and chemical reagents. California's increased production of celestite in 1956 came principally from claims a few miles northwest of Ludlow, San Bernardino. This property was inactive in 1957, because the special requirements of a southern Nevada manganese concentrator did not materialize.

Sulfur.—Production of contained sulfur from all sources in 1957 was 14 percent above that in 1956; shipments were 13 percent above; and the value of shipments was up 6 percent. Except for pyrite, mentioned elsewhere, three sources produced sulfur or sulfur-containing materials in California in 1957. Oil refineries recovered hydrogen sulfide; sulfur ore was mined and smelters recovered sulfur dioxide from sulfide ores. The sulfur content of the hydrogen sulfide made up about two-thirds of the total tonnage and about one-third of the sulfur ore. The sulfur dioxide sulfur tonnage was small.

Hydrogen sulfide was recovered from petroleum by the same 11 refineries as in 1956. Of these, 4 refineries sold the gas for direct conversion to sulfuric acid, 3 sold for conversion to brimstone, and 4 converted directly to brimstone. Fifty-five percent of the entire hydrogen sulfide output was converted to brimstone. The first group included the Standard Oil Co. of California refineries at Richmond and El Segundo, the Tidewater Oil Co. refinery at Avon, and the Shell Oil Co. refinery at Dominguez. The second group sold to the Hancock Chemical Co. at Watson, which company converted hydrogen sulfide to brimstone by the Claus process. These included the General

Petroleum Co., the Texas Co., and the Richfield Oil Corp., all near the Hancock plant. The refineries converting directly to brimstone were the Union Oil Co. of California refineries and sulfur-recovery plants at Oleum, Wilmington, and Santa Maria and the Wilshire Oil Co. refinery at Norwalk. The sulfur-content tonnage of the hydrogen sulfide recoveries from the 11 refineries mentioned was slightly more than in 1956, and the value rose about 10 percent. Brimstone shipments were slightly above 1956; the value was about the same.

Production of liquid sulfur dioxide from sulfide ore gases by the American Smelting and Refining Co. (Contra Costa County) continued about the same as in 1956; shipments and value were slightly greater. About one-half of the total sulfur dioxide gas recovered was converted to liquid sulfur dioxide; the remainder, to sulfuric acid.

Sulfur ore in 1957 came almost entirely from the Leviathan mine in Alpine County; it produced substantially more but shipped slightly less than in 1956. The value of shipments was also slightly less than in 1956. The ore was trucked to The Anaconda Co. open-pit mine in Lyon County, Nev., for use as a source of sulfur dioxide, which was manufactured into sulfuric acid for leaching oxide ore. A very small output of ore came from claims in Inyo County and a small quantity of soil sulfur was produced from the Sulfur Bank mine in Lake County.

Talc, Soapstone, and Pyrophyllite.—The decline in consumption of talc for use in ceramics was the major reason for decreased mine production of this mineral in 1957. The quantity requirements by manufacturers of insecticides and toilet preparations were lower, which also adversely affected the output of talc and soapstone. However, more pyrophyllite was produced for use by the insecticide industry than in 1956. The demand for talc and soapstone as an extender in paint remained virtually unchanged, but the quantity of pyrophyllite consumed for this purpose decreased noticeably. The total State output of talc was obtained from deposits in Inyo and San Bernardino Counties; the entire 1957 soapstone yield was produced in El Dorado and Los Angeles Counties; and most of the pyrophyllite came from producers in Mono and San Diego Counties. Limited quantities of crude talc were shipped out of State to grinders or sold directly to consumers; the mine output went mostly to California grinding plants for processing. Grinding plants in Alameda, Inyo, Los Angeles, Sacramento, San Bernardino, San Francisco, and San Diego Counties processed 124,000 tons of crude talc, soapstone, and pyrophyllite. The tonnage of these materials ground or otherwise processed that was sold or used in 1957 was 13 percent below the 1956 figure.

Vermiculite.—Prospecting for vermiculite was done in San Diego and Tulare Counties. Crude vermiculite was imported and exfoliated in an Orange County plant for use in plaster aggregate. Exfoliation plants were also operated in Los Angeles and Sacramento Counties by a company that shipped the crude mineral from its mine in Montana. The expanded mineral was used for thermal and acoustical insulation and as a lightweight aggregate in concrete and plaster.

A small increase in the tonnage of vermiculite processed was accompanied by a notable increase in unit value.

Wollastonite.—Over 1,000 tons of float wollastonite was gathered in the Blythe-Midland area of Riverside County and shipped to the Los Angeles and San Francisco Bay areas for use as ornamental stone. The material was used as rubble-type facing of building structures because of its distinctive weathered appearance.

METALS

Chromium.—The output of chromite ore and concentrate in 1957 (over one-fifth the total domestic production) including Alaska, increased nearly 29 percent above 1956 figures. The increase was due almost entirely to the continued Government chromite carlot program inasmuch as the total output was shipped to a Government stockpile at the Grants Pass (Oreg.) Purchase Depot. Shipments of concentrate, containing more than 45 percent Cr_2O_3 , rose 75 percent above 1956 figures, indicating a further trend toward mining low-grade ores, which trend had become apparent by 1956. Although 120 properties in 23 counties were the source of California's total chromite shipments, 69 percent of the tonnage and 67 percent of

TABLE 18.—Shipments of chromite ore and concentrate in 1957, by counties

County	Active mines and prospects	Rank in State (by value)	Milling ore treated ¹ (gross long tons)	Material shipped (dry weight, long tons)				Value	
				Total wet weight (long tons)	Under 45 percent Cr_2O_3		Over 45 percent Cr_2O_3		
					Ore	Concentrate	Ore		Concentrate
Alameda.....	1	11	1,500	140			133	\$14,501	
Butte.....	2	3	(²)	(²)	(²)		(²)	(²)	
Colusa.....	1	9	43	194			176	22,848	
Del Norte.....	35	4	1,734	2,744	328	313	1,700	307	294,762
El Dorado.....	2	12		(²)	(²)			(²)	
Fresno.....	3	2	(²)	(²)	(²)		(²)	(²)	
Glenn.....	1	7	(²)	(²)	(²)		(²)	(²)	
Humboldt.....	2	16		(²)	(²)		(²)	(²)	
Mendocino.....	2	23		(²)	(²)		(²)	(²)	
Monterey.....	3	13	(²)	(²)	(²)		(²)	(²)	
Napa.....	1	19	80	69			36	30	8,282
Placer.....	4	17		79	11		68		8,807
Plumas.....	3	22	(²)	(²)			(²)	(²)	
San Benito.....	2	14	223	82			77		8,527
San Luis Obispo.....	8	1	39,156	14,520	522	4,243	1,202	7,532	1,174,508
Santa Barbara.....	1	10	1,053	150		60		82	11,498
Shasta.....	2	20		34	28		6		3,137
Siskiyou.....	35	5	2,130	1,661	84	59	715	693	170,021
Sonoma.....	1	21		23			22		2,955
Stanislaus.....	3	8	(²)	(²)			(²)	(²)	
Tehama.....	3	6	1,282	605		46	93	425	60,164
Trinity.....	2	18	(²)	(²)		(²)	(²)	(²)	
Tuolumne.....	3	15	(²)	(²)		(²)	(²)	(²)	
Undistributed.....			25,515	10,861	457	2,474	228	6,992	1,008,480
Total.....	120								2,788,490
Long tons.....			72,716	31,162	1,430	7,195	4,246	16,287	
Short tons.....			81,442	34,901	1,602	8,058	4,756	18,241	

¹ Partly estimated.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals

County	Mines producing ¹		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine.....	1							
Amador.....	(²)	2	(³)	(³)	52	\$1,820	³ 52	³ \$1,820
Butte.....	(²)	3	(³)	(³)	123	4,305	³ 123	³ 4,305
Calaveras.....	6	1	77	\$2,695	(⁴)	(⁴)	⁴ 77	⁴ 2,695
El Dorado.....	4	1	5,778	202,230	(⁴)	(⁴)	⁴ 5,778	⁴ 202,230
Fresno.....		(²)			193	6,755	193	6,755
Humboldt.....	1	1	438	15,330	3	105	441	15,435
Imperial.....	3		1	35			1	35
Inyo.....	22		693	24,255			693	24,255
Kern.....	11	(²)	701	24,535	(⁴)	(⁴)	⁴ 701	⁴ 24,535
Los Angeles, Shasta, and Yuba ⁵	4	8	1,473	51,555	81,380	2,848,300	82,853	2,899,855
Madera and San Diego ⁵	3		53	1,855			53	1,855
Mariposa.....	6	1	1,055	36,925	(⁴)	(⁴)	⁴ 1,055	⁴ 36,925
Mono.....	5		75	2,625			75	2,625
Nevada.....	6	6	3,522	123,270	294	10,290	3,816	133,560
Placer.....	4	4			254	8,890	254	8,890
Plumas.....	3	4	37	1,295	246	8,610	283	9,905
Riverside.....	4		7	245			7	245
Sacramento.....	1	1	98	3,430	(⁴)	(⁴)	⁴ 98	⁴ 3,430
San Bernardino.....	12		31	1,085			31	1,085
Sierra.....	7	11	16,083	562,905	389	13,615	16,472	576,520
Siskiyou.....	8	6	18,952	663,320	472	16,520	19,424	679,840
Trinity.....	2	6	(³)	(³)	3,478	121,730	³ 4,78	³ 121,730
Tuolumne.....	7	(²)	36	1,260	(⁴)	(⁴)	⁴ 36	⁴ 1,260
Undistributed ⁶	2		158	5,530	34,733	1,215,655	34,891	1,221,185
Total.....	118	55	49,268	1,724,380	121,617	4,256,595	170,885	5,980,975

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine.....	8	\$7			8	\$7
Amador.....	(³)		6	\$5	³ 6	³ 5
Butte.....	(³)	(³)	10	9	³ 10	³ 9
Calaveras.....	57	52	(⁴)	(⁴)	⁴ 57	⁴ 52
El Dorado.....	3,560	3,222	(⁴)	(⁴)	⁴ 3,560	⁴ 3,222
Fresno.....			27	24	27	24
Humboldt.....	4,307	3,895			4,307	3,895
Imperial.....	200	181			200	181
Inyo.....	450,511	407,735			450,511	407,735
Kern.....	531	481	(⁴)	(⁴)	⁴ 531	⁴ 481
Los Angeles, Shasta, and Yuba ⁵	213	193	5,024	4,547	5,237	4,740
Madera and San Diego ⁵	188	170			188	170
Mariposa.....	316	286	(⁴)	(⁴)	⁴ 316	⁴ 286
Mono.....	2,438	2,207			2,438	2,207
Nevada.....	952	862			952	862
Placer.....			41	37	41	37
Plumas.....			26	24	26	24
Riverside.....	152	137	36	33	188	170
Sacramento.....	7	6			7	6
San Bernardino.....	19	17	(⁴)	(⁴)	⁴ 19	⁴ 17
Sierra.....	2,980	2,697			2,980	2,697
Siskiyou.....	3,187	2,834	56	51	3,243	2,935
Siskiyou.....	45,385	41,076	62	56	45,447	41,132
Trinity.....	(³)	(³)	362	328	³ 362	³ 328
Tuolumne.....	6	5			6	5
Undistributed ⁶	36	33	1,585	1,434	1,621	1,467
Total.....	515,053	466,149	7,235	6,548	522,288	472,697

See footnotes at end of table.

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Alpine							\$7
Amador							³ 1,825
Butte							³ 4,314
Calaveras	49,300	\$14,839	200	\$29			⁴ 17,615
El Dorado	34,200	10,294	35,600	5,091	13,200	\$1,531	⁴ 222,368
Fresno							6,779
Humboldt	128,100	38,558	3,600	515			58,406
Imperial	1,400	422	3,300	472	1,400	162	1,272
Inyo	1,630,300	490,720	6,829,500	976,618	5,908,200	685,351	2,584,679
Kern	100	30					⁴ 25,046
Los Angeles, Shasta, and Yuba ⁵	400	120					2,904,715
Madera and San Diego ⁶	18,700	5,629					7,654
Mariposa							⁴ 37,211
Mono	6,500	1,957	12,800	1,830			8,619
Nevada							134,459
Placer							8,914
Plumas	2,900	873					10,948
Riverside	2,600	782					1,033
Sacramento							⁴ 3,447
San Bernardino	6,900	2,077	31,000	4,433	15,100	1,752	12,044
Sierra					100	12	579,467
Siskiyou	7,900	2,378					723,350
Trinity	(²)	(²)					³ 122,058
Tuolumne							⁴ 1,265
Undistributed ⁶	700	211					1,222,863
Total	1,890,000	668,890	6,916,000	988,988	5,938,000	688,808	8,700,358

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 Lode output withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Placer output withheld to avoid disclosing individual confidential data; included with "Undistributed."

⁵ Combined to avoid disclosing individual output.

⁶ Includes output indicated by footnotes 3 and 4.

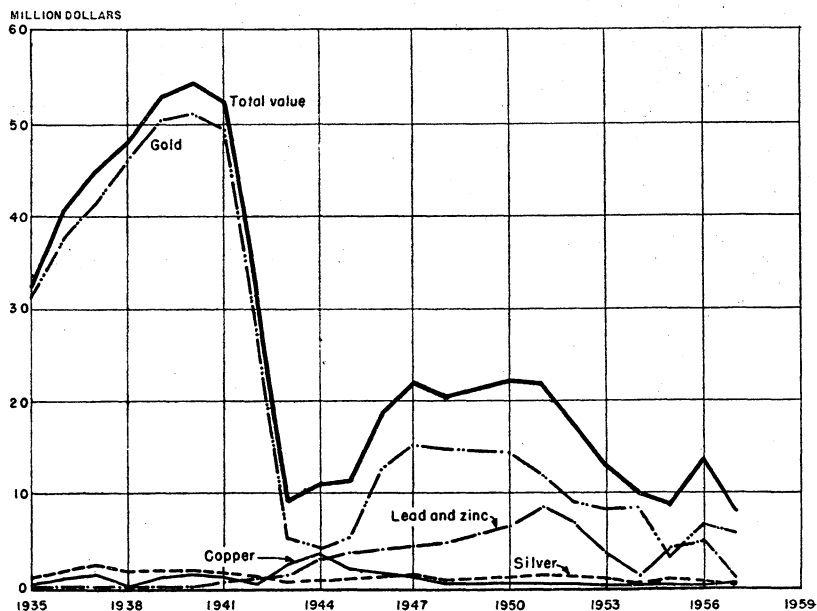


FIGURE 2.—Value of mine production of gold, silver, copper, lead, and zinc in California, 1935-57.

the value came from chromite deposits in Fresno and San Luis Obispo Counties. The chromite mines of these two counties and Butte County yielded the low-grade ores from which 87 percent of total shipping-grade concentrate was produced. The major producing mines were: Butler Estate No. 1, Fresno County; Norcross, Trinidad, and Hardface, San Luis Obispo County; and Lambert, Butte County. Although Del Norte and Siskiyou Counties had no large operations, the collective output in each was substantial.

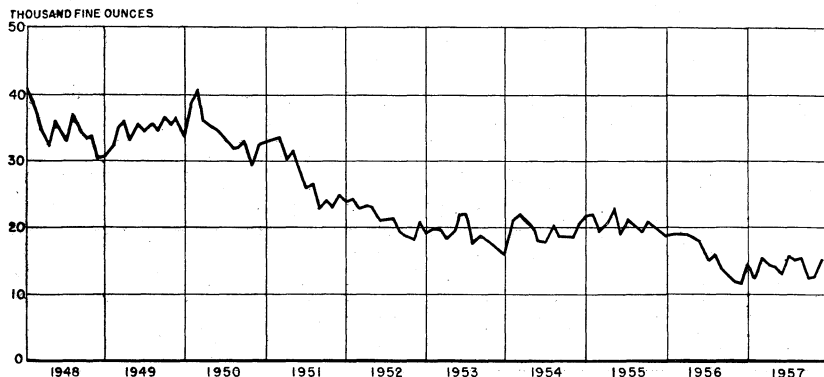


FIGURE 3.—Mine production of gold in California, 1948-57, by months, in terms of recoverable gold.

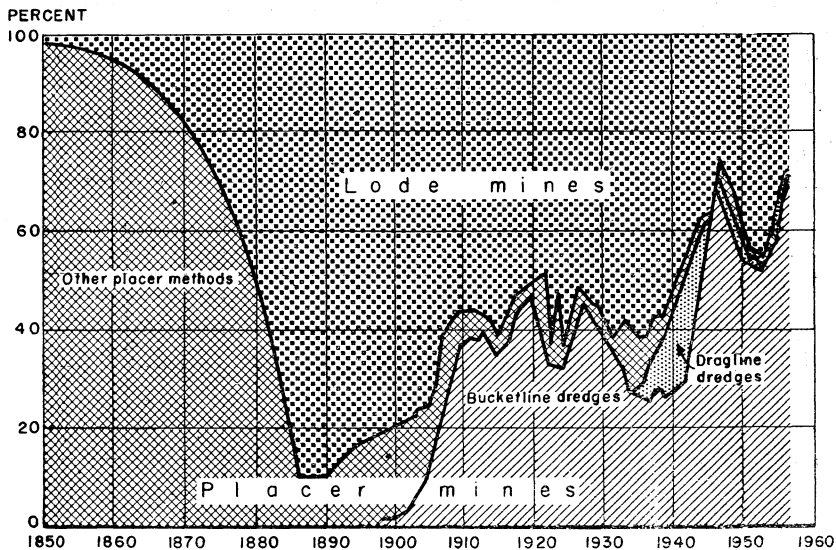


FIGURE 4.—Percentage of total California gold produced at lode and placer mines and by various methods of placer mining, 1850-1957.

TABLE 20.—Gold production at placer mines, 1948-52 (average), 1953-57, and total 1848-1957, by classes of mines and methods of recovery ¹

Class and method	Mines producing ²	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1948-52 (average).....	15	27	75,885,900	202,970	\$7,103,943	\$0.094
1953.....	3	14	45,528,800	119,022	4,165,770	.091
1954.....	3	15	44,910,720	134,096	4,693,960	.105
1955.....	3	11	40,810,210	142,548	4,989,180	.122
1956.....	3	10	36,356,640	130,631	4,572,085	.126
1957.....	3	9	31,043,570	117,832	4,124,120	.133
Dragline dredges: ³						
1948-52 (average).....	18	17	2,433,640	12,090	423,157	.174
1953.....	8	7	302,600	935	32,725	.107
1954.....	9	9	179,400	1,466	51,310	.286
1955.....	7	7	131,710	589	20,615	.157
1956.....	7	7	328,010	871	30,485	.093
1957.....	4	4	260,630	759	26,565	.102
Suction dredges:						
1948-52 (average).....	11	11	173,580	849	29,722	.171
1953.....	7	8	87,700	341	11,935	.136
1954.....	3	3	3,800	53	1,855	.488
1955.....	5	5	2,400	46	1,610	.670
1956.....	2	2	23,920	27	945	.040
1957.....						
Nonfloating washing plants: ^{3 4}						
1948-52 (average).....	21	21	65,540	2,315	81,032	1.236
1953.....	24	24	40,800	1,143	40,005	.486
1954.....	24	24	8,820	2,298	80,430	.836
1955.....	18	18	80,140	1,865	65,275	.288
1956.....	18	22	2,520	1,624	56,840	1.583
1957.....	4	21	11,940	1,549	54,215	.970
Gravel hydraulically handled:						
1948-52 (average).....	22		260,480	1,138	39,816	.153
1953.....	16		216,200	469	16,415	.076
1954.....	8		43,600	235	8,225	.189
1955.....	7		115,520	230	8,050	.070
1956.....	6		9,090	101	3,535	.389
1957.....	6		10,990	85	2,975	.271
Small-scale hand method: ⁵						
1948-52 (average).....	61		130,620	3,289	115,115	.881
1953.....	53		76,500	1,271	44,485	.583
1954.....	46		119,800	1,802	63,070	.527
1955.....	28		94,130	1,182	41,370	.439
1956.....	26		78,730	1,029	36,015	.459
1957.....	32		36,020	1,283	44,905	1.246
Underground placers:						
Drift:						
1948-52 (average).....	13		6,320	224	7,833	1.239
1953.....	12		3,330	165	5,775	1.794
1954.....	17		6,580	247	8,645	1.313
1955.....	14		4,780	153	5,355	1.120
1956.....	11		3,880	164	5,740	1.481
1957.....	6		3,080	109	3,815	1.240
Grand total placers:						
1948-52 (average).....	160		78,956,080	222,875	7,800,618	.099
1953.....	123		46,255,930	123,346	4,317,110	.093
1954.....	110		45,272,720	140,197	4,906,895	.106
1955.....	82		41,238,890	146,613	5,131,455	.122
1956.....	73		36,802,790	134,447	4,795,645	.126
1957.....	55		31,366,230	121,617	4,266,595	.133
1848-1957.....			(⁶)	67,625,926	1,502,645,056	(⁶)

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, but material treated and average value per cubic yard refer only to straight gold dredging.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 Complete data not available.

TABLE 21.—Mine production of gold, silver, copper, lead, and zinc 1948-52 (average), 1953-57, and total 1848-1957, in terms of recoverable metals¹

Year	Mines producing ²		Material sold or treated (short tons) ³	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1948-52 (average).....	208	160	498,097	369,746	\$12,941,110	965,089	\$873,454
1953.....	150	123	390,583	234,691	8,210,685	1,036,372	937,969
1954.....	131	110	231,517	237,886	8,326,010	309,575	280,181
1955.....	130	82	304,519	251,737	8,810,795	954,181	863,582
1956.....	116	73	281,102	193,816	6,783,560	938,139	849,063
1957.....	118	55	204,251	170,885	5,980,975	522,288	472,697
1848-1957.....			(4)	105,250,279	2,385,863,417	118,383,530	96,357,390

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average).....	609	\$313,232	12,085	\$3,846,980	7,821	\$2,394,200	\$20,368,976
1953.....	382	219,268	8,664	2,269,908	5,358	1,232,340	12,870,230
1954.....	362	213,580	2,671	731,854	1,415	305,640	9,857,265
1955.....	613	457,298	8,265	2,462,970	6,836	1,681,656	14,276,301
1956.....	859	730,150	9,296	2,918,944	8,049	2,205,426	13,487,143
1957.....	945	568,890	3,458	988,988	2,969	688,808	8,700,358
1848-1957.....	634,889	206,060,150	262,511	52,153,679	149,355	35,253,698	2,775,688,334

¹ Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes re-treated; tungsten ore; and ore, old tailings, slag, fine 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 22.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	14,732	87,534	79	807	666
February.....	12,073	80,548	59	741	498
March.....	15,403	71,885	84	572	600
April.....	14,427	68,479	52	625	508
May.....	14,196	66,990	90	547	548
June.....	13,115	17,717	50	23	15
July.....	15,684	24,037	93	18	15
August.....	15,073	22,289	89	21	18
September.....	15,426	23,477	112	22	21
October.....	12,360	20,806	77	29	29
November.....	12,671	18,301	73	31	27
December.....	15,125	20,225	87	32	24
Total.....	170,885	522,288	945	3,458	2,969

TABLE 23.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	20,935	4,135			
Old tailings	58	11			
Total	20,993	4,146			
Cyanidation:					
Ore	18,877	45,299			
Total	18,877	45,299			
Total recoverable in bullion	39,870	49,445			
Concentration and smelting of concentrates:					
Ore ¹	8,643	368,032	1,710,200	4,704,200	5,172,800
Old tailings	291	238			
Total	8,934	368,270	1,710,200	4,704,200	5,172,800
Direct smelting:					
Ore	464	97,318	135,600	2,211,600	765,200
Copper precipitates		20	44,200	200	
Total	464	97,338	179,800	2,211,800	765,200
Placer	121,617	7,235			
Grand total	170,885	522,288	1,890,000	6,916,000	5,938,000

¹ Includes gold recovered as "natural gold." ² Includes tungsten-ore concentrate.

³ Combined to avoid disclosing individual company confidential data.

TABLE 24.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	76	92,589	47,770	54,409	500	35,600	13,300
Dry gold-silver	2	43	4	78	900		
Dry silver	2	37	8	1,323			
Total	80	92,669	47,782	55,810	1,400	35,600	13,300
Copper and tungsten ore ²:							
Copper-zinc	18	8,198	702	138,108	1,634,600	3,900	
Lead	1	53	40	24	6,300		
Lead-zinc	9	1,609	395	30,287	700	792,000	3,400
Total	9	68,153	395	290,555	202,800	6,084,300	5,921,300
Total	37	78,013	1,137	458,974	1,844,400	6,880,200	5,924,700
Other "lode" material:							
Old tailings	(⁴)	33,525	349	249			
Copper precipitates	1	44		20	44,200	200	
Total	1	33,569	349	269	44,200	200	
Total "lode" material	118	204,251	49,268	515,053	1,890,000	6,916,000	5,938,000
Gravel (placer operations)	55	(⁵)	121,617	7,235			
Total, all sources	173		170,885	522,288	1,890,000	6,916,000	5,938,000

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 31,366,230 cubic yards. Does not include material washed at commercial gravel plants to produce 1,218 ounces of byproduct gold and 147 ounces of byproduct silver included in placer totals.

TABLE 25.—Mine production of gold, silver, copper, lead and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters ¹ and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Amador, Butte, and Riverside ²	5	5	2	4	52	12			
Calaveras.....	186	55	25	1	1				
El Dorado.....	21,202	682	97	586	5,096	3,463	34,200	35,600	13,200
Humboldt.....	4,264			348	438	4,307	128,100	3,600	
Imperial.....	17	1	1						
Inyo.....	61,243	50	18	12,269	443	359,197	1,547,500	4,665,000	5,159,500
Kern.....	1,035	709	280						
Madera and Plumas ³		7	1						
Mariposa.....	191	1,012	283	1	37	20			
Mono.....	20	6	4						
Nevada.....	34,205	2,971	605	86	531	346			
Sacramento.....	9	98	19						
San Bernardino and Yuba ²	2,646	1,113	139	26	361	328	400		
San Diego, Shasta, and Trinity ²	87	67	13						
Sierra.....	21,473	14,120	2,634	155	1,963	553			100
Siskiyou.....	47,532	18,940	45,319	3	12	44			
Tuolumne.....	104	34	5						
Total: 1957.....	194,219	39,870	49,445	13,479	8,934	368,270	1,710,200	4,704,200	5,172,800
1956.....	261,029	50,886	49,543	33,304	7,484	713,182	1,379,400	13,877,400	14,857,400
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore.....	92,411	39,812	49,434	776	7,749	3,782	400	35,600	13,300
Old tailings.....	33,525	58	11	17	291	238			
Dry silver: Crude ore.....	2			1		254			
Copper: Crude ore and tungsten ore ²	37,280			2,284	625	136,903	1,557,700	3,900	
Lead-zinc: Crude ore.....	61,001			10,401	269	227,093	152,100	4,664,700	5,159,500
Total 1957.....	194,219	39,870	49,445	13,479	8,934	368,270	1,710,200	4,704,200	5,172,800
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS ¹									
Dry gold.....				793	8,040	4,020	400	35,600	13,300
Dry silver.....				1		254			
Copper.....				42,283	4,624	136,827	1,557,700	3,600	
Lead.....				46,180	4,243	210,459	106,400	4,463,000	774,100
Zinc.....				4,222	27	16,710	45,700	202,000	4,385,400
Total 1957.....				13,479	8,934	368,270	1,710,200	4,704,200	5,172,800

See footnotes at end of table.

TABLE 25.—Mine production of gold, silver, copper, lead and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued*B. For material shipped directly to smelters*

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Alpine.....	1	8				
Calaveras.....	85	21	32	49,300	200	
Imperial.....	55		199	1,400	3,300	1,400
Inyo.....	9,011	200	91,296	82,800	2,164,500	748,700
Kern, Madera, and Mariposa ²	120	72	456	18,800		
Mono.....	141	69	2,434	6,500	12,800	
Nevada.....	5	20	1			
Plumas, Riverside, and Siskiyou ²	267	8	174	13,400		
San Bernardino.....	298	22	2,724	6,900	31,000	15,100
Trinity.....	42	47	13	700		
Tuolumne.....	3	2	1			
Undistributed.....	4	3				
Total: 1957.....	10,032	464	97,338	179,800	2,211,800	765,200
1956.....	20,073	999	168,094	333,600	4,714,600	1,240,600
BY CLASSES OF MATERIAL						
Dry gold: Crude ore.....	178	209	1,193	100		
Dry gold-silver: Crude ore.....	43	4	78	900		
Dry silver: Crude ore.....	35	8	1,069			
Copper:						
Crude ore.....	918	77	1,205	78,900		
Copper precipitates.....	44		20	44,200	200	
Copper-zinc: Crude ore.....	53		24	6,300		
Lead: Crude ore.....	1,609	40	30,287	700	792,000	3,400
Lead-zinc: Crude ore.....	7,152	126	63,462	50,700	1,413,600	761,800
Total: 1957.....	10,032	464	97,338	179,800	2,211,800	765,200

¹ Includes concentrate treated only by amalgamation and/or cyanidation.² Combined to avoid disclosing individual company confidential data.³ Tungsten-ore tonnage not included with material treated.⁴ Includes concentrate and contained recoverable metal from tungsten³ore.

Copper.—California's moderate copper production increased 10 percent above that in 1956. The rise was due chiefly to a greater output of copper in concentrate recovered in treating tungsten ores mined in the Bishop (Pine Creek) district, Inyo County. Nearly 13 percent of the total State copper output was recovered at smelters from copper ores mined in the Trinity River area, Humboldt County; the West Belt district, Calaveras, El Dorado, and Madera Counties; and the Ubehebe district, Inyo County. Exploration continued for ore bodies with enough copper content to allow shipment of ore to smelters outside the State, and for deposits of the complex low-grade copper ores large enough to warrant the large capital outlay for concentrating plants.

DMEA projects in 1957 consisted of 2 exploration contracts for copper ore in Shasta County and 1 in Humboldt County. These three properties were also considered as possible sources for considerable zinc. In 1957 the State-produced copper ores and concentrates were shipped to Arizona, Nevada, Washington, and Utah

smelters. Copper was also recovered from other base-metal ores and concentrates produced in the State, in matte form at lead smelters in California and Utah, and from the residues at a Montana zinc plant.

Gold.—The gold output in California, lowest since the end of World War II, was 12 percent below 1956. The continued decline in the State gold output has been attributed to rising operating costs and an unchanged price for gold. In 1957 the decline was abetted by curtailed activity at copper, lead, and zinc mines, inasmuch as gold was an important byproduct of these base-metal ores and failure of the Empire Star group of mines in Nevada County to resume operations in 1957 after closing down in 1956.

Placer mines contributed 71 percent of the total gold produced in the State; 97 percent was recovered by bucketline dredges. In 1957, 55 placer operations in 19 counties were credited with the State placer-gold output compared with 73 operations in 21 counties in 1956. A very high percentage of the 1957 placer-gold production was recovered by dredges in the Yuba River district, Yuba County, and the American River (Folsom) district, Sacramento County. Diversification of activities by the State's two leading gold-dredging firms, which trended toward nonmining pursuits was noteworthy in 1957.

TABLE 26.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Dry gold	793	8,040	4,020	610	36,027	16,853
Dry silver	1	—	254	—	—	—
Copper	¹ 2,283	¹ 624	¹ 136,827	¹ 1,590,591	6,497	—
Lead	6,180	¹ 243	¹ 210,459	125,218	¹ 4,634,265	¹ 979,863
Zinc	4,222	27	16,710	46,674	212,594	4,488,824
Total:						
1957	13,479	8,934	368,270	1,763,093	4,889,383	5,485,540
1956	33,304	7,484	713,187	1,450,095	14,145,623	15,808,246
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry Gold: Crude ore	178	209	1,201	126	70	—
Dry gold-silver: Crude ore	43	4	78	956	—	—
Dry silver: Crude ore	35	8	1,069	—	—	—
Copper:						
Crude ore	918	77	1,207	79,091	—	—
Copper precipitates	44	—	20	45,586	448	—
Copper-zinc: Crude ore	53	—	24	6,440	—	14,182
Lead: Crude ore	1,609	40	30,287	1,021	800,253	4,238
Lead-zinc: Crude ore	7,152	126	63,462	66,425	1,460,398	964,303
Total:						
1957	10,032	464	97,348	199,645	2,261,169	982,723
1956	20,073	999	168,102	366,823	4,807,194	1,570,166

¹ Includes concentrate and contained metal from tungsten ore.

TABLE 27.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals¹

County and district	Mines producing ²		Lode material (short tons)	Gold (fine ounces)			Silver (lode and placer, fine ounces) ³	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Alpine County: Monitor	1	2	1			52	8				\$7
Amador County: East Belt ⁴							6				1,825
Butte County:											
Butte Creek		1				1					35
Houck		(⁵)				1					35
Magalia		(⁵)				4					151
Oroville	(⁵)	(⁵)	(⁵)			112	19				1,822
Yankee Hill		1				5					173
Calaveras County:											
East Belt ⁴	3	(⁵)	112	60		63	19				2,222
Mokelumne River		(⁵)				2					70
El Dorado County:											
East Belt ⁴	2	(⁵)	14,186	4,890	(⁵)	8,938	2,938	35,600	13,200		\$180,431
Mother Lode ⁶	1	(⁵)	4,000	863	(⁵)	3,883	3,127				\$30,320
West Belt ⁶	1		3,016	25		25	495	34,200			11,617
Fresno County:											
San Joaquin River (Friant)		(⁵)				193	27				6,779
Humboldt County:											
Orleans	1					3					105
Trinity River South (Hoopa)		1	4,284	438		438	4,307	128,100	3,600		58,301
Imperial County:											
Mesquite	1		23				83	1,400			497
Paymaster	1		32				116				739
Peacho	1		17				1	3,300	1,400		36
Inyo County:											
Chloride Cliff	1		36	16		16	29	1,100			744
Fish Springs	1		54	2		2	198	5,700	3,600		1,481
Modoc	3		1,626	25		25	28,477	4,300	769,400	1,500	138,140
South Park	4		43	35		35	13				1,237
Ubehebe	2		250	4		4	284	19,700			6,327
White Mountain	1		95				264	10,100	11,800		3,052
Kern County:											
Clear Creek	1		3	2		2	1				71
Randsburg	7		993	672		672	272				23,766
Mariposa County:											
Bear Creek		(⁵)				3	1				106
East Belt ⁴	3	(⁵)	149	65		70	15				2,464
Mono County:											
Mammoth Lake	1		57	52		52	555				2,322
Masonic	1		6	17		17	345				907
Nevada County:											
Chicago Park		(⁵)				1					35
French Corral		(⁵)				192					6,745
Wolf Creek	1	(⁵)	60	31		6	28				1,302

See footnotes at end of table.

TABLE 27.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals—
Continued

County and district	Mines producing ²		Lode material (short tons)	Gold (fine ounces)			Silver (lode and placer, fine ounces) ³	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Placer County:											
Auburn.....		(6)		33	33		2				\$1,157
Collax.....		(6)		27	27		5				949
Foresthill.....		(6)		26	26		4				944
Last Chance (Canada Hill).....		(6)		40	40		4				1,404
Michigan Bluff.....		(6)		1	1						35
Plumas County:											
Butte Valley.....	1	(6)	(6)	3	3		(1)				7,105
Genesee.....		(6)		3	3		106				106
Granite Basin.....		(6)		6	6		1				211
Johnsville.....		(6)		4	4		1				141
La Porte.....		(6)		26	26		2				702
Quincy.....		(6)		7	7						245
San Bernardino County:											
Lava Bed.....	1		7				69		900	600	249
Needles.....	1		1				1				35
Shirhan.....	1		2				254				230
Whipple Mountain.....	3		44				4		2,000		746
Shasta County:											
Castle Creek-La Moine.....		(6)		1	1						35
Cottonwood Creek.....		(6)		4	4						140
Flat Creek.....		(6)		1	1						35
French Gulch.....	2	(6)	(6)	11	11		71				7,889
Geo.....		(6)		4	4		1				141
Shasta.....		(6)		3	3						105
Sierra County:											
Downsville.....	1	(6)	4,304	270	9,344		1,960		100		328,826
Dusonville.....		(6)		25	25		4				879
Pike.....	1		1	11	13		2				457
Plover Hill.....		(6)		11	11		1				386
Sierra City.....		(6)		1	1						35
Siskiyou County:											
Kearney River.....	3	1	47,479	18,898	18,898		45,331	7,900			\$704,835
Salmon River.....	2	4	40	27	45		42				1,613
Scott River.....	3	1	57	27	27		13				\$957
Shasta River.....		(6)		15	15		3				528
Trinity County:											
Climnabar (Crow Creek).....		1	1	4	4						140
New River.....		1	1	5	5						175

Tuolumne County:											948
East Belt 4	4	(0)	92	27	(0)	27	69	4			\$ 317
Mother Lode 5	3		15	9				2			70
Yuba County:											1 422
Challenge	1	(0)	(0)				2	2			870
Dobbins	1	(0)					12				70
Smartville		(0)					2				
Strawberry		1	123,286		25		25				877
Undistributed 11	53	25	123,286	14,001	120,439	184,440	435,947	1,692,400	6,086,300	5,905,900	7,164,780
Total	118	55	204,251	49,268	121,617	170,885	522,288	1,890,000	6,916,000	5,938,000	8,700,358

¹ Only those districts are shown separately for which Bureau is at liberty to publish figures; other producing districts are listed in footnote 11, and their output grouped as "Undistributed."

² Excludes itinerant prospectors, "snipers", "high-graders", and others, who gave no evidence of legal right to property.

³ Source of total silver as follows: 515,053 ounces from lode mines and 7,235 ounces from placer mines.

⁴ East Belt district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

⁵ From property not classed as a mine.

⁶ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁷ Exclusive of lode output, which is included with "Undistributed."

⁸ Exclusive of placer output, which is included with "Undistributed."

⁹ Mother Lode district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

¹⁰ West Belt district lies in Amador, Calaveras, El Dorado, Madera, and Mariposa Counties.

¹¹ Includes the following districts: Mother Lode, Amador County; Mother Lode and West Belt, Calaveras County; Bishop, Darwin (Caso), Deep Springs, Lee, Resting Springs, Slate Range, Waucoba and Wildrose, Inyo County; Greenhorn Mountain, Kern River, Mojave and Sageland, Kern County; San Gabriel, Los Angeles County; Potter's Ridge and West Belt, Madera County; Mother Lode and West Belt, Mariposa County; Homer (Lundy) and West Walker River, Mono County; Graniteville, Grass Valley-Nevada City, Washington-North Columbia and Yon Bet, Nevada County; Butcher Ranch, Dutch Flat, Iowa Hill and Rocklin, Placer County; Edmanston, Feather River, Greenville (Crescent Mills) and Saw Pit Flat, Plumas County; Bendigo and Dale (Gold Park), Riverside County; Amer can River (Folsom), Sacramento County; Belleville (Old Mountain), Granite Mountains (Morrow), Ivanpah, Morongo, Randsburg, and Solo (Old Dad Mountain), San Bernardino County; Julian, San Diego County; Redding, Shasta County; Alleghany and Poker Flat, Sierra County; Hayfork and Trinity River, Trinity County; Browns Valley, Camptonville, and Yuba River, Yuba County; and "Undistributed" for various counties.

Over 170,000 tons of ore was mined from 118 lode mines in 23 counties, which yielded nearly 49,000 ounces of gold. Nearly 81 percent of this yield was recovered as bullion from amalgamation and cyanidation processes. Gold recoveries from smelting concentrates and ores were 18 and 1 percent, respectively. Although the United States Mint at San Francisco was a principal depository for gold and silver bullion produced in the State during 1957, the American Smelting and Refinery Co. gold refinery operated in conjunction with the lead-smelter at Selby, Contra Costa County, also received shipments of bullion.

Iron Ore.—Possibly reflecting to some extent the 4-percent decrease in the value of building permits in California in 1957, iron-ore production declined an estimated 9 percent from 1956. The production and shipments of direct shipping ore, however, both increased 45 percent, and the value of shipments rose 43 percent. Shipment to concentrators decreased 33 percent, the tonnage of concentrates shipped declined 28 percent; and the value was 27 percent less.

Riverside and San Bernardino Counties continued to be the only iron-ore-producing counties in the State. The Kaiser Steel Corp. Eagle Mountain mine, Riverside County, remained the only active mine in the county and was by far the leading producer supplying ore both to the Kaiser Steel Corp. blast furnaces at Fontana and for export. The export figure was substantially greater than in 1956. Small tonnages were used as cement additive and heavy aggregate for atomic shielding. Five mines were active in San Bernardino County during the year; the leading mine was the Vulcan mine of the Mineral Materials Co.

The average grade of ore shipped in 1957 was 52.9 percent iron, slightly below the 1956 average of 53.3 percent.

Iron and Steel.—The Fontana plant of the Kaiser Steel Corp. in San Bernardino County continued to be the only producer of pig iron in California in 1957. Production was below that in 1956, although the dollar value of the pig iron sold, used, or withdrawn from stock was considerably higher. Three blast furnaces with a combined annual capacity of 1,314,000 tons were in operation during the year; a fourth was being constructed. Most of the pig iron produced was used at the Fontana plant to make steel. The remainder was sold to Pacific coast foundries, to one steel plant, or exported. The Columbia-Geneva Steel Division of the United States Steel Corp. with plants at Pittsburg, Contra Costa County, and at Torrance, Los Angeles County, was supplied with pig iron by the division's Geneva (Utah) blast furnaces. The South San Francisco plant of the Bethlehem Pacific Coast Steel Corp. was a small consumer of pig iron, as was National Supply Co., Torrance, Calif. Other steel plants in the State used scrap iron and steel exclusively.

The production of steel ingots and steel for castings in 1957 was estimated at about 3,100,000 tons, which approximates the 1956 figure (3,136,483 tons). During the 10-year period, January 1, 1948, to January 1, 1958, the capacity of California steel plants increased from 2,071,800 tons to 3,285,700, or 59 percent.

Iron and Steel Scrap.—Overall ferrous scrap consumption decreased 5 percent in 1957. Although the production of ingots and steel for castings in California in 1957 was approximately that in 1956,

TABLE 28.—Iron ore and other metallic materials consumed and pig iron produced, 1948-52 (average) and 1953-57, in net tons

Year	Iron and manganiferous iron ores		Sinter ¹	Miscellaneous	Total	Pig iron produced
	Domestic	Foreign				
1948-52 (average).....	625,693	747	459,754	115,314	1,201,508	685,104
1953.....	987,471	-----	805,938	150,504	1,943,913	1,095,118
1954.....	752,766	-----	650,609	134,768	1,538,143	860,162
1955.....	1,008,256	-----	800,929	134,358	1,943,543	1,122,091
1956.....	1,256,344	-----	1,094,319	110,857	2,461,520	1,409,105
1957.....	1,319,727	-----	1,001,463	93,877	2,415,067	1,334,124

¹ Includes sintered flue dust.

TABLE 29.—Consumption of ferrous scrap and pig iron, 1948-52 (average) and 1953-57, in short tons

Year	Total scrap used	Pig iron used	Year	Total scrap used	Pig iron used
1948-52 (average).....	2,258,533	959,343	1955.....	2,777,589	1,223,264
1953.....	2,574,840	1,233,898	1956.....	2,789,406	1,430,737
1954.....	2,185,451	1,000,576	1957.....	2,656,218	1,436,691

TABLE 30.—Consumption of ferrous scrap and pig iron in 1956-57, by types of furnaces and miscellaneous uses, in short tons

Ferrous scrap and pig iron charged to—	1956	1957	Ferrous scrap and pig iron charged to—	1956	1957
Steel furnaces: ¹			Miscellaneous uses: ²		
Scrap.....	2,331,570	2,258,955	Scrap.....	40,476	38,393
Pig iron.....	1,242,812	1,267,690	Total scrap.....	2,789,406	2,656,218
Total.....	3,574,382	3,526,645	Total pig iron.....	1,430,737	1,436,691
Iron furnaces: ²			Grand total.....	4,220,143	4,092,909
Scrap.....	417,369	358,870			
Pig iron.....	187,925	169,001			
Total.....	605,285	527,871			

¹ Includes open-hearth and electric furnaces.

² Includes cupola, air, and blast furnaces; also direct castings.

³ Includes rerolling, copper precipitation, nonferrous, and chemical uses.

the consumption of iron and steel scrap by the 9 active steel plants was reduced 3 percent. Iron-furnace-scrap consumption decreased 14 percent, and miscellaneous consumption declined 5 percent. Overall stocks decreased 3 percent during the year.

Lead.—The quantity of lead recoverable from California ores and concentrates mined in 1957 decreased 63 percent from 1956. This sharp decline was attributed almost entirely to closing down of operations at the Shoshone group of mines in the Resting Springs district and the Darwin group in the Darwin (Coso) district, Inyo County, by the State's major lead producer, The Anaconda Co., in March and June, respectively, following a sharp break in the price of lead. Additional lead production in Inyo County came from ores of active mines in the Modoc, Lee, and Slate Range districts. A modest lead output was also obtained from mining operations in the East Belt

district, El Dorado County, and the Morongo district, San Bernardino County.

The State's lead production was derived largely from lead-zinc ores and from smaller quantities from ores of lead, gold, and copper. At Selby, Contra Costa County, California's only primary lead smelter reduced lead ores and concentrates from both foreign and domestic sources. At Pittsburg, Contra Costa County, a plant for producing tetraethyl lead used as an antiknock compound in gasoline was under construction. A similar plant at Antioch in the same county was placed in operation in 1956.

Manganese.—In 1957 the production of Metallurgical-grade manganese ore and concentrate increased 144 and decreased 24 percent, respectively, compared with 1956. In contrast to 36 percent in 1956, ore comprised 64 percent of all shipments during the year. Deposits in the McCoy (Ironwood) district, Riverside County, yielded most of the manganese ore shipped; however, ore from the Pioneer mine, Imperial County, was the source of a high percentage of the manganese concentrate produced and shipped. The State's entire output (with two exceptions) went to Government stockpiles on the carlot program. One carload of low-grade manganese ore from San Bernardino County was consigned to the low-grade manganese depot at Butte, Mont., and the other shipment was a carlot of manganese ore from Lake

TABLE 31.—Mercury produced in 1957, by counties

County	Producing mines	Ore treated (short tons)	Mercury recovered	
			76-pound flasks	Value ¹
Colusa.....	1	10	6	\$1,482
Fresno.....	1	541	40	9,879
Monterey.....	1	388	51	12,596
Santa Barbara.....	1	5,000	272	67,179
Santa Clara.....	2	8,465	2,529	624,613
Other counties ²	51	111,536	13,613	3,382,138
Total.....	57	125,940	³ 16,511	4,077,887

¹ Value calculated at average price at New York, \$246.98 per flask.

² Includes Kings, Lake, Marin, Merced, Napa, San Benito, San Luis Obispo, San Mateo, Sonoma, and Trinity counties to avoid disclosure individual company confidential data, and 112 flasks from unknown sources.

³ Includes mercury from dump and placer material treated.

TABLE 32.—Mercury produced, 1948-52 (average) and 1953-57, by methods of recovery

Year	Furnaced ¹		Retorted		Unclassified ² 76-pound flasks	Total		Operating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks		76-pound flasks	Value ³	
1948-52 (average)....	58,348	5,750	705	236	225	6,211	\$773,419	19
1953.....	95,325	8,874	1,556	343	73	9,290	1,793,249	28
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	2,343,639	71
1957.....	115,134	13,722	10,806	2,228	561	16,511	4,077,887	57

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.

County to a custom mill in Arizona. Inyo, Plumas, and San Luis Obispo Counties each had 1 producer, who made 1 or more shipments during the year. Exploration for manganese ore under the DMEA program was limited to one contract in San Bernardino County, which contract was terminated in June.

Mercury.—California 1957 mercury production increased 85 and 75 percent, respectively, in quantity and value over 1956, despite a drop in the open-market price. The yield was the highest in 10 years, and approximately 50 percent of the Nation's (including Alaska) output. Although there were 57 producing mines, some of which had several operators during the year, over 80 percent of the State's mercury production came from 5 mines in 4 counties. The New Idria mine, San Benito County, the Nation's leading producer, was followed in order by the Abbott mine, Lake County; the Mt. Jackson-Great Eastern mine, Sonoma County; the New Almaden mine, Santa Clara County; the Farm Hill No. 2 mine, San Mateo County; and the Guadalupe mine, Santa Clara County.

The Altoona mine, in Trinity County, was acquired by Rare Metals Corp. of America in November. The mine, a former leading mercury producer, had been flooded for many years. Under a DMEA contract the underground workings were dewatered, and new ore was discovered. Ten additional DMEA contracts for mercury exploration were in effect during 1957. Of these, 2 were terminated, both in San Luis Obispo County, and 2 were initiated, 1 each in San Benito and Santa Clara Counties.

Molybdenum.—The source of California's entire output of molybdenum concentrates was the tungsten ores of the Pine Creek area, Inyo County. These concentrates, both sulfide and oxide, were recovered as byproducts in the treatment of the tungsten ore by one operator, and were shipped for export.

Nonferrous Metal Scrap.—California was considered a plus area for nonferrous scrap in 1957, since the quantity generated plus that shipped in exceeded State consumption and shipments out of State. The total inter-State rail shipments were estimated at 180 million pounds. The bulk of the State's consumption consisted of approximately 125 million pounds of lead scrap and 75 million pounds of copper scrap. Although the Selby smelter in Contra Costa County processed lead scrap, including special lead alloys and battery plates, important quantities of lead scrap were shipped to plants in Oregon and Washington. A plant at Ontario, San Bernardino County, processed lead from secondary sources and used the metal in battery-plate production.

Large remelt plants in San Francisco and Los Angeles consumed major quantities of copper and brass scrap, however, shipments were made to Arizona and for export. Little zinc scrap was consumed in the State during the year. Some zinc scrap was exported, but most die-cast scrap remained in dealer yards. Although moderate quantities of aluminum scrap went to the Los Angeles area, out-of-State shipments were made to the Detroit and Chicago areas. The State had no magnesium processing plants, yet only small shipments of magnesium scrap were made to out-of-State plants.

Platinum.—The relatively small quantity of platinum recovered as a byproduct of gold dredging in Sacramento and Yuba Counties

was virtually the same as in 1956. Most of the output came from the Yuba River district, Yuba County.

Rare-Earth Minerals.—The only active rare-earth-mineral mine in the State, a barite-carbonate ore body at Mountain Pass in the Mescal Range was in the northeastern section of San Bernardino County. A concentrate, containing fluocarbonates of the cerium-group metals, was produced by flotation. Some of the concentrate received further treatment by acid leaching and roasting to produce a higher grade material. Both grades of concentrate (approximately 60 and 90 percent rare-earth oxides, respectively) were shipped to a Pennsylvania plant for further treatment and extraction of the rare-earth elements. Shipments in 1957 were substantially below those of 1956 and were based on requirements by the eastern plant for research in recovery of the contained metals.

Silver.—Because it was principally a byproduct metal recovered in the course of treating ores of other metals, the State's 1957 output of silver reflected the slump in lead and zinc mining and fell 44 percent below the 1956 figure. This sharp drop was due largely to the shut-down of lead-zinc mining operations at The Anaconda Co. Darwin and Shoshone groups of mines in the Darwin and Resting Springs districts, respectively, in Inyo County. Despite closing of these mines during the first half of the year, Inyo County produced 86 percent of the State's total silver output. The county was the principal source of the lead-zinc ore of these two properties and the tungsten ore of the Bishop district. Small tonnages of straight silver ore were mined in the Randsburg and Silurian districts, San Bernardino County. Lead-zinc ores yielded most of the silver, followed by ores of tungsten, gold, lead, copper, and silver. Over 98 percent of the total silver recovered came from 118 lode mines in 24 counties, and 2 percent from 55 placer mines in 17 counties.

Tungsten.—Ore from California mines was the source of nearly one-third of the Nation's tungsten-concentrate production in 1957. The end of the Government domestic tungsten-purchase program in January resulted in the closing of all but one tungsten mine by September. The number of producers dropped from a total of 212 in 1956 to 1 by the end of 1957, yet 19 properties in 10 counties, were active during the year. A mining and milling operation, in conjunction with a digestion plant, was still producing at year end. Production and shipments of tungsten concentrate dropped 46 and 53 percent, respectively, below 1956 figures. Most of the State's tungsten output came from 2 properties; the Pine Creek mine, Inyo County, and the Black Rock mine, Mono County. Mines in nine counties were the source of the State's tungsten production in 1957. In order of total output, these counties were: Inyo, Mono, San Bernardino, San Diego, Madera, Nevada, Mariposa, Tulare, and Kern. Exploration activities under DMEA contracts consisted of 2 new projects, both in Inyo County, and initiated in September and October, respectively; and 3 projects, 1 each in Alpine, Fresno and Nevada Counties, and terminated in February, November and June, respectively.

Uranium.—Three operators, one each in Kern, Lassen, and Madera Counties, shipped ore to Utah processing plants during the year. None of these mines had produced Shipping-grade ore before this

year. Despite the decline in tonnage mined, the average grade of all shipments exceeded those in the preceding year by 0.20 percent U_3O_8 . Two mining companies carried on drilling programs in Kern County but shipped no ore. Some exploration work was reported in the Bear Lake Area of San Bernardino County. The only exploration activity for uranium in 1957 under the DMEA program was in Inyo County. That contract was terminated in September.

Zinc.—The sharp drop in lead and zinc prices, a decrease that resulted in closing down the mining at the Darwin and Shoshone group of mines in Inyo County before midyear, was largely responsible for the 63-percent drop in the recoverable zinc from California ores compared with 1956. Although the lead-zinc ores and lead and zinc concentrates from The Anaconda Co. mines in the Darwin (Coso) and Resting Springs districts, Inyo County, yielded a large percentage of California's zinc output, important additions to the total production were made from ores of other districts and counties treated at California and Utah smelter-fuming plants. Chief among these were: Gold ore mined in the East Belt district, El Dorado County, and the Downieville district, Sierra County; lead ore from the Paymaster district, Imperial County, and the Modoc district, Inyo County; and lead-zinc ore from the Morongo district, San Bernardino County. All the zinc concentrates shipped from California mines in 1957 were treated at a Montana zinc smelter.

Other Metals.—Undisclosed quantities of antimony, contained in gold, lead, and lead-zinc ores from mines in several California counties, were recovered at smelters outside the State. At the Selby smelter, Contra Costa County, antimony contained in the smelted ores and concentrates was recovered in crystal form and shipped to an east coast plant for conversion to metal. Lead and zinc concentrates from ores of the Darwin and Shoshone mines, Inyo County, contained recoverable cadmium and selenium. The quantities of these metals recovered at smelters outside the State was undetermined but was considerably less than in 1956 due to the lower output of ore from the mines.

Work at cobalt-nickel prospects in Del Norte, Imperial and San Diego Counties consisted of surveying, drilling, and sampling. An ilmenite placer deposit in Los Angeles County showed some promise as a possible producer, based on exploration, and a chemical plant to treat the ore was under consideration. The Peterson pit on the lower San Joaquin River, Madera County, worked chiefly for sand and gravel, was idle in 1957, but production of ilmenite and zircon in 1958 was anticipated. A mill run was made on a few tons of material from the Major claims near Mojave, Kern County, recovering zirconium-hafnium. The test was inconclusive, and no production was reported. In Trabuco Canyon near Santa Ana, Orange County, a property was prospected for tin ore.

REVIEW BY COUNTIES

Mineral-production value in six counties—Kern, Los Angeles, Ventura, Orange, Fresno, and Santa Barbara—represented 78 percent of the State total. These counties have consistently been production leaders, because they are the sources of a high percentage of California's

mineral-fuels output. Kern replaced Los Angeles County as the leading producer of minerals, by virtue of its petroleum output. Orange County regained fourth place in 1957, over Fresno, owing to the volume of mineral fuels produced. Ventura County led all others in yields of natural gas and natural-gas liquids. San Bernardino County was again the top producer of nonmetallic minerals, through preparation of cement and output of boron minerals, and stone. Riverside County remained the major source of metals and metallic ores produced in 1957 owing to its iron-ore production.

TABLE 33.—Value of mineral production in California, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value ¹
Alameda.....	² \$19, 180, 754	\$17, 112, 606	Sand and gravel, salt, magnesium compounds, stone, bromine, clays, chromite.
Alpine.....	(³)	(³)	Sulfur ore, sand and gravel, silver.
Amador.....	1, 633, 536	1, 209, 898	Sand and gravel, clays, coal (lignite), stone, gold, silver.
Butte.....	2, 559, 164	3, 393, 284	Natural gas, sand and gravel, stone, chromite, gold, gem stones, silver.
Calaveras.....	11, 466, 710	12, 065, 210	Cement, stone, sand and gravel, clays, copper, gold, gem stones, silver, lead.
Colusa.....	406, 861	373, 226	Sand and gravel, natural gas, chromite, mercury, gem stones.
Contra Costa.....	4, 254, 063	4, 054, 320	Stone, natural gas, sand and gravel, peat, sulfur, clays, gem stones.
Del Norte.....	599, 216	929, 262	Sand and gravel, chromite, stone.
El Dorado.....	2, 282, 684	2, 390, 198	Lime, stone, sand and gravel, gold, soapstone, slate, chromite, copper, lead, silver, zinc, gem stones.
Fresno.....	123, 483, 407	134, 767, 707	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel, chromite, clays, mercury, gold, pumice, silver.
Glenn.....	1, 910, 200	4, 929, 056	Natural gas, sand and gravel, chromite.
Humboldt.....	1, 734, 711	2, 565, 261	Sand and gravel, natural gas, stone, copper, gold, chromite, silver, lead, gem stones.
Imperial.....	2, 446, 840	2, 379, 174	Gypsum, sand and gravel, manganese ore, stone, pumice, mica (scrap), gem stones, lead, copper, silver, zinc, gold.
Inyo.....	17, 239, 485	7, 848, 408	Tungsten, molybdenum, lead, talc and pyrophyllite, sodium carbonate, zinc, copper, silver, pumice, pumicite and volcanic cinder, stone, sand and gravel, boron minerals, clays, perlite, gold, manganese ore, sulfur ore, asbestos, gem stones.
Kern.....	² 337, 211, 064	368, 979, 681	Petroleum, boron minerals, natural-gas liquids, natural gas, cement, stone, sand and gravel, gypsum, clays, salt, sodium sulfate, pumice, gold, uranium, tungsten, gem stones, silver, copper.
Kings.....	12, 257, 020	11, 825, 970	Petroleum, natural gas, natural-gas liquids, sand and gravel, gypsum, mercury, stone.
Lake.....	⁴ 829, 667	⁴ 892, 832	Mercury, sand and gravel, pumice, pumicite and volcanic cinder, stone, sulfur ore, gem stones.
Lassen.....	656, 227	129, 593	Sand and gravel, stone, volcanic cinder, uranium.
Los Angeles.....	333, 549, 285	326, 313, 319	Petroleum, natural-gas liquids, sand and gravel, natural gas, stone, sulfur (byproduct), cement, diatomite, iodine, clays, gold, soapstone, gem stones, silver.
Madera.....	² 1, 619, 024	1, 801, 286	Sand and gravel, natural gas, stone, pumicite, copper, tungsten, gold, silver, uranium, gem stones.
Marin.....	2, 339, 295	2, 174, 090	Stone, clays, sand and gravel, mercury.
Mariposa.....	234, 594	144, 545	Sand and gravel, gold, tungsten, slate, silver.
Mendocino.....	436, 245	1, 799, 082	Sand and gravel, stone, chromite, gem stones.
Merced.....	1, 478, 685	1, 120, 195	Sand and gravel, gypsum, mercury.
Modoc.....	429, 459	748, 629	Sand and gravel, pumice and volcanic cinder, peat, gem stones.
Mono.....	² 4, 335, 082	1, 531, 991	Tungsten, pumice and volcanic cinder, sand and gravel, pyrophyllite, clays, gold, silver, copper, lead.
Monterey.....	28, 302, 774	33, 372, 319	Petroleum, lime, magnesium compounds, sand and gravel, stone, feldspar, natural gas, salt, mercury, chromite, gem stones.
Napa.....	1, 647, 973	1, 231, 909	Stone, sand and gravel, mercury, diatomite, asbestos, perlite, chromite.
Nevada.....	1, 454, 234	198, 944	Gold, sand and gravel, barite, tungsten, silver.
Orange.....	117, 873, 865	142, 041, 235	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays, salt, iodine, peat.
Placer.....	563, 314	896, 256	Clays, sand and gravel, stone, gold, chromite, silver.
Plumas.....	154, 386	538, 919	Sand and gravel, stone, manganese ore, gold, chromite, copper, silver, mica (scrap).

See footnotes at end of table.

TABLE 33.—Value of mineral production in California, 1956-57, by counties—Con.

County	1956	1957	Minerals produced in 1957 in order of value ¹
Riverside.....	\$39,477,680	\$39,461,951	Iron ore, cement, stone, sand and gravel, clays, gypsum, manganese ore, petroleum, copper, gem stones, gold, silver.
Sacramento.....	18,136,327	16,546,767	Natural gas, sand and gravel, gold, clays, platinum, stone, silver.
San Benito.....	5,163,927	7,801,824	Cement, petroleum, stone, mercury, sand and gravel, natural gas, gem stones, chromite, clays.
San Bernardino...	81,846,486	⁴ 77,360,987	Cement, boron minerals, sodium carbonate, stone, potassium salts, sodium sulfate, sand and gravel, salt, iron ore, talc and pyrophyllite, calcium chloride, petroleum, lime, bromine, clays, rare earths, perlite, pumicite and volcanic cinder, tungsten, natural gas, manganese ore, feldspar, barite, gem stones, lead, silver, copper, zinc, gold, fluor spar.
San Diego.....	7,281,856	7,562,239	Sand and gravel, stone, salt, magnesium compounds, clays, pyrophyllite, tungsten, gem stones, strontium, gold, silver.
San Francisco.....	617,903	194,890	Stone, sand and gravel.
San Joaquin.....	6,262,844	5,364,243	Natural gas, sand and gravel, clays.
San Luis Obispo...	10,812,246	11,472,808	Petroleum, chromite, sand and gravel, natural gas, stone, natural-gas liquids, sulfur (byproduct), mercury, gypsum, clays, manganese ore, gem stones.
San Mateo.....	² 11,110,082	11,660,381	Cement, stone, salt, magnesium compounds, petroleum, mercury, clays, sand and gravel, natural gas, gem stones.
Santa Barbara....	101,973,862	108,905,564	Petroleum, diatomite, natural-gas liquids, natural gas, sand and gravel, stone, mercury, chromite, clays.
Santa Clara.....	24,782,941	27,501,823	Cement, stone, sand and gravel, mercury, clays, masonry cement, gem stones.
Santa Cruz.....	7,631,707	7,548,198	Cement, stone, sand and gravel, clays, potassium salts, gem stones.
Shasta.....	1,531,280	2,098,480	Sand and gravel, pyrites, stone, volcanic cinder, gold, chromite, silver.
Sierra.....	377,425	665,761	Gold, sand and gravel, stone, silver, zinc.
Siskiyou.....	2,165,914	1,965,302	Gold, sand and gravel, pumice and volcanic cinder, chromite, stone, silver, copper, gem stones.
Solano.....	11,112,903	10,352,104	Natural gas, sand and gravel, clays, stone.
Sonoma.....	3,595,124	4,309,538	Stone, sand and gravel, mercury, natural gas, clays, chromite, petroleum, gem stones.
Stanislaus.....	782,414	933,212	Sand and gravel, chromite, clays.
Sutter.....	2,215,262	502,609	Natural gas, sand and gravel, clays.
Tehama.....	667,606	700,903	Sand and gravel, natural gas, chromite, stone.
Trinity.....	540,620	1,649,368	Sand and gravel, stone, gold, mercury, chromite, silver, copper.
Tulare.....	3,022,299	3,141,098	Natural gas, sand and gravel, petroleum, stone, barite, clays, tungsten, gem stones.
Tuolumne.....	² 4,151,969	1,211,204	Stone, lime, sand and gravel, chromite, gold, gem stones, silver.
Ventura.....	158,526,508	202,605,322	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone, clays, gypsum.
Yolo.....	1,318,930	1,357,951	Sand and gravel, natural gas, stone.
Yuba.....	3,651,441	4,131,995	Gold, sand and gravel, stone, clays, platinum, silver, copper.
Undistributed ⁵ ...	² 8,085,620	4,090,073	
Total.....	² 1,551,413,000	⁶ 1,650,855,000	

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 petroleum, sand and gravel, gem stones, mercury, gold, and value indicated by footnote 3.⁶ Total has been adjusted to eliminate value of gas blown to air for which the county distribution is unknown.

Alameda.—The decreased output of stone, clay, and especially sand and gravel that greatly affected the total value of Alameda County's mineral production was the result of near completion of major freeway projects and the decline in home construction and consequent requirement of less paving and fill material, structural sand and gravel, and building brick. Most of the decrease occurred at sand and gravel operations near Pleasanton and at Niles, where one plant was closed

down during 1957. Despite this decline the value of the 1957 output of sand and gravel was higher than that of any other mineral commodity produced. Basalt was quarried and processed at the Leona quarry in Oakland, and sandstone was produced near Hayward, principally for use in constructing roads. Miscellaneous stone quarries in the San Leandro, Hayward, and Fremont areas yielded 574,000 tons of paving and fill material during 1957.

A small quantity of refractory-type clay for foundry or steelworks use was produced from an underground mine south of Livermore. Miscellaneous clay was dug near Irvington for building-brick manufacture. The Niles area was the source of clay used in manufacturing vitrified sewer pipe, floor and wall tile, building brick, and other heavy clay products. At Berkeley, Industrial Minerals & Chemical Co. ground soapstone from El Dorado County for foundry facings, insecticides, paint, and rubber.

Salt was recovered from sea water by evaporation at 3 plants in the county during 1957—2 at Newark and 1 at Mount Eden. A high percentage was produced by solar evaporation, but appreciable quantities were prepared by open- and vacuum-pan methods. In 1957 more of the high-purity grades of salt were produced compared with 1956.

A chemical plant at Emeryville made magnesium carbonate from magnesium hydroxide produced locally, and a company in Berkeley produced hydrous magnesium sulfate (epsom salt) from magnesite and brucite, which came from Nevada. The Westvaco Chemical Division, Food Machinery and Chemical Corp., produced various magnesium compounds and byproduct synthetic gypsum in its salt-works-bitterns processing plant at Newark. Raw dolomite from the company quarry in San Benito County was used in the magnesia plant. Ethylene dibromide was also manufactured as a byproduct in processing the bitterns at the plant. The production was about 9 percent below 1956, although the unit value remained virtually unchanged. The finished product was used as an ingredient of antiknock gasoline.

Chromite ore was mined from the Cedar Mountain mine in the *Tesla* district southeast of Livermore by the Palo Alto Mining Corp. and hauled to the company mill at San Jose for treatment. The concentrate was shipped to the Government stockpile in Oregon.

The Judson Steel Corp., at Emeryville, and Pacific States Steel Corp., at Niles operated open-hearth furnaces, using iron and steel scrap as the exclusive source of metal. The 1957 production was limited to steel reinforcing rods for concrete. The C. K. Williams Co., at Emeryville, was the only manufacturer of iron oxide pigments in California. About two-thirds of the product was synthetic iron oxide manufactured from sulfuric acid, caustic soda, and steel scrap. The remaining third was natural oxide pigment produced by calcining limonite obtained from northwestern Oregon. The tonnages sold were slightly less than in 1956—the value was slightly higher.

Alpine.—The output of sulfur ore (Alpine county's principal mineral commodity) exceeded that in 1956. The unit value of the production increased, inasmuch as the average sulfur content of the 1957 output was 3 percent higher, and the tonnage required at the operator's copper-leaching operation in Nevada was 8 percent under the 1956 figure.

Sand and gravel was prepared and used for paving by contractors for the California Division on Highways.

The county's tungsten mines did not produce in 1957, and an exploration contract for tungsten ore at the Valpine mine (near Woodfords) under the DMEA program was terminated in February. A few ounces of silver was recovered from ore mined at a prospect in the *Monitor* district and constituted the only metal mining during the year.

Amador.—Sand and gravel became the county's most valuable mineral commodity in 1957, surpassing clays, the leader in 1956, chiefly because of the lower output of clays used for firebrick. The increased production of glass sand (a coproduct of clays in the Ione area) and the greater demand for paving gravel by the Amador County Road Department furnished a total output of sand and gravel that exceeded 1956 by more than 18,000 tons.

Most of the clay produced during 1957 was used in refractories, heavy clay products, and manufacturing cement. Smaller quantities were prepared for use in pottery, stoneware, and tile and as a filler in paints. In January a new plant was put in production at Indian Hill, a few miles west of Ione, for the exclusive manufacture of refractories. It operated the remainder of the year. Large tonnages of clays were shipped to processing plants outside the county.

Stone production in Amador County increased over 1956; it was credited to the tonnage of crushed miscellaneous stone used by the Amador County Road Department near Pine Grove and to the quantity, naturally colored, quarried, and prepared for roofing granules from a quarry in the Lancha Plana area. California's only active lignite mine (near Ione) yielded a slightly lower tonnage from open pits than in 1956. The lignite was processed at Buena Vista, chiefly for its montan-wax content.

The *East Belt* district was the source of a few ounces of placer gold and silver, produced by hydraulicking bench gravels near Sutter Creek and by dragline-dredging stream gravel near Volcano. A cleanup at the idle Kennedy lode mine in the *Mother Lode* district yielded some recoverable gold and silver.

Butte.—Dry-natural-gas production rose 55 percent above that in 1956, and the gas maintained its position as the county's most valuable mineral product. The output from the Wild Goose, Durham, Chico, and Perkins Lake fields was augmented by production from the Schohr Ranch, 1 of the 3 new gasfields discovered in the State during 1957. The Wild Goose field continued to rank fifth in production in California.

The output of sand and gravel in the county dropped appreciably compared with 1956, chiefly because production of gravel for building, paving, and railroad ballast in the Chico and Oroville areas declined. The production of miscellaneous stone and crushed sandstone rose considerably over that in 1956, owing to increased activity in highway construction and maintenance by State and county agencies. A considerable quantity of idocrase for gem-stone use was gathered in the Feather River area. Most of the material was obtained at Nelson's Bar north of Cherokee.

Chromite was produced from a mine 4 miles southwest of Magalia. Although some crude ore under 45 percent Cr_2O_3 was shipped direct to the Government stockpile at Grants Pass, Oreg., most of the ore

and a small tonnage of Milling-grade ore obtained from a deposit near Pulga were trucked to a mill at Castella, Shasta County, and upgraded before shipment to the stockpile. Only one exploratory contract for chromite under the DMEA program was in force during the year. The contract was terminated in October. Several small placer-gold operations in the *Butte Creek*, *Honcut*, *Magalia*, and *Yankee Hill* districts were sources of the county's small gold and silver output.

Calaveras.—The 5-percent increase in the value of Calaveras County's mineral output over 1956 resulted largely from the rise in shipments of cement produced in the county and in the output of paving sand and gravel. Shipments of cement from the five-kiln plant at Kentucky House, the county's principal mineral installation, increased in 1957—a reverse of the decline in other sections of the State. The chief reason for this increase was the large volume of cement used in the Eastshore Freeway, Alameda County, and at Travis Air Force Base, Solano County. The large tonnage of raw materials, limestone and clay, required at this portland-cement plant was obtained from deposits in the *East Belt* district.

Appreciable quantities of disintegrated granite were quarried in the county by crews of the Calaveras County Highway Department for road paving, and about 23,000 tons of sand and gravel were dug and used on county roads. Over 40,000 tons of silica sand was mined and processed in Pacific Clay Products' new flotation plant at Camanche.³ The silica product was sold to the glass industry. In addition to clays mined in the East Belt for the San Andreas cement plant, clays dug in the Valley Springs area were used outside the county in manufacturing sewer pipe and other heavy clay products. The Valley Springs area was also the source of sizable quantities of agate collected for gem use.

Gold ore from the Blackstone, Little Tiger, and Weelock mines in the *East Belt* district and the Blue Eagle mine in the *Mother Lode* district yielded relatively small quantities of gold and silver. Old tailing at the Parnell property in the latter district was reworked for a few ounces of gold. Copper precipitate containing recoverable silver and lead, obtained at the Penn mine in the Campo Seco area by in-place leaching operations, and some direct-smelting copper ore (containing silver) from the Calaveras (Union Copper) mine, were shipped to an out-of-State smelter. Several placer properties in the county were worked by small-scale hand equipment, chief of which was the Cassinelli (Rising Sun) deposit in the *Mother Lode* district, yielded small quantities of gold and silver. Tungsten ore was produced and stockpiled at the Moore Creek underground mine near Pioneer during the course of exploration and development.

Colusa.—The 55-percent increase in sand and gravel production in 1957, compared with 1956, was due principally to the tonnages of paving gravel produced at various places in the county by contractors for State and county road agencies. In comparison with the preceding year, stone production in the county was almost nonexistent. In 1956 a San Francisco contractor had quarried and dressed "Colusa" sandstone at a quarry near Sites for an extension on a church in San

³ Utley Harry F., High-Solids Conditioning and Flotation in Glass-Sand Plant; Pit and Quarry, vol. 50, No. 4, October 1957, pp. 72-74, 100.

Mateo County that had originally been faced with sandstone from the same quarry. The Sulphur Creek area was the source of onyx collected for gem-stone use.

The value of natural-gas production in 1957 was exceeded only by that of sand and gravel. Despite the added output of the newly discovered Arbuckle field, production dropped 30 percent below 1956 owing principally to a 37-percent lower yield from the Princeton field, the only other producer.

A producer in the *Stonyford* district mined a moderate tonnage of chromite ore, some of which was upgraded before shipment to the Government stockpile in Oregon. The Cr_2O_3 content of all ore and concentrate shipped exceeded 45 percent. A few flasks of mercury was recovered from cinnabar ore mined at an open-pit deposit in the *Wilbur Springs* district.

Contra Costa.—Stone was the leading raw mineral produced in the county, despite a 440,000-ton drop in yield from 1956. The tonnage of crushed stone used in road construction was appreciably less, and the quantities required in flood control projects and commercial construction were also lower. However, important tonnages of sandstone were produced at the San Pablo quarry near Richmond and miscellaneous stone in the Clayton area. Although sand production for Government-and-contractor projects increased, the output by commercial plants declined in 1957. Much of the county requirement of sand and gravel was filled from sources in Alameda and San Joaquin Counties. Conversely, of the 51,000 tons of sand produced at the Morris pit near Antioch, 13,000 tons was shipped by rail to San Francisco and used as asphalt mix. Clay and shale production in the Port Costa and Richmond areas declined 23 percent compared with 1956, chiefly in the quantities used locally in manufacturing building brick.

Although no petroleum was produced in Contra Costa County, it was one of California's chief oil-refining centers. Crude petroleum from domestic and foreign sources was refined at plants in Richmond, Oleum, Martinez, and Avon. Their combined throughput capacity was 422,800 barrels per day in 1957 compared with 391,800 barrels per day in 1956. Refineries at Richmond and Avon recovered hydrogen sulfide from crude oil and piped the gas to nearby chemical plants for direct conversion to sulfuric acid. A refinery at Oleum converted the recovered hydrogen sulfide to brimstone, while one at Martinez (because of marketing difficulties) burned the gas for fuel. Sulfur dioxide was recovered from sulfide ores and concentrates at the Selby smelter; about half was converted to sulfuric acid; the remainder was condensed to liquid SO_2 . This smelter, California's only major smelter handling primary nonferrous material, treated principally imported lead ores and concentrates and also refined gold and silver. Zinc fume recovered at the slag plant was shipped out of State for conversion to the metal and zinc oxide.

Natural-gas output in Contra Costa County climbed 43 percent above 1956 production and came entirely from the Rio Vista field, the State's largest and most productive dry gasfield, which lies mostly in Sacramento County and to a lesser extent in Contra Costa and Solano Counties. The quantity of peat dredged from the San Joaquin River delta at Bethel Island exceeded that in 1956 by over 100 percent. The material was processed and shipped for use as a soil-conditioning

agent. An Antioch plant produced gypsum plaster, lath, and wall-board from crude gypsum imported from the company-owned deposit on San Marcos Island, Lower California, Mexico.

In the Pittsburg area one of California's principal steel plants prepared rolled structural shapes and tinplate, and a refractories plant used special clays shipped into the county. Shasta County pyrites was used to prepare sulfuric acid at plants near Richmond and Nichols, and copper salts were prepared at Mococo, largely from scrap copper.

Del Norte.—The value of the 1957 sand and gravel production was 46 percent of the total value of all mineral commodities produced in the county. The output of structural sand, paving gravel, and basalt and miscellaneous stone used for paving and riprap increased. A moderate tonnage of sandstone was quarried and crushed in the county for roadstone.

Del Norte County ranked third in the State in the tonnage of chromite ore mined and shipped during the year. Although there were 35 producing properties, the major tonnage was obtained from a mine north of Gasquet in the High Plateau area. The chromite produced at this mine was direct-shipping-grade ore containing from 44 to 54 percent Cr_2O_3 . Large quantities of chromite ore and concentrate were also produced and shipped to the Government stockpile from properties in the *Big Flat* district south of Gasquet.

El Dorado.—Lime continued to be El Dorado County's most valuable mineral commodity in 1957. The old Mountain quarry was reopened as a source of limestone for the Diamond Springs lime plant. Two rotary kilns and a continuous hydrator were used to prepare quick and hydrated lime for chemical and industrial uses and the building trades. During the year a bucket tramway was converted to trucking to increase the plant capacity, and an asphalt-mix plant was added.⁴ The output of limestone dropped below the 1956 figure because of lower requirements outside the county in manufacturing lime used in sugar refining, and the increased use of sand and gravel locally instead of crushed limestone for road construction. The tonnage of rhyolite quarried and cut near Camino and Placerville for use as rubble and building stone exceeded that in 1956. The demand for slate dropped in 1957, and the slate quarry near Kelsey was not worked. Some slate was quarried at the Chili Bar mine near Placerville and prepared by crushing and grinding for roofing granules and rock flour, respectively. A few pounds of opalized wood were gathered east of Placerville by a collector of gem materials.

The Hazel Creek mine in the *East Belt* district yielded a high percentage of the gold and silver credited to the county and was the sole source of recoverable lead and zinc in 1957. Ore from the Lilyama mine in the *West Belt* district supplied all of the county's recoverable copper and appreciable quantities of gold and silver. Considerable gold and silver was also recovered from ores of the Yellow Jacket mine in the *Mother Lode* district. Placer mining for gold was limited to several stream-gravel operations, using small-scale hand-operated equipment in the aforementioned districts. Moderate tonnages of chromite ore were shipped from the Pilliken mine in the *West Belt* district and the Wilson property in the *Mother Lode* district to the Grants Pass (Oreg.) purchase depot.

⁴ Pit and Quarry, vol. 50, No. 4, October 1957, p. 24.

Soapstone produced at the Hayden and Shrub deposits in the Latrobe and Shingle Springs areas, respectively, was shipped to grinding plants in Alameda, Sacramento, and San Francisco Counties and prepared for use chiefly as a carrier for insecticides and fumigants.

Fresno.—The value of Fresno County's mineral production ranked fifth in the State, owing chiefly to the output of mineral fuels. There were 12 active oilfields and 5 operating natural-gasoline plants, and the oil and gas industry continued dominant in the economy of the county. The major producing fields were the Coalinga East Extension (credited with nearly half the total), Coalinga, Kettleman, North Dome (which includes part of Kings County), Gujarral Hills, and Raisin City. Total crude-oil yield dropped 4 percent in 1957, and the volume of natural gas marketed fell 3 percent. Wet gas from crude-oil fields was processed in 5 natural-gasoline plants, 2 each near Avenal and Coalinga and 1 at Burrel. No new oilfields were discovered in the county during the year; but a significant new pool—the Gatchell—was brought in at the Gujarral Hills field.

The total output of granite and sand and gravel exceeded that in 1956, owing to the quantities produced and used for fill and aggregate by contractors at the Pacific Gas & Electric Co. Wishon and Court-right Dams. Production of sand and gravel in other sections of the county was lower in 1957 than in 1956. Slightly larger tonnages of dimension architectural and monumental granite were quarried near Clovis in 1957 than in 1956. Miscellaneous clay was dug from pits near Fresno and used in manufacturing common brick. Areas along the San Joaquin River were the sources of quartz crystal collected for gem use. Pumice (for use as decorative stone facings and as aggregate in building block and tile) was produced at the South Dome quarry near Friant.

In the *Idria* district chromite ore from the Butler Estate No. 1 mine, and concentrate produced in the company gravity plant were shipped to the Government stockpile at Grants Pass, Oreg., under the carlot program. This mine was the source of the State's leading output of chromite in 1957. In the same district, chromite ores were also shipped from the Lot No. 8 and Big Ridge mines. Also in the *Idria* district, ore from the Esperanza open-pit mercury mine was furnaceed by a producer in San Benito County and yielded 40 flasks of the metal. Gold and silver were recovered from ancient riverbed and stream deposits at four sand and gravel preparation plants in the Friant area. Exploration for tungsten was carried on at the Obelisk mine near Dinkey Creek under the DMEA program until November, when the contract was terminated.

At Fresno, one processing plant custom-ground crude barite as a constituent of well-drilling muds; another plant expanded crude perlite, mined outside the county, for aggregate in plaster and oil-well cementing.

Glenn.—The production of natural gas, Glenn County's most valuable mineral commodity, rose 195 percent above 1956. This marked increase resulted almost entirely from development in the Beehive Bend-Willows area, inasmuch as the natural-gas production from the older Afton and Ord Bend fields in 1957 was 31 percent below that in 1956. Seventeen dry-gas-producing wells were added in the Beehive Bend-Willows area during the year. This area was

second in yield only to the Rio Vista field in Sacramento County and was credited with 12 percent of California's entire gas output. The substantially increased output of paving gravel for the Glenn County Road Department supplied the overall increase in sand and gravel production, compared with 1956. Pits at Wyo were the source of a large tonnage of gravel for railroad ballast. Chromite ore was produced at the Burrows mine and mill near Newville in the *Elk Creek* district; some of this ore was concentrated at the Castella mill, Shasta County. The entire output was shipped to the Government stockpile at Grants Pass, Oreg.

Humboldt.—The appreciably increased production of sand and gravel, the county's major mineral commodities, resulted chiefly from the greater output of structural sand and gravel at pits in the Arcata, Eureka, and Fortuna areas for use in local projects. The quantities of paving sand and gravel produced in the county to meet the requirements of the Humboldt County Road Department in 1957 was 374,000 cubic yards, compared with 64,000 cubic yards in 1956. Stone production rose in 1957 owing to the output by contractors for the California Division of Highways, who crushed 169,000 tons of sandstone used in road paving. Basalt produced from Haw's quarry near Eureka was used as riprap on a project for the United States Army Corps of Engineers. About 500 pounds of jasper was collected along the ocean beach near Trinidad for gem-stone material. The natural-gas output from the Eureka field, the only gas-producing area in the county, dropped 6 percent below the 1956 figure.

Ore from the Copper Bluff mine in the Trinity River area south of Hoopa was the source of the copper and most of the silver and gold produced in the county. Copper-flotation concentrate was shipped to a Washington smelter. A few ounces of placer gold was recovered from bench gravels in the *Klamath River* district near Orleans by small-scale hand equipment. Chromite ore was produced and shipped from the White Cedar mine in the *Klamath River* district and the Twin Lakes mine in the Orleans area. The Cr_2O_3 content of the ores varied from 43 to 46 percent, and the entire quantity was shipped to the Grants Pass (Oreg.) Government depot.

Imperial.—A general slump in the demand for building materials adversely affected the 1957 output of gypsum. Despite the decline this commodity led all others in the county in the value of the 1957 output. The crude material was shipped from pits in the Fish Creek Mountains to the producer's plant at Plaster City and prepared for use as a soil conditioner and cement retarder and in manufacturing plaster and wallboard. Sand and gravel production was slightly higher than in 1956, owing to the larger tonnages required for paving projects by contractors for the Federal Bureau of Public Roads and by the Imperial County Road Commission. Filter sand was dredged near Brawley and prepared for use in installing farm drintile in the Imperial Valley.

The 1957 output of stone was 29 percent less than in 1956. It consisted of basalt crushed and prepared for roofing granules near Jacumba and disintegrated granite used in road construction from the Plaster City area. Pumice was quarried near Calipatra and prepared for use as lightweight aggregate in concrete. Agate, kyanite, chrysocolla, and amethyst were collected in the Ogilby area

for gem use. Two open-pit deposits near Ogilby yielded the State's entire output of mica (sericite schist) in 1957. Sericite from the Mica Schist mine was ground for use in manufacturing shingles and roofing paper and crude material from the Redbird mine was wet-ground and used as an extender in paints.

Manganese ore was produced at the Pioneer mine in the *Paymaster* district and was mostly custom-treated at a flotation and sintering plant near Winterhaven. Manganese ore was also mined from the Alaskan and Black Beauty claims in the *Palo Verde* district. All ores and concentrates were shipped to an out-of-State Government stockpile. A shipment of direct smelting copper ore containing some silver was made to an Arizona smelter from the Britt property in the *Mesquite* district, and a car of lead ore containing recoverable silver and zinc was shipped to the Selby smelter, Contra Costa County, from the Annex No. 2 and No. 7 claims in the *Paymaster* district. These copper and lead ores were produced in the course of assessment work.

Inyo.—Curtailed operations and the shutdown of major lead and zinc mines chiefly supplied the nearly \$10-million drop in the total value of the county's mineral output from that in 1956. Despite this retrenchment, tungsten was the most valuable mineral or mineral material produced. The Pine Creek mine near Bishop was one of the State's few tungsten mines active at the end of 1957. The company-owned Morgan Creek flotation mill and digestion plant produced tungsten concentrates and synthetic scheelite from Pine Creek ore and low-grade concentrates and was California's only active tungsten plant at year end. Also in the Bishop area, tungsten ores from the Brownstone and Moonlight mines were milled and the concentrates sold to local buyers. Tungsten concentrate produced at the Red Hill mill during terminal-cleanup operations was sold to an out-of-State consumer. Near Trona, San Bernardino County, concentrate produced from tungsten ore of the Red Rock mine was sold in Bishop. Exploration contracts for tungsten ore under the DMEA program were executed in October and September at the Adamson mine and the Round Valley-Tungsten Hill properties, respectively. The tungsten ores of the Pine Creek area were the source of the State's entire output of molybdenum concentrates and a high percentage of its copper production. The molybdenum concentrates, both oxide and sulfide, recovered as byproducts in treating tungsten ores were shipped for export, and the copper concentrate, which contained gold and silver, went to a Utah smelter.

Although the major lead and zinc mines in the *Darwin* and *Resting Springs* districts were closed down during the last half of the year, ores from these mines were the source of most of the county output of recoverable lead, zinc, silver and gold, and some of the copper. Much of the remaining lead and zinc credited to the county was recovered at a California smelter-fuming plant from ores produced at the Santa Rosa mine in the *Lee* district and the Defense mine in the *Modoc* district. The ores from 22 lode mines in 14 mining districts supplied the Inyo County total output of recoverable gold, silver, copper, lead, and zinc.

Deposits in Inyo County were the major sources of the State talc production. Large tonnages of talc were produced at mines in the

Shoshone, Tecopa, Bigpine, and Keeler areas. The slightly lower output, compared with 1956, was shipped to grinding plants and prepared for use, principally in ceramics, paint, and toilet preparations. Although most of the grinders were in southern California, 2 county producers, 1 at Laws and 1 at Keeler, operated grinding plants in conjunction with mining. Pyrophyllite was mined and stockpiled at the Colton mine near Bishop, but was not shipped.

At Bartlett a chemical company recovered soda ash and trona from the brines of Owens Lake. The quantities recovered were greater than in 1956, but unit prices of the materials remained substantially the same. At the close of the year the producer was constructing a new recovery plant adjacent to the present operations. Colemanite was mined at the Corkscrew Canyon underground and East Coleman open-pit mines near Death Valley Junction, and crude sodium-calcium borate was obtained from the Gerstley underground property near Shoshone. The crude minerals were processed in the company mill and refinery at Boron, Kern County.

The total production of pumice, pumicite, and volcanic cinder in the county was 24 percent less than in 1956, but appreciable tonnages were mined in the Bishop and Little Lake areas. The output was used mostly for concrete aggregate; lesser quantities were consumed in insulation and as roofing granules. The limestone quarried in the Argus Range was calcined at a chemical plant near Trona, San Bernardino County, for the carbon dioxide to produce sodium carbonate at the plant. Most of the lime byproduct was stockpiled, but some was sacked and sold. Marble was quarried for roofing granules in the Lone Pine area, and dimension stone for building purposes was quarried in the county at properties near Death Valley Junction and several miles north of Trona, San Bernardino County. Sand and gravel production for the commercial trade declined in 1957; however, the output for Government projects nearly offset the drop. Crews of the Inyo County Highway Department produced 49,000 tons of paving gravel for county roads, and the Department of Water and Power, city of Los Angeles, prepared 16,000 tons of sand and gravel at its Lone Pine plant for use in the Los Angeles Aqueduct.

The production of clays declined below that in 1956, owing chiefly to the limited outlet for clay products prepared from the grades that were mined in 1957. Fuller's earth was obtained from a deposit near Olancho, and bentonitic clays were mined at pits near Death Valley Junction and Tecopa. The clays produced in the county during the year were processed mainly for use in filter aids and insecticides, although smaller quantities were used for fillers, in chemicals, and as concrete admixtures. The Fish Springs quarry yielded a moderate tonnage of crude perlite, which was expanded by the producer and others at plants in Los Angeles County. A small tonnage of asbestos (amphibole) shorts, some of which was used in manufacturing insulation board and pipe, was mined at the Lawrence claim near Tin Mountain. The Inyo Mountains and the Argus Range were the source areas of pyrite, azurite, and quartz crystals collected for gem use.

Some manganese ore was mined at a group of claims in the Wingate Wash area west of Tecopa and shipped to an out-of-State Government stockpile.

Kern.—Kern County led the State as a source of minerals and as an oil producer, despite a 5-percent decline in petroleum output below that in the preceding year. In contrast, the total natural gas marketed rose 10 percent during 1957. Three of the six new oilfield wildcat completions in California during the year were in Kern County—the Tejon North, Bellevue West, and Pleito Ranch fields. Although only two wells were completed at Tejon North by the end of 1957, this field was considered the most significant discovery in the State during 1956 and 1957. In addition to the three new fields, important new pool discoveries were made in the following fields: Tejon-Grapevine, Mountain View, East Gasford, Buena Vista Hills, and Paloma. A new gas well was brought in at the Wheeler Ridge field.

Seven of the 37 operating oil refineries in the State were in the Bakersfield area and represented a 66,000-barrel-per-day-crude-oil capacity—about 5 percent of the State total. Two other smaller refineries were idle during 1957. Natural-gas liquids were recovered at 15 natural-gasoline plants and 2 cycling plants. The major producers were the cycling plants in the Paloma field and at South Coles Levee and the natural-gasoline plant at North Coles Levee. Altogether, these 17 plants produced about 890,000 gallons of natural-gas liquids a day, 27 percent of the State total.

The leading producer of boron compounds in the Nation mined nearly equal tonnages of kernite and tincal from each of its Jenifer underground and Boron open-pit mines near Boron. Mining at the pit began in May 1957. The company also operated a mill and refinery at Boron, where these crude minerals and borates from its deposits in Inyo County were processed. Substantial quantities of the crude minerals and partly refined compounds were shipped to the company refinery in Los Angeles County for further processing. Small tonnages of crude borates were ground and sold as a weed-killing agent on a railroad right-of-way. Appreciable quantities of byproduct salt cake, which were sold to the paper-pulp industry, were recovered at the Boron plant during the processing. An important tonnage of salt was recovered by solar evaporation of dry-lake brines near Randsburg by a salt company and sold to California consumers for use in preparing a wide variety of products.

Two portland-cement plants produced during 1957, one at Monolith and the other at Mojave. The five-kiln Monolith plant mined limestone and clay locally but obtained gypsum from a Ventura County deposit. The Mojave plant was also a 5-kiln plant, 3 of which were placed in operation during the year. The latter planned to install a special closed-circuit television relay throughout the crushing section to facilitate maintenance and a constant check on operations.

Stone production was higher than in 1956, due mainly to the greater tonnages of limestone quarried for cement. Granite quarried and crushed northeast of Bakersfield was used chiefly in paving projects for State and county agencies and the city of Bakersfield. Crushed and dimension stone produced in the Mojave and Rosamond

areas was sold for roofing granules and building facings, respectively. Although larger tonnages of sand and gravel were produced for Government agencies (particularly the Federal Bureau of Reclamation, which required important tonnages of sand and gravel in 1957 for structures, and concrete pipe and culverts), the output for private construction declined sharply from the preceding year.

Gypsite used to improve the texture of soils in agricultural areas was mined at deposits in the Lost Hills and McKittrick areas and from pits near Wasco and Maricopa. In addition to the clay dug in the Monolith-Tehachapi area for cement manufacture, dry-lake clay from the Boron, Rosamond, Mojave, and McKittrick areas was sold or used for fillers, absorbents, and pottery and as an ingredient in drilling muds, owing to its viscosity combined with a low specific gravity. Moderate quantities of pumice were quarried from the Calsilco claims near Inyokern and used for cleaning compounds, paint fillers, and absorbents.

Lode-gold mines of the *Randsburg* district were the source of 96 percent of the gold and 51 percent of the silver recovered from ores mined in the county during 1957. A high percentage of this gold and silver output was obtained from the Yellow Aster, Mount Line, Florence, and Butte Lode mines. The Silver Queen mine in the *Mojave* district yielded much of the silver, some gold, and all the recoverable copper produced in the county. Except for a few ounces of gold recovered with small-scale hand equipment by various prospectors, the entire recorded 1957 county placer-gold output had been produced in 1955 and 1956 as a byproduct at a sand- and gravel-preparation plant near Bakersfield and was shipped to the United States Mint in 1957.

Uranium ore from the Little Sparkler mine in *Miracle Hot Springs* district was shipped to a Utah concentrator. The U_2O_5 content of the ore was higher than that of any other uranium ore mined and shipped in the State during 1957. A few tons of tungsten ore was mined and stocked at the Last Hope group of claims near Mojave. Tungsten concentrates were produced from ores of the Billie Burke mine and Lila King claims near Randsburg. The concentrate produced from the Billie Burke ore was sold to a California buyer and was the only sale of tungsten ore or concentrate made in the county during 1957.

Members of several gem societies collected agate, jasper, and petrified wood in the various canyon areas of the county.

Kings.—Oil and gas headed the list of minerals produced in Kings County during 1957; petroleum output was reduced 14 percent; and natural-gas use dropped 18 percent from 1956. The county had but three active oilfields—Pyramid Hills, Kettleman Middle Dome, and Kettleman North Dome (part of which lies in Fresno County). Supplementing the wet-gas production from these fields were the dry-gas fields—Dudley Ridge, Trico Northwest, and Trico. The major part of the last field is in Tulare and Kern Counties. The capacity of the county's lone oil refinery at Hanford was increased 50 percent in 1957 to 7,500 barrels per day. Natural-gas liquids were recovered in three natural-gasoline plants near Avenal.

Sand and gravel production increased substantially in 1957 to meet the requirements of State and county road agencies for road construc-

tion and maintenance. Crews of the Kings County Road Department produced 135,000 tons of paving material, and an additional 453,000 tons was produced by contractors for the California Division of Highways. Stone output was limited to approximately 26,000 tons of crushed granite, quarried and prepared in the county for constructing State highways. Operation of the gypsite quarry near Avenal was continued in 1957, and the crude material was marketed for agricultural use.

The open pits at the Fredanna group of claims near Parkfield yielded mercury ore, which was furnaced to produce 208 flasks of the metal. Three flasks of mercury was recovered from ore mined at the Dawson pit in the same area.

Lake.—The value of Lake County's mercury production in 1957 was 83 percent of the total value of all mineral commodities produced and represented 20 percent of all mercury output in the State. The Abbott mine in the *Sulphur* district near Willow Springs was the major producer. Extensive exploration work was carried on at this mine during 1957, under the DMEA program. The Sulphur Bank mine and plant in the *Clear Lake* district also produced mercury during the year. Sulfur ore was produced at the Sulphur Bank mine by another operator, who sold it for soil improvement. Three other properties in the county near Lower Lake south of Middletown were operated intermittently for mercury in 1957, and together yielded a few flasks of the metal.

Sand and gravel production decreased in 1957, owing to a drop in local demand for building and paving sand and gravel. The State requirements for these materials in maintaining roads in the county were also lower than in 1956. The principal sources of sand and gravel during the year were pits near Clearlake Highlands, Clearlake Oaks, Kelseyville, and Lakeport. The entire small output of stone in 1957 was sandstone, quarried and crushed by crews and contractors of the California Division of Highways for road paving. Pumice, pumicite, and volcanic cinder were produced at two deposits near Clearlake Highlands and prepared for aggregate in acoustic plaster and concrete, and for soil improvement and fill. Quartz, jasper, nephrite and agate were collected at various places in the county as gem material.

Lassen.—Sand and gravel were the chief minerals produced in the county during 1957. The output of these materials and of miscellaneous stone was limited to the requirements of State and county highway projects, which used smaller quantities in 1957 than in 1956. A moderate tonnage of granite was quarried and dressed in the Susanville area for curbing. Volcanic cinder was dug from a deposit near Susanville and used as concrete aggregate. A shipment of uranium ore was made from the Cornelia C No. 2 mine in the *Red Rock* district to a Utah processing plant. This mine had not yielded Shipping-grade ore before 1957.

Los Angeles.—Los Angeles County retained second place among California oil producers, despite an 11-percent drop in crude-oil production from 1956. The county dropped from first to third place in natural-gas production—a 12-percent reduction in gas yield. Of the 6 new California oilfield discoveries during 1957, 3 were in Los Angeles County—Canton Canyon, Tapia Canyon, and Saugus. Significant

new pool discoveries were also made in the older Bandini and Rosecrans fields. Los Angeles County continued to have the greatest concentration of oil refineries in the State, made up of about half the plants and almost two-thirds of the operating capacity. The Long Beach area led with 4 operating plants (2 more shut down), followed by 4 at Wilmington, 2 each at Watson and Torrance, and 1 each at El Segundo, Santa Fe Springs, Paramount, and Newhall. The three largest—Richfield Oil Corp. at Watson, General Petroleum Co. at Torrance, and Standard Oil Co. of California at El Segundo—comprise 30 percent of the State refining capacity. Of the 71 operating natural-gasoline plants in the State, 26 were in Los Angeles County. The leading producers were General Petroleum, Corp. (2 plants), Union Oil Co. (6 plants), and Lomita Gasoline Co. (1 plant).

Five oil companies at El Segundo, Wilmington, Watson, and Torrance continued to recover hydrogen sulfide from sour refinery gases. Three sold their hydrogen sulfide gas to a chemical company at Watson for conversion to elemental sulfur. Refineries at Wilmington and Norwalk continued to recover sulfur in their own plants. Waste oil-well brines of the Los Angeles Basin, largely from Los Angeles County, were the source of the State's crude-iodine production. A plant near Compton produced various iodide and iodate compounds, although much of the recovered iodine was sold to other chemical plants crude. Most of the brines treated were transferred to a Seal Beach plant, Orange County, for recovery of iodine.

Los Angeles County led the State in producing clays, with 19 percent of the total tonnage. Deposits in the county yielded over 517,000 tons—about 38 percent of the total used in California for manufacturing brick and other heavy clay products. Pits in the Los Angeles, Monterey Park, Compton, Gardena, and Castaic areas were worked by 10 firms (9 produced for their own use and 1 for sales). One operator produced a small quantity of miscellaneous clay near San Fernando for filler in fungicides and insecticides. A leading clay-products manufacturer used feldspar mined in San Bernardino County and custom-ground at Los Angeles. A deposit near San Fernando yielded 3,300 tons of soapstone, which was prepared as asphalt filler at a Los Angeles grinding plant. Six other grinding plants in the Los Angeles area prepared talc, soapstone, and pyrophyllite from California and out-of-State mines.

Sand and gravel production dropped 32 percent below 1956 figures because of the general decline in home and industrial construction. Commercial sand and gravel (used mainly for building and paving) decreased 28 percent. The Government-and-contractor output (mostly for highway projects) dropped from 2.2 million tons in 1956 to 250,000 tons in 1957. Despite such setbacks, Los Angeles still led all California counties in sand and gravel production, with a yield that constituted nearly 25 percent of the State total output of these materials. Specialty sands, including blast sand from WALTERIA and El Segundo and engine sand from El Segundo, dropped in output, but there were slight gains over the 1956 yields of molding sand from Torrance, El Segundo, and Redondo Beach and of filter sand from Saugus.

Use of crushed decomposed granite, produced mainly in the Sun Valley, Monterey Park, Montebello and Irwindale areas for structural

and paving purposes, increased 21 percent; this increase compensated somewhat for the decline in output of sand and gravel for the same use. Production of dimension and crushed miscellaneous stone for rough and dressed construction, rubble, flagging, breakwater and seawalls increased slightly over 1956. Most of these quarries were in the Saugus, Bouquet Canyon, and Rolling Hills areas and on Catalina Island.

A Los Angeles cement company continued producing portland cement in 1957 from purchased clinker. Diatomite mined and milled near WALTERIA was sold as filter aid and insulation and filler materials. Raw gypsum for a Long Beach plaster, wallboard, and lathboard plant was imported from the company gypsum quarry on San Marcos Island, Gulf of California, Mexico. Another company used crude gypsum from its quarry near Henderson, Nev., for manufacturing wallboard and lath at Southgate. A Los Angeles exfoliating plant expanded crude vermiculite mined in Montana. The mica plant at Los Nietos was shut down during 1957 for installation of new equipment to process crude and ground mica from foreign and out-of-State sources.

Two aggregate plants in the *San Gabriel* district recovered placer gold and silver as byproducts in processing ancient riverbed and stream gravels. Several refineries at Los Angeles accepted primary and secondary precious metals for refining. Small quantities of various semiprecious gem materials were collected in the Mojave Desert and in the Acton and Tick Canyon areas.

Four steel companies in the Los Angeles-Torrance area operated furnaces with a combined ingot and finished annual capacity of nearly 800,000 tons. At Torrance, 1 company operated 4 open-hearth furnaces, using iron and steel scrap, and iron ore from Utah, as sources of metal; the other 3 companies (1 at Torrance and 2 at Los Angeles) operated electric furnaces that used scrap as the sole source of metal.

Madera.—In 1957 natural-gas production from Madera County's 3 dry-gas fields—Gill Ranch, Moffat Ranch, and Chowchilla—dropped 13 percent under the 1956 total.

Commercial building and paving needs in 1957 required greater outputs of sand and gravel as compared with 1956. Contractors also produced larger tonnages of sand for State-highway projects in 1957. Although these materials were produced at various places in the county, noteworthy tonnages were obtained from pits in the Herndon and Pinedale areas. Stone output rose appreciably in 1957, owing to the increased use of crushed granite in highway construction. The production of dimension granite from the Raymond quarry also increased. Most of the output was rough-construction stone for building construction and sawed slabs for monuments, shipped out-of-State. Three deposits in the Millerton Lake area were the source of pumicite produced for lightweight aggregate and as a carrier in pesticides. Quartz crystals and chialtolite specimens were gathered at Miner's Flat and the Sample Ranch by collectors of gem materials.

One carload of copper ore was shipped from the Jesse Belle mine in the *West Belt* district to a Nevada smelter. The ore contained recoverable gold and silver. A few ounces of gold was recovered during cleanup at the old-mill site of the Enterprise mine in the *Potters Ridge* district. In January, a few tons of tungsten ore from the

Victory Ridge mine near North Fork was milled, and the concentrate was sold to GSA. The Sierra group of claims on Chiquito Creek near Shuteye Peak yielded a few tons of uranium ore, which was shipped to a Utah concentrator. Ore had been shipped from these claims in 1956 by another operator.

Marin.—The output of stone and sand and gravel in 1957 was affected adversely by the decline in suburban-housing developments in the county and, to a small extent, by lower tonnage requirements for paving material in highway construction. Much of the production decline occurred in the Novato area, a major source of the county crushed basalt and prepared sand and gravel. The tonnage of sandstone removed from the McNear and Greenbrae quarries near San Rafael was also less than in the preceding year. Over half of the sandstone quarried at the McNear property was transported by barge up the Sacramento River for use as riprap at flood-control projects of the United States Army Corps of Engineers. The quantity of shale produced near San Rafael and used in manufacturing common brick declined compared with the 1956 figure. About 28,000 tons of this shale was bloated at the Haydite plant and sold for lightweight aggregate.

An appreciable quantity of mercury was recovered from ore produced at the Edwards mine in the Walker Creek area. The new lessee (Panco Mining Co.) installed a 20-ton rotary furnace, in addition to crushing and hauling equipment that had been put in operation the latter part of 1956 and early 1957. Ore from the nearby Gambonini property also yielded some mercury.

Mariposa.—Sand and gravel production declined 35 percent from the preceding year, yet the value of the output led that of all other mineral commodities produced in the county. The decrease resulted from completing Government road projects and a general drop in commercial requirements. Most of the 1957 output was obtained from the Morman Bar area, where small quantities of gold and silver were recovered at a washing plant during the process of preparing sand and gravel. A modest tonnage of slate was quarried at the Aqua Fria Slate quarry west of Mariposa and marketed as flagging.

Mariposa County's principal gold and silver output was recovered from ore of the Red Banks lode mine near Bagby and small quantities from another mine in the same area. In the *East Belt* district 3 mines, 1 cleanup operation, and reworked tailing contributed a few ounces of gold and silver to the county totals for these metals, most of which was recovered by amalgamation. Placer mining for gold in the county was restricted to a few small-scale operations by prospectors using hand methods and to the small recovery operations at sand and gravel washing plants. Tungsten ore mined in 1956 at the Garnet Queen mine near El Portal was milled in February 1957, and the concentrate was purchased by GSA.

Mendocino.—Sand and gravel production was a million-dollar industry in Mendocino County in 1957. The value of the yield exceeded that in 1956 by more than 100 percent and comprised 85 percent of the value of the county's total mineral production. A high percentage of the gravel output was used at the Coyote Dam project and was prepared at a plant near Ukiah. The California Division of Highways required over 80 percent more sand and gravel for road

construction and maintenance than it did in 1956. In 1957 considerable quantities of broken and crushed sandstone and miscellaneous stone were used at Government projects for riprap in flood control and as roadstone. Some jade and jasper were gathered by gem collectors near Covelo in the Williams Creek area.

A small tonnage of chromite ore, containing 50 to 55 percent Cr_2O_3 , was mined from a deposit near Cummings in the *Eel River* district and shipped to the Government stockpile of Grants Pass, Oreg.

Merced.—Sand and gravel production furnished 99 percent of the value of all mineral commodities produced in the county during 1957. However, the output of these materials was 18 percent lower than in 1956, despite an increased use (nearly 100 percent) by the Merced County Road Department. Smaller requirements for State and Federal highway projects were the chief reasons for the decline. A moderate tonnage of bentonite, mined in San Bernardino County, was processed at a plant in Merced where the clay, and barite, were prepared for use in well-drilling mud. Gypsite was mined from the Ortigalita Creek deposit near Los Banos and sold for agricultural use. Some mercury was recovered in a two-tube retort from ore mined at the Stayton mine east of Hollister near the San Benito County line.

Modoc.—The requirement of the city of Alturas for structural and paving sand and gravel (again the county's most important mineral commodity during 1957) was the principal reason for the increased production of these materials in Modoc County—more than double the output in 1956. The principal sources of the sand and gravel were pits in the immediate vicinity of Alturas. Paving sand and gravel was prepared at various places by contractors for the State and county highway agencies for several road projects in the county. Volcanic cinder was quarried at the Ainshea Butte deposit near Mammoth for railroad ballast and fill. At Newell, pumice quarried in Siskiyou County was cut and trimmed at the Tulelake Mill for use as scouring blocks. In the Lassen Creek area an appreciable quantity of obsidian was gathered for gem material.

Hypnum peat moss, recovered from a bog in Jess Valley near Likely, was processed and shipped in bulk for ultimate use as a soil-conditioning agent.

Mono.—The sharp drop in tungsten production, Mono County's leading mineral, was chiefly responsible for the decline to \$1.5 million in total value of all minerals from the 1956 figure. Decreased tungsten output resulted after the Government tungsten-purchase program ended in January. The Black Rock mine and mill near Benton, the State's second largest tungsten operation, yielded concentrate, which was shipped to the company plant in New York. The entire operation closed down August 31. A few tons of ore from the Nichols mine on Hilton Creek near Crowley Lake was treated, and the concentrate was sold to GSA.

The demand for pumice was considerably less than in 1956, especially for scouring blocks. Volcanic cinder was quarried near Bishop and used in road surfacing, and pumice taken from quarries in the Benton and Bishop areas was prepared for acoustic plaster and lightweight aggregate. The Lee Vining mill cut and trimmed pumice from the Frank Sam mine for scouring blocks. Sand and gravel production (less than in 1956) was prepared and used only in construct-

ing and maintaining State and county roads. The output of clay was limited to the kaolin type dug from the Little Antelope pit in Little Antelope Valley and prepared for use outside the county in whiteware and for filler in paper, rubber, and plaster. The State's major source of pyrophyllite in 1957 (and the county's only active deposit) was the Pacific Pyrophyllite mine in the *White Mountain* district. The crude material was processed at the nearby Laws plant, Inyo County, for use as a carrier in insecticides.

Several small metal mines were active during part of 1957. In the *Homer* district, copper ore containing recoverable silver was shipped from the Copper Mountain mine to a Utah smelter. In the same district gold ore from the Tamarack mine was amalgamated and the gold-silver amalgam sold to the United States Mint. Gold ore mined at the Chemung property in the *Masonic* district and lead ore from the Topaz lead-silver mine near Topaz were shipped to the Selby smelter, Contra Costa County. Both ores contained recoverable silver. Gold ore mined at the Sierra Washington group in the *Masonic* district was shipped to a Nevada smelter for gold and silver recovery.

Monterey.—Petroleum again had the highest value of all minerals produced in 1957; however, Monterey County barely held its position in the oil and gas industry, with a 1-percent increase in volume output of both crude oil and natural gas. The market value of the crude oil produced improved 25 percent over 1956 as a result of a higher price. The entire oil and gas output came from the San Ardo field, seventh largest in the State. During the year 64 new wells with an average rated initial capacity of 97 barrels per day were completed in this field. As yet the county has no refineries or natural-gasoline plants.

At Natividad quick and hydrated lime was produced in a plant using three rotary kilns and a continuous hydrator, from limestone and dolomite obtained from a nearby quarry. The lime was prepared chiefly for chemical and industrial uses, the manufacture of refractories, and the building trades. The producer used a high percentage of the plant output in his sea-water-processing plant at Moss Landing to recover magnesia, also mostly used in manufacturing refractories. For this operation the company imported large tonnages of Refractory-grade chromite, largely from the Philippine Islands.

Larger tonnages of sand and gravel were produced in 1957 than in 1956 in order to meet the requirements for road construction in the county, chiefly by the California Division of Highways. Pits in the Seaside and Pacific Grove areas were the State's principal source of blast and engine sand and a large part of the molding-sand output. Two companies in the Pacific Grove area produced large tonnages of feldspathic sand (silspar) from dune-sand deposits, much of which was used in manufacturing glass. One producer used flotation to obtain both silica and feldspar, in addition to the silspar. These products were blended, and the mixtures were ground to customer specifications. Contractors for the California Division of Highways produced and prepared larger tonnages of miscellaneous stone for use in paving projects in 1957 than in the preceding year. Disintegrated granite was quarried near Pebble Beach and a few miles south of Salinas and used as road base. At Carmel Valley several hundred tons of stone was obtained from the Carmel Stone

Quarry and dressed for use in building construction. Jade from Jade Cove and jasper from the Stone Canyon area were gathered by collectors of gem materials.

Mercury output in Monterey County during 1957 was limited to 51 flasks retorted from ore taken from the old Patriquin mine near Parkfield. Several shipments of chromite ore and concentrate were made from the Lilly group of claims and the South Slope and Treasure Chest mines in the *Los Burros* district to the Government depot at Grants Pass, Oreg.

Napa.—In spite of a 20-percent decline in the value of stone production from 1956, this material was by far Napa County's most valuable mineral in 1957. The drop in private construction, combined with lesser requirements by Government-and-contractor projects, resulted in less production of stone and reduced the output of sand and gravel. The principal stone quarries were in the Napa and Pope Valley areas. Paving jobs of the Napa County Engineering and Road Department used smaller quantities of crushed stone in 1957 but appreciably larger tonnages of sand and gravel. Several contractors, who were engaged in relocating county roads around the Berryessa Reservoir, removed large quantities of sand and gravel from the Putah and Pope Creek deposits.

Perlite was quarried and expanded at St. Helena for use in plaster and concrete. Near Napa material containing diatomaceous silica was quarried and prepared for use in pozzolanic cement, and shale from Solano County was bloated for lightweight aggregate by the same company at Napa Junction. Chrysotile asbestos was produced at the Phoenix mine in the Monticello area—one of the few active asbestos operations in the State during 1957.

Most of Napa County's mercury output was retorted from newly mined and dump ore at the Oat Hill mine a few miles southeast of Middletown. A small quantity of mercury was recovered from cinnabar found in stream gravels of James Creek. Exploration for mercury, under the DMEA program was done at the Harrison mine in the *Knoxville* district. Chromite ore and concentrate were shipped from the Grubstake No. 1 mine in the *Pope Valley* district to the Government depot at Grants Pass, Oreg.

Nevada.—Gold was the county's most valuable mineral commodity marketed in 1957, despite the fact that a high percentage of the gold and the coproduct silver output was largely from cleanup and salvage operations by lessees at the Brunswick and Empire-North Star lode mines in the Grass Valley-Nevada City area. Gold-mining activity was limited to 2 small operations in the *Washington (North Columbia)* district and 1 in the Wolf Creek area, where gold and silver were recovered by amalgamation. Although two nonfloating washing plants treated ancient riverbed gravels in the *French Corral* district, most of the placer gold and silver was produced by prospectors, using small-scale hand equipment to recover the precious metals. The tonnages of sand and gravel used in Government-and-contractor paving projects were virtually the same as in 1956; however, the quantities produced for use in commercial building and paving fell short of the output in the preceding year. During 1957, the Nevada County Highway Department prepared sand and gravel for road requirements at its own plant. A modest tonnage of crude barite

was mined in 1957 at the Spanish mine near Washington. Although the producer shipped a few tons to the company grinding plant in Sacramento County, most of the crude mineral went to a stockpile at Washington for future sale and distribution. Tungsten mining in the county was limited to a small tonnage of ore, which was obtained from the Amanda mine near Grass Valley, and treated at the nearby Idaho-Maryland mill. The concentrate was sold to a California buyer. An exploration contract for tungsten ore at the Brunswick mine, under a DMEA loan, was terminated in June.

Orange.—Although no new discoveries were made in the existing fields, Orange County regained fourth place in the output of mineral fuels. Petroleum production increased only slightly, but the value rose 26 percent. Natural-gas output gained 25 percent. The Huntington Beach field continued as California's third ranking oil producer and contributed approximately half of the county total. The only oil refinery in Orange County during 1957 was operated at Huntington Beach. This plant had a rated throughput capacity of 2,100 barrels per day. Natural-gas liquids were recovered from oil-well gas in 7 natural-gasoline plants—2 each near Brea, Huntington Beach, and Placentia, and 1 at La Habra.

Sand and gravel production exceeded that in 1956, owing principally to the demand for sand used in paving and building construction. Appreciable tonnages of paving sand and gravel were prepared at a pit and plant operation, a few miles northeast of El Modena, which was the largest single-unit operation in Orange County. The quantities of molding sand produced at Newport Beach and Trabuco Canyon were exceeded only by the output in Los Angeles County. Kaolin-type clay was produced from three pits in the El Toro area for use in whiteware and in ganister for foundries and steel plants. Fire and stoneware clays were dug from pits near Corona del Mar and used in manufacturing firebrick and block, and clays from a pit near Irvine were used by manufacturers of vitrified sewer pipe. Miscellaneous clay from pits near Olive and Huntington Beach was used by the producers in making drain tile and sewer pipe.

A plant near Corona del Mar recovered salt from sea water by solar evaporation and sold the output to local consumers for various uses. Crude iodine was recovered at a Seal Beach plant from waste oil-well brines pumped from the Los Angeles Basin. About 3 percent of the output was credited to brines from wells in Orange County. Although the producer converted an appreciable quantity of the crude iodine to potassium iodide, most of the output was sold to chemical and pharmaceutical companies in the crude form.

The Lahabralite Co. imported crude vermiculite and expanded the material in an exfoliation plant at Anaheim; most of the vermiculite was used in plaster.

Placer.—In 1957, clays led all other minerals produced in the county in value. Fire and stoneware clays from pits near Lincoln were either sold outside the county or used locally for manufacturing high-alumina brick, vitrified sewer pipe, and other heavy clay products. Both fixed and portable plants were employed in producing the 160 percent higher output of sand and gravel compared with 1956. This production was used chiefly to meet construction demands for the structural and paving requirements in the county. The principal

sources of sand and gravel were pits in the Auburn, Colfax, and Dutch Flat areas. Dimension granite for building construction and monuments and crushed granite for poultry grit and nursery fines were quarried and prepared at Rocklin.

The county's small gold and silver output in 1957 came entirely from placers. Ancient riverbed gravel was worked by drift-mining methods near Foresthill, Iowa Hill, and Meadow Vista. In the Dutch Flat area and elsewhere stream and bench gravels were worked by several miners and prospectors, using small-scale hand equipment. Small tonnages of chromite ore were shipped from 3 open-pit mines in the *Iowa Hill* district and 1 in the *Dutch Flat* district, to the Government Purchase Depot at Grants Pass, Oreg.

Plumas.—Structural and paving projects of Federal, State, and county agencies were responsible for the 200-percent increase in sand and gravel output over that in 1956. The value of this output was more than four times the combined value of all other minerals produced in the county in 1957. Much of the sand and gravel output was prepared at Rodgers Flat and used in the Upper Feather River Project for concrete aggregate and road surfacing. In constructing the Caribou Afterbay Dam, a public-utilities company also required large quantities of sand and gravel and nearly 50,000 tons of crushed and broken miscellaneous stone. Stone production also increased, and most of the output was used as fill material. At Tobin, miscellaneous stone was quarried and used for riprap by a railroad company.

Manganese ore was produced at the Mount Hough mine near Quincy in the *Genesee* district. A moderate tonnage of the ore, containing over 40 percent manganese, was shipped to a Government stockpile outside the State. The gold and silver output in 1957 was confined principally to small-scale placer mines in the *Edmonton*, *Feather River*, and *La Porte* districts. Although the quantities recovered from placer operations exceeded those of 1956 by large percentages, production was small and obtained largely in the course of assessment work by the various claim holders. A small tonnage of copper ore containing some gold and silver was mined at a property in the *Sawpit Flat* district near Quincy and shipped to an out-of-State smelter. Chromite ore obtained from the White Pine mine in the *Edmonton* district and chromite concentrate produced from ore of the Mine Spike claim in the same area were shipped to the Grants Pass (Oreg.) Government Purchase Depot. A token shipment of sericite schist was made from the Hyalumsil claims near Quincy to a grinder in Fresno County for test purposes.

Riverside.—The Eagle Mountain open-pit mine was the State's major metal mine and its only source of iron ore. The value of the magnetite-hematite ore from this mine and iron concentrate from the associated beneficiation plant exceeded the combined value of all other minerals and mineral materials produced in the county in 1957. Shipments of iron ore and concentrate to the producer's blast furnaces at Fontana, San Bernardino County, and of ore for export declined less than 2 percent from 1956 figures.

The 13-kiln cement plant at Crestmore, the county's second ranking mineral industry, used purchased gypsum, sandstone and pyrite cinder in addition to company-mined limestone and shale in producing portland cement. This plant used more than 85 million kilowatt-

hours of electrical energy in 1957. Although most of the county's limestone was produced at the Crestmore quarry for portland cement, limestone was also quarried for riprap and fill at the Palo Verde diversion dam near Blythe and for roofing granules near Riverside. The output of granite and miscellaneous stone compared with 1956 decreased substantially. Granite quarried and crushed near Desert Hot Springs was used for aggregate in a project for the Los Angeles Metropolitan Water District, and granite, produced in the Riverside area, was used for riprap and prepared for poultry grit. The Federal Bureau of Indian Affairs used nearly 20,000 tons of crushed granite in road-construction projects during 1957. The output of dimension and crushed miscellaneous stone for commercial use was greater than in 1956; however, the demand for this material in Government paving projects dropped appreciably. Most of the dimension stone was produced for decorative facings on building fronts and on fireplaces in homes. Andesite, quarried in Temescal Canyon near Corona was crushed, artificially colored, and sold for roofing granules.

The output of sand and gravel was greater than in 1956 due to an increased demand for these materials in paving projects by Government agencies and to the large tonnages used for aggregate at the Palo Verde diversion dam. A sand plant at Corona produced and prepared 195,000 tons of glass sand in 1957, compared with 168,000 tons in 1956. Pits in Riverside County yielded 16 percent of the State's total clay output, 80 percent was used in clay products. Sixty percent of the 1957 production was fire clay, the remainder, miscellaneous clay. The major active pits were near Alberhill, Corona, and Elsinore. In September, 110 acres of clay deposits in the Corona area and a clay-pipe plant at Corona were purchased by Pacific Clay Products Co. from Tillotson Refractories Co. Near Midland, a plaster and wallboard plant was supplied with crude gypsum from a nearby quarry in the Little Maria Mountains.

In March considerable interest was aroused in the oil industry by the successful completion of the Government G-G 1 well in the Prado Dam area by Lyle A. Garner. Although this was the first oil production from Riverside County, the pool was considered a part of the nearby Mahala field in San Bernardino County. Two additional wells, drilled in the same area later in the year, were abandoned as dry.

California's major production of manganese ore came from the Arlington, Langdon, and Kyle group of mines in the *Ironwood (McCoy)* district northwest of Blythe. Two producers shipped approximately 4,000 tons of manganese ore and concentrate, containing over 40 percent Mn, to an out-of-State Government stockpile. A few carloads of copper ore (some contained recoverable gold and silver) were mined at the New Road mine and Vidal Lime claim in the *Bendigo* district and shipped to an Arizona smelter. A few ounces of gold, and some silver, were recovered by amalgamation from gold ore of the Duplex mine in the *Dale (Gold Park)* district.

Several hundred tons of wollastonite float was gathered near the Little Maria Mountains and sold as ornamental stone for building facings. Blue calcite and geodes were collected for gem materials at several places in the county. Crude perlite mined in San Bernardino County was expanded for plaster aggregate in a plant at Crestmore.

Sacramento.—The Sacramento County yield of dry natural gas during 1957 was far greater than for any other county in the State. Despite a production slump of 14 percent from the 1956 figure, natural gas was the most valuable mineral produced. The decline was due largely to the lower output from the Rio Vista field, the State's largest dry-gas field, which extends slightly into Contra Costa and Solano Counties. The 96 producing wells in the county from this field yielded 28 percent of California's dry-gas production in 1957, and nearly 4 times more than the next largest field. Production from the Thornton field rose 33 percent, while that from the smaller Freeport field declined from the preceding year.

A greater demand for sand and gravel in constructing levees, roads and streets, schools, and industrial and Government buildings was credited with much of the 200,000-ton increased output of these materials as compared with 1956. The sources of most of the sand and gravel used in 1957 were pits and extensive fixed plants along the American River, in the Sacramento, Perkins, Del Paso, and Fair Oaks areas. Stone production in 1957 was limited to the relatively small tonnages of quartzite and chert quarried by crews and contractors for the California Division of Highways for use in road construction. The output of clays declined appreciably from that in 1956, owing chiefly to the lesser quantities used in common brick. Pits in the Michigan Bar, Sloughhouse, and Sacramento areas supplied most of the fire clay and miscellaneous clay used for pottery and heavy clay products.

The output of gold in Sacramento County was second only to Yuba County and came from operations in the *American River (Folsom)* district. The major part of the gold output, considerable quantities of the coproduct silver, and some platinum, were produced by a fleet of bucketline dredges operated by the Natomas Co. Several sand and gravel preparation plants recovered gold and silver as a byproduct of their operations. The Little White Rock lode deposit near Folsom was the source of gold and silver recovered during the year from ore mined in 1956 and 1957.

Talc mined in Inyo County and soapstone from an El Dorado County deposit were ground in a processing plant at Florin, for foundry facings, carriers in insecticides, and as a filler in paint and rubber. Crude vermiculite mined in Montana was shipped to the producer's exfoliation plant in Sacramento and prepared for use as insulation and plaster aggregate.

San Benito.—The value of the county's mineral output rose 51 percent from that in 1956. A part of the rise was due to a greater value for a slightly lower cement production, the county's leading mineral industry. The 4-kiln plant at San Juan Batista produced general use and plastic cements, using raw materials from the nearby San Juan limestone quarry and shale from the Chittenden (San Mateo County) quarry. Dolomite produced at the Hollister quarry was used in manufacturing rock wool at a plant in Santa Clara County and in producing various magnesium compounds at a chemical plant in Alameda County. Granite, produced and crushed at a quarry near Logan, was used for riprap, road stone, and railroad ballast. A small tonnage of county-produced miscellaneous stone was used by the California Division of Highways in a paving project. Sand and

gravel output in 1957 was confined to the paving requirements of State and county road agencies, who used 437,000 tons of these materials in 1957, compared with 159,000 tons in 1956.

Although crude-oil production rose 400 percent from the 1956 total, the 26 producing wells yielded only 521,000 barrels in 1957. Most of this output came from the Vallecitos field and small volumes from the Bitter Water, Ciervo, and Flint Hill fields. A new gasfield was brought in at Pimental during the year; it supplemented the output from the oilfields (wet-gas) and the older Hollister dry-gasfield. The total consumption of gas in the county rose 250 percent in 1957.

Thirteen active mercury mines yielded over 6,500 flasks of the metal, 40 percent of the State total. The New Idria mine in the *Idria* district was by far the leading producer. The San Carlos mine in the same district was the only other mine in the county having an output of more than 100 flasks of mercury in 1957. Chromite production declined appreciably, and the output was limited to the chromite concentrates produced from ores of the Margaret and Saw Mill Creek mines in the *Idria* district. The entire production was shipped to the Grants Pass (Oreg.) purchase depot.

Gem collectors gathered jadeite, jasper, chrysoprase and peridotite in the Clear Creek and Hidden Valley areas.

San Bernardino.—One-third of the State's total cement was produced in San Bernardino County, which led the State. The value of this output was almost half the total for all minerals and mineral materials produced at 4 plants—a 9-kiln plant at Colton, a 10-kiln plant at Oro Grande, a 9-kiln plant at Victorville, and a 2-kiln plant near Lucerne Valley. All plants produced before 1957 except the Cushenbury plant (Lucerne Valley), which was placed in operation in May 1957. The Victorville plant, second largest in the State, was southern California's major cement producer.

Quarries in the county were important sources for the State's output of crushed and broken stone. They produced more than 4 million tons of limestone and dolomite for cement, flux, whiting, and roofing granules. The large limestone quarries in the Oro Grande and Victorville areas were sources of lime for cement, and the quarry near Lucerne Valley not only supplied the Cushenbury cement plant but furnished flux for the iron and steel plants at Fontana. Marble was quarried for terrazzo near Victorville, and dimension granite was produced near Lucerne Valley and Lytle Creek. Granite was quarried for rubble, and crushed and decomposed granite was prepared for concrete and roadstone by fixed and portable plants at several places along the major highways south of San Bernardino. Quartzite quarried near Twentynine Palms was used as building stone.

The production of sand and gravel for structural use increased slightly; however, the output for paving sand and gravel declined, resulting in a grand total virtually unchanged from that of the preceding year. Pits at Colton, Rialto, Fontana, San Bernardino, Oro Grande, and Redlands were the major sources of the county's 1957 sand and gravel production. A lime plant at Colton and one near Trona produced quick and hydrated lime for the building trades, agricultural purposes, and for various chemical and industrial uses. Near Ludlow, the Klondike quarry was a source of crude perlite expanded in California and Nevada plants for the building trades, and

the Pisgah pit yielded volcanic cinder for railroad ballast. Pumicite from the Kleen-Gro deposit near Hinkley was used in gardens and lawns as a soil additive.

Two chemical companies extracted various compounds from the brines of Searles Lake. The plant at Trona produced borax, boric acid, sodium tetraborate and pentaborate, potassium chloride and potassium sulfate, soda ash, salt cake, elemental liquid bromine, and lithium carbonate. The West End plant extracted borax, soda ash, salt cake, and glauber salt. The capacity of the granular-potash section at the Trona plant was doubled in December. The liquid bromine was shipped to the Los Angeles area where it was used in preparing bromine compounds. California's entire output of calcium chloride was recovered from Bristol Lake brines. Two plants in the area produced a liquid product; a third plant purchased the liquid chloride and prepared a flake calcium chloride. Halite was mined from an open pit near Amboy and a high percentage of the output was consumed by chlorine plants and water-softening services in California and Nevada. Near Rice, salt was also extracted from dry-lake brines by solar evaporation. The producer used his entire output in the City of Los Angeles water-softening plant. Near Trona, a salt producer sold his product principally to the rubber and oil industries.

Five iron-ore mines were active in the county during 1957, 3 more than in 1956. Two mines near Twentynine Palms, the Bradley & Horn and the Iron Age, and the Bessemer mine north of Lucerne Valley, all produced for the iron and steel plant at Fontana. Iron ore from the Vulcan mine, south of Kelso, and at the Cave Canyon deposit near Yermo was used by the cement industry and as aggregate in concrete for atomic shielding. The integrated operation of Kaiser Steel Corp. at Fontana was California's major steel plant and the only pig-iron producer. Although the production by the company in 1957 was below that in 1956, the value of products used, sold, or withdrawn from stocks increased considerably from 1956 figures. At year end a fourth blast furnace was under construction at Fontana. The company's coking plant used coal from Utah.

Sixteen talc deposits were worked during the year—2 less than in 1956—in the area north of Baker near Inyo County. A decreased demand for talc by the ceramic industry was responsible for a 23-percent decline in output compared with the preceding year. All the crude talc was shipped to processing plants in Los Angeles County where it was prepared for ceramics, as a carrier in insecticides, and an extender in paints. Pyrophyllite produced at the Victor mine near Oro Grande was ground for insecticides at a Los Angeles plant. Ball-type clay was dug from deposits near Hart and used largely in wall and floor tile. A small quantity was sold for use in whiteware. Bentonite mined at the Hector deposit near Daggett and bentonitic clay from pits near Vidal and Newberry were sold to pharmaceutical companies, which used some of the material in refining mineral oils and greases. Miscellaneous clay mined near Colton was used in cement, while that produced in the Chino area was used in heavy clay products. The Leviathan mine near Barstow was the source of crude barite shipped to the company processing plant at Compton, Los Angeles County, and ground for use in compounding well-drilling fluids. The State's output of rare-earth-element minerals, containing

largely cerium, was mined from a barite-fluocarbonate deposit at Mountain Pass. Concentrates, produced by flotation, leaching, and roasting, were shipped east for treatment and basic research on separation of the rare-earth elements.

Despite a 55-percent increase in crude-oil output and a ninefold jump in use of oilfield gas from 1956 figures, the San Bernardino County production of these fuels in 1957 was relatively low in comparison with other oil- and gas-producing counties. Most of the petroleum was derived from the Abacherli area of the Mahala field; the newer Chino-Soquel field supplied a small volume.

An important tonnage of tungsten ore was produced in 1957 at the Atolia mine near Red Mountain, but no concentrate was shipped. Two operators worked the El Mirage mine during 1957 and the entire tungsten concentrate produced was sold to a California buyer. During the year manganese ore was shipped under the Government's carlot program from the Owl's Head mine in the *Owl Springs* district, north of Baker. Shipments of low-grade ore were also made from the same mine to the Government Butte, Mont. depot. These latter shipments, however, will not be recorded as production until shipment is made from the depot in usable form. Ores from 12 lode mines in 10 mining districts were the sources of the county's 1957 output of gold, silver, copper, lead, and zinc. The Golden Banner mine, *Belleville* district and the O. C. J. No. 1, War Eagle, and Wyatt Earp mines, *Whipple Mountains* district, yielded small tonnages of ore, which was shipped to Arizona smelters for recovery of gold, silver, and copper. Copper ore, containing recoverable gold and silver, from the New Trail mine, *Ivanpah* district, was consigned to a Utah smelter. Shipments were made to a California smelter-fuming plant from the Silver Prince mine (lead-zinc ore), *Morongo* district, the Golden Eagle mine (gold ore), *Granite Mountains* district, and the Kelley mine (silver ore), *Randsburg* district. Lead ore produced during the course of assessment work at the Last Chance mine, *Lava Bed* district, and the Black Lead mine, *Solo* district, were also shipped to this plant. Silver concentrate produced at the Mammoth mine, *Silurian* district, was sold to a California silver refinery.

The Jasper and Jean claims near Ludlow, California's major source of celestite (strontium sulfate) in 1956, were inactive during the year. Feldspar, mined at the Beck open-pit mine near Four Corners, was custom-ground in Los Angeles County and used by the producer in manufacturing refractories. A small quantity of Acid-grade fluorspar was produced from a deposit near Nipton and sold to a chemical company at Nichols, Contra Costa County. A wide variety of gem materials were gathered at various places in the county by collectors, who reported finding good specimens of rhodonite, blue agate, turquoise, jasper, malachite, onyx, and verde antique marble.

San Diego.—The production of sand and gravel and stone as in 1956 dominated the county's mineral industries in 1957. The value of the increased output of these materials contributed appreciably to the 4-percent rise in total value of the county's mineral production. In contrast to 1956, the demand for paving material was much greater, particularly in the San Diego metropolitan area. The major aggregate producers were equipped to process more than 200,000 tons of sand and gravel per year and were in the San Diego, Santee, Otay, and

Camp Miramar areas. The increased output of dimension granite at the Escondido Quarries pit was used in constructing the Los Angeles County Court House. The requirements for crushed granite and miscellaneous stone in highway construction exceeded those of 1956. Six companies produced 509,000 tons of crushed and broken granite of which 406,000 tons was used for concrete, roadstone and fill, and the rest for railroad ballast, riprap, and roofing granules. At the Red Rose Variegated Quarry near La Cresta, 775 tons of dimension quartzite was produced for constructing a Chula Vista church. Miscellaneous clay from pits near San Diego was used in manufacturing common brick and other heavy clay products.

Near Chula Vista a salt company recovered salt from sea water by solar evaporation. Although some of the salt was sold to chemical plants, most was used by local food processors. The bittern from the salt works was sold to a nearby chemical plant and treated to extract magnesium chloride.

In the Escondido, Rancho Santa Fe, and Chula Vista areas a total of 7,300 tons of pyrophyllite was mined, more than double the output in 1956. The crude mineral was processed for use as a carrier in insecticides at grinding plants in Escondido, Chula Vista, and in Los Angeles County. Facilities at Escondido were used to expand crude perlite, mined in San Bernardino County and Arizona, for lightweight aggregate. Prospecting for crude vermiculite was continued in 1957 near the Bear mine near Escondido, under a permit issued by the California State Lands Commission.

A small tonnage of tungsten ore from the Pay-Off mine in the San Ysidro Mountains was milled by the producer and the concentrate was shipped to a buyer in Los Angeles County. A few tons of celestite was mined at a deposit in the Fish Creek Mountains and sold to a chemical company in Los Angeles County for conversion to various strontium compounds. Small quantities of gold and silver bullion were recovered by amalgamation of gold ores mined at two prospects in the *Julian* district. Exploration for copper-nickel-cobalt ore under the DMEA program was in progress during the year at the Friday mine in the *Julian* district.

Gem collectors gathered tourmaline, kunzite, rhodonite and topaz in the Pala, Jacumba, and Ramona areas.

San Francisco.—Sand was excavated at the Balboa reservoir; rock was quarried at Candlestick point; and stone was removed from the Sunset Reservoir. These materials were used for embankments at the reservoirs and as road base elsewhere. A large tonnage was hauled to Stanley Drive near Lake Merced and used as fill. All other raw materials for construction purposes in the City and County of San Francisco were supplied by truck and rail from pits and quarries in nearby counties.

The Stauffer Chemical Co. purchased crude borates mined in Kern County and produced boric acid and sodium sulfate from these borates in its San Francisco plant. The quantity of crude material purchased and used was substantially the same as in 1956. Talc and soapstone mined in Inyo and El Dorado Counties, respectively, were processed by Commercial Minerals Co. in San Francisco for use in paint, rice polishing, and cement admixtures.

San Joaquin.—San Joaquin County ranked fourth among the State's dry-natural-gas producers in 1957, but the output dropped 16 percent from the 1956 yield. The McDonald field, California's third leading dry-gas producer in 1957, supplied 77 percent of the county yield and 7 percent of the State total gas output despite a reduction of 23 percent below the 1956 output. The Thornton field, two-thirds of which lies in Sacramento County, gained 33 percent in dry-gas production over that of the preceding year. The Lodi-Galt, Roberts Island, and Vernalis fields contributed a lesser volume to the total natural-gas yield.

The lower tonnages of sand and gravel required to meet the needs of road construction projects in 1957 furnished most of the decline in output of these materials compared with 1956. The extensive fixed plant operations in the Tracy, Stockton, and Clements areas supplied more than half the sand and gravel produced in the county. During the year, Munn and Perkins, contractors, began suction-dredging on the Stanislaus River near Escalon and prepared building sand and gravel and paving gravel. The company installed handling equipment that included a chute and conveyor belt.

San Luis Obispo.—Crude-oil production from the county's five fields dropped slightly in 1957, but oilfield gas utilization declined 15 percent from 1956 figures. More than half the petroleum output came from the Cuyama group of fields, and the remainder from the Arroyo Grande and Guadalupe fields. Petroleum products were manufactured at a 21,500-barrel-per-day refinery near Arroyo Grande. Also, molten sulfur was produced by incomplete combustion of recovered hydrogen sulfide gas. Natural-gas liquids were recovered from oil-field gas in the Russell Ranch natural-gasoline plant near Cuyama.

San Luis Obispo County led all other California counties in producing and shipping chromite ore and concentrate during 1957. The entire output was obtained from eight mines in the Santa Lucia Range north of San Luis Obispo. In 1957 about 12,000 tons of chromite concentrate and 1,500 tons of crude ore were shipped under the Government carlot program to an out-of-State depot.

Sand and gravel production declined from that in 1956 due chiefly to less State and Federal highway construction in the county during 1957. A portable sand and gravel preparation plant near Santa Margarita produced important quantities of paving materials for State highway projects and the Hunter Liggett military reservation. The requirements for sandstone and miscellaneous stone used as riprap at the Vaquero Dam near Santa Maria, Santa Barbara County, was supplemented by an increased demand for roadbase material in the San Luis Obispo area and resulted in a higher stone output compared with 1956. Limestone was quarried and crushed at Lime Mountain near Adelaida for use in sugar refining. Agricultural gypsum was shipped to consumers from an open pit near Simmler. A small tonnage of miscellaneous clay was dug from pits near San Luis Obispo and used locally in manufacturing common brick.

The sharp rise in mercury production over the 1956 output resulted mainly from stepped-up operations at the Buena Vista mine near Klau in the *Adelaida* district. Three mines in the Paso Robles area and one each in the Cambria and San Simeon areas contributed lesser quantities of mercury to the total output. Exploration contracts for

cinnabar ore at the Oceanic mine, in the Cambria area, and Buena Vista mine, under the DMEA program were terminated in March and November, respectively. A shipment of manganese ore was made from the Johe Ranch mine, a few miles southeast of San Luis Obispo, to an out-of-State Government stockpile.

San Mateo.—The value of San Mateo County's mineral output rose from 1956, despite a notable drop in cement shipments, the most important mineral or mineral commodity produced. Ideal Cement Co. operated its 4-kiln Redwood City plant using oystershell and clay dredged from San Francisco Bay as raw material. During the year the company placed orders for two kilns, grinding equipment and other machinery, and began operating a deep-water facility on the Sacramento River at Broderick, Yolo County. Bulk cement was barged from Redwood City to the new terminal for distribution to central and northern California points.

Although the quantity of shell dredged from the bay near Redwood City declined compared with 1956, the tonnage produced for cement and poultry grit exceeded the combined output of all other stone in the county during 1957. Large tonnages of stone were used in freeway construction, and the quantities of sandstone produced and used for this purpose were higher than in 1956 while those of disintegrated granite were lower. The Belmont area was a major source for limestone; Brisbane, for sandstone, and Pescadero, Redwood City and Half Moon Bay, for disintegrated granite. Miscellaneous stone removed from the Hillsborough Tunnel project was used as fill material. Two stone quarries in the county were abandoned during the year, one as a result of pollution to a nearby lake during the rainy season, and the other because the company began to purchase its requirements for aggregate rather than continue to work the quarry. Paving projects of the California Division of Highways required larger tonnages of sand and gravel than in 1956, which supplied most of the increased output of these materials in 1957. Near Edgemar, 68,000 tons of sand was prepared for paving and building construction.

At Redwood City, a major salt company, whose operations extend to Alameda County, recovered a large quantity of salt from the sea water of San Francisco Bay by solar evaporation and exported the entire output. The chemical division of a pharmaceutical company in South San Francisco produced precipitated magnesium carbonate, magnesium hydroxide, and U. S. P. magnesia from raw sea water, using a calcined limestone-dolomite mixture in the process.

San Mateo County's 1957 oil production was small but had increased elevenfold over the 1956 output by virtue of five new wells completed during the year in the La Honda field, which was discovered late in 1956. The 2-well Oil Creek field, discovered in 1955, continued to produce about 30 barrels per day. Wet-gas output in 1957 increased at nearly the same proportion as crude petroleum.

Mercury production was confined to the Farm Hill No. 2 mine near Redwood City, but the yield was enough to give San Mateo County fifth place in State output. Two refineries, one each at South San Francisco and at Belmont, accepted primary and secondary precious metals for refining. A steel plant in South San Francisco with an annual 5-furnace capacity of 276,000 tons operated open-hearth furnaces in 1957 using pig iron and scrap as a source of metal.

The Kaiser Gypsum Co. maintained a stockpile of crude gypsum at the Port of Redwood City. The stockpile was maintained through imports from the company mine in Lower California, Mexico. Some of the crude gypsum was sold to several portland-cement plants for use as a retarder.

Petrified whalebone and jasper were gathered along the county's ocean beaches by collectors of gem materials.

Santa Barbara.—The volume of crude petroleum produced in 1957 was slightly below that in 1956. Of the 14 active fields, the South Cuyama yielded approximately half of the total output. Other important producing fields were the Cat Canyon, Santa Maria, and Russell Ranch (partly in San Luis Obispo County). The La Goleta gasfield was used as a storage area for natural gas produced both in and outside the county. Natural-gas liquids were recovered in seven natural gasoline plants; however, a plant at Cuyama and one near Santa Maria were the major producers in 1957. A natural-gasoline plant near Orcutt was shut down permanently in October. Two refineries with a combined capacity of 8,200 barrels a day were operated near Santa Maria.

The world's leading diatomite quarries in the Lompoc area furnished nearby processing plants with the crude material. A large part of the plant products were used as a filter-aid in the refining of sugar, oil, and other chemicals, appreciable quantities were consumed as extenders in paper, paint, insecticides, and asphalt products, and for heat and sound insulation. In the Casmalia area oil-saturated diatomaceous shale was mined, and, after burning, the product was prepared for use either in pozzolan cement or sold as lightweight aggregate.

The much lower demand for paving materials by State and county road agencies in 1957 adversely affected the output of sand and gravel. The main sources of the limited 1957 production were areas along the Santa Maria and Santa Ynez Rivers. The demand for stone was appreciably higher than in 1956. A large tonnage of sandstone was produced at the Rincon quarry near Ventura County and used in constructing an offshore drilling island for Richfield Oil Corp. Building stone, rubble, and flagging was obtained from the Santa Maria quarry in the Tepusquet Canyon area. Clay dug from a pit on the San Marcos Pass road near Santa Barbara was used by the producer in manufacturing brick.

The only mercury recovered in the county during 1957 was the 270 flasks from ore produced at the Gibraltar mine a few miles northeast of Santa Barbara. The production of chromite ore was limited to the tonnage shipped from the Davis mine in the *Cachuma* district to the depot at Grants Pass, Oreg.

Santa Clara.—The 1957 shipments of cement, the most valuable mineral or mineral commodity produced in the county, were second only to those from San Bernardino County. The 6-kiln plant operated by Permanente Cement Co. at Permanente was by far the State's largest cement plant in both production and capacity. Limestone for this plant was quarried by the company from the nearby deposit while the lateritic clay used came from Amador County. Limestone for use in concrete and asphalt paving was quarried near Palo Alto, and clay for use in heavy clay products came from pits near San Jose. Stone production in 1957 was above that in 1956, due chiefly to the

increased tonnages required as base material used in public roads and airfield runways which offset a decline in stone output for commercial building and paving projects. Dimension stone for rubble and crushed stone for stucco were quarried near Los Gatos. The Los Altos and Cupertino areas were the chief sources of crushed stone used in concrete and paving. In the San Jose area, large sand and gravel plants produced and prepared important tonnages of these materials also at Gilroy, Campbell, and Los Gatos. Sand and gravel production decreased noticeably from that in 1956, and the lower output was due principally to the decline in residential and industrial building during 1957.

Mercury output increased 33 percent, compared with the 1956 production, all from 2 mines in the *Almaden* district. Reworked dump material at the New Almaden mine was the source of more than 50 percent of the 1957 output. These dumps were worked by 27 different independent operators during the year and, except for two consistent producers, each contributed relatively small quantities of metal to the total. Palo Alto Mining Co. operated the Guadalupe mine, the State's sixth largest individual producer, and began exploration for cinnabar ore at the mine in August, under the DMEA program.

Gem collectors gathered geodes in the Lone Hill area, and jasper near Morgan Hill.

Santa Cruz.—The value of Santa Cruz County's 1957 mineral production was slightly under that of 1956 owing to the lower output of stone and cement, the county's principal minerals. A 9-kiln cement plant, including the 2 new kilns installed during the year, was operated at Davenport. The raw materials, limestone and sandstone, used in the plant were quarried locally, and shale was obtained from a quarry near Chittenden. The Chittenden deposit also supplied shale for a cement plant at San Juan Bautista, San Benito County. Flue-dust accumulations from the Davenport cement plant were used in moderate quantities by the California fruit industry for soil improvement because of the potash content. The lower tonnages of limestone and sandstone quarried for manufacturing cement and the decreased output of crushed granite for road construction were the chief reasons for the decline in the quantity of stone compared with the 1956 production. Much of the granite was quarried and crushed in the Felton and Soquel areas. Dimension limestone for rubble and crushed limestone and sandstone used in road construction and for poultry grit, were produced in the Felton and Santa Cruz areas.

Sand and gravel requirements for State and County paving projects were higher in 1957 than in 1956. The reverse was true for the quantities of crushed stone needed as base-course material in road construction. The major active pits used as sources of sand and gravel were also in the Felton and Santa Cruz areas with additional tonnages produced in the county from pits near Soquel and Saratoga, Santa Clara County.

The ocean beaches at Capitola and Santa Cruz were sources of petrified whalebone gathered by collectors of gem materials.

Shasta.—Sand and gravel, with a value 60 percent of the total of all mineral commodities produced in the county, became the leading mineral commodity produced in the county during 1957, and chiefly because local, State, and Federal agencies required large tonnages of structural and paving sand and gravel during the year. Pits in the

Redding area were the source of a high percentage of the sand and gravel used as aggregate in highway projects. Stone production declined appreciably from the 1956 figures and was limited to basalt and miscellaneous stone quarried by crews and contractors of the Shasta County Road Department and the Lassen Volcanic National Park. The stone was used principally for rubble and riprap. Volcanic cinder was obtained from deposits in the Glenburn and MacArthur areas, and the entire output used in surfacing roads and driveways.

The State's only producer of pyrite worked the Hornet open-pit mine and shipped ore to two sulfuric acid plants in Contra Costa County. The resulting pyrite cinder from the acid plants was sold to cement manufacturers for use as a quick-set additive. A few ounces of gold and a lesser quantity of silver were recovered by amalgamation from ores of two small lode mine operations in the *French Gulch* district. Two exploration contracts for copper-zinc ore under the DMEA program were in effect during the year, both in the *Flat Creek* district northwest of Redding. At Castella, a concentrator was operated to upgrade chromite ore mined in Trinity, Butte, and Glenn Counties. Small tonnages of chromite ore were mined at two deposits in the *Beegum* district southwest of Platina. All ores and concentrates were shipped to the Government stockpile at Grants Pass, Oreg.

Sierra.—The value of the county's gold and silver output, obtained principally from lode mines, contributed 87 percent of the value of all mineral production in 1957. A high percentage of the gold and silver output came from ores of the Original 16 to 1 mine in the *Alleghany* district and the Brush Creek mine in the *Downieville* district. Amalgamation was the principal method of gold and silver recovery at these mines; however, a sulfide concentrate containing gold and silver was also produced at the former by gravity concentration and at the latter by flotation. The concentrates were shipped to a California smelter. A few ounces of lode gold and silver were produced collectively by several smaller mines in the *Alleghany* district. The small output of placer gold and silver was produced principally by small-scale hand methods at various places in the county, a dragline and nonfloating washing plant were operated on gravel in the *Downieville* district, and hydraulicking was carried on at one place in the *Pike* district during the summer months.

Sand and gravel production in 1957 was limited to the requirements of State and county road agencies, which used greater tonnages than in the preceding year. In addition to the output of these materials for paving in the county, the Sierra County Road Department procured gravel produced in Yuba County. Stone production during the year consisted of 5,500 tons of quartz, averaging 99.5 percent SiO₂, quarried in the Crystal Peak area northwest of Verdi, Nev. The material was crushed to minus-2½-inch and shipped to a silicon plant in Oregon.

Siskiyou.—Gold was the principal mineral produced in the county during 1957, and its value comprised more than one-third the total value of all mineral production during the year. The Siskon mine, in the *Klamath River* district southwest of Happy Camp, was the major source of gold and of considerable silver. Recovery was by cyanidation. Several other smaller lode gold mines in the Klamath, Salmon, and Scott River areas were active during the year and yielded

a few ounces of gold each. The county's only copper output was a carload of ore shipped from a new prospect in the Klamath River area to a Washington smelter. The ore also contained recoverable silver. The output of placer gold and silver came mainly from a dredging operation at the Hayden property in the Scott River area where stream and bench gravels were treated in a floating washing plant. Although stream gravels worked by small-scale hand equipment at various places in the county yielded most of the remaining gold and silver output, a drift mine in the Klamath River area, and a hydraulic operation in the Salmon River area, were the sources of some gold and silver.

The output of sand and gravel declined in 1957 owing to the completion of several bridge-construction projects by the Federal Bureau of Public Roads late in 1956 and early 1957. These projects had required appreciable tonnages of sand and gravel produced during the preceding year. The Mount Shasta and Tulelake areas were the principal sources of these materials in 1957. County, State, and Federal agencies used 76,000 tons of crushed and broken basalt and miscellaneous stone—the entire stone that was quarried during 1957. This output was a drop of 31 percent from the 110,000 tons of basalt, sandstone, and miscellaneous stone produced for concrete and roadstone in 1956.

The State's major output of volcanic cinder came from a deposit at Kegg where over 200,000 tons was produced for use as railroad ballast. Lesser quantities were quarried in the Hambone, Tulelake, and Yreka areas for lightweight aggregate, insulation, and road-surfacing material. Pumice from the Glass Mountain and Tulelake areas was used for concrete aggregate, scouring blocks, and insulation. The Callahan, Etna, Happy Camp, and Indian Creek areas were the sources of calcite, californite, and rhodonite collected as gem material.

Solano.—The county contains only a third of the Rio Vista dry gasfield, yet it ranked second in California producing dry gas despite an 8-percent drop in production from that in 1956. Although more than half the 1957 output came from the Rio Vista field, yields were reported from the Maine Prairie, Suisun Bay, Kirby Hill, Winters, Cache Slough, Millar, and Liberty Cut fields.

Sand and gravel production in 1957 increased in total value but decreased in quantity and was limited chiefly to the output of paving gravel prepared for commercial and Government projects. The active pits were in the Denverton, Putah Creek, Rio Vista, Suisun, and Winters areas. The stone output credited to the county during 1957 was about the same as in 1956 because of the appreciable tonnages of sandstone quarried in the Suisun area for road construction. The Cordelia Quarry near Thomasson yielded a substantial part of the county's basalt output, and the Vallejo and Benicia areas were the sources of miscellaneous stone (red rock) used in paving and fill. Shale quarried from the Chabot pit near Vallejo was bloated for lightweight aggregate at the producer's Napa County plant.

Sonoma.—The value of the stone production credited to Sonoma County increased substantially above the 1956 figure, exceeding the value of the next most important mineral material produced by a wide margin. Substantially increased tonnages of sandstone and miscellaneous stone were quarried and crushed in the Cotati and Petaluma

areas for road construction, but dimension stone quarried in the Glen Ellen and Kenwood areas for building, flagging, and rubble declined 70 percent in quantity compared with 1956. Although the outputs of sand and gravel for fill material at plants in the Santa Rosa, Mirabel, and Cloverdale areas were appreciably higher than in 1956, the increase did not offset the drop in the tonnage of these materials produced in the Healdsburg area for State and county paving projects. The Healdsburg fixed preparation plant continued as a major source of sand and gravel in the county despite the notable decrease in output. Shale obtained from pits near Santa Rosa and Forestville was used as paving material.

Oil and gas production in the county, all from the Petaluma area, dropped to a new low in 1957. The 1 producing oil well yielded less than 1,000 barrels, and the volume of dry gas produced from the county's 3 wells was 27 percent under the 1956 total.

The Buckman mine, a few miles east of Cloverdale, and the Mount Jackson-Great Eastern mine near Guerneville were the sources of most of the county mercury output in 1957; however, three smaller mines in the Healdsburg area yielded lesser quantities of the metal. Cinnabar crystals were collected at the Buckman mine for gem use. Exploration for cinnabar ore under the DMEA program had been underway at the Mount Jackson mine since June 1956. A moderate tonnage of chromite ore was shipped from the Meadowlark claim in the *Cazadero* district to the Government stockpile at Grants Pass, Oreg.

Stanislaus.—Sand and gravel production supplied 97 percent of the value for all minerals produced in the county during 1957. Substantially increased quantities were used in paving projects for the city of Modesto, and State and county road agencies. The major sand and gravel operations were along the Tuolumne River near Modesto and Hughson and the Stanislaus River near Oakdale and Knights Ferry. The Knights Ferry area was also the source of clays dug for manufacturing architectural tile. Crude barite, received from mines in Nevada, was prepared for use in producing glass and for barium chemicals at a Modesto processing plant.

A moderate tonnage of chromite concentrate was obtained from ore produced at several small mines in the *Red Mountain* district west of Patterson, and shipped under the Government carlot program.

Sutter.—The natural-gas output from the Marysville Butte field, source of the county's only gas production, rose 31 percent over that of the preceding year. The value of this output was 70 percent of the value of all mineral production in the county in 1957.

Sand and gravel decreased considerably compared with the 1956 figures. The chief reason for the drop was the completion of major flood control and road projects in the county by the United States Army Corps of Engineers. Most of the 1957 output of sand and gravel was produced from pits near Yuba City. Miscellaneous clay from a pit near Nicolaus was shipped by the producer to its Placer County plant and used in manufacturing heavy clay products.

Tehama.—Natural-gas was produced only in the Corning and South Corning gasfields and dropped 42 percent from that in 1956. These fields, except the Eureka field in Humboldt County, are the State's northernmost dry-gas producers.

The requirements of the California Division of Highways and the Tehama County Road Department for paving projects contributed largely to the higher sand and gravel output in 1957, compared with 1956. Fixed preparation plants at Red Bluff and Richfield, and several portable plants in the Red Bluff area, were operated to supply the needs of Government and commercial projects. The quantity of miscellaneous stone prepared for paving material increased from 11,000 tons in 1956 to 31,000 tons in 1957. Some basalt was used as rubble by crews of the Lassen Volcanic National Park.

Chromite ores and concentrates were produced at the Grau and Kleinsorge leases in the *Elder Creek* district, and chromite ore was mined from the Pine Tree mine in the *Beegum-Tedoc* district. All ores and concentrates as well as ore mined at the Apex and Tops in the latter district, were purchased by GSA.

Trinity.—Sand and gravel was the most important mineral commodity produced in the county during 1957, followed closely by stone. The value of the combined output of these materials was 92 percent of the total value for all minerals produced. The 1957 output of sand and gravel and crushed and broken granite increased substantially from the 1956 figures, owing to the large tonnages required for the Trinity Dam project. The requirements of State and county road agencies for sand and gravel in paving and for sandstone and miscellaneous stone used as fill also contributed considerably to the total output. A high percentage of the sand and gravel was produced from pits in the Lewiston and Weaverville areas.

Most of the gold and silver output in 1957 was derived from placers in the *Trinity River* district, by bucketline dredge in the Lewiston area and by hydraulicking near Big Bar. The lode gold and silver yields were chiefly from gold ore of the Layman mine in the *Hayfork* district although recoveries were also made from reworked tailings at the Kelly property in the same district and from the Forty-nine-Wonder-Maybee property near Minersville in the *Trinity River* district. The metals were recovered by amalgamation. A shipment of copper ore, containing some silver, was made from a prospect in the latter district to a Washington smelter. Although chromite-ore production was limited principally to the output taken from the Costa mine and trucked to the producer's mill at Castella, Shasta County, for upgrading, a few tons of hand-sorted ore was taken from the Lost Dog mine near Big Bar. The ores and concentrates were shipped to the Government stockpile at Grants Pass, Ore. Ore from the Altoona mine, a few miles west of Castella, yielded the only mercury produced in the county during 1957. In November the mine was sold to Rare Metals Corp. of America. The new owner planned to install a 100-ton-per-day furnace at the mine to treat the ore. An exploration project under the DMEA program has been in effect at the mine since June 1955.

Tulare.—Oil and gas production in the county was relatively low among California producing areas, but the output of petroleum and natural gas increased over the 1956 figures by 11 and 7 percent, respectively. Crude-oil production was confined to the Deer Creek field, and the gas output came entirely from the Trico field, which also extends into Kern and King Counties. The Trico field was

the fourth leading dry-gas producer in California during 1957 yet was credited with less than 6 percent of the State total.

The production of sand and gravel rose nearly 1 million tons above the 1956 figure, principally because of the greater tonnage of paving materials required by the California Division of Highways and the aggregate needs of the Federal Bureau of Reclamation for concrete pipe and canal linings. Stone production rose 37 percent from 1956 and the entire output, all crushed granite, was used in State highway-construction projects. A small tonnage of miscellaneous clay dug near Exeter was used in manufacturing heavy clay products. Deposits in the Nine Mile Canyon area west of Little Lake, Inyo County, supplied a large part of the State's crude-barite output in 1957. Crude ore was trucked from the Barite King open-pit mine to a crushing and jigging plant at Linnie Station, Inyo County, where the product was trans-shipped to the producer's grinding plant at Rosamond, Kern County. Crude barite mined at a nearby deposit in Nine Mile Canyon was consigned to a Los Angeles County grinder.

Although the Big Jim tungsten mine and mill in the Lindsay-Exeter area were operated until the end of June, no concentrate was shipped. Tungsten ores produced at the Royal mine near Three Rivers and the Sherman Peak mine near Kernville, Kern County, were milled, and the concentrates sold to an Inyo County buyer.

Small quantities of rock crystal were gathered by collectors of gem materials near Kings Highway.

Tuolumne.—The drop in production of stone and especially sand and gravel in the county in 1957 was directly related to the near fulfillment, by the beginning of the year, of requirements for these materials used as fill and aggregate by Tri-Dam Constructors at the Beardsley irrigation project. However, comparatively large tonnages of stone and sand and gravel were produced and used for road construction by Federal, State, and county agencies. Although the Sonora area was a major source of sand and gravel, and for marble used for terrazzo, moderate tonnages of sand and gravel were prepared at portable plants near Jacksonville and Tuolumne. The quantities of limestone quarried in 1957 were virtually the same as in the preceding year, yet the tonnages used in lime manufacture and for chemicals used in glass were slightly lower than in 1956. The Sonora limestone quarry was worked in 1957, but the Columbia quarry was idle during the entire year. A lime plant was operated at Sonora using 5 kilns (1 rotary and 4 shaft type) and a continuous hydrator. Although the plant output was sold principally to chemical and industrial consumers, small tonnages were used by the building trades and for agricultural purposes.

Lessees at the McCormick mine in the *West Belt* district and Mum mine in the *Mother Lode* district produced chromite ores and concentrates, which were shipped to the Government stockpile at Grants Pass, Oreg. Small quantities of gold and silver were produced at 7 small-lode prospects in the county, 4 were in the Big Oak Flat area of the *East Belt* district and 3 in the *Mother Lode* district. The gold ore containing silver from a mine near Sonora was treated at the Selby smelter in Contra Costa County; the other metals were recovered by amalgamation. Activity at placer properties was limited to a

small quantity of gold recovered at the Snowstorm prospect in the *Mother Lode* district during cleanup.

Ventura.—In 1957 Ventura County led all others in output of natural gas and natural-gas liquids, and was third in the volume of petroleum produced. Crude-oil production from the 19 active fields gained 8 percent over the 1956 figure. Nearly one-half of the petroleum output was derived from the Ventura field, but the West Montalvo, Fillmore, Oxnard, Rincon, and South Mountain fields each yielded more than 1 million barrels. Natural-gas use in the county was 20 percent above that in 1956. Refining capacity comprised 3 small plants, 2 near Oxnard and 1 near Ventura, which were essentially asphalt producers with a combined throughput capacity of 9,000 barrels a day. One other asphalt plant near Oxnard did not produce during the year. Natural-gas liquids were recovered at 9 plants; 5 near Ventura, 2 at Fillmore, and 1 each near Oxnard and Santa Paula. Two of the units near Ventura were credited with more than two-thirds of the county's total capacity.

The heavy demand for sand used as fill was chiefly responsible for a 7-percent increase in output of total sand and gravel compared with 1956. A pit in the Ventura area yielded a moderate quantity of molding sand. One of the county's major producers operated a sand and gravel preparation plant in each the Ventura and Santa Paula areas. Near the end of the year an aggregate producer at Saticoy installed a sink-float beneficiation plant for the preparation of Santa Clara River gravel.⁵ Ventura County benefited from the output of the Rincon stone quarry at the Santa Barbara County line. Sandstone from this quarry was used in constructing Rincon Island No. 1, for oil drilling, offshore from Punta Gorda. Grimes Canyon, south of Bardsdale, was the source of building stone marketed as "Grimes Canyon Volcanic Rock." The Tapo Alto quarry near Santa Susana yielded limestone for agricultural use and as filler in asphalt. Shale was quarried and expanded for lightweight aggregate by one company near Frazier Park, Kern County, and by another in the Ventura oilfield area. A cement company at Monolith, Kern County, used gypsum quarried in the Cuyama Valley as a retarder in producing portland cement.

Yolo.—State and county road projects in 1957 required increased tonnages of sand and gravel compared with 1956. A number of aggregate producers supplied sand and gravel from preparation plants at Madison and Esparto for concrete at the Monticello Dam. Construction at the dam also required pozzolan for cement from a Napa County diatomite producer and a moderate tonnage of sandstone used for riprap. A San Mateo County cement company placed its cement-distribution terminal at Broderick in operation about the middle of the year.

Natural dry gas production in the county rose 6 percent from the 1956 figure. The output was mainly from the Winters field, which lies partly in Solano County, but the Dunnigan Hills, Sycamore Slough, Fairfield Knolls, and Pleasant Creek fields also contributed to the total gas yield.

⁵ Pit and Quarry, vol. 50, No. 6, December 1957, pp. 132-136.

Yuba.—The State's principal gold production came from stream and ancient riverbed gravels worked by a fleet of electrically controlled bucketline dredges in the Yuba River basin near Hammonton. Silver and platinum were also recovered in combination with the gold. Some gold and silver were recovered at a sand and gravel washing plant in the same area, when construction materials were being prepared for sale. At various other places in the county a few ounces of placer gold and silver were recovered using small-scale hand-operated equipment. Gold ore, containing silver and copper, mined at the Browns Valley group of claims near Browns Valley was treated in the Empire mill in Nevada County, and the concentrates were shipped to the Selby smelter, Contra Costa County.

Sand and gravel production was higher than in 1956. The greater tonnages were required principally by the California Division of Highways and the United States Army Corps of Engineers in constructing roads and revetments in the county. The Marysville area was the principal source of sand and gravel for building and paving, and the sand produced for blast, engine, and filter uses. Except for 1,000 tons used in road construction, the output of crushed and broken stone in the county during 1957 was used for bank protection along a part of the Yuba River and as base course and aggregate for a runway at the United States Air Force Base at Camp Beale.

Miscellaneous clay was dug from a pit near Wheatland for heavy clay products in the producer's Placer County plant.

The Mineral Industry of Colorado

By Alfred L. Ransome,¹ Frank J. Kelly,² William H. Kerns²
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COLORADO produced minerals valued at a record \$340.6 million in 1957 (including \$15.6 million for uranium) compared with \$321.9 million (including \$12.4 million for uranium) in 1956. Although the total value for the State was 6 percent above 1956 and marked the 12th successive year of increases, had it not been for a higher value for the mineral fuels produced, a small overall gain in nonmetal output, and an advance in uranium and molybdenum production, the total value of all minerals would have decreased. Crude petroleum continued to be the major mineral product in the State, molybdenum the principal commodity in the metals group (followed by uranium), and cement and sand and gravel the primary nonmetals.

As the result of an increase in its unit price the 2-percent greater value of petroleum production offset what otherwise would have been a decline because of lower output. The drop in output reflected lessened production activity in the Colorado portion of the Denver-Julesburg basin and the Rangely field. In contrast, marketed natural-gas output more than doubled, and recovery of natural-gas liquids gained substantially over 1956. Coal production increased slightly to above the 1955 figure, and the \$21.8 million value represented 6 percent of the value of the State's mineral production. The production of commercially used carbon dioxide was one-third lower.

As a direct result of the increase in value for molybdenum and uranium, which offset the effect of a reduced price for tungsten following termination of the General Services Administration (GSA) purchase program, output in the metals group increased 5 percent in total value compared with 1956. A drop in the prices of copper, lead, and zinc affected the total value of metals; and, although the decline was not as significant as with tungsten, it was nonetheless significant to an important segment of the metal-mining industry, even though output of the three base metals rose slightly. Of the 14 metal commodities reported produced in 1957, the output all showed increased production except gold, tungsten, and iron ore, and all values decreased except silver, uranium, vanadium, and molybdenum increased. Silver output rose because the production of silver-bearing lead-zinc ores from four producers (the major source of silver) gained. Several of the principal lead and zinc producers were forced to cease mining during the year, because operations became uneconomic owing to lower prices.

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Among the 14 nonmetallic minerals and commodities produced, the most noteworthy advances (both in quantity and value of production) were made by those in the construction industry—sand and gravel and cement. Although stone output gained moderately, its value declined, as well as that of the remaining nonmetals except flourspar, gem stones, and salt.

Nonmetal production, as a group, was 6 percent above 1956 in terms of value and accounted for 11 percent of the total value of all minerals produced in 1957. However, had it not been for increased highway construction—1957 was the biggest year in highway work in Colorado history—the value of nonmetal output would have declined.

Production of uranium ore in Colorado increased in 1957 and represented 20 percent of the total domestic output in 1957. Three new

TABLE 1.—Mineral production in Colorado, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate..... gross weight.....	179	\$94	182	\$91
Clays..... thousand short tons.....	533	1, 215	403	978
Coal..... do.....	3, 502	19, 832	3, 594	21, 831
Columbian-tantalum concentrate..... pounds.....	52	(²)	5	(²)
Copper (recoverable content of ores, etc.).....	4, 228	3, 594	5, 115	3, 079
Feldspar..... long tons.....	47, 014	327	43, 818	307
Gem stones.....	(³)	30	(³)	35
Gold (recoverable content of ores, etc.)..... troy ounces.....	97, 668	3, 418	87, 928	3, 077
Gypsum..... thousand short tons.....	88	353	(⁴)	(⁴)
Lead (recoverable content of ores, etc.).....	19, 856	6, 235	21, 003	6, 007
Lime..... thousand short tons.....			2	45
Manganese ore and concentrate (35-percent or more Mn) ⁵ gross weight.....			175	14
Mica:				
Sheet..... pounds.....	8	(²)	14	(²)
Scrap.....	517	7	312	6
Natural gas..... million cubic feet.....	54, 205	5, 312	6 119, 500	6 12, 000
Peat.....			3, 559	(⁴)
Petroleum (crude)..... thousand 42-gallon barrels.....	58, 516	162, 674	6 54, 867	6 165, 698
Pumice..... thousand short tons.....	50	109	25	53
Pyrite..... thousand long tons.....	(⁴)	(⁴)	62	(⁴)
Rare-earth metals concentrates.....	16	23	577	20
Sand and gravel..... thousand short tons.....	15, 152	11, 082	16, 400	13, 994
Silver (recoverable content of ores, etc.)..... thousand troy ounces.....	2, 285	2, 068	2, 788	2, 523
Stone..... thousand short tons.....	2, 250	5, 217	2, 438	4, 168
Tungsten concentrate..... 60-percent WO ₃ basis.....	873	3, 010	45	55
Uranium ore.....	7 496, 517	7 12, 410	740, 055	15, 605
Vanadium (recoverable content of ores, etc.)..... thousand pounds.....	5, 582	(⁴)	6, 264	(⁴)
Zinc (recoverable content of ores, etc.).....	40, 246	11, 027	47, 000	10, 904
Value of items that cannot be disclosed: Carbon dioxide, cement, flourspar, iron ore, iron oxide pigments (1957), molybdenum, natural-gas liquids, perlite, salt, and values indicated by footnote 4.....		7 75, 650		81, 917
Total, Colorado ⁸		7 321, 914		340, 638

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Less than \$1,000.

³ Weight not recorded.

⁴ Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

⁵ Excludes shipments to the Government purchase depot under the "low-grade" program; quantity and value for this manganese ore and concentrate were: 1956, 6 short tons, \$340; 1957, none.

⁶ Preliminary figure.

⁷ Revised figure.

⁸ The total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

TABLE 2.—Average unit value of selected mineral commodities produced in Colorado, 1953-57¹

Commodity	1953	1954	1955	1956	1957
Beryl.....dollars per short ton	526.87	452.17	498.91	523.73	502.32
Cement.....dollars per barrel	3.02	3.04	3.19	3.33	3.36
Clays.....dollars per short ton	1.84	1.17	2.41	2.33	2.43
Coal.....dollars per short ton	5.37	5.54	5.63	5.66	6.08
Columbian-tantalum.....dollars per pound	1.70	1.99	1.68	0.62	0.50
Copper.....cents per pound	28.7	29.5	37.3	42.5	30.1
Feldspar.....dollars per long ton	6.15	6.54	6.80	6.96	7.01
Fluorspar.....dollars per short ton	53.91	54.01	52.28	52.26	52.71
Gold.....dollars per troy ounce	35.00	35.00	35.00	35.00	35.00
Gypsum.....dollars per short ton	3.70	3.91	4.30	4.01	4.01
Iron ore.....dollars per long ton	4.25			5.92	6.81
Lead.....cents per pound	13.1	13.7	14.9	15.7	14.3
Mica (scrap).....dollars per short ton	12.17	17.88	18.02	14.69	20.51
Molybdenum.....dollars per pound		1.02	1.05	1.15	1.19
Natural gas.....cents per thousand cubic feet	5.8	8.7	9.9	8.8	10.0
Perlite.....dollars per short ton	9.00	9.98	10.00	10.71	10.55
Petroleum.....dollars per 42-gallon barrel	2.71	2.77	2.75	2.78	3.02
Pumice.....dollars per short ton	2.08	2.13	2.30	2.18	2.14
Pyrite.....dollars per long ton	3.31	4.32	5.30	6.86	
Salt.....dollars per short ton			4.72	4.66	4.50
Sand and gravel.....cents per short ton	69.2	66.6	69.0	73.1	85.3
Silver.....cents per troy ounce	90.5+	90.5+	90.5+	90.5+	90.5+
Stone.....dollars per short ton	1.98	1.17	1.63	2.32	1.71
Tungsten.....dollars per short-ton unit	59.19	61.47	59.00	57.47	20.45
Zinc.....cents per pound	11.5	10.8	12.3	13.7	11.6

¹ Prices are discussed in detail in the commodity chapters, Minerals Yearbook, Vol. I.

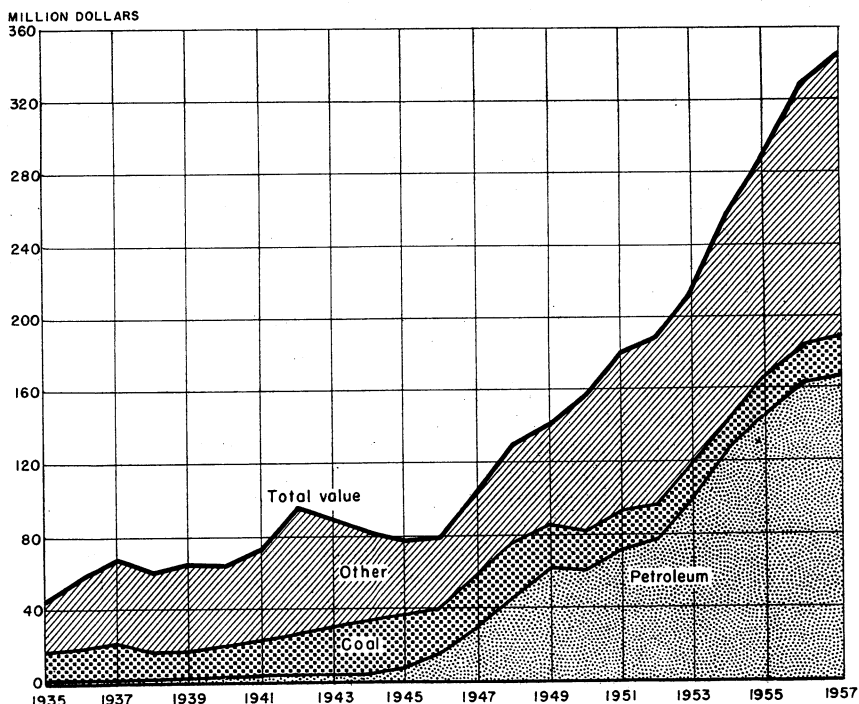


FIGURE 1.—Value of petroleum, coal and total value of all minerals produced in Colorado, 1935-57 (excludes uranium, 1941-55).

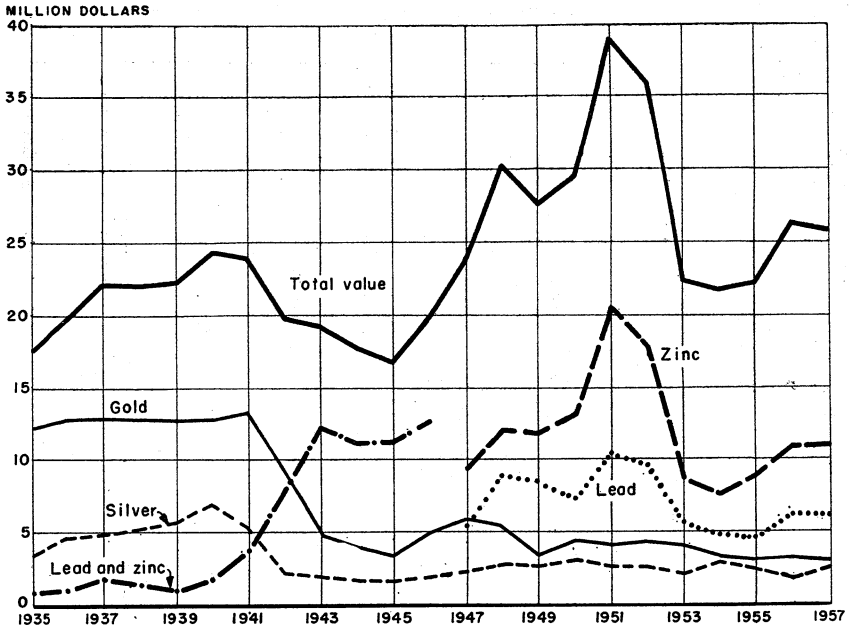


FIGURE 2.—Value of mine production of gold, silver, lead, and zinc and total value of these minerals in Colorado, 1935-57.

uranium mills were completed during the year, and by year end 7 mills were operating in the State. Exploration and development drilling for uranium ore gained slightly in 1957. The number of companies actively engaged in uranium exploration and production was less than in 1956, but activity among the few larger companies increased.

Experimental work on retorting oil shale was continued during the year by two private firms, although the Bureau of Mines plant at Rifle remained closed. Oil from one experimental plant in Colorado was used successfully commercially—probably for the first time—at a vanadium-uranium processing plant.

Continued interest was shown in certain of the less common metals—beryl, columbium and tantalum, and the rare-earth metals—although production remained relatively small.

Antimony, arsenic, bismuth, cadmium, and selenium were recovered from Colorado ores; but, because the quantities were small and not accounted for in early metallurgical processing, no quantitative data are available.

Several new plants for treating or processing ores and mineral commodities were completed or under construction in Colorado in 1957. In the field of mineral fuels the American Gilsonite Co. formally opened its gilsonite refinery near Grand Junction on August 2 after an extended period of testing. The unique plant was designed to produce high-grade metallurgical coke and gasoline from gilsonite mined at Bonanza, Utah, and transported 72 miles by pipeline.

The Union Carbide Nuclear Co. completed and placed in operation at Rifle a 1,000-ton-per-day uranium mill which replaced the smaller plant formerly operated there. The company also completed a uranium-ore upgrading plant at Slick Rock. At Gunnison the Gunnison

Mining Co. completed a 200-ton-per-day uranium mill, and at Maybell the Trace Elements Corp. began operating its newly finished 300-ton-per-day mill. The Cotter Corp. began constructing a 90-ton-per-day pilot plant at Canon City to test the processing of uranium ore from the Front Range. Construction was begun during the year by Climax Molybdenum Co. of a new byproducts-recovery unit of its huge molybdenum plant at Climax. The new unit will replace an older section of the mill used to recover tungsten, tin, and pyrite.

Of potential significance was development by the Vitro Corp. of America of a process for extracting manganese from rhodonite ore from deposits in the Silverton area of San Juan County.

Western Mineral Products Co. constructed an expanded-perlite section for its Denver exfoliated vermiculite plant, the second perlite facility to serve Colorado consumers of this commodity.

EMPLOYMENT AND INJURIES

The average annual employment in the mining industry of Colorado declined 1 percent in 1957, and the ratio to the total nonagricultural employment was slightly lower than in 1956. Employment in metal mining (the greater proportion of the total for all types of mining) was the same as in 1956. Cutbacks in lead-zinc mining were offset by increased activity in molybdenum and uranium. Wages increased generally during the year, in the metal and mineral-fuels phases of the mineral industry, coal-mine employees received the highest advance in average hourly earnings. However, the average workweek in 1957 was shorter for coal miners than in 1956, the same for metal miners, and longer for employees in the petroleum and natural-gas industry. Therefore, those persons in the last industrial group gained the most because of the longer workweek.

TABLE 3.—Average employment, average hourly earnings, average weekly hours, and average weekly earnings in the nonagricultural and mining industries, 1956-57

[United States Department of Labor, Bureau of Labor Statistics]

Industry	Average employment		Average hourly earnings		Average weekly hours		Average weekly earnings	
	1956	1957	1956	1957	1956	1957	1956	1957
Total nonagricultural.....	457,800	465,100						
Total mining.....	16,000	15,800	\$2.36	\$2.46	41.4	41.1	\$97.70	\$101.11
Metal mining.....	6,500	6,500	2.26	2.34	43.7	43.7	98.76	101.32
Coal mining.....	2,400	2,400	2.76	2.94	34.1	33.1	94.12	97.31
Petroleum and natural gas...	6,300	6,000	2.38	2.43	42.2	43.3	100.44	105.22
Other mining and quarrying.	800	900						

Data on employment and earnings presented in the accompanying table were supplied by the Bureau of Labor Statistics. 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.

During the past few years there has been an indicated trend toward a lessening in the rate of frequency of disabling work injuries in the mineral industries. The apparent decline has been less marked in the metal-mining category, owing to the higher percentage of underground operations and the greater hazards inherent in the type of work involved. During 1957 there were 17 fatal accidents in the mineral industries, exclusive of coal mining. That industry can be justly proud of operating the entire year without a fatality.

GOVERNMENT PROGRAMS

Government participation in the search for strategic minerals continued during 1957 but at a slightly lower rate than in 1956. Fourteen Defense Minerals Exploration Administration (DMEA) contracts were executed during the year for a total of \$808,539 (16 totaling \$946,515 in 1956). Contracts during 1957 covered exploration principally for uranium, but also for thorium, copper, lead, and zinc.

TABLE 4.—DMEA contracts executed in 1957

County and contractor	Property	Commodity	Contract	
			Date	Total amount ¹
CUSTER				
Cotter Corp.....	Star et al. claims.....	Thorium...	Aug. 29, 1957	\$18,876
FREMONT				
Cunac Minerals, Inc.....	Pink Lady et al. claims.....	do.....	July 24, 1957	20,760
JEFFERSON				
Arthur A. Cervi.....	Cervi lease.....	Uranium...	Aug. 5, 1957	17,536
Caleb V. Haynes, Jr.....	Black Knight and Billikin lodes.....	do.....	Sept. 11, 1957	20,256
Uranium Enterprises.....	Mann No. 1 mine.....	do.....	Nov. 5, 1956	11,700
Yellow Queen Uranium Co.....	Ascencion mine.....	do.....	July 3, 1957	42,192
MESA				
Lisbon Uranium Corp.....	John Brown claim group et al.....	do.....	Mar. 6, 1957	45,572
New Idria Mining & Chemical Co.....	Johannie Mae claim group.....	do.....	Apr. 4, 1957	53,444
MONTROSE				
Strategic Minerals Exploration Co. ²	Joan, La Ray, and Ella claims.....	do.....	June 3, 1957	6,750
PARK				
Leadville Lead & Uranium Corp.....	Hilltop mine.....	Lead-zinc-copper.	Aug. 21, 1957	99,418
RIO GRANDE				
General Minerals Corp.....	Summitville mine.....	Copper-lead.	July 15, 1957	149,380
SAQUACHE				
D. & J. Uranium & Exploration Co.....	Bonita et al. claims.....	Uranium...	Aug. 5, 1957	44,800
Universal Metals Co.....	Friendly Neighbor and Sage Hen group.	do.....	Nov. 7, 1956	29,475
SAN MIGUEL				
Climax Uranium Co.....	D. V. and Vanderwalker claim groups.	do.....	Oct. 14, 1957	248,380
Total.....				808,539

¹ Government participation: Thorium and uranium, 75 percent; copper, lead, and zinc, 50 percent.

² Property in Montrose County, Colo., and San Juan County, Utah; value of contract has been split 50-50.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt and Related Bitumens.—The processing plant of the American Gilsonite Co. near Fruita in Mesa County and the pipeline for transporting crude material from the mines at Bonanza, Utah, were completed; and after testing, operations began in April 1957. The gilsonite delivered through the 72-mile, 6-inch pipeline as a slurry was processed to produce a high-grade metallurgical coke and gasoline. Intermediate products were used at the refinery to provide process heat. The plant produced daily in excess of 300 tons of coke used by aluminum companies in the northwestern States as anode material and 1,300 barrels of high-grade gasoline which was marketed locally. Investigations were underway on the feasibility of producing higher value fractions.

Carbon Dioxide.—Carbon dioxide was produced from wells in the Nina View field in Las Animas County, the McElmo field in Montezuma County, and the McCallum-North field in Jackson County. Gas from the Nina View field was processed at a plant at Ninaview in Bent County to produce dry ice and liquid carbon dioxide, which was marketed as far away as Montana and Texas. A plant on McElmo Creek processed the gas from that field and marketed it as dry ice and liquid carbon dioxide in the Four Corners area of Colorado, New Mexico, Arizona, and Utah. Carbon dioxide from the McCallum-North field was produced in conjunction with petroleum. The gas was formerly used to repressure the oilfield, but the practice proved to be uneconomic and was discontinued. Currently the gas is wasted. Production of commercially used carbon dioxide in 1957 declined 24 percent compared with 1956.

Coal.—Coal production from 107 mines (102 underground and 5 strip) producing over 1,000 tons each in 17 counties increased to 3.6 million tons in 1957 compared with 3.5 million tons in 1956. Value increased 10 percent—to \$21.8 million—and represented 6 percent of the value of Colorado's mineral production. During the year the State's coal mines produced the 500 millionth ton of coal since operations were begun in 1864. The total production through 1957, 500.2 million tons, was slightly more than 0.5 percent of the State's estimated reserve. Colorado coal producers can be proud of an entire year's operation without a fatal accident. The State coal mine inspector's report shows that 2,499 men worked 22,019 days in 1957, with 76 compensable accidents.

Coal shipped to coke ovens within the State increased to 1.29 million tons compared with 1.20 million in 1956. All was mined in Las Animas County and used by the Colorado Fuel & Iron Corp. at its steel furnaces in Pueblo. Nearly 600,000 tons (17 percent of the total production) was shipped to consumers outside the State. More than 500,000 tons was used for generating power within Colorado. A report on Las Animas County coal reserves was published.³

The Branch of Coal Technology, Federal Bureau of Mines, at Denver continued to investigate the high- and low-temperature carboniza-

³ Wood, G. H., Jr., Johnson, R. B., and Dixon, G. H., *Geology and Coal Resources of the Starkville-Weston Area, Las Anima County, Colo.*: Geol. Survey Bull. 1051, 1957, 68 pp.

TABLE 5.—Production of coal, 1956–57, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1956		1957	
	Short tons	Average value per ton ¹	Short tons	Average value per ton ¹
Boulder.....	5,410	\$6.59		
Delta.....	58,066	5.63	61,674	\$5.45
El Paso.....	47,172	4.77	263,720	\$6.75
Fremont.....	240,522	3.73	224,503	\$3.71
Garfield.....	24,096	6.03	38,441	5.45
Gunnison.....	302,968	5.51	290,958	5.93
Huerfano.....	61,892	5.83	69,297	6.46
Jackson.....	2,051	3.97	1,448	5.37
La Plata.....	51,447	4.21	38,737	4.10
Las Animas.....	1,232,916	7.11	1,318,124	7.78
Mesa.....	70,360	5.36	76,617	6.95
Moffat.....	96,460	5.59	108,024	5.71
Montezuma.....			1,035	4.10
Montrose.....	2,707	6.54	1,974	5.95
Pitkin.....	153,979	7.19	(²)	(²)
Rio Blanco.....	13,630	5.53	12,901	5.97
Routt.....	489,938	4.37	465,065	4.11
Weld.....	643,540	4.50	621,102	4.70
Total.....	3,502,163	5.66	3,593,629	6.08

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 that of El Paso County to avoid disclosing individual company confidential data.

tion of coals from the Western States and other areas. Portions of the research were carried out under cooperative agreements with industrial organizations using coal for power generation and the production of metallurgical coke.

Natural Gas and Natural-Gas Liquids.—Marketed natural gas increased more than twofold in 1957 compared with 1956. Dry gas was produced from 36 fields in 11 counties. The major producing areas were Rio Blanco, La Plata, Logan, and Moffat Counties. Wet gas from oilfields, processed at plants in four counties, provided the remainder of the marketed natural gas. Wet gas from fields without processing facilities was repressured, flared, or otherwise wasted. The total recorded production of dry and wet gas in 1957 was 145 billion cubic feet. The recovery of natural-gas liquids at plants in Logan, Moffat, Morgan, and Rio Blanco Counties in 1957 increased 11 percent compared with 1956. Of the wildcat completions, 18 new gasfields were discovered in 1957 compared with 20 in 1956. The number of successful development wells in gasfields also declined in 1957, with 73 successful completions compared with 87 in 1956. Most of the successful wells were in La Plata (45) and Rio Blanco (11) Counties.

Petroleum.—Petroleum production in 1957 was 54.9 million barrels, a 6-percent decline compared with 1956, but the value increased 2 percent because of an advance in crude-oil prices. Production was from 197 fields in 18 counties. Rio Blanco County led the State in the quantity of petroleum produced, followed by Washington, Morgan, Logan, and Weld Counties. Of the 9 counties that together produced 99 percent of the petroleum in Colorado, 5 showed declines, and 4 showed increases in 1957 compared with 1956. Declines of more than a million barrels each were reported in Rio Blanco and Logan Counties.

TABLE 6.—Production of crude petroleum, 1956-57, by counties ¹

(Thousand barrels)

County	1956	1957 (preliminary)	Principal fields in 1957 in order of production
Adams.....	1,067	1,000	Badger Creek, Middlemist, Beacon.
Archuleta.....	152	137	Price Gramps.
Bent.....	5	6	Bent's Fort.
Boulder.....	3	3	Boulder.
Fremont.....	30	25	Florence-Canyon City.
Jackson.....	725	886	McCallum-N, Battleship.
Jefferson.....	3	1	Soda Lake.
Kiowa.....		7	McClave.
La Plata.....	10	12	Red Mesa, Barker Dome.
Larimer.....	181	226	Fort Collins, Wellington.
Logan.....	7,975	6,503	Yenter, Cliff, Graylin-NW, Beall Creek, Lewis Creek.
Moffat.....	1,281	1,372	Thornburg, Powder Wash, Iles.
Montezuma.....	6	5	Dove Creek.
Morgan.....	7,376	6,824	Adena, Sand River, Pinneo, McRae.
Rio Blanco.....	30,618	28,410	Rangely Weber, Wilson Creek, Rangely Shale.
Routt.....	65	94	Tow Creek.
Washington.....	7,192	7,013	Little Beaver, Big Beaver, Plum Bush Creek.
Weld.....	1,827	2,343	Pierce, Black Hollow.
Total.....	58,516	54,867	

¹ Distribution by county effected by using Colorado Oil and Gas Conservation Commission data, adjusted to Bureau of Mines total.

TABLE 7.—Wildcat- and development-well completions in 1957, by counties

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage ¹	County	Oil	Gas	Dry	Total	Footage ¹
WILDCAT						San Miguel.....			1	1	5,400
Adams.....	1		14	15	105,600	Sedgwick.....			18	18	69,700
Arapahoe.....			8	8	47,400	Washington.....	10	1	128	139	670,700
Archuleta.....			1	1	2,500	Weld.....	9	1	42	52	362,200
Baca.....			8	8	43,400	Yuma.....			12	12	45,400
Bent.....		1	7	8	41,800	Total wildcat.....	34	18	498	550	2,872,900
Boulder.....			1	1	5,700	DEVELOPMENT					
Crowley.....			3	3	19,800	Adams.....	5		1	6	36,100
Delta.....			2	2	12,500	Archuleta.....	2			2	1,200
Elbert.....			10	10	67,200	Baca.....		1	2	3	15,400
El Paso.....			1	1	6,600	Bent.....			1	1	5,500
Fremont.....			3	3	7,600	Fremont.....			2	2	2,600
Garfield.....		3	5	8	29,400	Garfield.....			4	3	26,700
Grand.....			3	3	13,500	Jackson.....	5		2	7	24,500
Jackson.....	1		4	5	26,400	Kiowa.....			1	1	4,300
Kit Carson.....			2	2	10,300	La Plata.....		45	2	47	281,100
Kiowa.....	1	2	8	11	55,500	Larimer.....	2		1	3	15,200
Larimer.....	1		7	8	30,000	Logan.....	30		28	58	285,300
Las Animas.....			3	3	11,200	Mesa.....		2	2	4	13,700
La Plata.....	1	5	5	11	59,400	Moffat.....	3	6	1	10	44,800
Lincoln.....			11	11	51,400	Montezuma.....			1	3	9,400
Logan.....	5	1	85	91	442,200	Morgan.....	10	2	13	25	132,000
Mesa.....		1	9	10	18,100	Rio Blanco.....	1	11	4	16	53,000
Moffat.....	3		14	17	107,600	Routt.....	3		2	5	15,900
Montezuma.....			25	25	150,100	Sedgwick.....			1	1	3,800
Morgan.....		1	26	27	153,500	Washington.....	24		25	49	242,400
Montrose.....			1	1	1,200	Weld.....	25	1	28	54	390,800
Otero.....			3	3	17,600	Total develop-	110	73	122	305	1,603,700
Park.....			1	1	7,500	Total, all drill-	144	91	620	855	4,476,600
Phillips.....			1	1	4,100						
Pitkin.....			1	1	3,600						
Provers.....			8	8	43,200						
Pueblo.....			1	1	5,200						
Rio Blanco.....	1	2	14	17	105,600						
Routt.....	1		2	3	12,800						

¹ Footage has been rounded to nearest 100 feet.

Exploratory drilling was most active in the Denver-Julesburg basin in the northeastern counties where 70 percent of the wildcat wells were drilled. The area also had most of the discoveries, with 26 oilfields and 4 gasfields. In the western counties 7 oilfields and 8 gasfields were discovered and in the southeastern counties 1 oilfield and 3 gasfields. Exploratory drilling in 1957 totaled 550 wells (2.9 million feet) compared with 675 wells totaling 3.4 million feet in 1956. Development drilling also declined from 547 completions in 1956 to 305 completions in 1957. Results of investigations⁴ on the characteristics of Colorado crude oils was published.

Shale Oil.—Experimental work on retorting oil shale continued during the year. Union Oil Co. of California completed constructing its pilot plant on Parachute Creek, 12 miles north of Grand Valley. Operations were begun in March and continued throughout the year. Throughput reached the initial design rate of 360 tons a day in early summer and after several improvements had been made, reached 550 tons a day without any reduction in yield. It was expected that that rate could be increased further without any reduction in yield. The process was described as “continuous, underfeed, countercurrent retorting.” Raw shale forced upward through the retort by a “rock pump” is contacted by hot gases derived from the burning of residual carbon in the spent shale and drawn downward through the fresh shale by blowers. Oil and combustible gases are withdrawn from the bottom of the retort and spent-shale ash is removed from the top. Experimental work in refining the shale oil was done at the company laboratories at La Brea, near Los Angeles, Calif. Oil from the experimental retort was used successfully at the uranium-vanadium processing plant of the Union Carbide Nuclear Co. at Rifle and was probably the first commercial use of shale oil in the United States. Further experimental work was planned for 1958.

The Denver Research Institute completed experimental work for the Oil Shale Corp. of Beverly Hills, Calif., in a small 300-pound-per-hour laboratory kiln using the Aspeco (Swedish) process with good results. A 25-ton-a-day unit was built in Denver to test the process further and obtain design and operating data. The process utilizes a horizontal rotary kiln with heat transferred to the crushed shale by a countercurrent flow of heated ceramic balls. Oil and gas are withdrawn from the kiln and condensed. The ceramic balls and spent shale are discharged from opposite ends of the kiln. The balls are reheated and returned to the circuit. Operation of the plant was begun in April and continued for several months. Results of the work were being analyzed and an estimate of costs was being prepared. The Oil Shale Corp. plans to continue the work through a larger pilot plant and eventual erection of a semicommercial plant in western Colorado. Reports of investigations on oil shale were published.⁵

⁴ Wenger, W. J., Whisman, M. L., Lanum, W. J., and Ball, J. S., Characteristics and Analyses of Ninety-two Colorado Crude Oils: Bureau of Mines Rept. of Investigations 5309, 1957, 60 pp.

⁵ Donnell, J. R., Preliminary Report on Oil-Shale Resources of Piceance Creek Basin, Northwestern Colorado: Geol. Survey Bull. 1042-H, 1957, pp. 255-271.

Allbright, C. S., Van Meter, R. A., Dinneen, G. U., and Ball, J. S., Analysis of Crude Shale Oil. 2. Some Brazilian and U. S. A. Oils: Bureau of Mines Rept. of Investigations 5286, 1956, 28 pp.

Stanfield, K. E., Rose, C. K., McAuley, W. S., and Tesch, W. J., Jr., Oil Yields of Sections of Green River Oil Shale in Colorado, 1952-54: Bureau of Mines Rept. of Investigations 5321, 1957, 132 pp.

METALS

Beryllium.—Output of beryllium concentrate (beryl) in Colorado in 1957 was virtually the same as 1956. The entire production was sold to Beryl Ores Co., Arvada, International Minerals & Chemical Corp., Parkdale, Government purchase depot, Custer (S. Dak.), Joe Collins, and Antero Refining Co. Other associated minerals in the pegmatite—feldspar, mica, and columbite-tantalite—were recovered as byproducts or coproducts of the beryl. Most of the beryl output in 1957 came from 3 counties (Park, Larimer, and Fremont) but small quantities were produced from 3 other counties (Jefferson, Chaffee, and Clear Creek). The Boomer Lode, 7 miles west of Lake George in Park County, owned by G. H. Sager and operated by the Mountain Dale Mining Co., was again by far the outstanding producer in the State; 91 percent of Colorado's beryl output came from this mine in 1957.

Cadmium, Indium, and Thallium.—The Globe smelter of the American Smelting and Refining Co. in Denver recovered cadmium, indium, and thallium from flue dust, dross, and other byproduct material shipped to it from other company smelters in 1957.

Columbium-Tantalum.—A small quantity of columbium-tantalum concentrate (columbite-tantalite) was recovered by 3 operators—1 each in Clear Creek, Fremont, and Larimer Counties—as a byproduct of the recovery of beryl from pegmatite.

Copper.—In 1957 copper production increased 25 percent above 1956, but the value of output declined 14 percent because of a drop in copper prices during 1957. The principal copper producer in Colorado was the Treasury Tunnel-Black Bear-Smuggler Union group of mines in the Upper San Miguel district of San Miguel County, operated by the Idarado Mining Co. An increased copper output by this company and by the second largest copper producer in the State in 1957—The New Jersey Zinc Co. Eagle mine in the Red Cliff district of Eagle County—furnished most of the advance in copper production in Colorado in 1957.

Gold.—Gold output in Colorado in 1957 decreased 10 percent below 1956. Fifty-one percent of the State's gold production came from Teller County, 26 percent from San Miguel County, and 15 percent from Clear Creek, Eagle, and Lake Counties combined. Most of the remaining 8 percent came from Mineral and San Juan Counties.

Seventeen mining operations in the Cripple Creek district producing gold ore mined from underground or from old mine dumps supplied the Teller County output of gold in 1957. All of this ore was treated in the 1,000-ton-per-day Carlton custom mill of the Golden Cycle Corp. The principal gold producers in this district and county were the Ajax mine operated by Golden Cycle Corp., Cresson mine operated by Cresson Consolidated Gold Mining & Milling Co., and the Vindicator mine operated by United Gold Mines Co. The Free Coinage, Grace Greenwood, El Paso, and Dexter mines were also substantial producers of gold in this county in 1957.

A large part of the gold output in San Miguel County came from the Treasury Tunnel-Black Bear-Smuggler Union group of mines (Colorado's leading gold producer in 1957) operated as a unit by

Idarado Mining Co. This gold was recovered as a byproduct of the mining of copper-lead-zinc ore.

Fifty-two percent of the total gold output was recovered from ores of gold and silver, 46 percent from ores of copper, lead, and zinc, and the remaining 2 percent mostly from placer mining. Fifty-one percent of the gold was recovered by cyanidation of ore, 35 percent by smelting of concentrate produced from ore, and the remainder by amalgamation, direct smelting of ore and cleanup material, and placer mining.

Iron Ore.—Output of iron ore in Colorado in 1957 was one-eighth of that produced in 1956. From May through October Boyd Robinson

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, 1948–52 (average), 1953–57, and total, 1858–1957, in terms of recoverable metals¹

Year	Mines producing		Material sold or treated ² (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1948–52 (average)....	219	24	1,440,100	125,781	\$4,402,349	2,999,940	\$2,715,097
1953.....	118	19	1,204,517	119,218	4,172,630	2,200,317	1,991,398
1954.....	123	19	973,177	96,146	3,365,110	3,417,072	3,092,623
1955.....	120	14	908,416	88,577	3,100,195	2,772,073	2,508,866
1956.....	124	18	1,156,019	97,668	3,418,380	2,284,701	2,067,770
1957.....	115	16	1,110,892	87,928	3,077,480	2,787,892	2,523,183
1858–1957.....			(³)	40,344,666	905,940,274	761,446,086	595,644,127

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948–52 (average)....	2,932	\$1,310,136	27,881	\$8,991,228	49,512	\$14,957,529	\$32,376,339
1953.....	2,941	1,688,134	21,754	5,699,548	37,809	8,696,070	22,247,780
1954.....	4,523	2,668,570	17,823	4,883,502	35,150	7,592,400	21,602,205
1955.....	4,323	3,224,958	15,805	4,709,890	35,560	8,696,100	22,240,009
1956.....	4,228	3,593,800	19,856	6,234,784	40,246	11,027,404	26,842,138
1957.....	5,115	3,079,230	21,003	6,006,858	47,000	10,904,000	25,590,751
1858–1957.....	288,651	87,993,743	2,716,224	316,787,033	1,821,058	334,340,296	2,240,705,473

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 9.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	7,897	293,757	589	1,745	4,300
February.....	8,213	242,534	433	1,732	3,841
March.....	8,682	284,863	520	2,007	4,418
April.....	7,460	309,032	498	2,371	4,626
May.....	6,614	274,436	463	2,239	4,528
June.....	6,526	292,704	434	2,101	4,292
July.....	7,119	292,902	583	1,998	4,264
August.....	7,538	198,263	357	1,836	4,002
September.....	5,528	150,462	306	1,204	2,992
October.....	8,023	164,547	312	1,247	3,280
November.....	7,600	149,272	320	1,220	3,140
December.....	6,728	135,120	300	1,303	3,317
Total.....	87,928	2,787,892	5,115	21,003	47,000

TABLE 10.—Gold and silver produced at placer mines, 1948-52 (average) and 1953-57, in fine ounces, in terms of recoverable metals

Year	Small-scale hand methods ¹			Gravel mechanically handled						Total		
	Number of operations	Gold	Silver	Nonfloating washing plants ²			Bucketline and dragline dredges					
				Number of operations	Gold	Silver	Number of operations	Gold	Silver	Number of operations	Gold	Silver
1948-52 (average)---	14	77	19	7	1,043	162	3	11,195	2,217	24	12,315	2,398
1953-----	9	37	11	9	1,046	159	1	546	75	19	1,629	245
1954-----	6	79	16	11	1,112	163	2	364	47	19	1,555	226
1955-----	3	61	11	8	1,125	181	3	610	82	14	1,796	274
1956-----	4	41	6	8	1,227	189	6	* 648	* 88	18	1,915	283
1957-----	6	27	2	8	1,278	194	2	296	40	16	1,601	236

¹ Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.

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

³ Includes 8 fine ounces of gold and 3 fine ounces of silver—byproduct of tungsten ore.

mined and shipped bog iron ore (hematite) from the Iron Springs placer mine at Ophir in San Miguel County for C. K. Williams & Co. for use in manufacturing paint. In addition, he produced a small quantity of similar material from his Iron Lode No. 3 claim near the C. K. Williams property and sold it in sacks and bulk to farmers in the Grand Junction area for use as a soil conditioner. Iron ore for the Colorado Fuel & Iron Corp. steel plant at Pueblo was obtained from company mines in Utah and Wyoming. Early in December the company curtailed operations at this plant because of inadequate orders for its products. The firm's 8,400 employees' workweek schedule was reduced from 40 hours to 32.

Lead.—Despite a 1,000-ton increase in lead output in Colorado in 1957, the value of production declined \$228,000 because of a drop in the price of lead during the year. Increased output was reported from the State's four leading lead producers (in order of output)—Idarado Mining Co., The New Jersey Zinc Co., Resurrection Mining Co., and Emperius Mining Co. These companies supplied 86 percent of Colorado's total lead output in 1957.

The operation at the Irene, Hellena, and Julia Fisk shafts, Lake County—a joint venture by American Smelting and Refining Co. and Resurrection Mining Co. and operated by the latter company—along with the Ibex and Iowa Gulch mines and Resurrection custom mill owned and operated by this company, was closed late in September. According to the printed annual report of the Newmont Mining Corp., owner of the Resurrection Mining Co., the suspension was necessary when the operation became unprofitable because of the decline in lead- and zinc-metal prices during the latter half of the year.

Two other major producers of lead and zinc in former years, Rico Argentine Mining Co. with operations at Rico in Dolores County and the Keystone Unit of the American Smelting and Refining Co. in Gunnison County, were forced to close in June and July, respectively, because of the lower prices.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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		Fine ounces	Value	Fine ounces	Value
Adams.....		5		993	\$34,755	139	\$126
Boulder.....	5	2	128	169	5,915	820	742
Chaffee.....	1		330	4	140	2,188	1,980
Clear Creek.....	22		12,432	4,589	160,615	49,459	44,763
Custer.....	5		1,067	47	1,645	1,350	1,222
Dolores.....	1		2,326	13	455	8,829	7,991
Eagle.....	1		296,760	3,201	112,035	931,850	843,371
Fremont.....	1		44			9	8
Gilpin.....	5	4	2,823	97	3,395	1,680	1,520
Gunnison.....	5		42,701	56	1,960	242,896	219,853
Hinsdale.....	1		2			21	19
Jefferson and Lake ²	12	3	93,729	6,169	215,915	374,080	338,562
La Plata.....	1		458	113	3,955	95	86
Mesa.....			(³)	30	1,050	17	15
Mineral.....	4		50,010	1,662	58,170	279,249	252,734
Moffat.....	1		12			5	5
Montezuma.....	1		17	59	2,065	69	62
Montrose.....	1		1			836	802
Park.....	4	2	1,800	264	9,240	13,547	12,261
Pitkin.....	1		(³)			48	43
Routt.....	2		2,342	12	420	638	577
Saguache.....	3		237	2	70	1,339	1,212
San Juan.....	8		17,245	2,180	76,300	54,757	49,558
San Miguel.....	4		459,072	22,840	799,400	782,376	708,090
Summit.....	9		10,958	105	3,675	35,149	31,812
Teller.....	17		116,398	45,323	1,586,305	6,396	5,789
Total: 1957.....	115	16	1,110,892	87,928	3,077,480	2,787,892	2,523,183
1956.....	124	18	1,156,019	97,668	3,418,380	2,284,701	2,067,770

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams.....							\$34,881
Boulder.....	1,300	\$391	30,800	\$4,404			11,452
Chaffee.....	1,700	512	144,300	20,635			23,267
Clear Creek.....	88,700	26,699	861,300	123,166	9,000	\$1,044	356,287
Custer.....	2,500	752	3,600	515			4,134
Dolores.....	600	181	402,200	57,515	318,600	36,958	103,100
Eagle.....	2,385,800	718,126	8,953,400	1,280,336	48,209,400	5,592,290	8,546,158
Fremont.....	1,500	451					459
Gilpin.....	5,900	1,776	16,500	2,359			9,050
Gunnison.....	594,900	179,065	1,718,800	245,788	3,470,700	402,601	1,049,247
Hinsdale.....	100	30					49
Jefferson and Lake ²	538,600	162,118	7,387,600	1,056,427	13,136,700	1,523,857	3,296,879
La Plata.....			100	14			4,041
Mesa.....			100	14			1,079
Mineral.....	136,200	40,996	4,462,200	638,095	3,638,800	422,101	1,412,096
Moffat.....	100	30	100	14			49
Montezuma.....							2,127
Montrose.....	1,600	482					1,284
Park.....	8,900	2,679	433,300	61,962	117,800	13,665	99,807
Pitkin.....			200	29			72
Routt.....	64,100	19,294	61,000	8,723			29,014
Saguache.....	1,700	512	26,600	3,804	13,500	1,566	7,164
San Juan.....	131,700	39,642	1,124,800	160,846	624,100	72,396	398,742
San Miguel.....	6,249,200	1,881,009	15,442,900	2,208,335	23,142,000	2,684,472	8,281,306
Summit.....	14,900	4,485	936,300	133,891	1,319,400	153,050	326,913
Teller.....							1,592,094
Total: 1957.....	10,230,000	3,079,230	42,006,000	6,006,858	94,000,000	10,904,000	25,590,751
1956.....	8,456,000	3,593,800	39,712,000	6,234,784	80,492,000	11,027,404	26,342,138

¹ Operations at slag dumps and old mill or miscellaneous cleanups not counted as a producing mine.

² Combined to avoid disclosing individual company confidential data.

³ Less than 1 ton.

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	32	120,342	45,875	8,530	400	9,500	
Dry gold-silver.....	11	4,955	202	8,733	67,700	115,200	
Dry silver.....	11	2,208	42	11,079	3,700	118,200	
Total.....	53	127,505	46,119	28,342	71,800	242,900	
Copper.....	8	32,138	2,313	599,688	1,872,100	257,000	
Copper-lead.....	1	709	5	469	4,600	7,800	
Copper-lead-zinc.....	4	498,853	22,838	1,021,900	6,845,100	17,041,700	26,507,700
Lead.....	37	25,935	5,319	120,589	160,700	2,517,900	93,700
Lead-zinc.....	19	422,610	9,320	1,009,975	1,267,400	21,827,300	67,274,800
Zinc.....	4	785	228	2,237	7,400	17,800	123,800
Total.....	62	981,030	40,023	2,754,858	10,157,300	41,669,500	94,000,000
Other "lode" material:							
Cleanings (gold-silver).....	1	11	5	85		900	
Fluorspar ore.....	1		72	476	600	30,500	
Mill cleanings (lead).....	2	22	44	1,070	300	13,500	
Old slag (lead).....	1	1,268	4	2,556		48,700	
Old tailings (gold).....	2	1,056	60	269			
Total.....	7	2,357	185	4,456	900	93,600	
Total "lode" material.....	115	1,110,892	86,327	2,787,656	10,230,000	42,006,000	94,000,000
Gravel (placer operations).....	16		1,601	236			
Total, all sources.....	131	1,110,892	87,928	2,787,892	10,230,000	42,006,000	94,000,000

¹ Detail will not necessarily add to totals, because some mines produce more than 1 class of material.**TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of material processed, in terms of recoverable metals**

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore.....	7,579	2,920			
Cyanidation:					
Ore.....	45,110	6,298			
Old tailings.....	38	260			
Total.....	45,148	6,558			
Total recoverable in bullion.....	52,727	9,478			
Concentration, and smelting of concentrates:					
Ore.....	30,681	2,125,152	8,286,600	40,512,500	93,991,300
Fluorspar ore.....	72	476	600	30,500	
Old tailings.....	22	9			
Total.....	30,775	2,125,637	8,287,200	40,543,000	93,991,300
Direct-smelting:					
Ore.....	2,772	648,830	1,942,500	1,399,900	8,700
Cleanings.....	5	85		900	
Mill cleanings.....	44	1,070	300	13,500	
Old slag.....	4	2,556		48,700	
Total.....	2,825	652,541	1,942,800	1,463,000	8,700
Placer.....	1,601	236			
Grand total.....	87,928	2,787,892	10,230,000	42,006,000	94,000,000

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters ¹ and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Boulder.....	100			176	81	581	600	30,500	
Clear Creek.....	11,983	151	44	1,417	4,384	43,801	88,000	824,200	9,000
Custer.....	1,006	38	260	10	1	531	2,500	1,100	
Delores.....	2,328			557	13	8,829	800	402,200	318,600
Eagle.....	265,430			63,082	905	333,751	546,800	8,699,500	48,209,400
Gilpin.....	2,801	29	8	56	46	33,619	5,600	3,100	
Gunnison.....	42,639			6,612	53	241,464	594,000	1,705,300	3,470,700
Lake.....	89,337	1,761	1,017	23,417	3,761	356,070	520,400	7,104,500	13,136,700
La Plata.....	453			10	44	50			
Mineral.....	49,260			7,662	1,596	275,281	134,700	4,388,300	3,638,800
Park.....	825	73	6	170	157	2,117	7,400	20,700	117,800
Saguache.....	199			53	1	521	700	22,400	13,500
San Juan.....	17,080			1,776	2,164	52,997	122,300	1,064,300	615,400
San Miguel.....	459,050	5,565	1,845	44,162	17,255	780,263	6,249,100	15,440,300	23,142,000
Summit.....	10,421			2,309	101	28,864	14,500	836,600	1,319,400
Teller.....	116,398	45,110	6,298	30	213	98			
Total: 1957.....	1,069,343	52,727	9,478	151,499	30,775	2,125,637	8,287,200	40,543,000	93,991,300
1956.....	1,120,685	58,618	8,829	133,901	35,143	1,872,599	7,180,200	38,352,600	80,492,000
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore.....	120,305	45,292	6,351	134	448	2,039	400	9,500	
Old tailings.....	1,056	38	260	(²)	22	9			
Dry gold-silver.....	2,033	4	2	153	109	3,237	3,300	17,000	
Dry silver.....	75			3	1	497	200	700	
Copper.....	575			30	5	303	7,600	1,000	
Copper-lead.....	709			27	5	469	4,600	7,800	
Copper-lead-zinc.....	498,819	5,565	1,845	50,543	17,273	1,019,634	6,841,800	17,035,500	26,500,200
Fluorspar.....				174	72	476	600	30,500	
Lead.....	22,376			2,203	5,120	87,781	153,900	1,595,900	92,500
Lead-zinc.....	422,610	1,755	1,014	98,060	7,565	1,008,961	1,267,400	21,827,300	67,274,800
Zinc.....	785	73	6	172	155	2,231	7,400	17,800	123,800
Total 1957.....	1,069,343	52,727	9,478	151,499	30,775	2,125,637	8,287,200	40,543,000	93,991,300
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS¹									
Dry gold.....				83	380	453	100	1,200	
Dry gold-silver.....				49	17	262	100	3,200	
Copper.....				10,583	7,673	204,152	5,364,100	473,600	161,000
Copper-lead.....				15,496	7,211	757,736	1,379,200	14,497,300	
Copper-lead-zinc.....				324	1,042	5,718	25,100	260,900	74,100
Copper-zinc.....				8		73	900	400	7,900
Iron [*]				402	16	558	1,000	4,700	8,400
Lead.....				20,068	12,746	961,276	794,800	23,797,000	24,200
Lead-zinc.....				899	75	17,834	10,500	893,100	223,800
Zinc.....				103,587	1,615	177,575	711,400	611,600	93,491,900
Total: 1957.....				151,499	30,775	2,125,637	8,287,200	40,543,000	93,991,300

See footnotes at end of table.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Boulder.....	28	7	223	700	4 300	
Chaffee.....	330	4	2, 188	1, 700	144, 300	
Clear Creek.....	449	54	5, 814	700	37, 100	
Custer.....	61	8	559		2, 500	
Eagle.....	31, 300	2, 296	598, 099	1, 839, 000	253, 900	
Fremont.....	44		9	1, 500		
Gilpin.....	22	14	1, 053	300	13, 400	
Gunnison.....	62	1	1, 432	900	13, 500	
Hinsdale.....	2		21	100		
Jefferson and Lake ¹	4, 392	153	16, 915	18, 200	283, 100	
La Plata.....	(²)	69	45			
Mesa.....	(²)	30	17		100	
Mineral.....	750	66	3, 968	1, 500	73, 900	
Moffat.....	12		5	100	100	
Montezuma.....	17	59	69			
Montrose.....	1		886	1, 600		
Park.....	975	11	11, 421	1, 500	412, 600	
Pitkin.....	(²)		48		200	
Routt.....	2, 342	12	638	64, 100	61, 000	
Saguache.....	38	1	818	1, 000	4, 200	
San Juan.....	165	16	1, 760	9, 400	60, 500	8, 700
San Miguel.....	22	20	268	100	2, 600	
Summit.....	537	4	6, 285	400	99, 700	
Total: 1957.....	41, 549	2, 825	652, 541	1, 942, 800	1, 463, 000	8, 700
1956.....	35, 334	1, 991	402, 990	1, 275, 800	1, 359, 400	
BY CLASSES OF MATERIAL						
Dry gold: Crude ore.....	37	135	140			
Dry gold-silver:						
Crude ore.....	2, 922	89	5, 494	64, 400	98, 200	
Cleanings.....	11	5	85		900	
Dry silver: Crude ore.....	2, 133	41	10, 582	3, 500	117, 500	
Copper: Crude ore.....	31, 563	2, 308	599, 385	1, 864, 500	256, 000	
Copper-lead-zinc: Crude ore.....	34		421	3, 300	6, 200	7, 500
Lead:						
Crude ore.....	3, 559	199	32, 808	6, 800	922, 000	1, 200
Mill cleanings.....	22	44	1, 070	300	13, 500	
Old slag.....	1, 268	4	2, 556		48, 700	
Total 1957.....	41, 549	2, 825	652, 541	1, 942, 800	1, 463, 000	8, 700

¹ Excludes concentrates treated only by amalgamation and/or cyanidation.

² Less than 1 ton.

³ From copper-lead-zinc and lead-zinc ores.

⁴ Includes concentrate and contained recoverable metal from fluorspar ore.

⁵ Combined to avoid disclosing individual company confidential data.

TABLE 15.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Material shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Dry gold.....	83	380	453	246	1,472	-----
Dry gold-silver.....	49	17	262	109	3,355	-----
Copper.....	10,583	7,673	204,152	5,529,754	789,110	1,193,079
Copper-lead.....	15,496	7,211	757,736	1,622,568	15,101,229	1,113,627
Copper-lead-zinc.....	324	1,042	5,718	32,386	271,749	95,712
Copper-zinc.....	8	-----	73	915	492	8,136
Iron ¹	402	16	558	1,283	4,950	11,128
Lead.....	² 20,068	² 12,746	² 961,276	² 944,227	² 24,789,077	1,466,426
Lead-zinc.....	899	75	17,834	12,722	930,283	267,049
Zinc.....	103,587	2,200	226,625	859,073	887,150	104,081,080
Total: 1957.....	151,499	31,360	2,174,687	9,003,283	42,778,867	108,236,237
1956.....	133,901	35,736	1,922,711	7,858,269	40,220,931	94,208,065
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold: Crude ore.....	37	135	140	83	17	-----
Dry gold-silver:						
Crude ore.....	2,922	89	5,494	65,717	140,650	2,718
Cleanings.....	11	5	85	84	946	73
Dry silver: Crude ore.....	2,133	41	10,582	3,972	123,447	-----
Copper: Crude ore.....	31,563	2,308	599,385	1,902,654	426,712	3,722
Copper-lead-zinc: Crude ore.....	34	-----	421	3,910	6,448	9,534
Lead:						
Crude ore.....	3,559	199	32,308	8,536	960,289	201,186
Mill cleanings.....	22	44	1,070	349	14,130	18
Old slag.....	1,268	4	2,556	-----	50,720	-----
Total: 1957.....	41,549	2,825	652,541	1,985,305	1,723,359	217,251
1956.....	35,334	1,991	402,990	1,323,880	1,547,863	31,450

¹ From copper-lead-zinc and lead-zinc ores.

² Includes concentrate and contained metal from fluorspar ore.

Manganese.—Manganese ore (35 percent or more Mn) was produced in Gunnison and San Miguel Counties in 1957 and shipped to the Government under the "carlot" program administered by the GSA. These were the first shipments from Colorado under this program.

Vitro Corp. of America, Sheer-Korman Associates, Inc., and Great Divide Mining & Milling Corp. joined forces to produce, by a new process, manganese from rhodonite deposits owned by Great Divide and located in the Eureka area of San Juan County near Silverton. The process was invented by Sheer-Korman, and Vitro was awarded a GSA contract to equip and operate a pilot plant at West Orange, N. J., on the rhodonite. The United States Manganese Corp. was formed to produce manganese from these rhodonite deposits by this new process. Vitro and Sheer-Korman own 40 percent of this corporation apiece and Great Divide the remaining 20 percent. Diamond core drilling of the deposits continued throughout the year to determine the extent of the ore. The pilot plant was completed at the close of the year and placed in operation.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals

County and district	Mines producing 1		Lode material sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Adams County.....		5		988	988		139	139				\$84,881	
Boulder County:													
Central (Jamestown)	2		22	72	72	476		476	1,300	80,500		7,708	
Gold Hill 2	2	2	105	16	16	254		254		300		883	
Grand Island	1		1			74		74				67	
Chaffee County: Monarch.....	1		330	4	4	2,188		2,188	1,700	144,300		23,267	
Clear Creek County:													
Alice.....	1		199	80	80	96		96	100	600		3,003	
Argentine.....	2		1,175	94	94	5,945		5,945	7,100	80,500	5,200	22,923	
Empire.....	1		73	19	19	89		89	200	1,400		1,006	
Griffith.....	2		233			1,681		1,681		200		1,560	
Igano Springs.....	10		9,961	4,850	4,350	89,736		89,736	80,700	693,500		308,072	
Montana.....	4		601	18	18	5,305		5,305	400	47,200	3,800	12,743	
Trail Creek or Freeland (Lamar-tine).....	2		170	28	28	587		587	200	87,000		6,990	
Custer County: Hardscrabble.....	5		1,067	47	47	1,350		1,350	2,500	3,600		4,184	
Dolores County: Pioneer.....	1		2,326	13	13	8,829		8,829	600	402,200	318,600	103,100	
Eagle County: Red Cliff (Battle Mountain).....	1		206,760	3,201	3,201	931,850		931,850	2,385,800	8,963,400	48,208,400	8,546,158	
Freemont County: Cotopaxi.....	1		44			9		9	1,500			469	
Glavin County:													
Northern.....	1	2	500	5	5	269		269	5,300	600		2,239	
Southern.....	4	2	2,323	84	88	1,411		1,411	600	15,900		6,811	
Gunnison County:													
Domingo, Roek Creek, and Taylor Park 3	3		77	6	6	1,453		1,453	900	15,600	2,200	4,281	
Elk Mountain.....	2		42,624	48	48	241,443		241,443	594,000	1,703,200	3,468,500	1,044,896	
Tin Chip.....	1		2		2				100			70	
Hinsdale County: Galena.....	1	3		575	575	21		21				49	
Jefferson County: 14	11		93,729	5,675	5,675	374,002		374,002	538,600	7,387,600	13,186,700	20,210	
Lake County: California 1	1		458	113	113	95		95		100		3,279,518	
La Plata County: California.....	1		(9)	30	30	17		17				4,041	
Mesa County.....	1		50,010	1,662	1,662	279,249		279,249	186,200	4,462,200	3,683,800	1,412,086	
Mineral County: Creede.....	4												
Mofat County: Douglas Mountain (Sunbeam).....	1	1	12	59	59	5		5	100	100		49	
Montezuma County: California.....	1		17			69		69				2,127	
Montrose County: La Sal.....	1		1			886		886	1,600			1,284	

See footnotes at end of table.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals—Continued

County and district	Mines producing ¹		Lode material sold or treated (short tons)	Gold (fine ounces)		Silver (fine ounces)		Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Lode	Placer					Total
Park County:											
Alma Placers-Fairplay	2			230	6	2,123	1	7,400	20,700	117,800	\$211
Buckskin Gulch	2		825	11	230	11,421		1,600	412,600		28,823
Horseshoe	2		975								70,176
Tarryall Creek		2		17	17	48	2				597
Pitkin County:	1		(²)				48		200		72
Routt County:											
Hahn's Peak	1		4			11					10
Yarmony	1		2,338	12	12	627		64,100	61,000		29,004
Saguache County:											
Kerber Creek (Bonanza)	3		237	2	2	1,339		1,700	26,600	13,500	7,164
San Juan County:											
Animas	4		14,687	2,144	2,144	50,799		103,100	1,015,000	530,000	338,674
Eureka	4		2,558	36	36	3,958		28,600	109,800	94,100	40,068
San Miguel County:											
Upper San Miguel	4		459,072	22,840	22,840	782,376		6,249,200	15,442,900	23,142,000	8,281,306
Summit County:											
Breckenridge	4		3,284	99	99	9,431		10,500	543,300	765,500	181,692
Montezuma	5		7,674	6	6	25,718		4,400	393,000	553,900	145,261
Teller County:											
Cripple Creek	17		116,396	45,323	45,323	6,396					1,592,094
Total Colorado	115	16	1,110,892	86,327	1,601	37,928	2,787,656	10,230,000	42,006,000	94,000,000	25,590,751

¹ Operations at slag dumps and old mill or miscellaneous cleanups not counted as a producing mine.
² Placer production of Gold Hill district combined with placer production of Jefferson County to avoid disclosing individual company confidential data.

³ Combined to avoid disclosing individual company confidential data.
⁴ Lode production of Jefferson County combined with lode production of Lake County to avoid disclosing individual company confidential data.
⁵ Less than 1 ton.

Molybdenum.—Colorado's entire output of molybdenum in 1957 was produced by Climax Molybdenum Co. from its mine on Fremont Pass 13 miles north of Leadville in Lake County. In November an announcement was made of the approval by the directors of a merger between this company and the American Metals Co., Ltd.—the new firm to be known as American Metal Climax, Inc. The plan was approved by the stockholders with merger to be effective on January 1, 1958. In its annual report for 1957, the company reported that production of molybdenum in 1957 was 13 percent above 1956. The increase was largely attributed to a new record production of ore from the mine in 1957 and to additional mill capacity installed in 1956.

Rare-Earth Metals.—Activity in the rare-earth industry in Colorado remained relatively the same as in 1956. Rare earths sold in 1957 were valued at \$20,000 and consisted principally of yttrium-bearing ores from Jefferson and Gilpin Counties and thorite from Custer and El Paso Counties. The most important producer of yttrium ores was Michigan Chemical Corp., and Trail Mines, Inc., produced approximately half of the thorite sold. The Wah Chang Corp. mill at Sugarloaf (Boulder County) processed thorite and other rare-earth ores and shipped the concentrates to eastern consumers.

Silver.—Ninety-nine percent of the silver output in Colorado in 1957 was recovered as a byproduct of ores of copper, lead, and zinc. Five operations—The New Jersey Zinc Co., Idarado Mining Co., Resurrection Mining Co., Emperius Mining Co., and American Smelting and Refining Co. (Keystone Unit)—supplied 93 percent of the State's total silver production in 1957. Except for the Keystone Unit, each of these operations had an increased output of silver in 1957. Because of this, Colorado's silver production was 22 percent above that in 1956.

Tin.—As a byproduct of the treatment of molybdenum ore, Climax Molybdenum Co. recovered 44.09 short tons of tin concentrate containing 38.86 percent tin during 1957. This, along with the production in 1956, was not marketed and remained as stocks at the close of the year. Because of nonshipment it was not recorded as production in Colorado in 1957 but will be shown in the year when sold.

Tungsten.—The recorded production (shipments) of tungsten concentrate (60-percent WO_3 equivalent) came from 3 mills. The largest producer (Climax Molybdenum Co.) sold a small part of its output, recovered as a byproduct of the treatment of molybdenum ore from the Climax mine near Leadville, to Wah Chang Corp., N. Y. According to the company annual report, concentrate containing 744,000 pounds of tungsten was produced in 1957, compared with 672,000 pounds in 1956. Of this material produced in 1957, concentrate containing 30,000 pounds of tungsten was sold by the end of the year.

Tungsten ore produced during 1956 and in January of 1957 from a number of mines in Boulder County was treated at the Tungsten Refining, Inc., and Wah Chang Corp. mills near Nederland. Concentrate produced from this ore at the Tungsten Refining mill was sold to the Government in February, and concentrate from the Wah Chang mill was shipped in March and April to the company plant in Glen Cove, N. Y. Cold Spring Tungsten, Inc., treated ore from

its mine and other mines in the Nederland area and produced tungsten concentrate but had no sales of concentrate during the year.

TABLE 17.—Shipments of tungsten concentrate (60-percent WO_3), 1948-52 (average), 1953-57, and total, 1900-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average)-----	317	\$886,440	1956-----	873	\$3,010,074
1953-----	817	2,902,490	1957-----	45	54,885
1954-----	927	3,420,563			
1955-----	1,152	4,079,341	1900-57-----	30,027	141,123,263

¹ Partly estimated.

Uranium.—Production of uranium ore in Colorado in 1957 increased 49 percent compared with 1956. The 740,055 tons of ore delivered to mills and stockpiles from 15 counties (principally Montrose, Mesa, and San Miguel), in 1957 contained 3.8 million pounds of uranium oxide (an average grade of 0.26 percent) and represented 20 percent of the total domestic production. This was a decline of 0.04 percent from the 0.30 percent grade of production in 1956. The average value at the mines declined from \$25 per ton in 1956 to \$21 in 1957. Production data and value are based on information supplied by the Atomic Energy Commission (AEC). The Colorado ore reserve of 4.1 million tons averaging 0.29 percent U_3O_8 , as determined by the AEC on December 31, represented 5.3 percent of the total reserve in States west of the Mississippi River. This compares with an estimated reserve as of November 1, 1956, of 4.1 million tons averaging 0.33 percent U_3O_8 . The increase in the reserve during 1957 equaled production but at a reduction of 0.04 percent of contained U_3O_8 . At year end seven mills were operating in the State. Three new mills were completed and began operating during the year. The 1,000-ton-per-day mill of Union Carbide Nuclear Co. at Rifle was completed and replaced the 280-ton mill formerly operated by the company at the same location. The company completed an upgrading plant at Slick Rock and began shipping to the new mill at Rifle. Trace Elements Corp., controlled by Union Carbide Nuclear Co. since 1956, completed a 300-ton-a-day uranium mill at Maybell and began operation in October. The 200-ton-per-day mill of the Gunnison Mining Co. at Gunnison was completed and began operations in December. Ore for the mill will be primarily from the Los Ochos mine near Gunnison. The Cotter Corp. of Santa Fe, N. Mex., began constructing a 90-ton-per-day pilot plant at Canon City. The plant was designed, after extensive experimental work by the Colorado School of Mines Research Foundation, to process ores from the Colorado Front Range and when completed about mid-1958 will provide a limited outlet for ores that now are treated at Salt Lake City, Utah.

Exploration and development drilling for uranium ores increased from 1.1 million feet in 1956 to 1.2 million in 1957. Footage drilling in underground workings declined from 84,000 feet in 1956 to 65,000 in 1957. Other forms of exploration in 1957 included 1,000 linear feet of trenching and 1.4 million cubic yards of material moved by stripping.

TABLE 18.—Mine production of uranium ore, July 1955—December 1957¹

County	July 1—December 31, 1955					1956					1957					
	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ²
Boulder.....	3	189	1,477	6,472	3	545	1,745	5,349	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Clear Creek.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Conjaco.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Cuscuta.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Dolores.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Eagle.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
El Paso.....	3	(³)	(³)	(³)	7	4,202	22,521	98,956	4	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Fremont.....	4	(³)	(³)	(³)	2	29	170	698	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Garfield.....	2	(³)	(³)	(³)	1	(³)	(³)	(³)	2	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Gilpin.....	2	(³)	(³)	(³)	10	(³)	(³)	(³)	6	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Grand.....	2	(³)	(³)	(³)	5	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Huerfano.....	8	1,004	7,321	31,691	3	120	300	725	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Jefferson.....	1	(³)	(³)	(³)	106	36,441	252,519	1,085,618	109	122,028	704,784	2,976,085	9	(³)	(³)	(³)
La Plata.....	1	(³)	(³)	(³)	13	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)
Larimer.....	1	(³)	(³)	(³)	106	36,441	252,519	1,085,618	109	122,028	704,784	2,976,085	9	(³)	(³)	(³)
Las Animas.....	51	(³)	(³)	(³)	13	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)
Mesa.....	5	(³)	(³)	(³)	191	94,497	576,847	2,446,730	191	276,543	1,613,053	6,786,864	245	425,330	2,169,750	9,036,508
Moffat.....	1	(³)	(³)	(³)	3	(³)	(³)	(³)	3	(³)	(³)	(³)	3	(³)	(³)	(³)
Montezuma.....	116	(³)	(³)	(³)	12	(³)	(³)	(³)	12	(³)	(³)	(³)	8	(³)	(³)	(³)
Montrose.....	11	(³)	(³)	(³)	4	(³)	(³)	(³)	4	(³)	(³)	(³)	5	(³)	(³)	(³)
Park.....	11	(³)	(³)	(³)	106	34,840	205,440	864,180	106	84,002	471,322	1,965,554	119	88,514	454,087	1,868,275
Pueblo.....	11	(³)	(³)	(³)	6,521	6,521	25,065	91,718	3	299	4,969	3,170	102,477	102,477	463,816	1,681,013
Rio Blanco.....	1	(³)	(³)	(³)	471	173,986	1,072,476	4,543,994	471	496,517	2,943,025	12,409,624	514	740,055	3,804,611	15,604,611
Saguache.....	5	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)
San Juan.....	1	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)
San Miguel.....	69	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)
Undistributed.....	69	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)	286	(³)	(³)	(³)
Total.....	286	173,986	1,072,476	4,543,994	471	496,517	2,943,025	12,409,624	514	740,055	3,804,611	15,604,611	514	740,055	3,804,611	15,604,611

¹ Based on data supplied to the Bureau of Mines by the A.E.C.

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."

Ten contracts for exploration were executed by DMEA in Jefferson (4), Mesa (2), Montrose (1), Saguache (2), and San Miguel (1) Counties. The total value of the contracts was \$520,105, of which the Federal Government would advance 75 percent (\$390,079). In comparison, 10 contracts were executed in 1956 having a total value of \$700,149.

Vanadium.—Vanadium was recovered as vanadium oxide at five Colorado mills processing uranium ores. All uranium ores did not contain enough vanadium to warrant the expense of recovery. The major portion of uranium ores in Colorado containing significant quantities of vanadium was mined in Montrose, Mesa, and San Miguel Counties. Colorado mills also processed vanadium-bearing ores from other States (principally Arizona and Utah). Recoverable vanadium oxide in Colorado ores in 1957 was 6.2 million pounds compared with 5.6 million pounds in 1956.

Zinc.—Zinc output in Colorado in 1957 increased 18 percent in quantity but decreased 1 percent in value of production, compared with 1956. The decrease in value reflected a drop in the price of zinc metal. A large part of the increased output resulted from larger production by the Eagle mine, the State's leading zinc producer, operated by The New Jersey Zinc Co. Substantially increased output also was reported from Colorado's 2d and 3d ranking zinc producers—Idarado Mining Co. and Resurrection Mining Co. groups of mines. The Emperius mine operated by Emperius Mining Co. and the Keystone Unit mine of the American Smelting and Refining Co. ranked 4th and 5th, respectively, in zinc production in the State. These 5 operations supplied 98 percent of the total zinc production in Colorado in 1957. Suspension of operations at several of the major lead-zinc mines because of the drop in price for lead and zinc during 1957 is mentioned in the lead section.

NONMETALS

Cement.—Shipments of portland and masonry cements in 1957 set a new record, with a 6-percent rise above 1956. Three cement plants in the State operated by Ideal Cement Co. at Portland (wet and dry process) and Boettcher (dry process) continued to operate at optimum capacity throughout 1957, producing types I, II, and III and water-proof-portland and masonry cements. Sixty-three percent of the total quantity of cement shipped was by truck, and railroads carried the remainder. To supply its need for raw materials, Ideal mined limestone, clay, gypsum, sandstone, and sand. Other raw materials were purchased locally or brought in from other States. The cement plants consumed 101.7 million kw.-hr. of electrical energy in 1957, and 9 rotary kilns were in operation during the year. Shipments were reported into Kansas, Nebraska, New Mexico, Texas, Utah, and Wyoming, as well as to local consumers in Colorado.

In March Ideal completed a \$12 million expansion and improvement program at its Boettcher plant, which increased plant capacity 800,000 barrels annually. The old dry-process plant was converted to the Fuller-Humboldt preheater process, with two such units. Also installed were two Allis-Chalmers raw mills, as well as dust collectors and a Fuller quadrant raw-material blending system.

Ideal Cement Co. negotiated a 1-year labor contract with the United Cement, Lime, & Gypsum Workers International during 1957; as a result, it was not involved in strike difficulties which idled 16,000 workers in 75 cement plants—nearly half of all such operations in the United States.

Clays.—The drop in residential and industrial construction utilizing brick during the latter half of 1957 resulted in a 23-percent decline in Colorado clay production. Mining in 1957 was conducted at 35 underground and open-pit mines compared with 40 in 1956. Jefferson, Douglas, Pueblo, and Boulder were the principal clay-producing counties of the 11 that reported output. Fire-clay production was 229,500 tons, miscellaneous clay 173,800 tons, and bentonite 20 tons. The use of clays in manufacturing building brick and other structural clay products was the principal outlet for mine production in 1957.

Mining activities were carried on by 24 companies or individuals that either sold their entire output or used it in manufacturing clay products. Of the 403,000 tons of clays produced in Colorado in 1957, 216,000 tons was sold by producers and 187,000 tons used. The principal fire-clay producers were Stroud A. Whisenhunt, G. W. Parfet Estate, Inc., General Refractories Co., and H. M. Rubey Clay Co. The major producers of miscellaneous clay in the State were Colorado Brick Co., Robinson Brick & Tile Co., Wesley Conda, Lakewood Brick & Tile Co., and Summit Pressed Brick & Tile Co. The average price for fire clay f. o. b. mine as reported by producers was \$2.90 per ton and for miscellaneous clay \$1.80 per ton.

TABLE 19.—Production of clays, 1956-57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Bent.....			20	\$80
Boulder.....	97,751	\$171,065	50,757	88,825
Delta.....	801	1,402	587	1,027
Douglas.....	77,243	206,563	71,000	184,150
El Paso.....	11,892	44,178	6,810	18,689
Fremont.....	6,282	21,358	4,813	16,850
Huerfano.....	9,501	49,880	5,597	30,784
Jefferson.....	236,605	501,091	183,658	383,703
Las Animas.....	7,543	16,972	10,578	24,329
Mesa.....	1,764	2,664	1,696	2,561
Pueblo.....	73,191	200,132	67,840	227,273
Total.....	522,573	1,215,305	403,356	978,271

Feldspar.—The decreased demand for ground feldspar resulting from a decline in industrial activity was reflected in a 6-percent drop in the mine production of crude feldspar. The average price for crude ore f. o. b. Denver (\$6.96 per ton) was unchanged from 1956.

The M & S mine in Chaffee County was the largest single producer. Thirteen mines or prospects in Jefferson County supplied 6,000 long tons of feldspar, whereas 5 mines in Fremont and 1 in Gunnison produced 3,000 and 2,500 tons, respectively. The Salida mill of Western Feldspar Milling Co. ground ore from the M & S mine, whereas the Denver mill of International Minerals & Chemical Co. processed ore purchased from individual Colorado mine operators.

Fluorspar.—Sales of Acid-grade fluorspar remained at the same low level reported in 1956. Ozark-Mahoning Co. and General Chemical Division, Allied Chemical & Dye Corp., again were the only producers of crude and Acid-grade material. Mining operations were in Boulder and Jackson Counties. Of the Acid-grade fluorspar sold in 1957, 63 percent went to the Government stockpile and 37 percent was used in manufacturing hydrofluoric acid.

Gem Stones.—The value of mineral specimens and some gem material collected in Colorado climbed to \$35,000 in 1957. Material consisted mainly of turquoise, agate, onyx, quartz crystal, beryl, garnet, amazonite, jasper, pyromorphite, and rhodonite. Specimens and gem stones were reportedly collected in 20 counties. In terms of value, turquoise from the Villa Grove turquoise lode was the most important stone, followed by agate and amethyst.

Gypsum.—A drop in output of crude gypsum in 1957 resulted from decreased production by United States Gypsum Co. and Ernest W. Munroe. United States Gypsum Co. shipped gypsum to its wallboard plants outside of Colorado, and Munroe supplied gypsum to Ideal Cement Co. for use as a retarder in manufacturing cement.

Lime.—Lime produced in 1957 (from 1 rotary kiln and 1 continuous hydrator) comprised 500 tons of metallurgical quicklime and 2,000 tons of hydrated lime used for metallurgical, sewage, and trade-wastes treatment purposes. Basic Chemical Corp. (plant in Garfield County) was the operating company.

Mica.—The scrap-mica industry of Colorado again in 1957 reduced its production of ground scrap mica to one of the lowest in the history of the State. Adequate supplies of good-quality raw material at a relatively low price were the main problem in 1957, as they have been for several years. Grinding mills were operated at Pueblo by International Minerals & Chemical Corp. and at Arvada by Beryl Ores Co. The former company purchased some Colorado ore, but the bulk of the mill feed was scrap mica mined by the company in Custer and Pennington Counties, S. Dak.

Perlite.—The Great Lakes Carbon Corp. announced in 1957 that it was discontinuing mining its Rosita perlite deposit. The company also stated plans to dismantle its Florence grinding plant and move portions of the facility to its El Grande operation at No Agua, N. Mex. The new mine and plant were expected to be in operation some time after the middle of 1958 at which time the company Colorado operations will cease officially. The reason given for this move was that present conditions made mining and processing at Florence uneconomic. The expanded perlite for the Colorado market was produced by Persolite Products, Inc., and Western Mineral Products Co., both of Denver. Western Mineral Products Co. began installing a perlite-expanding system at its Denver exfoliated-vermiculite plant. The new facility was a completely new plant that will produce expanded perlite previously received for resale in Colorado from a company plant at Omaha, Nebr.

Pumice.—Despite 2 new scoria operations, which were reported in 1957, output for the State was only 25,000 tons or half of the 1956 total. Shipments of scoria by Colorado Aggregates Co., Inc., Costilla County, and McCoy Aggregate Co., Routt County, fell considerably below previous operational rates. This decline was caused by a

cutback in the demand for scoria as a concrete aggregate. The principal market traditionally had been concrete-block and cinder-block manufacturers; however, in the past few years high costs of production and transportation have hampered mine operators' plans for expansion and even retaining present customers. Additionally, the use of bloated-shale lightweight aggregates made serious inroads into the aggregate market to a point where some Colorado block manufacturers will use nothing but aggregate made from shale.

Ideal Lava Products Co. of Dotsero and Roaring Forks Pumice Co. of Carbondale, both in Eagle County, mined scoria during 1957. Ideal produced a processed material, which was used in concrete aggregate, as ballast, as an insulating medium, as roof chips, and for cindered driveways, whereas Roaring Forks Pumice Co. sold its output for use in concrete only.

Pyrites.—A drop in recorded pyrite production in 1957 to 13 percent below 1956 was the direct result of a reduction in the quantity of pyrite produced by Rico Argentine Mining Co. because of a temporary shutdown of the company acid plant. According to the company annual report to stockholders, the sulfuric acid plant produced 42,010 tons, 100-percent basis during the fiscal year ended June 30, 1957. The first 6 months of the fiscal year the plant feed consisted of pyrite concentrate from the upgrading plant constructed in 1956. This feed was excessively fine and caused a severe operating problem. To overcome the difficulty, the plant was modified to utilize newly mined pyrite ore, and this necessitated a shutdown of several months. Climax Molybdenum Co. also recovered pyrite—a byproduct of its molybdenum-recovery operation—and sold the concentrate to General Chemical Division, Allied Chemical & Dye Corp., which operated a sulfuric acid plant at Denver.

Salt.—Salt (in brine) was produced by Union Carbide Nuclear Co. in Montrose County. Output in 1957, almost double the 1956 total, was used solely by the company for processing uranium ores.

Sand and Gravel.—Sand and gravel produced in Colorado during 1957 reached an alltime high of 16.4 million tons, as producers of this commodity generally continued to share in the overall industrial and residential growth of Colorado. Continuation of work on the Federal Interstate Highway System was another factor that affected increased output of sand and gravel. Of the sand and gravel sold or used in 1957, 8.6 million tons was commercial production and 7.8 million tons Government-and-contractor output.

Government-and-contractor production was reported in 49 counties and commercial output in 26. Sand and gravel was reported produced from 52 of Colorado's 63 counties, and Adams County (with a record output of 2.3 million tons) was the leading source, followed by Jefferson, Arapahoe, and El Paso Counties, all of which produced 1 million tons or more. Twenty-nine percent of the total sand and gravel in 1957 was produced and used by private contractors in conjunction with highway contracts with Federal, State, and county agencies. Of the 7.8 million tons of Government-and-contractor production, 71 percent was washed, screened, or otherwise prepared, and of the 8.7 million tons of commercial material 90 percent was processed. The leading commercial producers included Brannan Sand & Gravel Co., Clear Creek Rock Products Co., Colorado Materials Co., Cooley

Gravel Co., Fountain Sand & Gravel Co., and Western Paving Construction Co. Some of the principal contractors engaged in contractual highway construction were Pioneer Construction Co., C. L. Hubner Co., Peter Kiewit Sons' Co., San Ore Construction Co., and Lowdermilk Bros.

TABLE 20.—Production of sand and gravel in 1957, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Adams.....	2,345	\$2,618	Las Animas.....	305	\$229
Arapahoe.....	1,640	1,503	Lincoln.....	194	93
Baca.....	6	12	Logan.....	457	322
Bent.....	7	3	Mesa.....	774	577
Boulder.....	399	352	Mineral.....	2	2
Chaffee.....	100	55	Moffat.....	270	176
Cheyenne.....	219	101	Montezuma.....	356	259
Clear Creek.....	19	12	Montrose.....	294	250
Costilla.....	5	4	Morgan.....	312	233
Crowley.....	13	23	Otero.....	184	96
Custer.....	55	32	Phillips.....	8	4
Delta.....	462	352	Prowers.....	90	63
Denver.....	340	251	Pueblo.....	992	956
Dolores.....	42	42	Rio Blanco.....	4	10
Douglas.....	67	33	Rio Grande.....	266	93
Eagle.....	51	28	Routt.....	(¹)	(¹)
Elbert.....	72	36	Saguache.....	1	1
El Paso.....	1,317	960	San Juan.....	61	70
Fremont.....	28	27	San Miguel.....	58	50
Garfield.....	5	4	Sedgwick.....	60	30
Grand.....	263	349	Teller.....	28	17
Gunnison.....	155	99	Washington.....	303	218
Huerfano.....	153	80	Weld.....	234	177
Jefferson.....	2,037	2,055	Yuma.....	551	342
Kiowa.....	119	81	Undistributed.....	81	50
Kit Carson.....	4	2			
La Plata.....	301	247			
Larimer.....	291	315			
			Total.....	16,400	13,994

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

The December 31, 1957, report of the Federal Bureau of Public Roads showed that Colorado ranked 5th in the Nation in mileage of all construction underway on the interstate system with 105.4 miles. In all mileage completed on the 41,000-mile superhighway network, Colorado ranked 14th, with 39.2 miles. For total work programmed—in all stages of planning and construction since the Federal-Aid effort began on July 1, 1956—Colorado was 12th with 162.4 miles.

Stone.—Stone production continued to advance and in 1957 reached 2.4 million tons—8 percent more than in 1956. The principal gain was in the quantity of crushed limestone and sandstone, which composed 97 percent of the total stone output. Small gains were noted for dimension marble and granite and crushed limestone and sandstone. Decreases were reported in shipments of dimension sandstone and crushed granite, marble, and miscellaneous stone. Basalt was quarried in 1957 but was not reported in 1956.

The major portion of the total stone tonnage production in 1957 was used in the manufacture of cement. Additional important uses were as a flux, as concrete aggregate, as a refractory, as riprap, and in sugar refining. Sandstone was again the principal dimension stone produced. Flagging and rough and dressed building stone were the important uses. The leading limestone producers were Ideal Cement

TABLE 21.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton ¹		Total (thousands)	Average per ton ¹
COMMERCIAL OPERATIONS						
Sand:						
Molding.....	(²)	(²)	\$0.80	16	\$17	\$1.05
Building.....	1,452	\$1,261	.87	2,751	2,756	1.00
Paving.....	170	159	.93	407	308	.76
Blast.....	(²)	(²)	(²)	(²)	(²)	(²)
Engine.....	(²)	(²)	(²)	(²)	(²)	(²)
Filter.....	1	1	1.50	18	18	.99
Railroad ballast.....				(²)	(²)	(²)
Other.....	72	92	1.46	78	101	1.30
Total sand.....	1,695	1,513	.89	3,270	3,200	.98
Gravel:						
Building.....	1,752	1,956	1.12	2,072	2,740	1.32
Paving.....	1,872	1,894	1.01	3,055	2,721	.89
Other.....	40	41	1.02	163	161	.99
Total gravel.....	3,664	3,891	1.06	5,290	5,622	1.06
Total sand and gravel.....	5,359	5,404	1.01	8,560	8,822	1.03
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	288	173	.60	117	88	.75
Paving.....	72	48	.66	173	205	1.19
Total sand.....	360	221	.61	290	293	1.01
Gravel:						
Building.....	5	7	1.40	293	196	.67
Paving.....	9,428	5,450	.58	7,257	4,683	.65
Total gravel.....	9,433	5,457	.58	7,550	4,879	.65
Total sand and gravel.....	9,793	5,678	.58	7,840	5,172	.66
ALL OPERATIONS						
Sand.....	2,055	1,734	.84	3,560	3,493	.98
Gravel.....	13,097	9,348	.71	12,840	10,501	.82
Grand total.....	15,152	11,082	.73	16,400	13,994	.85

¹ Calculated before rounding.

² Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 22.—Production of stone in 1957, by counties

County	Short tons	Value	County	Short tons	Value
Adams.....	167,900	\$125,100	Jefferson.....	2,900	\$58,000
Boulder.....	44,653	371,593	Lake.....	500	3,500
Chaffee.....	378,176	687,700	La Plata.....	7,900	39,500
Douglas.....	(¹)	(¹)	Larimer.....	419,699	629,330
Eagle.....	(¹)	(¹)	Las Animas.....	8,500	25,500
El Paso.....	213,000	402,600	Mesa.....	1,000	1,000
Fremont.....	1,167,968	1,764,892	Teller.....	755	11,325
Garfield.....	21,600	34,600	Other counties.....	1,803	9,372
Gunnison.....	2,111	4,290	Total.....	2,438,465	4,168,302

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

TABLE 23.—Stone sold or used by producers, 1953–57, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	2, 117	\$34, 157	458	\$8, 800	378	\$15, 284	678, 926	\$1, 234, 607
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, 290, 500	3, 238, 900

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	181, 318	\$448, 488	20, 907	\$9, 390	² 884, 104	² \$1, 750, 726
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

¹ Figure withheld to avoid disclosing individual company confidential data; included with "Other."
² Excludes limestone for cement and lime.

TABLE 24.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble..... short tons.....	104, 917	\$1, 606, 957	23, 314	\$242, 895
Dressed construction..... cubic feet.....	-----	-----	5, 953	22, 600
Approximate equivalent in short tons.....	-----	-----	500	-----
Rough architectural..... cubic feet.....	65, 773	111, 263	51, 634	100, 192
Approximate equivalent in short tons.....	5, 153	-----	4, 079	-----
Dressed architectural..... cubic feet.....	80, 987	124, 864	75, 008	104, 103
Approximate equivalent in short tons.....	6, 317	-----	5, 856	-----
Rough monumental..... cubic feet.....	11, 647	29, 920	11, 561	29, 395
Approximate equivalent in short tons.....	978	-----	1, 092	-----
Dressed monumental..... cubic feet.....	1, 200	23, 000	900	20, 000
Approximate equivalent in short tons.....	101	-----	76	-----
Curbing..... cubic feet.....	438	1, 315	265	812
Approximate equivalent in short tons.....	34	-----	21	-----
Flagging..... cubic feet.....	75, 648	75, 378	150, 213	43, 285
Approximate equivalent in short tons.....	5, 943	-----	11, 717	-----
Total dimension stone (quantities approximate in short tons).....	123, 443	1, 972, 697	46, 655	563, 282
Crushed and broken stone:				
Riprap..... short tons.....	54, 047	151, 500	54, 200	67, 400
Metallurgical..... do.....	514, 487	927, 701	534, 800	1, 025, 200
Concrete and roadstone..... do.....	89, 856	181, 803	344, 600	425, 000
Chemical..... do.....	(¹)	(¹)	(¹)	(¹)
Miscellaneous..... do.....	² 1, 468, 335	² 1, 982, 940	³ 1, 458, 210	³ 2, 087, 420
Total crushed and broken stone..... do.....	2, 126, 725	3, 243, 944	2, 391, 810	3, 605, 020
Grand total (quantities approximate in short tons).....	2, 250, 168	5, 216, 641	2, 438, 465	4, 168, 302

¹ Figure withheld to avoid disclosing individual company confidential data; included with "Miscellaneous."

² Includes sugar factories, terrazzo, dust for coal mines, asphalt filler, foundry supply, cement, lime, marble dust, and miscellaneous uses.

³ Includes sugar factories, terrazzo, filter beds, cement, lime, marble chips, and special-use aggregate.

Co., Colorado Fuel & Iron Corp., Castle Concrete Co., and Colorado Materials Co.

Vermiculite.—Exfoliated vermiculite was produced at Denver by Western Mineral Products Co. from ore produced in Montana. The finished product was used as loose-fill insulation, lightweight plaster, and concrete aggregate.

REVIEW BY COUNTIES

Adams.—Petroleum produced from 16 fields declined 6 percent in 1957 compared with 1956. One new field (Doherty) was discovered in the "J" sandstone member of the Dakota formation. Initial flow was 28 barrels of oil a day from a depth of 8,400 feet. Fourteen other exploratory wells were failures. Five successful development wells were completed.

The output of sand and gravel in 1957 was 2.3 million tons—compared with 2.4 million tons in 1956, but the county continued to rank first in the State as the principal source of this material. Production operations were reported by 14 operators—7 classed as commercial and 7 as Government-and-contractor producers. Brannan Sand & Gravel Co. led in production, followed by Western Paving Construction Co. and Cooley Gravel Co. These firms produced 88 percent of the 1.7 million tons of commercial output. Quarrying operations of the State and county highway departments and the production of sand and gravel by contractors for Federal, State, and county agencies supplied 680,500 tons of paving gravel.

All of the gold and silver output in Adams County in 1957 was recovered as a byproduct at sand and gravel washing and screening plants. Kerkling & Slensker recovered gold and silver from sluiceboxes at the stationary plants of Brannan Sand & Gravel Co. gravel pits 8 and 10, F. S. Rizzuto gravel pit, and Inland Sand & Gravel Co. gravel pit. Cooley Gravel Co. recovered gold and silver in sluiceboxes on its floating washing and screening plant (fed by dragline) at the North Plant pit.

Arapahoe.—Sand and gravel continued as the only mineral-industry activity of the county in 1957. Quarrying operations of 7 commercial and 3 Government-and-contractor producers resulted in the production of 1.6 million tons of sand and gravel valued at \$1.5 million. Of the commercial operators, Colorado Materials Co., Cooley Gravel Co., and Hall Sand & Gravel, Inc., were the principal producers. In the Government-and-contractor category, Schmidt Construction, Inc., Peter Kiewit Sons' Co., and county construction crews were responsible for all output.

Archuleta.—Petroleum and natural gas produced at 2 fields declined 9 percent compared with 1956. Two development wells in the Chroma field were successful. One wildcat well was a failure.

Baca.—Natural gas produced from the Greenwood field increased 28 percent compared with 1956. One successful development well was completed. Eight wildcat wells and 2 development wells were failures.

Bent.—Construction crews of the State highway department were the only sand and gravel-pit operators in 1957; accordingly, only 6,600 tons of paving gravel for maintenance work was produced.

TABLE 25.—Value of mineral production in Colorado, 1956-57, by counties

County	1956 ¹	1957 ²	Minerals produced in 1957 in order of value
Adams.....	\$4,865,652	\$5,798,631	Petroleum, sand and gravel, stone, gold, silver.
Alamosa.....	89,000		
Arapahoe.....	1,468,750	1,503,300	Sand and gravel.
Archuleta.....	422,500	414,909	Petroleum.
Baca ³	27,000	12,500	Sand and gravel.
Bent.....	101,700	20,678	Petroleum, sand and gravel, clays.
Boulder.....	4,355,760	2,103,932	Fluorspar, stone, sand and gravel, clays, tungsten concentrate, peat, petroleum, gold, lead, gem stones, feldspar, silver, copper.
Chaffee.....	977,425	970,629	Stone, feldspar, sand and gravel, lead, silver, gem stones, copper, gold, beryllium concentrate.
Cheyenne.....	67,000	101,000	Sand and gravel.
Clear Creek.....	⁴ 481,836	370,797	Gold, lead, silver, copper, sand and gravel, feldspar, zinc, uranium ore, gem stones, mica (scrap), beryllium concentrate, columbium-tantalum concentrate.
Conejos.....	121,000		
Costilla.....	85,791	27,470	Pumice, sand and gravel.
Crowley.....		22,900	Sand and gravel.
Custer.....	778,043	533,248	Perlite, sand and gravel, rare-earth metals concentrate, gold, silver, copper, lead.
Delta.....	617,211	688,585	Sand and gravel, coal, clays.
Denver.....	382,500	250,800	Sand and gravel.
Dolores ⁵	⁴ 1,580,607	509,539	Pyrite, lead, sand and gravel, zinc, uranium ore, silver, gold, gem stones, copper.
Douglas.....	384,078	223,059	Clays, sand and gravel, stone, gem stones.
Eagle.....	⁴ 7,752,034	8,583,711	Zinc, lead, silver, copper, gold, sand and gravel, pumice, stone.
Elbert.....	85,020	36,215	Sand and gravel, gem stones.
El Paso.....	1,172,090	1,533,484	Sand and gravel, stone, coal, clays, gem stones, uranium ore, rare-earth metals concentrate.
Fremont.....	⁶ 12,972,603	13,629,466	Cement, stone, coal, gypsum, petroleum, uranium ore, sand and gravel, clays, feldspar, beryllium concentrate, mica (scrap), copper, gem stones, silver, columbium-tantalum concentrate.
Garfield ⁷	174,220	295,643	Coal, lime, stone, sand and gravel, uranium ore, gem stones.
Gilpin.....	52,378	19,782	Rare-earth metals concentrate, peat, gold, lead, copper, silver.
Grand.....	82,000	350,887	Sand and gravel, uranium ore, gem stones.
Gunnison.....	3,818,583	2,906,473	Coal, zinc, lead, silver, copper, sand and gravel, feldspar, manganese ore and concentrate, stone, gold.
Hinsdale.....	16,795	49	Copper, silver.
Huerfano.....	⁴ 573,821	558,074	Coal, sand and gravel, clays.
Jackson.....	3,688,470	(⁸)	Petroleum, fluorspar, coal.
Jefferson.....	2,274,039	3,588,560	Sand and gravel, uranium ore, clays, stone, feldspar, gold, rare-earth metals concentrate, copper, petroleum, mica (scrap), beryllium concentrate, silver.
Kiowa.....	17,000	100,816	Sand and gravel, petroleum.
Kit Carson.....	72,000	2,200	Sand and gravel.
Lake.....	⁶ 46,010,817	50,344,051	Molybdenum, zinc, lead, silver, gold, copper, pyrite, tungsten concentrate, stone.
La Plata ⁷	348,124	486,557	Sand and gravel, coal, stone, petroleum, gold, silver.
Larimer ²	5,582,767	5,589,923	Cement, petroleum, stone, sand and gravel, gypsum, feldspar, beryllium concentrate, mica, columbium-tantalum concentrate.
Las Animas ⁵	8,950,802	11,059,872	Coal, uranium ore, sand and gravel, stone, clays, carbon dioxide.
Lincoln.....	368,000	93,400	Sand and gravel.
Logan ⁹	22,378,500	19,963,489	Petroleum, sand and gravel, gem stones.
Mesa ⁷	3,048,301	4,090,736	Uranium ore, sand and gravel, coal, clays, gold, stone, silver, lead.
Mineral.....	805,501	1,417,646	Lead, zinc, silver, gold, copper, gem stones, sand and gravel.
Moffat ⁹	4,498,830	4,937,255	Petroleum, coal, sand and gravel, copper, lead, silver.
Montezuma.....	⁴ 51,888	286,133	Sand and gravel, petroleum, carbon dioxide, coal, gold, silver.
Montrose ⁵	6,871,144	9,327,512	Uranium ore, sand and gravel, salt, coal, silver, copper.
Morgan ⁹	20,651,300	20,841,269	Petroleum, sand and gravel.
Otero.....		95,650	Sand and gravel, gem stones.
Ouray.....	577,119	355	Gem stones.
Park.....	109,282	190,985	Beryllium concentrate, lead, zinc, silver, gold, feldspar, copper, mica (scrap), gem stones.

See footnotes at end of table.

TABLE 25.—Value of mineral production in Colorado, 1956-57, by counties—Con.

County	1956 ¹	1957 ²	Minerals produced in 1957 in order of value
Phillips.....	\$8, 000	\$3, 700	Sand and gravel.
Pitkin.....	1, 141, 846	(³)	Coal, silver, lead.
Prowers.....	87, 000	62, 900	Sand and gravel.
Pueblo.....	1, 004, 732	1, 183, 273	Sand and gravel, clays.
Rio Blanco ¹⁰	85, 280, 520	85, 969, 835	Petroleum, uranium ore, coal, sand and gravel.
Rio Grande.....	235, 150	93, 600	Sand and gravel, gem stones.
Routt.....	\$ 2, 461, 122	2, 280, 252	Coal, petroleum, sand and gravel, pumice, copper, lead, silver, gold.
Saguache ⁵	148, 054	75, 984	Uranium ore, gem stones, lead, zinc, silver, copper, sand and gravel, gold.
San Juan ⁵	⁴ 597, 763	469, 242	Lead, gold, zinc, sand and gravel, silver, copper.
San Miguel ⁵	10, 857, 580	10, 219, 988	Zinc, lead, copper, uranium ore, gold, silver, sand and gravel, iron ore, manganese ore and concentrate, gem stones.
Sedgwick.....	29, 060	30, 200	Sand and gravel, gem stones.
Summit.....	¹¹ 583, 871	326, 913	Zinc, lead, silver, copper, gold.
Teller.....	1, 904, 372	1, 630, 020	Gold, sand and gravel, stone, feldspar, silver, peat, gem stones.
Washington ³	20, 197, 000	21, 395, 738	Petroleum, sand and gravel.
Weld ⁹	8, 321, 641	10, 171, 415	Petroleum, coal, sand and gravel, rare-earth metals concentrate.
Yuma.....	164, 500	341, 600	Sand and gravel.
Undistributed ¹²	20, 857, 525	34, 271, 370	
Total ¹³	321, 914, 000	340, 638, 000	

¹ Revised to include value of carbon dioxide and uranium production except as indicated by footnote 4.

² Carbon dioxide (natural), natural gas, and petroleum values are preliminary.

³ Excludes natural gas.

⁴ Uranium value withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Excludes vanadium.

⁶ Revised figure.

⁷ Excludes natural gas and vanadium.

⁸ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁹ Excludes natural gas and natural-gas liquids.

¹⁰ Excludes natural gas, natural-gas liquids, and vanadium.

¹¹ Excludes manganese ore sold and blended at Government low-grade stockpiles for future beneficiation.

¹² Includes all natural gas, vanadium, and natural-gas liquids and some uranium (1956), sand and gravel, gem stones, stone (1956), and values indicated by footnote 8.

¹³ The total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

Clay Productions, Inc., reported selling 20 tons of bentonite for use in drilling mud.

Petroleum and natural gas were produced at the Bent's Fort field. One new gasfield was discovered at a depth of 4,766 feet in the McClave formation; initial production was 560,000 cubic feet of gas a day; the well was shut in. Seven wildcat wells and 1 development well were failures. Carbondioxide gas produced in Las Animas County was processed at a plant at Nina View.

Boulder.—Although Boulder County mine operators produced a variety of metals, nonmetals, and fuels, the nonmetals represented 98 percent of the total value of all minerals. In terms of value, sales of Acid-grade fluorspar headed the list of nonmetals. General Chemical Division, Allied Chemical & Dye Corp., operated the Burlington mine and Jamestown mill throughout 1957; all output was used in manufacturing hydrofluoric acid. Ozark-Mahoning Co. operated its Jamestown mines and mill, and the Acid-grade concentrate was shipped to the Government stockpile and hydrofluoric acid producers.

Sand and gravel output totaled 398,600 tons, of which 363,800 tons was produced by Boulder Gravel Products, Inc., Golden Transfer Co., and C & M Sand & Gravel Co. Government-and-contractor output resulted from the activities of L. J. Hesser, contractor for the

Colorado Department of Highways. The value of stone produced in the county dropped to a more normal level as a result of a cutback in quarrying operations of the University of Colorado. Output in the county in 1957 was 44,700 tons of dimension and crushed sandstone valued at \$372,000. This compares with 94,000 tons valued at \$1.7 million in 1956, when the University of Colorado was in the midst of its building program.

Clay production centered around the activities of the Colorado Brick Co., which produced miscellaneous clay from its Valmont pit and brick and other structural-clay products from its Valmont brickworks.

The SNN Mining Co. continued to operate the Little Bonnie pegmatite and produced 127 long tons of crude feldspar.

Mineral specimens collected during the year consisted mainly of agate and petrified wood and amounted to approximately 1,000 pounds valued at \$1,500.

Five lode and two placer mines supplied the gold, silver, copper, and lead output in the county in 1957. The aggregate \$11,000 value of these four metals was less than one-half of the comparable \$25,000 total in 1956. Ozark-Mahoning Co., which has been the county's major producer of these metals from lead concentrate produced as a byproduct of the treatment of fluorspar ore at its Jamestown operation, did not produce lead concentrate in 1957. The General Chemical Division of Allied Chemical & Dye Corp., the producer of the bulk of these metals in the county, recovered a lead concentrate containing gold, silver, copper, and lead as a byproduct of the treatment of fluorspar ore from the Burlington mine. E. J. McLellan recovered placer gold and silver from the operation of the McLellan Placer mine near Gold Hill from May 1 to November 1, and Boulder Gravel Products, Inc., recovered gold and silver as a byproduct of the production of sand and gravel during the washing and screening process at its George Sawhill Ranch pit.

The tungsten-ore mining and milling industry of Boulder County, which has been important in the past, was virtually nonexistent in 1957. A small production (shipments) of tungsten concentrate (60-percent WO_3 equivalent), recovered from ore mined from several properties during 1956 and in January 1957 at the Tungsten Refining, Inc., and Wah Chang Corp. mills, was sold in 1957. Cold Spring Tungsten, Inc., produced some tungsten concentrate during 1957 that was not sold and remained in storage at the close of the year. George Cowdery (Tungsten Mining Co.) operated the Tungsten mine during part of the year but did not market the product. Two other operators maintained development programs throughout 1957; George Jump kept a three-man crew at the Good Friday mine for Shiprock Industries, and Elliot Ralston (Eureka Tungsten Co.) continued development work at the Eureka mine.

There were no reported shipments of uranium ore from mines in the county during 1957.

Petroleum was produced at the Boulder and Highland fields and output increased slightly compared with 1956. One wildcat well drilled was a failure. Peat humus for use in fertilizers and as a soil conditioner was produced from deposits in the county.

Chaffee.—With 98 percent of the total value of mineral production

to its credit the nonmetals group of minerals dominated the mineral industry of Chaffee County in 1957. M & S, Inc., produced nearly all the feldspar mined, except for a small quantity produced by Glenn Lamberg & Sons. M & S ore was shipped to the Western Feldspar Milling Co. mill at Salida, and Lamberg ore was stockpiled.

Limestone was the predominant type of stone quarried in 1957, and all came from the Monarch quarry of Colorado Fuel & Iron Corp. The entire output was used as a flux at the company Pueblo steel plant. Glenn Lamberg mined 600 tons of crushed basalt and Colorado Granite Co., in operating its Crystal quarry, produced 76 tons of dressed monumental stone. Sand and gravel output consisted of 96,300 tons produced by crews of the State and county highway departments and a small quantity quarried by Colorado Constructors, Inc. Epidote, onyx, and beryl crystals comprised the gem or ornamental stones collected in 1957.

The entire output of gold, silver, copper, and lead from Chaffee County in 1957 (valued at \$23,000) came from the Lilly mine operated by Minerals Production Co. from March 1 (when it acquired the property) to the end of the year. Most of the ore mined came from exploration and development work. A small quantity of beryl was produced and sold by Albert B. Cox from the Golden Eagle Lode.

Clear Creek.—Mining activity continued at about the same level in the county in 1957 although the overall value of minerals produced was lower than in 1956. The \$356,000 value of the gold, silver, copper, lead, and zinc output was 96 percent of the total value of mineral production in the county in 1957. These 5 metals were produced from 22 lode mines; no placer mines were active. Most of these mines were operated for only part of the year and the minor production resulted from exploration and development. More than 500 tons of ore was produced from only 4 mines, Bald Eagle, Grizzly Gulch, Freighter's Friend group, and Dixie, in Clear Creek County.

Bald Eagle mine, operated by the Bald Eagle Mining Co., was the largest producer of these metals (with the exception of zinc) in the county. The ore was milled at the Front Range mill and the property operated throughout most of the year. Ore from the Grizzly Gulch mine, operated by British Western American Uranium Corp., was trucked to the Commonwealth mill for treatment. G. B. L. Co., operator of the Freighter's Friend group of mines in 1957, installed a new surface plant, rehabilitated the shaft, and was drifting on ore by the close of the year. Ore from this development was milled at the Silver Spruce mill. The Dixie mine and mill were operated by LeRoy Giles & Co. during the first half of the year. Vicon, Inc., then acquired the property and conducted considerable development consisting of sinking the shaft an additional 100 feet and drifting on the vein. In connection with this work, the company produced some ore that was milled and yielded small quantities of gold, silver, and lead.

A small tonnage of uranium ore produced at the Anon mine by R. Stauss was shipped to Salt Lake City, Utah, for processing.

Pegmatites and sand and gravel deposits were the only source of nonmetals in Clear Creek County during 1957. Construction crews of the State highway department and Herren-Strong, contractors, produced a combined total of 18,700 tons of sand and gravel valued at \$12,200. Joe Grover produced 200 pounds of beryl, 10 pounds

of columbie-tantalite, 83 tons of potash feldspar, and 2 tons of scrap mica from Grover Dike in 1957 and sold it to Beryl Ores Co., Arvada, and International Minerals & Chemical Corp., Denver, during 1957. In addition, he produced 250 pounds of beryl crystals, which were sold to a gem-stone dealer. Charles Winn mined 145 tons of soda feldspar from the Beaver Park mine and shipped it to Denver for grinding.

Costilla.—Limited highway construction, and the general decline in the use of scoria as a lightweight aggregate resulted in a severe decline in the total value of mineral production in Costilla County in 1957. Colorado Aggregate Co., Inc., was responsible for the output of scoria and construction and maintenance crews of the State highway department, the sand and gravel produced.

Custer.—Custer County lost its most important producing mine with the announcement by Great Lakes Carbon Corp. that it was closing the Rosita perlite mine. The company also stated that the Florence grinding plant was to be dismantled and any usable equipment transferred to the new mill at No Agua, N. Mex. Although some perlite was mined in 1957, production was considerably below previous output. Highway construction was an important source of income to the mineral industry, as K. S. Mittry Construction Co. and Siegrist Construction Co., contractors for the Colorado Department of Highways, mined 55,000 tons of paving gravel valued at \$32,500.

Production of rare earths in Custer County in 1957 was limited to thorite mined by Cotter Corp. and Trail Mines, Inc. Cotter Corp. produced 93 tons of thorite, which was shipped to the Wah Chang Corp. mill at Sugarloaf (Boulder County) for processing. Trail Mines, Inc., operated the Hardwich property in the Hardscrabble district. Some ore was shipped to Davison Chemical Co. via Wah Chang Corp., and the remainder was stockpiled at Florence. The material shipped averaged 4.08 percent ThO_2 . Cotter Corp. received a DMEA loan to explore its Star claims for thorite. Under the contract (totaling \$18,876) the Government will furnish 75 percent of the funds and the company the remainder.

Gold, silver, copper, and lead output in Custer County had a combined value of \$4,000 in 1957, compared with \$7,000 in 1956. Reynolds Mineral Corp.—the major producer of gold—treated tailing from the Bassick mill. The remaining output of these metals came from 4 mines; each produced less than 100 tons of ore mostly from assessment or exploration and development.

Delta.—Highway construction in Delta County continued at peak levels and output of sand and gravel reached 462,500 tons in 1957 valued at \$351,500. Construction crews of the county and State highway departments, Pioneer Construction Co., and San Ore Construction Co. produced 452,500 tons and the Delta Sand & Gravel Co. the remainder. The Delta Brick & Tile Co. operated its open-pit clay mine and produced 600 tons of miscellaneous clay for use in manufacturing building brick and other structural-clay products.

Coal produced at seven underground mines increased slightly compared with 1956. The principal producer was the Juanita Coal & Coke Co. operating the King mine.

Denver.—Denver continued as the focal point for the manufacture

of brick and other structural-clay products in Colorado, and plants were operated by Denver Brick & Pipe Co., Denver Fire Clay Co., Overland Pressed Brick Co., Denver Terra Cotta Co., Western Tile Manufacturing Co., and the Robinson Brick & Tile Co. The Denver Brick & Pipe Co. and the Denver Fire Clay Co. also manufactured refractory-grade products. All companies either purchased raw clay from local mine operators or mined their own. The exception was certain special clays obtained from out-of-State sources.

Consolidated Feldspar Department, International Minerals & Chemical Corp., operated its Denver feldspar-grinding plant on crude material from mines in adjacent counties and from Wyoming. Western Mineral Products Co. continued to produce exfoliated vermiculite at its Denver plant, using crude vermiculite from Montana. During 1957 the company added an expanded-perlite plant to its Denver facilities. The General Chemical Division, Allied Chemical & Dye Corp., operated its sulfuric-acid plant, using pyrite concentrate obtained from Lake County.

The five petroleum refineries in the Denver metropolitan area operated the entire year. The total capacity of the plants was 34,600 barrels daily and total throughput in 1957 was 10.2 million barrels, a 3-percent increase over 1956. A \$1.4 million program of modernization was completed at the Continental Oil Co. Denver plant. The refinery now has a rated capacity of 12,300 barrels a day. Bay Petroleum Corp. announced that plans had been completed and a contract awarded for installing a 3,500-barrel-a-day catalytic reforming unit at its 10,000-barrel-a-day refinery. Construction was begun near the end of the year and was expected to be completed in 1958. The Denver Research Institute completed construction and operated its prototype oil-shale-processing unit (based on the Swedish Aspeco process) in southwestern metropolitan Denver for several months. The research was undertaken for the Oil Shale Corp. of Beverly Hills, Calif.

Dolores.—The value of mineral production in Dolores County in 1957 was \$510,000, only one-third of the comparable 1956 total of \$1.6 million. Most of this drop resulted from discontinuance of the mining of lead-zinc ore in June at the Rico Argentine Mining Co. Rico-Argentine mine. According to the company, this step was necessary because of the fall in lead and zinc prices during 1957. This mine, which ranked 3d, 5th, and 6th in output of lead, zinc, and silver, respectively, in Colorado in 1956, could not be considered among the State's major metal producers in 1957.

The normal plan of development at the Rico-Argentine mine was altered near the end of 1956, when it became evident that mine-run pyrite would have to be available for acid-plant feed either to supplement or even supplant the pyrite then being produced from old tailing. The pyrite concentrate from the tailing was excessively fine, causing severe operating problems in the acid plant. Mining of pyrite for use in the acid plant was begun in January 1957. In June the mining and development of lead-zinc ore were suspended, and all underground efforts were directed toward producing pyrite. The plant used for re-treating tailing to recover pyrite was closed, and production of acid was curtailed for several months while a crushing plant was installed and changes made in the roaster at the acid plant

to handle the mine-run pyrite. In addition to pyrite used in the acid plant, fluxing-grade pyrite was produced and shipped direct to users.

Uranium ore produced at the Ace in the Hole mine in the Slick Rock district was shipped to processing mills in southwestern Colorado.

Crews of the county highway department were active in 1957 and produced 41,600 tons of paving gravel for road use. Five-hundred-and-fifty pounds of pyrite crystals for specimens was collected in the Rico area.

Douglas.—Nonmetals composed the entire output of mineral commodities in Douglas County in 1957. In terms of value, clay was the most important. Fire clay from the Helmer Bros. mine, Stevens mine (S. A. Whisenhunt), and Hogback mine (Robinson Brick & Tile Co.) amounted to 68,000 tons. A small tonnage of miscellaneous clay was removed from the Diamond and Ute mines of Robinson Brick & Tile Co. Gardner Construction Co., as contractor for the State highway department, and crews of the State and county highway departments produced 66,600 tons of paving gravel for use in constructing and maintaining highways. John T. Fox quarried a small quantity of crushed limestone and sold it for use as flux. No crude feldspar was produced in 1957.

Eagle.—The value of mineral production in Eagle County in 1957 increased 11 percent above 1956. Metals (gold, silver, copper, lead, and zinc) supplied most of the \$8.6 million value of all mineral production, whereas nonmetals (stone, pumice, and sand and gravel) accounted for only \$38,000.

The Eagle mine, operated throughout the year by The New Jersey Zinc Co., was the largest producer of zinc and silver and the second largest of copper and lead in Colorado in 1957. The output of each of these metals in 1957 was substantially higher than in 1956. Copper ore was produced and shipped directly to the smelter. Lead-zinc ore was milled in the company 1,200-ton-per-day underground mill, and the lead and zinc concentrates produced were shipped to smelters.

Sand and gravel was the most important nonmetal in terms of value, and all output was quarried by crews of the county and State highway departments. Sale of volcanic scoria was reported by Ideal Lava Products Co. from a mine near Dotsero and Roaring Forks Pumice Co. from a deposit near Carbondale. Both crude and prepared sales were reported for such end uses as concrete aggregate, ballast, insulating medium, etc. Colo-Tex Stone Co. produced a small quantity of dressed building sandstone from the Peachblow quarry.

El Paso.—Sand and gravel continued to be the principal mineral-industry activity of El Paso County in 1957, composing two-thirds of the total value of all minerals produced. Output was divided between 8 commercial operations and 8 Government-and-contractor producers. The noncommercial operators—contractors for the State highway department and Air Force Academy Construction Agency and road crews of the county and city of Colorado Springs—produced 792,600 tons. Daniels Sand Division of Transit Mix Concrete Co., Carroll S. Jones, and Broderick & Gibbons, Inc., supplied the bulk of the 524,800 tons produced at commercial operations.

Broken and crushed granite and limestone used largely for riprap and concrete aggregate totaled 212,500 tons in 1957. In addition,

Carroll S. Jones quarried and dressed 500 tons of building stone for the Air Force Academy near Colorado Springs. Clay output in 1957 came from the Apache No. 7 mine of Robinson Brick & Tile Co., Husted quarry of Standard Fire Brick Co., and a pit operated by National Clay Products Co. Both fire and miscellaneous clays were produced and used by mining companies in producing brick and other clay products. Mineral specimens and ornamental stones of commercial value consisted of agate, uranium, thorium, and rare earths.

Trail Mines, Inc., of Colorado Springs operated the Twenty-One claim in the St. Peters Dome mining district and sold thorite averaging 5 percent ThO_2 .

Coal production from the Franceville strip mine and the Pikeview underground mine declined slightly compared with 1956. The Pikeview mine, operated by the Pikes Peak Fuel Division, Golden Cycle Corp., was permanently shut down in June.

Fremont.—Production and shipments of portland and masonry cements continued to be the most important single activity of the mineral industry of Fremont County in 1957. Sales (shipments)—all from the Portland plant of Ideal Cement Co.—were 6 percent greater than in 1956. Nineteen men were employed at the quarry and 163 at the crusher and cement plant. Two 400-foot and five 120- to 125-foot rotary kilns were operated.

The total value of stone produced in 1957 reached \$1.8 million—a 9-percent increase over 1956. Operation of Portland limestone quarry by Ideal Cement Co. supplied the bulk of the stone output, of which limestone was 95 percent. Dimension marble was produced by Cowan Bros., operating their Travertine and Royal Breche quarries, and crushed miscellaneous stone by the county highway department. Crushed sandstone was used as a refractory by a number of companies; Ray B. Sturbaum, Ralph J. Pierce, and Laclede-Christy Co. were the principal producers.

Operation of the Pabco wallboard plant of Fibreboard Paper Products Co. at Florence permitted mining of gypsum throughout 1957. This company also mined gypsum for Ideal Cement Co. for use as a cement retarder; total output in 1957 was approximately the same in 1956.

The county and State highway departments and the State penitentiary reported production of 27,800 tons of structural and paving gravel. The \$275 worth of mineral specimens or ornamental stones collected in 1957 was jasper and agate.

Although pegmatite mining still played a part in the activity of the mineral industry of the county, its importance continued to decline. Only 3,000 long tons of crude feldspar and 120 tons of scrap mica were mined and sold in 1957. Pegmatites were also a source of rare earths. The Olhio claims in the Tallahassee mining district were operated for a short time, and 40 tons of yttrium ore was produced and sold. A DMEA contract for \$20,760 was signed with Cunac Minerals, Inc. With Federal financing composing 75 percent of the contract figure, the company plans to explore for thorite on the Pink Lady claims.

Beryl produced from 2 mines by 4 operators in the county was sold to Beryl Ores Co., Arvada, and to International Minerals & Chemical Corp., Parkdale. Lockhart & Sons, which operated the Mica lode,

was the leading beryl producer. Others included Kenneth R. Cox, Larry Ellington, and Kenneth J. Smith. In addition to beryl, Kenneth R. Cox produced and sold a few pounds of columbite-tantalite from the Devil's Hole mine.

A small quantity of iron ore (magnetite) was produced in 1956 from the Iron Mountain mine by Florence Aggregate Co. for use as a concrete aggregate for coating underwater pipelines to make them heavy, but none was produced in 1957. It was reported that the company had moved its operation to another State. Small quantities of silver and copper were recovered from one mine in 1957.

Coal production by 19 companies operating 18 underground and 1 strip mine declined 7 percent compared with 1956.

Petroleum was produced at the Florence-Canon City field. Three wildcat and two development wells were failures.

Uranium ore, produced at four mines, was shipped to mills at Rifle and Salt Lake City, Utah. The principal producer was Juniper Mining Co., which operated the Dickson Lease.

Garfield.—In 1957 Garfield County was a source of coal, natural gas, lime, stone, sand and gravel, and uranium ore. The county also continued to be an important processing point for uranium-vanadium ore.

Coal production from 6 underground mines increased 60 percent compared with 1956. The principal producers were Hass Coal Co., operating the I. H. I. No. 3 mine, and Rifle Coal Co., operating the North Canon mine. Natural-gas production, from the Garmesa and Twin Buttes fields, increased 19 percent compared with 1956. Three new gasfields were discovered—Castle, Carbonera, and South Canyon; initial flow ranged from 4.2 to 2.1 million cubic feet of gas a day. Although 4 development wells were successful, 5 wildcat and 3 development wells were failures.

Uranium ore from the End of Trail No. 2 mine was shipped to mills at Rifle and Grand Junction. The new 1,000-ton uranium-vanadium processing mill of Union Carbide Nuclear Co. at Rifle was completed and replaced the previous 280-ton mill operated by the same company.

Nonmetals in Garfield County in 1957, in order of importance, consisted of lime, stone, sand and gravel, and gem stones. Basic Chemical Corp. of Glenwood Springs produced 2,500 tons of hydrated lime and quicklime from purchased stone. Frank H. Norberg Co. operated its Glenwood Springs quarry, producing crushed limestone for sugar refiners and for use as a filter, flux, and concrete aggregate. Sand and gravel was produced by crews of the State highway department. Oil shale was collected by Cross Jewelry Co. for sale as specimens.

Gilpin.—Gold, silver, copper, and lead output in Gilpin County in 1957 came from 5 lode and 4 placer mines. The Royal Mining & Milling Co. milled material from the Evergreen dump at its Golden Gilpin mill at Black Hawk. R. D. Stahl trucked small quantities of ore from the Expectation and War Dance dumps to this same mill for treatment. Concentrates produced were shipped to the American Smelting and Refining Co. smelter at Leadville. Cherokee Uranium Mining Corp. made a cleanup of the Goldridge mill during the first quarter of 1957. Glory Hole, Inc., mined and milled ore from the Patch mine and shipped the recovered gold and silver bullion to the

Denver Mint and the concentrate containing gold, silver, and lead to the Leadville smelter.

Rare earths were produced in Gilpin County in 1957. The yttrium-bearing ore, produced or purchased by Michigan Chemical Corp., was shipped to the company plant in an eastern State for refining.

Peat humus was produced by Colorado Peat, Inc., for use as a soil conditioner and as an admixture to fertilizers.

Grand.—Highway construction resulted in production of 262,700 tons of sand and gravel in Grand County in 1957. Bramley Construction Co., Colorado Constructors, Inc., Granby Sand & Gravel Co., and crews of the State highway department were the quarry operators. Jasper and agate valued at \$100 were collected for mineral specimens and ornamental stones.

Uranium ore produced by Newmont Exploration, Ltd., was processed at Salt Lake City, Utah.

Gunnison.—Coal production by 8 companies at 9 underground mines declined 4 percent compared with 1956 but furnished nearly two-thirds of the total value of minerals attributed to Gunnison County in 1957. A major portion of the production was sold in out-of-State markets, primarily for manufacturing coke.

The total value of output of gold, silver, copper, lead, and zinc in Gunnison County was \$1 million in 1957 and composed 36 percent of the total value of mineral production, compared with \$2.1 million and 55 percent in 1956. Most of the decline in 1957 resulted from closing of the county's major metal-producing mine—Keystone Unit of the American Smelting and Refining Co. It dropped from the 3d largest silver and zinc and 4th largest lead producer in the State in 1956 to 5th place in all 3 categories in 1957.

Production of these metals in 1957 came from five active mines, including the Keystone Unit. Redwell Basin Mining Venture mined a substantial quantity of lead-zinc ore from the Daisy mine near Crested Butte. Most of this ore was treated at the Atlas mill, but some was shipped to the Combined Metals Reduction Co. Bauer mill in Utah. Less than 100 tons of ore came from each of the 3 remaining active mines in the county in 1957.

A small quantity of manganese ore (35 percent or more Mn) was produced and shipped to the Government under the GSA "carlot" program.

The 200-ton-a-day uranium-processing mill of the Gunnison Mining Co. at Gunnison was completed at an estimated cost in excess of \$2 million and began operations in December. Ore for the mill will be primarily from the Los Ochos mine in Saguache County.

Construction materials—sand and gravel and stone—composed the bulk of the nonmetals in 1957. Sand and gravel output jumped from 5,000 tons in 1956 to 155,400 in 1957. Hunt Construction Co. was the producer, and output was divided between paving sand and paving gravel. Crushed limestone was quarried by the county highway department, and Colo-Tex Stone Co. mined a small quantity of dimension and crushed marble. C S & H Mining Co. continued to develop its Last Chance pegmatite and shipped 2,500 tons of crude feldspar to Denver for grinding.

Hinsdale.—A pit on the Frank Hough group of patented claims was opened late in September by Joe R. Brown, and 2 tons of ore

mined was shipped to the American Smelting and Refining Co. Garfield (Utah) smelter to recover the contained silver and copper.

Huerfano.—Coal production from underground mines by 10 companies was 12 percent greater than in 1956. The major producers were Delcarbon Coal Co. operating the Calumet mine, Morning Glory Coal Co., operating the Morning Glory mine, and Skinner Coal Co., operating the Gordon mine.

Standard Fire Brick Co. operated its Chamblin underground clay mine during 1957 and produced 5,600 tons of fire clay. Sand and gravel production resulted from highway contracts let by the State highway department to Domenic Leone Construction Co., Inc., and J. S. Kloberdanz Contractors.

Jackson.—Petroleum was produced from the Battleship, Canadian River, and McCallum-North fields; output increased 22 percent compared with 1956. A new producing horizon in the Muddy sandstone was discovered in the McCallum-North field. Five successful development wells in the Canadian River and McCallum-North fields were completed; four wildcat and two development wells were failures. Over 25 billion cubic feet of carbon dioxide annually, produced in conjunction with petroleum at the McCallum-North field, was formerly used to repressure the field; however, the cost of collecting the gas for that purpose was excessive, and the practice was discontinued, so the gas is wasted by venting.

Coal production from the Marr mine decreased, compared with 1956.

Acid-grade fluorspar prepared from ores mined by Ozark-Mahoning Co. was the second-ranking mineral in the county, in terms of value. Ozark-Mahoning Co. operated its open-pit and underground mines an average of 198 days, with 41 men employed; the mill utilized 24 men 352 days.

Jefferson.—Nonmetal output in Jefferson County in 1957 was valued at \$2.5 million (56 percent greater than 1956), and nonmetals represented 71 percent of the total value of all minerals. In terms of value, sand and gravel was the most important commodity in this group and was responsible for the major portion of the increased value for nonmetals. Construction and maintenance crews of the Colorado Department of Highways and Gardner Construction Co., contractor for the highway department, supplied the 8,000 tons of Government-and-contractor production. Commercial output reached 2.03 million tons compared with 757,000 tons in 1956. The principal producing companies in the commercial group were Clear Creek Rock Products Co., Rio Grande Co., Bramley Construction Co., Suburban Reddi-Mix Sand & Gravel Co., Western Paving Construction Co., H. N. Lee Sand & Gravel Co., and Colorado Materials Co.

Production of fire and miscellaneous clay was an important part of the activity of the Jefferson County mineral industry, although output in 1957 fell to 184,000 tons from 237,000 in 1956. Twenty open-pit and underground mines were operated during the year. Robinson Brick & Tile Co. operated 5 mines, Denver Brick & Pipe Co., 2 mines, and Denver Fire Clay Co., 2 mines; all other companies or individuals operated 1 mine each. The principal producers were George W. Parfet Estate, Inc., Wesley Conda, Robinson Brick &

Tile Co., H. M. Rubey Clay Co., Denver Brick & Pipe Co., and Lakewood Brick & Tile Co.

Continued increases in the cost of production and a uniform price throughout the year caused a decline in the output of feldspar in 1957. The number of operations fell from 17 in 1956 to 14 in 1957, and shipments dropped from 11,000 tons to 6,000 for the same period. L. M. Hollingsworth and V. O. Eagle, operating the Madonna Lode mine, were the principal producers. The Madonna Lode was also worked by Dale & Perry Dunkle and E. S. Robinson. The White Cloud mine was operated for short periods by Perry Dunkle and Albert Miller. Other properties which were worked on an intermittent basis were the California Lode, Burroughs, Butterfield No. 1, B. W., Circle S Nos. 1 and 2, Delbert No. 2, Dory Snider, and Tall Timber No. 1 mines.

Stone production consisted of 2,900 tons of crushed basalt quarried by Frederick Raff, Inc., of Colorado Springs for use by the Air Force Academy Construction Agency.

Beryl output in 1957 was the same as it was in 1956—1 ton—collected by Milford Stephens, Dean Gregg, and Ted Morse in the course of prospecting and exploration activities. Mica production consisted of 97 tons of scrap mica. All output was sold to Beryl Ores Co. of Arvada, which produced ground mica, mainly for the roofing industry.

Beal & Associates again was active in rare-earth mining in 1957, producing and selling yttrium ores. J. J. McRoberts reported mine output of yttriofluorite and gadolinite, which was shipped to Michigan Chemical Corp. for refining. In all, 47 tons of rare earths valued at \$9,600 was mined in 1957.

Gold and silver were recovered as byproducts at three sand-and-gravel washing and screening plants. The Kerklung & Slensker operation was the principal producer. Robert R. Ray recovered gold and silver from the Suburban Sand & Gravel Co. and Clear Creek Rock Products Co. sand and gravel pits. Copper ore containing some gold and silver was mined and shipped from the Malachite mine by the Arapahoe Mining & Uranium Ore Corp. in 1957.

Uranium ore was produced at 6 operations by 5 producers and shipped to mills in Colorado, South Dakota, and Utah. The major producer was the Denver-Golden Oil & Uranium Co., operating the Schwartzwalder and Ralston Creek mines. The pitchblende- and uraninite-type ores mined were considerably higher in grade than the carnotite-type ores of the Colorado Plateau area and more difficult to process.

Petroleum production from the Soda Lakes field declined 67 percent compared with 1956.

Kiowa.—Kiowa County entered the ranks of petroleum producers in 1957, when the McClave field was discovered as an oil-producing horizon in the Lynn No. 1 well that had previously been completed as a gas well in Pennsylvanian formation. The oil-producing formation was the Marmaton, and initial production was 240 barrels of oil a day at a depth of 4,232 to 4,254 feet. It was one of the few commercial producers on the Las Animas arch. Two other discoveries, later combined with the McClave field, were completed as gas wells, producing 5 and 10 million cubic feet of gas a day. One development

well was a failure, and eight other wildcat wells also were failures. The discovery was southwest of the 357,000-cubic-foot discovery made in 1952 as the first discovery on the Las Animas arch.

A sand and gravel output of 119,100 tons resulted from quarrying operations of Baab Construction Co., C. L. Hubner Co.—contractors for the Colorado Department of Highways—and construction crews of the highway department.

Lake.—The entire output of molybdenum from Colorado came from the Climax mine operated by the Climax Molybdenum Co. Most of the county value of mineral production can be credited to the molybdenum produced from this mine. According to the company annual report in 1957, 10.6 million tons of ore was mined and milled, which averaged 0.367 percent molybdenum disulfide. This was a new record for ore production and compared with the former record output of 9.9 million tons averaging 0.361 percent in 1956. From this ore concentrate containing 42.5 million pounds of molybdenum was produced in 1957, compared with 37.5 million pounds in 1956. In addition, concentrate containing 744,000 pounds of tungsten (compared with 672,000 pounds in 1956) was recovered from the ore in the byproduct plant. This plant, which also produced minor quantities of pyrite, tin, and other minerals, was being expanded and when completed will begin to process efficiently all of the tailing from the mill rather than only a part of it. Tungsten concentrate containing 30,000 pounds of tungsten was sold in 1957. With the unsold 1956 and 1957 production, the company had a substantial quantity of tungsten concentrate on hand at the close of 1957. According to the company, although more than 100 million tons of ore has been mined at Climax in the past 40 years of production, the proved ore reserve at present cost and price levels is now calculated to total 418 million tons of ore averaging 0.43 percent molybdenum disulfide before dilution in mining. The full extent of the deposit, however, has not yet been defined.

The total value of gold, silver, copper, lead, and zinc produced in the county in 1957 was \$3.3 million, compared with \$1.5 million in 1956. Most of this increase reflected the substantial gain in output from the Iowa Gulch (Hellena & Julia Fisk shafts) and Irene shaft group of mines operated by Resurrection Mining Co. This operation, a joint venture between American Smelting and Refining Co. and Resurrection Mining Co., was managed by the latter company. According to the 1957 annual report of the Newmont Mining Corp. (sole owner of the Resurrection Mining Co.), 87,325 tons of ore containing 4.32 percent lead, 9.19 percent zinc, and 4.79 ounces of silver per ton was produced from this group of mines in 1957. As a result of the decline in lead- and zinc-metal prices during the latter half of the year, the operations became unprofitable and were suspended by October.

Other major producers of these metals in the county in 1957 included Ellis Webster (Commerce mine and dump), Cadwell Mining Co. (Hayden shaft), and Froelich Kaiser Lease (Yak tunnel).

Nonmetals continued to supply only a small portion of the total mineral output in Lake County; pyrite and stone again were the only commodities produced in this group. Climax Molybdenum Co. remained the one producer of pyrite (a byproduct of the treatment of

molybdenum ore), and all was used in manufacturing sulfuric acid at the Denver plant of the Allied Chemical & Dye Corp. Stone production consisted of 500 tons of crushed sandstone quarried by Standard Fire Brick Co. at its Pineview placer and used at the company refractory-manufacturing plant at Pueblo.

La Plata.—Coal produced at 12 underground mines by 10 companies was 25 percent lower than in 1956. The principal producer was Victory Coal Co., operating the Victory Nos. 1, 2, and 3 mines. Natural-gas production was from 6 fields, 3 of which also yielded petroleum. The Ignacio-Blanco field was the largest producer of natural gas. Gas discoveries were made at the Alkali Gulch, Blanco, and Ignacio-Blanco fields. Petroleum was produced from the Barker Dome, Ignacio-Blanco, and Red Mesa fields. Development drilling was particularly active in the county with 45 successful gas completions.

Sand and gravel was the most important nonmetal in La Plata County in 1957. Commercial quarrying and preparation activities of Burnett Construction Co. and Northwestern Engineering Co. resulted in the production of 123,200 tons of structural sand and structural and paving gravel. M. C. Jacobs Construction Co. and E. J. Rippy & Sons, contractors for the State highway department, produced 177,900 tons of paving gravel in conjunction with highway contracts. Stone output consisted of 7,900 tons of crushed sandstone quarried by Burnett Construction Co. and used in manufacturing refractories.

The entire output of gold and silver in the county came from ore produced from the Bessie G. group of claims by Zodomok Mines, Inc. Most of the ore was milled by the company and the concentrate shipped to the smelter at Leadville. One lot of less than 1 ton of high-grade ore was shipped directly to the smelter.

The 430-ton Vanadium Corp. of America processing mill at Durango operated the entire year recovering uranium and vanadium oxides from uranium-vanadium ores from the Colorado Plateau in Arizona, Colorado, New Mexico, and Utah. A small quantity of uranium ore, produced at the Good Hope mine, was shipped to Grand Junction for processing.

Larimer.—Activities of the nonmetal segment of the mineral industry contributed 88 percent of the total value of all minerals produced in Larimer County in 1957. Cement and the raw materials required for its manufacture once again were the principal mineral commodities produced. Shipments of portland and masonry cements by Ideal Cement Co. at its Boettcher dry-process plant increased 6 percent in 1957. Two rotary kilns were operated for 223 and 241 days, respectively; the finished product was shipped to consumers in Nebraska, New Mexico, and Wyoming, as well as Colorado.

Limestone for cement was mined by Ideal, whereas gypsum was produced by E. W. Munroe. Other gypsum production was reported by United States Gypsum Co. from its Loveland quarry. Crude rock from this deposit was shipped to company-owned plaster and wallboard plants outside of Colorado. Limestone not consumed in cement was used in refining sugar and was quarried by Frank H. Norberg Co. In addition, local stone quarries in 1957 produced

5,000 tons of dimension and 200 tons of crushed sandstone, and 336 tons of dimension and 1,000 tons of crushed granite.

Sand and gravel production amounting to 291,300 tons came from pits operated by Loveland Ready-Mix Concrete, Inc., Sterling Sand & Gravel Co. (commercial producers), and L. J. Hesser, contractor for the State highway department, as well as construction crews of both county and State road departments.

Scrap and hand-cobbed mica, feldspar, beryl, and columbite-tantalite comprised the products recovered from pegmatite mining in 1957. Dikes operated by Lucas Mining Co. (Gracie and Mica Ridge No. 1), Watters & Cullum (No. 5 mine), and James W. Strait (Shoestring) produced 2,000 tons of potash feldspar, which was shipped to Denver for grinding. H. A. Snider (Emerald Gem), Richard McCall (Horsetooth), Lucas Mining Co. (Mica Ridge No. 1), and Hugh Mattox (Thodab No. 1) recovered scrap mica and sold it to Beryl Ores Co.; 173 pounds of hand-cobbed mica was sold to the Government mica-purchasing depot at Custer, S. Dak.

Beryl output in 1957 (valued at \$4,000) was reported from 10 operations compared with production worth \$18,000 from 15 mines in 1956. The beryl was sold to Beryl Ores Co., Arvada, and to the Government purchase depot administered by the GSA. Outstanding county producers were the Colard & Edmonds operation at the Pole Hill Lode and W. R. Allphin from the Big Boulder mine. One operator recovered and marketed a small quantity of columbite-tantalite as a coproduct of beryl mining.

Petroleum (Larimer County's second-ranking mineral in value) was produced from the Berthoud, Clark Lake, Fort Collins, Loveland, and Wellington fields and from an extension of the Highland field that lies in both Larimer and Boulder Counties. Natural gas was produced from all fields except the Highland. Two successful development wells were completed. Eight wells (seven wildcat and one development) were failures.

Las Animas.—Las Animas County was the leading producer of coal, which came from 12 underground mines. The major operator was the Colorado Fuel & Iron Corp. (Allen and Frederick mines); the entire output (coking coal) was used at the company steel plant at Pueblo. Employment in county coal mines averaged 1,193 men, 1,122 of whom were employed at the Allen and Frederick.

Sand and gravel and stone continued to supply the bulk of the income from the sale of nonmetals in Las Animas County in 1957. Highway-construction activities of crews of the State and county highway departments resulted in production of 305,300 tons of structural and paving sand and gravel, and the county highway department quarried 8,500 tons of rough construction sandstone.

The Santa Fe mine of Scott-Ruiz Coal Co. was the only source of commercial quantities of clay in 1957. Mine output was classified as fire clay and used in manufacturing fire brick and block.

Uranium ore was produced at 9 properties by 5 operators and processed at Colorado mills.

Carbon dioxide was produced at the Nina View field and transported by pipeline to Ninaview in Bent County for processing into dry ice and liquid carbon dioxide. Products of the plant were sold as far away as Montana and Texas.

Logan.—Crude-oil output from 63 fields declined 18 percent in 1957 compared with 1956. Production from the 3 largest fields, Cliff, Graylin-Northwest, and Yenter, dropped 31 percent with the largest decreases in the Cliff and Graylin-Northwest fields. Total drilling also declined from 192 (94 wildcat, 98 development) completions in 1956 to 149 (91 wildcat, 58 development) completions in 1957. There were 6 discoveries (4 oilfields, 2 gasfields) in 1957 and a new producing horizon was found in the Amber field discovered in 1956. New oilfields were the Elm Grove, Key, Pebble, and Twin Mills. Thirty of the development wells drilled were successful. Natural gas (dry) was produced from six fields and wet gas from most of the oilfields. New gasfields discovered in 1957 were the Daily and Rift. Natural-gas liquids were recovered from wet petroleum gas at three plants in Sterling. Two were operated by Ginther, Warren & Ginther, and one was operated by the Kansas-Nebraska Natural Gas Co.

The need for improved roads in Logan County resulted in the letting of construction contracts to L. J. Hesser and Pioneer Construction Co. by the Colorado Department of Highways. In the course of construction activity these companies quarried 103,900 tons of paving gravel, and construction and maintenance crews of the State and county road departments produced 251,800 tons of paving and structural gravel.

Members of the Northeastern Rock & Arrowhead Club reportedly collected \$1,000 worth of agate, petrified wood, and miscellaneous mineral specimens or ornamental stones during 1957.

Mesa.—The mining and milling of uranium ore continued as the principal mineral-industry activity in Mesa County in 1957. Production of uranium ore from 109 operations increased to 122,028 tons in 1957 compared with 88,597 tons from 106 operations in 1956. The grade, however, declined from 0.32 percent U_3O_8 to 0.29 percent in 1957. Climax Uranium Co. operated its 350-ton mill at Grand Junction throughout the year and recovered both uranium oxide and vanadium oxide from Colorado Plateau ores. Uranium oxide was delivered to the AEC; and the vanadium oxide, after further processing at plants in the Eastern States, was used in alloy steels.

Coal production in 1957 from 7 mines increased 9 percent compared with 1956. The Kerr Coal Co., operating the Cameo mine, was the principal producer. Of major importance was completion of the 22,000-kilowatt generating plant at Cameo by the Public Service Co. of Colorado. The plant, built at the Kerr coal mine began operating in September. Coal for the plant was crushed at the mine tippie and delivered by 2 conveyor belts, having a total length of 730 feet, to the plant stockpile. A third conveyor belt, 457 feet long, delivered the coal from the stockpile to storage bunkers at the plant. Approximately 160 tons of coal per hour was delivered to the plant stockpile. The plant was designed to provide for additional generating units as they are required. The reserve at the mine is sufficient to supply the plant and any future additions for at least 30 years. Other reserves also are available in the immediate area.

Sand and gravel totaling 774,200 tons was produced in Mesa County from 2 commercial pits operated by United Sand & Gravel Co. and White Water Sand & Gravel Co. and from Government-and-contractor activities of the State and county highway departments,

Corn Construction Co., Gardner Construction Co., and Pioneer Construction Co.—contractors for the State highway department.

At Grand Junction the Grand Junction Brick Co. operated its open-pit mine and produced 1,700 tons of miscellaneous clay for use at its brick plant. Sandstone used as riprap was quarried by Silmon Renick in connection with a contract with the Federal Bureau of Reclamation.

Natural gas (dry) was produced from the Asbury Creek and Bar X fields. Production in 1957 more than doubled that in 1956. A new gasfield (Mack Creek) was discovered in the Morrison formation at a depth of 2,395 feet. Initial daily flow was 2.5 million cubic feet. Another well in the same field discovered an additional producing horizon in a stray sandstone member of the Brushy Basin formation at a depth of 2,090 feet. Initial daily production was 1.25 million cubic feet. Successful development wells were completed in the Divide Creek and Hunters Canyon fields, discovered in 1956.

The plant of the American Gilsonite Co. near Fruita was completed and after preliminary testing, starting in April, began to produce in June. The plant was officially dedicated on August 2. Gilsonite delivered through a 72-mile, 6-inch pipeline from the mines at Bonanza, Utah, was refined into a high-grade metallurgical coke used as anode material by aluminum companies in the Northwest and premium gasoline, marketed locally.

Small quantities of gold, silver, and lead were recovered from material salvaged from cleanups at several mills in the county by Albert McClusky and shipped to the smelter at Leadville.

Mineral.—The value of all minerals produced in Mineral County in 1957 was 76 percent above 1956. Except for gem stones and sand and gravel, the entire value of mineral production in the county (\$1.4 million) came from gold, silver, copper, lead, and zinc. A substantially increased output from Mineral County's leading metal producer—Emperius Mining Co. operation at the Emperius mine—was responsible for the big rise in the total value of mineral production in 1957.

The Emperius mine at Creede—the State's fourth largest silver, lead, and zinc producer in 1957—was active throughout the year. Most of the ore mined was treated in the company 150-ton-per-day flotation mill completed in June 1956; lead and zinc concentrates produced were shipped to smelters. Some crude ore was also shipped to a smelter without beneficiation. The Holy Moses No. 2 mine was operated from June 3 throughout the remainder of the year by the Sublet Mining Co. Considerable exploration and development was conducted and 327 tons of ore containing 35 ounces of gold, 202 ounces of silver, 21 tons of lead, and 11 tons of zinc was shipped for smelting.

Moffat.—Production of mineral fuels continued to be the principal activity of the mineral industry of Moffat County in 1957.

Petroleum output from 12 fields in 1957 increased slightly from that produced in 1956. Major producing fields were the Powder Wash, Hes, and the Thornburg. The latter lies in both Moffat and Rio Blanco Counties. Natural gas (wet) was produced from 9 fields and dry gas from 6 fields. Production decreased slightly over 1956. Mountain Fuel & Supply Co. operated its natural-gasoline plant and

recovered natural gasoline and liquid-petroleum gases from wet natural gas produced with petroleum.

Coal was produced at the Red Wing mine by the Colowyo Coal Co.; output in 1957 was 12 percent greater than in 1956.

The 300-ton uranium-processing mill of Trace Elements Corp. at Maybell was completed and began operations in October. Crude ore for the mill originated at properties in northwestern Colorado and the Baggs area in southern Wyoming. Trace Elements Corp. was acquired by Union Carbide Nuclear Co. in 1956.

Requirements for sand and gravel to be used in highway and building construction provided work at five operations in Moffat County in 1957. Contractors for the Colorado Department of Highways and the Moffat County Highway Department quarried and prepared 180,600 tons of paving gravel, and construction crews of the State road department quarried 19,800 tons of pit-run material. Commercial structural, paving, and fill sand and structural and paving gravel totaling 69,400 tons were reported produced by the Craig Sand & Gravel Co.

Montezuma.—Sand and gravel was the only nonmetal reported produced in 1957. All output—substantially above the 1956 total—was used in highway construction and was produced by Nielson, Inc., contractor for the National Park Service; Hamman Bros., contractor for the Federal Bureau of Public Roads; and Graham Construction Co., E. J. Rippey & Sons, and Morrison-Knudsen Co., Inc., contractors for the State highway department. Crews of the Colorado Department of Highways quarried 700 tons of paving gravel.

Petroleum production from the Dove Creek field declined slightly compared with 1956. During 1957, 25 wildcat and 4 development wells were completed. Except for 1 successful gas well in the Mancos River field, all were failures.

Carbon dioxide was produced at the McElmo field and processed at a plant on McElmo Creek by Colorado Carbonics Corp. Dry ice and liquid carbon dioxide were marketed in the Four Corners area of Colorado, New Mexico, Arizona, and Utah.

Coal was produced at Montezuma No. 2 mine by Glen E. Wilson.

The First National Oil & Mineral Co. conducted exploration and development at the Gold Dollar mine during the first 6 months of the year, made 1 small shipment of gold ore to the smelter at Leadville, then subleased the property to Minerals Consolidated, Inc. This company continued exploration and development and made one shipment of ore containing gold and silver to the Leadville smelter.

Montrose.—Uranium mining and milling continued to be the primary mineral-industry activities of Montrose County. Uranium ore, produced from 245 operations, represented 57 percent of the total production of uranium ore in the State—a 54-percent increase compared with 1956. The value of this ore, amounting to \$9 million, represented 97 percent of the value of all mineral production from the county. The principal uranium producers were Union Carbide Nuclear Co., Vanadium Corp. of America, Climax Uranium Co., Worcester Mines, Golden Cycle Corp., and LaSalle Mining Co. The uranium ore was processed principally at the Union Carbide Nuclear Co. 1,100-ton-a-day mill at Uravan and the Vanadium Corp. of America mill at Naturita. Some ore was processed at mills in Durango,

Rifle, and Grand Junction. The Uravan and Naturita mills also recovered vanadium oxide from uranium ores containing sufficient vanadium to warrant recovery. The contract for purchasing uranium oxide from a 200-ton-a-day mill to be built at Bedrock by Atomic Fuels Extraction Co. was canceled.

On July 20 approximately 99,000 acres of public land in the Monogram-Mesa-Long Park area in Montrose and San Miguel Counties was reopened to entry for location of uranium claims. The area had been withdrawn from public entry since 1948 to permit AEC to conduct exploratory and geological work. Approximately 1,000 claims were filed in the Montrose County Court House at Montrose.

Of the 294,100 tons of sand and gravel reported by producers in Montrose County, 261,100 tons was Government-and-contractor output produced by contractors in conjunction with highway contracts held with the Colorado Department of Highways. The remainder was commercial output for local use.

Ammon E. Nix produced coal at the Independence mine.

Morgan.—Although petroleum production in 1957 from 28 fields declined 7 percent compared with 1956, it continued to be the most important mineral commodity by far produced in Morgan County. Natural gas was produced in all but one of the fields, and dry gas was recovered at the Adena and Vallery fields. Wet petroleum gas was processed at plants at Fort Morgan by Continental Oil Co. and Pure Oil Co. to recover natural gasoline, propane, and butane. One new gasfield—the Young—was discovered. Initial production was 3 million cubic feet a day from the “D” sandstone. A new producing horizon was found in the Jackpot field at a depth of 6,589 feet in a workover well in the Greenhorn formation. Development drilling resulted in 10 successful oil completions and 2 successful gas completions from 25 wells drilled. With unit operation of the Adena field by Pure Oil Co. as the operator, the largest water-injection project in Colorado history began. An unusual feature of the project is injection of water into the gas-oil contact zone of the “J” sandstone to prevent the escape of oil into the gas cap and to force oil through the producing wells. The method permits unlimited production of gas from the field. The program, over a 10-year period, was expected to increase recovery from an estimated 41 million barrels to 91 million. Ultimately, daily injection of water will be 34,500 barrels into 23 wells.

Intensified highway construction in Morgan County boosted sand and gravel production from 223,000 tons in 1956 to 311,600 in 1957. Both the Colorado Department of Highways and the county road department had contractors and their own crews actively engaged in highway work during most of the year.

Ouray.—The Camp Bird mine near Ouray, Ouray County's and one of Colorado's major gold, silver, lead, and zinc producers in past years, was nonproductive in 1957. On December 1, 1956, the King Lease, Inc., discontinued operating this mine and relinquished its lease to the owners, Camp Bird, Ltd. The owners immediately began a rehabilitation and exploration and development program preparatory to a full-time large-capacity production, but a labor strike on May 8, 1957, curtailed it. No ore was mined, milled, or shipped from this mine during 1957.

Park.—The value of beryl output in Park County in 1957, which

composed 44 percent of the total value of mineral production in the county, was \$84,000, compared with \$68,000 in 1956. Mountain Dale Mining Co. (G. H. Sager), by far the leading beryl producer in the county and in the State, reported an output of 332,436 pounds of beryl from the Boomer Lode 7 miles west of Lake George. This beryl was sold to the Government purchase depot, Custer (S. Dak.); Beryl Ores Co., Arvada; and Antero Refining Co., Poncha Springs. Beryl also was recovered from the Big Sheep Horn mine by Globe Hill Mining Co. and sold to J. T. Collins during 1957.

Gold, silver, copper, lead, and zinc output in the county in 1957 came from 4 lode mines (Phillips, Red Cross dump, Last Chance-Hilltop, and Little Star & Twinkle Lode), and 2 placer mines, (Black Butterfly and Fortune). The Phillips mine, Park County's only producer of zinc and the principal gold and copper producer, operated by Buckskin Joe Mines, Ltd., was active from January 1 to July 12. All ore mined was shipped to the Resurrection Mining Co. mill at Leadville for treatment. Leadville Lead & Uranium Corp. operated the Last Chance-Hilltop mine during the last 4 months of the year and shipped ore to the American Smelting and Refining Co., Leadville smelter. This mine was the principal silver and lead producer in the county in 1957.

Feldspar, recorded at 900 long tons, was produced from the Blue Spruce, Douglas No. 1, Hackett, and Lone Lode mines. The principal mine operators were M. E. Johnson and Harold E. Douglas. H. E. Douglas also recovered 22 tons of scrap mica from the Douglas claims near Hartsel and E. M. Erickson reported the shipment of 19 tons of scrap mica from the Holsted Mica mine near Lake George.

The Antero Lake and Pine areas of the county were the source of agate, amazonite, topaz, and other mineral specimens and semiprecious stones.

Pitkin.—Coal—the principal mineral commodity of Pitkin County—was produced at the Thompson Creek Nos. 1 and 3 mines by the Thompson Creek Coal & Coke Corp. and at the Dutch Creek mine operated by the Mid-Continent Coal & Coke Co. Production in 1957, most of which was shipped to Utah coke ovens, was greater than in 1956.

Pueblo.—Sand and gravel and clays were the only minerals produced in Pueblo County during 1957. Sand and gravel sold or used rose to 991,900 tons valued at \$956,000 from 985,500 tons at \$796,000 in 1956. Fountain Sand & Gravel Co. and Broderick & Gibbons, Inc., were the principal commercial operators that accounted for the bulk of the 772,700 tons of commercial material. Government-and-contractor production consisted of 219,200 tons of structural and paving gravel mined by crews of the State, county, and City of Pueblo road departments and Graham Construction Co., J. H.-N. M. Monaghan & Associates Cos., and Shore-Bailey Construction Co., which were contractors for the Colorado Department of Highways. Clay continued to be an integral part of the economy of Pueblo County in 1957. The total output of all clays was 67,800 tons valued at \$227,200. Five mines or group of mines operated in 1957 and fire clay totaling 48,900 tons was produced at 4 mines and 18,900 tons of miscellaneous clay at 1 property. Fire-clay producers were Colorado Fire Clay Co., General Refractories Co., Freeman Fire Brick Co.,

and Standard Fire Brick Co; Summit Brick & Tile Co. was the miscellaneous-clay producer. The fire clay was used in the manufacture of firebrick, block, mortar, and heavy clay products. The miscellaneous clay was used in the manufacture of building brick and other clay products.

Rio Blanco.—Rio Blanco County continued to lead the State in petroleum production from 7 fields, although output declined 2.2 million barrels or 7 percent compared with 1956. The value of petroleum produced furnished all but a small fraction of the total for all minerals, which included coal, uranium, and sand and gravel.

The Rangely field, producing from 4 horizons, was largest, and accounted for 91 percent of the county total. The Pinnacle field was discovered at a total depth of 4,397 feet. Oil from the Dakota sandstone at 3,754 feet was produced initially at the rate of 12 barrels per day on pump. Two gasfields (Powell Park and Sulphur Creek) were listed as 1957 discoveries. Initial production at the Powell Park field was 7.8 million cubic feet a day and at the Sulphur Creek field 2 million cubic feet a day. Development drilling included 1 successful oil well and 11 successful gas wells. Natural gas was produced from 6 fields, 2 of which yielded dry gas. Natural-gas liquids were recovered from wet petroleum gas from the Rangely field at the plant operated by The California Co. Wesco Refining Co. operated its 2,000-barrel-a-day refinery at Rangely.

The Rangely field was unitized in 1957, with The California Co. as unit operator. Unitization became effective on October 1 after 11 years of negotiation between operators assisted by the Colorado Oil & Gas Conservation Commission and the Federal Geological Survey. The unit was the second largest, in terms of reserves, ever formed in the United States, only the Sacroc unit, Scurry County, West Texas, being larger. It has been estimated that the field, discovered in 1902, could produce 350 million barrels by primary methods. Unitization with water flooding and gas injection was expected to produce 400 million barrels additional. The total production of the field through 1957 exceeds 244.5 million barrels.

Coal was produced at the Rienau, White River Fuel, and Blue Streak underground mines. Output declined 31 percent compared with 1956.

A limited tonnage of uranium ore was produced at 8 mines by 5 operators. The ore was shipped to mills at Grand Junction and Rifle for processing.

The only sand and gravel produced during the year was reported by Albert Kirkpatrick and consisted of 1,400 tons of structural sand and 3,000 tons of structural gravel.

Routt.—Coal produced at 4 underground mines and 3 strip mines (465,000 tons) declined 5 percent compared with 1956.

Petroleum production was from the Tow Creek field. A new producing horizon was found in fractured Niobrara shale at a depth of 3,738 feet in the Hidden Valley field. Initial production was 93 barrels of oil a day on pump. Three successful development wells were completed in the Tow Creek field.

Colorado Constructors, Inc., was the only company reporting any sand and gravel output in 1957, and all production was classed as paving gravel for use in constructing highways. McCoy Aggregate

Co. of Steamboat Springs produced scoria again in 1957. Shipments to building-block manufacturers, mainly on Colorado's eastern slope, amounted to 14,000 tons, only half of the 1956 sales total.

Gold, silver, copper, and lead were recovered from ore mined from the Greenville mine by Charles Toole and from the Copper King mine by McFarland & Hullinger and shipped to the American Smelting and Refining Co. smelter at Garfield (Utah). The ore mined from the Greenville mine resulted from assessment work on the claims. McFarland & Hullinger suspended operations and terminated its lease on the Copper King mine March 19.

Saguache.—Uranium ore was produced at five mines and shipped to plants in Colorado and Utah for processing. Ore produced at the Los Ochos mine by the Gunnison Mining Co. was shipped to the company's new 200-ton-per-day mill at Gunnison, which was completed in December.

Revenue from the sale of 420 pounds of turquoise produced at the Villa Grove turquoise lode amounted to \$15,600; this material ranked as the second most important product in the county during 1957. A small quantity of paving gravel for road use was reported by the Colorado Department of Highways.

The Rawley mine, operated by the Costello Lease, the largest base-metal producer in the county in 1956, had no recorded production in 1957. All ore mined in 1957 was stockpiled at the mine and mill. The relatively minor output of gold, silver, copper, lead, and zinc in Saguache County in 1957 came from Cliff, Little Jennie, and Warwick mines, operated by Tri-Em Corp., Johnson Mining Co., and Warwick Mines, Inc., respectively.

San Juan.—The value of output of gold, silver, copper, lead, and zinc in San Juan County declined to \$399,000 in 1957 from \$537,000 in 1956. This drop resulted from curtailing production at some mines and suspension of operation at others. The entire output of these metals came from eight mines. Most of the ore was treated at the Pride custom mill, operated by the Argyle Mining & Milling Co. The major producing mines and operators in this county included the Mystery Gold (Giant Resources, Inc.), Osceola (Tech Ser Mining Co., first half of year and Argyle Mining & Milling Co., last half of year), Pride (Argyle Mining & Milling Co.), and Caledonian (Tech Ser Mining Co.). Less than 1,000 tons of ore was produced from each of the 4 remaining active mines in the county in 1957.

Vanadium Corp. of America produced uranium ore at the Barlow Creek and Dunning Graysill mines; ore was shipped to the company processing plant at Durango.

Lowdermilk Bros., as contractor for the Colorado Department of Highways, and construction and maintenance crews of the State highway department quarried and prepared 60,800 tons of paving gravel. This production represented the only nonmetal output in the county in 1957.

San Miguel.—Most of the gold, silver, copper, lead, and zinc produced in San Miguel County in 1957 (which supplied \$8 million of the \$10 million total value of mineral production in the county) came from the Treasury Tunnel-Black Bear-Smuggler Union group of mines operated by Idarado Mining Co. The Newmont Mining Corp., which owns 74.2 percent of the Idarado Mining Co., stated in

its annual report that during the year 457,850 tons of ore averaging 0.062 ounce of gold and 1.96 ounces of silver per ton, 1.98 percent lead, 0.78 percent copper, and 3.26 percent zinc, was mined from this group of mines and milled at the company Pandora mill; this compared with 481,700 tons in 1956. According to the company, centralized milling at the new Pandora mill and improvements in mining efficiency aided the company in maintaining a profitable operation throughout the year despite the sharp reductions in base-metal prices. At the close of the year operations were being conducted on a 5-day-week basis at a scheduled rate of 35,000 tons of ore per month compared with the installed capacity to treat 45,000 tons per month. This group of mines was the State's leading gold, copper, and lead producer and ranked second to the Eagle mine in Eagle County in silver and zinc output. In addition to this group of mines, production of these metals was reported from three other properties; ore was shipped from the Atlas mine dump, Bradley mine, and Cimmaron-mill tailing dump.

Iron ore classed as bog iron (limonite) was mined from the Iron Springs Placer for C. K. Williams & Co. for use in manufacturing paint, and Boyd Robinson produced similar material from the Iron Lode No. 3 claim for use as a soil conditioner. The entire production of iron ore in Colorado in 1957 came from these two deposits. The total output in 1957 was substantially above 1956.

Manganese ore (35 percent or more Mn) was mined from the Wolf claim in San Miguel County and marketed under the "carlot" purchase program administered by the GSA.

San Miguel County ranked third in the State in the production of uranium-vanadium ores. Ore produced at 120 properties was processed at Colorado mills, where vanadium oxide also was recovered. The principal producers included Union Carbide Nuclear Co., Dulaney Mining Co., Ortmayer Mining Co., Gayno Mining Co., and Vanadium Corp. of America. Union Carbide Nuclear Co. completed its upgrading plant at Slick Rock. Output of the plant was shipped to the company mill at Rifle. With reopening to entry of the Monogram Mesa-Long Park area in Montrose and San Miguel Counties in July, 700 to 800 claims were recorded at the county court house, Telluride.

Production of 58,300 tons of sand and gravel in 1957 was valued at \$50,100. Lowdermilk Bros., as contractor for the Colorado Department of Highways, was the contractor-producer.

Mineral specimens or ornamental stones reported in 1957 amounted to only 30 pounds of peacock copper collected in the Telluride area by San Miguel Woodcraft & Gem Shop.

Summit.—The total value of mineral output in Summit County in 1957 came from gold, silver, copper, lead, and zinc produced from 9 mines—4 in the Breckenridge and 5 in the Montezuma district. All these mines except the Wellington, Burke Martin, and Chautauqua were small producers, with output of less than 1,000 tons of ore.

The Horn & Burger partnership operated the Wellington mine throughout the year. The ore mined was shipped to the United States Smelting Refining and Mining Co. mill at Midvale (Utah). The Burke Martin Mines shipped a small quantity of ore from the Burke Martin mine to the lead smelter at Leadville and treated the remainder in its mill. Lead concentrate was shipped to the Leadville smelter and

zinc concentrate to the Amarillo (Tex.) smelter, both operated by the American Smelting and Refining Co. The Lisbon Valley Uranium Co. shipped ore from the Chautauqua mine directly to the Leadville smelter and milled some in the Toledo mill. The mine was operated from February 1 and the mill from June 1 throughout the remainder of the year.

Teller.—Gold production in Teller County in 1957 accounted for 97 percent of the total value of mineral output in the county and 52 percent of the total value of gold production in Colorado in 1957. All of this gold came from the 17 mines in the Cripple Creek district. The 5 major gold producers, each with an output of more than 1,000 fine ounces of gold, included the Ajax, Cresson, Free Coinage, Grace Greenwood, and United Gold mines. The entire output of gold ore and mine-dump material from all active operations in the district in 1957 was treated at the Carlton custom mill, owned and operated by the Golden Cycle Corp. According to the company printed annual report, 116,408 tons of ore with an average gross value of \$14.13 per ton was treated in the Carlton mill in 1957, compared with 121,843 tons valued at \$15.09 per ton in 1956.

The Ajax mine, the leading gold producer in the district, ranked second in gold output (next to Treasury Tunnel-Black Bear-Smuggler Union group of mines in San Miguel County) in Colorado in 1957. The Golden Cycle Corp. reported that production from this mine in 1957 was 28,868 tons of ore with an average gross value of \$27.45 per ton, compared with 24,890 tons valued at \$37.19 per ton in 1956. The decline in value of ore was partly accounted for by the fact that a large proportion of the ore produced in 1957 came from development work.

The Cresson mine, operated by the Cresson Consolidated Gold Mining & Milling Co., was second to the Ajax mine in gold output in the district in 1957. A total of 44,409 tons of ore containing 13,759 ounces of gold was mined and trucked to the Carlton mill for treatment. The mine was operated on a curtailed basis; the ore came from newly developed areas in the lower levels mined by the company and from the upper levels mined under a contract and leasing system.

All gold ore mined from the Free Coinage mine by the Deadwood Leasing Co. was hoisted through the United Gold Mines Co. shaft. Output of gold from this mine was slightly higher in 1957 than in 1956. LeClair Consolidated Mines Co. continued to produce gold ore from the Grace Greenwood mine. The ore was shipped to the Carlton mill in the name of Johnson & Peiffer. The United Gold Mines Co. operated its mines from January 1 to September 28; the output of gold ore in 1957 was less than in 1956.

Other mines in this district, each with an output of more than 100 ounces of gold in 1957, included the Dexter, El Paso, Lexington, and Strong.

Pegmatites were mined only for feldspar in 1957, and 1,000 tons of crude material was shipped to Denver for grinding by Carl Quist from the Black Cloud mine and E. S. Robinson from the Daisybell, Gaver, and Snowflake properties.

Twenty-eight thousand tons of paving gravel was quarried and used on road jobs by Domenic Leone Construction Co., Inc., contractor for the Colorado Department of Highways, and construction crews of the State highway department. Pikes Peak Granite Co.

was again active in 1957, and 755 tons of rough monumental stone was quarried and sold.

Peat humus was produced for use as a soil conditioner and as a fertilizer admixture.

Washington.—Washington County ranked second in the State in the production of petroleum. Output, from 42 fields, was approximately the same as in 1956. Major producing fields were the Little Beaver, Big Beaver, and Plum Bush Creek, with yields over 1 million barrels each. Natural gas was produced in conjunction with petroleum in 41 fields, and 3 fields produced only dry gas. The county led all others in the Denver-Julesburg basin in exploration activity, with 139 completions. Eleven new oilfields and 1 new gasfield were discovered. One of the more important discoveries was the Azure field, early in the year. Initial production was 132 barrels a day on pump from the "D" sandstone at a depth of 4,863 feet. Other discoveries included the Becker, Barrow, Buffalo Slough, East Prong, Fremont Butte, Lone Valley, and Topaz. One reported discovery was combined with the Surveyor Creek field, and a new producing horizon was found in the "D" sandstone in the Akron gasfield. Two reported discoveries were abandoned. Development drilling resulted in 24 successful oil-well completions out of 49 drilled.

The output of sand and gravel in 1957 consisted of 303,200 tons of paving gravel. All material was produced by contractors for or construction crews of the Colorado Department of Highways.

Weld.—Petroleum production—which accounted for 70 percent of the total value of all minerals produced in Weld County—came from 30 fields and increased 28 percent compared with 1956. Natural gas was produced in 28 fields, 5 of which produced dry gas. Nine new oilfields and one new gasfield were discovered out of 52 wildcat completions. Development drilling resulted in 25 successful oil wells and 1 successful gas well out of 54 completions. Oilfield discoveries included the Fringe, Grail, Lost Creek, McKenzie, New Windsor, Spurgin N, and Vim. One discovery was combined with the Loveland field, and an additional producing horizon was found in the New Windsor field—a 1957 discovery. The Loam field (a gas discovery) produced 4 million cubic feet a day and was shut in.

Coal was produced from 6 underground mines by 4 operators. Imperial Coal Co. operating the Eagle and Imperial mines and Clayton Coal Co. operating the Lincoln and Washington mines were the principal producers. Boulder Valley Coal Co. operated the Boulder Valley No. 3 mine, and McNeil Coal Corp. operated the Sterling mine. Production in 1957 declined 3 percent compared with 1956.

Nonmetal production in Weld County consisted of 181,900 tons of Government-and-contractor and 52,000 tons of commercial sand and gravel. The material classified as Government-and-contractor was mined by the Colorado Department of Highways and contractors for that agency, the county highway department, the Greeley city engineer, and a contractor for that agency.

The Mineral Industry of Connecticut

By James R. Kerr¹ and Mary E. Otte²



VALUE of mineral production in Connecticut increased 35 percent from \$11.7 million in 1956 to \$16.1 million in 1957. Stone and sand and gravel output, which increased to meet the heavy demand caused by building of the Connecticut Turnpike and other local construction, was responsible for the increased value of Connecticut's mineral production. Of the 8 mineral-producing counties, 5 reported an output of more than \$1 million compared with 3 the preceding year. New Haven County replaced Hartford as leader in total value of mineral production, increasing to \$6.4 million. Hartford County's mineral output totaled \$4.4 million, and Litchfield, Fairfield, and New London Counties each had mineral production valued at more than \$1 million.

TABLE 1.—Mineral production in Connecticut, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays.....	337, 984	\$390, 295	308, 236	\$408, 669
Lime.....	39, 748	609, 202	30, 341	503, 295
Mica, sheet..... pounds.....	310	2, 064	(²)	(²)
Peat.....	³ 3, 190	³ 12, 512	2, 004	11, 268
Sand and gravel.....	4, 368, 727	4, 100, 666	4, 776, 977	5, 041, 499
Stone.....	⁴ 4, 427, 987	⁴ 6, 589, 727	6, 198, 801	10, 040, 435
Value of items that cannot be disclosed: Beryllium concentrate, feldspar, gem stones (1957), dimension limestone (1956) and values indicated by footnote 2.....		123, 409		118, 955
Total Connecticut ⁴		11, 736, 000		16, 055, 000

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 certain stones, value for which is included with "Items that cannot be disclosed."

⁵ Total has been adjusted to eliminate duplicating the value of stone.

REVIEW BY MINERAL COMMODITIES NONMETALS

Clays.—Clay output in Connecticut decreased 9 percent in 1957; conversely, production value increased 5 percent. This paradox was caused by higher values reported for captive production. Miscellaneous clay produced was used mostly for manufacturing building

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brick, but output from one pit was used to make lightweight aggregate. Decreased structural activity slackened demand for building brick, hence the clay output was smaller.

Feldspar.—Although the output of feldspar increased in 1957, production value dropped, as the average price per ton fell from \$9.41 to \$8.41. Feldspar was mined from open pits, processed locally, and sold to the pottery, abrasives, and soap industries.

Lime.—The output and value of lime in Connecticut dropped 24 and 17 percent, respectively, in 1957. Decreased lime output was directly attributed to the decreased demand for the calcined material for manufacturing magnesium and calcium metal at the Government-owned, silicothermic plant at Canaan operated by Nelco Metals, Inc. Demand for mason's lime was greater, while demand for agricultural lime decreased.

Mica.—The output of mica decreased considerably in quantity and value in 1957. Only 2 producers were reported active in the State; 1 produced full-trimmed mica in Middlesex County and 1 hand-cobbed sheet mica in New Haven County for sales to the Government through the General Services Administration Materials Service Depot.

Sand and Gravel.—The sand and gravel industry increased 9 percent in production and 23 percent in value compared with 1956. Construction of the Connecticut Turnpike and general overall activity in road building in the State were chiefly responsible for the increase. Building and paving uses represented 93 percent of the total State sand and gravel output.

TABLE 2.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS:						
Sand:						
Molding.....	1,600	\$1,280	\$0.80	(¹)	(¹)	-----
Structural.....	1,117,975	1,043,143	.93	1,260,560	\$1,295,098	\$1.03
Paving.....	1,188,715	1,077,728	.91	1,288,620	1,185,754	1.92
Grinding and polishing.....	7,100	5,680	.80	(¹)	(¹)	(¹)
Gravel:						
Structural.....	1,033,939	1,254,872	1.21	986,216	1,349,605	1.37
Paving.....	471,335	441,892	.94	648,897	746,273	1.15
Railroad ballast.....	20,000	24,000	1.20	(¹)	(¹)	(¹)
Other.....	159,694	112,767	.71	(¹)	(¹)	(¹)
Undistributed ²	64,601	34,502	.53	352,804	362,423	1.03
Total.....	4,064,959	3,995,864	.98	4,537,097	4,939,153	1.09
GOVERNMENT-AND-CONTRACTOR OPERATIONS:						
Sand: Paving.....	240,993	81,593	.34	181,990	81,911	.45
Gravel:						
Structural.....	2,025	709	.35	-----	-----	-----
Paving.....	60,750	22,500	.37	57,890	20,435	.35
Total.....	303,768	104,802	.35	239,880	102,346	.43
Grand total.....	4,368,727	4,100,666	.94	4,776,977	5,041,499	1.06

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

² Includes engine sand (1956), filter sand, other sand, and values indicated by footnote 1.

Higher prices were realized for most classes of sand and gravel and explained for the above average increase in total value. A good demand and increased markets were noted by most producers, although some reported keener competition and lower profits.

Stone.—Stone continued to be the leading mineral commodity produced in Connecticut, contributing 62 percent to the total State mineral wealth. The value of stone output increased 52 percent over 1956, as construction of the Connecticut Turnpike created greater demand for roadstone. Traprock (crushed basalt) producers met this demand, increasing production 45 percent (valuewise) during the year. In addition, considerable tonnages of crushed granite for concrete aggregate and roadstone were produced during the year. Dimension limestone and granite were produced, but the output of crushed and broken stone predominated. Silica (quartz) was quarried and crushed for use chiefly in manufacturing glass.

TABLE 3.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Dimension stone: Building stone:				
Rubble.....	1,642	\$14,559	918	\$13,900
Rough construction.....			425	3,573
Rough architectural.....	42	1,117	(¹)	(¹)
Rough monumental.....	366	38,716	(¹)	(¹)
Dressed construction.....	1,858	59,596	2,534	89,391
Dressed architectural.....	323	7,774	1,089	26,246
Curbing and flagging.....	434	12,135	264	7,610
Undistributed.....			2,483	39,669
Total dimension stone (quantities approximate in short tons).....	4,665	133,897	5,713	180,389
Crushed and broken stone:				
Riprap.....	60,777	83,464	(¹)	(¹)
Concrete, roadstone.....	4,181,379	5,693,864	5,930,823	8,982,647
Quartz (ground).....	15,500	112,750	(¹)	(¹)
Undistributed.....	165,666	565,752	262,265	877,399
Total crushed and broken stone.....	4,423,322	6,455,830	6,193,088	9,860,046
Grand total.....	4,427,987	6,589,727	6,198,801	10,040,435

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

² Includes values indicated by footnote 1.

³ Incomplete figure; portion not included is combined with "Undistributed." Includes railroad ballast.

⁴ Includes agricultural, flux, other crushed and broken stone, portion of concrete roadstone (1956), and values indicated by footnote 1.

⁵ To avoid disclosing confidential information total is incomplete and excludes dimension limestone.

METALS

Beryllium.—Output of beryl concentrate increased in quantity and value in 1957 as compared with 1956. The beryl as purchased by GSA averaged 12.50 percent BeO content.

Calcium.—Calcium metal was produced at Canaan by Nelco Metals Inc. the Nation's largest producer of calcium metal.

Columbium-Tantalum.—For the second consecutive year no sales of columbite-tantalite ores were reported in Connecticut.

Magnesium.—Magnesium metal was produced by Nelco Metals Inc. at the Canaan silicothermic plant.

METAL PROCESSING

Ferrous.—Carpenter Steel Company acquired the Northeastern Steel Corporation Bridgeport plant in November 1957, changed the name to Carpenter Steel of New England, Inc., and operated it as a subsidiary. Two electric furnaces with an annual capacity of 84,000 tons were in operation as of January 1, 1958, as the company discontinued operation of the 3 open-hearth furnaces.

Nonferrous.—Nonferrous-metal rolling mills consumed copper, lead, zinc, tin, and nickel to produce a variety of fabricated products. Also active during the year were aluminum, magnesium, calcium, and zinc-smelting plants.

MINERAL FUELS

Peat.—Peat was recovered from bogs in Hartford, Middlesex, and Tolland Counties and used chiefly as a soil conditioner.

REVIEW BY COUNTIES

Coverage of the sand and gravel canvass in the State was enlarged through cooperation of the Connecticut State Highway Department, which provided names, counties, and tonnages of local producers from which sand and gravel was purchased during the year. Noncommercial operators are not discussed by counties; but a considerable tonnage was produced, chiefly by the Connecticut State Highway Department, in every county except Fairfield and New London. The Hartford County Superintendent of Public Works reported an output of paving sand and gravel.

Fairfield.—Fifteen commercial sand and gravel operations, mostly bank-type operations scattered throughout the county, produced chiefly structural and paving sand and gravel. Production increased 1 percent, while the value of production rose 40 percent as average value per ton increased from \$1.09 in 1956 to \$1.50 in 1957. A dredge formerly operated by Ralph L. Vick Co. on the Five Mile River at New Canaan was sold in June to Calve Bros. Co. of Darien.

Connecticut Agstone Co., the only dimension-limestone producer in the State, produced dimension stone for rough construction use and crushed and broken stone for use as flux, agstone, and roadstone.

TABLE 4.—Value of mineral production in Connecticut, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Fairfield.....	(1)	(1)	Sand and gravel, stone.
Hartford.....	\$4, 130, 208	\$4, 405, 894	Stone, sand and gravel, clays, peat.
Litchfield.....	1, 535, 256	1, 615, 996	Stone, lime, sand and gravel.
Middlesex.....	470, 853	499, 659	Sand and gravel, clays, feldspar, peat, mica, gem stones.
New Haven.....	4, 009, 427	6, 431, 052	Stone, sand and gravel, clays, beryl, mica.
New London.....	358, 212	(1)	Stone, sand and gravel.
Tolland.....	(1)	(1)	Sand and gravel, peat.
Windham.....	461, 300	(1)	Sand and gravel, stone.
Undistributed.....	770, 744	3, 101, 975	
Total.....	11, 736, 000	16, 055, 000	

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

Hartford.—Although the total value of minerals produced increased 7 percent in 1957, Hartford County dropped to second place in the State. Basalt production increased 5 percent. Increased demand for traprock as roadstone was noted in certain areas. The Rocky Hill quarry of the New Haven Trap Rock Co., Inc., was idle for the second consecutive year.

Seventeen sand and gravel operations, concentrated in the southwestern section of the county and consisting mostly of fixed plants, were active. The sand and gravel output from these operations was used principally for structural and paving purposes. During the year Dunning Sand and Gravel Co., Inc., added a new crusher, and Materials Service, Inc., enlarged its screening facilities. Certified Sand Co. was dissolved April 30.

Hartford County, with six active producers, led in producing miscellaneous clay. The area around Berlin was the main source of the clay, which was used entirely for manufacturing building brick. County production decreased 7 percent, as demand for building brick slackened owing to the cement strike and lagging building activity.

Peat was produced from a bog near Manchester.

Litchfield.—Production of crushed limestone as reported by 3 producers decreased 9 percent in 1957, owing chiefly to a 36-percent decrease in output of crushed limestone for manufacturing lime. Other uses for crushed limestone included flux, agstone, whiting, asphalt filler, and stucco filler. The New England Lime Co., only lime producer in the State, reported decreased lime output during the year. The 24-percent decline can be traced directly to reduced demand for dolomitic lime for manufacturing magnesium metal. The company, operating 2 rotary kilns fired by fuel oil and 1 batch-type hydrator, operated at 66 percent of capacity. Building Materials, Inc., increased production of crushed basalt for concrete and roadstone 46 percent as demand for road-building material increased.

Sand and gravel output increased 23 percent, owing principally to increased canvass coverage—from 5 producers to 18. Structural and paving uses claimed the major part of production.

No output of beryl was reported in Litchfield County in 1957.

Nelco Metals, Inc., operated a silicothermic plant at Canaan and produced calcium and magnesium metal from lime provided by the New England Lime Co.

Middlesex.—The output of nine sand and gravel producers was used entirely for structural and paving purposes. Sebastian Ortisi, a former producer, was not in business in 1957.

Miscellaneous clay mined at an open pit near Middletown by the Michael Kane Brick Co. was used for manufacturing building brick.

The Worth Spar Co. recovered potash-type feldspar from an open pit at Cobalt, and Eureka Feldspar Mining & Milling Co., Inc., mined mixed potash-soda-type feldspar at the Hale mine near Portland. The output was ground locally and sold to soap, abrasives, and pottery manufacturers. Toll Gate Mining Co., a former feldspar and mica producer, was not in business in 1957.

Harry E. Leach produced a small quantity of full-trimmed mica at the Toll Gate quarry at Middletown for sale to the Government.

New Haven.—New Haven County resumed the leading position in value of total mineral production in the State, as 5 crushed basalt

producers operating 6 quarries reported a 74-percent increase in value of output. Basalt producers generally increased their output, particularly New Haven Trap Rock Co., operators of quarries near Wallingford and North Branford. Output expanded to meet the heavy demand caused by construction of the Connecticut Turnpike.

The county also led the State in the value of sand and gravel production, with output by 21 producers. Structural and paving uses consumed most of the product, the major portion of which was mined in the southern part of the county near New Haven and Milford.

North Haven Brick Co., the only clay producer in the county, mined miscellaneous clay from an open pit near Hamden for use as lightweight aggregate and for manufacturing building brick.

Output of beryl was reported by only one producer, Burritt R. Curtis, at the Southford quarry, Southbury. Beryl was sold to the Government through the GSA Franklin, N. H., Depot.

National Gypsum Co. purchased the Adamant Plaster Co. New Haven plant and announced plans to expand plant operations to include other gypsum building products such as sheathing and roof deck.

New London.—Sand and gravel was produced by 10 operators with mining operations paralleling the Thames River and its northern tributaries. Structural and paving sands were the leading types produced.

Lantern Hill Silica Co. quarried quartz near North Stonington and produced ground material, chiefly for manufacturing glass. Golden Pink Granite Quarry and E. Locarno & Sons quarried dimension granite at Niantic for monuments and mausoleums. The Millstone Granite Quarry, Inc., produced both dimension and crushed granite at Waterford. The Barrett Division of Allied Chemical & Dye Corp. in its first full year of operation mined a large tonnage of crushed granite for use as concrete aggregate and roadstone from a quarry near Montville.

Tolland.—The Connecticut State Highway Department reported output of sand and gravel in Tolland County, both by its own crews and by purchases from independent contractors.

Windham.—Structural and paving sand and gravel and gravel for railroad ballast were produced in 1957. Dunning Sand & Stone Co., principal producer in the county, operated an open pit and a processing plant, including crushing, washing, and sizing units.

R. B. Marriott & Sons produced dimension granite from a quarry at Oneco for rough construction and curbing use.

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. Thomson¹



DELAWARE mineral production in 1957 decreased 15 percent in value compared with 1956. All three commodities—sand and gravel, stone, and clay—declined in value of output mainly from a drop in demand for construction materials.

In addition to the mineral producers, other segments of the mineral industry were active in 1957. Colorado Fuel & Iron Corp. operated its open-hearth steel plant at Claymont. The annual steel capacity for this plant at the end of the year was 506,500 net tons, an increase of 7,000 net tons from the previous year. Ferrous scrap dealers were active in Wilmington, Dover, and Smyrna. Shipments from yards in 1957 consisted principally of No. 1 and No. 2 heavy melting steel, bundles, and cast-iron scrap other than borings.

Various petroleum commodities were produced at two refineries in 1957.

TABLE 1.—Mineral production of Delaware, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Sand and gravel.....	1, 159, 544	\$967	974, 014	\$860
Stone.....	81, 503	232	(?)	(?)
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 2.....		33		182
Total Delaware.....		1, 232		1, 042

¹ Production as measured by mine shipments, sales, and marketable production (including consumption by producers).

² Figure withheld to avoid disclosing individual company confidential data.

¹ Acting chief, Division of Mineral Industries, Region V, Bureau of Mines, Pittsburgh, Pa.

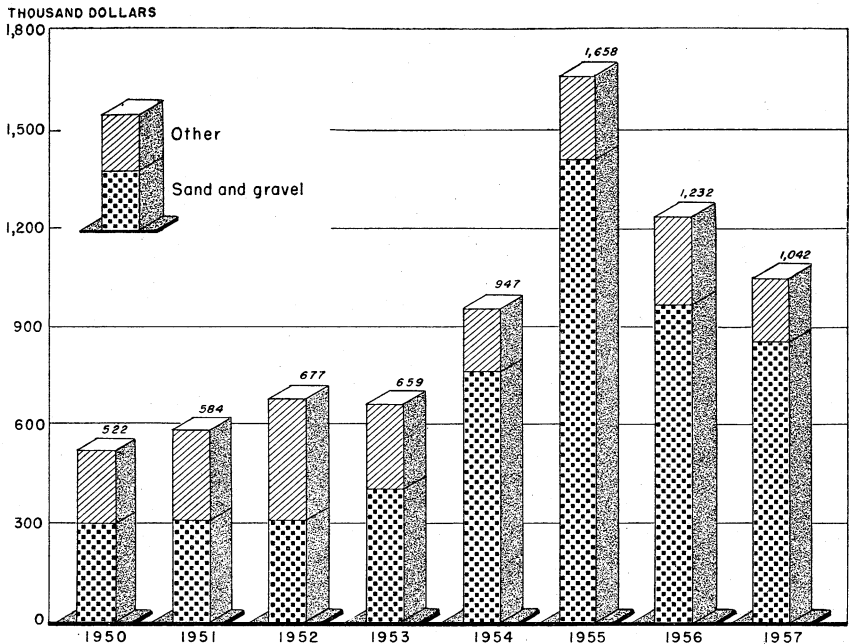


FIGURE 1.—Value of mineral production in Delaware, 1950-57.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of clays continued downward, owing mainly to declining residential building. Miscellaneous clay produced in Kent and New Castle Counties in 1957 was used in building brick.

Sand and Gravel.—Sand and gravel production, the principal mineral industry in Delaware, decreased owing mainly to the declining demand for structural and paving materials. Approximately 19 percent less sand and gravel was marketed as structural material in 1957 than in 1956 and about 10 percent less as paving material. Sand was marketed for commercial use as structural and paving material and engine sand; gravel was sold as structural and paving material and for other uses. Forty-nine percent of the sand and gravel was washed or screened, and 68 percent of the output was transported by truck.

Stone.—Granite was the only stone produced in Delaware in 1957; production was less than in the preceding year. The demand for crushed stone for highway construction declined slightly in 1957; demand for granite decreased greatly. This was brought about through greater shipments of limestone and basalt from outside the State.

REVIEW BY COUNTIES

Kent.—Sand and gravel was produced near Dover and Milford and processed principally as building material. Overall production of sand and gravel increased approximately 11 percent over the previous year's production.

J. H. Wilkerson & Son produced miscellaneous clay for use in building brick from an open pit 6 miles west of Harrington.

New Castle.—New Castle County in 1957 continued to lead the State in mineral production supplying approximately 75 percent of the total value.

Sand and gravel was produced in the northern part of the county, a few miles west of the Delaware River. Petrillo Bros., Inc., produced washed sand and gravel for building purposes and a quantity of bank gravel for fill. The fixed plant of this company was at Minquadale. Parkway Gravel, Inc., produced gravel as paving material from a pit near Hares Corner.

Petrillo Bros., Inc., produced and crushed granite from a quarry near Wilmington for use as aggregate for ready-mix concrete. The company used 3 benches averaging 60 feet in height and 50 feet in width at its quarry.

Clay was produced near New Castle from an open pit and was used for building brick.

Various petroleum products were produced at two refineries in 1957. The Texas Co. operated its asphalt refinery at Claymont and Tidewater Oil Co. and its skimming and cracking plant at Delaware City.

Sussex.—Sand and gravel was produced from pits near Lewes. Paving sand and gravel was produced by Henry G. Graves & Sons. Lewes Sand Co. produced engine sand, shipping it by rail to consumers.

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 James L. Valley¹ and Robert O. Vernon²



MINERAL production in Florida declined 3 percent to \$136 million from the recordbreaking output of \$140.5 million in 1956. The value of phosphate-rock production declined (\$9.5 million) 13 percent; titanium concentrates, 7 percent; monazite, 34 percent; and zirconium concentrate, 9 percent; and although clays, sand and gravel, stone, and petroleum were higher, the State total was \$4.5 million less than in 1956.

Florida led the States in producing phosphate rock and zircon, ranked second in output of monazite and titanium concentrates, and stood third in peat production. Leading industries were mining and processing phosphate rock, quarrying limestone, and manufacturing cement.

TABLE 1.—Mineral production in Florida, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays.....	432	\$5,826	422	\$6,067
Gem stones.....	(²)	(³)	(²)	(³)
Lime.....	40	490	(⁴)	(⁴)
Natural gas..... million cubic feet..	35	3	40	3
Peat.....	58	203	38	195
Petroleum..... thousand 42-gallon barrels..	479	(⁴)	461	(⁴)
Phosphate rock..... thousand long tons..	11,822	74,290	10,191	64,789
Sand and gravel.....	5,815	5,033	6,753	6,148
Stone.....	18,779	25,183	21,786	30,167
Titanium concentrates.....	284	6,651	263	6,204
Zirconium concentrate.....	44	2,160	57	1,976
Value of items that cannot be disclosed: Cement, abrasive garnet (1956), rare-earth metals concentrates, staurolite (1957), and values indicated by footnote ⁴		21,802		22,514
Total Florida⁵.....		140,490		136,026

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 The total has been adjusted to eliminate duplicating the value of clays and stone.

¹ Commodity-industry analyst, Knoxville Field Office, Region V, Bureau of Mines, Knoxville, Tenn.

² Director, Florida Geological Survey, Tallahassee, Fla.

TABLE 2.—Average unit value of mineral commodities in Florida, 1948-52 (average) and 1953-57

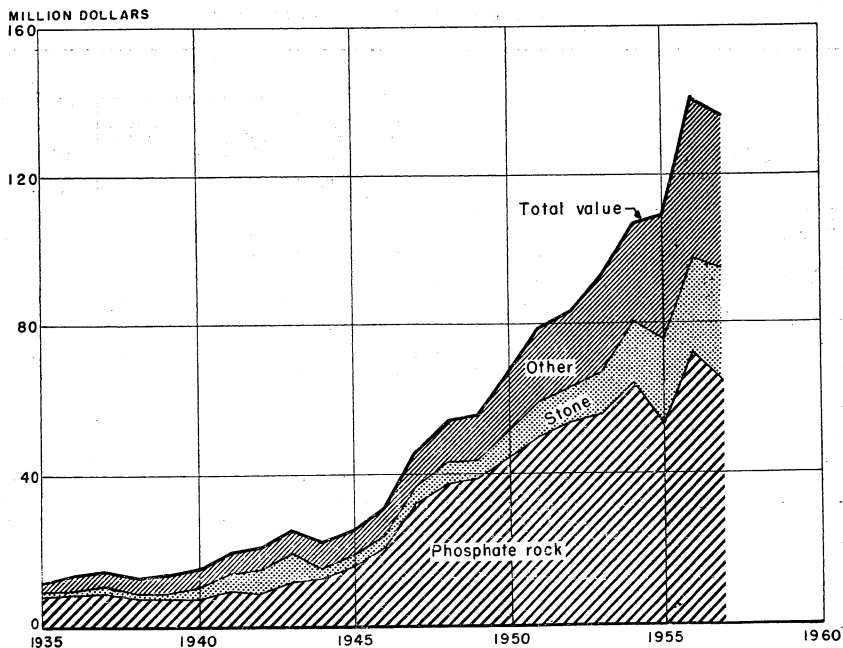
Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Cement:						
Masonry.....376-pound barrel..	(1)	(1)	(1)	\$3.78	\$4.03	\$4.16
Portland.....do.....	\$2.57	\$2.87	\$2.89	2.96	3.21	3.34
Clays:						
Fuller's earth.....short ton.....	17.18	18.84	19.82	21.46	22.37	24.34
Kaolin.....do.....	22.73	23.92	24.49	23.09	25.24	26.03
Miscellaneous.....do.....	.82	1.00	.78	1.03	1.05	1.02
Garnet (abrasive).....do.....	42.25	46.49	30.00	60.69	25.00	-----
Lime.....do.....	12.95	12.57	11.97	12.03	12.39	12.51
Natural gas.....thousand cubic feet.....	.06	.06	.08	.11	2.09	3.08
Peat.....short ton.....	5.42	6.70	4.49	3.79	3.47	5.15
Phosphate rock.....long ton.....	5.76	6.06	6.18	6.13	6.28	6.34
Sand and gravel:						
Gravel.....short ton.....	1.23	1.27	1.50	1.51	1.43	1.47
Sand.....do.....	.82	.82	.71	.76	.77	.77
Staurolite.....do.....	-----	3.57	4.40	4.75	4.50	4.21
Stone:						
Limestone:						
Crushed.....do.....	1.19	1.20	1.25	1.31	1.30	1.39
Dimension.....do.....	9.74	9.00	2.53	143.96	32.26	30.66
Shell.....do.....	-----	-----	-----	2.28	2.03	1.34
Titanium:						
Ilmenite.....do.....	15.41	15.37	15.36	18.97	(4)	(4)
Rutile.....do.....	59.09	108.54	119.05	122.20	(4)	(4)
Zircon.....do.....	43.42	37.38	45.66	49.31	49.31	34.78

1 Data not available.

2 Revised figure.

3 Preliminary figure.

4 Figure withheld to avoid disclosing individual company confidential data.

**FIGURE 1.**—Value of phosphate rock and stone and total value of mineral production in Florida, 1935-57.

EMPLOYMENT AND INJURIES

Reports submitted to the Bureau of Mines indicate that employment in the mineral industries increased 8 percent above 1956. Employment increased 40 percent for quarries and mills and 9 percent for sand and gravel mines but decreased 3 percent for nonmetal mines and 8 percent for metal mines. Most companies worked a regular 5-day week, although cement mills worked continuously.

Injury experience was worse than in 1956, as the frequency rate increased 28 percent over 1956—51 percent for nonmetal mines and 3 percent for quarries and mills. It decreased 21 percent for metal mines. Three fatalities occurred compared with 4 in 1956 and 1 in 1955.

CONSUMPTION, TRADE, AND MARKETS

Florida's construction minerals, limestone, shell, and sand and gravel, together with cement and lime, were marketed almost exclusively within the State. Crude gypsum, perlite, and vermiculite produced elsewhere were processed in Florida for local consumption. Fuller's earth, kaolin, titanium and zirconium concentrates were shipped out of the State for further processing and consumption. Phosphate rock was processed into ordinary and triple superphosphate, elemental phosphorus, and phosphoric acid and marketed throughout the United States. Over 2.6 million tons of dried phosphate rock, 25 percent of the State's marketable production, was exported.

Unit values of most minerals produced in the State in 1957 were higher than 1956. Exceptions were miscellaneous clay, natural gas (estimated), staurolite, dimension limestone, shell, and zircon.

TRENDS AND DEVELOPMENTS

The phosphate industry continues to expand. During the year two new superphosphate-plant improvements to produce powdered superphosphate were under construction. International Minerals & Chemical Corp. contracted to supply more than 10,000 tons of fluosilicic acid (a byproduct of processing phosphate rock) to Kaiser Aluminum & Chemical Corp. Kaiser planned to convert the fluosilicic acid into sodium silicofluoride at a new plant in Mulberry for shipment to Louisiana for final processing into synthetic cryolite.³ The Virginia-Carolina Chemical Corp. byproduct uranium-from-phosphate plant at Nichols was found to be uneconomical. Plans for a new plant to produce lightweight aggregate at Bartow from phosphate slimes to cost \$250,000 were announced. Also announced was immediate construction at Tampa of a \$2-million electric steel-rolling mill; locally obtained scrap will be melted by the new electrical process to produce 35,000 tons of reinforcing bars and merchant bars annually. Interest continues in exploration for titanium minerals; the Union Carbide & Carbon Corp. new dredge and plant on Amelia Island was the chief development in this field. Construction of two new cement plants near Miami will guarantee ample supply of this material for the State's needs for several years. A new natural-gas pipeline which will be constructed to serve the State has been author-

³ Mining Congress Journal, vol. 43, No. 12, December 1957, p. 79.

ized. At present only the northwestern part of the State has natural-gas service except for the small production in Collier County.

TABLE 3.—Employment in the mineral industries, 1955–57

Industry	1955			1956			1957 ¹		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Nonmetal mines.....	1,640	284	465,523	3,068	295	906,248	3,193	274	875,236
Quarries and mills.....	1,895	284	537,521	1,334	294	391,501	1,959	279	546,676
Oil and gas.....	1,175	256	300,819	593	256	151,516	(?)	(?)	(?)
Metal mines.....	391	293	114,497	423	300	126,838	416	279	116,138
Sand and gravel mines.....	‡ 292	‡ 275	‡ 80,335	‡ 328	‡ 279	‡ 91,578	368	271	99,875
Total.....	5,393	278	1,498,695	5,746	290	1,667,771	5,936	276	1,637,925

¹ Preliminary figures.

² Data not available.

³ Excluding Government-and-contractor operations.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The value of cement production was little changed from 1956. Portland cement decreased 4 percent in tonnage and less than .5 percent in value. Masonry cement declined 1 percent in tonnage but increased 3 percent in value. Construction of two new cement plants west of Miami was in progress at the end of the year, and both were expected to operate in 1958. Their combined capacity will increase the State's total by 4.5 million barrels. The expansion program at Lehigh Portland Cement plant at Bunnell was described.⁴

Clays.—Production of clay was 422,000 tons valued at \$6.1 million—2 percent less in tonnage but 4 percent higher in value than in 1956. Fuller's earth totaled 223,000 tons valued at \$5.4 million—a decline of 2 percent in tonnage but 6 percent higher in value. Kaolin and miscellaneous clay declined in both tonnage and value; kaolin decreased 16 percent in tonnage and 13 percent in value and miscellaneous clay, 1 and 4 percent in tonnage and value, respectively. Fuller's earth was mined in Gadsden County, kaolin in Putnam, and miscellaneous clay in Citrus and Gadsden Counties.

Gypsum.—Imported crude gypsum was calcined and used in manufacturing building products by the United States Gypsum Co. at Jacksonville.

Lime.—Production and value of lime were lower than in 1956. The City of Miami and Dixie Lime Products Co. were the only producers.

Perlite.—Crude perlite shipped from Western States was expanded for use as a lightweight aggregate and building plaster by three companies at plants in Hialeah, Jacksonville, and Vero Beach. Production of the expanded material increased 15 percent and 25 percent in tonnage and value, respectively.

⁴ Rock Products, Cement Plant Expands: Vol. 60, No. 6, June 1957, pp. 90-93, 174-177.

TABLE 4.—Injuries in the mineral industries, 1955-57

Industry	1955				1956				1957 ¹			
	Fatal	Nonfatal	Total	Injuries per million man-days	Fatal	Nonfatal	Total	Injuries per million man-days	Fatal	Nonfatal	Total	Injuries per million man-days
Metal mines.....	7	7	14	61	2	11	13	87	2	8	10	69
Nonmetal mines.....	25	25	50	54	46	46	92	53	2	68	70	80
Oil and gas.....	30	30	60	100	13	13	26	86	(²)	(²)	(²)	(²)
Quarries and mills.....	1	158	159	296	2	94	96	245	1	137	138	252
Sand and gravel mines.....	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	1	48	49	480
Total.....	1	220	221	156	4	164	168	107	3	261	264	161

¹ Preliminary figures.
² Data not available.

Phosphate Rock.—Florida was the leading State in phosphate-rock production, 73 percent of the Nation's output in 1957. Marketable production was 10.2 million tons valued at \$64.8 million, a decrease of 14 percent in tonnage and 13 percent in value from 1956. Phosphate rock sold or used by producers, however, increased 1 percent and 4 percent in tonnage and value, respectively, over 1956, totaling 10.6 million tons valued at \$67.9 million.

Land-pebble phosphate comprised more than 98 percent of the total production; output came from 8 companies at 15 mines in Polk and Hillsborough Counties. American Cyanamid Co. began producing at the new Orange Park mine washer and flotation plant, 4 miles north of Lakeland, to replace the Saddle Creek mine that was depleted and closed early in the year. Large-scale plant improvements and additions were undertaken by several pebble-phosphate companies during the year, including new triple-superphosphate plants of American Cyanamid at Brewster and International Minerals & Chemical Co. at Bonnie. Several articles on Florida's phosphate industry were published during the year.⁵

Hard-rock phosphate decreased 17 percent in tonnage and 15 percent in value. Kibler-Camp Phosphate Enterprises in Citrus County was the only producer. Most hard-rock production was used for elemental phosphorus.

Soft-rock production was 14 percent lower in tonnage but only 3 percent lower in value. Output came from 5 producers in Citrus County and 1 producer at mines in Columbia and Gilchrist Counties. Soft-rock phosphate was used for stock and poultry feed and direct application to the soil.

TABLE 5.—Marketable production of phosphate rock, 1948-52 (average) and 1953-57

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)
1948-52 (average).....	58	\$445	80	\$403	7,836	\$45,065	7,974	\$45,913
1953.....	68	537	77	474	9,186	55,513	9,331	56,524
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

Sand and Gravel.—Sand and gravel ranked fifth as a mineral in the State in value and was produced at a record new high for the third consecutive year—6.8 million tons valued at \$6.1 million, gains of 16 percent in tonnage and 22 percent in value. Both sand and gravel

⁵ Rock Products, vol. 60, No. 1, January 1957, pp. 115-120. Chemical Week, vol. 80, No. 18, May 4, 1957, pp. 66-72. Farm Chemicals, vol. 120, No. 8, August 1957, pp. 49-52. Mining Congress Journal, vol. 43, No. 10, October 1957, pp. 60-64, 108. Engineering and Mining Journal, vol. 158, No. 12, December 1957 pp. 81-83.

TABLE 6.—Phosphate rock sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Long tons	Value	Long tons	Value
Ordinary superphosphate.....	5,024,144	\$32,674,165	4,611,066	\$29,391,573
Triple superphosphate ¹	1,534,209	9,663,519	1,812,717	11,360,500
Elemental phosphorus, ferrophosphorus, phosphoric acid.....	700,871	4,248,603	704,699	4,457,547
Direct application to soil.....	637,400	4,146,704	622,663	3,984,106
Stock and poultry feed.....	228,745	1,485,493	279,950	1,807,331
Other uses.....	7,740	50,387	8,000	50,229
Exports.....	2,394,661	13,333,426	2,604,787	16,894,649
Total.....	10,527,770	65,602,297	10,643,882	67,945,935

¹ Rock for phosphoric acid (wet process) included with triple superphosphate.

increased in tonnage and value—the latter more than 50 percent. Thirty-one operators were actively producing sand in 14 counties; 4 of these companies also produced gravel in Dade, Escambia, Gadsden, and Putnam Counties. Sand and gravel was used principally for building and paving; small tonnages were classified as blast, engine, filter and molding sands, and railroad ballast.

TABLE 7.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Sand		Gravel		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948-52 (average).....	(¹)	(¹)	(¹)	(¹)	3,185	\$3,053
1953.....	3,386	\$2,760	345	\$439	3,731	3,199
1954.....	3,202	2,261	266	400	3,468	2,661
1955.....	(¹)	(¹)	(¹)	(¹)	5,066	4,349
1956.....	(¹)	(¹)	(¹)	(¹)	5,815	5,033
1957.....	5,424	4,198	1,329	1,950	6,753	6,148

¹ Figure withheld to avoid disclosing individual company confidential data.

Staurolite.—Staurolite was recovered as a byproduct in concentrating titanium minerals and marketed principally as an iron and aluminum additive in making portland cement; a small quantity was used for sandblasting monumental stone. Staurolite production is included for the first time in 1957 in the total of the State's mineral production.

Stone.—Total stone production, including shell and limestone used for cement and lime, continued to rise and exceeded 1956 production 16 percent in tonnage and 21 percent in value, totaling 21.8 million tons valued at \$30.5 million. Dimension limestone made up only 1 percent of the production value, crushed limestone 92 percent, and shell the remaining 7 percent.

Crushed stone was produced at 66 quarries in 21 counties by 49 companies and 1 county highway department.

TABLE 8.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	(1)	(1)	(1)	(1)	(1)	(1)
Paving.....	(1)	(1)	(1)	(1)	1,029,795	\$902,312
Railroad ballast.....	(1)	(1)	(1)	(1)	23,314	20,257
Engine.....	10,825	\$5,600	-----	-----	10,825	5,600
Filter.....	(1)	(1)	-----	-----	(1)	(1)
Other.....	(1)	(1)	(1)	(1)	4,750,752	4,105,306
Total.....	(1)	(1)	(1)	(1)	5,814,686	5,033,475

Use	1957					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	4,474,332	\$3,519,949	¹ 1,329,436	² \$1,949,977	² 5,803,768	² \$5,469,926
Paving.....	601,685	478,340	(³)	(³)	³ 601,685	³ 478,340
Railroad ballast.....	-----	-----	-----	-----	-----	-----
Engine.....	7,000	3,500	-----	-----	7,000	3,500
Filter.....	2,465	2,960	-----	-----	2,465	2,960
Other.....	338,361	193,148	-----	-----	338,361	193,148
Total.....	5,423,843	4,197,897	1,329,436	1,949,977	6,753,279	6,147,874

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes paving gravel.

³ Excludes paving gravel.

TABLE 9.—Crushed limestone sold or used by producers, 1948-52 (average), and 1953-57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948-52 (average) ¹	6,012	\$7,147	1955.....	16,304	\$21,312
1953 ¹	9,429	11,309	1956 ²	18,774	25,030
1954.....	14,225	16,832	1957 ²	21,776	30,144

¹ Excludes limestone for cement and lime.

² Includes shell.

TABLE 10.—Crushed limestone and shell sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Concrete and roadstone.....	14,308,602	\$19,373,986	18,109,420	\$24,553,343
Agriculture.....	594,198	1,721,388	588,655	1,634,349
Railroad ballast.....	35,030	34,868	-----	-----
Other.....	3,836,050	3,899,630	3,077,802	3,906,134
Total.....	18,773,880	25,029,872	21,775,877	30,143,826

Dimension stone was quarried by 4 companies in 3 counties, and shell was dredged in 5 counties by 4 producers.

METALS

Rare-Earth Metals.—Monazite production was 22 percent higher in tonnage but 34 percent lower in value than in 1956. Humphreys Gold Corp. was the only producer, recovering monazite as a byproduct in concentrating titanium minerals.

Titanium Concentrates.—Production of titanium concentrates—ilmenite and rutile—totaled 263,000 tons valued at \$6.2 million, a decrease of 7 percent in tonnage and value from 1956. Ilmenite tonnage and value decreased more than 5 percent and rutile over 10 percent. Humphreys Gold Corp. produced a mixed titanium concentrate, zircon, and staurolite at the Highland and Trail Ridge dredges and concentration plants in Clay County for E. I. du Pont de Nemours & Co., Inc. Humphreys also recovered ilmenite, rutile, and zircon at a dredge and concentrating plant for the Rutile Mining Co. of Florida at Jacksonville. Florida Minerals Co. produced ilmenite, rutile, and zircon from sands mined in Indian River County. E. I. du Pont de Nemours & Co., Inc., announced that the Trail Ridge and Highland plants would be operated by Du Pont when the 10-year contract with Humphreys Gold, Inc., expires in February, 1958.

Union Carbide & Carbon Corp. announced plans for mining and concentrating titanium sands on a 3,000 acre tract on Amelia Island, 30 miles northeast of Jacksonville. Production will begin in 1958. Nuclear Magnetic Mining, Inc., merged with the Chesapeake and Colorado Corp. in December and expected to begin producing titanium concentrates in 1958. Heavy Minerals Co. has a new titanium mining plant in Walton County at Panama City.

Zircon.—Production of zircon in 1957 was 57,000 tons valued at \$2 million, a 30-percent increase in tonnage but 9 percent lower in value. Zircon was obtained as a byproduct in concentrating ilmenite and rutile from heavy sands at the Trail Ridge and Highland plants of Humphreys Gold Corp., the National Lead plant at Jacksonville, and the Florida Minerals Co. plant.

Columbia National Corp. was constructing a \$7.5 million plant for producing zirconium near Pensacola. Zircon concentrate produced in Florida was to be used in the plant.

MINERAL FUELS

Natural Gas.—Production of natural gas in Collier County was about the same as in 1956.

Peat.—Peat produced chiefly for agricultural purposes dropped to 38,000 tons valued at \$195,000, 35 percent lower in tonnage but only 4 percent less in value than in 1956. Production came from Hillsborough, Orange, Palm Beach, and Putnam Counties.

Petroleum.—Crude-petroleum production, all from Collier County, declined 4 percent in quantity but increased 8 percent in value.

REVIEW BY COUNTIES

Mineral production was recorded from 38 of 67 counties in Florida. Limestone was produced in 21 counties, sand and gravel in 14, phosphate rock in 5, and both clays and titanium minerals in 3 counties. The five leading counties, in the order of production value, were Polk, Hillsborough, Flagler, Dade, and Hernando.

Alachua.—Crushed limestone was quarried for concrete aggregate and roadstone by Newberry Corp., Ocala Lime Rock Co., and Williston Shell Rock Co. (2 quarries). Production was considerably below 1956.

Bay.—Cato Sand Co. produced 73,000 tons of building sand.

Broward.—Broward County ranked third in the State as a limestone producer; its output of 5 million tons of crushed limestone valued at \$5.7 million was an increase of 30 percent in tonnage and 20 percent in value above 1956. Eleven companies operated 14 quarries, the same as in the preceding year. The principal producers were: Deerfield Rock Corp., Hollywood Quarries, Maule Industries, Inc., and Meekins, Inc.

TABLE 11.—Value of mineral production in Florida, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Alachua.....	\$682, 276	(²)	Limestone.
Bay.....	(²)	\$59, 319	Sand.
Brevard.....	(²)	-----	-----
Broward.....	³ 4, 768, 434	5, 709, 913	Limestone.
Citrus.....	1, 595, 640	2, 431, 487	Limestone, phosphate rock, clays.
Clay.....	(²)	(²)	Ilmenite, zircon, staurolite.
Collier.....	(²)	1, 994, 864	Limestone, petroleum, natural gas.
Columbia.....	(²)	(²)	Phosphate rock.
Dade.....	8, 432, 010	9, 653, 675	Limestone, sand and gravel, lime, gem stones.
Duval.....	(²)	(²)	Rutile, ilmenite, zircon, monazite.
Escambia.....	282, 500	265, 944	Sand and gravel.
Flagler.....	(²)	(²)	Cement, limestone.
Gadsden.....	5, 398, 184	(²)	Clays, sand and gravel.
Gilchrist.....	(²)	(²)	Phosphate rock.
Hamilton.....	(²)	-----	-----
Hernando.....	5, 089, 461	6, 233, 659	Limestone.
Hillsborough.....	³ 21, 506, 358	19, 899, 754	Cement, phosphate rock, shell, peat, and gem stones.
Indian River.....	(²)	(²)	Rutile, zircon, ilmenite, sand.
Jackson.....	7, 256	(²)	Limestone.
Lafayette.....	190, 867	195, 369	Limestone, sand.
Lake.....	(²)	(²)	Sand.
Lee.....	-----	(²)	Limestone.
Leon.....	58, 918	52, 209	Sand.
Levy.....	1, 218, 820	1, 305, 721	Limestone.
Manatee.....	(²)	(²)	Limestone, shell.
Marion.....	1, 530, 592	(²)	Limestone, lime.
Monroe.....	504, 244	(²)	Limestone.
Orange.....	(²)	78, 957	Peat.
Osceola.....	(²)	-----	-----
Palm Beach.....	³ 180, 942	174, 595	Limestone, peat, sand.
Pasco.....	-----	109, 458	Limestone, shell.
Pinellas.....	141, 303	(²)	Oystershell, sand, limestone.
Polk.....	67, 927, 448	58, 404, 358	Phosphate rock, sand.
Putnam.....	³ 1, 246, 629	1, 261, 098	Sand, clays, peat.
St. Johns.....	(²)	(²)	Limestone.
St. Lucie.....	-----	-----	-----
Sarasota.....	⁴ 453, 820	(²)	Limestone.
Sumter.....	(²)	170, 000	Do.
Suwannee.....	(²)	(²)	Do.
Volusia.....	17, 858	(²)	Sand.
Walton.....	-----	(²)	Oystershell.
Washington.....	26, 000	6, 267	Sand.
Undistributed ⁵	⁴ 19, 229, 769	28, 019, 353	-----
Total Florida.....	140, 490, 000	136, 026, 000	-----

¹ The following counties are not listed because no production was reported: Baker, Bradford, Calhoun, Charlotte, De Soto, Dixie, Franklin, Glades, Gulf, Hardee, Hendry, Highlands, Holmes, Jefferson, Liberty, Madison, Martin, Nassau, Okaloosa, Okeechobee, Santa Rosa, Seminole, Taylor, Union, and Wakulla.

² Figure withheld to avoid disclosing individual company confidential data. Included with "Undistributed."

³ Excludes value of peat in 1956, included with "Undistributed."

⁴ Revised figure.

⁵ Includes values indicated by footnote 2 and value of peat in Broward, Hamilton, Hillsborough, Orange, Palm Beach, and Putnam Counties in 1956.

TABLE 12.—Crushed limestone sold or used by producers in Broward County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	659,861	\$588,582	1955.....	3,342,348	\$3,861,095
1953.....	1,893,827	2,024,771	1956.....	3,883,288	4,768,434
1954.....	2,434,387	2,433,638	1957.....	5,035,512	5,709,363

Citrus.—The production of soft phosphate rock was 48,000 tons valued at \$341,000—an increase of 1 percent in tonnage but 13 percent in value. Producers were Camp Phosphate Co., Kellogg Co., Soil Builders, Inc., Sun Phosphate Co., and Superior Phosphate Co.

Kibler-Camp Phosphate Co. produced 80,000 tons of hard phosphate rock valued at \$689,000, decreases of 16 percent in tonnage and 15 percent in value from 1956.

General Portland Cement Co. mined clay and limestone for use in its cement mill at Tampa.

Clay.—Titanium concentrates and byproduct staurolite and zircon were produced by Humphries Gold Corp. at the Trail Ridge and Highland plants of E. I. du Pont de Nemours & Co., Inc. Production and value exceeded 1956 by 7 percent.

Collier.—Although crude-petroleum output from the Sunniland field decreased from 479,000 barrels to 461,000 barrels its value rose 8 percent above 1956. Natural-gas production was about the same. Industrial Limerock opened a new quarry and with Sunniland Limerock Co. crushed stone for aggregates and roadstone.

Columbia.—Loncala Phosphate Co. produced soft rock phosphate at the Fort White mine and was the only mineral producer in the county.

Dade.—Dade County continued to rank fourth in the State as a mineral producer; the total production value was \$9.7 million compared with \$8.4 million in 1956. Crushed stone totaled \$7.2 million, 74 percent of the county total. At the end of the year 5 producers were active at 8 quarries in the county compared with 8 companies and 13 quarries in 1956. Three Bays Improvement Co. acquired Troup Quarries, Inc., and had two active quarries when the year closed; it had abandoned Section 2 quarry in July. Maule Industries, Inc., abandoned the Ojus quarry in July but had three other active quarries. Other active companies were Naranja Rock Co., Oolite Rock Co., and Seminole Rock Products Co.

The City of Miami recovered 24,000 tons of lime as a byproduct of water purification—virtually the same as in 1956.

TABLE 13.—Crushed limestone sold or used by producers in Dade County, 1948-52 (average), and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	2,807,425	\$3,091,355	1955.....	4,913,760	\$6,680,940
1953.....	4,038,367	3,805,333	1956.....	4,517,382	6,820,809
1954.....	5,193,757	6,622,989	1957.....	4,794,634	7,237,530

Producers of sand were Des Rochers Sand Co., Inc., Ideal Crushed Stone Co., and T. J. James Construction Co., Inc.

Perlite, Inc., expanded western perlite at Hialeah for use as light-weight aggregate. Gem material in the form of calcite was reported by the Rock & Shell Shop.

Duval.—Ilmenite, rutile, and byproduct monazite and zircon were recovered in the Humphreys Gold Corp. mill near Jacksonville from sands dredged by the Rutile Mining Co. of Florida; the total production value was 10 percent below 1956. Tennessee Products & Chemical Corp. expanded perlite, Zonolite Co. exfoliated vermiculite, and United States Gypsum Co. calcined gypsum; all crude minerals used in these plants were shipped into the State.

Escambia.—Campbell Sand & Gravel Co., Clark Sand Co., and Word Gravel Co. produced building sand and gravel; production was 131,000 tons valued at \$93,000.

Flagler.—The county remained the third most important in mineral production in the State, owing to its output of cement by Lehigh Portland Cement Co. Coquina (limestone) mined in the county was used in the cement plant at Bunnell.

Gadsden.—Fuller's earth production was 223,000 tons valued at \$5.4 million—a decrease of 2 percent in tonnage and an increase of 6 percent in value. Three companies were active during the year: Floridin Co., Inc., Minerals & Chemical Corp. of America, and Magnet Cove Barium Corp. Appalachee Correctional Institute mined 14,000 tons of clay for use in manufacturing heavy clay products, and Florida Gravel Co. mined sand and gravel for building and paving use.

Gilchrist.—The Loncala Phosphate Co. mined soft phosphate rock, the only mineral produced in the county.

Hernando.—Crushed limestone production totaled 3.4 million tons valued at \$6.2 million, an increase of 6 percent in tonnage and 22 percent in value above 1956. Florida Rock Products operated the new Diamond Hill quarry and the Lansing quarry. Other producers were Brooksville Rock Co. (Broco quarry), Camp Concrete Rock Co. (Gay quarry), and Wm. P. McDonald Corp. of Florida (Conrock quarry).

TABLE 14.—Crushed limestone sold or used in Hernando County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	951, 100	\$1, 658, 038	1955.....	3, 706, 520	\$5, 579, 106
1953.....	1, 503, 297	2, 426, 951	1956.....	3, 233, 594	5, 089, 461
1954.....	2, 117, 071	3, 214, 713	1957.....	3, 378, 139	6, 233, 659

Hillsborough.—Hillsborough ranked second in the State as a mineral producer. Phosphate rock was produced by American Agricultural Chemical Co. at Boyette and by American Cyanamid Co. at Sydney. General Portland Cement Co. manufactured masonry and portland cement at its Tampa mill, and Bay Dredging & Construction Co. dredged oystershell. Peat was also produced in the county in 1957.

Zonolite Co. exfoliated vermiculite at a plant in Tampa.

Indian River.—Florida Minerals Co. mined heavy sands containing ilmenite, rutile, and zircon at the Vero mine and shipped them to the

Palm Bay plant for concentration and separation. Ben Walker mined structural sand and Airlite Processing Corp. of Florida expanded raw perlite shipped into the State for use in lightweight concrete and plaster.

Jackson.—Marjax Co. quarried limestone for agricultural use.

LaFayette.—Williston Shell Rock Co. quarried 170,000 tons of limestone from the Dell quarry for concrete and roadstone. Suwannee River Sand Co. produced 37,000 tons of paving sand.

Lake.—Central Sand Co. produced structural and paving sand from its pit near Tavares.

Lee.—West Coast Rock Co. crushed limestone for concrete and roadstone at its quarry south of Fort Myers.

Leon.—Asa Paige Sand Co. and Middle Florida Sand Co. were the only mineral producers in the county.

Levy.—Production of crushed limestone increased 11 percent in tonnage and 7 percent in value over 1956. Producers were Connell & Schultz, Dixie Lime Products Co., Levy County Lime Rock Co., United Limerock Co., Chas. E. Peacock, and W & M Construction Co.

TABLE 15.—Crushed limestone sold or used by producers in Levy County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	225,360	\$385,445	1955	756,964	\$958,230
1953.....	320,415	651,311	1956	947,521	1,218,820
1954.....	(¹)	(¹)	1957	1,054,541	1,305,721

¹ Figure withheld to avoid disclosing individual company confidential data.

Manatee.—Southern Dolomite Co. and Manatee Dolomite Co. crushed limestone for agricultural use. Burkhart Quarry & Supplies Co. quarried rough architectural stone at the limestone quarry formerly operated by the Bradenton Stone Co. Florida Travertine Co. produced rubble, dressed stone, and flagging. Bradenton Dredging & Shell Co. produced oystershell for concrete and road material.

Marion.—Production of crushed limestone in the county increased 37 percent in tonnage and 20 percent in value over 1956. Producers were: W. L. Cobb Construction Co., Cummer Lime & Mfg. Co., Dixie Lime Products Co., and Ocala Lime Rock Co. Output was used for concrete aggregate and roadstone, agricultural stone, lime, and chemical purposes. Dixie Lime Products Co. also operated limekilns at Kendrick.

TABLE 16.—Crushed limestone sold or used by producers in Marion County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average) ¹	576,870	\$698,648	1955	1,090,772	\$1,281,890
1953 ¹	530,843	722,369	1956	1,006,526	1,288,977
1954 ¹	1,171,124	1,187,188	1957	1,378,687	1,540,872

¹ Exclusive of limestone used in manufacturing lime.

Monroe.—Charley Toppino & Sons crushed limestone for concrete and roadstone at the Stock Island quarry, and Keystone Art Co. quarried dressed stone and rubble at Winley Key quarry.

Orange.—Peat production in the county was 16,000 tons valued at \$79,000.

Palm Beach.—The value of mineral production in 1957 was 3 percent lower than in 1956; crushed-limestone value decreased 12 percent. Belle Glade Rock Co., Driskell & Mayo, Maule Industries, Inc., and Palm Beach County Highway Department crushed limestone for concrete and roadstone, and Hoyt Sand & Muck Co. mined and sold unwashed sand. Zonolite Co. expanded vermiculite from material shipped into the State at Boca Raton.

Pasco.—Crushed limestone was produced by the Bailey Production Co., and oystershell by Dean F. Cox.

Pinellas.—Charles E. Phillips crushed limestone, and Benton & Co., Inc., dredged oystershell for concrete and roadstone. Largo Washed Sand Co. produced structural sand.

Polk.—Value of mineral production in Polk County—the leading mineral producer in the State—was \$58.4 million compared with \$67.9 million in the preceding year; the decrease resulted from a 15-percent decline in both tonnage and value of phosphate production. American Cyanamid Co. closed the Saddle Creek mine and began producing at the new Orange Park mine, washer, and flotation plant northeast of Lakeland. Other producers were American Agricultural Chemical Co., Coronet Phosphate Division of Smith-Douglas Co., Davidson Chemical Division of W. R. Grace & Co., International Minerals & Chemical Corp., Swift & Co., and Virginia-Carolina Chemical Corp.

Sand production, used principally for building, increased 13 percent in tonnage and 11 percent in value over 1956. Nine producers were active, compared with 8 the previous year; Gall Silica Mining Co. was the new producer.

Putman.—Sand and gravel production decreased about 1 percent, but value rose 5 percent. Six producers were active as in 1956. Kaolin production decreased 16 percent in tonnage and 13 percent in value. Peat production was 6,000 tons valued at \$47,000.

St. Johns.—Phillip McLeod produced a small tonnage of crushed limestone.

Sarasota.—Florida Dolomite Co. quarried crushed limestone for agricultural use and was the only mineral producer in the county.

Sumter.—Central Quarries, Inc., produced crushed limestone for concrete aggregate and roadstone.

Suwannee.—Live Oak Stone Co. and Suwannee Lime Rock Co. quarried and crushed limestone, principally for concrete aggregate and roadstone.

Volusia.—White Sand & Materials Co. produced a small tonnage of building sand.

Walton.—Bay Dredging & Towing Co. dredged oystershell for concrete aggregate and roadstone.

Washington.—Miller & Jenkins produced structural and blasting sand.

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. Vallely¹ and Garland Peyton²



MINERAL production in Georgia in 1957 was valued at \$69.8 million—3 percent higher than the \$67.9 million output in 1956. Of the State's principal minerals, barite, clay, iron ore, slate, and stone increased in value, while cement and sand and gravel declined. Bauxite, feldspar, and talc declined in both tonnage and value. Scrap-mica production was higher. Although less was produced than in 1956, sheet mica increased in value.

Nonmetals made up more than 96 percent of the total production value with the construction minerals—clay, cement, sand and gravel, slate, and stone—comprising 91 percent. Metals and mineral fuels made up the balance and totaled less than 4 percent.

Among the States, Georgia ranked first in the production of kaolin and crude iron oxide pigments, second in fuller's earth, third in bauxite, barite, and mica, and fourth in talc.

TABLE 1.—Mineral production in Georgia, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays.....	3,047	\$29,501	2,707	\$30,120
Coal.....	8	42	13	63
Gem stones.....	(²)	(³)	(²)	(³)
Iron ore (usable) thousand long tons, gross weight.....	357	1,609	443	2,109
Manganiferous ore.....do.....	(⁴)	(⁴)	2	(⁴)
Mica, sheet.....pounds.....	20,149	149	16,933	158
Peat.....	6	48	5	44
Sand and gravel.....	2,426	2,183	2,127	2,096
Stone ⁵	9,196	20,714	9,065	15,833
Talc.....	58	122	49	106
Value of items that cannot be disclosed: Barite, bauxite, beryllium concentrates, cement, feldspar, iron oxide pigments, manganese, mica (scrap), slate, crushed sandstone and marble, dimension marble (1957), and values indicated by footnote ⁴		14,558		20,082
Total Georgia ⁶		67,912		69,799

¹ Production as measured by mine shipments, mine 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 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.

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² Director, Geological Survey of Georgia, Atlanta, Ga.

TABLE 2.—Average unit values of principal mineral commodities produced in Georgia, 1948-52 (average) and 1953-57¹

Commodity	1948-52 (aver- age)	1953	1954	1955	1956	1957
Barite.....short ton..	\$10. 70	\$12. 82	\$13. 91	\$13. 73	\$18. 73	\$18. 67
Beryl.....do.....	596. 40		634. 75	394. 50	618. 50	585. 68
Cement:						
Masonry.....376-pound barrel..				3. 31	3. 62	3. 64
Portland.....do.....	2. 40	2. 65	2. 71	2. 76	3. 00	3. 16
Clays:						
Fuller's earth.....short ton..	17. 61	18. 73	19. 98	21. 43	21. 97	19. 34
Kaolin (china, paper, etc.).....do..	14. 88	15. 89	16. 49	16. 67	17. 37	18. 69
Kaolin (refractory).....do.....	6. 60	6. 00	7. 39	6. 80	6. 13	6. 52
Miscellaneous.....do.....	. 87	. 93	. 80	. 40	. 40	. 40
Coal.....do.....	5. 34	5. 00	5. 00	5. 00	5. 00	4. 65
Feldspar.....long ton..	4. 98		8. 22	8. 40	13. 46	12. 32
Iron ore.....do.....	3. 47	4. 23	3. 93	3. 87	4. 51	4. 77
Mica:						
Sheet.....pound.....	. 46	5. 25	5. 01	11. 49	7. 42	9. 32
Scrap.....short ton..	23. 88	24. 01	(²)	(²)	13. 50	20. 95
Mineral pigments (crude).....do.....	(³)	(³)	3. 91	5. 80	7. 42	(²)
Peat.....do.....	21. 48		11. 83	(²)	7. 69	9. 49
Sand and gravel:						
Gravel.....do.....	1. 94	1. 57	1. 63	. 61	(²)	(²)
Sand:						
Structural and paving.....do.....	(³)	. 65	. 69	. 63	. 69	. 66
All other.....do.....	(³)	1. 70	1. 20	1. 56	2. 31	2. 64
Slate (crushed and ground).....do.....	6. 81	7. 41	5. 63	4. 32	3. 65	3. 35
Stone:						
Granite:						
Crushed.....do.....	1. 37	1. 56	1. 59	1. 47	1. 43	1. 36
Dimension.....do.....	25. 79	19. 04	19. 03	18. 96	28. 09	26. 29
Limestone:						
Crushed.....do.....	2. 56	2. 48	2. 06	1. 48	2. 46	1. 65
Dimension.....do.....	3. 76	2. 58	2. 79	2. 50	1. 62	1. 06
Marble:						
Crushed.....do.....	6. 24	8. 35	8. 43	7. 21	6. 95	(²)
Dimension.....do.....	127. 17	136. 65	123. 63	123. 34	160. 39	(²)
Sandstone:						
Crushed (quartzite).....do.....	1. 50	1. 56	1. 42	1. 42	1. 42	(²)
Dimension.....do.....				19. 43	25. 28	27. 19
Talc:						
Crude.....do.....	(³)	3. 50	3. 50	2. 19	2. 11	2. 15
Ground.....do.....	9. 76	10. 33	10. 05	10. 09	10. 04	8. 68

¹ For greater detail on prices, by grades and markets, see vol. I, Minerals Yearbook, 1957.

² Figure withheld to avoid disclosing individual company confidential data.

³ Data not available.

EMPLOYMENT AND INJURIES

Employment in the mineral industries in 1957 was 21 percent higher than in 1956, sand and gravel mines being the only group to show a decrease. In 1957, 5,000 men worked an average of 260 days compared with 4,200 men who worked an average of 256 days in 1956. Figures are not quite comparable, as data on brown-iron mines were not as complete in 1956 as in 1957.

Injury experience for sand and gravel mines is shown in 1957 for the first time. Only 1 fatal accident was reported in 1957 (quarries and mills) compared with 5 (4 in quarries and mills and 1 in nonmetal mines) in 1956. Although the total number of injuries increased from 246 to 279, the frequency rate was 12 percent lower in 1957—215 injuries per million man-days compared with 244 in 1956; the lower rate resulted from the greater number of men employed in 1957. Coal and metal mines reported no injuries during the year,

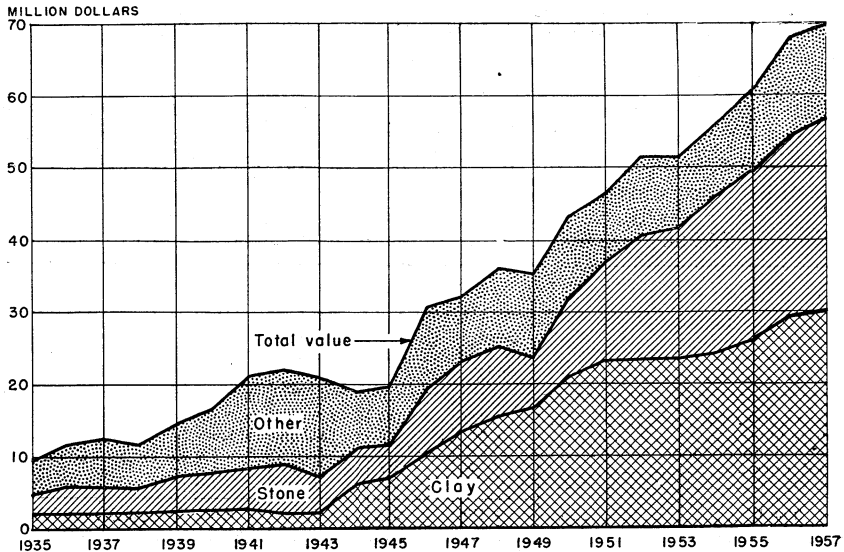


FIGURE 1.—Value of clays and stone and total value of mineral production in Georgia, 1935-57.

TRENDS AND DEVELOPMENTS

There were few changes in the mineral industry of Georgia in 1957. Several new pits and quarries were opened during the year. Among them were: A new fuller's earth operation by Milwhite Co. in Decatur County, a kaolin mining and processing operation at Sandersville by American Industrial Clays, Inc. (still under development), new crushed-granite quarries in Bibb and Douglas Counties, and a limestone quarry in Mitchell County. Plant improvements and expansion were announced by Georgia Vitrified Brick, Augusta (\$500,000); Marquette Cement Mfg. Co. and Georgia Lightweight Aggregate Co., Rockmart; and Georgia Marble Co., Tate. Other developments included plans for a new mica-processing plant at Hartwell, a 20-year mining lease (titanium minerals) by the Glidden Co. on Cumberland Island, and a proposed \$3 million asphalt refinery to be built near Savannah.

LEGISLATION AND GOVERNMENT PROGRAMS

Under the Defense Minerals Exploration Administration (DMEA) program in which the Government participates financially in exploring and developing critical and strategic minerals, 5 mica projects were active, 2 of which were completed in 1957. Three contracts were in Hart County and two in Upson County; their total value was \$31,532, with Government participation 75 percent. In 1956, four mica contracts valued at \$26,464 were in force.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Production of crude barite for use in drilling muds and barium chemicals and as fillers increased 16 percent in tonnage and value over 1956. All production came from Bartow County, with two major producers.

TABLE 3.—Employment in the mineral industries, 1956–57

Industry	1956			1957 ¹		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Quarries and mills.....	2, 219	266	589, 595	2, 697	257	693, 293
Nonmetal mines.....	1, 690	244	412, 764	1, 909	273	521, 164
Sand and gravel mines.....	² 261	² 259	² 67, 710	199	260	51, 690
Metal mines.....	28	218	6, 097	172	174	29, 848
Coal mines.....	12	128	1, 536	23	150	3, 443
Total.....	4, 210	256	1, 077, 702	5, 000	260	1, 299, 438

¹ Preliminary figures.

² Excludes Government-and-contractor operations.

TABLE 4.—Injuries in the mineral industries, 1956–57

Industry	1956				1957 ¹			
	Fatal	Non-fatal	Total	Injuries per million man-days	Fatal	Non-fatal	Total	Injuries per million man-days
Metal mines.....		3	3	492				0
Coal mines.....				0				0
Sand and gravel mines.....	(²)	(²)	(²)	(²)		8	8	161
Nonmetal mines.....	1	101	102	247		89	89	171
Quarries and mills.....	4	137	141	239	1	181	182	262
Total.....	5	241	246	244	1	278	279	215

¹ Preliminary figures.

² Not available.

TABLE 5.—Defense Minerals Exploration Administration mica contracts in force during 1957

Operator	Property	County	Contract		
			Date	Total value	Status, Dec. 31, 1957
Wood, Earnest B.....	E. B. Wood prospect..	Hart.....	July 1956.....	\$6, 348	Terminated.
Phillips, John.....	Bray prospect #1.....	do.....	September 1956..	6, 276	Do.
Boone, Homer.....	Taylor prospect.....	do.....	July 1957.....	6, 532	In force.
Boone's & Phillips'.....	Mercer prospect.....	Upson.....	October 1957.....	5, 686	Do.
Medford, Lee.....	Mathis prospect.....	do.....	November 1957..	6, 680	Do.

Cement.—Portland-cement production decreased 17 and 12 percent in tonnage and value, respectively, below 1956. Masonry cement, however, increased 8 percent in tonnage and 9 percent in value.

Marquette Cement Mfg. Co., Rockmart, manufactured portland and masonry cements, and Penn-Dixie Cement Corp., Clinchfield, manufactured portland cement only.

Clays.—Clay, with a total production of 2.7 million tons valued at \$30.1 million, was the top-ranking mineral in the State in terms of value. Compared to 1956, output was down 11 percent but with 2 percent increase in value. Total kaolin tonnage was virtually the same as in 1956, but it increased 6 percent in value. Kaolin for china, paper, etc., was 2 percent lower in tonnage but 5 percent higher in value. Refractory kaolin rose 12 percent in tonnage and 19 percent in value. Fuller's earth declined 28 percent in quantity and 37 percent in value; miscellaneous clay was 24 percent lower in both tonnage and value. Kaolin was mined in Baldwin, Glascock, Richmond, Twiggs, Washington, and Wilkinson Counties; fuller's earth in Decatur, Grady, Jefferson, Thomas, and Twiggs Counties; and miscellaneous clay in eight other counties.

Feldspar.—Appalachian Minerals Co. mined feldspar rock and produced flotation concentrate for glass and pottery uses; tonnage declined 10 percent and value 18 percent below 1956.

Gem Stones.—Corundum from Towns County was the only gem material reported.

Iron Oxide Pigments (Crude).—Crude iron oxide pigment production was somewhat lower than in 1956. New Riverside Ochre Co. in Bartow County was the only producer. Finished-pigment production by the same company declined 10 percent in value from the preceding year.

Mica.—Sheet-mica production was 17,000 pounds valued at \$158,000, including 3,300 pounds of full-trimmed sheet mica and 4,900 pounds of punch obtained from 82,000 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 (N. C.) Purchase Depot. Compared with 1956, production of sheet mica was 16 percent lower in quantity but 6 percent higher in value. Scrap mica was 3 percent higher in tonnage and considerably above the 1956 value.

Upson and Hart were the principal sheet-mica-producing counties, with minor production from Butts, Cherokee, Elbert, Jasper, Macon, Monroe, Oconee, and Pike. The principal scrap-mica-producing counties were Cherokee, Hart, Jasper, and Pickens.

Five DMEA mica-exploration contracts were active in 1957—3 in Hart County and 2 in Upson County. The total amount of the contracts was \$31,532, with Government participation 75 percent.

Sand and Gravel.—Production of sand and gravel declined for the second consecutive year and totaled 2.1 million tons valued at \$2.1 million, compared with 2.4 million tons valued at \$2.2 million in 1956—a decrease of 12 percent in tonnage and 5 percent in value. Structural sand and gravel had the greatest losses. Paving sand, together with glass, molding, blast, and filter sands, increased in tonnage and value. Sands for grinding and polishing or furnace or engine use and gravel for railroad ballast were not produced during the year. Total gravel production was 13 and 9 percent lower in tonnage and value, respectively.

TABLE 6.—Clays sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	2,394,936	\$20,342,168	1955.....	2,953,278	\$26,144,672
1953.....	2,651,153	23,455,315	1956.....	3,047,467	29,500,993
1954.....	2,711,422	24,106,926	1957.....	2,707,213	30,120,473

TABLE 7.—Kaolin sold or used by producers, 1948-52 (average) and 1953-57

Year	China clay, paper clay, etc.		Refractory uses		Total kaolin	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	1,057,772	\$15,776,348	144,538	\$881,950	1,202,310	\$16,658,298
1953.....	1,170,679	18,606,351	171,046	1,053,274	1,341,725	19,659,625
1954.....	1,196,211	19,722,623	108,654	803,283	1,304,865	20,525,906
1955.....	1,339,748	22,333,808	153,235	1,041,960	1,492,983	23,375,768
1956.....	1,459,627	25,353,611	204,080	1,251,280	1,663,707	26,604,891
1957.....	1,430,098	26,729,592	228,596	1,490,115	1,658,694	28,219,707

TABLE 8.—Miscellaneous clay sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	1,033,840	\$877,244	1955.....	1,356,412	\$542,608
1953.....	1,163,766	1,076,891	1956.....	1,275,128	509,980
1954.....	1,278,377	1,020,486	1957.....	970,320	388,174

TABLE 9.—Kaolin sold or used by producers, 1956-57, by uses

Uses	1956	1957	Uses	1956	1957
	Short tons	Short tons		Short tons	Short tons
Pottery and stoneware.....	109,900	55,714	Filler—Continued		
Enameling.....		(¹)	Paper coating.....	658,555	658,335
Floor and wall tile.....	7,737	(¹)	Rubber.....	47,024	82,581
Refractories:			Asbestos products.....	591	
Firebrick and block.....	193,066	229,039	Insecticides and fungi-		
Glass.....	10,895	(²)	cides.....	4,138	(³)
Foundries and steel-			Other.....	40,435	64,289
works.....	440	(²)	Chemicals.....	6,308	(¹)
Other.....	3,151	15,564	All other.....	31,833	60,635
Filler:			Total.....	1,663,707	1,658,694
Paper filling.....	549,634	492,537			

¹ Included with "All other."² Included with "Refractories, other."³ Included with "Filler, other."

Sand was produced in 19 counties and sand and gravel in 2. Crawford, Muscogee, Talbot, Thomas, and Effingham were the principal producing counties.

■ Slate.—Production of crushed and ground slate was 10 percent higher in tonnage but only 1 percent greater in value than in 1956. Funkhouser Co. operated an underground mine in Bartow County for

TABL 10.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average) ¹	1,352,361	\$1,116,788	1955.....	2,987,570	\$2,198,905
1953 ¹	2,051,058	1,900,987	1956.....	2,425,832	2,183,260
1954.....	2,703,281	2,466,352	1957.....	2,126,718	2,096,446

¹ Excludes ground sand.

TABLE 11.—Sand and gravel sold or used by producers, by uses, 1956-57

Use	1956		1957	
	Short tons	Value	Short tons	Value
Sand:				
Structural.....	1,617,396	\$1,122,671	1,137,372	\$729,249
Paving.....	280,145	183,923	428,052	303,820
Grinding and polishing.....	849	467		
Engine.....	12,564	5,902		
Railroad ballast.....	10,742	5,370	(1)	(1)
Other ²	(1)	(1)	(1)	(1)
Gravel.....	(1)	(1)	(1)	(1)
Total sand and gravel.....	2,425,832	2,183,260	2,126,718	2,096,446

¹ Figure withheld to avoid disclosing individual company confidential data.

² Glass, molding, blast, filter, ground, and other sands.

producing flour and roofing granules, and Georgia Lightweight Aggregate Co. quarried slate for use in its lightweight-aggregate plant at Rockmart.

Stone.—Total stone production exceeded that in 1956 by 1 and 4 percent in tonnage and value, respectively.

Total crushed-stone tonnage and value were virtually the same as in 1956. Crushed granite increased 6 percent in tonnage but less than 1 percent in value. Crushed-limestone figures are not comparable for 1956 and 1957, as some crushed and ground marble was classed as limestone in 1956. Production in 1957, however, was 15 percent lower in tonnage and 5 percent less in value than in 1956. Output of crushed sandstone and quartzite also decreased, while that of crushed marble was considerably higher.

Total dimension-stone production was higher because of increased output of dimension marble. Dimension granite, with an increase of 4 percent in tonnage, decreased 2 percent in value. Only small tonnages of dimension limestone and sandstone were produced.

Granite was produced in 15 counties—quartzite in Richmond County; sandstone in Jasper and Pickens Counties; limestone in Bartow, Dade, Fannin, Floyd, Houston, Mitchell, and Walker Counties; and marble in Gilmer and Pickens Counties. Operations at four quarries were described.³

³ Pit and Quarry, Albany Limerock Corp.: Vol. 50, No. 3, September 1957, pp. 138, 146. Macon Quarries Co.: Vol. 49, No. 8, February 1957, pp. 84-85, 88-89. Marble Products Co.: Vol. 49, No. 12, June 1957, pp. 102-103, 106-137.

Rock Products, Marquette Cement Mfg. Co.: Vol. 60, No. 9, September 1957, pp. 88-89, 114.

TABLE 12.—Stone sold or used by producers, 1956–57, in short tons

	1956		1957	
	Short tons	Value	Short tons	Value
Crushed stone:				
Granite.....	7,348,901	\$10,496,767	7,756,520	\$10,533,093
Limestone.....	1,704,412	4,187,368	1,174,628	1,939,392
Marble, sandstone, and quartzite.....	(¹)	(¹)	(¹)	(¹)
Total ².....	9,053,313	14,684,135	8,931,148	12,472,485
Dimension stone:				
Granite.....	121,014	3,398,720	126,346	3,321,421
Limestone.....	4,405	7,150	6,419	6,780
Marble.....	16,175	2,594,366	(¹)	(¹)
Sandstone and quartzite.....	1,158	29,280	1,182	32,144
Total.....	142,752	6,029,516	* 133,947	* 3,360,345
Grand total ⁴.....	9,196,065	20,713,651	9,065,095	15,832,830

¹ Figure withheld to avoid disclosing individual company confidential data.

² Incomplete total; excludes crushed marble, sandstone, and quartzite.

³ Incomplete total; excludes dimension marble.

⁴ Incomplete total; excludes stone shown under footnote 2 or 3.

TABLE 13.—Production of crude and sales of ground talc and soapstone, 1948–52 (average) and 1953–57

Year	Production (crude)		Sales (ground)	
	Short tons	Value	Short tons	Value
1948–52 (average).....	62,128	(¹)	61,369	\$596,220
1953.....	57,891	\$202,619	57,581	594,900
1954.....	50,536	176,876	50,248	505,219
1955.....	53,828	117,656	53,419	538,890
1956.....	57,916	122,166	57,521	577,475
1957.....	49,372	106,000	49,132	426,479

¹ Data not available.

Talc and Soapstone.—Production of crude talc and soapstone was 49,000 tons valued at \$106,000—decreases of 15 and 13 percent in tonnage and value, respectively, from 1956. Sales of ground talc and soapstone were 49,000 tons valued at \$426,000—15 percent lower in tonnage and 26 percent in value. Sawed material declined considerably in tonnage but increased 7 percent in value. All production came from Murray County.

METALS

Bauxite.—Production of bauxite decreased 18 percent in tonnage and 7 percent in value from 1956. American Cyanamid Co. was the only producer and operated mines in Floyd, Sumter, and Macon Counties and a drying plant at Halls Station in Bartow County.

Beryllium.—Beryl production decreased 9 percent in quantity and 14 percent in value from 1956. Output came from the Cochran mine in Cherokee County and the Hogg mine in Troup County, the latter having been abandoned early in the year.

TABLE 14.—Sales of ground and sawed talc, 1898–1957

Year	Short tons	Value	Year	Short tons	Value
1898	639	\$4,054	1929	4,989	\$146,025
1899	1,062	42,085	1930	3,439	89,690
1900	6,477	77,213	1931	3,672	65,873
1901	693	4,717	1932	2,510	26,487
1902	850	8,000	1933	1,178	15,551
1903	1,012	9,042	1934	6,005	61,088
1904	960	9,500	1935	7,315	81,373
1905	900	10,000	1936	11,473	114,545
1906	820	10,700	1937	11,984	148,177
1907	739	11,473	1938	15,117	130,595
1908	2,000	14,000	1939	20,090	177,881
1909	700	7,000	1940	20,104	219,959
1910	1,202	23,270	1941	28,511	364,560
1911	1,191	18,883	1942	29,930	464,160
1912	1,608	21,172	1943	35,210	396,031
1913	990	25,916	1944	30,425	363,342
1914	2,612	51,864	1945	32,433	296,163
1915	498	12,050	1946	36,410	380,477
1916	3,080	88,364	1947	49,441	673,251
1917	3,819	94,314	1948	53,602	624,694
1918	1,123	42,474	1949	49,338	580,405
1919	1,288	79,740	1950	70,749	774,148
1920	1,174	48,248	1951	77,895	823,133
1921	1,025	15,000	1952	56,491	653,144
1922	1,506	40,042	1953	57,891	678,474
1923	796	16,568	1954	50,536	572,005
1924	1,885	30,548	1955	53,828	640,897
1925	5,022	76,028	1956	57,916	686,101
1926	4,220	89,000	1957	49,372	542,553
1927	3,110	42,370			
1928	4,888	85,264			
			Earliest record to date	985,743	11,899,681

Iron Ore.—Brown-iron-ore shipments increased for the third consecutive year to 443,000 long tons valued at \$2.1 million, rising 24 percent in tonnage and 31 percent in value over 1956. Production from Stewart County was more than double that in the preceding year, and an initial small output came from Webster County. Bartow and Polk Counties' production also increased.

Manganese.—Manganese ore (plus 35 percent Mn) dropped to less than 15 percent of the preceding year's total, and manganiferous ore (10 to 35 percent Mn) was considerably less than in 1956. Kingman Mines, Inc., Floyd County, ceased operations in July 1957.

MINERAL FUELS

Coal.—Output of bituminous coal was 13,500 tons valued at \$63,000—compared with 8,500 tons valued at \$42,000 in 1956. Production came from four underground mines in Walker County and was marketed for local use.

Peat.—Production of peat was 4,700 tons valued at \$44,000, 25 percent lower in tonnage and 7 percent in value than in 1956. Peat humus, although classed as a fuel, was used principally for agricultural and horticultural purposes. Production came from Charlton, Lowndes, and Screven Counties.

TABLE 15.—Production and shipments of usable brown iron ore, 1948–52 (average) and 1953–57¹

Year	Production	Shipments	
	Long tons	Long tons	Value
1948–52 (average).....	286, 373	276, 513	\$979, 043
1953.....	210, 664	259, 964	1, 100, 725
1954.....	221, 576	221, 576	871, 601
1955.....	256, 700	256, 700	994, 289
1956.....	356, 735	356, 735	1, 609, 093
1957.....	457, 672	442, 672	2, 109, 352

¹ Includes hematite: 1950—213 tons; 1951—266 tons; 1952—200 tons; 1953—250 tons; 1954—217 tons.

TABLE 16.—Bituminous-coal production, 1952–57

Year	Short tons	Value	Year	Short tons	Value
1952.....	32, 100	\$160, 500	1955.....	12, 471	\$62, 360
1953.....	14, 109	70, 500	1956.....	8, 471	42, 355
1954.....	8, 099	40, 450	1957.....	13, 464	62, 607

TABLE 17.—Production of peat, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	2, 104	\$45, 200	1955.....	5, 554	(¹)
1953.....	2, 305	(¹)	1956.....	6, 225	\$47, 843
1954.....	5, 150	60, 920	1957.....	4, 690	44, 496

¹ Figure withheld to avoid disclosing individual company confidential data.

REVIEW BY COUNTIES

Mineral production was reported from 69 of Georgia's 159 counties. Fourteen counties, in the order listed—Twiggs, Pickens, Wilkinson, Washington, Bartow, Polk, Houston, De Kalb, Gilmer, Richmond, Elbert, Henry, Warren, and Fulton, each with a production of more than \$1 million—accounted for \$59 million or 85 percent of the State's mineral production.

Baldwin.—Refractory kaolin was mined at Stevens Pottery by General Refractories Co. for use in its own plants.

Bartow.—Increased production of barite and brown iron ore more than offset decreases in limestone, slate, manganese, and iron oxide

TABLE 18.—Value of mineral production in Georgia, 1956–57, by counties¹

County	1956	1957	Minerals produced in 1957 in order of value
Baldwin.....	(²)	(²)	Kaolin.
Bartow.....	\$3, 716, 987	\$3, 906, 146	Barite, iron ore, slate, limestone, iron oxide pigments, manganese.
Bibb.....	845, 903	942, 888	Granite, clay, sand.
Brooks.....	38, 190	(²)	Sand.
Butts.....	(²)	(²)	Mica.
Charlton.....	(²)	(²)	Peat.
Chatham.....	(²)	(²)	Sand.
Chattooga.....	(²)	7, 009	Do.
Cherokee.....	(²)	(²)	Mica, beryl.
Cobb.....	845, 392	(²)	Granite.
Colquitt.....	20, 000	24, 000	Sand.

See footnotes at end of table.

TABLE 18.—Value of mineral production in Georgia, 1956-57, by counties ¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value
Columbia.....	(2)	-----	
Crawford.....	\$277, 973	(2)	Sand, clay.
Dade.....	33, 152	(2)	Limestone.
Decatur.....	(2)	(2)	Fuller's earth.
De Kalb.....	(2)	(2)	Granite.
Dougherty.....	122, 019	\$88, 645	Sand.
Douglas.....	(2)	(2)	Granite.
Effingham.....	(2)	(2)	Sand.
Elbert.....	1, 523, 140	1, 516, 817	Granite, sand, mica.
Evans.....	6, 370	10, 194	Sand.
Fannin.....	110, 725	167, 579	Limestone, granite.
Fayette.....	(2)	(2)	Granite.
Floyd.....	704, 433	581, 839	Limestone, bauxite, clay, manganese.
Fulton.....	(2)	(2)	Granite, sand and gravel.
Gilmer.....	(2)	(2)	Marble.
Glascocok.....	(2)	(2)	Kaolin.
Glynn.....	(2)	(2)	Sand.
Gordon.....	12, 000	9, 800	Clay.
Grady.....	(2)	(2)	Fuller's earth.
Gwinnett.....	197, 093	(2)	Granite.
Hancock.....	(2)	(2)	Do.
Haralson.....	5, 000	-----	
Hart.....	(2)	(2)	Mica.
Henry.....	1, 445, 443	(2)	Granite.
Houston.....	(2)	(2)	Cement, limestone.
Jasper.....	(2)	(2)	Feldspar, mica, quartz.
Jefferson.....	19, 475	136, 800	Fuller's earth.
Long.....	(2)	(2)	Sand.
Lowndes.....	(2)	(2)	Peat.
Macon.....	(2)	(2)	Bauxite, mica.
Madison.....	479, 049	449, 994	Granite.
Mitchell.....	(2)	(2)	Limestone.
Monroe.....	(2)	3, 402	Mica.
Montgomery.....	(2)	(2)	Sand.
Murray.....	122, 166	106, 000	Talc, soapstone.
Muscogee.....	1, 122, 131	939, 138	Granite, sand and gravel.
Oconee.....	(2)	(2)	Mica.
Oglethorpe.....	630, 121	608, 192	Granite.
Pickens.....	(2)	(2)	Marble, sandstone, mica.
Pike.....	* 2, 421	(2)	Mica.
Polk.....	(2)	(2)	Cement, iron ore, slate, clay.
Rabun.....	3, 750	(2)	Sand.
Richmond.....	2, 307, 339	2, 059, 515	Quartzite, clays.
Screven.....	(2)	(2)	Peat.
Stephens.....	51, 869	-----	
Stewart.....	277, 427	533, 172	Iron ore.
Sumter.....	(2)	(2)	Bauxite.
Talbot.....	(2)	224, 245	Sand.
Taylor.....	(2)	60, 750	Do.
Telfair.....	(2)	-----	
Thomas.....	(2)	(2)	Sand, fuller's earth, clay.
Toombs.....	5, 200	-----	
Towns.....	50	10	Gem stones.
Troup.....	(2)	(2)	Beryl.
Twiggs.....	16, 365, 323	17, 213, 584	Kaolin, fuller's earth.
Union.....	3, 400	-----	
Upson.....	134, 515	133, 316	Mica.
Walker.....	139, 065	126, 087	Limestone, coal.
Ware.....	22, 324	41, 341	Sand.
Warren.....	(2)	(2)	Granite.
Washington.....	5, 344, 237	4, 739, 856	Kaolin.
Webster.....	(2)	(2)	Iron ore.
Whitfield.....	15, 200	12, 800	Clay.
Wilkinson.....	(2)	(2)	Kaolin.
Undistributed.....	* 30, 962, 911	35, 105, 678	
Total Georgia.....	67, 912, 000	69, 799, 000	

¹ The following counties are not listed, since no production has been reported from them: Appling, Atkinson, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantley, Bryan, Bulloch, Burke, Calhoun, Camden, Candler, Carroll, Catoosa, Chattahoochee, Clarke, Clay, Clayton, Clinch, Coffee, Cook, Coweta, Crisp, Dawson, Dodge, Dooly, Early, Echols, Emanuel, Forsyth, Franklin, Greene, Habersham, Hall, Harris, Heard, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Jones, Lamar, Lanier, Laurens, Lee, Liberty, Lincoln, Lumpkin, McDuffie, McIntosh, Marion, Meriwether, Miller, Morgan, Newton, Paulding, Peach, Pierce, Pulaski, Putnam, Quitman, Randolph, Rockdale, Schley, Seminole, Spalding, Taliaferro, Tattnall, Terrell, Tift, Treutlen, Turner, Walton, Wayne, Wheeler, White, Wilcox, Wilkes, Worth.

* Figure withheld to avoid disclosing individual company confidential data.

² Revised figure.

pigments and raised total county production to \$3.9 million, 5 percent above 1956, placing it fifth in rank in the State in value of mineral production.

Barite producers were: B. R. Cain, Homer Cox, Paga Mining Co., and New Riverside Ochre Co. The latter also produced crude and finished iron oxide pigments. Limestone was quarried by Marquette Cement Mfg. Co. for use in its cement plant at Rockmart, and Funkhouser Co. continued mining slate south of Fairmount for slate flour and roofing granules. Seven companies produced iron ore compared with 11 in 1956. The principal producers were: Hodge Mining Co., Lake Mining Co., Lam and Shropshire, and Mosteller Bros. Manganese ores were produced by Hale-Georgia Minerals Corp. and Lake Mining Co.

TABLE 19.—Shipments of brown iron ore in Bartow County, 1948-52 (average) and 1953-57

Year	Long tons	Value	Year	Long tons	Value
1948-52 (average).....	113, 585	\$384, 281	1955.....	184, 892	\$632, 516
1953.....	113, 024	447, 169	1956.....	179, 485	726, 557
1954.....	148, 601	564, 778	1957.....	198, 880	853, 772

Bibb.—The total value of mineral production in Bibb County was \$943,000, 11 percent higher than the previous year. Weston & Brooker Co. opened a new granite quarry, while Macon Quarries closed its granite quarry about the middle of the year. Hitchcock Corp. was the third crushed-granite producer. Burns Brick Co. and Cherokee Brick & Tile Co. mined clay for use in the manufacture of clay products at plants in Macon. Cornell-Young Co. produced paving sand.

Brooks.—Bannockburn Sand Co. mined building and paving sand from its pit at Troupeville.

Butts.—J. R. Berry mined a small quantity of sheet mica.

Charlton.—Four hundred and seventy-five tons of peat was produced in the county in 1957.

Chatham.—Building sand was mined by J. W. Fitzgerald Co., Inc., and National Gypsum Co. calcined crude gypsum shipped into the State at the Savannah plant.

Chattooga.—Wolf Creek Sand Co. reported initial production of unwashed foundry sand.

Cherokee.—Glenn Young (Cochran mine) produced beryl and sheet mica, and Thompson-Weinman & Co. mined and shipped scrap mica (sericite) from the Brady mine to its grinding plant at Cartersville.

Cobb.—Crushed granite for concrete and road metal was quarried by Kennesaw Stone Co. and Stockbridge Stone Co.

Colquitt.—Baxter & Sanders produced paving sand from a pit near Moultrie.

Crawford.—Atlanta Sand & Supply Co. produced building, paving, and other sands from the Rollo pit near Roberta.

Dade.—Dave L. Brown Co. quarried and crushed limestone for concrete and roadstone.

Decatur.—Milwhite Co. opened a new fuller's earth mine and was the only producer in the county in 1957, since the Amsterdam mine of Minerals & Chemical Corp. of America was closed in 1956.

De Kalb.—The value of granite production in 1957 was lower than in the preceding year; dimension granite declined 10 percent and crushed granite 15 percent. Producers of crushed granite were Consolidated Quarries Corp., Davidson Granite Co., and Stone Mountain Grit Co. Rubble and curbing were quarried by J. T. Reagan Granite Co.; Stone Mountain Granite Corp., a new producer in 1957; and Davidson Granite Co. (which also quarried dressed architectural stone).

Dougherty.—The production of sand used for building and paving, and as fertilizer filler declined 23 percent in tonnage and 27 percent in value in 1957. Producers were Albany Lime & Cement Co., Garrett Base Materials Products Co., Musgrove Sand Co., and Quick Service Sand Co.

Douglas.—Consolidated Quarries Corp. opened a new quarry for production of crushed granite 2 miles west of Douglasville.

Effingham.—Dawes Silica Mining Co. mined sand at the Eden pit for building, blast, filter, molding, and other uses.

Elbert.—The output of dimension granite in Elbert County was 54,000 tons valued at \$1.5 million—an increase of 16 percent in tonnage and 5 percent in value over 1956. Rough monumental stone was quarried by American Granite Quarries, Inc., Coggins Granite & Marble Industries, Inc., Continental Granite Co., Elberton City Quarries, Inc., Robin Blue Quarries, Inc., and A. G. & M. H. Veal. Rough and dressed monumental stone was produced by Comolli Granite Co., Elbert County Granite Co., and Elberton Granite Industries, Inc. M. W. Kantala & Sons quarried rough architectural stone, and Neal T. McLanahan produced crushed granite for concrete and roads. Bond Sand & Gravel Co. and Coldwater Sand Co. each produced minor tonnages of building sand. Henry Grindstaff produced hand-cobbed mica.

TABLE 20.—Dimension granite sold or used by producers in Elbert County, 1948–52 (average) and 1953–57

Year	Short tons	Cubic feet	Value	Year	Short tons	Cubic feet	Value
1948–52 (average)	37,367	468,036	\$1,324,931	1955	38,439	463,123	\$1,401,114
1953	39,254	472,967	1,212,089	1956	39,993	481,846	1,399,140
1954	43,398	522,864	1,561,490	1957	46,569	528,402	1,464,192

Evans.—Evans Concrete Products Co. mined building sand.

Fannin.—Campbell Lime & Stone Co. quarried and crushed limestone for concrete, roadstone, and agricultural uses; and Fannin County Highway Department crushed 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 Lennig and New Holland mines. Manganese-ore production by Kingman Mines, Inc., which ceased operations in July, was only a fraction of the previous year. Crushed limestone was produced by Ready-Mix Concrete Co. for concrete, roadstone, and railroad ballast. Floyd

County Highway Department quarried limestone for rubble and roadstone. Oconee Clay Products Co. mined shale for use in its clay-products plant at Milledgeville.

Fulton.—Hitchcock Corp. and Stockbridge Stone Co. quarried and crushed granite for concrete and roadstone. J. D. Jones and Thompson Bros. Co. produced building sand from pits near Atlanta. Alabama Vermiculite Co. operated an exfoliating plant at Atlanta.

Gilmer.—Willingham-Little Stone Division of Georgia Marble Co. produced crushed marble for agstone, roofing granules, and terrazzo.

Glascok.—General Refractories Co. and Harbison-Walker Refractories Co. mined refractory kaolin for use in their clay-products plants.

Glynn.—Crews Sand Co. and Gray Towing Co. mined sand for building uses.

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.—Crushed granite for concrete and roadstone was quarried by Stockbridge Stone Co. and Georgia State Board of Corrections.

Hancock.—Weston & Brooker Co. produced crushed granite at Granite Hill for concrete and roadstone.

Haralson.—Haralson County Highway Department mined a small quantity of paving sand for its own use.

Hart.—Funkhouser Co. produced scrap mica from mica schist, and Payne Bros. produced full-trimmed mica only. Sheet and hand-cobbed mica were produced by Southern Mining Co., and hand-cobbed mica by Henry Grindstaff and Arthur Mining Co. Three DMEA contracts for exploration of strategic mica were active during the year. E. B. Wood and John Phillips completed their exploration contracts, and Homer Boone began to explore the Taylor prospect.

Henry.—Stockbridge Stone 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 Lime-rock Co. produced limestone for agricultural use.

Jasper.—Appalachian Minerals Co. mined feldspar rock from several pits and produced flotation-grade feldspar, scrap mica, and quartz in its plant near Monticello. Duncan Mineral Co. mined a small quantity of sheet mica.

Jefferson.—Tennessee Absorbent Clay Co. mined fuller's earth at its new plant near Wrens for absorbent uses.

Long.—Dawes Silica Mining Co. mined building sand at Ludowici.

Lowndes.—Peat was the only mineral produced in the county in 1957.

Macon.—American Cyanamid Co. mined bauxite from the Pierce-Norris mine, and L. M. Johnson produced sheet mica.

Madison.—Rough monumental dimension granite was quarried near Carlton by Coggins Granite & Marble Industries, Inc.

Mitchell.—Bridgeboro Stone Co., Inc., produced crushed limestone for concrete, roadstone, and agricultural use.

Monroe.—E. V. Curtis, J. & B. Mining Co., and Spalding Mining Co. produced sheet mica.

Montgomery.—H. H. Van Dyke mined a small quantity of building sand.

Murray.—All talc and soapstone produced in the State came from Murray County; producers were Cohutta Talc Co., Georgia Talc Co., and Southern Talc Co., all of Chatsworth.

Muscogee.—Crushed granite for riprap, concrete, roadstone, and railroad ballast was quarried by Alabama Aggregates Co. and Stockbridge Stone Co. Building and paving sand and gravel was produced by J. J. Brown Sand & Gravel Co. and Calhoun Sand & Gravel Co.

Oconee.—C. F. Thomas mined a small quantity of sheet mica.

Oglethorpe.—Although production of dimension granite increased 6 percent, its value was down 3 percent from 1956. Producers were: Bennie & Harvey, Dixie Granite Quarries, Enterprise Granite Co., Hoover Granite Quarries, Liberty Granite Co., and Oglethorpe Quarrying Co.

TABLE 21.—Dimension granite sold or used by producers in Oglethorpe County, 1952-57

Year	Short tons	Cubic feet	Value	Year	Short tons	Cubic feet	Value
1952.....	17, 265	208, 003	\$368, 655	1955.....	22, 196	254, 307	\$558, 627
1953.....	22, 527	256, 912	533, 135	1956.....	22, 266	239, 168	630, 121
1954.....	23, 331	267, 595	766, 392	1957.....	23, 695	268, 697	608, 192

Pickens.—Pickens County ranked second in the State in terms of value of its mineral production. The Georgia Marble Co. quarried and dressed marble for building and monumental use and crushed and ground marble for roofing granules, terrazzo, whiting, and agricultural use. Marble Products Co. at Whitestone also mined and crushed marble for the same uses. Thompson-Weinman & Co. mined scrap mica (sericite) at the Martin mine. Carl Johnson and Hardy Johnson quarried sandstone for flagstone.

Pike.—McKinley Mica Co. produced a small quantity of sheet mica.

Polk.—Mineral production in Polk County rose 5 percent over 1956. Cement, crushed slate, and iron ore all increased over the previous year. Brown-iron-ore production was 129,000 tons valued at \$643,000, compared with 123,000 tons valued at \$605,000 in 1956. Seven operators were active. The principal producers were: Acree Mining Co., Albea-York Mining Co., Inc., and Graves Mining Co. Baker & Howell and W. W. Mundy, Jr., were new producers in 1957. Other producers were Arrington Mining Co. and E. L. Gammage.

TABLE 22.—Shipments of brown iron ore in Polk County, 1948-52 (average) and 1953-57

Year	Long tons	Value	Year	Long tons	Value
1948-52 (average).....	121, 309	\$462, 006	1955.....	71, 808	\$361, 773
1953.....	146, 690	652, 306	1956.....	122, 518	605, 109
1954.....	72, 635	304, 682	1957.....	128, 521	642, 777

Marquette Cement Mfg. Co. produced masonry and portland cement at Rockmart from clay mined in the vicinity of the plant and limestone mined in Bartow County. Georgia Lightweight Aggregate Co. mined slate and manufactured lightweight building aggregate at its plant at Rockmart.

Rabun.—Hubert Hill produced a small tonnage of building sand.

Richmond.—The total value of mineral production decreased 11 percent below 1956. Production of kaolin and sand and gravel increased but that of quartzite and miscellaneous clay diminished. Albion Kaolin Division of Interchemical Corp. mined kaolin at Hepzibah principally for whiteware and refractories, and Georgia-Carolina Brick & Tile Co. and Merry Bros. Brick & Tile Co. mined miscellaneous clay for the manufacture of brick and other clay products. Superior Stone Co. operated the Dan quarry, producing crushed quartzite for concrete and roadstone. Augusta Sand & Gravel Co. produced building and paving sand and paving gravel.

Screven.—Peat was the only mineral produced in Screven County in 1957.

Stewart.—Brown-iron-ore production increased 100 percent in tonnage and 110 percent in value over 1956. Producers during the year were: Brown-Nuggett Mining Co., Dunbar & Layton, Glenjack Mining Co., Patoula Mining Co., Shaver & Lynn, and Southern Iron Corp.

Sumter.—American Cyanamid Co. mined bauxite from the Holloway and Easterlin mines.

Talbot.—Brown Bros. mined glass and building sands, and Taylor Sand Co. produced paving and building sand.

Taylor.—Howard Sand Co. produced building and paving sand.

Thomas.—Waverly Petroleum Products mined and processed 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.—A few pounds of corundum was collected by J. M. Steinoff during the year.

Troup.—Mineral Processing Co. recovered beryl at the Hogg mine before ceasing operations about the middle of the year.

Twiggs.—Twiggs County again led all counties in the State in value of mineral production, producing kaolin and fuller's earth valued at \$17.2 million, compared with \$16.4 million in 1956, an increase of 5 percent. Diversey Corp. mined and processed fuller's earth for insecticides, fungicides, absorbents and filters. Georgia

Coating Clay Co., Georgia Kaolin Co., J. M. Huber Corp., and Southern Clays, Inc., produced kaolin for whiteware, refractories, paper, rubber, filler, and other uses.

Upson.—Total mica production was valued at \$133,000 compared with \$134,500 in 1956, a decrease of 1 percent. Southern Mining Co. produced hand-cobbed and full-trimmed mica; Ira Buchanan, J & B Mining Co., S. & B. Mining Co., and A. Ward produced full-trimmed mica. All mica was sold to the Government through the GSA at the Spruce Pine (N. C.) Purchase Depot. Under DMEA contracts Boone & Phillips explored the Mercer prospect and Lee Medford the Mathis prospect for mica.

Walker.—Four companies produced bituminous coal. Output was 13,464 tons valued at \$62,607, an increase of 59 percent in tonnage and 48 percent in value over 1956. Willard Parker quarried a small tonnage of dimension limestone before ceasing operations in February. Dave L. Brown Co. produced crushed limestone for concrete and roadstone.

Ware.—E. W. Pafford dredged sand near Waycross, principally for building use.

Warren.—Weston & Brooker crushed granite at Camak quarry for concrete, roadstone, and railroad ballast.

Washington.—Washington County ranked fourth in the State in terms of value of mineral production. Kaolin output decreased to 258,000 tons valued at \$4.7 million, a decrease of 18 percent in tonnage and 11 percent in value. Kaolin was used principally for paper coating and as filler, followed by floor and walltile, refractories, whiteware, insecticides, and fungicides. Producers were Champion Paper & Fiber Co., Minerals & Chemical Corp. of America, Thiele Kaolin Co., and United Clay Mines Corp.

Webster.—Brown iron ore was mined for the first time in Webster County in 1957. Producers were E. L. Gammage and Webster Mining Co.

Whitfield.—Shale for manufacturing brick was mined by the Dalton Brick & Tile Co.

Wilkinson.—Wilkinson County ranked third in the State in value of its mineral production and as a kaolin producer. Production of kaolin was 344,000 tons valued at \$5.6 million, increases of 11 and 24 percent in tonnage and value, respectively, over 1956. Evans Clay Co., M & M Clays Co., and Minerals & Chemical Corp. of America mined kaolin for paper, rubber, paint, and other uses. Harbison-Walker Refractories Co., D. C. Hardie, and Oconee Clay Products Co. mined kaolin for refractory uses.

TABLE 23.—Kaolin and fuller's earth sold or used by producers in Twiggs County, 1952-57

Year	Short tons	Value	Year	Short tons	Value
1952.....	1 716,362	1 \$11,327,653	1955.....	848,565	\$14,331,993
1953.....	1 707,960	(?)	1956.....	926,931	16,365,323
1954.....	750,441	12,543,077	1957.....	916,772	17,213,584

¹ Revised figure.

² Figure withheld to avoid disclosing individual company confidential data.

TABLE 24.—Kaolin sold or used by producers in Washington County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	237,535	\$3,534,391	1955.....	282,411	\$4,543,775
1953.....	1 265,532	1 4,078,739	1956.....	316,296	5,344,238
1954.....	264,195	4,162,386	1957.....	258,153	4,739,856

¹ Revised figure.

TABLE 25.—Kaolin sold or used by producers in Wilkinson County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average) ¹	200,095	\$2,427,384	1955.....	290,520	\$4,235,741
1953 ¹	269,129	3,717,204	1956.....	310,528	4,525,537
1954.....	241,198	3,692,143	1957.....	344,089	5,620,704

¹ Revised figure.

The Mineral Industry of Hawaii and Pacific-Island Possessions

By L. E. Davis¹ and R. Y. Ashizawa²



HAWAII

MINERAL production for the Territory of Hawaii in 1957 declined about 15 percent in value from the alltime high of 1956. The decreased value was reflected in the output of lime and salt, but the stone industry showed the greatest drop in value. The major advances in producing volcanic cinder, clays, and sand and gravel could not offset this decline. Little interest was shown in the titanium-bearing clays during the year, but considerable attention was given the aluminum-bearing clays of the Territory by several mainland aluminum producers. Field teams representing these companies gave much time and effort to exploring the quality and extent of these clay deposits. When compiled, the exploration results will influence the future possibility of an alumina industry in the Islands, an industry that would contribute appreciably to the Territory's economy.

At Honolulu, Pacific Oil Co. (Delaware), a wholly owned subsidiary of Standard Oil Co. of California, processed a special blend of oil shipped from the mainland at its 3,500-barrel-a-day-capacity plant. The parent company has planned to construct a new refinery at Barber's Point, 20 miles west of Honolulu, on a 310-acre leased site. The refinery ultimately will be equipped to manufacture aviation and motor gasoline, jet fuel, distillate, and fuel oils. Construction will begin near the end of 1958.

Markets.—All of the Territory's 1957 mineral production was consumed locally. The limitations of the mineral industries necessitated imports of many essential mineral commodities in substantial quantities from continental United States—chiefly petroleum products, fertilizer materials, salt, natural asphalts, and certain construction materials, including cements. Preliminary information received from the United States Army, Corps of Engineers, revealed that important tonnages of iron and steel scrap, including tinplate, were shipped to United States and foreign ports in 1957. In 1956 the total exceeded 66,000 tons; foreign ports received nearly 90 percent of this scrap; west coast ports, about 6½ percent; and eastern and gulf ports, the remainder.

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Employment.—According to a communication received from the Bureau of Labor Statistics, employment in the Territory mineral industries dropped from an average of 200 workers in 1956 to 172 in 1957, but the average weekly wage rose from \$72.82 to \$92.93. Several factors influenced the wage increase. A general wage increase was granted in 1957, and considerable overtime was required to supply building materials for the increased building activity on Oahu. The 1,326-unit Capehart housing project in Schofield Barracks was begun in 1957, and a bonus was given to many management workers at the end of the year.

TABLE 1.—Mineral production in the Territory of Hawaii and Pacific Island possessions, 1956-57¹

Area and mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
American Samoa: Stone (crushed).....	2,493	\$6,505	33,731	\$37,246
Canton: Stone (crushed).....	1,620	4,860	-----	-----
Guam:				
Sand and gravel.....	18,668	24,437	688	1,450
Stone (crushed).....	341,072	311,248	1,033,546	1,131,571
Total	-----	335,685	-----	1,133,021
Territory of Hawaii:				
Clays.....	1,590	1,988	2,488	3,110
Lime.....	9,555	305,709	8,469	270,686
Pumice (volcanic cinder).....	58,851	91,695	266,222	492,553
Salt.....	270	13,119	194	15,239
Sand and gravel.....	193,149	502,692	286,493	538,432
Stone.....	3,493,717	6,076,040	2,584,508	4,631,932
Total ²	-----	6,971,233	-----	5,930,057
Midway: Stone (crushed).....	203,049	304,574	3,875,001	6,700,000
Wake: Stone (crushed).....	21,500	21,500	5,000	6,340

¹ Supplemental production data for American Samoa furnished by the Government of American Samoa; Canton and Wake, by the U. S. Department of Commerce, Civil Aeronautics Administration; Guam by the Government of Guam; Midway, by the U. S. Department of the Navy.

² Total has been adjusted to eliminate duplicating the value of limestone used in lime.

REVIEW OF MINERAL COMMODITIES

NONMETALS

Clays.—Miscellaneous clay production in 1957 was limited to one producer, Gaspro, Ltd., at Kailua, Oahu. Although the output was 56 percent above that of 1956, 30 percent less was used in manufacturing pottery and stoneware. The quality of Territory clays precludes their use for other than heavy clay products, except as an admixture with other and better clays. Waialae Tile, Ltd. (formerly Wilsonite Brick Co., Ltd.), was formed during the year, but no mining was done by the company at its Waimanalo pit, Honolulu County.

Lime.—Gaspro, Ltd., prepared lime at its Honolulu kiln and hydrator from coral quarried on Oahu. Except for a few tons of quicklime, produced for the building trades, the output was hydrated for agricultural use by pineapple and sugarcane growers in the Territory. In view of the difficulty of producing specification lime for the growers, the company began converting from shaft-type to rotary kilns the

latter part of the year. As a result, the quantity in 1957 was about 11 percent below 1956; however, the unit price of these lime products remained virtually unchanged.

Pumice (Volcanic Cinder).—The major sugar companies on the Island of Hawaii produced a large tonnage of volcanic cinder at company-owned pits for use in constructing and maintaining plantation roads.

Salt.—Chum Mew Ting Co., the Territory's only producer, recovered salt from sea water by solar evaporation. This product, used chiefly in processing special foods, was in light demand during 1957, and the output was several tons less than in 1956.

Sand and Gravel.—Increased demand for building and paving sand on the Island of Oahu and paving gravel on the Island of Hawaii caused the rise in the Territory's total output of sand and gravel in 1957, compared with 1956. On the Island of Oahu, Chang's Express, Honolulu Construction & Draying Co., Ltd., and Pacific Concrete & Rock Co., Ltd., operated fixed and portable plants, principally in the Waialua area. Hawaii Trucking Co., Ltd., was the major producer of paving gravel on the Island of Hawaii.

Stone.—*Basalt.*—Fixed and portable plants on Hawaii, Kauai, Maui, and Oahu Islands produced the Territory's requirements of crushed basalt for use in concrete and road stone. Riprap, roofing granules, and fill material were products of the basalt quarried on Oahu. The overall tonnage decrease, in 1957, of crushed basalt, was caused by the decline in Government construction projects.

Limestone.—Limestone was quarried and crushed by Grove Farm Co., Ltd., on Kauai for building, paving, and agricultural use. On the Island of Oahu, Gaspro, Ltd., Kailua Limestone Co., and Nanakuli Paving & Rock Co., Ltd., prepared limestone for use in building and paving. Gaspro, Ltd., also prepared limestone for use in agriculture and lime manufacture. Kailua Limestone Co. produced dimension stone for use as rubble.

Miscellaneous Stone.—The tonnage of unclassified stone, including coral, was appreciably below 1956, due to the large quantity produced and stockpiled for the Department of the Navy on Oahu in the preceding year. In 1957 the Department of Defense and its contractors produced miscellaneous stone for building and paving purposes. The Territorial Department of Public Works quarried stone on Maui and Molokai for use in road maintenance and repair.

Vermiculite.—Vermiculite of Hawaii, Ltd., obtained crude vermiculite from the Western United States and processed the material at its exfoliation plant in Honolulu County. The expanded mineral was used for plaster aggregate, acoustical and thermal insulation, and agricultural purposes.

PACIFIC ISLAND POSSESSIONS

American Samoa.—The Government of American Samoa quarried and crushed basalt and dredged and prepared coral for riprap, building, and paving.

Canton.—The Civil Aeronautics Administration reported no coral crushing on the island during 1957.

Guam.—The joint venture of Hawaiian Dredging-Pomeroy-Koster prepared a considerable tonnage of coral aggregate under contract to the Department of Defense, for constructing an air base on Guam. Frank D. Perez & Bros. Co., Koster & Wythe, and maintenance crews of the Territory Public Works Department also prepared coral and/or beach sand for island building and paving requirements.

Midway.—The Hawaiian Dredging & Construction Co., Ltd., under a contract with the Department of Defense, dredged and prepared coral aggregate and fill material, principally for paving. The coral was transported from an offshore submerged reef by hydraulic pipeline.

Wake.—Maintenance crews of the Civil Aeronautics Administration and the contractor (J. H. Pomeroy & Co., Inc.) used bulldozers and a crane to recover coral rock, which was crushed and used in several construction projects.

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 Norman S. Petersen,¹ and A. J. Kauffman, Jr.²



MINING in Idaho was beset with difficulties arising from slackening metal markets and higher costs in 1957. Nearly all parts of the industry, and particularly tungsten and lead-zinc mining, faced adverse conditions. Several metal mines closed, including the only large tungsten mine; employment dropped; and in general metal-mining activity was slower at the end of the year than in January. Most major producers were able to maintain full-scale output by strict economy measures to hold down costs and development; as a result, the value of State mineral production

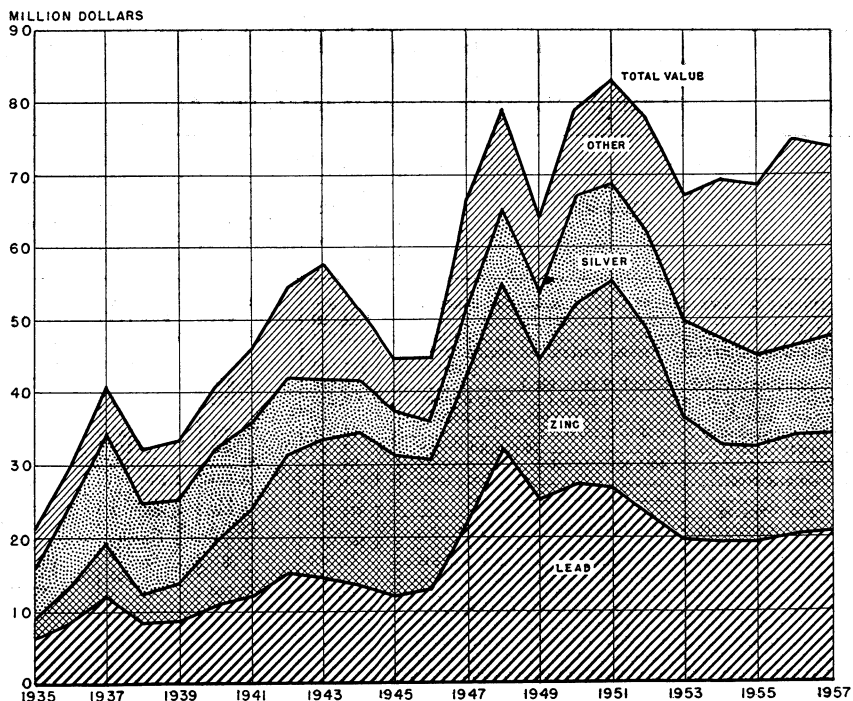


FIGURE 1.—Value of silver, lead, and zinc and total value of mineral production in Idaho, 1935-57.

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² Chief, Division of Mineral Industries, Region I, Bureau of Mines, Albany, Oreg.

THOUSAND SHORT TONS

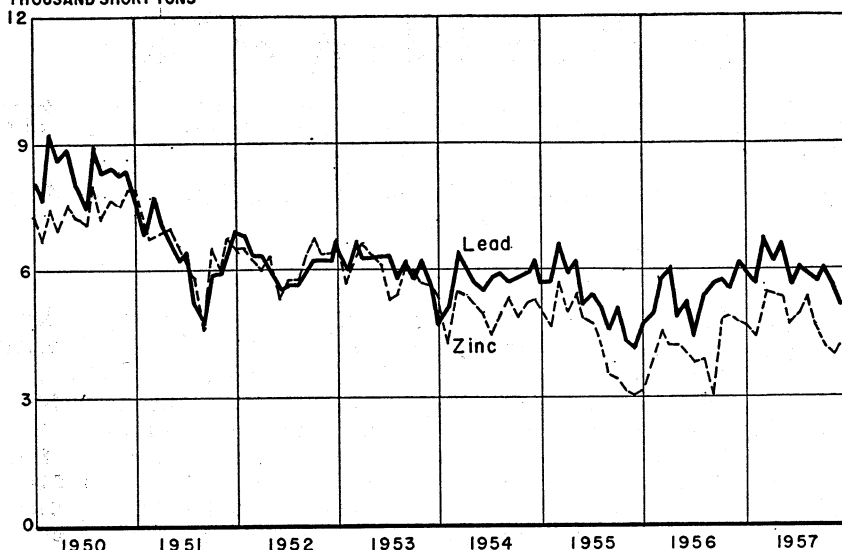


FIGURE 2.—Mine production of lead and zinc in Idaho, 1950-57, by months in terms of recoverable metals.

TABLE 1.—Mineral production in Idaho, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate.....antimony content.....	549	(?)	664	(?)
Clays.....	\$ 22,620	\$13	\$ 23,185	\$16
Cobalt (content of concentrate).....pounds.....	2,385,013	(?)	2,617,737	(?)
Columbium-tantalum (oxide content of concentrate) pounds.....	215,900	(?)	364,768	(?)
Copper (recoverable content of ores, etc.).....	6,656	5,658	7,912	4,763
Gold (recoverable content of ores, etc.).....troy ounces.....	4,9,210	4,322	12,301	431
Iron ore (usable).....long tons, gross weight.....	800	(?)	(?)	(?)
Lead (recoverable content of ores, etc.).....	64,321	20,197	71,637	20,488
Mercury.....76-pound flasks.....	3,394	832	2,260	558
Nickel (content of ore and concentrate).....pounds.....	98,495	(?)	74,040	55
Phosphate rock.....long tons.....	1,438,151	6,530	1,306,742	5,684
Pumice.....	101,913	206	100,137	163
Sand and gravel.....	7,874,460	5,661	6,601,035	5,236
Silver (recoverable content of ores, etc.).....troy ounces.....	13,471,916	12,193	15,067,430	13,637
Stone.....	1,791,077	2,752	1,542,125	2,759
Titanium concentrate (ilmenite).....gross weight.....	48,619	(?)	28,387	(?)
Tungsten concentrate (60-percent WO ₃ basis).....	582	(?)	35	(?)
Zinc (recoverable content of ores, etc.).....	49,561	13,580	57,831	13,417
Value of items that cannot be disclosed: Barite, beryl- lium (1957), cement, abrasive garnet, gem stones, gypsum (1957), mica (1957), monazite, peat (1957), uranium (1957), and values indicated by footnote 2. Excludes value of limestone used in manufacturing cement.....		6,889		6,252
Total Idaho.....		4 75,152		73,464

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 Incomplete total—fire clay included with items that cannot be disclosed.

⁴ Revised figure.

was down only 2 percent from the 4-year record reached in 1956. Shoshone County output reached \$47.4 million compared with \$45.9 million in 1956.

No mineral commodity except tungsten dropped more than \$1 million in annual production value. Silver (up \$1.4 million) was the only major product to show a marked rise; however, cobalt and columbium-tantalum output also gained. The combined value of lead and zinc remained the same as in 1956, despite a 14-percent increase in quantity recovered. Copper increased 19 percent in quantity but declined 16 percent in value. Silver, lead, zinc, and copper supplied 71 percent of the mineral production value of the State.

Decreased phosphate-rock output resulted when producers used more stockpiled material and closed two small mines. In contrast with the decreased mine output, the upward trend continued in demand for the commodity for both industrial and agricultural applications.

Long-range expansion of the industry continued to be highlighted by programs of The Bunker Hill Co., which developed the old Crescent mine, formerly an important silver-copper-lead producer, and further enlarged and modernized its lead smelter and zinc plant, including expanded facilities for byproducts recovery. Other projects of particular note included exploration of clay deposits near Moscow by The Anaconda Co. as a possible commercial source of alumina for its aluminum-reduction plant in Montana and a start in construction by Central Farmers Fertilizer Co. of a phosphate-rock-processing plant in southeastern Idaho.

Consumption, Trade, and Markets.—Falling industrial demand, reduced Government purchases, and consequently lower prices seriously affected the lead-zinc mining industry of Shoshone County, center of mineral production in Idaho. After price quotations had been stable throughout 1956, metal prices dropped from 16 cents to 13 cents in the case of lead and from 13½ cents to 10 cents for zinc.

The price of copper continued to fall sharply, from the 90-year record in February 1956 (46 cents per pound) to 27 cents by September 1957. This drastic price reduction resulted in suspension or curtailment of exploration projects aimed at bringing a number of small, long-idle copper mines into production throughout the State.

Tungsten mining ceased when Government purchases for stockpiling were suspended and producers were unable to compete with foreign imports. The value per flask of mercury produced declined as the market fell to the Government purchase price of \$225 and domestic output of the metal began to move into Government stockpiles.

Sand and gravel for building and paving purposes decreased in tonnage mined. A decline of building was indicated by a 4-percent drop in building permits issued by municipalities and covering most industrial, commercial, and residential construction in the State. After midyear construction was accelerated at the Brownlee damsite, on the highway building program, and in connection with expansion of the National Reactor Test Station at Arco; otherwise, construction was reported to be below that of 1956 throughout the State.

Trends and Developments.—The number of producing metal mines continued to decrease. In 1957 only 123 metal mines produced, as against 133 in 1956. Curtailment of lead-zinc and tungsten mining caused this decline. Three major producers—the Triumph and Frisco lead-zinc mines and the Ima tungsten mine—shut down after midyear. There were 113 lode and placer properties producing gold, silver, copper, lead, and/or zinc compared with 125 in 1956 and 230 in 1950. In nonmetal mining 142 operations were active, a reduction of 6 from the 1956 total because of fewer sand and gravel and phosphate-rock operations.

Because of lower prices and greater costs of production, companies were able to mine only the higher grade ores, and for the year lead-zinc ore, by far the principal lode material produced, averaged 5.4 percent recoverable lead (4.8 percent in 1956) and 4.2 percent recoverable zinc (3.6 percent in 1956).

Idaho metallurgical plants treated an increased tonnage of foreign base-metal ores and concentrates in 1957 to supplement the declining quantity available from domestic sources as the result of mine closures. Purchase of foreign-produced material was necessary to maintain operations near capacity and thus keep unit costs down.

TABLE 2.—Employment and wages in mining and mineral manufacturing, 1948-52 (average) and 1953-57, by industries ¹

Year	Mining							
	Metals		Nonmetals		Fuels		Total	
1948-52 (average)....	5,208	\$21,203,143	251	\$908,515	18	\$63,997	5,477	\$22,175,655
1953.....	4,479	21,838,855	326	1,374,802	14	27,223	4,819	23,237,880
1954.....	4,206	19,753,622	283	1,204,006	9	11,790	4,498	20,969,418
1955.....	4,112	20,012,050	297	1,333,588	28	88,054	4,437	21,433,692
1956.....	4,498	23,161,247	268	1,210,320	26	94,146	4,792	24,465,713
1957.....	4,388	23,716,345	249	1,122,986	21	83,919	4,658	24,923,250

Year	Mineral manufacturing							
	Stone and clay products		Primary metals		Chemical and allied products		Total	
1948-52 (average)....	332	\$1,249,762	1,109	\$4,551,902	413	\$1,744,090	1,904	\$7,545,754
1953.....	391	1,524,228	1,041	4,800,556	757	3,372,287	2,189	9,697,071
1954.....	385	1,496,787	1,147	5,214,121	796	3,614,231	2,328	10,328,139
1955.....	427	1,690,725	1,120	5,408,913	797	3,993,813	2,344	11,093,451
1956.....	458	1,894,254	1,173	6,398,533	877	4,658,156	2,508	12,947,943
1957.....	451	1,979,533.	1,232	6,818,079	(²)	(²)	(²)	(²)

¹ Employment covered by Idaho Employment Security Act, compiled from State employment-security-agency tabulations. These industry groups may vary from those in the Bureau of Mines canvass.

² Figure for mineral industry not available.

TABLE 3.—Hours and earnings of production workers in mining, 1953-57

Annual average	1953	1954	1955	1956	1957
Weekly earnings.....	\$39.68	\$36.27	\$39.69	\$97.11	\$101.02
Hourly earnings.....	\$2.11	\$2.13	\$2.22	\$2.34	\$2.47
Weekly hours.....	42.5	40.5	40.4	41.5	40.9

¹ Idaho Employment Security Agency.

TABLE 4.—Defense Minerals Exploration Administration contracts active during 1957

County and contractor	Property	Commodity	Contract		Government participation, percent
			Date	Total amount	
BLAINE					
Silver Star-Queens Mines, Inc.	Queen of the Hills...	Lead, zinc.....	Apr. 25, 1955	\$235,730	50
BUTTE					
Ralph M. Taylor, et al...	Copper Mountain...	Copper, lead.....	Oct. 13, 1955	14,250	50
CUSTER					
Clayton Silver Mines.....	Clayton.....	Lead, zinc.....	July 19, 1957	130,840	50
Cordero Mining Co.....	Wild Horse.....	Tungsten.....	Jan. 17, 1957	28,572	75
Hecla Mining Co. (assignee of Idaho Custer Silver-Lead Mines).	Livingston.....	Lead, zinc.....	July 28, 1953	1 91,790	50
Alfred G. Hoyl & Associates.	The Meadows.....	Monazite, thorium..	Sept. 20, 1956	26,986	75
Salmon River Scheelite Corp.	Tungsten Jim.....	Tungsten.....	Apr. 21, 1955	1 129,136	75
IDAHO					
Idaton, Inc. (assignee of Squaw Creek Mining Co.).	Smothers.....	Fluorspar.....	Apr. 12, 1957	10,000	50
LEMI					
Bradley Mining Co.....	Ima.....	Tungsten.....	Oct. 28, 1952	1 224,400	75
Idaho Consolidated Mines, Inc.	Twin Peaks.....	Lead, zinc.....	Nov. 10, 1955	17,370	50
Idaho Metallurgical Industries, Inc.	Tinkers Pride.....	Cobalt, copper.....	Aug. 26, 1955	1 345,558	62½
Montana Coal & Iron Co.	Black Pine.....	Copper.....	Mar. 25, 1955	1 134,600	50
Roger Pierce.....	Gilmore.....	Lead, zinc.....	June 29, 1956	82,366	50
SHOSHONE					
American Smelting and Refining Co.	East Page.....	Lead, zinc.....	Sept. 18, 1957	660,206	50
Bunker Hill Co.....	Crescent.....	Lead, zinc, copper...	Feb. 25, 1953	1,098,750	50
Day Mines, Inc.....	Hercules.....	Lead, zinc.....	Dec. 6, 1956	1 415,250	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.	June 3, 1953	1 873,340	50
Sidney Mining Co.....	Sidney.....	Lead, zinc.....	July 3, 1952	1 523,440	50
Silver Buckle Mining Co.	Vindicator.....	do.....	Oct. 12, 1953	1 229,500	50
Sunset Mines, Inc.....	Liberal King.....	do.....	Nov. 22, 1954	101,125	50

1 Amended.

Production of sand and gravel and stone was expected to increase sharply in 1958 under the impact of the Federal-Aid Highway Act of 1956. Under this act, States would receive reimbursement from Federal funds for 90 percent of costs of interstate projects, plus an increase in Public Land States, the Idaho rate being about 92.5 percent. The Idaho Board of Highway Directors, in its 6th annual report, issued December 1, 1957, estimated that value of all highway work placed under contract in the last 3 months of 1957 would total \$9.3 million as compared with \$11.1 million for the first 9 months of the year and \$14.2 million for all of 1956. There were 4 highways in the interstate system in Idaho, with total length of 610.8 miles. Federal funds allocated for Idaho, including funds matched equally

by the State on the normal primary and secondary State highway system, totaled \$20.1, \$25.5, and \$28.8 million for fiscal years ending June 30, 1957, 1958, and 1959, respectively.

Employment.—Employment in the mining industry declined from 4,900 in January to 4,300 in December. Labor turnover was much lower than in previous years, and hiring was limited to experienced miners. By the end of 1957 work prospects were poor, and even well-qualified miners were unable to find work in the Coeur d'Alene district, which was very unusual for this mining area.

Total wages paid by mining companies increased 2 percent because of 6-percent higher hourly rates. Employment and wages in smelting and refining advanced 5 and 6 percent, respectively.

Average weekly earnings of production workers in the mining industry exceeded \$100 for the first time, as the result of an increase from \$2.34 in 1956 to \$2.47 in 1957 in hourly earnings. Average weekly hours (40.9) dropped slightly.

Legislation.—The program of the Defense Minerals Exploration Administration (DMEA) continued to provide Government aid in financing the cost of projects for exploration of new or undeveloped sources of strategic or critical metals and minerals. Twenty-one contracts were active, mainly in Custer, Lemhi, and Shoshone Counties.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—The Anaconda Co. continued testwork on recovery of alumina from clay deposits in Latah County. (See Clays.)

Antimony.—Production of cathode antimony metal from Sunshine Mining Co. at its electrolytic plant near Kellogg, Shoshone County, increased from 549 to 664 short tons. The metal was obtained by leaching and electrolysis of concentrate from ore from the Sunshine mine and adjoining properties operated by the company and from purchased concentrate from the American Smelting and Refining Co. Galena mine. Sunshine Mining Co. continued work on facilities to purify the cathode metal by removing contained arsenic; the company also concluded and began fulfilling a \$1 million Government contract for 1,500–2,000 tons of refined metal during the 2-year period ending June 30, 1959.

Processing a large quantity of impure cathode antimony metal purchased from Sunshine Mining Co., which had stockpiled metal produced after reactivation of its antimony plant in 1953, was completed during the year by Bradley Mining Co.; refined metal was shipped to the Government under a purchase contract. Afterward, the Bradley company completed dismantling and removing its big antimony smelter at Stibnite, which was closed in 1952 and partly reactivated late in 1955 to remove arsenic from metal purchased from Sunshine.

Cadmium.—Byproduct cadmium was recovered from foreign and domestic ores treated at The Bunker Hill Co. lead smelter and nearby electrolytic zinc plant in Shoshone County. According to the company annual report, production and sales of electrolytic cadmium from the electrolytic zinc plant were 599,809 and 540,674 pounds,

respectively, in 1957 compared with 467,091 and 434,094 pounds in 1956. At the lead smelter sale of 54,372 pounds of cadmium was reported, compared with 103,461 pounds the preceding year.

Cobalt.—Production of cobalt concentrate from the Blackbird cobalt-copper mine, southwest of Salmon in Lemhi County, was again higher in 1957. Calera Mining Co., subsidiary of Howe Sound Co., shipped 8,783 short tons of concentrate containing over 2.6 million pounds of cobalt, an increase of nearly 10 percent. The operation continued as the major domestic source of cobalt.

Mine output, previously from underground workings, was augmented with ore from a new open pit. According to the company report to stockholders, an ore body estimated to contain 350,000 tons was suitable for open-pit mining. The surface operation, under contract carried out by Isbell Construction Co., supplied about 11 percent of the ore mined.

Concentrate produced at Cobalt was shipped to the Calera refinery at Garfield, Utah, where the company reported completing numerous process changes on the leaching and purification sections. Continued difficulties incident to the final reduction step of the original process led to a decision in 1956 to use an electrolytic method that had proved successful in pilot-plant tests. The electrolytic section was completed and placed in operation in October. The company also reported that comprehensive investigation of flotation problems experienced with the Blackbird mine cobalt-copper ore led to finding some reagents that promised to reduce mill costs and improve recovery.

Operations at the Calera Mining Co. refinery at Garfield were described in an article published during the year.³

Columbium-Tantalum.—Two dredges in Bear Valley, Valley County, supplied nearly the entire domestic production of columbium-tantalum. Crude concentrate from sand processed on the Porter Bros. Corp. dredges was shipped to a plant at Lowman where the heavy sand constituents were separated using a combination of gravity and electrostatic and electromagnetic methods. Output from the dredges, which began operating late in 1955, was considerably higher than in 1956. The two dredges were reported on a 24-hour-per-day schedule. A stockpile of dredge concentrate was accumulated at the company plant at Lowman in order that operations could be continued during the shutdown of the dredges for the winter season. The columbium-tantalum pentoxide content of concentrate shipped from Lowman was 364,768 pounds compared with 215,900 pounds in 1956. The material was delivered to the Mallinckrodt Chemical Works, St. Louis, Mo., for further processing to separate and recover the rare earth, thorium, and uranium content, and the columbium and tantalum from the concentrate. The Porter Bros. Corp. operations were conducted under a Government contract for 1,050,000 pounds of columbium-tantalum pentoxide of 90-percent pentoxide content.

³ Mitchell, J. S., How Calera Solved Metallurgical Problems at Garfield Cobalt Plant: Mining World, vol. 19, No. 7, June 1957, pp. 54-56.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, 1948–52 (average), 1953–57, and total, 1863–1957, 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		Fine ounces	Value	Fine ounces	Value
1948–52 (average).....	162	63	3,320,431	58,799	\$2,067,972	13,453,868	\$12,176,430
1953.....	114	34	2,090,185	17,630	617,050	14,639,740	13,249,704
1954.....	101	23	1,960,962	13,245	463,575	15,867,414	14,360,811
1955.....	109	34	1,960,816	10,572	370,020	13,831,458	12,518,168
1956.....	104	21	2,071,451	³ 9,210	³ 322,350	13,471,916	12,192,764
1957.....	93	20	2,099,677	12,301	430,535	15,067,420	13,636,776
1863–1957 ⁴			135,200,944	8,262,685	192,333,378	670,978,478	495,235,295

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948–52 (average).....	2,108	\$949,686	83,660	\$26,808,840	80,630	\$24,000,542	\$65,993,470
1953.....	3,136	1,800,064	74,610	19,547,820	72,153	16,595,190	51,809,828
1954.....	4,828	2,848,520	69,302	18,988,748	61,528	13,290,048	49,951,702
1955.....	5,618	4,191,028	64,163	19,120,574	53,314	13,115,244	49,315,034
1956.....	6,656	5,657,600	64,321	20,196,794	49,561	13,579,714	51,949,222
1957.....	7,912	4,763,024	71,637	20,488,182	57,831	13,416,792	52,735,309
1863–1957 ⁴	148,119	57,654,547	6,781,661	911,000,460	2,074,278	421,331,021	2,077,554,701

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.

² Does not include gravel washed.

³ Revised figure.

⁴ Partly estimated for years before 1901

TABLE 6.—Gold produced at placer mines, 1948-52 (average) and 1953-57, by classes of mines and methods of recovery

Class and method	Mines producing ¹	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	
				Total	Average per cubic yard
Surface placers:					
Grave, mechanically handled:					
Bucketline dredges:					
1948-52 (average)	4	1,932,878	10,355	\$362,432	\$0.188
1953	2	904,000	3,865	135,275	.180
1954 ²	3	904,300	4,832	169,120	.187
1955 ³	2	434,000	3,149	110,215	.254
1956	1	319,848	2,125	74,375	.233
1957 ⁴	6	192,900	1,756	61,490	.319
Dragline dredges:					
1948-52 (average)	3	384,798	1,405	49,182	.147
1953	4	332,000	1,476	51,660	.156
1954	2	289,000	1,308	45,780	.158
1955	4	63,969	285	9,975	.156
1956	2	3,000	52	1,820	.607
1957 ⁵					
Suction dredges:					
1948-52 (average)	1	2,693	18	623	.231
1953-57					
Nonfloating washing plants: ⁴					
1948-52 (average)	4	184,437	1,790	62,664	.340
1953	2	16,200	46	1,610	.100
1954	4	26,100	262	10,220	.392
1955	3	21,200	141	4,935	.233
1956	3	25,340	209	7,315	.289
1957 ⁵	8	40,560	273	9,555	.236
Gravel hydraulically handled:					
1948-52 (average)	7	22,363	152	5,334	.239
1953	9	181,250	425	14,875	.082
1954	7	15,800	193	6,755	.428
1955	13	27,300	283	9,905	.363
1956	7	1,340	98	3,430	2.560
1957	6	18,570	936	32,760	1.764
Small-scale hand methods: ⁶					
1948-52 (average)	42	11,830	191	6,671	.564
1953	17	2,800	75	2,625	.937
1954	7	2,966	68	2,380	.820
1955	12	5,550	88	3,080	.555
1956	8	2,450	38	1,330	.543
1957 ⁶					
Underground placers (drift):					
1948-52 (average)	2	390	6	196	.503
1953-57					
Grand total placers:					
1948-52 (average)	63	2,489,389	13,917	487,102	.196
1953	34	1,436,250	5,887	206,045	.143
1954	23	1,238,100	6,693	234,255	.189
1955	34	551,950	3,946	138,110	.250
1956	21	351,978	2,522	88,270	.251
1957	20	252,030	2,965	103,775	.412

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

² Includes monazite dredge recovering gold as byproduct.

³ Includes production from bucketline dredges and dragline dredges, which cannot be shown separately.

⁴ Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

⁵ Includes production from nonfloating washing plants and small-scale hand methods, that cannot be shown separately.

⁶ Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long-toms, dip boxes, pans, etc. "Wet" method used exclusively in Idaho.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Blaine.....	4	-----	378	\$13,230	314,377	\$284,527
Boise.....	8	3	93	3,255	1,174	1,063
Custer.....	15	1	624	21,840	174,405	157,845
Idaho.....	5	12	3,549	124,215	669	605
Lemhi.....	12	1	3,748	131,180	83,734	75,784
Owyhee.....	-----	1	4	140	-----	-----
Shoshone.....	31	-----	2,254	78,890	14,397,771	13,030,710
Undistributed ¹	18	2	1,651	57,785	95,290	86,242
Total.....	93	20	12,301	430,535	15,067,420	13,636,776

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Blaine.....	25	\$15,050	1,918	\$548,548	1,523	\$353,336	\$1,214,691
Boise.....	-----	-----	-----	-----	-----	-----	4,318
Custer.....	503	302,806	1,415	404,690	643	149,176	1,036,357
Idaho.....	-----	-----	-----	-----	-----	-----	124,820
Lemhi.....	3,904	2,350,208	1,014	290,004	829	192,328	3,039,504
Owyhee.....	-----	-----	-----	-----	-----	-----	140
Shoshone.....	3,473	2,090,746	67,125	19,197,750	54,825	12,719,400	47,117,496
Undistributed ¹	7	4,214	165	47,190	11	2,552	197,983
Total.....	7,912	4,763,024	71,637	20,488,182	57,831	13,416,792	52,735,309

¹ Includes values and quantities that cannot be shown separately for Ada, Bonner, Boundary, Camas, Clark, Elmore, Gem, Jerome, Kootenai, Twin Falls, and Valley Counties.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	390	1,234,560	511	6,009	4,718
February.....	970	1,164,360	737	5,695	4,432
March.....	580	1,343,120	596	6,788	5,542
April.....	810	1,350,230	759	6,257	5,421
May.....	1,140	1,272,730	699	6,623	5,379
June.....	1,550	1,269,840	623	5,670	4,819
July.....	1,530	1,347,670	673	6,026	4,959
August.....	1,640	1,276,560	672	5,914	5,387
September.....	1,720	1,353,090	639	5,810	4,746
October.....	758	1,280,519	756	6,034	4,188
November.....	590	1,058,692	573	5,646	4,027
December.....	623	1,116,049	674	5,165	4,213
Total.....	12,301	15,067,420	7,912	71,637	57,831

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold.....	15	2,839	1,962	6,740			
Dry gold-silver.....	3	9	25	1,151			
Dry silver.....	15	403,584	1,085	10,323,161	6,069,800	5,659,700	404,500
Total.....	33	406,432	3,072	10,331,052	6,069,800	5,659,700	404,500
Copper.....	13	282,550	4,284	18,160	8,680,800	600	22,700
Copper-lead.....	1	22		294	1,800	8,400	
Lead.....	22	55,897	41	237,339	34,600	5,649,900	295,100
Lead-zinc.....	20	1,157,206	1,891	4,287,035	922,100	123,956,000	96,881,200
Other ²	1	(³)	9	62,834	91,900	118,200	
Total.....	57	1,495,675	6,225	4,605,662	9,731,200	129,733,100	97,199,000
Other "lode" material:							
Dry gold: Mill cleanings.....	3	99	30	71			
Copper: Old tailings.....	1	305	4	68	19,800		
Lead: Mill cleanings.....	1	6		6		4,900	
Lead-zinc:							
Mill cleanings.....	1	24	1	109		3,700	6,400
Old tailings.....	2	90,404	4	60,756	3,200	1,928,100	820,900
Old slag.....	1	18,305		10,147		1,901,400	1,658,000
Zinc:							
Old slag fumed.....	1	16		2		600	3,800
Old slag smelted.....	1	88,411		59,062		4,042,500	15,569,400
Total.....	11	197,570	39	130,221	23,000	7,881,200	18,058,500
Total "lode" material.....	93	2,099,677	9,336	15,066,935	15,824,000	143,274,000	115,662,000
Gravel (placer operations).....	20	(⁴)	2,965	485			
Total.....	113	2,099,677	12,301	15,067,420	15,824,000	143,274,000	115,662,000

¹ Detail will not necessarily add to total, because some mines produce more than 1 class of material.
² Includes production from tungsten ore yielding copper-lead concentrates.
³ Tungsten-ore tonnage (30,824), not included in total.
⁴ 252,030 cubic yards.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1957, by types of material processed and methods of recovery, in terms of recoverable metals

Method of recovery and type of material processed	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation.....	832	518			
Concentration, and smelting of concentrates:					
Ore ¹	7,151	14,811,690	14,977,300	134,776,600	97,590,700
Old tailings.....	4	60,756	3,200	1,928,100	820,900
Total.....	7,155	14,872,446	14,980,500	136,704,700	98,411,600
Direct smelting:					
Ore.....	1,314	124,506	823,700	616,200	12,800
Old tailings.....	4	68	19,800		
Old slag.....		69,211		5,944,500	17,231,200
Mill cleanings.....	31	186		8,600	6,400
Total.....	1,349	193,971	843,500	6,569,300	17,250,400
Placer.....	2,965	485			
Grand total.....	12,301	15,067,420	15,824,000	143,274,000	115,662,000

¹Includes production from tungsten ore yielding copper-lead concentrates.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Material sold or treated (short tons)	Gold, lode and placer (ounces) ¹	Silver, lode and placer (fine ounces) ²	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Blaine County:									
Galena and Mineral Hill and Camas ³	3		5,186	237	68,692	9,400	1,250,900	631,000	\$325,369
Warm Springs	1		30,455	141	245,685	40,600	2,685,100	2,415,000	889,822
Boise County:									
Boise Basin	3	2	8	32	432				1,511
Gambrius	3		60	34	18				1,292
Grimes Pass	1	1		5	2				177
Ploneerville	1			3	134				226
Summit Flat	3		16	19	593				1,202
Custer County:									
Alder Creek	4		9,629	555	8,074	973,900	24,800	22,700	323,055
Alta, East Fork, and Stanley ⁴	3	1	1,687	17	16,869	3,000	102,700	2,700	31,812
Bayhorse	4		36,227	44	148,813	28,900	2,702,500	1,260,800	677,619
Yankee Fork	4		268	8	1,149	200			1,380
Idaho County:									
Burgdorf-Marshall Lake	1		750	120	145				4,331
Camp Howard (Salmon River)	1	1	30	1,370	72				48,015
Elk City	1	4	5	1,857	373				65,333
Lowell, Orogrande, and Warren ⁵	1	4	95	1,201	78				7,105
Selway River	1		10	1	1				86
Lemhi County:									
Blackbird, Eureka, Gibbonsville, Rattlesnake Creek, and Salmon River ⁶	7		270,893	3,719	9,494	7,339,600	8,400	2,349,151	
Blue Wing	1		(⁷)	9	62,834	91,900	118,200		101,748
Leadore	1		107		25,100				7,555
McDevitt	2		2,282	17	1,289	351,400			107,533
Nicholla	1		18,305		10,147		1,901,400	1,658,000	473,412
Yellow Jacket	1	1		3					105
Owyhee County: Carson or French				4					140
Shoshone County:									
Beaver and Hunter ⁸	8		305,161	578	1,117,938	281,900	28,105,900	37,345,000	9,468,105
Evolution	4		262,693	244	6,376,616	2,389,300	6,287,500	636,000	7,328,677
Lelande and Placer Center ⁹	10		219,348	692	3,997,102	3,671,100	9,545,600	2,829,000	6,427,490
Yreka	9		923,240	840	2,916,215	603,700	91,311,100	68,839,400	23,893,293
Undistributed ⁶	18	2	13,241	1,651	95,290	14,000	330,600	22,000	197,983
Total	93	20	2,099,577	12,301	15,097,420	15,824,000	143,274,000	115,662,000	52,735,309

¹ Source of gold: 9,336 ounces from lode mines; 2,965 ounces from placers.

² Source of silver: 15,069,385 ounces from lode mines; 486 ounces from placers.

³ Continued to avoid disclosing individual company confidential data.

⁴ Includes production from property not classified as a mine.

⁵ Unregular ore yielding copper-lead concentrates.

⁶ Includes values and quantities that cannot be shown separately for Black Hornet (Knox) district, Valley County.

district, Ada County; Clark Fork, Lakeview, and Pond Oreille districts, Bonner County; Port Hill district, Boundary County; Willow Creek district, Cassia County; Birch Creek district, Clark County; Middle Boise district, Elmore County; Reservoir district, Gem County; Snake River district, Jerome County; Clear Fork district, Latah County; Snake River district, Twin Falls County; and Unorganized (Knox) district, Valley County.

A description of Bureau of Mines research on beneficiation of Idaho alluvial sands was published.⁴ Exploration for columbium, tantalum, and uranium minerals at the Dismal Swamp placer deposit in Elmore County was the subject of a report.⁵

Copper.—Copper production again was higher in 1957 than in the preceding year, increasing from 6,656 tons in 1956 to 7,912 tons. The output of the metal has increased each year since 1953, when production totaled 3,136 tons. The leading producer in the State continued to be the Blackbird mine of Calera Mining Co. in Lemhi County; however, the percentage of the total produced by Calera dropped in 1957 owing to rather substantial increases in copper recovered in Shoshone County, chiefly from ores from the Galena mine of American Smelting and Refining Co. The Sunshine mine and adjoining properties mined by Sunshine Mining Co. in Shoshone County and the old Empire mine, worked by Idaho Alta Metals Corp. in Custer County, ranked third and fourth.

Copper production in the State was principally byproduct. Cobalt-copper ore was recovered at the Blackbird mine, and the Galena and Sunshine mines yielded primarily silver ore. Lead-zinc mines in the State also provided substantial quantities of copper.

Gold.—Gold output increased from the long-time low level of 9,210 ounces recovered in 1956 to 12,301 ounces in 1957. About 76 percent of the total came from lode mines. Calera Mining Co. Blackbird cobalt-copper mine in Lemhi County was the leading producer in the State; Talache Mines, Inc., Boise-Rochester mine in Elmore County ranked second. Quantities of gold also were recovered at silver-lead-zinc mines in Shoshone County. Clearwater Dredging Co., at its Crooked River claim in Idaho County, ranked third as a producer in the State—the largest placer property. Over 92 percent of the placer gold produced in Idaho in 1957 came from the Elk City and Camp Howard districts of Idaho County.

The Idaho Supreme Court in September overruled a State land board decision dating back to August 1956 that revoked the gold-dredging permit of Clearwater Dredging Co. The action of the State land board was based upon what the board termed a failure to maintain reasonable stream clarity. Operations were continued by the company while the decision was being appealed, except for a normal winter shutdown. After announcement of the Supreme Court decision, Vernon B. Finch, owner of Clearwater Dredging Co., announced sale of the company dredge to H. M. McKibben.

Iron Ore.—Iron ore was mined from a deposit on Iron Mountain north of Weiser in Washington County. E. L. Jones & Associates shipped a quantity of the ore to Oregon Steel Mills in Portland, Oreg., and reported plans for further development at the property and installation of additional equipment.

Lead.—Lead production increased to the highest level since 1953. Output of 71,637 tons was 11 percent greater than the 64,321 tons produced in 1956. Greater output was reported for most of the major companies; The Bunker Hill Co. Bunker Hill mine and the American

⁴ Shelton, J. E., and Stickney, W. A., How to Process Alluvial Sand for Tantalum-Columbium: Eng. and Min. Jour., vol. 158, No. 4, April 1957, pp. 93-95.

⁵ Armstrong, Frank C., Dismal Swamp Placer Deposit, Elmore County, Idaho: Geol. Survey Bull. 1042-K, 1957, 12 pp.

Smelting and Refining Co. Page mine recorded the largest increases. The Bunker Hill mine (Shoshone County) continued as by far the leading source of lead in the State followed by the Star mine (also operated by The Bunker Hill Co.) and the Page mine. Of the 11 leading mines in 1956, only 4 recorded decreased output in 1957 despite lower lead prices. The greatest decline was reported concerning the American Smelting and Refining Co. Frisco mine, which was closed at the end of 1956 except for salvage.

Most of the lead-zinc companies were finding it increasingly difficult to operate profitably. Lower prices and increasing costs resulted in application of strict economy measures, and a few operations closed. The Triumph Mining Co. Triumph mine (Blaine County) restricted operations early in the year, and work was suspended completely in July. The mine had been the largest lead-zinc-silver producer in the State outside the Coeur d'Alene district. Nabob Silver Lead Co. closed its mine and mill in June, pending enough improvement in metal prices to warrant reopening, and operations at the Hull lease on the Frisco mine were suspended permanently in April.

The old Morning mill of American Smelting and Refining Co. was destroyed by a \$500,000 fire in May. Work in the Morning mine was confined to exploration and development after the fire until arrangements were made with Golconda Lead Mines Co. for milling Morning mine ore at the Golconda mill.

Mercury.—Quicksilver output was sharply reduced in 1957, declining 33.4 percent (1,134 76-pound flasks) from 1956. Nearly all of the metal came from the Idaho Almaden mine in Washington County, operated by Rare Metals Corporation of America. The company produced 2,177 flasks from 57,836 tons of ore in a 175-ton-per-day Gould rotary furnace; this output was nearly 20 percent less than the quantity produced the preceding year. The Vermillion property near Stibnite in Valley County was the only other producer in the State in 1957. United Mercury Mines Corp. reported output of 83 flasks, the first recorded production from the mine.

A report describing mining methods, performance, and costs at the Idaho Almaden mine was published.⁶ The Idaho Almaden and other mercury deposits in Washington County were described in a bulletin issued during the year.⁷

The Holly Minerals Corp. Hermes mine (Cinnabar mine), for some years the only active mercury operation in the State until the Idaho-Almaden mine was reopened in 1955, was idle throughout the year. Surface facilities at the mine were destroyed in a fire in August 1956. The Holly company was experimenting with recovering mercury from ore by a new method involving concentration, leaching, and electrolytic deposition.

Nickel.—Cobalt concentrate, containing nickel, was produced from the Calera Mining Co. Blackbird mine, Lemhi County, and shipped to the company refinery at Garfield, Utah. Despite the advance in quantity of cobalt concentrate produced, the nickel content of concentrate was lower, declining from 98,495 pounds in 1956 to 74,040 pounds.

⁶ Lickes, Margaret R., *Mining, Processing, and Costs—Idaho Almaden Mercury Mine, Washington County, Idaho*: Bureau of Mines Inf. Circ. 7800, 1957, 33 pp.

⁷ Ross, Clyde P., *Quicksilver Deposits Near Welsler, Washington County, Idaho*: Geol. Survey Bull. 1042-D, 1956 (1957), 26 pp.

Rare-Earth Metals.—Monazite, a rare-earth mineral also containing thorium, was recovered as a byproduct at the Porter Bros. Corp. columbium-tantalum dredging operation in Bear Valley, Valley County. The monazite concentrate was sold to eastern processing firms. Rare earths and thorium also were recovered from columbium-tantalum concentrates shipped to Mallinckrodt Chemical Works by Porter Bros. (see Columbium-Tantalum).

Monazite was recovered as a byproduct at the Baumhoff-Marshall, Inc., sand plant at Boise (see Titanium). The material was sold to processing firms in the East.

Exploration and development work for thorium ore were reported at properties in northern Idaho.

Silver.—Silver output increased 12 percent to 15.1 million ounces valued at \$13.6 million. Four operations—Sunshine Mining Co. Sunshine mine, American Smelting and Refining Co. Galena mine, The Bunker Hill Co. Bunker Hill mine, and Polaris Mining Co. Silver Summit mine, all in Shoshone County—provided over 80 percent of the State total. Each of these mines produced more than 1 million ounces of silver; the Sunshine mine and adjoining areas worked by Sunshine Mining Co. were the largest, yielding over 5 million ounces. Output from each of the properties increased in 1957; the Galena mine recorded the largest advance.

Idaho continued as the Nation's leading silver-producing State; its output was more than twice that of next-in-rank Utah and more than a third of the national total.

Titanium.—Baumhoff-Marshall, Inc., continued re-treatment of stockpiled ilmenite concentrate recovered from 1951 to mid-1955 as a byproduct of dredging for monazite near Cascade in Valley County. The company reported shipment of 28,397 short tons of ilmenite concentrate, containing approximately 45 percent titanium dioxide, to National Lead Co. in St. Louis, Mo., in 1957. Processing the stockpiled ilmenite concentrate was completed during the year.

Tungsten.—The output of tungsten in the State dropped very low owing to cessation of Government purchases for stockpiling. The quantity produced was the smallest since 1936. Shipments were reported from two properties—the Ima mine in Lembi County and the Snowbird mine in Valley County. Bradley Mining Co. closed the Ima mine at the end of June; the property had been the leading producer in the State and a major source of high-grade hübnerite (manganese tungstate).

Uranium.—A quantity of uranium was recovered from euxenite concentrate produced at the Porter Bros. Corp. operations in Bear Valley, Valley County; the concentrate was processed by Mallinckrodt Chemical Works (see Columbium-Tantalum).

Western Fluorite Co. was the only producer of uranium ore in the State in 1957. A small quantity of uranium concentrate was shipped by the company from the Lightning claims in Custer County.

Uranium minerals in placer deposits in Idaho County were discussed in a report published during the year.³

Zinc.—In company with gold, silver, copper, and lead, zinc output also increased in 1957, advancing to 57,831 tons from 49,561 tons in

³ Armstrong, F. C., and Wels, P. L., Uranium-Bearing Minerals in Placer Deposits of the Red River Valley, Idaho County, Idaho: Geol. Survey Bull. 1046-C, 1957, 12 pp.

1956. The Bunker Hill Co. Star and Bunker Hill mines and the American Smelting and Refining Co. Page mines were the major sources of the metal. Additional large quantities of zinc were recovered from The Bunker Hill Co. slag-fuming plant and at the Sidney Mining Co. Sidney mine. Each of these operations, particularly the Page mine, had increased output in 1957.

The Bunker Hill Co. placed a fifth unit into full operation at its electrolytic zinc plant near Kellogg. The addition increased production capacity by 25 percent. Operations at the company slag-fuming plant near Kellogg were suspended for a period early in the year owing to a fire in the coal-storage and coal-transfer belts in the plant.

NONMETALS

Barite.—The Sun Valley mine of J. R. Simplot Co., Blaine County, continued to be the only source of barite production in Idaho. Crude ore output was more than double the 1956 rate and was the highest ever reported for the State. The crude material was shipped to the company plant at Pocatello, Bannock County, for processing and grinding. Ground barite was marketed for use in oil-well drilling muds. Shipments of ground barite to consumers in Idaho, Illinois, Montana, Oklahoma, and Utah also were more than double the 1956 rate.

Cement.—Production and shipments of cement decreased 12 percent and 10 percent, respectively, in 1957 compared with the preceding year. Idaho Portland Cement Co. operated the only cement-producing plant in the State at Inkom, Bannock County. Portland and masonry cements were shipped chiefly to destinations within the State, but some cement was shipped to Wyoming, Nevada, and Utah. The principal mode of transportation was truck; a smaller quantity was reported going by rail. Limestone, the principal raw material, was quarried at the nearby company-operated Inkom quarry.

Clays.—Output of clays increased 6 percent in quantity and 23 percent in value compared with 1956. Fire clay was produced in Latah County and miscellaneous clay for making heavy clay products, chiefly building brick, was mined in Ada, Bonneville, Cassia, and Minidoka Counties. A. P. Green Firebrick Co. made refractories at its Troy plant from the Latah County fire clay. Output of this type of refractory clay rose 26 percent compared with the preceding year. Bentonite from Owyhee County was used in rotary-drilling muds and for sealing irrigation canals and reservoirs.

Deposits of clay in Latah County were explored further during the year to determine if the clay was suitable as a source of alumina and as a ceramic raw material. J. R. Simplot Co. tested clay in the Bovill area to determine if the material would be acceptable for ceramic use and paper manufacture; 1,960 acres of State land were under lease in the county. The company in midyear announced plans for constructing a clay-processing plant near Bovill in 1958. The Anaconda Co. continued to investigate clay deposits in the Moscow area to evaluate these deposits as a source of alumina for producing aluminum. Clay was shipped during the year to the company test plant at Anaconda, Mont. Completion of a 50-ton-per-day pilot plant

was scheduled for early 1958 to confirm on a larger scale operating methods and costs of the new process, which had been demonstrated successfully in the smaller test plant.

Garnet (Abrasive).—Increased demand for abrasive garnet resulted in increases of 34 and 26 percent in production and sales, respectively, of this commodity compared with 1956. Output came from the Benewah County Emerald Creek deposits worked by Idaho Garnet Abrasive Co. and from the Boise plant of Baumhoff-Marshall, Inc., where garnet was recovered in processing stockpiled ilmenite concentrate. The latter production was obtained from material that was dredged previously in Valley County. Shipments were made to out-of-State consumers.

Gem Stones.—As in past years, no commercial gem stones were mined in the State. Many vacationers, rockhounds, and others gathered a variety of mineral specimens, including garnet, agate, and jasper. Some of this material was cut and polished for costume jewelry, while the rest was used for ornamental and display purposes.

Gypsum.—Rock Island Gypsum Co., Weiser, began working the Rock Creek gypsum mine in Washington County. The deposit, formerly operated by the Northwest Gypsum Co., was obtained by the Rock Island firm in 1956. Output was marketed as a soil conditioner.

Mica.—Output of mica was reported from an area north of Deary, Latah County. Western Mica Corp. produced hand-cobbed and full-trim mica, which was shipped to the General Services Administration (GSA) Government stockpile at Custer, S. Dak. A quantity of scrap mica also was produced, but no sales of this material were reported. The last production of mica in Idaho came from the Muscovite mine of Idaho Beryllium & Mica Corp. in 1955. The company had shipped mica and beryl concentrate to the GSA for stockpiling. In June 1957 the assets of Idaho Beryllium & Mica Corp. were sold at a public auction by the Reconstruction Finance Corporation (RFC). Much of the equipment of the liquidated firm was obtained by Western Mica Corp.

Peat.—A small quantity of peat humus was produced by the Idaho Peat Co. near Downey, Bannock County. Output was marketed principally for horticultural uses as a soil conditioner.

Phosphate Rock.—Production of marketable phosphate rock declined 9 percent compared with 1956. This decrease marked a reversal of the upward trend in the State begun in 1953. An output of 1.3 million long tons of marketable phosphate rock in 1957 was reported from 5 mines—2 in Caribou and 1 each in Bear Lake, Bingham, and Clark Counties. Two mines, one each in Bingham and Caribou Counties, that were active in 1956 were reported idle in 1957. Lower production was caused chiefly by inactivity of these two mines and by reduced output at the Ballard surface mine in Caribou County. Bingham County continued to be the principal producing area in the State, owing largely to the output of phosphatic shale at J. R. Simplot Co. Gay mine near Fort Hall.

Phosphate rock sold or used by producing companies increased 18 percent above the 1956 rate. The largest use of phosphate rock mined in Idaho was for manufacturing electric-furnace elemental phosphorus; smaller quantities, in order of tonnages used, were con-

sumed in making triple superphosphate, superphosphate fertilizers, and wet-process phosphoric acid. Despite the decrease in tonnage of phosphate rock produced in 1957, all uses, including exports, increased over 1956.

Central Farmers Fertilizer Co. began constructing a phosphate-rock-processing facility and calcium metaphosphate plant at Georgetown, Bear Lake County. Development of phosphate deposits in Georgetown Canyon and construction of roads and rail lines from the mine to the plant site began in 1956. Construction was scheduled for completion by the end of 1958.

Pumice.—Output of pumice in Idaho decreased about 2 percent compared with 1956. The material was used chiefly as aggregate for precast and poured concrete products. Pumice is used for this purpose, chiefly to reduce the weight of the finished product and, when used in place of sand and gravel, can effectively reduce the weight of concrete by 50 to 60 percent. A small quantity of pumice was reported sold for decorative stone. Pumice operations in Bonneville County contributed the bulk of the output; a small tonnage was produced in Blaine County. Most of the pumice mined was used by consumers in the State, but out-of-State shipments were reported to destinations in Montana, Utah, and Wyoming.

Sand and Gravel.—Gross output of sand and gravel declined 16 percent in quantity and 8 percent in value compared with 1956. Production from commercial operations in the State declined 7 percent in tonnage and 10 percent in value, and noncommercial production (Government-and-contractor) decreased 20 percent in volume and 6 percent in value below the preceding year. The chief cause of the drop in production was the decreased use of this commodity by the Bureau of Reclamation at the Palisades project, the Idaho Department of Highways, and the Bureau of Public Roads.

Sixty-nine percent of the sand and gravel produced in 1957 was used for road building and maintenance, 30 percent for building and construction projects, and the remaining 1 percent for miscellaneous uses, including special sands. Fifty-nine percent of the sand and gravel produced was crushed, washed, screened, or otherwise processed before marketing, and 41 percent was used as pit-run material. Output was reported from operations in 35 of the 44 counties in the State. Bonneville County led the State in tonnage of sand and gravel produced; Twin Falls and Ada Counties ranked second and third, respectively.

Production of special sands continued at 2 operations—1 each in Gem and Nez Perce Counties. Special high-quality sands for abrasive, plaster, filter, foundry, and filler purposes were produced.

TABLE 12.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

	1956			1957			Percent of change in—	
	Short tons	Value		Short tons	Value		Ton-nage	Aver-age value
		Total	Aver-age per ton		Total	Aver-age per ton		
COMMERCIAL OPERATIONS								
Sand and gravel:								
Building	640,720	\$765,501	\$1.19	594,650	\$779,558	\$1.31	-7	+10
Road material	1,460,298	1,307,541	.90	1,694,474	1,344,652	.79	+16	-12
Railroad ballast	(¹)	(¹)	-----	15,808	12,177	.77	-----	-----
Other ?	423,969	322,925	.76	36,681	25,439	.69	-91	-9
Total	2,524,987	2,395,967	.95	2,341,613	2,161,826	.92	-7	-3
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand and gravel:								
Building	1,750,381	164,158	.09	1,387,850	426,295	.31	-21	+244
Road material	3,599,092	3,101,292	.86	2,871,572	2,647,560	.92	-20	+7
Total	5,349,473	3,265,450	.61	4,259,422	3,073,855	.72	-20	+18
ALL OPERATIONS								
Sand and gravel:								
Building	2,391,101	929,659	.39	1,982,500	1,205,853	.61	-17	+56
Road material	5,059,390	4,408,833	.87	4,566,046	3,992,212	.87	-10	0
Railroad ballast	(¹)	(¹)	-----	15,808	12,177	.77	-----	-----
Other ?	423,969	322,925	.76	36,681	25,439	.69	-91	-9
Grand total	7,874,460	5,661,417	.72	6,601,035	5,235,681	.79	-16	+10

¹ Included with "Other" to avoid disclosing individual company confidential data.

² Includes blast, filter, and ballast sands and sand and gravel used for miscellaneous unspecified purposes.

Stone.—Output of 1.5 million tons of stone, valued at \$2.8 million, was 14 percent lower than 1956. The quantity produced in 1957 about equal in value the larger output of the preceding year, mainly because higher grade material was used at several major construction projects. Production of crushed stone from commercial operations declined 24 percent in volume and 7 percent in value, and output from noncommercial operations (Government-and-contractor production) declined 8 percent in tonnage but increased 6 percent in value. Basalt was the principal stone quarried and was used chiefly for road construction and maintenance. The Idaho Department of Highways reported an increase of 11 percent in crushed stone for road purposes compared with the preceding year. Limestone was quarried in Bannock and Lewis Counties. Output was 12 percent less than in 1956 and was used principally in making cement and at metallurgical, paper, and sugar plants. A small quantity of crushed limestone also was used for agricultural applications.

A report listed the principal limestone deposits and gave pertinent data regarding various occurrences in Alaska, British Columbia, Idaho, Oregon, and Washington.⁹

Quartzite for use as flux in electric furnaces at phosphate-rock-processing plants was quarried in Caribou and Power Counties. Output was reduced sharply compared with 1956.

Sixty-eight percent of the 1.5 million tons of stone produced in 1957 was used for concrete aggregate and roadstone, compared with 59 percent used for these purposes in 1956. Production of stone was reported from 18 of 44 counties in the State.

Sulfuric Acid.—The output of byproduct sulfuric acid by The Bunker Hill Co. acid plant at Kellogg, Shoshone County, more than doubled the 1956 rate. In its 1957 annual report to shareholders the company reported production of 96,041 tons of 100-percent-basis sulfuric acid, compared with 45,860 tons in 1956. The acid facility used waste sulfur dioxide gases produced in roasting zinc concentrate at the Kellogg electrolytic zinc plant. The leading use of sulfuric acid in Idaho was for manufacturing phosphate fertilizers.

REVIEW BY COUNTIES

Mineral production was reported from 39 of the 44 counties in the State in 1957. Based on value, 9 counties supplied over 90 percent of this output. The large production of metal ores in Shoshone County alone furnished nearly 65 percent of the value of minerals produced.

The number of operating metal mines in the State was 8 percent lower than 1956. Production of metal ores was reported from mines in 20 counties, compared with 24 counties in the preceding year.

Only 10 properties produced ores from which were recovered metals other than gold, silver, copper, lead, or zinc. These mines were in Custer County (uranium), Latah County (beryllium), Lemhi County (cobalt, nickel, tungsten), Shoshone County (antimony), Valley County (columbium-tantalum, mercury, tungsten), and Washington County (iron, mercury). Placer production of gold and silver was reported in eight counties; the largest output came from Idaho County. Lode production of gold, silver, copper, lead, and zinc came principally from Shoshone County; other counties adding substantially to the total were Lemhi, Custer, and Blaine. Ores and concentrates from placer gold and silver and lode gold, silver, copper, lead, and zinc properties were shipped to various purchasers, including gold-bullion buyers, the United States Mint, and smelters at Tacoma (Wash.), Kellogg (Idaho), Anaconda (Mont.), East Helena (Mont.), Great Falls (Mont.), Garfield (Utah), and Midvale (Utah).

⁹ Libbey, F. W., Limestone Resources of the Pacific Northwest: Raw Materials Survey, Inc., Resource Rept. 9, 1957, 92 pp.

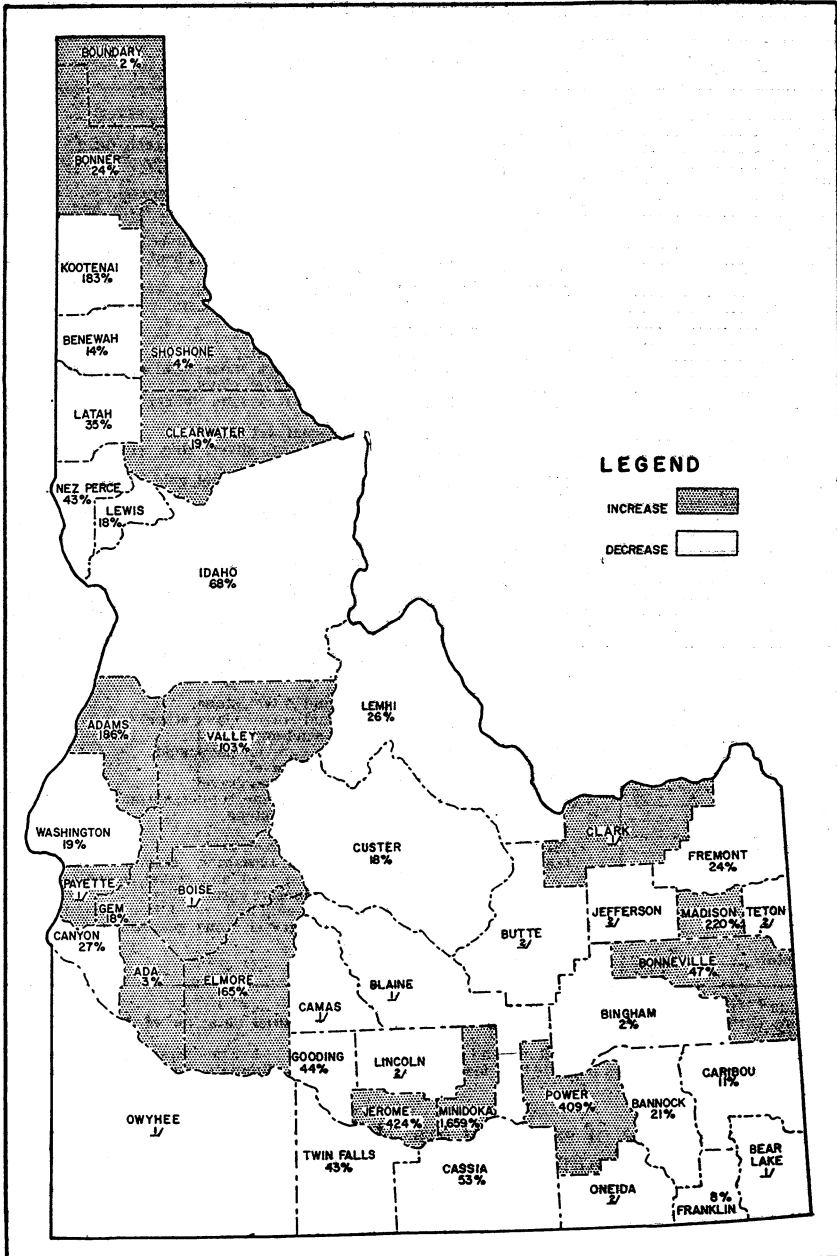


FIGURE 3.—Change in value of county mineral production, 1956–57.

¹ Figure withheld to avoid disclosing individual company confidential data

² No production in 1957.

TABLE 13.—Value of mineral production in Idaho, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Ada.....	\$333,600	\$342,179	Sand and gravel, clays, gold, silver.
Adams.....	70,605	202,053	Stone, sand and gravel.
Bannock.....	(²)	(²)	Cement, sand and gravel, stone, peat.
Bear Lake.....	(²)	249,732	Phosphate rock, sand and gravel.
Benchwah.....	(²)	(²)	Garnet.
Bingham.....	(²)	(²)	Phosphate rock, sand and gravel.
Blaine.....	1,829,815	(²)	Lead, zinc, silver, barite, sand and gravel, copper, gold, pumice.
Boise.....	530	(²)	Sand and gravel, gold, silver.
Bonner.....	286,414	355,074	Sand and gravel, silver, lead, gold, stone, zinc, copper.
Bonneville.....	738,088	1,083,647	Sand and gravel, pumice, stone, clays.
Boundary.....	29,416	29,999	Sand and gravel, lead, stone, silver, zinc.
Butte.....	69,183		
Camas.....	39,172	(²)	Gold, silver.
Canyon.....	254,516	184,735	Sand and gravel.
Caribou.....	(²)	(²)	Phosphate rock, stone, sand and gravel.
Cassia.....	142,930	67,948	Sand and gravel, clays.
Clark.....	(²)	331,495	Phosphate rock, sand and gravel, copper, silver, gold.
Clearwater.....	227,760	270,814	Stone, sand and gravel.
Custer.....	1,348,314	1,104,084	Lead, copper, silver, zinc, sand and gravel, gold, uranium.
Elmore.....	152,111	402,342	Stone, sand and gravel, gold, silver.
Franklin.....	51,619	47,768	Sand and gravel.
Fremont.....	274,892	207,856	Do.
Gem.....	80,427	95,220	Stone, sand and gravel, gold.
Gooding.....	230,900	129,543	Sand and gravel.
Idaho.....	970,073	310,615	Sand and gravel, gold, silver.
Jefferson.....	(²)		
Jerome.....	75,620	396,040	Sand and gravel, gold.
Kootenai.....	149,920	424,870	Stone, sand and gravel, copper, lead, silver.
Latah.....	741,598	484,184	Stone, clays, mica, beryllium.
Lemhi.....	7,874,962	5,838,797	Cobalt, copper, lead, zinc, gold, silver, tungsten nickel, stone, sand and gravel.
Lewis.....	(²)	(²)	Stone.
Lincoln.....	(²)		
Madison.....	41,549	133,000	Sand and gravel, stone.
Minidoka.....	3,332	58,592	Sand and gravel, clays, stone.
Nez Perce.....	232,712	133,619	Stone, sand and gravel.
Owyhee.....	72,062	(²)	Sand and gravel, clays, gold.
Payette.....	9,000	(²)	Sand and gravel.
Power.....	41,117	209,314	Stone, sand and gravel.
Shoshone.....	45,865,401	47,447,294	Lead, silver, zinc, copper, antimony, gold, sand and gravel, stone.
Teton.....	113,106		
Twin Falls.....	581,277	330,627	Sand and gravel, gold.
Valley.....	583,801	1,182,152	Columbium-tantalum, titanium (ilmenite), monazite, sand and gravel, mercury, tung- sten, abrasive garnet, silver.
Washington.....	714,742	578,025	Mercury, sand and gravel, iron ore, gypsum.
Undistributed ³	10,921,153	10,832,345	Sand and gravel, stone, gem stones.
Total.....	75,152,000	73,464,000	

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, and gem stones 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.)

Large quantities of sand and gravel and stone for roads, building and construction, riprap, and ballast uses were produced from a wide variety of operations throughout the State. Sand and gravel and/or stone were produced in 37 counties in 1957. Individual companies produced stone and sand and gravel for their own use and for the market; other output came from contractors for public agencies, such as the State and county highway departments, and Federal agencies, such as the Bureau of Reclamation, Bureau of Public Roads, United States Army Corps of Engineers, and the United States Forest Service.

Information concerning the more significant activities of mineral industries, by counties, is given below.

Ada.—Ada County ranked third in the State in sand and gravel production, with 327,000 tons valued at \$338,000 in 1957. Output was principally for building and road uses; a quantity of crushed gravel also was produced for railroad ballast. Pullman Brick Co., Inc., Boise, mined clay for processing to building brick. Output was reported to be substantially the same as in 1956.

Ilmenite concentrate stockpiled at the Baumhoff-Marshall, Inc., plant at Boise was reprocessed, and the cleaned material was shipped to the National Lead Co. plant at St. Louis, Mo. Work on the stockpile, accumulated from dredging operations for monazite in Valley County during 1951-55, was completed during the year. Some monazite and garnet, recovered during the processing, also was shipped from the plant.

Bannock.—Because of the production of cement at the only cement plant in the State and the value of sand and gravel and stone, the county ranked second in the State for value of nonmetal commodities produced in 1957. Idaho Portland Cement Co. produced cement at a facility near Inkom. Limestone, the principal raw material used, was quarried at the nearby company-operated Inkom quarry.

Barite from the Sun Valley mine at Hailey, Blaine County, also was processed at the Pocatello facility. A quantity of peat humus was produced by Idaho Peat Co. near Downey. In addition, sand and gravel and crushed stone, principally for road construction and maintenance, were produced.

Bear Lake.—Phosphate-rock mining continued to be the principal mineral activity in the county. San Francisco Chemical Co. produced phosphate rock from the Waterloo open-pit mine near Montpelier. The product was sold to fertilizer-manufacturing companies on the west coast. Output from the mine was at a reduced rate compared with 1956. Construction of a phosphate-fertilizer facility at Georgetown was begun by Central Farmers Fertilizer Co. Development of the phosphate claims and construction of transport routes from the mine to the plant site were continued during the year. Sand and gravel for road construction and maintenance also was produced. The chief consumer of this commodity was the State highway department, which contracted for requirements of gravel for road construction and maintenance.

Benewah.—Production of garnet by Idaho Garnet Abrasive Co. from the Emerald Creek garnet-bearing deposits east of Fernwood increased substantially in 1957. The Fernwood operation was 1 of 2 plants producing garnet in the State in 1957. An enlargement of the processing plant was reported by the company.

Bingham.—Bingham County continued as the leading phosphate-rock-producing area in the State. Mine production of this commodity in the county, however, declined slightly below the level of the previous year because the Fort Hall pit of the Westvaco Mineral Products Division, Food Machinery & Chemical Corp., was inactive. J. R. Simplot Co. mined phosphate rock and phosphatic shale from the Gay mine east of Fort Hall. Output from the operation was increased compared with 1956. The lower grade phosphatic shale was shipped to the electric-furnace elemental-phosphorus facility of Westvaco Mineral Products Division in Power County west of Pocatello. The

higher quality phosphate rock produced at the mine was used at the Simplot fertilizer plant at Pocatello for manufacturing superphosphate fertilizers. A quantity of road gravel for use by the Idaho Department of Highways and the county road department also was produced during the year.

Blaine.—Barite, sand and gravel, and pumice were the nonmetal commodities produced, in order of value, in 1957. J. R. Simplot Co. operated the Sun Valley barite property west of Hailey from June through October. Crude barite was shipped to the company plant at Pocatello, Bannock County, for grinding. A quantity of road gravel was produced for use by the Bureau of Public Roads and the State and county highway departments. A small tonnage of crude pumice for ornamental purposes was produced by Sun-ite Corp. at the Sun-ite open pit north of Magic Reservoir. The property had been idle since 1954.

Mineral Hill and Camas District.—Output of lead-zinc ore from the Silver Star-Queens mine (Silver Star-Queens Mines, Inc.) again increased substantially. The company reported shipment of 4,994 tons of ore to the Midvale, Utah, smelter. Work at the end of the year was on a 3-shift basis; 25 men were employed.

Warm Springs District.—Ore output by Triumph Mining Co. dropped to 30,309 tons compared with more than 56,000 tons in 1956 and over 77,000 tons in 1955. Economic considerations were reported by the company to be the reason for cessation of mining on July 15. Gross metal content of ore mined to that date was 1,839 ounces of gold, 259,419 ounces of silver, 1,404 tons of lead, and 1,537 tons of zinc. Lead and zinc concentrates, which also contained some recoverable copper, were shipped to the East Helena and Anaconda, Mont., smelters, respectively. The mine, which was the leading producer of zinc outside Shoshone County in 1957, was developed by 2 vertical shafts, 500 and 600 feet in depth, and the Triumph tunnel (11,000 feet) and Plummer tunnel (3,500 feet).

Bonner.—**Clark Fork District.**—Whitedelf Mining Co. shipped a small quantity of lead concentrate to the Bunker Hill smelter before its Whitedelf mine was closed in February. The mine remained idle for the rest of the year.

Lakeview District.—Silver ore was shipped by Austin-Meyers Corp. from the Weber mine to the Tacoma (Wash.) smelter. Output was substantially greater than in 1956. No ore was shipped from the Conjecture mine, operating control of which was acquired in 1956 by Federal Uranium Corp. Development reported included deepening the 1½-compartment shaft from 500 to 700 feet and about 650 feet of drifting on the 700 level. The company also acquired operating control of the adjoining Keep Cool and Hewer mines, both intermittent producers since about 1890, and made preliminary plans to work them from a shaft on the Conjecture property.

Bonneville.—Because of the output of large quantities of sand and gravel for the Bureau of Reclamation Palisades project, Bonneville County again led the State in production of this commodity. Output, however, was 10 percent less than in the preceding year. The county also was the principal pumice-producing area in the State. Idaho Falls Pumice Co. produced pumice from the Indian Siding pit and Gemstone Insulation Products Co. operated the Albino pit,

both near Idaho Falls. Pumice, Inc., prepared pumice from the Katie Lee pit near Ammon. Output was chiefly for use as light-weight-concrete aggregate. Production of pumice in the county declined slightly compared with 1956. Clay for making heavy clay products was mined near Idaho Falls.

Caribou.—Two phosphate-rock mines were active in 1957 compared with 3 in 1956. The Anaconda Co. continued open-pit production of phosphate rock at the Conda mine near Conda. The mine was operated from June through October; output was almost twice the 1956 rate. Phosphate rock was crushed and beneficiated before shipping to the company fertilizer plant at Anaconda, Mont., where it was used to make phosphate fertilizers and phosphoric acid. Monsanto Chemical Co. continued producing phosphate rock at the Ballard surface mine north of Soda Springs, at a reduced rate compared with the preceding year. Phosphate rock was processed to elemental phosphorus at the company Soda Springs plant. Quartzite for use as a flux at the Monsanto phosphorus facility was obtained from the Monsanto quarry north of Soda Springs. A quantity of road gravel for use of the Idaho Department of Highways also was produced.

Clark.—J. R. Simplot Co. continued producing phosphate rock from the Centennial mine on the Idaho-Montana border. The mine was active from July to October. Mined rock was trucked to Monida, Mont., for shipment by rail to a Canadian fertilizer plant. Production from the Idaho part of this mine increased 35 percent compared with 1956, the first year of output from the property. Road gravel for use by the State and county highway departments also was produced.

Custer.—*Alder Creek District.*—A substantial quantity of copper ore was produced by Idaho Alta Metals Corp. from the Empire mine. Ore was shipped to the Combined Metals Reduction Co. Bauer mill in Utah. The mine was purchased in 1955, and shipments were begun in October 1956.

Bayhorse District.—According to the company annual report, Clayton Silver Mines produced and milled 39,705 tons of ore at its Clayton mine—the leading source of lead outside Shoshone County in 1957. Over 50 percent of the ore came from the 400 level of the mine (which was depleted), 36 percent came from the 500 south area, and 12 percent from the 500 north area. The ore reserve in the latter area was estimated at a little over 96,000 tons at the end of the year. Sinking of the main Clayton shaft was resumed with DMEA assistance in July. Total underground development during the year was 372 feet of drifting, 260 feet of crosscutting, 73 feet of raising, 141 feet of sinking, and 12,459 cubic feet of underground excavation. The company mill ran at capacity 24 hours per day, 7 days per week; 2,094 tons of lead concentrate and 1,012 tons of zinc concentrate were produced. The company stockpiled 675 tons of zinc concentrate averaging 56 percent zinc. About 24 men were employed throughout the year.

Gem.—Del Monte Properties, Inc., Sand Division, produced special sands for abrasive, foundry, filler, and glass purposes at the company-operated processing plant at Emmett. Sands were washed, ground, sized, and concentrated by magnetic separation to the finished product. The raw material was obtained at the company-operated

pit 4 miles south of Emmett. Output increased over fourfold compared with 1956. Sand and gravel for building and road purposes also was produced; however, production of this commodity was reduced sharply owing to decreased requirements by the State highway department.

Idaho.—*Camp Howard (Salmon River) District.*—A substantial quantity of gold was recovered at the Gold Bar placer by Salmon River Gold Co. and Del Dewey. The operation was the second largest source of placer gold in the State.

Elk City District.—Gold produced by Clearwater Dredging Co. from its Crooked River claim was considerably less in 1957 than in the preceding year, although the firm continued as the leading placer operation and ranked third as a source of gold in the State. The company operated only 3 months (April-June) compared with 8 months in 1956; gravel washed was 79,962 cubic yards compared with 319,848 cubic yards. A bucketline dredge with sixty-four 2-cubic-foot buckets was used. On appeal by the company from a decision of the Idaho Land Board, the Idaho Supreme Court ruled that certain provisions of the State dredge-mining protective act, passed in 1954, were unconstitutional and restored the company-dredging permit in September. The company dredge in the meantime was reported sold to H & M Dredging Co., which continued limited operations.

Latah.—Contractors provided the roadstone requirements of the Idaho Department of Highways. A. P. Green Firebrick Co. processed clay mined near Helmer to firebrick at the new company refractories plant at Troy; this was the first year of production at the plant. Western Mica Corp. produced mica from operations north of Deary. Hand-cobbed and full-trim mica were shipped to Custer, S. Dak., for the Government stockpile of the General Services Administration (GSA). A quantity of scrap mica also was produced during the year. The Anaconda Co. and J. R. Simplot Co. were exploring and testing clay deposits in the county during the year.

Lemhi.—*Blackbird District.*—As in previous years, the Blackbird mine near Cobalt was the leading domestic producer of cobalt. Calera Mining Co. continued underground operations at the property and also milled ore from a new open pit, which was worked under contract by Isbell Construction Co. The Calera 1,000-ton flotation mill treated 268,562 tons of ore, which yielded 14,585 tons of copper concentrate containing recoverable gold, silver, and copper (shipped to Tacoma, Wash., smelter) and 8,957 tons of cobalt concentrate that also contained nickel. Cobalt concentrate was shipped to the company refinery at Garfield, Utah. The Blackbird mine was the only cobalt operation in the State and was the leading source of copper and gold. Underground workings at the mine comprised a 325-foot vertical shaft, an 850-foot inclined shaft, and 8 tunnels totaling 47,000 feet. A new open pit was developed with benches averaging 12½ feet in height and 400 feet in width.

In the same area, Montana Coal & Iron Co. completed constructing a 90-ton flotation mill and produced some copper concentrate during experimental mill runs from June to October. The copper concentrate was shipped to Garfield, Utah, for smelting.

Blue Wing District.—A sharp decline in the open-market tungsten price and cessation (in 1956) of Government purchases of tungsten for stockpiling forced closure of the Ima mine of Bradley Mining Co. in June. This mine had produced high-grade hübnerite, scheelite concentrate, and byproduct sulfide concentrate containing gold, silver, copper, and lead, continuously since 1949. No production was reported in 1948 owing to a fire, which destroyed the mill in December 1947. Large tonnages of ore also were produced from the mine during and before World War II. The Bradley company processed 30,824 tons of ore in its 150-ton flotation-gravity mill in 1957 and produced 1,191 tons of sulfide concentrate and over 15,000 units of tungsten (tungstic oxide content of concentrate), mostly hübnerite.

Nicholia District.—Over 29,000 tons of slag from the Nicholia smelter dump was shipped to the Bunker Hill smelter by J. H. Stocks and C. A. Gunderson. The slag averaged 5.3 percent lead and 6.1 percent zinc.

Lewis.—Lewiston Lime Co. quarried and crushed limestone at the Mission Creek quarry 22 miles southeast of Lewiston. Output, which declined slightly from the preceding year, was used at paper plants, sugar refineries, and metallurgical plants and for miscellaneous purposes including agricultural limestone.

Minidoka.—Burley Brick & Sand Co. mined clay from a pit near Heyburn for use at the company brick plant at Burley, Cassia County. The clay was processed to building brick, which was marketed in the Pocatello-Boise-Twin Falls area. Sand and gravel for building and road use and crushed roadstone also were produced.

Nez Perce.—Production of special high-quality sands for plaster, filter, and abrasive uses was continued at the H. P. Terteling sand plant near Lewiston. A small increase in production was reported in 1957 compared with the preceding year. Sand and gravel for building and road uses was produced by three commercial operators, and crushed stone was produced for the Idaho Department of Highways by contractors.

Owyhee.—Bentonite was produced by E. N. Bennett from the Ben-Jel and Sweaty Brow claims at Grandview. The clay was sold for use in oil-well drilling muds and for sealing irrigation canals and reservoirs. Output in 1957 increased 54 percent over 1956. The Idaho Department of Highways contracted production of a small quantity of gravel for highway construction and maintenance.

Power.—J. R. Simplot Co. operated a fertilizer plant west of Pocatello. Phosphate rock mined at the company Gay mine, Bingham County, was processed to superphosphate fertilizers and phosphoric acid at the facility. Sulfuric acid from The Bunker Hill Co. byproduct-acid plant near Kellogg was used to acidulate the phosphate rock. Westvaco Mineral Products Division, Food Machinery & Chemical Corp., processed phosphatic shale obtained from a Bingham County mine to elemental phosphorus at a plant west of Pocatello. Quartzite was quarried and crushed at the Kit quarry near Pocatello by Wells Cargo, Inc., for use as a flux in the electric-furnace manufacture of elemental phosphorus. Output from the quarry in 1957 increased over fourfold compared with the preceding year. Gravel for road construction and maintenance was produced for the State and county highway departments.

Shoshone.—The "big three" in value of mineral production in Shoshone County, as well as in Idaho, continued to be lead, silver, and zinc. In 1957, however, lower prices for zinc and higher output of silver led to the latter replacing zinc as second in value in the county.

Total value of mineral production in Shoshone County increased moderately (4 percent), despite lower lead and zinc prices, owing to the greater quantities produced. Copper, antimony, gold, sand and gravel, and stone also contributed to the total. The county supplied nearly 65 percent of the value of minerals produced in Idaho.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1948-52 (average), 1953-57, and total 1884-1957, in terms of recoverable metals

Year	Mines producing		Material sold or treated (short tons)	Gold, lode and placer (fine ounces)	Silver, lode and placer (fine ounces)
	Lode	Placer			
1948-52 (average).....	62	2	2,542,408	2,875	12,438,501
1953.....	43		1,788,426	2,376	13,636,680
1954.....	37		1,630,250	2,047	14,898,699
1955.....	41		1,637,121	1,777	12,984,323
1956.....	36	2	1,674,781	¹ 1,963	12,663,214
1957.....	31		1,701,442	2,254	14,397,771
1884-1957.....			(²)	420,667	572,295,521

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value
1948-52 (average).....	1,638	77,867	77,916	\$60,188,616
1953.....	2,100	69,885	68,650	47,729,514
1954.....	2,566	64,812	58,736	45,515,124
1955.....	2,637	59,520	50,527	44,036,867
1956.....	2,839	60,221	46,738	¹ 45,700,809
1957.....	3,473	67,125	54,825	47,117,496
1884-1957.....	88,532	6,316,326	1,945,172	1,703,195,505

¹ Revised figure.

² Complete data not available; 1904-1957, 101,332,344 short tons.

Sagging metal prices brought an end to the brief respite in 1956 from economic difficulties caused by labor in 1955 in the Coeur d'Alene lead-zinc mining area. According to producers in the area, the price dip, amounting to some 3 cents per pound for lead and 3½ cents per pound for zinc during the year, was caused by heavy imports from foreign mines. Rising cost of production in the face of the price decline forced curtailment and/or closure of a number of operations.

The Bunker Hill Co. (Bunker Hill and Star mines) continued as the leading operation in the county, both in terms of tons of ore mined and value of minerals processed. At the company lead smelter and electrolytic zinc plant near Kellogg, domestic and foreign ores and concentrates were processed. Forty years of continuous operation of the smelter was noted in the company annual report to stockholders. The report stated that for the third consecutive year, all previous production records were broken for metallic lead and zinc in fume and sales of both were highest in history. Lead output at the smelter was 106,027 tons; sales were 99,688 tons of lead, 21,001 tons of zinc in

fume, 54,372 pounds of cadmium, 5,932,170 ounces of silver, 703 tons of antimony, 805 tons of copper, and 9,769 ounces of gold. A new blast furnace at the smelter was blown-in in April.

All former production records for zinc, cadmium, and sulfuric acid were exceeded at The Bunker Hill Co. electrolytic zinc plant near Kellogg. Work on a fifth electrolytic-cell unit was completed in April. The company annual report stated that output from the plant was 68,832 tons of high-grade zinc and 599,809 pounds of electrolytic cadmium; sales were 65,820 tons and 540,674 pounds of zinc and cadmium, respectively. Capacity operations were reported for the sulfuric acid plant throughout the year except for a 1-week shutdown for maintenance in August. The plant used gas evolved from roasting sulfide-zinc concentrate to manufacture the acid. Production and sales each were over 96,000 tons of 100 percent acid.

Beaver District.—Lessees continued ore production from four Day Mines, Inc., properties. The largest of these was the Zanetti & Kennedy lease on the Mountain Goat mine. Lead and zinc concentrates containing recoverable gold, silver, copper, lead, and zinc were shipped to the Bunker Hill and East Helena (Mont.) smelters, respectively. Substantial tonnages of lead and zinc concentrates also were produced from the Zanetti Bros. and Smith & Korsage leases on the Silver Tip and Sunset mines. Wally Norman produced a small quantity of lead ore at the Day Mines Sitting Bull property.

Evolution District.—Mining of more tons of ore and reduction in the cost per ton of ore produced were cited as accomplishments at the Sunshine Mining Co. Sunshine mine and adjoining properties (operated by Sunshine on a profit-sharing basis). However, a lower silver content and a lower price per pound for lead and copper resulted in decreased income, according to the company annual report to shareholders. Discovery of a new ore shoot made possible the development of 3 tons of new ore for each 4 tons that was mined. Ore mined and milled during the year totaled 206,385 tons, averaging 25.95 ounces per ton of silver and 1.37 percent lead. Tonnage produced from the several areas was: Sunshine—29,128 tons, Omega—82,710 tons, Rambo—19,850 tons, Rotbart—54,439 tons, Suncon—18,138 tons, and Yankee Girl—2,120 tons. Total ore in reserve at the company operation was estimated at 389,000 tons. Development for the year was reported by the company as 6,785 feet of drifting, 3,698 feet of raises, 949 feet of crosscutting, and 55 diamond-drill holes, totaling 12,128 feet. Operating costs were reduced from \$20.60 per ton in 1956 to \$20.55 per ton in 1957, despite increased labor and material costs. The company 1,200-ton flotation mill treated 206,885 tons of ore; the gross metal content was 5,343,402 ounces of silver, and 5,617,920 pounds of lead. Operated in conjunction with the mill was the company antimony-leaching and electrolysis plant. Copper residue from the leaching plant totaled 2,644 tons, and lead concentrate from the mill was 7,016 tons. The total of metals contained in the concentrates was 162 ounces of gold, 5,206,298 ounces of silver, 1,916,001 pounds of copper, 5,474,837 pounds of lead, and 485,392 pounds of zinc. Electrolysis of the leach solution at the antimony plant yielded cathode antimony metal, which was re-treated to remove arsenic and shipped to the Government stockpile under terms of a purchase contract signed during the year.

Agreement was reached between Polaris Mining Co., Sunshine Mining Co., and Silver Dollar Mining Co. to mine the Sunshine, Omega, and Rotbart areas and a western part of the New Purim area on a unitized basis by Sunshine Mining Co. This method of operation would become effective on January 1, 1958. The Polaris Mining Co. annual report gave production from the Silver Summit mine as 50,304 tons of ore assaying 23.11 ounces of silver per ton and 0.56 percent copper. Polaris shared income and cost in the New Purim area of the mine with Silver Dollar Mining Co. The company stated that reserves in this area were mined out during the year and that westerly development on the 2,500 and 3,200 levels failed to disclose additional ore. Developed reserves in the Silver Summit mine at the end of 1957 included 18,322 tons in the Silver Summit area and 6,507 tons in the Rainbow area. About 48,000 tons of ore was developed during the year. The Silver Summit property is developed by 2 vertical shafts totaling 3,923 feet in depth and 2 tunnels having a combined length of 22,280 feet.

Hunter District.—Output from The Bunker Hill Co. Star mine was higher than in 1956. A total of 199,020 tons of ore was milled, yielding 11,950 tons of lead concentrate and 26,669 tons of zinc concentrate. Combined, the concentrates contained 216,991 ounces of silver, 7,697 tons of lead, and 15,741 tons of zinc, according to the company annual report. The ore reserve at the end of 1957 was 1,080,000 tons, a 21-percent decline, owing to the use of lower metal prices in the calculating reserves. Underground workings of the mine included 2 vertical shafts of 6,008 feet combined depth, and 4 tunnels totaling 13,315 feet in length.

Ore output by Lucky Friday Silver-Lead Mines Co. was down slightly from 1956; 39,893 tons milled yielded 5,249 tons of lead concentrate and 175 tons of zinc concentrate. The gross metal content of the concentrates was 341 ounces of gold, 693,183 ounces of silver, over 150,000 pounds of copper, 7,299,628 pounds of lead, and 831,632 pounds of zinc.

Lead and zinc concentrates extracted from ore from the Golconda Lead Mines Co. Golconda mine totaled 222 tons, compared with 602 tons in 1956. The gross metal content of the concentrates was 3,036 ounces of silver, 87,600 pounds of lead, and 177,900 pounds of zinc. Only small quantities of gold and copper were contained. The company in midyear began milling ore from the American Smelting and Refining Co. Morning mine after the Morning mill was destroyed by fire. Ore from the Lucky Friday, and Silver Tip and Sunset mines (Day Mines leases) also was milled on a custom basis.

American Smelting and Refining Co. reported that output from the Morning mine was reduced considerably in 1957. The mill on the property was destroyed by fire May 21, and output for the remainder of the year was treated at the Golconda mill. Underground workings at the mine included a 900-foot vertical shaft and one 10,000-foot tunnel.

Lelande District.—Ore production at the American Smelting and Refining Co. Frisco mine was small in 1957. The company suspended its operations at the mine at the end of 1956, and the Hull lease on the mine was closed on March 15. The mine had been a long-time producer in the district, with output dating back to 1884.

The Day Mines, Inc., Hercules mine was the only large operation in the district. The company annual report stated that mining of developed ore became the chief activity at the beginning of 1957 as ore-reserve estimates justified the change in status. However, after midyear stoping was greatly reduced because of metal-price declines. Ore from the mine was processed at the Sherman mill; the Hercules mill was not in operation. Small output also was reported for the company Sherman mine.

Placer Center District.—The quantity of ore recovered from the American Smelting and Refining Co. Galena operation was increased substantially in 1957. The mine, leased from Vulcan Silver-Lead Co. by AS&R (75-percent interest) and by Day Mines, Inc. (25-percent interest), yielded 119,922 tons of good-grade silver-copper ore, according to the Day Mines annual report. An additional 3,207 tons of low-grade ore resulting from exploration work was treated at a custom mill. An inclined winze from the 3,400 level was reported to be nearing the 3,700 foot point at year end, disclosing average grade ore. The mine was developed by 2 vertical shafts—the Callahan, 2,450 feet deep, and the Galena, 3,540 feet deep—plus a 960-foot adit to the Callahan shaft.

Day Mines, Inc., continued substantial production of lead ore at its Dayrock mine and considerable tonnages of lead-zinc ore were produced by lessees at the company Tamarack mine from January to October, when work was halted pending an increase in lead and zinc prices. The Day Mines annual report stated that work early in 1957 was devoted to deepening the Dayrock main shaft to establish a new 1,250 level. However a vein named the Bonanza was discovered in May on the 500 level and in the face of the falling metal market, work was diverted to the new vein in preference to opening up the lower level. The Bonanza vein was reported to be narrow in width although of excellent grade and over 900 feet long. The Dayrock mine was developed by one 1,250-foot, 2-compartment, vertical shaft and by 2 tunnels that were 800 and 1,100 feet in length.

Yreka District.—The rate of ore extraction at the Bunker Hill mine was about the same as in 1956; however, because of an increase in grade, metal production was greater than for many years past, according to The Bunker Hill Co. annual report. The ore reserve was at an alltime high (3,306,510 tons) as more ore was developed than mined during the year. A total of 522,933 tons of ore was processed in the company 2,500-ton-per-day selective flotation mill. Metals recovered, including that from operations by several lessees, were: Lead, 35,428 tons; zinc, 12,460 tons; and silver, 2,212,799 ounces. The ore also contained some recoverable gold and copper. Underground workings of the mine include 3 inclined shafts aggregating 12,520 feet in depth and one 9,100-foot tunnel.

At the Crescent mine The Bunker Hill Co. reported that a 3-compartment raise was driven from the 3,100 level to a point above the 2,500 level to develop a small but persistent ore body. Development produced 12,032 tons of ore yielding 191,875 ounces of silver, as well as some copper, lead, and zinc, in 1957. A report describing methods and costs of deepening the Crescent shaft in 1953-54 was published.¹⁰

¹⁰ Olds, E. B., and Parsons, E. W., Methods and Costs of Deepening the Crescent Shaft, Bunker Hill & Sullivan Mining and Concentrating Company, Kellogg, Shoshone County, Idaho: Bureau of Mines Inf. Circ. 7783, 1957, 19 pp.

Output of recoverable lead and zinc at the American Smelting and Refining Co. big Page mine was about 40 percent greater than in 1956. Ore was treated in the company 500-ton flotation mill. Access to the mine workings was provided by a timbered inclined shaft 3,502 feet deep.

Sidney Mining Co. ore output at the Sidney mine increased 14 percent to 44,461 tons in 1957. Mill production was 3,287 tons of lead concentrate and 7,380 tons of zinc concentrate containing 77,563 ounces of silver, 3,824,848 pounds of lead, and 8,791,525 pounds of zinc, as well as some gold and copper.

Nabob Silver-Lead Co. reported closure of the Nabob mine June 24 because of market conditions and high operating costs. The company produced about 100 tons of lead concentrate and 500 tons of zinc concentrate before the mine was shut down. Leaseholders produced most of the ore recovered from the Sunset Mines, Inc., Liberal King mine in 1957. Output was 4,415 tons of lead-zinc ore.

Valley.—Garnet, monazite, and ilmenite were recovered at the Boise plant of Baumhoff-Marshall, Inc., as a result of reprocessing stockpiles of ilmenite concentrate, which were a byproduct of processing alluvial sands dredged near Cascade from 1951 to mid-1955. Upgraded ilmenite was shipped to St. Louis, Mo.; the monazite was sold to eastern processing firms, and the garnet was shipped to out-of-State consumers for abrasive purposes.

Dredges operated by Porter Bros. Corp. produced concentrate containing columbium, tantalum, rare earths, thorium, and uranium, from alluvial deposits in Bear Valley. The rough concentrate was trucked to a company plant at Lowman for separating the mineral constituents. No production of mercury was reported at the Holly Minerals Corp. Cinnabar (formerly Hermes) mine; fire destroyed the company plant in August 1956. The company experimented with an electrolytic process for producing mercury during the year. First recorded production of mercury was reported for the Vermillion property in the same area as the Cinnabar mine near Stibnite. United Mercury Mines Co., former operator of the Hermes property, mined and retorted a quantity of ore.

Washington.—The Idaho Almaden mine, operated by Rare Metals Corporation of America, was the only large mercury producer in the State in 1957. Output was less than in 1956. Iron ore was shipped from Iron Mountain near Weiser to a steel mill in Portland, Oreg., by E. L. Jones & Associates. This iron mine was the only such operation in Idaho during the year.

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



MINERAL output in Illinois established a new record in value in 1957, despite the declining quantity of production for most minerals. The total value—\$579.6 million—surpassed the preceding high of \$572.3 set in 1956. The new mark resulted from high unit prices for certain commodities, chiefly coal and petroleum. Other minerals that increased in total value of output over 1956 were clays, fluorspar, lime, natural gas, natural-gas liquids, and stone. Increased quantity of output over 1956 was reported only for natural gas, natural-gas liquids, and tripoli.

Mineral fuels furnished 78 percent of the total for all minerals. Nonmetals contributed 21 percent; metals, the remainder.

TABLE 1.—Mineral production in Illinois, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland..... thousand 376-pound barrels..	8, 629	\$24, 866	8, 097	\$24, 560
Masonry..... do.....	672	2, 397	478	1, 796
Clays..... thousand short tons.....	2, 258	4, 005	1, 917	5, 155
Coal ² do.....	48, 102	184, 678	46, 993	187, 908
Fluorspar.....	178, 254	8, 470	169, 939	8, 827
Gem stones.....			(³)	2
Lead (recoverable content of ores, etc.).....	3, 832	1, 203	2, 970	849
Natural gas..... million cubic feet.....	6, 177	933	⁴ 8, 500	⁴ 1, 000
Peat.....	14, 451	158	11, 480	106
Petroleum (crude)..... thousand 42-gallon barrels..	82, 346	241, 274	⁴ 78, 278	⁴ 244, 227
Sand and gravel ⁵ thousand short tons.....	31, 239	33, 254	30, 151	32, 572
Silver (recoverable content of ores, etc.).....				
..... thousand troy ounces.....	2	1		
Stone..... thousand short tons.....	31, 855	40, 859	31, 861	41, 835
Zinc (recoverable content of ores, etc.).....	24, 039	6, 587	22, 185	5, 147
Value of items that cannot be disclosed: Lime, natural-gas liquids, elemental sulfur, and tripoli.....		26, 048		27, 925
Total Illinois ⁶		572, 321		579, 584

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 Preliminary figure.

⁵ Includes friable sandstone.

⁶ Total adjusted to eliminate duplicating value of clays and stone.

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Illinois produced a wide variety of mineral commodities, and in 1957 led the Nation in producing fluorspar, ranked fourth in bituminous-coal output, and was among the leading States in producing minerals of construction—cement, clays, lime, sand and gravel, and stone. The State also ranked high as a center for processing raw materials. Pig iron and steel were produced at furnaces in Chicago and East St. Louis. There were large petroleum refineries in these same areas.

Production of minerals of construction in 1957 was affected by declining building activity. Lead and zinc production declined because prices for these metals dropped.

Some Illinois ores contain valuable small quantities of certain metals, such as cadmium, gallium, and germanium. These quantities

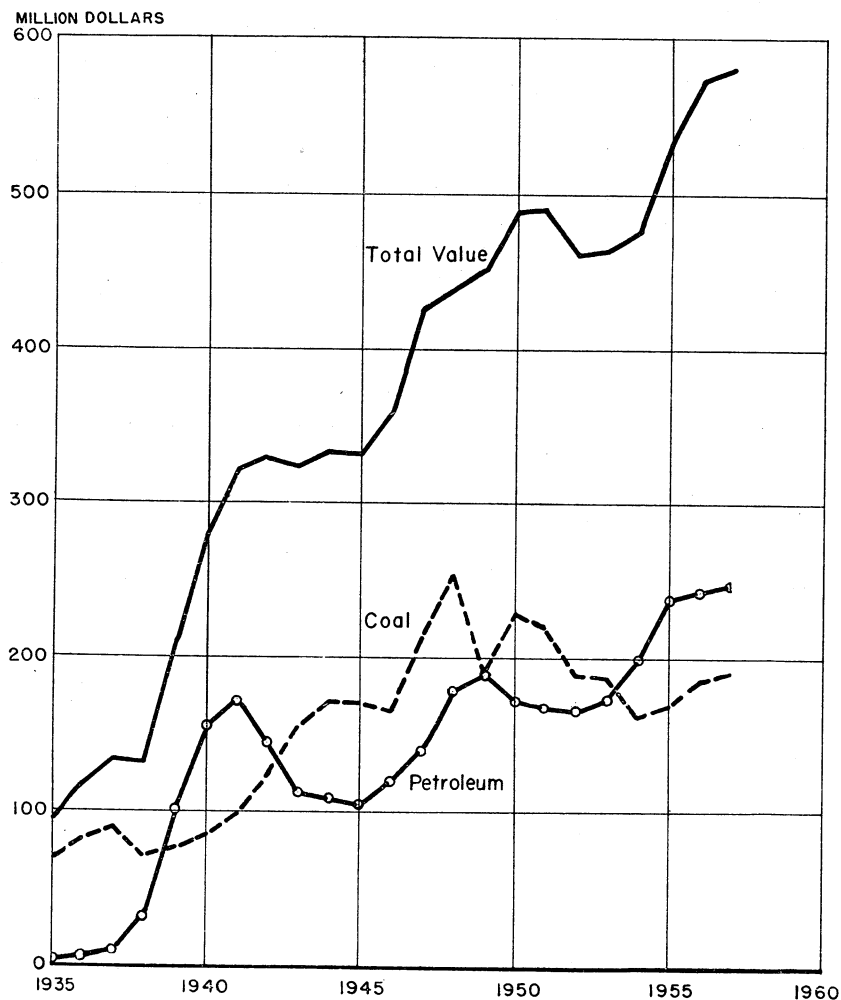


FIGURE 1.—Value of coal, petroleum and total value of mineral production in Illinois, 1935-57.

TABLE 2.—Average unit values of selected mineral commodities produced in Illinois, 1953-57, in dollars per unit

Mineral	1953	1954	1955	1956	1957
Cement:					
Portland.....376-pound barrel..	\$2.54	\$2.54	\$2.64	\$2.88	\$3.03
Masonry.....do.....	(¹)	(¹)	2.89	3.57	3.76
Clays:					
Fire.....short ton..	4.01	2.15	2.06	1.97	5.36
Miscellaneous.....do.....	1.60	1.64	1.64	1.73	1.90
Coal.....do.....	3.95	3.82	3.66	3.84	4.00
Fluorspar.....do.....	52.46	55.54	47.12	47.51	51.94
Lead ².....pound..	.131	.137	.149	.157	.143
Lime.....short ton..	13.44	13.95	14.62	(³)	(³)
Limestone:					
Dimension.....do.....	5.78	7.41	8.08	7.51	22.04
Crushed and broken.....do.....	1.29	1.18	1.23	1.28	1.31
Natural gas.....million cubic feet..	167.96	141.95	128.97	151.04	4117.65
Peat.....short ton..	(³)	(³)	(³)	10.90	9.26
Petroleum.....42-gallon barrel..	2.89	2.98	2.91	2.93	43.12
Sand and gravel:					
Sand ⁴.....short ton..	1.18	1.42	1.40	1.38	1.41
Gravel.....do.....	.72	.77	.79	.79	.81
Zinc.....pound..	.115	.108	.123	.137	.116

¹ Data not available.

² Yearly average weighted price on all grades of primary metal sold by producers.

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Preliminary figure.

⁵ Includes friable sandstone.

sometimes are unknown and at times, though known by analyses, are not accounted for metallurgically in early processing stages. Because it is virtually impossible to distribute such mineral products by States of origin, their values are not included in the total value of mineral output of any State.

EMPLOYMENT AND INJURIES

Employment and injury data shown in table 3 represent virtually complete coverage for all commodities, except limestone. Data for limestone operations, some of which are included in the cement group

TABLE 3.—Summary of employment and injuries for selected mineral industries in Illinois, 1956-57¹

Year and commodity	Average number of men working	Total man-shifts	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury-frequency rate	Injury-severity rate
				Fatal	Nonfatal			
1956								
Cement ²	1,009	332,237	2,657,888	-----	2	(³)	0.75	(³)
Coal.....	12,529	2,657,977	20,693,640	20	1,031	162,709	50.79	7,863
Coke ovens.....	1,035	353,491	2,827,921	1	19	(³)	7.07	(³)
Fluorspar.....	637	172,606	1,380,840	-----	50	3,912	36.21	2,833
Limestone ⁴	2,457	566,502	4,719,031	1	110	(³)	23.52	(³)
Smelters.....	1,675	539,544	4,316,356	-----	84	3,626	19.46	840
1957								
Cement ²	952	296,664	2,373,303	-----	-----	-----	-----	-----
Coal.....	12,163	2,525,614	19,676,683	21	817	163,962	41.52	8,333
Coke ovens.....	893	322,115	2,572,158	2	5	(³)	2.72	(³)
Fluorspar.....	375	102,469	819,746	-----	35	3,010	42.70	3,672
Limestone ⁴	2,132	508,647	4,340,426	-----	114	(³)	26.26	(³)
Smelters.....	1,463	471,974	3,773,859	-----	46	1,369	12.19	363

¹ Data exclude office workers and are preliminary for 1957.

² Includes cement plants and quarries producing raw material used in manufacturing cement.

³ Figure not available.

⁴ Excludes quarries producing limestone used exclusively in manufacturing cement and lime.

in the table, represent about 95 percent of the total Illinois limestone output in 1957. Approximately two-thirds of the fatalities at coal mines in 1957 were attributable to roof falls. The injury-frequency rate for coal mines improved over 1956, but the injury-severity rate in 1957 was greater. Not one lost-time injury was reported in the State's cement industry in 1957.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Output of bituminous coal from Illinois mines in 1957 was nearly 47 million tons, a 2-percent decrease in quantity below 1956. The total value of production increased 2 percent because of the higher unit price. Average value per ton for Illinois coal in 1957 was \$0.16 per ton greater than in 1956.

Illinois coal was sold mostly for electric power. A substantial quantity was sold for local consumption. Sales to railroads continued to decline and amounted to less than a million tons in 1957.²

During 1957 coal was produced from 168 mines in 34 counties, 12 of which recorded an output over a million tons. The major producing counties, in order of decreasing tonnage, were Williamson, Christian, Fulton, Franklin, Perry, St. Clair, and Jefferson. Fifteen companies furnished 83 percent of the total 1957 State output.

Underground mines supplied 57 percent of the total production; strip mines furnished the remainder. Coal was crushed and/or treated at 93 mines in 1957. Approximately 90 percent of the total output was mechanically cleaned at 60 plants. Virtually the entire underground production was cut by machines, and 99 percent was mechanically loaded, using 38 continuous mining machines, 179 mobile loaders, and 8 duckbills or self-loading conveyors. Nearly 88 percent of the total 1957 output was shipped to consumers by rail or waterways; most of the remainder was shipped by truck.

Peat.—Production of peat was reported by four companies in Cook, Kane, and Lake Counties. The output in 1957 decreased 21 percent in quantity and 33 percent in total value below 1956. The entire output was used as a soil conditioner.

Petroleum, Natural Gas, and Natural-Gas Liquids.—Production of crude petroleum in Illinois in 1957 decreased 5 percent in quantity below 1956. However, the total value of output increased slightly because of higher prices. Production came mostly from wells in the southeastern part of the State. In 1957, 1,295 producing oil wells were completed in 35 counties throughout the State.³

An estimated 8.5 billion cubic feet of natural gas was marketed in Illinois in 1957, a 38-percent increase over 1956. The total value of output increased 7 percent. Production of natural-gas liquids in the State in 1957 increased 4 percent in quantity and 8 percent in total value compared with the preceding year.

² Illinois Department of Mines and Minerals, Seventy-Sixth Coal Report: 1957, p. 56.

³ Illinois Department of Mines and Minerals, Division of Oil and Gas, Seventy-Sixth Coal Report: 1957, p. 11.

TABLE 4.—Bituminous coal production, value, and number of mines operated in 1957, by counties

(Exclusive of mines producing less than 1,000 net tons)

County	Production (net tons)			Value		Number of mines operated		
	Under-ground	Strip	Total	Average per ton	Total	Under-ground	Strip	Total
Bureau.....		(1)	(1)	(1)	(1)		1	1
Christian.....	5,738,338		5,738,338	\$3.52	\$20,186,645	2		2
Clinton.....	96,574		96,574	4.58	442,771	3		3
Douglas.....	(1)		(1)	(1)	(1)	1		1
Franklin.....	4,592,021		4,592,021	4.35	19,958,656	4		4
Fulton.....	55,982	5,428,072	5,484,054	4.02	22,021,687	3	11	14
Gallatin.....	106,668	88,621	195,289	3.17	618,422	4	7	11
Greene.....		5,248	5,248	4.05	21,240		1	1
Grundy.....		(1)	(1)	(1)	(1)		1	1
Hancock.....		34,522	34,522	6.59	227,410		1	1
Henry.....	81,414		81,414	4.64	377,522	3		3
Jackson.....	(1)	505,601	(1)	(1)	(1)	2	4	6
Jefferson.....	(1)	6,281	(1)	(1)	(1)	1	1	2
Kankakee.....		(1)	(1)	(1)	(1)		1	1
Knox.....		(1)	(1)	(1)	(1)		4	4
La Salle.....		(1)	(1)	(1)	(1)		2	2
Livingston.....		2,222	2,222	8.50	18,887		2	2
Logan.....	31,659		31,659	5.00	158,295	1		1
Macoupin.....	471,035		471,035	4.06	1,913,180	3		3
Madison.....	876,586		876,586	4.05	3,546,619	4		4
Marion.....	18,989		18,989	4.07	77,361	1		1
Menard.....	14,817		14,817	6.01	89,077	3		3
Montgomery.....	(1)		(1)	(1)	(1)	1		1
Peoria.....	33,912	315,311	349,223	4.92	1,719,160	6	7	13
Perry.....	(1)	3,073,685	(1)	(1)	(1)	2	5	7
Randolph.....	624,062	42,082	666,144	3.40	2,265,243	2	1	3
St. Clair.....	2,037,897			(1)	(1)	5	4	9
Saline.....	(1)	1,322,413	(1)	(1)	(1)	4	13	17
Sangamon.....	(1)		(1)	(1)	(1)	2		2
Schuyler.....	12,383	5,234	17,617	5.51	97,061	2	1	3
Vermillion.....	60,996	1,012,545	1,073,541	4.41	4,732,701	4	5	9
Washington.....	35,706		35,706	4.10	146,355	2		2
Will.....		(1)	(1)	(1)	(1)		2	2
Williamson.....	3,662,738	2,467,223	6,129,961	3.96	24,245,774	17	16	33
Undistributed.....	8,441,904	5,690,284	21,078,065	4.03	85,043,439			
Total.....	26,993,681	19,999,344	46,993,025	4.00	187,907,505	280	288	2168

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.² Total adjusted to eliminate duplicating mine count for operations extending into 2 or more counties.

NONMETALS

Cement.—In 1957 sales of portland and masonry cements from plants in Illinois decreased 6 and 29 percent in quantity, respectively, below 1956, reflecting chiefly the decline in building activity. A labor strike at one plant during July and the threat of strikes at other plants caused part of the loss in output. The value of portland-cement production decreased only 1 percent because of an increase in price of 15 cents per barrel. The value of output of masonry cement decreased 25 percent below 1956.

Four companies operated plants in the northern part of the State, in La Salle and Lee Counties. Nearly 83 percent of the total Illinois output of portland and masonry cements was shipped to consumers within the State. Most of the remainder was shipped to neighboring States.

Estimated annual portland-cement-manufacturing capacity in Illinois at the end of 1957 was 9,977,000 barrels. The capacity in the State was increased during the year by adding three 150-foot kilns at 1 plant.

TABLE 5.—Finished portland cement produced and shipped, 1948-52 (average) and 1953-57

Year	Active plants	Production (barrels)	Shipments from mills		
			Barrels	Value	
				Total	Average per barrel
1948-52 (average).....	4	8,124,099	8,099,270	\$17,844,033	\$2.20
1953.....	4	8,869,342	8,651,385	21,961,761	2.54
1954.....	4	8,841,848	9,109,076	23,147,871	2.54
1955.....	4	8,809,655	8,654,735	22,886,351	2.64
1956.....	4	8,822,611	8,629,432	24,866,396	2.88
1957.....	4	8,794,368	8,097,059	24,559,938	3.03

Clays.—The total production of fire clay and miscellaneous clay in Illinois in 1957 decreased 15 percent below 1956, chiefly because of the general decline in building construction. The output of fire clay was reported by 11 producers in Greene, Grundy, Knox, La Salle, McDonough, Madison, and Rock Island Counties. The material was used for refractory purposes and for making pottery and heavy clay products.

Miscellaneous clay was produced in 22 counties in 1957 and was used chiefly for manufacturing building brick, draintile, sewer pipe, and other heavy clay products. Approximately 119,000 tons of miscellaneous clay produced in the State in 1957 was used in cement manufacture. Some of the output was used as lightweight aggregate and for pottery.

TABLE 6.—Clays sold or used by producers, 1948-52 (average) and 1953-57, by kinds

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	426,233	\$1,404,611	1,996,719	\$2,013,808	2,422,952	\$3,528,419
1953.....	367,385	1,473,859	1,937,817	3,099,142	2,305,202	4,573,001
1954.....	313,679	675,407	1,713,413	2,807,043	2,027,092	3,482,450
1955.....	363,385	747,660	1,975,194	3,231,312	2,338,579	3,978,972
1956.....	440,981	869,627	1,816,894	3,135,813	2,257,875	4,005,440
1957.....	437,644	2,344,641	1,479,334	2,809,886	1,916,978	5,154,527

¹ Includes 9,409 tons of fuller's earth valued at \$105,865.

Fluorspar.—In 1957 Illinois continued to be the leading fluorspar producer in the Nation, supplying 52 percent of the total domestic shipments. Output decreased 5 percent in quantity below 1956, in spite of a new record high for industrial consumption. Imports from foreign countries established a new record and exceeded domestic shipments for the sixth consecutive year. The total value of Illinois shipments in 1957 increased 4 percent over the preceding year, chiefly because of Government purchases. Domestic Acid-grade fluorspar was purchased under a program established by Public Law 733. Some Metallurgical-grade fluorspar was also purchased by the Government for the national stockpile.

TABLE 7.—Fluorspar shipped from mines, 1948-52 (average) and 1953-57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948-52 (average)...	168, 137	\$7, 166, 134	\$42. 62	1955.....	166, 337	\$7, 838, 471	\$47. 12
1953.....	163, 303	8, 567, 026	52. 46	1956.....	178, 254	8, 469, 450	47. 51
1954.....	107, 830	5, 989, 219	55. 54	1957.....	169, 939	8, 827, 171	51. 94

Approximately 68 percent of the Illinois shipments was classified as Acid grade; the remainder was divided nearly equally between Ceramic and Metallurgical grades. Nearly three-fifths of the output was shipped to the aluminum and chemical industries. Approximately one-fourth was sold to the glass, enamel, and steel industries. The remainder was sold mostly to the Government.

Leading Illinois producers in 1957 were Aluminum Company of America, Mackey-Humm Mining Co., Minerva Oil Co., and Ozark-Mahoning Co. In the latter part of 1957 the Mackey-Humm operation was acquired by the Southern Illinois Mining Co. The entire State fluorspar production in 1957 was credited to Hardin County, but some crude material was mined in Pope County.

Gem Stones.—Fluorite specimens were collected by several individuals in Hardin County. The material was used chiefly for private gem collections.

Lime.—Lime was produced by 4 companies at 6 plants in Adams, Cook, and St. Clair Counties. The quantity of quick and hydrated lime decreased slightly below 1956, but the value of shipments increased 7 percent over the preceding year. Nearly 61 percent of the State output was sold for refractory purposes; 33 percent, for chemical and industrial purposes; and 6 percent, for building use. Illinois ranked fifth in the Nation in 1957.

Perlite.—Crude perlite mined in Western States was expanded at five plants in Champaign, Cook, Lake, and Will Counties. The total sales of the expanded product were 22,500 short tons valued at nearly \$1,214,000—a slight increase compared with 1956. The output was used principally as a lightweight aggregate in plaster and concrete, loose-fill insulation, and soil conditioner and for filter purposes and other uses.

Sand and Gravel.—The total output (about 30.2 million tons) was valued at approximately \$32.6 million in 1957; Illinois ranked fourth in the Nation in producing sand and gravel. These quantities represent a decline of over 3 percent in quantity and 2 percent in value below 1956. Substantially decreased consumption of sand and gravel for building purposes was offset by larger quantities of lower valued material used in an extensive roadbuilding program. The quantities of sand used for glass, molding, and sandblasting held up well during the year. Production was reported from 69 of the State's 102 counties.

Nearly 82 percent of the quantity produced by the State in 1957 was employed for building and paving. Other substantial uses were: Glass manufacture, molding, grinding and polishing, and railroad ballast and as a ground product for filler and filter purposes.

Commercial operations furnished about 95 percent of total production; Government-and-contractor operations supplied the remainder. Nearly 57 percent of the commercial production was transported to consumers by truck, 32 percent by rail, and 11 percent by water.

Major producers of sand and gravel in Illinois in 1957 were: Chicago Gravel Co., Consumers Co., Material Service Corp., and Wedron Silica Co., all of Chicago; Elmhurst-Chicago Stone Co., Elmhurst; McGrath Sand & Gravel Co., Lincoln; Ottawa Silica Co. and Standard Silica Co., both of Ottawa; Crystal Lake Trucking & Excavating Co., Crystal Lake; Larson Bros. Sand & Gravel, Rockford; and Rowe Construction Co., Bloomington.

TABLE 8.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand: ¹						
Glass.....	1,316,721	\$3,175,237	\$2.41	1,321,550	\$3,216,458	\$2.43
Molding.....	1,030,859	2,583,222	2.51	834,324	2,184,013	2.62
Building.....	8,224,086	6,553,423	.80	5,874,777	4,909,122	.84
Paving.....	2,664,363	2,080,129	.78	3,910,616	3,134,818	.80
Grinding and polishing.....	154,271	401,054	2.60	(?)	(?)	(?)
Blast.....	210,562	1,221,375	5.80	191,375	1,116,354	5.83
Fire or furnace.....	7,620	23,413	3.07	(?)	(?)	(?)
Engine.....	86,347	114,584	1.33	85,545	130,013	1.52
Filter.....	24,790	22,584	.91	(?)	(?)	(?)
Railroad ballast.....	63,548	43,332	.68	5,250	3,943	.75
Fill.....				431,853	259,305	.60
Ground.....	264,960	2,611,054	9.85	212,161	2,179,368	10.27
Other.....	496,876	1,366,086	2.75	498,364	1,834,607	3.68
Total.....	14,545,003	20,195,493	1.39	13,365,815	18,968,001	1.42
Gravel:						
Building.....	7,721,934	6,711,023	.87	5,628,097	5,116,771	.91
Paving.....	6,249,004	4,673,035	.75	7,764,732	6,376,159	.82
Railroad ballast.....	616,909	404,977	.66	659,019	432,291	.66
Fill.....				362,640	241,937	.67
Other.....	513,190	531,488	1.04	733,019	697,172	.94
Total.....	15,101,037	12,320,523	.82	15,152,507	12,864,330	.85
Total sand and gravel.....	29,646,040	32,516,016	1.10	28,518,322	31,832,331	1.12
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	1,112	278	.25	1,989	597	.30
Paving.....	161,354	57,417	.36	155,928	54,805	.35
Total.....	162,466	57,695	.36	157,917	55,402	.35
Gravel:						
Building.....	79,455	29,015	.37	35,804	13,981	.39
Paving.....	1,350,622	651,653	.48	1,439,221	670,329	.47
Total.....	1,430,077	680,668	.48	1,475,025	684,310	.46
Total sand and gravel.....	1,592,543	738,363	.46	1,632,942	739,712	.45
ALL OPERATIONS						
Sand.....	14,707,469	20,253,188	1.38	13,523,732	19,023,403	1.41
Gravel.....	16,531,114	13,001,191	.79	16,627,532	13,548,640	.81
Grand total.....	31,238,583	33,254,379	1.06	30,151,264	32,572,043	1.08

¹ Includes friable sandstone.

² Figures combined with "Other" to avoid disclosing individual company confidential data.

Stone.—The total production of stone in Illinois in 1957—approximately 32 million tons—was virtually the same as in 1956. However, the total value (nearly \$42 million) represented an increase of over 2 percent above the preceding year. This high rate of production reflected continuation of the extensive roadbuilding program and growing use of limestone for agricultural purposes and railroad ballast. The quantity and value of crushed limestone used as flux in blast furnaces increased sharply. Aside from a small production of refractory sandstone from Alexander County, the entire output of stone in Illinois was limestone.

Production of crushed limestone was reported from 55 of 102 counties in the State in 1957. The larger producing counties were Cook, La Salle, St. Clair, and Will. Almost 73 percent of the total limestone output was used for concrete aggregate and roadstone. Other important uses were for agricultural purposes, railroad ballast, flux, cement, and lime. Relatively small quantities of dimension limestone employed for architectural purposes were produced in Kankakee, McHenry, St. Clair, and Union Counties in 1957.

Leading producers of limestone in the State were: Allied Chemical & Dye Corp., Columbia Quarry Co., Consumers Co., Dolese & Shepard Co., East St. Louis Stone Co., Elmhurst-Chicago Stone Co., Lehigh Stone Co., Lincoln Stone Co., Materials Service Co., and Mississippi Lime Co. The only producer of sandstone in Illinois was Western Fire Brick Co.

TABLE 9.—Limestone sold or used by producers in 1956-57, by uses ¹

Use	1956			1957		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension: ²						
Rubble, rough construction, and rough architectural short tons..	2,353	\$12,659	\$5.38	538	\$2,596	\$4.83
House-stone veneer, cutstone, curbing and flagging cubic feet..	9,404	11,021	1.17	29,312	64,189	2.19
Total dimension equivalent short tons ³ ..	3,152	23,680	7.51	3,030	66,785	22.04
Crushed and broken:						
Riprap.....short tons..	153,007	197,810	1.29	180,346	231,969	1.29
Flux.....do.....	280,500	496,724	1.77	363,108	709,422	1.95
Refractory.....do.....	(4)	(4)	(4)	(4)	(4)	(4)
Concrete aggregate and roadstone.....short tons..	23,175,590	30,709,970	1.33	23,081,191	31,056,816	1.35
Railroad ballast.....do.....	982,979	1,258,465	1.28	1,093,438	1,373,798	1.26
Agriculture.....do.....	3,094,594	4,014,372	1.30	3,236,650	4,387,019	1.36
Other uses.....do.....	4,164,415	4,150,757	1.00	3,902,402	4,001,783	1.03
Total crushed and broken short tons..	31,851,085	40,828,098	1.28	31,857,135	41,760,807	1.31
Grand total.....do.....	31,854,237	40,851,778	1.28	31,860,165	41,827,592	1.31

¹ Includes both commercial and Government-and-contractor production.

² Uses as shown combined to avoid disclosing individual company confidential data.

³ Average weight of 170 pounds per cubic foot used to convert cubic feet to tons.

⁴ Figures for refractory combined with "Other uses" to avoid disclosing individual company confidential data.

Sulfur.—Byproduct sulfur was recovered by the Pure Oil Co. at its Lemont Refinery in Cook County, using a modified Clauss process. The production and its value in 1957 decreased below 1956.

Tripoli.—Tripoli was mined and processed by two companies in northern Alexander County. The output of crude and prepared material increased slightly in quantity over 1956; however, the total value of production decreased. Sales were for abrasive use, filler, and other purposes.

Vermiculite.—The sales of exfoliated vermiculite from Illinois plants in 1957 decreased 8 percent in quantity and 7 percent in total value below 1956. The output was used as insulating material, lightweight aggregate in plaster and concrete, and for other purposes. Crude vermiculite (mined in Montana, South Carolina, and South Africa) was processed at plants in Cook, Macoupin, and Will Counties.

METALS

Lead, Silver, and Zinc.—The output of lead and zinc from Illinois mines in 1957 decreased 22 and 8 percent, respectively, below 1956, chiefly because of the steadily falling prices which resulted from an oversupply. The total production values of these metals were 29 percent less for lead and 22 percent less for zinc, compared with 1956. In 1957 no silver was recovered from ores mined in the State.

Production came from two districts, Northern Illinois (all in Jo Daviess County) and Southern Illinois (mostly in Hardin County; a small quantity of zinc was recovered from ore mined in Pope County in 1957). In Northern Illinois, Tri-State Zinc, Inc., and Eagle-Picher Co. operated their mines and mills, changing from a 6-day workweek to a 5-day week for the latter half of the year. The Little Ginte Mining Co. produced lead-zinc ore and Hickory Hill Mining Co. mined lead sulfide at their respective properties in the same district.

In Southern Illinois all output was a byproduct or coproduct of fluorspar mining. When the prices for lead and zinc declined, several operators avoided, so far as possible, mining areas relatively high in lead and zinc. The principal producers in 1957 were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co.

The average weighted yearly prices used to calculate total values of lead and zinc production in 1957 were 14.3 cents per pound for lead and 11.6 cents per pound for zinc. Comparable prices used for 1956 were 15.7 cents and 13.7 cents per pound, respectively.

TABLE 10.—Mine production of silver, lead, and zinc, 1953-57, 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	
1953.....	21	700,844	2,338	\$2,116	3,391	\$388,442	14,556	\$3,347,880	\$4,238,438
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	5,146,920	5,996,340

¹ Data include fluorspar ore from which lead and/or zinc was recovered as follows: 1953—353,570 tons; 1954—202,478 tons; 1955—309,311 tons; 1956—336,635 tons; and 1957—360,406 tons.

TABLE 11.—Mine production of lead and zinc in 1957, by months, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January.....	240	1, 930	August.....	170	1, 875
February.....	325	1, 700	September.....	165	1, 600
March.....	330	2, 140	October.....	150	1, 825
April.....	445	2, 035	November.....	140	1, 735
May.....	435	2, 140	December.....	140	1, 655
June.....	270	2, 040			
July.....	160	1, 510	Total.....	2, 970	22, 185

Pig Iron.—Over 6 million tons of all classes of pig iron were produced in Illinois in 1957, slightly less than in 1956. The total value of output was nearly \$360 million. Blast furnaces were operated by six companies in Chicago and Granite City. Approximately 99.4 percent of the 10 million tons of iron and manganese ores consumed in Illinois blast furnaces (excluding ores consumed in sintering plants and steel furnaces) in 1957 was from domestic mines; the remainder was imported. Over 5 million tons of coke and 2 million tons of limestone were consumed in Illinois blast furnaces during the year. Ending stocks of pig iron totaled 206,000 tons, compared with 93,000 in 1956.

REVIEW BY COUNTIES

Mineral output, excluding natural gas and liquid fuels, was reported in 93 of the 102 counties in Illinois in 1957. Eleven counties recorded total value of mineral production exceeding \$10 million. La Salle County led the State, followed by Cook, Williamson, Fulton, and Christian Counties. Total values increased for 50 counties but decreased in 43 counties below 1956.

Adams.—The Marblehead Lime Co. and Menke Stone & Lime Co. produced quick and hydrated lime at plants near Marblehead and Quincy, respectively, for building, chemical, and industrial uses. Both companies also produced limestone from underground mines in the county. The Missouri Gravel Co. operated portable crushing plants near Damon, Fall Creek, Kellerville, Loraine, and Richfield, producing limestone for road use. Limestone quarries also were operated near Quincy by the Black & White Limestone Co. and Western Illinois Stone Co. The output of limestone in the county in 1957 was used for riprap, flux, concrete aggregate and roadstone, agricultural use, asphalt filler, mineral food, manufacturing lime, and various other purposes.

The Quincy Sand Co. produced sand and gravel for building and other purposes at a dredge on the Mississippi River near Quincy. Paving sand was produced under contract for the State highway department.

Alexander.—The output of tripoli in Illinois in 1957 was produced in Alexander County. Ozark Minerals Co. and Tamms Industries, Inc., operated underground mines and processing plants near Elco and Tamms, respectively. Output was slightly greater than in 1956 and was sold for abrasive use, filler, and other purposes.

TABLE 12.—Value of mineral production in Illinois, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Adams.....	\$1,377,859	\$1,462,997	Stone, lime, sand and gravel.
Alexander.....	247,535	183,438	Tripoli, sand and gravel, stone.
Bond.....	88,805	125,325	Stone, sand and gravel, clays.
Boone.....	162,338	136,959	Sand and gravel, stone.
Brown.....	42,700	38,500	Sand and gravel, clays.
Bureau.....	(²)	4,138,270	Coal, sand and gravel, clays.
Calhoun.....	21,005	17,250	Stone, sand and gravel.
Carroll.....	118,281	199,164	Do.
Cass.....	200	400	Sand and gravel.
Champaign.....	161,657	192,685	Do.
Christian.....	19,575,794	20,340,169	Coal, stone.
Clark.....	547,107	597,862	Stone, sand and gravel.
Clay.....	26,912	25,000	Stone.
Clinton.....	699,277	484,627	Coal, stone, sand and gravel.
Coles.....	(²)	555,735	Stone, sand and gravel.
Cook.....	25,867,660	26,925,542	Stone, lime, clays, sand and gravel, peat, sulfur.
Crawford.....	96,490	117,805	Sand and gravel.
Cumberland.....	42,590	(²)	Do.
De Kalb.....	458,104	428,899	Do.
De Witt.....	(²)	(²)	Do.
Douglas.....	1,677,170	(²)	Coal.
Du Page.....	1,740,788	(²)	Stone, sand and gravel.
Edwards.....	55,950	27,900	Clays.
Effingham.....	(²)	68,750	Stone.
Fayette.....	83,679	39,984	Sand and gravel, clays.
Ford.....	93,716	61,797	Sand and gravel.
Franklin.....	20,208,174	19,958,676	Coal.
Fulton.....	20,906,957	22,667,998	Coal, sand and gravel.
Gallatin.....	721,309	642,525	Do.
Greene.....	185,423	417,595	Stone, clays, coal.
Grundy.....	2,324,148	3,728,589	Clays, coal, sand and gravel.
Hancock.....	297,914	562,094	Stone, coal.
Hardin.....	11,999,726	10,873,284	Fluorspar, zinc, lead, stone, gem stones.
Henderson.....	183,990	222,834	Stone.
Henry.....	531,441	438,979	Coal, sand and gravel.
Jackson.....	(²)	(²)	Coal, stone, sand and gravel.
Jefferson.....	10,831,249	(²)	Coal.
Jersey.....	36,391	33,625	Stone.
Jo Daviess.....	4,685,338	(²)	Zinc, lead, stone, sand and gravel.
Johnson.....	(²)	(²)	Stone.
Kane.....	1,471,452	1,394,238	Sand and gravel, peat.
Kankakee.....	(²)	4,595,586	Coal, stone, clays, sand and gravel.
Kendall.....	311,677	(²)	Stone, sand and gravel.
Knox.....	(²)	8,257,750	Coal, clays, stone, sand and gravel.
Lake.....	615,657	551,327	Sand and gravel, peat, stone, clays.
La Salle.....	34,903,809	33,985,762	Cement, sand and gravel, stone, clays, coal
Lawrence.....	82,863	(²)	Sand and gravel.
Lee.....	(²)	(²)	Cement, stone, sand and gravel, clays.
Livingston.....	1,679,487	1,828,344	Stone, clays, sand and gravel, coal.
Logan.....	571,880	718,806	Sand and gravel, stone, coal.
Macon.....	(²)	(²)	Sand and gravel.
Macoupin.....	1,285,773	1,913,180	Coal.
Madison.....	5,495,406	4,732,133	Coal, stone, sand and gravel, clays.
Marion.....	33,653	77,361	Coal.
Marshall.....	570,394	514,786	Sand and gravel, clays.
Mason.....	697	(²)	Sand and gravel.
Massac.....	16,472	(²)	Stone, sand and gravel.
McDonough.....	425,487	305,591	Stone, clays.
McHenry.....	1,906,230	2,481,806	Sand and gravel, stone.
McLean.....	(²)	(²)	Sand and gravel.
Menard.....	378,388	433,676	Stone, coal, clays.
Mercer.....	132,941	73,583	Clays, stone.
Monroe.....	(²)	(²)	Stone, sand and gravel.
Montgomery.....	(²)	(²)	Coal, stone.
Ogle.....	1,421,841	1,387,038	Sand and gravel, stone.
Peoria.....	3,620,831	3,779,092	Coal, sand and gravel, stone.
Perry.....	17,621,732	(²)	Coal, sand and gravel.
Pike.....	302,259	234,183	Sand and gravel, stone.
Pope.....	4,893	(²)	Zinc, sand and gravel.
Pulaski.....	(²)	(²)	Stone.
Putnam.....	35,565	10,100	Sand and gravel.
Randolph.....	(²)	3,447,015	Coal, stone, sand and gravel.
Rock Island.....	879,172	989,523	Stone, sand and gravel, clays.
St. Clair.....	17,139,879	17,725,105	Coal, stone, sand and gravel, clays, lime.
Saline.....	11,347,675	11,383,410	Coal, clays.
Sangamon.....	844,491	1,161,146	Coal, sand and gravel, clays.
Schuyler.....	153,647	134,474	Coal, sand and gravel, stone.
Scott.....	(²)	(²)	Stone, sand and gravel.
Shelby.....	(²)	35,750	Sand and gravel.
Stark.....	(²)	6,000	Do.

See footnotes at end of table.

TABLE 12.—Value of mineral production in Illinois, 1956-57, by counties ¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value
Stephenson.....	\$197, 041	\$305, 073	Stone, sand and gravel.
Tazewell.....	1, 057, 640	997, 770	Sand and gravel, clays.
Union.....	354, 431	(?)	Stone, sand and gravel.
Vermilion.....	5, 202, 705	5, 702, 325	Coal, stone, clays, sand and gravel.
Wabash.....	249, 134	183, 133	Sand and gravel.
Warren.....	86, 234	99, 753	Stone.
Washington.....	145, 356	157, 541	Coal, stone.
White.....	(?)	(?)	Sand and gravel.
Whiteside.....	377, 759	465, 047	Stone, sand and gravel.
Will.....	7, 937, 900	7, 241, 187	Sand and gravel, stone, coal.
Williamson.....	24, 862, 098	24, 281, 374	Coal, stone.
Winnebago.....	1, 974, 023	1, 990, 691	Sand and gravel, stone.
Woodford.....	120, 574	115, 989	Sand and gravel.
Undistributed.....	300, 402, 517	320, 161, 651	
Total.....	572, 321, 000	579, 584, 000	

¹ County figures exclude 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."

The Western Fire Brick Co. produced sandstone near Elco for refractory purposes.

Sand and gravel for building and road construction, engine use, and other purposes was produced by the H. H. Halliday Sand Co. at a dredge on the Ohio River near Cairo. The State highway department contracted for road gravel.

Bond.—The Richards Brick Co. mined clay near New Douglas. The output was used by the company for manufacturing building brick.

Sand and gravel for building use was produced near Greenville by the Greenville Gravel Co., Inc.

Crushed and broken limestone for riprap, roadstone, and agricultural purposes was produced by the Bond Stone Co. near Sorento.

Brown.—Approximately 5 miles from Mount Sterling, the Frederic Brick & Tile Co. produced clay for manufacturing building brick and drain tile.

Sand and gravel for road construction and other purposes was produced by T. F. Hollembeak & Sons and Bridgewater & Gaskill.

Bureau.—The sole producer of bituminous coal in the county in 1957 was the Midland Electric Coal Corp. strip mine near Mineral. Jigging methods were used in cleaning the entire output.

Sheffield Shale Products Co. mined clay near Sheffield for building brick and other heavy clay products.

Output of sand and gravel for building and road construction, railroad ballast, and other uses was reported from operations near Bureau, Manlius, and Princeton. Road gravel was produced by the county highway department and under contract for the State highway department.

Calhoun.—The West Point Sand Plant produced sand for building purposes at a dredge on the Mississippi River near Batchtown.

Limestone was quarried by the Calhoun Quarry Co. and Paul C. Herter near Batchtown and Golden Eagle, respectively. The output was sold principally for agricultural and road purposes.

Champaign.—Crude perlite mined outside the State was processed by the Ryolex Corp. at its plant in Champaign. The expanded product was sold principally for lightweight aggregate in plaster and concrete.

Sand and gravel for building and road construction and other uses was produced by several companies at fixed and portable plants near Mahomet. Paving sand was produced under contract for the State highway department.

Christian.—For the fourth consecutive year, Christian County ranked second in the State in the production of bituminous coal, yielding 5.7 million tons. The production came from two underground mines operated by Peabody Coal Co.; one, the No. 17 mine near Pana, was closed in December, and the other was the No. 10 mine near Pawnee. The latter mine ranked second in output of bituminous coal in the United States in 1957. Approximately 80 percent of the county coal output was mechanically cleaned, utilizing jigs, and hydroseparators. A small quantity was oil-treated.

Crushed limestone for concrete aggregate and roadstone and railroad ballast was produced by the Tri-County Stone Co. near Nokomis.

Clinton.—Bituminous coal furnished over 91 percent of the total value of mineral output in Clinton County in 1957. Coal was produced chiefly for local consumption at 3 underground mines. Two of the mines were at Breese; the third was near Centralia. The latter mine also extended into Marion County. Breese Coal Co., Inc., closed its mine at Breese in May 1957.

Alphouse Huelsmann and the Buehne Quarry Co. crushed limestone for road use. Road gravel was produced by W. D. Lindsey and the county highway department.

Cook.—Crushed limestone was produced in the county for concrete aggregate and roadstone, railroad ballast, agricultural use, asphalt filler, flux, and refractory use. Material Service Corp. operated four quarries near Chicago, Lyons, McCook, and Thornton. The company also produced sand near Wheeling. Consumers Co. quarried limestone near Hillside and La Grange. Dolese & Shepard Co. reported the output of crushed limestone from a quarry near Hodgkins.

The Chicago Gravel Co. operated a fixed sand and gravel plant near Elgin and reported output for building and road construction, railroad ballast, and other purposes. Sand for engine use was produced near Chicago by the Bos Sand Co.

Marblehead Lime Co. operated plants at South Chicago and Thornton, producing quick and hydrated lime for building, chemical, and industrial uses. The Standard Lime & Cement Co. produced quicklime for refractory use at its plant near La Grange.

Producers of clay in the county in 1957 were Brisch Brick Co., Carey Brick Co., Chicago Brick Co., Illinois Brick Co., and Tuthill Building Materials Co. Output was used for manufacturing building brick and other heavy clay products.

Elemental sulfur was recovered as a byproduct by the Pure Oil Co. at its Lemont Refinery.

Henry Frenzer produced peat for use as a soil conditioner.

Crude perlite mined in Western States was expanded at plants operated in Chicago by the American Bildrok Co. and Silbrico Corp.

Output was used chiefly as a lightweight aggregate in plaster and concrete.

The Zonolite Co. processed vermiculite at its plant in Chicago. The crude material was mined in Montana, South Carolina, and South Africa.

Other plants in the county, all in the Chicago area, that processed mineral raw materials included blast furnaces and coke-oven plants. The Illinois coke output was consumed mostly in blast furnaces in the State. Companies producing coke in 1957 were Interlake Iron Corp., International Harvester Co., Youngstown Sheet & Tube Co., and Republic Steel Corp. Pig-iron production in 1957 decreased slightly below 1956. Companies operating blast furnaces during the year were Interlake Iron Corp., International Harvester Co., Republic Steel Corp., United States Steel Corp., and Youngstown Sheet & Tube Co.

Douglas.—The Moffat Coal Co. produced bituminous coal from an underground mine near Murdock. The company also operated a preparation plant, cleaning coal by jigging methods. Part of the output was oil-treated.

Edwards.—Miscellaneous clay was produced at Albion by the Albion Brick Co. The output was used for manufacturing building brick.

Fayette.—The St. Elmo Brick & Tile Co. mined clay near St. Elmo. The company used the output in manufacturing building brick.

The output of Burtschi Sand & Gravel Co. at a fixed sand and gravel plant near Vandalia was used for building and road construction and other purposes. Molding sand was produced by Chas. D. Lutz & Sons near Mulberry Grove. Road gravel was produced under contract for the State highway department.

Franklin.—Franklin County was the fourth largest coal-producing county in Illinois in 1957. Output originated at underground mines, three of which were operated by Old Ben Coal Corp. and the other by Chicago, Wilmington & Franklin Coal Co. Preparation plants were operated at each of the mines in 1957.

Fulton.—Fulton County continued to rank third as a coal-producing county in Illinois with an output of 5.5 million tons. Production in 1957 came from 3 underground mines and 11 strip mines, operated by 13 companies. Over 95 percent of the county output was shipped to consumers by rail and barge. Eight preparation plants were in operation in the county during the year.

Sand and gravel for building and road construction and fill was produced by dredging near Canton and Macomb. The State highway department contracted for road gravel.

Gallatin.—Nine companies produced bituminous coal at 4 underground and 7 strip mines in the county in 1957. Nearly 78 percent of the output was shipped by barge on the Ohio River.

Paving sand was produced near Junction. The county highway department produced sand and gravel near New Haven and Shawneetown for building and road purposes. Road gravel was produced under contract for the State highway department.

Greene.—Lyndall W. Wyatt produced clay near Roodhouse. The output was sold chiefly for manufacturing firebrick and block.

Coal for local consumption was produced by the Birch Creek Coal Co. from a strip mine near Roodhouse. Part of the output was oil-treated.

Crushed limestone was produced near Carrollton and Hillview for agricultural use and roadstone.

Grundy.—The Illinois Clay Products Co. mined clay from pits 5 miles north of Coal City and 12 miles east of Morris. The output was used in refractories and heavy clay products.

The Grundy County part of the Northern Illinois Coal Corp. strip mine was the only source of bituminous coal in the county in 1957. The mine near Braidwood extended also into Kankakee and Will Counties.

Material Service Corp. produced sand near Morris for building use.

Hancock.—Bituminous coal for local trade was produced from a strip mine near Augusta by Triple S Mines. A substantial quantity of the tonnage produced underwent crushing and oil treatment.

Crushed and broken limestone was produced by several companies near Carthage, Hamilton, and Nauvoo. The output was used for riprap, roadstone, and agricultural purposes.

Hardin.—Hardin County furnished 52 percent of the total shipments of finished fluorspar in the Nation in 1957. Aluminum Company of America operated its Fairview-Blue Diggings mine and Rosiclare mill during the year. Ore was mined by a modified shrinkage stoping method and hauled to the 800-foot-deep main shaft by trucks. The ore was hoisted by automatic skips to the surface where trucks hauled the crude material to the adjacent company mill for treatment. The mill processed the ore by dense-medium separation, followed by flotation. Mill products were lead, zinc, and fluorspar concentrates.

Minerva Oil Co. operated the Crystal and Minerva No. 1 mines and mills near Cave in Rock. The Crystal mine operation included the Victory, Bazon, and Jefferson properties. The mines were worked mostly by room-and-pillar methods. A small quantity of ore from the Crystal was mined by open-pit methods. Zinc-fluorspar ore mined from the Minerva No. 1 was processed at the all-flotation mill at the mine. Zinc concentrate and Acid and Ceramic grades of fluorspar concentrate were produced at the Minerva No. 1 plant. Metallurgical, Ceramic, and Acid grades of fluorspar and lead concentrate were produced at the company Crystal mill in 1957 from ore mined at the Crystal group. Zinc concentrate produced by the company was shipped by barge on the Ohio River from Cave in Rock to a smelter near Pittsburgh, Pa.

Ozark-Mahoning Co. operated mines near Cave in Rock and a flotation plant at Rosiclare. Ores were hauled approximately 18 miles by truck to the mill for processing. The plant, which has separate lead, zinc, and fluorspar circuits, also treated custom ores in 1957. Some of the fluorspar concentrate was pelletized before shipment to consumers.

Mackey-Humm Mining Co. produced fluorspar concentrate from company-mined ore and purchased ore at a mine and mill near Rosiclare. Rosiclare Lead & Fluorspar Mining Co. reported sales of finished fluorspar. Several other companies mined fluorspar ore, some of which contained lead and/or zinc.

Fluorite specimens were collected by several individuals and used chiefly for mineral collections.

Limestone was quarried near Cave in Rock, Golconda, and Shelleyville. The output was used for concrete aggregate and roadstone, flux, and agricultural purposes.

Henry.—Coal was produced from 3 underground mines—2 near Alpha and 1 at Coal Valley. In August 1957 the Shuler Coal Co. acquired the property formerly operated by Bugos White Coal Co.

Collinson Bros. operated a portable sand and gravel plant near Kewanee and reported output of road gravel. The State and county highway departments contracted for sand and gravel for road use.

Jackson.—Output of bituminous coal (the principal mineral produced in Jackson County in 1957) was reported by 5 companies, operating 2 underground and 4 strip mines in the eastern part of the county. Most of the shipments went to consumers by rail.

The Illinois Quarry Co. produced crushed limestone near Ava for roadstone and agricultural use.

Sand and gravel for building and road construction, engine use, and fill was produced by the Lawder Sand Co. at a dredge near Grand Tower.

Jefferson.—Jefferson continued to be one of the major coal-producing counties in the State. Production in 1957 was from the Orient No. 3 underground mine, operated by Freeman Coal Mining Corp. near Waltonville, and from a strip mine operated by the Belle River Mining Co., Inc., near Belle Rive.

Jo Daviess.—Eagle-Picher Co. mined zinc ore from its Graham, Snyder, Spillane, and Feehan properties throughout 1957. Ore was mined by open-stope mining methods, hoisted from a 270-foot shaft, and treated at the company Graham mill. Concentration by jigging and flotation was used. Custom ores and ore mined by Eagle-Picher Co. in Wisconsin were also processed at the Graham mill in 1957. In the latter half of the year the company changed from a 6-day workweek to a 5-day week.

Tri-State Zinc, Inc., produced zinc-lead ore from its Gray and Amelia mines approximately 5 miles southeast of Galena. The company operated throughout the entire year, except for a 2-week-vacation period in July. For the latter half of 1957 the company reduced its workweek from 6 to 5 days. Open stoping and modified shrinkage stoping methods were employed at the Gray mine. Ore was hauled by diesel trucks through an inclined adit to the company Gray mill, where it was concentrated by jigging and flotation. A report described mining and milling methods and costs at the Gray mine.⁴ The Amelia mine was operated by open-stoping methods. Ore was hauled by truck to the Gray mill for treatment.

Other producers of lead and/or zinc ore in Jo Daviess County in 1957 included Hickory Hill Mining Co. and Little Ginte Mining Co.

Limestone was quarried near Galena, Lanark, Stockton, and Warren. Output was crushed and used principally for roadstone, railroad ballast, and agricultural purposes.

Road gravel was produced under contract for the Apple River Highway Commission.

⁴ Cole, W. A., *Mining and Milling Methods and Costs*, Tri-State Zinc, Inc., Jo Daviess County, Ill.: Bureau of Mines Inf. Circ. 7780, 1957, 19 pp.

Kane.—Peat was produced in the county by Batavia Soil Builders. The output was used as a soil conditioner.

Sand and gravel was produced by six companies, chiefly for building and road construction and fill. Output was reported from pits near Algonquin, Elgin, and Sugar Grove.

Kankakee.—Northern Illinois Coal Corp. produced coal near Braidwood from a strip mine, which extended into Grundy and Will Counties.

Miscellaneous clay used in manufacturing building brick and other heavy clay products was produced near Kankakee and St. Anne. Producers were Eastern Illinois Clay Co., Kankakee Clay Products Co., and St. Anne Brick & Tile Co.

The Lehigh Stone Co. and Manteno Limestone Co. crushed limestone near Lehigh and Manteno, respectively. The output was used for roadstone, railroad ballast, and agricultural purposes. Dimension limestone for house-stone veneer, flagging, and rubble was produced near Bourbonnais by the Bourbonnais Stone Quarry.

Sand for molding use was produced by the Portage-Manley Sand Co. near Essex. The State highway department contracted for paving sand.

Knox.—Output of bituminous coal in the country was reported by 3 companies, operating 4 strip mines. Mining was centered at Farmington and Victoria. Virtually the entire production was cleaned mechanically at preparation plants.

Clay was produced near Galesburg by the Purington Brick Co. for use in manufacturing building brick.

The Abingdon Rock Co., Inc., crushed limestone near Abingdon for roadstone and agricultural use. The county highway department contracted for crushed limestone for road use.

Sand and gravel for road construction and fill was produced by the L. K. Bandy Construction Co. at a portable plant near Maquon.

Lake.—Peat was produced in the county by Milburn Peat Co., Inc., near Lake Villa and the Marvin Walker Peat Co. The output was used principally as a soil conditioner.

Clay used in manufacturing building brick was produced near Deerfield by the National Brick Co. Output was affected by a building decline.

Production of sand and gravel and crushed limestone was reported by several companies near Ingleside, Wadsworth, and Gurnee. Output was used for building and road construction, fill, and other purposes. The county highway department produced paving sand, and the State highway department contracted for road gravel.

Crude perlite mined in Colorado and New Mexico was processed by the Lake Zurich Concrete Products Co. at its Lake Zurich plant. The expanded product was used as lightweight aggregate in plaster and concrete.

The Chevrolet & Saginaw Grey Iron Foundry, Division of General Motors Corp., operated coke ovens at Waukegan and produced coke for foundry use.

La Salle.—In 1957 La Salle County led the State in total value of mineral output (excluding natural gas and liquid fuels). Portland and masonry cements were produced at plants operated by Alpha Portland Cement Co. at La Salle, and by Lehigh Portland Cement Co.

and Marquette Cement Mfg. Co. near Oglesby. The output was affected by a labor strike at the plant of Lehigh Portland Cement Co. during the period June 29 to July 29 and threatened strikes at other plants in the county. The three companies also quarried limestone for manufacturing cement. Other limestone producers included Sheridan Stone Co., Troy Grove Stone Co., and Utica Stone Co. These companies quarried near Sheridan, Troy Grove, and Utica, respectively. The output was crushed and used for roadstone, railroad ballast, and agricultural purposes.

The Conco-Meier Co. and Arthur Mart produced clay from pits near Lowell and Utica, respectively. Output was used for manufacturing building brick. LaClede-Christy Co. produced clay for refractory use near Ottawa. Matthiessen & Hegeler Zinc Co. produced clay from an underground mine near La Salle. The company used the material principally for manufacturing zinc retorts. Alpha Portland Cement Co. and Marquette Cement Mfg. Co. produced shale for their own use in manufacturing cement.

Coal was produced by LaClede-Christy Co. and Arthur Mart, in conjunction with their clay-pit operations.

Sand and gravel was produced in the county by 13 commercial operators for a variety of purposes, including building and road construction, fill, and special uses, such as glass, molding, grinding and polishing, sandblasting, engine use, filter purposes, foundry use, enamel, filler, pottery, and other purposes. Operations were chiefly near Ottawa. The State and county highway departments contracted for road gravel.

Lee.—The Medusa Portland Cement Co. produced portland and masonry cements at its plant near Dixon. Three new 150-foot kilns were put into operation during the year. The company also produced clay and limestone in the county for use in manufacturing cement. Several other companies operating portable crushing plants produced limestone from quarries near Dixon, Lee Center, Rochelle, and Sterling. The output was used chiefly for roadstone and agricultural purposes. Sand and gravel was produced near Dixon, Nelson, and Steward for building and road construction and other uses. Road gravel was produced under contract for the State highway department.

Livingston.—Clay was produced by the Diller Tile Co. and Streator Drain Tile Co. near Chatsworth and Streator, respectively. The companies used the material for manufacturing draintile and other heavy clay products.

A small quantity of coal was mined from two strip pits near Streator. The Streator Drain Tile Co. consumed its entire output in manufacturing draintile. The output of Baiett & Talbot Coal Co., the other producing company, was consumed locally.

Limestone was produced by several companies from quarries near Chenoa and Pontiac. The output was employed for roadstone, agricultural use, asphalt filler, and other purposes.

A quantity of sand and gravel for road construction and other uses was produced by two companies.

Logan.—The Lincoln Coal Mining Co., operating an underground mine near Lincoln, was the only producer of coal in Logan County in 1957. The total output increased substantially over the preceding year and was sold to local trade.

The Rocky Ford Limestone Co. quarried limestone near Lincoln and sold the material for roadstone and agricultural purposes.

Sand and gravel for building and road construction, engine use, and fill was produced by the Lincoln Sand & Gravel Co., operating a dredge near Lincoln.

Macoupin.—In 1957 coal was produced by 3 companies, operating 3 underground mines in the eastern section of the county. Production increased approximately 30 percent over 1956. In June the Mt. Olive & Staunton Coal Co. closed its mine, which also extended into Madison County.

Vermiculite produced outside the State was processed at the Girard plant of International Vermiculite Co. The exfoliated product was used for loose fill and high temperature insulation.

Madison.—The output of coal in the county in 1957 was obtained from four underground mines. The operators during the year were Livingston-Mt. Olive Coal Co., Livingston; Glen Carbon Mines, Inc., and Lumaghi Coal Co., both near Collinsville; and Mt. Olive & Staunton Coal Co., Staunton. The mine of the latter company was closed in June.

Clay was produced by the Alton Brick Co. near Alton for use in manufacturing building brick.

Limestone was produced by three companies near Alton and Godfrey. The county output was used for riprap, roadstone, agricultural use, rubber filler, pottery, asphalt filler, fertilizer filler, rock dust for coal mines, and other purposes.

Sand and gravel was produced at four dredging operations near Alton and Granite City. The output was used for building and road construction, engine, and other purposes. The State highway department contracted for paving sand.

Coke ovens, blast furnaces, and open-hearth steel furnaces were operated at Granite City by the Granite City Steel Co.

Marion.—The only producer of coal in the county during 1957 was the Marion County Coal Mining Corp., operating an underground mine at Centralia. Production increased substantially over 1956.

Marshall.—The Hydraulic-Press Brick Co. mined clay two miles south of Sparland. Output was consumed by the company in manufacturing brick.

Sand and gravel for building and road construction was produced by Consumers Co. at its fixed plant near Lacon. Vernon Henry produced road gravel near La Rose.

McDonough.—Fire and miscellaneous clays mined near Colchester by the Baird Clay Mine and Frank Nelson were used in manufacturing stoneware, art pottery, and building brick.

Crushed and broken limestone for riprap, roadstone, and agricultural use was produced by three companies near Colchester and Industry.

Menard.—Coal was produced from 3 underground mines—1 near Tallula and 2 at Petersburg. The entire output was sold to local trade.

The Springfield Clay Products Co. mined clay near Springfield. Output was used by the company in manufacturing building brick and other heavy clay products.

Crushed limestone was produced near Athens and Mason City for roadstone and agricultural use.

Mercer.—The Hydraulic-Press Brick Co. produced clay from a pit approximately five miles from Aledo and used the material for manufacturing building brick. Seventeen kilns were operated periodically throughout 1957.

Independent Materials Co. quarried limestone near Viola for use as roadstone.

Montgomery.—An underground mine operated by Freeman Coal Mining Corp. near Farmersville furnished all the coal produced in Montgomery County in 1957. Over 82 percent of the output was shipped to consumers by rail; the remainder was sold to local trade.

Limestone was produced from quarries near Litchfield and Nokomis for concrete aggregate and roadstone and agricultural use.

Peoria.—Coal production was reported by 13 companies in Peoria County in 1957. Over 90 percent of the output was furnished by 7 strip mines; the remainder was supplied by 6 underground mines. Production was consumed locally, except for a small quantity shipped to consumers by barge on the Illinois River. Two mechanical cleaning plants were in operation in the county during the year. Coal was crushed and oil-treated by several companies.

Four companies quarried limestone near Hanna City and Princeville. The material produced was used for roadstone and agricultural purposes.

Sand and gravel was produced by six companies at plants near Chillicothe, Peoria, and Princeville. The output was used for building and road construction, railroad ballast, fill, and other purposes.

Perry.—Perry County was one of the leading coal-producing counties in the State, with 6 companies reporting production from 2 underground mines and 5 strip mines. Operations were near Du Quoin and Pinckneyville. Major producing companies were Southwestern Illinois Coal Corp., Truax-Traer Coal Co., Union Colliery Co., and The United Electric Coal Co.'s. Nearly 96 percent of the county output was shipped to consumers by rail.

Road gravel was produced under contract to the State highway department.

Pope.—Fluorspar-zinc ore was mined by J. W. Patton & Sons in Pope County in 1957. Crude material mined was treated at mills operated by two other companies in Hardin County.

The county highway department produced road gravel.

Randolph.—Coal furnished nearly 66 percent of the total value of mineral production in the county in 1957. Sparta Coal Co. and Ziegler Coal & Coke Co. produced from 2 underground mines and Ritter Coal Co. from 1 strip mine. In January 1957 Ziegler Coal & Coke Co. acquired the largest producing mine, the Bradbury, formerly operated by Midwest Utilities Coal Corp. All mining activities were near Sparta.

Several underground limestone mines were operated near Chester and Prairie du Rocher. The Illinois State Penitentiary quarried near Menard. The output of limestone in the county was used for roadstone, agricultural use, in alkali works, and for other purposes.

The Southern Illinois Sand Co. dredge near Chester produced sand for building, paving, engine use, railroad ballast, filter, and other purposes.

Rock Island.—Clay was produced near Carbon Cliff by the Van-Packer Co., Division of Flintkote Co. The output was used by the company in manufacturing flue liners.

Limestone was quarried by three companies near Cordova, Hillsdale, and Milan. Material was crushed for use as roadstone, railroad ballast, agricultural purposes, and filter beds.

Six plants near Cleveland, Coal Valley, Cordova, Milan, and Moline produced sand and gravel for building and road construction, railroad ballast, fill, and molding use. The State highway department contracted for sand and gravel for paving use.

St. Clair.—Bituminous coal was produced by 7 companies, operating 5 underground and 4 strip mines. In 1957 Peabody Coal Co. began operating its new River King strip mine near Freeburg. A 70-yard shovel was used for stripping overburden. Coal was hauled by 55-ton diesel-powered tractor trailers approximately 5 miles to the company preparation plant for processing. The plant, sheathed entirely in stainless steel, was designed to treat 1,000 tons of raw coal per hour. Processed coal was hauled over the company-owned railroad to Peabody's barge-loading dock on the Mississippi River at East St. Louis. Virtually the entire output was sold to power utilities in the midwest. In 1957 Peabody Coal Co. took over operation of two strip mines formerly operated by the Midwest Radiant Corp. and Seminole Coal Corp., and an underground mine formerly operated by Perry Coal Co. Other producers of coal in the county during 1957 included: Belle Valley Coal Co., East Side Coal Co., Mid-Continent Coal Corp., and Shiloh Valley Coal Co. mined underground; Morgan Coal Co., strip-mined.

Clay used for manufacturing building brick was produced near Belleville by the Hill Brick Co. The Hydraulic-Press Brick Co. mined clay near French Village. The material was used for lightweight aggregate.

The Aluminum Company of America produced quicklime at its East St. Louis plant. The output was used mostly by the company at its East St. Louis works, where it produced alumina, synthetic cryolite, and aluminum fluoride. The remainder was sold for building and metallurgical purposes. In November 1957 the company stopped producing alumina at East St. Louis and planned to divert that part of plant production to newer and more economical refining facilities in other States.

Dimension and crushed limestone was produced in the county near Columbia, East St. Louis, and New Athens. Output was reported by four companies and was used for building, flagging, rubble, riprap, roadstone, railroad ballast, stone sand, and agricultural purposes.

Sand and gravel for building and road construction and engine use was produced at a dredging operation near East St. Louis.

Saline.—Coal was produced from 4 underground and 13 strip mines in 1957. Major producers were Peabody Coal Co., Sahara Coal Co., and Saxton Coal Corp. Nine other companies also mined in the county during the year. The output was shipped to consumers

principally by rail. Two preparation plants processed coal from five mines in Saline County during the year. In the latter part of the year Sahara Coal Corp. suspended operations at its No. 7 underground mine. A new strip mine near Harrisburg was opened in June by the Egyptian Mining Co.

The Harrisburg Brick & Tile Co. produced clay for building brick near Harrisburg. However, mining and plant operations were discontinued in September because of the loss of the plant by fire.

Sangamon.—The Cantrall Coal Co. and Eddy Coal Co. produced coal for local consumption at underground mines near Cantrall.

Clay was produced near Springfield by the Posten Brick & Tile Co. and Springfield Clay Products Co. The material was used by the companies for manufacturing building brick and other heavy clay products.

Three companies near Springfield produced sand and gravel for building and road construction, fill, and other purposes.

Schuyler.—Coal was produced by three companies from two underground mines near Rushville and a strip pit at Camden. The entire output was sold to local trade. Production decreased slightly below 1956.

Western Illinois Stone Co. quarried limestone near Brooklyn for riprap, roadstone, and agricultural use. The Vern Mitchell Quarry Co. plant and quarry were both inactive the entire year, but shipments were made from stocks for agricultural and road purposes.

Sand and gravel for paving use was produced by Lyle B. Moushon and under contract for the State highway department.

Tazewell.—The Peoria Brick & Tile Co. mined clay near East Peoria. Output was used by the company chiefly for manufacturing building brick.

Sand and gravel was produced by three companies near East Peoria, Mackinaw, Pekin, and Washington. Material was employed principally for building and road construction, railroad ballast, engine use, filter purposes, and fill.

Vermilion.—The bulk of the coal produced in the county in 1957 was mined from two strip pits operated by Fairview Collieries Corp. and The United Electric Coal Cos. Three other strip mines and four underground mines furnished the remainder of the output. All mining was done near Danville. The Seymour Coal Co. began operating a new strip mine early in the year.

The Western Brick Co. mined clay near Danville. Material was used for lightweight aggregate and manufacturing building brick.

The Material Service Corp. quarry near Fairmont produced limestone for concrete aggregate and roadstone.

Sand and gravel was produced by five companies near Danville and Westville. The output was used for road construction, fill, and other purposes.

Washington.—The underground mines of Bois Coal Co. and Venedy Coal Co. supplied the entire coal output of the county in 1957. The total production was considerably less than in 1956.

Crushed limestone was produced in the county for use as roadstone.

Will.—Wilmington Coal Mining Corp. and Northern Illinois Coal Corp. produced coal from strip mines near Braidwood. The mine

of Northern Illinois Coal Corp. also extended into Grundy and Kankakee Counties.

Near Joliet and Lockport, three commercial companies and the Illinois State Penitentiary crushed limestone for flux, concrete aggregate, roadstone, railroad ballast, and agricultural purposes.

Four companies produced sand and gravel near Joliet, Lisle, Lockport, and Plainfield. The output was employed for building and road construction, railroad ballast, fill, and other uses. The State highway department contracted for road gravel.

Crude perlite and vermiculite, mined in Western States, was processed by the F. E. Schundler & Co., Inc., at Joliet. The output was used principally as lightweight aggregate in plaster and concrete and for insulation purposes.

Williamson.—The production of coal decreased about 5 percent below 1956, but Williamson County continued to lead the State in output, which came from 17 underground and 16 strip mines. Major producers among the 29 companies operating in 1957 were: Bell & Zoller Coal Co., Carmac Coal Co., Freeman Coal Mining Corp., Peabody Coal Co., and Stonefort Corp. Approximately 93 percent of the county production was shipped to consumers by rail. Twelve preparation plants were operated in the county in 1957. Mines closed during the year included an underground mine operated by Blue Bird Coal Co., and strip pits operated by Farley Bros. Coal Co. and P. & R. Coal Co.

Limestone for riprap and roadstone was produced by the county highway department.

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, United States Department of the Interior, and the Geological Survey, Indiana Department of Conservation.

By Donald F. Klyce¹ and John B. Patton²



MINERALS valued at over \$198 million were produced in Indiana in 1957, exceeding the record \$196.8 million reported for 1956.

Rising prices offset lessened production of several commodities, notably portland cement, coal, and stone.

Construction materials (cement, clay, sand and gravel, and crushed stone) declined in volume, following the national pattern for this industry; however, a slight increase in dimension-stone production reversed a downward trend that began in 1955.

About half of the mineral output was sold as mineral fuels (coal, natural gas, and petroleum), and most of the balance was utilized in building and road construction.

TABLE 1.—Mineral production in Indiana, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasives stones (whetstones).....	3	\$5	4	\$8
Cement, portland.....thousand 376-pound barrels.....	(?)	(?)	12, 598	40, 742
Clays.....thousand short tons.....	2, 051	3, 457	1, 475	2, 569
Coal.....do.....	17, 089	64, 061	15, 841	62, 055
Lime.....short tons.....	(?)	1		
Marl, calcareous (except for cement).....	99, 561	66	(?)	(?)
Natural gas.....million cubic feet.....	791	96	6 600	6 80
Peat.....	11, 383	79	13, 805	130
Petroleum (crude).....thousand 42-gallon barrels.....	11, 513	33, 733	6 12, 859	6 40, 249
Sand and gravel.....thousand short tons.....	7 18, 302	7 15, 432	16, 750	14, 206
Stone.....do.....	14, 700	31, 575	14, 460	33, 094
Value of items that cannot be disclosed: Masonry and natural cement gypsum, recovered elemental sulfur, and values indicated by footnote 2.....		50, 598		7, 974
Total Indiana ⁸		196, 753		198, 942

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Figure withheld to avoid disclosing of individual company confidential data.

³ Related only to mines with an annual production of 1,000 tons or more.

⁴ Less than 1,000 short tons.

⁵ Included with stone (1957).

⁶ Preliminary figure.

⁷ Revised figure.

⁸ Total adjusted to eliminate duplicating value of clays and stone.

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EMPLOYMENT AND INJURIES

The employment and injury data in table 2 represent virtually complete coverage of cement, coal, and coke production and a very high percentage of limestone and clay output.

TABLE 2.—Summary of employment and injuries for selected mineral industries, 1956-57¹

Commodity	Average number of men working	Total man-shifts	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			
1956:								
Cement ²	1,269	452,248	3,617,968	1	12	(3)	3.54	(3)
Clay.....	172	41,779	334,534	2	7	12,064	26.90	36,062
Coal.....	4,057	878,795	6,771,197	3	381	37,463	56.71	5,533
Coke Ovens.....	2,314	790,617	6,324,929	1	9	(3)	1.58	(3)
Limestone ⁴	2,987	712,906	5,786,501	-----	231	(3)	39.92	(3)
1957:								
Cement ²	1,567	537,455	4,299,628	2	12	(3)	3.26	(3)
Clay ⁵	673	169,625	1,379,725	-----	26	2,109	18.84	1,529
Coal.....	3,953	831,619	6,383,232	3	331	34,634	52.32	5,426
Coke Ovens.....	2,314	844,596	6,753,204	-----	15	(3)	2.22	(3)
Limestone ⁴	2,320	678,143	5,504,208	1	190	(2)	34.70	(3)

¹ Data exclude office workers and are preliminary.

² Includes cement plants and quarries producing raw material used in manufacturing cement.

³ Data not available.

⁴ Excludes quarries producing limestone used exclusively in manufacturing cement. Includes data on personnel of processing plants.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—The output of bituminous coal in 1957 decreased 7 percent in quantity. The average value per ton, at the mine, was 17 cents higher than in 1956 and the value of shipments declined only 3 percent. The cut in demand for coal led to the closing of several large mines. In 1957, 90 mines were operated in the State compared with 101 in 1956. The principal market outlet for Indiana coal in 1957 was electric powerplants.

Mines were operated in 16 counties in the southwestern part of the State. Warrick was the leading coal-producing county, supplying nearly a third of the State total. Vigo, Pike, Greene, and Knox Counties were also important coal-producing areas. Strip mines furnished 69 percent of the total production in 1957 and underground mines the remainder. Nearly 85 percent of the coal marketed was shipped to consumers by rail or water. The balance was hauled for local consumption chiefly by truck.

Approximately 9 million tons of coal was cleaned mechanically at 21 plants in 1957. Several cleaning plants processed material from more than one mine.

During 1957 the following companies contracted for new bituminous preparation facilities: Enos Coal Mining Co. (Oakland City), Lynnville Coal Co. (Lynnville), Squaw Creek Coal Co. (Bonneville); and Thunderbird Collieries Co. (Farmersburg). Mining-equipment sales

TABLE 3.—Bituminous coal production, value, and number of mines operated in 1957, by counties

(Exclusive of mines producing less than 1,000 net tons)

County	Production (net tons)			Value		Number of mines operated		
	Under-ground	Strip	Total	Average per ton	Total	Under-ground	Strip	Total
Clay.....		710,857	710,857	\$4.18	\$2,970,806		10	10
Davies.....		17,400	17,400	3.81	66,226		1	1
Dubois.....	23,796		23,796	3.57	85,049	4		4
Fountain.....		41,802	41,802	6.72	280,764		1	1
Gibson.....	323,120	205,045	528,165	4.44	2,344,359	2	1	3
Greene.....	13,577	1,618,966	1,632,543	4.16	6,796,908	3	9	12
Knox.....	932,105	348,316	1,280,421	4.02	5,141,051	3	1	4
Martin.....		63,263	63,263	3.81	240,785		1	1
Owen.....		(1)	(1)	(1)	(1)		2	2
Parke.....		(1)	(1)	(1)	(1)		2	2
Pike.....	56,598	2,260,373	2,316,971	3.78	8,747,038	6	7	13
Spencer.....	5,013	(1)	(1)	(1)	(1)	1	1	2
Sullivan.....	509,927	1,416	511,343	4.32	2,210,070	4	1	5
Vermillion.....	23,246	73,441	96,687	4.72	456,038	3	2	5
Vigo.....	2,501,432	511,260	3,012,692	4.14	12,469,860	6	2	8
Warrick.....	561,232	4,861,177	5,422,409	3.59	19,459,442	8	9	17
Undistributed.....		177,926	182,939	4.30	786,390			
Total.....	4,950,046	10,891,242	15,841,288	3.92	62,054,786	40	50	90

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

to Indiana producers in 1957 included: 3 mobile loading machines, 2 continuous mining machines, 3 shuttle cars, and 1 "mother" conveyor (sectional or extensible power-driven gathering and haulage units capable of handling over 500 feet of conveyor).³

The Indiana Geological Survey published a directory of Indiana coal producers.⁴

TABLE 4.—Production of peat, 1948-57

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1948.....	3	2,288	\$11,576	1953.....	6	6,919	\$41,049
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

Peat.—Peat output in 1957 was 21 percent greater than in 1956. Production was from bogs of late Pleistocene origin in Benton, Blackford, Cass, De Kalb, Grant, Hamilton, Marion, and Wells Counties. The output—sold for soil-conditioning purposes—was mostly moss peat, although reed peat and humus peat were also dug.

Petroleum and Natural Gas.—Data compiled by the Petroleum Section, Indiana Department of Conservation, indicated petroleum production in 1957 was 11.8 million barrels, an increase of 33,000 barrels over 1956. Natural-gas production was 650 million cubic feet, a decrease of 121 million from the preceding year.

³ Coal Age, February 1958, pp. 98, 99, 115, 117.

⁴ Welr, Charles E., Directory of Coal Producers in Indiana: Indiana Dept. of Conservation, Geol. Survey Directory 5, February 1957, 100 pp.

The preliminary petroleum figure published in table 1 by the Bureau of Mines was based on pipeline runs and is subject to revision when final data are available.

In all 727 wells were drilled, of which 508 were field wells and 219 were wildcats. This total number included 236 oil producers, 17 gas wells, and 474 dry holes. Nineteen successful exploratory wells in Posey, Gibson, Spencer, Pike, Knox, and Vanderburgh Counties resulted in 6 new pools, 9 extensions, and 4 new pays. The extensions were the most significant.⁵

The proved oil reserve, as of December 31, 1957, amounted to 66.7 million barrels, and total liquid hydro-carbon reserves amounted to 66.8 million barrels.⁶

TABLE 5.—Production of crude oil, 1957, by major fields¹

Field	County	Year discovered	Area (acres)	1957 production (barrels)	Number of wells, 1957	
					Producing	Completed
Bufkin West.....	Posey.....	1950	250	127,420	22	3
Caborn Consolidated.....	do.....	1940	420	255,570	113	(?)
College Consolidated.....	do.....	1941	550	248,676	46	3
Fairbanks.....	Sullivan.....	1950	420	144,365	19	0
Griffin Consolidated.....	Gibson and Posey.....	1938	6,130	2,061,044	611	(?)
Heuser Consolidated.....	Posey and Vanderburgh.....	1938	1,400	141,437	82	0
Inman East.....	Posey.....	1943	360	156,452	32	(?)
King.....	Gibson.....	1949	390	281,827	39	24
Lamott Consolidated.....	Posey.....	1941	740	169,832	56	0
Monroe City Consolidated.....	Knox.....	1950	1,720	146,657	108	0
Mount Carmel Consolidated.....	Gibson and Knox.....	1941	1,660	196,432	160	0
Mount Vernon Consolidated.....	Posey.....	1941	1,840	466,488	160	4
Mumford Hills.....	Gibson and Posey.....	1940	710	106,473	54	3
Owensville East Consolidated.....	Gibson.....	1948	840	637,273	77	5
Owensville North.....	do.....	1943	1,740	103,975	99	4
Patoka East.....	do.....	1947	810	127,475	64	5
Plainville.....	Daviess.....	1950	350	121,849	56	0
Rochester.....	Gibson.....	1948	430	187,539	43	0
Rock Hill (New).....	Spencer.....	1953	430	184,504	31	0
Spencer.....	Posey.....	1948	510	139,940	51	(?)
Springfield Consolidated.....	do.....	1946	2,210	590,609	258	(?)
Union-Bowman Consolidated (New).....	Gibson, Knox, and Pike.....	1941	12,650	360,879	492	68
Vienna.....	Vanderburgh.....	1933	310	314,665	49	(?)
Welborn Consolidated.....	Posey.....	1941	1,340	280,352	118	(?)
Undistributed.....	.....	.....	.....	4,258,267	1,557	84
Total.....	.....	.....	.....	11,810,000	4,397	203

¹ Petroleum Section, Indiana Geological Survey.

² Correct entry not determinable.

NONMETALS

Abrasive Materials.—Hindustan Whetstone Co. of Bedford quarried whetstones from the Hindostan quarry near Orleans in Orange County. The volume produced was about a third larger than in 1956.

Cement.—Cement shipments from Indiana plants were 7 percent lower than in 1956. The total value of shipments of all cements was only 4 percent lower than in 1956, because the average price per barrel of portland cement, which comprised the bulk of the shipments, increased 20 cents a barrel.

⁵ Carpenter, G. L., Developments in Indiana in 1957: 1958, repr. from Bull. Am. Assoc. Petrol. Geol., vol. 42, No. 6, June 1958, 4 pp.

⁶ "Proved reserves of crude oil, natural-gas liquids, and natural gas," vol. 12, Dec. 31, 1957, published by American Gas Association, American Petroleum Institute, and Canadian Petroleum Association.

Portland and masonry cements were produced by Lone Star Cement Corp. at Limesdale, Lehigh Portland Cement Co., at Mitchell, Louisville Cement Co. at Speed, and Universal Atlas Cement Co. at Buffington. Louisville Cement Co. also produced natural cement at the Speed plant.

Clays.—Production of clay in 1957 was 28 percent less than in 1956. Clay producers attributed the loss of business to the decline in building construction.

Fire-clay output was 38 percent less, and miscellaneous clay dropped 23 percent. Most of the loss was in clays used for manufacturing heavy clay products and cement.

Miscellaneous clay was mined in 22 counties and used chiefly for manufacturing cement and brick, tile, and other heavy clay products. Fire clay was produced in six counties and used in refractories, fire-brick, high-grade tile, stoneware, and pottery and for brick and other related heavy clay products.

TABLE 6.—Clays sold or used by producers, 1948–52 (average) and 1953–57

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	419, 699	\$719, 671	935, 206	\$861, 915	1, 354, 905	\$1, 581, 586
1953.....	582, 639	1, 163, 687	1, 071, 473	1, 350, 540	1, 654, 112	2, 514, 227
1954.....	374, 081	700, 044	1, 571, 988	2, 290, 672	1, 946, 069	2, 990, 716
1955.....	529, 310	1, 020, 703	1, 199, 989	1, 917, 307	1, 729, 299	2, 938, 010
1956.....	645, 254	1, 201, 863	1, 405, 366	2, 255, 247	2, 050, 620	3, 457, 110
1957.....	397, 825	748, 028	1, 077, 293	1, 820, 986	1, 475, 118	2, 569, 014

The Indiana Geological Survey estimated the value of products manufactured from clays at \$24.7 million.

Gypsum.—Gypsum was mined in Martin County by the National Gypsum Co. and United States Gypsum Co. Production was slightly larger than in 1956, but a price decrease resulted in a smaller total valuation. The gypsum was processed at mills near the mine sites and used to manufacture wallboard, lath, prepared plasters, and other products.

Lime.—The Indiana State Farm in Putnam County did not report lime production in 1957. For several years this has been the only lime producer in the State. All mineral production of the State Farm was used by it or other State agencies, and none was marketed.

Perlite.—Crude perlite was expanded at plants in Hammond and Vienna from ore mined in Western States. The expanded material was used as lightweight aggregate for plaster and concrete.

Sand and Gravel.—Sand and gravel production was reported from 68 counties. Production and value of shipments declined about 8 percent from 1956. Demand for road materials continued at nearly the same level as in 1956, but output for building construction was about a fourth less than in the preceding year. Sand and gravel fill totaled 700,000 tons in 1957, the first year it was reported as a separate item by producers. Fill material does not include dirt fill.

TABLE 7.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956 ¹			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Molding.....	410,338	\$569,589	\$1.39	(?)	(?)	(?)
Building.....	3,528,850	2,575,085	.73	2,775,282	\$2,085,794	\$0.75
Paving.....	3,388,415	2,794,662	.82	3,158,250	2,668,881	.85
Blast.....				1,000		.50
Fire or furnace.....	(?)	(?)	(?)	159,275	159,275	1.00
Engine.....	95,497	71,551	.75	100,532	72,897	.72
Fill.....				165,263	88,870	.54
Ground.....				2,025	1,500	.74
Other.....	128,740	87,989	.68	71,187	55,547	.78
Undistributed ²	170,000	203,943	1.20	524,339	598,420	1.14
Total sand.....	7,721,840	6,302,819	.82	6,957,203	5,731,634	.82
Gravel:						
Building.....	3,903,137	3,484,568	.89	2,532,254	2,417,558	.95
Paving.....	5,584,719	4,934,919	.88	5,560,760	5,121,292	.92
Railroad ballast.....	412,335	345,618	.84	502,575	393,647	.78
Fill.....				552,977	292,265	.53
Other.....	232,124	155,355	.67	47,526	41,361	.87
Total gravel.....	10,132,315	8,920,460	.88	9,196,092	8,266,123	.90
Total sand and gravel.....	17,854,155	15,223,279	.85	16,153,295	13,997,757	.87
GOVERNMENT-AND-CONTRACTOR						
Sand:						
Building.....				81,000	20,250	.25
Paving.....	25,102	10,650	.42	3,652	1,461	.40
Total sand.....	25,102	10,650	.42	84,652	21,711	.26
Gravel:						
Building.....	43,056	17,222	.40	130,424	37,923	.29
Paving.....	379,700	180,989	.48	382,141	149,013	.39
Total gravel.....	422,756	198,211	.47	512,565	186,936	.36
Total sand and gravel.....	447,858	208,861	.47	597,217	208,647	.35
ALL OPERATIONS						
Sand.....	7,746,942	6,313,469	.81	7,041,855	5,753,345	.82
Gravel.....	10,555,071	9,118,671	.86	9,708,657	8,453,059	.87
Grand total.....	18,302,013	15,432,140	.84	16,750,512	14,206,404	.85

¹ Revised figures.² Included with "Undistributed" to avoid disclosing individual company confidential data.³ Includes filter and fire or furnace sand (1956); molding sand (1957); and railroad-ballast sand (1956-57).

The 10 leading producers of sand and gravel were: Allen-Whitley County Gravel Co., Inc., Columbia City; American Aggregates Corp., Greenville, Ohio; Kickapoo Sand & Gravel Corp., Peru; Koch Sand & Gravel Co., Evansville; Irving Bros. Gravel Co., Marion; Materials 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.

Stone.—The value of all stone produced in Indiana in 1957 was nearly 5 percent greater than in 1956, while tonnage was down 2 percent.

The output of dimension limestone was 4 percent larger than in the preceding year, while crushed-limestone production dropped nearly 3 percent.

Leading producers of dimension limestone were: Indiana Limestone Co., Inc., 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.

TABLE 8.—Production of calcareous marl, 1952-57

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1952.....	5	16,414	\$9,021	1955.....	5	17,080	\$10,543
1953.....	4	13,540	6,398	1956.....	8	99,561	65,755
1954.....	6	28,536	18,515	1957.....	7	103,452	65,011

TABLE 9.—Limestone sold or used by producers, 1956-57, by uses

Use	1956			1957		
	Quantity	Value		Quantity	Value	
		Total	Average per unit measure		Total	Average per unit measure
Dimension: Building:						
Rough construction						
short tons.....				520	\$599	\$1.15
Rough architectural (block)						
cubic feet.....	3,185,090	\$3,592,069	\$1.13	2,936,811	2,928,327	1.00
Dressed (cut and sawed)						
do.....	3,612,995	10,546,860	2.92	4,296,833	12,151,107	2.83
Flagging and rubble.....	1,059,090	211,352	.20	965,144	156,088	.16
Total (short tons approximate) ¹	569,645	14,350,281	25.19	594,932	15,236,121	25.61
Crushed and broken:						
Riprap.....	359,329	171,256	.48	105,897	126,935	1.20
Flux.....	135,210	169,267	1.25	139,958	175,705	1.26
Concrete aggregate, road-stone, etc.....						
short tons.....	8,677,549	10,721,535	1.24	9,062,663	11,383,874	1.26
Railroad ballast.....	158,140	191,663	1.21	270,857	326,379	1.20
Agriculture.....	2,446,561	3,143,022	1.28	2,229,299	2,946,525	1.32
Other ²	2,277,993	2,009,326	.88	1,851,952	1,837,424	.99
Total crushed and broken short tons.....	14,054,782	16,406,069	1.17	13,660,626	16,796,842	1.23
Grand total.....do.....	14,624,427	30,756,350	2.10	14,255,558	32,032,963	2.25

¹ 145 pounds per cubic foot.

² Includes limestone for refractory (1956); filter beds, poultry grit, and scrap for miscellaneous use (1957); and calcium-carbide plants, glass factories, paint and rubber filler, pottery, asphalt, fertilizer, dust for coal mines, mineral food, mineral wool, and cement (1956-57).

Crushed-limestone production was reported from 39 counties. The leading counties, in order of value, were: Putnam, Clark, Lawrence, Allen, Hamilton, and Monroe. Major producers of crushed stone included Louisville Cement Co., May Sand & Gravel Co., Meshberger Stone Co., Inc., Mulzer Bros., and The Ohio & Indiana Stone Corp.

Sandstone production increased substantially over 1956. Dimension sandstone was quarried in Lawrence County by Indiana Sand-

stone Co., Inc., of Bedford and Leonard Sandstone Co., Inc., of Huron; in Monroe County by Hinkle Sandstone Co. of Bloomington; and in Orange County by Colored Sandstone Co., West Baden. French Lick Sandstone Co., Inc., French Lick, operated quarries in Lawrence and Martin Counties and a mill in Orange County.

Calcareous marl was classified under stone for the first time in 1957. It was produced at about the same rate as in 1956. Marl pits were operated in seven counties in Northern Indiana: Elkhart, Fulton, Kosciusko, La Grange, La Porte, Noble, and Steuben. The output was sold for soil conditioning.

Slag.—Blast furnaces in Lake County produced a considerable tonnage of slag as a byproduct of pig-iron production. It was used as a raw material in manufacturing cement. It was also crushed for use as aggregate and expanded for use in insulating material and lightweight aggregate.

Sulfur.—Standard Oil Co. of Indiana recovered byproduct sulfur from crude petroleum at Whiting. The Mathieson-Fluor process was used. The output was used at the Whiting refinery.

REVIEW BY COUNTIES

Minerals production was reported from all but 7 of the 92 counties in Indiana. Counties from which production was not reported were: Brown, Jefferson, Johnson, Ohio, Tipton, Union, and Washington.

Sand and gravel deposits were mined throughout the State; 186 commercial operations reported from 68 counties. Approximately seven-eighths of the material was used for aggregate and in building and road construction. Limestone was quarried and crushed, primarily for concrete aggregate, roadstone, and for agricultural use, at 80 plants in 39 counties.

Adams.—Clay, limestone, and a small amount of sand and gravel were produced. Krick Tyndall Co. (Findlay, Ohio) mined clays from a pit near Decatur for use in manufacturing heavy clay products. John W. Karch Stone Co., Bryant, produced flagging as well as crushed stone from a limestone quarry in Jefferson Township.

TABLE 10.—Value of mineral production in Indiana, 1956-57, by counties ^{1 2}

County	1956 ³	1957	Minerals produced in 1957 in order of value ²
Adams.....	\$510, 736	\$512, 228	Stone, clays, sand and gravel.
Allen.....	1, 287, 103	1, 232, 078	Stone, sand and gravel.
Bartholomew.....	342, 139	(4)	Do.
Benton.....	2, 910	(4)	Peat, sand and gravel.
Blackford.....	127, 622	(4)	Stone, peat, clays.
Boone.....	32, 035	(4)	Sand and gravel.
Carroll.....	(4)	(4)	Stone, sand and gravel.
Cass.....	(4)	(4)	Stone, peat, sand and gravel.
Clark.....	(4)	(4)	Cement, stone, clays, and sand and gravel.
Clay.....	4, 074, 119	3, 641, 992	Coal, clays, sand and gravel.
Clinton.....	30, 322	(4)	Sand and gravel.
Crawford.....	(4)	(4)	Stone.
Daviess.....	477, 158	117, 176	Coal, sand and gravel, stone.
Dearborn.....	209, 266	149, 953	Sand and gravel.
Decatur.....	(4)	(4)	Stone.
De Kalb.....	286, 729	241, 684	Sand and gravel, peat.
Delaware.....	487, 941	(4)	Sand and gravel.
Dubois.....	151, 847	137, 694	Coal, clays, sand and gravel.
Elkhart.....	286, 281	171, 163	Sand and gravel, stone (marl).

See footnotes at end of table.

TABLE 10.—Value of mineral production in Indiana, 1956-57, by counties^{1 2}—Continued

County	1956 ³	1957	Minerals produced in 1957 in order of value ⁴
Fayette	\$97,841	\$92,095	Sand and gravel.
Floyd		(4)	Stone.
Fountain	812,747	790,944	Sand and gravel, coal, clays.
Franklin	(4)	(4)	Clays.
Fulton	74,594	23,533	Sand and gravel, stone (marl).
Gibson	3,071,174	2,390,074	Coal, sand and gravel.
Grant	1,271,637	992,174	Stone, sand and gravel, peat.
Greene	6,110,449	(4)	Coal, clays, sand and gravel.
Hamilton	805,802	(4)	Stone, sand and gravel, peat.
Hancock	(4)	56,394	Sand and gravel.
Harrison	107,450	137,294	Stone.
Hendricks	(4)	210,646	Sand and gravel.
Henry	88,951	81,135	Do.
Howard	386,499	(4)	Stone, sand and gravel.
Huntington	(4)	(4)	Stone, sand and gravel, clays.
Jackson	323,469	271,364	Clays, sand and gravel.
Jasper	195,000	(4)	Stone, sand and gravel.
Jay	(4)		
Jennings	(4)	(4)	Stone.
Knox	5,172,969	5,428,494	Coal, sand and gravel.
Kosciusko	371,745	411,142	Sand and gravel, stone (marl).
Lagrange	(4)	(4)	Do.
Lake	(4)	(4)	Cement, sulfur, clays, sand and gravel.
La Porte	(4)	(4)	Sand and gravel, stone (marl).
Lawrence	12,808,478	12,719,644	Stone, cement, sand and gravel.
Madison	713,479	658,262	Stone, sand and gravel.
Marion	2,240,318	(4)	Sand and gravel, peat.
Marshall	71,575	84,489	Sand and gravel, clays.
Martin	2,455,500	2,214,129	Gypsum, stone, coal, clays.
Miami	484,955	362,417	Sand and gravel, stone.
Monroe	8,639,679	8,011,792	Stone.
Montgomery	100,541	152,422	Clays, sand and gravel.
Morgan	386,827	283,211	Do.
Newton	598,000	(4)	Stone.
Noble	13,891	(4)	Sand and gravel, stone (marl).
Orange	301,482	691,936	Stone, abrasives.
Owen	1,642,738	1,671,635	Stone, coal, sand and gravel, clays.
Parke	576,135	487,069	Clays, sand and gravel, coal, stone.
Perry	(4)	(4)	Stone, clays, sand and gravel.
Pike	8,808,003	8,747,038	Coal.
Porter	349,826	407,556	Sand and gravel, clays.
Posey	127,151	82,822	Sand and gravel.
Pulaski	519,616	(4)	Stone, clays, sand and gravel.
Putnam	(4)	(4)	Cement, stone, clays, sand and gravel.
Randolph	205,183	195,001	Stone, sand and gravel.
Ripley	163,156	240,532	Stone.
Rush	238,399	224,870	Stone, sand and gravel.
St. Joseph	775,024	650,193	Sand and gravel.
Scott	257,507	191,932	Stone.
Shelby	543,529	564,094	Stone, sand and gravel.
Spencer	(4)	(4)	Coal, sand and gravel.
Starke	59,510	71,542	Sand and gravel.
Steuben	206,677	354,671	Sand and gravel, stone (marl).
Sullivan	3,941,419	(4)	Coal, sand and gravel.
Switzerland	81,773	93,025	Stone, sand and gravel.
Tippecanoe	769,700	612,235	Sand and gravel.
Vanderburg	436,990	339,100	Sand and gravel, clays.
Vermillion	1,739,377	1,090,530	Sand and gravel, coal, clays.
Vigo	12,249,865	13,072,314	Coal, sand and gravel, clays.
Wabash	53,404	46,692	Sand and gravel.
Warren	(4)	185,431	Do.
Warrick	19,673,632	19,723,442	Coal, stone.
Wayne	605,363	661,156	Sand and gravel, stone.
Wells	297,055	(4)	Stone, sand and gravel, peat.
White	580,600	(4)	Stone.
Whitley	(4)	(4)	Sand and gravel.
Undistributed	88,280,552	109,126,078	
Total ⁵	196,753,000	198,942,000	

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, which was not available by counties. Value of these commodities is included with "Undistributed."

³ Revised figures.

⁴ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Total adjusted to eliminate duplicating value of clays and stone.

Benton.—Peat was dug from a bog by Milburn Peat Co., Inc. A small quantity of sand and gravel was produced.

Blackford.—Inman Tile Co. mined miscellaneous clay near Hartford City for use in manufacturing heavy clay products. Hartford Peat & Gravel Co. produced reed or sedge peat. Crushed limestone was also produced in the county.

Cass.—Peat was produced by Charles Measel Peat Co. Limestone and sand and gravel were produced in the county.

Clark.—Cement and materials used in manufacturing of cement were the principal mineral commodities produced in the county. Output in 1957 reflected the decline in the building industry; the volume of materials produced was substantially less than in 1956.

Louisville Cement Co. at Speed manufactured portland, masonry, and natural cements. The company also produced clays, and limestone used in cement.

Production of sand and gravel and crushed limestone was also reported in the county.

Clay.—The value of minerals produced was 10 percent less than in 1956. Clay, coal, and sand and gravel were produced.

Ayrshire Collieries Corp. Chinook mine No. 3 was the largest coal producer. Large tonnages were also reported for Quality Coal Corp. No. 1 mine and G & F Corp. Hickory No. 2 mine. Ten strip mines were operated in the county.

Fire and miscellaneous clays were mined by seven companies. Log Cabin Coal Co. and Quality Coal Corp. reported the largest tonnages. They produced from under clays beneath lower Pennsylvanian coals.

Daviess.—Hicks Coal Co. operated the No. 2 strip mine. Sand and gravel production was reported at two sites in the county.

De Kalb.—Humus Peat Moss Co. produced moss and humus peat from a bog near Corunna. Five operators reported sand and gravel production.

Dubois.—Clay, coal, and sand and gravel production was reported. Near Huntingburg Hugo H. Bartelt, Huntingburg Brick Co., and Louisville Pottery Co. (Louisville, Ky.) mined fire and miscellaneous clays for manufacturing firebrick, heavy clay products, pottery, and stoneware. Four underground mines were operated by Simon Ackerman Coal Mine, Frick Coal Co., Stenftenagel Coal Co. and Tedrow Coal Co. County minerals production was 10 percent under 1956.

Elkhart.—Marl and sand and gravel production was reported. E. M. Ulmer & Son mined marl from a pit near Elkhart.

Fountain.—Clay, coal, and sand and gravel were produced at about the same rate as in 1956.

Hydraulic-Press Brick Co. (Crawfordsville), Poston-Herron Brick Co. (Attica), and Rostone Corp. (Lafayette) mined clays for use in heavy clay products.

Morgan Coal Co. operated the Morgan-Kingman underground mine.

Franklin.—Herman H. Wessel Co. mined miscellaneous clay near Huntersville for use in heavy clay products.

Fulton.—Marl and sand and gravel were produced. M. E. Zellers reported production from a marl pit near Kewanna.

Gibson.—Coal was the principal mineral produced in Gibson County. Saxton Coal Corp. operated a strip mine, and production from underground mines was reported by Princeton Mining Co. and the Somerville Coal Co. A small amount of sand and gravel was produced in the county.

Grant.—Glacier Peat Moss Co. dug peat from a bog near Jonesboro. Pipe Creek Stone Co. produced flagging and crushed stone near Marion. Sand and gravel production was also reported in the county.

Greene.—Increased coal production raised the mineral output of the county substantially.

Coal was produced from 9 strip and 3 underground mines. Maumee Collieries Co. and Sherwood-Templeton Coal Co. were the leading producers. Bloomfield Brick Co. mined miscellaneous clay for use in heavy clay products. A relatively small amount of sand and gravel production was reported.

Hamilton.—Moss peat was dug near Noblesville by the Fox Prairie Products, Inc., of Indianapolis. Production of sand and gravel was reported by seven operators, and limestone was quarried and crushed at a plant near Noblesville.

Hancock.—The Irving Materials Co. sand and gravel plant near Greenfield was closed because the deposit became depleted. The company continued to produce sand and gravel at plants in Hamilton and Henry Counties.

Huntington.—Majenica Tile Co. mined miscellaneous clay and produced drain tile at two plants (Majenica and Simpson). Crushed limestone and sand and gravel production was also reported in Huntington County.

Jackson.—Clay and sand and gravel were produced. Miscellaneous clay for heavy clay products was produced by Jackson Brick & Hollow Ware (Ewing) and Medora Brick Co. (Medora). Lehigh Portland Cement Co. (Allentown, Pa.), mined clay near Brownstown for use in cement.

Jefferson.—Hanover Stone Co. opened a new limestone quarry 8 miles southwest of Madison. Plant capacity was estimated at 3,700 tons a day.

Knox.—Increased coal production raised the county mineral output about 5 percent over 1956. Production was reported for 1 strip and 3 underground mines. Enoco Collieries, Inc., and Shasta Coal Corp. were the leading producers. Sand and gravel production in the Vincennes area was reported by three operators.

Kosciusko.—Three marl pits and nine sand and gravel pits were operated in the county. Mineral production increased about 11 percent over 1956. Marl producers were: Aschliman & Weirich, Goshen; Custer Bros., Milford; and E. M. Ulmer & Son, Etna Green. The marl was used for agricultural purposes, while the sand and gravel was sold for building use, road construction, railroad ballast, and fill. Engine sand was also produced.

Lagrange.—Marl was produced by Glen Heshner near Howe. Sand and gravel production was reported from four sites in the county.

Lake.—Lake County was one of the major mineral-producing areas in the State, as well as part of one of the most important industrial complexes in the nation. Cement, clays, and sand and gravel were produced. Blast-furnace slag was crushed for use as aggregate and

as a raw material in manufacturing cement and expanded as insulating material and lightweight aggregate. In addition, several other mineral-processing operations were carried on in the county (petrochemicals, pig iron, etc.). Important refractory-manufacturing facilities have been developed in the area.

Universal Atlas Cement Co. (New York, N. Y.) produced portland and masonry cements at Buffington. Clinker produced at this plant was used in manufacturing cement at Buffington and was also shipped across Lake Michigan to the new company fine-grinding plant at Milwaukee, Wis. Miscellaneous clay was mined from a pit near Munster by National Brick Co. of Chicago, Ill. John N. Bos Sand Co. (also of Chicago, Ill.) produced molding and engine sands near Gary. Standard Oil Co. of Indiana (Chicago, Ill.) recovered byproduct sulfur for use in its refinery at Whiting.

La Porte.—E. M. Ulmer & Sons, Etna Green, mined marl from a pit near Walkerton. Sand and gravel production was reported from five pits.

Lawrence.—Cement, dimension limestone and sandstone, crushed limestone, and sand and gravel were produced. The value of mineral production in 1957 was less than 1 percent lower than in 1956. Improvement in the dimension-stone market offset declines in other mineral commodities.

Portland and masonry cements were produced by Lehigh Portland Cement Co. (Allentown, Pa.) at Mitchell. The company also produced crushed limestone for use in cement. Dimension limestone for building use was quarried and milled by Heltonville Limestone Co., Indiana Limestone Co., and Ingalls Stone Co. at Bedford. Several fabricators processed purchased stone at mills in the area. Indiana Sandstone Co., Inc. (Bedford), and a new operator, Leonard Sandstone Co., Inc. (Huron), quarried and sawed sandstone for architectural use. Bedford Ground Limestone Co. (Bedford) crushed spalls from building-stone mills.

Marion.—Peat Moss Indianapolis, Inc., produced humus peat from a bog in the county. Two of the largest sand and gravel producers in the State—American Aggregates Corp. (Greenville, Ohio) and Standard Materials Corp. (Indianapolis)—operated several pits and processing plants in the county.

Marshall.—Bremen Clay Products Co., Inc., mined clay near Bremen for use in heavy clay products. Ten sand and gravel operators reported production.

Martin.—Clay, coal, gypsum, and sandstone were produced. Heavy clay products were produced from clay mined near Loogootee by Loogootee Clay Products Corp. Loogootee Block Coal Co., Inc., operated the Burris pit. Near Shoals National Gypsum Co. and United States Gypsum Co. mined gypsum and manufactured plaster, wallboard, and other gypsum products. Also near Shoals, General Refractories Co. (Philadelphia, Pa.) quarried a quartz-pebble conglomerate for use in manufacturing silica brick.

Monroe.—Monroe County limestone quarries produced a major portion of the building-stone output of the State. Quarries and mills were operated by Bloomington Limestone Corp., Empire Stone Co., The Carl Furst Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Indiana Limestone Co., Ingalls Stone Co., Midwest

Quarries, Inc., Solomito Stone Co., Inc., Texas Quarries, Inc., Victor Oolitic Stone Co. and Woolery Stone Co., Inc. Purchased stone was cut and dressed by ten mills in the county. Several additional companies sawed stone and split it for veneer, and others split stone purchased in sawed form. Indiana Calcium Corp. operated a fine-grinding plant at Bloomington and produced high-calcium limestone from spalls purchased from stone mills in the area. Production was sold for filler, mineral food, coal-mine rock dust, and agricultural use. The Hinkle Sandstone Co. (Bloomington) produced veneer.

Montgomery.—Heavy clay products were manufactured from miscellaneous clay mined near Crawfordsville by American Vitrified Products Co. (Cleveland, Ohio) and Hydraulic-Press Brick Co. (Crawfordsville). Sand and gravel production was also reported in the Crawfordsville area.

Morgan.—Four clay pits were operated in the county near Martinsville by Adams Clay Products Co. and near Brooklyn by Brooklyn Brick Co., Inc., Indiana Drain Tile Co., Inc., and Midwest Aggregates, Inc. Sand and gravel production was also reported in the county. During the year Hydraulic Press Brick Co. (Crawfordsville) acquired the property of Midwest Aggregates, Inc., and increased plant capacity by adding a new kiln.

Noble.—Luther & Haney (Albion) produced marl for agricultural use. Production was reported from five sand and gravel pits.

Orange.—Hindustan Whetstone Co. produced whetstones from a quarry near Orleans. Dimension sandstone was quarried and milled at West Baden by the Colored Sandstone Co. French Lick Sandstone Co., Inc., milled its output from quarries in Lawrence and Martin Counties at French Lick. Crushed limestone was also produced in the county.

Owen.—Maumee Collieries Co. operated the Old Glory No. 33 strip-coal mine and also produced fire clay for sale to manufacturers of architectural terra cotta and heavy clay products. Burcham Bros., Inc., mined coal from its strip mine. Ingalls Stone Co. (Bedford) quarried limestone at Romona for its finishing plant in Lawrence County. Crushed limestone and sand and gravel production was also reported from the county.

Parke.—Fire clay and coal were mined by S. L. Turner Coal & Clay Co. from a strip mine. Maple Grove mine produced coal and Cayuga Brick & Tile Co. and G & F Corp. mined miscellaneous clays for heavy clay products. Crushed limestone and sand and gravel were produced.

Perry.—Clay, crushed limestone, and sand and gravel production was reported. Cannelton Sewer Pipe Co. (Cannelton) and United States Brick Co. (Tell City) operated clay pits.

Pike.—Coal was produced from 7 strip and 6 underground mines. The Enos mine of the Enos Coal Mining Co. was the largest operation. Ayrshire Collieries Corp. (Ayrshire), and Ayrshire No. 1 mines and the No. 2 mine of Blackfoot Coal & Land Corp. reported substantial tonnages.

Porter.—Clays and sand for industrial use were produced. Clay for use in stoneware was mined by Chas. S. Schrock (Chesterton) and for use in foundries and steelworks by J. S. Robbins (McCool). Production of molding, furnace, and engine sand was reported by

John N. Bos Sand Co. and Consumers Co. (Chicago, Ill.), Crisman Sand Co. (Gary) and Portage-Manley Sand Co. (Rockton, Ill.).

Pulaski.—Francisville Drain Tile Corp. mined miscellaneous clays for its own use in manufacturing farm tile. Sand and gravel and crushed limestone production was reported in the county.

Putnam.—Lone Star Cement Corp. (Indianapolis) produced portland and masonry cements at Limedale as well as clay and crushed limestone. Indiana State Farm (Greencastle) produced clay and crushed limestone for use by State agencies. The Ohio & Indiana Stone Corp. (Toledo, Ohio), operated a limestone quarry and two crushing plants near Greencastle. Production was sold for asphalt roofing, fertilizer, coal-mine rock dust, mineral food, metallurgical uses, railroad ballast, roadstone, and agricultural stone.

Spencer.—Mulzer Bros. operated a strip coal mine and St. Meinrad's Arch Abbey mine produced coal from an underground mine. Hardy Sand Co. (Evansville), produced molding sand from a pit near Richland.

Steuben.—Cleveland & Taylor (Fremont) produced marl for agricultural use. Production was reported from five sand and gravel pits.

Sullivan.—Coal production was reported from 1 strip and 4 underground mines. Fairview Collieries Corp. Minnehaha mine was the largest producer, followed by the Pandora mine of the Pandora Coal Co. Both were underground operations. Sand and gravel production was reported at three pits in the county.

Vanderburgh.—Clay was mined for use in heavy clay products by Standard Brick & Tile Corp. (Evansville). Large tonnages of sand and gravel were processed in the county, much of it dredged from the Ohio River.

Vermillion.—Clay, coal, and sand and gravel were produced. Arketex Ceramic Corp. (Brazil) and Cayuga Brick Corp. (Cayuga) mined clays for their own use. Coal production was reported from 2 strip and 3 underground mines. The Sunspot strip mine of Ayrshire Collieries Corp. was the largest operation.

Vigo.—Terre Haute Vitrified Brick Works, Inc., mined miscellaneous clays. Two strip and six underground coal mines produced large tonnages of coal. The Talleydale and Green Valley mines of Snow Hill Coal Corp., the Viking Coal Corp., and Maumee Collieries Co. were the largest producers. Four sand and gravel pits were operated.

Warrick.—Coal and crushed-limestone production was reported. The largest coal output in the State came from the 9 strip and 8 underground mines operated in the county. Large strip mines included the Victoria (Victoria Coal Corp.), Wright (Boonville Collieries Corp.), Lynnville (Lynnville Coal Co.), Tecumseh (Tecumseh Coal Corp.), Blackfoot Coal & Land Corp. No. 1 mine, and Sunlight No. 14 (Peabody Coal Co.). The Ditney Hill Mine (Ingle Coal Corp.) was the largest underground mine.

Wells.—Ballards Peat Moss produced moss peat from a bog near Jackson. Sand and gravel and crushed-limestone production was also reported in Well's County.

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



MINERALS produced in Iowa included common clays or shales, coal, gypsum, peat, sand and gravel, and limestone. Cement was manufactured from clay or shale, gypsum, and limestone that were produced in the State. Markets for the mineral products are chiefly within Iowa and adjacent States. The total value of minerals produced in Iowa has increased annually since 1953, and has established a new record each year. Minerals produced in 1957 were valued at \$69 million compared with \$66.5 million in 1956. The annual increases can be attributed both to increased output and to increased unit values. Iowa ranked 3d in the United States in the production of gypsum and 10th in the output of cement.

TABLE 1.—Mineral production in Iowa, 1956-57 ¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland.....376-pound barrels.....	10, 333	\$31, 159	10, 423	\$33, 219
Masonry.....do.....	427	1, 664	400	1, 662
Clays ²	852	1, 078	752	944
Coal ³	1, 358	4, 732	1, 312	4, 543
Gypsum.....	1, 777	3, 919	1, 123	3, 773
Peat.....	27	(4)	(4)	(4)
Sand and gravel.....	12, 895	9, 525	12, 042	8, 927
Stone.....	14, 035	17, 256	15, 214	18, 768
Value of items that cannot be disclosed: Fire clay, lime, and peat.....		467		614
Total Iowa ⁴		66, 529		68, 986

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 Figure withheld to avoid disclosing individual company confidential data.

⁵ Total has been adjusted to eliminate duplicating the value of clays and stone.

EMPLOYMENT AND INJURIES

Table 2 shows employment and injuries for selected commodities. Data for 1957 for cement, coal, and gypsum were compiled from reports from 100 percent of the companies producing these commodities.

¹ Chief, Minneapolis Field Office, Division of Mineral Industries, Region V, Bureau of Mines, Minneapolis, Minn.

ties. Data for clay are totals for 19 companies, which supplied 86 percent of the State's output. The data for limestone are totals of 94 companies' reports and represent 81 percent of Iowa's limestone output. Data for 1956 in the table, although representing slightly different coverage for clay and limestone, may be considered comparable.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Iowa in 1956-57¹

Commodity	Men working daily	Man-days worked	Man-hours worked	Total number of lost-time injuries		Total number of days lost or charged	Injury-frequency rate	Injury-severity rate
				Fatal	Non-fatal			
1956:								
Cement ²	1,035	343,158	2,748,144	1	6	(³)	2.18	(³)
Clay.....	349	93,334	752,268	-----	27	531	35.89	706
Coal.....	605	133,093	936,572	-----	33	4,280	35.23	4,570
Gypsum.....	236	67,988	543,897	-----	1	2	1.83	4
Limestone ⁴	743	149,244	1,379,432	1	60	(³)	43.50	(³)
1957:								
Cement ²	1,024	333,881	2,671,055	-----	6	(³)	2.25	(³)
Clay.....	278	66,618	542,575	-----	27	372	49.76	686
Coal.....	626	113,496	902,209	5	17	30,261	24.38	33,541
Gypsum.....	223	63,303	546,722	-----	1	145	1.83	265
Limestone ⁴	807	163,292	1,541,309	1	62	(³)	40.23	(³)

¹ Excluding office workers.

² Includes cement plants and quarries producing raw material used in manufacturing cement.

³ Figure not available.

⁴ Excludes quarries producing limestone exclusively for use in cement manufacture.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Sales of portland cement were slightly greater than in 1956; masonry-cement sales were less, indicating decreased building construction and increased highway construction. Unit prices per barrel f. o. b. mill, after cash discounts and excluding cost of containers, averaged about \$3.19 compared with \$3.02 in 1956. Masonry cements averaged \$4.16 per barrel compared with \$3.90 in 1956. Five plants were operating in Iowa—2 in Cerro Gordo County, 2 in Polk County, and 1 in Scott County. All plants produced types I and II, general-use and moderate-heat cements; and type III, high-early-strength; all produced air-entrained cement. Masonry cements were produced at four plants.

The cements produced were sold chiefly in Iowa and Minnesota; and smaller quantities in Illinois and Wisconsin. About 98 percent of all sales went to consumers in these 4 States.

The capacity of cement production within the State was increased by adding one 375-foot kiln at the Penn-Dixie Cement Corp. plant in West Des Moines, Polk County. The 5 plants had a total of 26 kilns. They ranged in size from 110 feet in length by about 7 feet in diameter to 475 feet in length by 11 foot 6 inches in diameter; the total estimated maximum capacity was about 13 million barrels per year. A labor strike at one company during July and the threat of strikes at other plants did not appreciably affect overall output; the

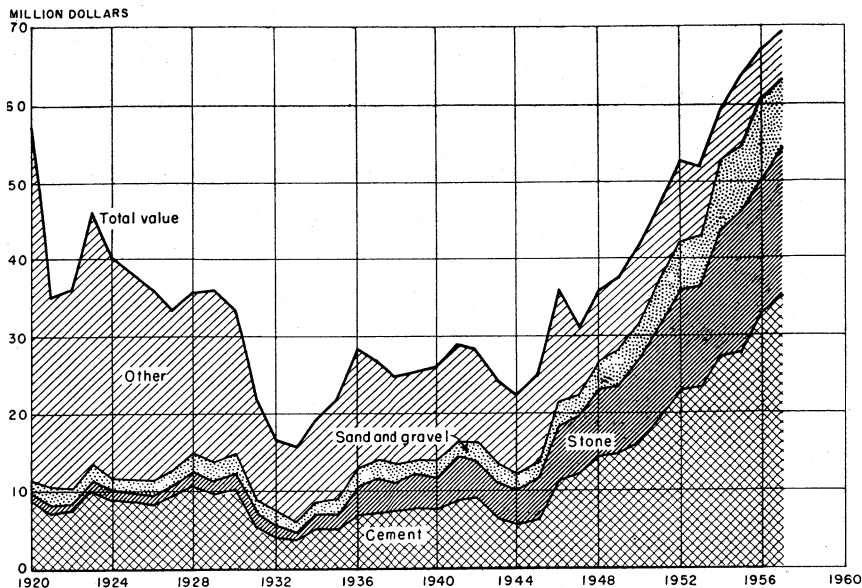


FIGURE 1.—Value of cement, stone, sand and gravel, and total value of mineral production in Iowa, 1920-57.

total stocks of the 5 plants at the close of the year were down only about 2 percent from the January 1 inventory.

Clays.—Iowa clay and shale deposits are of the type suitable chiefly for use in heavy clay products, such as common brick and sewer or draitile and as a constituent in cement. However, two companies produced material classified as fire clay and used in manufacturing refractories. About half of the clay produced in 1957 was used in brick and tile and the rest in cement. Production for both areas of use was down slightly from 1956.

Clay was produced from pits in 15 counties. Pits in Cerro Gordo, Dallas, Polk, Scott, and Webster Counties supplied 84 percent of the total.

Gypsum.—During 1957 crude gypsum was produced from mines in 21 States. The output from Iowa represented 12 percent of the total and ranked third in the Nation after Michigan and California. The State's output in 1957 was about 5 percent less than in 1956 and may be indicative of the slight downward trend of building construction; new production came from Indiana and Michigan. Four companies, all in Webster County, had board plants, except Celotex Corp.; its new plant was nearly completed. 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 notable quantities were sold for agricultural use, as a portland-cement retarder, and as a filler in various products. Relatively small tonnages were used in the glass and pottery indus-

tries, for art molding and castings, in dental and orthopedic plaster and for other uses.

Lime.—The Linwood Stone Products Co., Inc., limestone quarry and lime plant in Scott County produced both quick and hydrated lime. The uses of quicklime included metallurgy, paper, sewage, and water purification; hydrated lime was used for silica brick, insecticide filler, and water purification. Sales were considerably greater than in 1956.

Perlite.—Crude perlite, chiefly from mines in Colorado, was expanded in plants principally for manufacturing gypsum products by Bestwall Gypsum Company, National Gypsum Co., and United States Gypsum Co. in Webster County. The product was used in premixed lightweight building plaster. The Midwest Perlite Products Company, which operated a perlite-expanding plant in Polk County for several years, went into bankruptcy, July 1, 1957. No record of production in 1957 by this company was available.

Sand and Gravel.—The total production of sand and gravel in Iowa was about 7 percent under that in 1957. Production was reported from 65 counties by 125 commercial and 38 noncommercial or Government-contract operators. The State is not wealthy in sand and gravel deposits and is in especially short supply as regards coarser gravels. Most deposits contain the finer sizes of sand. Iowa is one of the few States where sand is frequently less costly per yard than gravel. A continuing trend toward improving the quality of sand and gravel produced was noted. Improvement usually included sizing, and the removal of iron oxide minerals, soft-limestone particles, and other unwanted substances, such as coal, wood chips, or vegetable matter.

The production was mostly for building and road construction; relatively small quantities went for industrial uses and as railroad ballast.

The 10 leading producers, several operating in 2 or more areas of the State, in alphabetical order, were:

Aeme Fuel & Material Co., Muscatine.
 Concrete Materials Co., Cedar Rapids.
 Coon Valley Gravel Co., Des Moines.
 L. G. Everist, Inc., Sioux Falls, S. Dak.
 Ferguson-Diehl Construction Co., Jefferson.
 Hallett Construction Co., Crosby, Minn.
 Maudlin Construction Co., Webster City.
 Mauer Construction Co., Sac City.
 Northern Gravel Co., Muscatine.
 West Des Moines Sand Co., West Des Moines.

An index of the State's sand and gravel deposits is on file in the Iowa State Highway Commission offices at Ames, Iowa.

Stone.—Limestone was the leading mineral commodity produced in Iowa. Deposits are widespread, and in 1957 production was reported from 61 counties. About 80 percent of the commercial production was crushed and/or ground for agricultural, concrete aggregate, or highway use; the remainder was used chiefly for cement manufacture. Other uses were relatively small tonnagewise. Non-commercial uses were chiefly for highway construction or for riprap in streams and riverbeds.

TABLE 3.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand:						
Glass.....				4, 935	\$3, 185	\$0. 65
Building.....	2, 514, 501	\$2, 049, 568	\$0. 82	1, 778, 561	1, 518, 573	. 85
Engine.....	37, 828	48, 737	1. 29	(2)	(2)	(2)
Paving ¹	1, 734, 050	1, 193, 696	. 69	1, 554, 835	1, 249, 184	. 80
Railroad ballast.....	22, 300	4, 000	. 18	32, 758	15, 517	. 47
Fill.....				159, 989	100, 575	. 63
Other.....	89, 691	49, 043	. 55	4, 153	7, 742	1. 86
Undistributed ³	128, 279	337, 958		175, 022	409, 102	
Total.....	4, 526, 649	3, 683, 002	. 81	3, 710, 253	3, 303, 878	. 89
Gravel:						
Building.....	1, 372, 847	1, 882, 572	1. 37	1, 103, 306	1, 587, 562	1. 44
Paving ¹	3, 793, 191	2, 652, 141	. 70	3, 909, 287	2, 626, 163	. 67
Railroad ballast.....	35, 876	15, 139	. 42	41, 935	22, 263	. 53
Fill.....				50, 053	19, 547	. 39
Other.....	86, 387	122, 017	1. 41	11, 095	69, 536	6. 27
Total.....	5, 288, 301	4, 671, 869	. 88	5, 115, 676	4, 325, 071	. 85
Total sand and gravel.....	9, 814, 950	8, 354, 871	. 85	8, 825, 929	7, 628, 949	. 86
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving ¹	172, 966	51, 951	. 30	469, 355	142, 167	. 30
Gravel: Paving ¹	2, 907, 337	1, 117, 863	. 38	2, 680, 578	1, 135, 574	. 42
Building.....				66, 180	19, 854	. 30
Total sand and gravel.....	3, 080, 303	1, 169, 814	. 38	3, 216, 113	1, 297, 595	. 40
ALL OPERATIONS						
Sand.....	4, 699, 615	3, 734, 953	. 79	4, 179, 608	3, 446, 045	. 82
Gravel.....	8, 195, 638	5, 789, 732	. 71	7, 862, 434	5, 480, 499	. 70
Grand total.....	12, 895, 253	9, 524, 685	. 74	12, 042, 042	8, 926, 544	. 74

¹ Includes materials used in bridges, culverts, etc.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

³ Value of items that cannot be disclosed: Molding, blast, and filter sand (1956-57).

The total production in 1957 was 8 percent greater than in 1956. The overall unit value, however, was unchanged at \$1.23 per ton; increases in unit value for some special uses have been offset by the fact that a greater part of the output was of lower value roadstone. Sales of ground limestone for agricultural use declined 29 percent, a normal decrease following a year of relatively poor crops.

Dimension stone was produced only in Hardin and Scott Counties; output was considerably less than in 1956 and was used entirely as rubble (irregular-shape stone for foundations, retaining walls, and so forth) or flagging.

Sales of fluxing stone increased slightly over 1956, in spite of the year-end decline in iron-foundry and furnace operations. Crushed limestone for railroad ballast was produced in Johnson and Scott Counties; the demand in 1957 was somewhat less than in the preceding year. Riprap was produced in 11 counties and used chiefly along

stream beds, and highway fills and in culverts to control erosion. Most of the production for this use in 1957 (88 percent) came from quarries in Harrison or Humboldt Counties. Demand was about a third less than in 1956.

TABLE 4.—Limestone sold and used by producers, 1956-57, by uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Commercial:						
Agriculture.....	1,563,775	\$2,153,714	\$1.38	1,106,109	\$1,508,908	\$1.36
Dimension.....	10,023	25,683	2.56	(1)	(1)	(1)
Fluxing stone.....	47,505	67,493	1.42	(1)	(1)	(1)
Railroad ballast.....	39,055	55,082	1.41	(1)	(1)	(1)
Riprap.....	455,079	505,098	1.11	302,313	394,257	1.30
Concrete aggregate, roadstone, etc.....	9,034,207	11,192,519	1.24	10,633,226	13,202,428	1.24
Other ²	2,207,732	2,651,563	1.20	2,382,585	2,915,761	1.22
Total.....	13,357,376	16,651,152	1.25	14,424,233	18,021,354	1.25
Noncommercial, all uses (concrete aggregate, roadstone, riprap).....	677,465	605,414	.89	739,542	746,935	.95
Grand total.....	14,034,841	17,256,566	1.23	15,213,775	18,768,289	1.23

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

² Includes limestone for filter beds (1956), chemical uses (1957), asphalt filler, fertilizer, dust for coal mines, mineral food, cement, lime, and other uses (1956-57).

Crushed stone for building and highway use, including both commercial and noncommercial, was about 18 percent greater than in 1956 chiefly because of increased highway construction. The increase in highway construction was not beneficial to all producers, as a large part of the increased highway construction was on major routes and not distributed throughout the State. Quarries adjacent to these routes increased production in 1957.

Limestone produced for use in cement manufacture came chiefly from quarries owned by the cement companies, and rate of output follows the demand for cement. Other uses of limestone produced in Iowa included chemical use by the sugar industry, asphalt filler, fertilizer filler, rock dust for coal mines, mineral food, and lime. Plants built after 1954 indicate a trend toward more rigid specifications as to particle size for the more special uses of limestone. These plants can deliver virtually any size product from that finer than flour up, or any mixture of sizes the customer may desire.

Standard specifications for State and county use of limestone are contained in a publication² issued by the Iowa State Highway Commission, Ames, Iowa, in 1956.

The 10 leading companies producing limestone in Iowa, based on sales value and listed alphabetically, were:

Concrete Materials & Constr. Co., Cedar Rapids.
C. B. Dewees Constr. Co., Marion.
Dewey Portland Cement Co., Kansas City, Mo.

² Iowa State High Commission, Standard Specifications for Construction on Primary, Farm to Market and Secondary Roads and Maintenance Work on the Primary Road System: 1956, 672 pp.

Kaser Constr. Co., Des Moines.
 Marquette Cement Mfg. Co., Chicago, Ill.
 Missouri Valley Limestone Co., Oakland.
 Penn-Dixie Cement Corp., Nazareth, Pa.
 E. I. Sargent Quarries, Inc., Des Moines.
 W. A. Schemmer Limestone Quarry, Inc., Logan.
 Weaver Construction Co., Iowa Falls.

MINERAL FUELS

Coal.—Iowa's coal deposits are in the south-central part of the State, and (as in 1956) production came from 10 counties; mines in Marion County furnished over half of the total output. Virtually all coal produced was consumed in Iowa, chiefly in generating electric power and in heating State, county, or municipal buildings or institutions. The production and average value did not differ significantly from 1956.

Of 63 mines producing coal in Iowa in 1957, only 5 employed 20 men or more. No mechanical cleaning plants were in operation in the State. However, much of the coal was handpicked and screened into various sizes at tipples having no mechanical cleaning facilities. Coal was loaded mechanically at only 3 of the State's 32 underground mines. Output from six mines was oil-treated.

TABLE 5.—Bituminous-coal production, value, and number of mines operated in 1957, by counties

(Exclusive of mines producing less than 1,000 net tons)

County	Production (net tons)			Value		Number of mines operated		
	Under-ground	Strip	Total	Average per ton	Total	Under-ground	Strip	Total
Appanoose.....	88,687		88,687	\$5.27	\$467,765	12		12
Davis.....	4,373	31,115	35,488	3.77	133,794	1	1	2
Lucas.....	27,508	2,268	29,776	3.80	113,140	1	1	2
Mahaska.....	3,000	167,211	170,211	3.29	559,948	1	8	9
Marion.....	94,007	674,151	768,158	3.23	2,478,491	8	11	19
Monroe.....	49,688	55,141	104,829	3.18	333,738	7	4	11
Polk.....		13,163	13,163	3.40	44,754		1	1
Van Buren.....		21,677	21,677	5.50	119,224		2	2
Wapello.....	1,786	73,760	75,546	3.62	273,465	1	3	4
Warren.....	4,140		4,140	4.48	18,528	1		1
Total.....	273,189	1,038,486	1,311,675	3.46	4,542,847	32	31	63

Peat.—Peat deposits are near the surface in several areas of Iowa; however, all production for several years has come from Worth and Winnebago Counties. Moss peat, reed or sedge peat, and humus were produced by two companies. Both sell in carlots, and both package peat in small units for the home gardener. Most of the peat was used as a soil conditioner; however, some peat was fortified with minerals, packaged, and sold as a complete soil for plant growth. The Iowa peat is near neutral or only slightly acid. Its production in 1957 was slightly less than in 1956. Unit value remained about the same.

REVIEW BY COUNTIES

Mineral production was reported from 91 of Iowa's 99 counties. Of the productive counties, all but Davis, Lucas, Monroe, and Warren produced sand and gravel, crushed limestone, or both for building construction or highway construction. Sixty-five counties reported sand or gravel, and 61 counties reported limestone production. One hundred and twenty-five commercial sand and gravel and 141 commercial limestone producers supplied data. Estimates were made for a few companies from previous records and other sources to obtain the State totals. In addition, reports from 38 noncommercial or Government-and-contractor sand and gravel and 11 limestone producers were received.

In view of the widespread occurrence and production of these minerals, the temporary nature of many of the portable processing plants, and the fact that this production was common to most counties, a detailed listing of each producer has not been made. Therefore, in the following review only those counties that produced minerals other than sand and gravel and crushed stone are mentioned.

TABLE 6.—Value of mineral production in Iowa, 1956–57, by counties¹

County	1956	1957	Minerals produced in 1957 in order of value
Adair.....	(?)	\$690,634	Stone.
Adams.....	\$102,240	(?)	Do.
Allamakee.....	127,807	202,742	Stone, sand and gravel.
Appanoose.....	907,414	902,659	Coal, stone, clays.
Audubon.....	.....	10,854	Sand and gravel.
Benton.....	201,817	124,051	Stone, clays.
Black Hawk.....	1,174,353	920,943	Stone, sand and gravel.
Boone.....	255,971	251,683	Sand and gravel.
Bremer.....	(?)	(?)	Stone, sand and gravel.
Buchanan.....	186,385	218,706	Stone.
Buena Vista.....	65,039	116,521	Sand and gravel.
Butler.....	178,182	193,405	Stone, sand and gravel.
Calhoun.....	354,613	10,530	Sand and gravel.
Carroll.....	102,564	87,543	Do.
Cass.....	64,255	(?)	Stone, sand and gravel.
Cedar.....	176,121	(?)	Stone.
Cerro Gordo.....	15,459,373	17,577,539	Cement, stone, clays, sand and gravel.
Cherokee.....	111,247	78,813	Sand and gravel.
Chickasaw.....	(?)	(?)	Stone.
Clarke.....	15,654	(?)	Do.
Clay.....	178,215	169,478	Sand and gravel.
Clayton.....	(?)	(?)	Sand and gravel, stone.
Clinton.....	88,200	309,700	Stone, sand and gravel.
Crawford.....	111,965	102,318	Sand and gravel.
Dallas.....	216,973	283,976	Sand and gravel, clays.
Davis.....	182,603	133,794	Coal.
Decatur.....	248,594	(?)	Stone.
Delaware.....	310,560	334,470	Stone, sand and gravel.
Des Moines.....	265,615	307,497	Do.
Dickinson.....	(?)	60,435	Sand and gravel.
Dubuque.....	501,230	317,010	Stone, sand and gravel.
Emmet.....	178,297	99,543	Sand and gravel.
Fayette.....	472,194	317,960	Stone, sand and gravel.
Floyd.....	146,814	212,421	Stone, sand and gravel, clays.
Franklin.....	421,891	361,256	Sand and gravel, clays, stone.
Freemont.....	(?)	(?)	Stone.
Greene.....	121,854	192,684	Sand and gravel.
Grundy.....	66,170	(?)	Stone, sand and gravel.
Guthrie.....	(?)	(?)	Sand and gravel.
Hamilton.....	42,492	52,348	Do.
Hancock.....	156,684	155,447	Sand and gravel, stone.

See footnotes at end of table.

TABLE 6.—Value of mineral production in Iowa, 1956-57, by counties¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value
Hardin	\$924, 556	\$1, 105, 290	Stone, sand and gravel.
Harrison	378, 091	(²)	Do.
Henry	205, 178	239, 112	Do.
Howard	91, 970	64, 072	Do.
Humboldt	499, 780	415, 978	Do.
Jackson	(²)	53, 585	Stone.
Jasper	187, 418	225, 580	Sand and gravel.
Jefferson	85, 000	78, 167	Stone.
Johnson	(²)	677, 780	Stone, sand and gravel.
Jones	63, 500	149, 308	Do.
Keokuk	(²)	169, 866	Stone, clays.
Kossuth	169, 320	109, 620	Sand and gravel.
Lee	469, 933	416, 715	Stone, sand and gravel.
Linn	755, 845	1, 218, 817	Do.
Louisa	254, 866	483, 951	Stone.
Lucas	(²)	113, 140	Coal.
Lyon	134, 268	123, 141	Sand and gravel.
Madison	931, 658	1, 630, 421	Stone, clays, sand and gravel.
Mahaska	958, 280	1, 023, 096	Coal, stone, sand and gravel, clays
Marion	3, 080, 498	2, 956, 764	Coal, stone, sand and gravel.
Marshall	(²)	(²)	Stone.
Mills	204, 734	(²)	Do.
Mitchell	232, 323	299, 766	Stone, sand and gravel.
Monona	23, 773	4, 823	Sand and gravel.
Monroe	451, 715	333, 738	Coal.
Montgomery	246, 479	(²)	Stone.
Muscatine	655, 405	682, 219	Sand and gravel, stone.
O'Brien	50, 519	(²)	Sand and gravel.
Osceola	154, 596	(²)	Do.
Palo Alto	83, 791	116, 638	Do.
Plymouth	248, 721	152, 395	Sand and gravel, stone.
Pocahontas	(²)	(²)	Stone, sand and gravel.
Polk	12, 234, 309	11, 082, 242	Cement, sand and gravel, stone, clays, coal.
Pottawattamie		(²)	Stone.
Sac		(²)	Sand and gravel.
Scott	10, 110, 376	10, 429, 826	Cement, stone, lime, clays.
Sioux	480, 785	629, 302	Sand and gravel.
Story	362, 000	347, 350	Stone, sand and gravel, clays.
Tama	(²)	(²)	Stone, sand and gravel.
Taylor		(²)	Stone.
Union	98, 799		
Van Buren	354, 270	620, 966	Stone, coal, sand and gravel.
Wapello	788, 119	718, 712	Stone, coal, sand and gravel, clays.
Warren	59, 943	37, 693	Clays, coal.
Washington	(²)	180, 469	Stone.
Webster	4, 291, 346	4, 137, 078	Gypsum, clays, sand and gravel, stone.
Winnebago	96, 006	22, 675	Sand and gravel, peat.
Winneshiek	292, 874	335, 685	Stone, sand and gravel.
Woodbury	267, 404	(²)	Sand and gravel.
Worth	324, 350	(²)	Peat, stone.
Wright	89, 977	90, 196	Sand and gravel.
Undistributed	5, 213, 754	6, 177, 459	
Total *	66, 529, 000	68, 986, 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 The total has been adjusted to avoid duplication in the value of clays and stone used in producing cement and lime.

Appanoose.—Iowa Clay Products Co., Centerville, produced clay for manufacturing building brick and draitile. Coal was produced by 11 companies, all underground operations. The leading producer was Sunshine Coal Co. Four companies produced limestone; all production was crushed for building or highway use or ground for agricultural use.

Benton.—Drain tile was produced from surface deposits of clay by the Garrison Brick & Tile Works at Garrison. Limestone was also produced by two companies for riprap, construction, and agricultural use.

Cerro Gordo.—Lehigh Portland Cement Co. and Northwestern States Portland Cement Co. produced cement at plants near Mason City and also quarried clay and limestone. There was a labor strike at Lehigh Portland Cement Co. operation from July 1-30. The 2 companies have a total of 16 kilns. The Mason City Brick & Tile Co. produced clay chiefly for manufacturing drain tile. Limestone was produced for metallurgical, construction, highway, agricultural, and fertilizer use. Sand and gravel was produced by three companies for construction and highway use.

Dallas.—Building brick or clay tile were produced by Adel Clay Products Co., United Brick & Tile Co., and Redfield Brick & Tile Co. The latter company also produced some clay for use in refractories. Sand and gravel was produced for general construction and highway use.

Davis.—Bituminous coal was produced from a strip mine by Davis County Coal Co. and an underground mine by Shute & Lewis Coal Co. The Continental Mining Corp., a producer in 1956, was idle in 1957.

Floyd.—Rockford Brick & Tile Co. clay pit and tile plant produced chiefly drain tile. Several companies produced sand and gravel, limestone, or both for construction or highway use.

Franklin.—Clay for heavy clay products was produced by the Sheffield Brick & Tile Co. Sand and gravel and limestone were produced by six companies, chiefly for highway use.

Keokuk.—Building brick was produced by John Nelson & Sons. Two companies at limestone quarries crushed stone, principally for highway and agriculture use.

Lucas.—Bituminous coal was mined by 2 companies; 1 used strip-ping, and 1 mined underground. The Oak Dale Coal Co. began strip-ping in 1957. The Big Ben Coal Co. has mined underground for a number of years.

Madison.—The Marquette Cement Manufacturing Co. operated a clay pit and a limestone quarry to furnish crude material for its cement plant in West Des Moines, Polk County. Several companies produced limestone, chiefly for construction and highway use. Some sand and gravel was produced for the State highway department.

Mahaska.—Bituminous coal was produced by the same companies as in 1956; all but one of the mines were strip-ping operations. Clay was produced by Oskaloosa Clay Products Co. for building brick and other heavy clay products. The What Cheer Clay Products Co. produced a plastic clay for use in refractories, vitrified sewer pipe, and allied products. Limestone and sand and gravel (chiefly for construction and highway use) were produced by several companies.

Marion.—Marion County mines furnished about half of the State coal output. Seven companies operated 8 underground mines and 11 strip-ping mines. Wilkinson Coal Co. was the State's leading producer. Limestone and sand and gravel were also produced in the county.

Monroe.—Bituminous coal was the only mineral produced in the county. Eleven companies were operating. All those operating in 1956 continued. New producers from the preceding year included Cedar Valley Coal Co., Whites Creek Coal Co., White Oak Coal Co., DeLong Coal Co., and C. N. Knox Coal Co. The production, however, was not significantly greater than in 1956.

Polk.—Several companies produced sand and gravel or crushed limestone for building construction and highway use chiefly in serving the metropolitan area of Des Moines. The sand deposits were adequate for the area's use; however, coarser gravels were rather scarce. The Hawkeye Portland Cement Co. and Penn-Dixie Cement Corp. produced cement; both companies obtained clay and limestone from pits and quarries in adjacent Madison County. Penn-Dixie Cement Corp. added a 375-foot by 11-foot kiln to its plant. Both companies purchased the power used. Clay was produced in the county by the Des Moines Clay Co., John Furman Contracting Co., Goodwin Tile & Brick Co., and United Brick & Tile Co. Products were chiefly common brick and sewer tile. The Hopkins Coal Co. produced bituminous coal from one strip mine.

Scott.—Limestone was produced and crushed or ground by several companies in the county and sold for a variety of uses in the industrial area of Davenport. The county produced quick and hydrated lime at the only lime plant in the State. This plant was operated by Linwood Stone Products Co. Dewey Portland Cement Co. produced limestone and clay locally at its cement plant and also sold crushed limestone.

Story.—Nevada Brick & Tile Co. produced clay for manufacturing brick, and processed sand and gravel and limestone.

Van Buren.—Bituminous coal was recovered from two stripping operations by Hamlin Bros. Coal Co. and Laddsdale Coal Co. Limestone and a relatively small quantity of sand and gravel were produced by several companies.

Wapello.—Ottumwa Brick & Tile Co. produced structural brick and tile. Bituminous-coal production was continued by four companies. Munterville Coal Co., Inc., abandoned its mine in April and did not produce in 1957. Limestone and sand and gravel were also produced in the county.

Warren.—Brick and other heavy clay products were produced by the Carlisle Brick & Tile Co. and Goodwin Tile & Brick Co. Coal was produced from one underground mine by S. & R. Coal Co.

Webster.—Gypsum was the leading mineral in value. All mining was done in open pits. Crude gypsum was mined and processed by four companies—Bestwall Gypsum Co., The Celotex Corp., National Gypsum Co., and United States Gypsum Co. These 4 companies worked in aggregate nearly $\frac{1}{2}$ million man-hours mining and processing over 1 million tons of gypsum with only 1 temporary lost-time injury. Clay was produced by Lehigh Sewer Pipe & Tile Co., Kalo Brick & Tile Co., Johnston Clay Works, Inc., and Vincent Clay Products. Brick, hollow tile, draintile, and considerable sand and gravel were produced in the county. Fort Dodge Limestone Co. quarried limestone underground.

Winnebago.—Eli Colby Co. produced peat. Sand and gravel were also produced.

Worth.—The Colby Pioneer Peat Co. and the Eli Colby Co. produced most of the peat output of the State from bogs in this county. Limestone was also produced.

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, United States Department of the Interior, and the State Geological Survey of Kansas.

By W. G. Diamond,¹ Walter H. Schoewe,² and Rosalie M. Miller³



KANSAS mineral industry attained a new high record in 1957 for the eighth consecutive year; mineral production was valued at \$505 million, compared with \$494 million in 1956. Mineral output was reported from 102 of the 105 counties. Seventeen

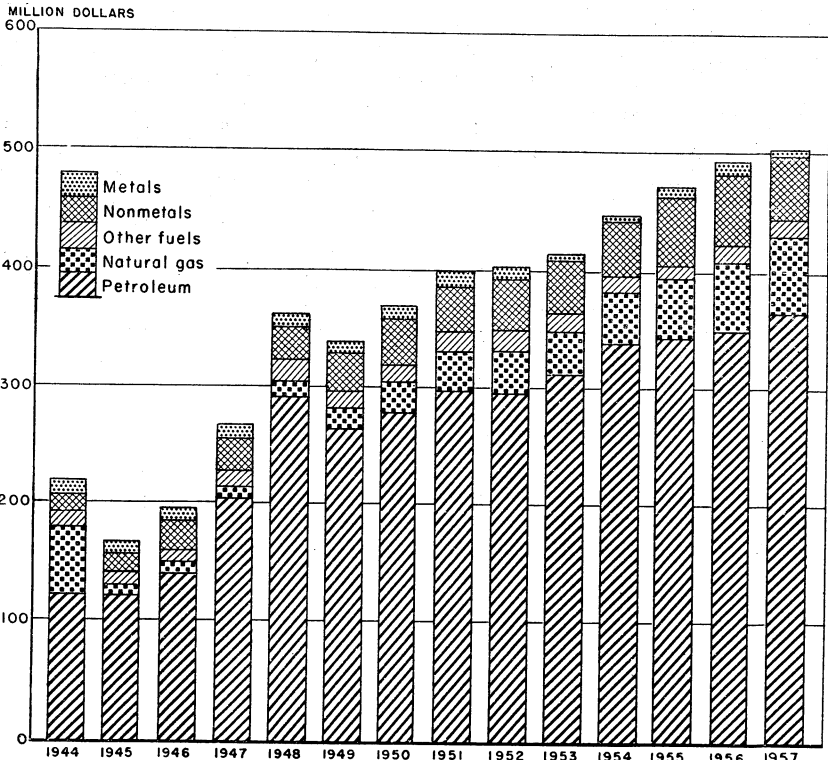


FIGURE 1.—Value of mineral production in Kansas, 1944-57.

¹ Commodity-industry economist, Region IV, Bureau of Mines, Bartlesville, Okla.

² Geologist, State Geological Survey of Kansas, University of Kansas, Lawrence, Kans.

³ Statistical clerk, Region IV, Bureau of Mines, Bartlesville, Okla.

counties credited with mineral production valued at \$10 million or more were, in order of rank: Barton, Ellis, Russell, Butler, Rooks, Greenwood, Graham, Rice, Stafford, Cowley, Grant, Barber, Sedgwick, Morton, McPherson, Stevens, and Allen. The five principal minerals, in order of value, were petroleum, natural gas, cement, stone, and natural-gas liquids.

Callery Chemical Co. began construction near Lawrence of a \$4 million plant to produce boron specialty chemicals for commercial use and for high-energy fuels required for jet aircraft and missiles.

TABLE 1.—Mineral production in Kansas, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)
Cement: ²				
Portland.....376-pound barrels..	10,239,578	\$29,371	7,863,624	\$23,593
Masonry.....do.....	358,739	1,325	313,706	1,221
Clays.....	977,099	1,169	908,693	1,240
Coal.....	883,877	3,856	749,001	3,331
Helium.....cubic feet..	45,035,200	698	36,743,000	570
Lead (recoverable content of ores, etc.).....	7,635	2,397	4,257	1,217
Natural gas.....million cubic feet..	526,091	59,448	³ 580,700	³ 66,200
Natural-gas liquids:				
Natural gasoline and cycle products				
.....thousand gallons..	105,482	5,928	119,247	6,569
.....do.....	90,287	3,843	103,494	4,042
LP-gases.....	124,204	346,529	³ 121,705	³ 366,332
Petroleum (crude).....thousand 42-gallon barrels..	1,004,042	9,167	1,018,027	10,353
Salt.....	12,515,164	8,022	9,344,908	6,175
Sand and gravel.....	13,433,852	15,703	⁴ 10,411,500	⁴ 11,926
Stone.....	28,665	7,854	15,859	3,679
Zinc (recoverable content of ores, etc.).....				
Value of items that cannot be disclosed:				
Gypsum (crude), natural cement, pumice, crushed and dimension sandstone (1957).....		1,465		1,191
Total Kansas ⁵		⁶ 493,770		505,084

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 for which is included with "Value of items that cannot be disclosed."

⁵ Total adjusted to eliminate duplicating values of clays and stone.

⁶ Revised figure.

Magnolia Petroleum Co. completed a natural-gasoline plant near Attica, Harper County, in February. The plant had a capacity of 55 million cubic feet of gas daily.

TABLE 2.—Average unit value of mineral commodities produced in Kansas, 1952-57

Commodity	1952	1953	1954	1955	1956	1957
Cement:						
Portland.....376-pound barrel.....	\$2.38	\$2.51	\$2.63	\$2.70	\$2.87	\$3.00
Masonry.....do.....				3.49	3.69	3.89
Natural.....do.....	3.01	2.98	2.96	2.95	3.16	3.25
Clays.....short ton.....	1.19	1.12	1.20	1.26	1.20	1.36
Fire clay.....do.....	2.18	2.00	2.00	2.34	2.22	2.38
Miscellaneous.....do.....	1.30	1.06	1.22	1.28	1.04	1.02
For cement manufacture.....do.....	1.00	1.00	1.00	1.00	1.00	1.00
Coal.....do.....	3.90	3.92	4.02	4.27	4.36	4.45
Gypsum (crude).....do.....	1.62	1.67	1.55	2.09	1.82	1.67
Gravel.....do.....	.54	.54	.69	.65	.61	.64
Helium.....thousand cubic feet.....	12.75	13.18	15.81	15.50	15.50	15.50
Lead.....pound.....	.161	.131	.137	.149	.157	.143
Natural gas.....thousand cubic feet.....	.083	.086	.106	.111	.113	.114
Natural-gas liquids:						
Natural gasoline and cycle products						
per gallon.....	.063	.056	.050	.053	.056	.055
LP-gases.....do.....	.040	.034	.031	.029	.043	.039
Petroleum.....42-gallon barrel.....	2.56	2.69	2.81	2.80	2.79	3.01
Pumice.....short ton.....	7.86	11.42	3.96	25.74	20.72	17.39
Salt.....do.....	7.51	8.26	8.87	9.26	9.13	10.17
Brine.....do.....					3.50	3.50
Evaporated.....do.....	13.31	14.26	15.37	16.09	17.03	19.53
Rock.....do.....	3.75	4.10	4.43	4.76	5.19	5.18
Sand.....do.....	.63	.70	.69	.65	.65	.67
Stone:						
Limestone: Crushed.....do.....	1.38	1.35	1.23	1.35	1.30	1.22
Dimension.....do.....	16.22	15.65	18.95	17.90	24.09	22.19
Miscellaneous.....do.....	.37	.40	.35	.41	.38	.42
Sandstone: Crushed.....do.....	1.65	1.35	1.87	1.64	1.58	1.65
Dimension.....do.....	1.25		7.89	19.19	19.62	19.62
Limestone for cement manufacture						
short ton.....do.....			.89	1.00	.90	1.00
Zinc.....pound.....	.166	.115	.108	.123	.137	.116

¹ Preliminary figure.

EMPLOYMENT AND INJURIES

Employment.—The average annual employment in Kansas mining industries in 1957 was 18,500, a decrease of 4 percent from 1956. Average employment in metal mining decreased 25 percent as a result of the depressed metal market. Employment in nonmetal mining and in petroleum and natural-gas production decreased 10 percent and 3 percent, respectively. Employment in coal mines approximated that of 1956.⁴

Injuries.—Three fatal accidents occurred in Kansas stone quarries in 1957. Causes were haulage involving quarry equipment, haulage involving railway cars and locomotives, and a fall from an elevation.

The oil and gas industry reported 8 fatal or permanent-disability injuries in 1957; of these, 4 were in refining, 1 was in production, and 3 were unclassified.

Wages.—The average weekly earning in the mining industry was \$96.07, the average weekly hours worked 42.6, and the average hourly earning \$2.26, according to the Employment Security Division of the Kansas Department of Labor. These averages represented a \$2.00 increase in weekly earnings, a 0.6-hour decrease in weekly hours, and an 8-cent increase in hourly earnings over 1956.

⁴ Employment Security Division, Department of Labor, State of Kansas.

TABLE 3.—Average annual employment, mining industries and products of petroleum and coal, 1948-52 (average) and 1953-57 ¹

Industry group	Average annual employment					
	1948-52 (average)	1953	1954	1955	1956 ²	1957 ³
Mining (total).....	17,760	18,500	18,400	19,000	19,300	18,500
Metal.....	700	400	300	400	400	300
Nonmetal.....	1,560	1,700	1,600	1,850	2,000	1,800
Coal.....	920	500	500	350	400	400
Petroleum and natural gas extraction.....	14,580	15,900	16,000	16,400	16,500	16,000
Products of petroleum and coal.....	5,120	5,400	5,000	4,900	4,900	5,000

¹ Employment Security Division, Department of Labor, State of Kansas.² Revised figures.³ Preliminary figures.

TRANSPORTATION

Kansas ranked fifth in the Nation in miles of Federal-aid highway construction in progress (1,374 miles). The State also was third in roads under contract or construction, with a total of 2,240 miles.

The county engineers built 4,974 miles of roads at a total cost of \$7.5 million and maintained 63,660 miles at a cost of \$11 million. Counties not reporting county road construction were Dickinson, Doniphan, Grant, Lincoln, Morton, Stanton, Wallace, and Wyandotte.⁵

Several pipelines were under construction in 1957, according to the Oil and Gas Journal. Eight miles of 16-inch, 20 miles of 8-inch, 20 miles of 6-inch, and 20 miles of 4-inch fieldlines were being laid in Barber County. Seven miles of 30-inch line was laid from Merriam to Kansas City, Kans. Construction was begun on a 50-mile, 12-inch crude-oil pipeline between Cunningham and Burrton, Kans.

TABLE 4.—County-road construction in 1957, by type ¹

Type	County disbursements			Contractor disbursements		
	Miles	Value	Average cost per mile	Miles	Value	Average cost per mile
Standard graded and drained.....	1,651	\$2,607,667	\$1,579	41	\$363,422	\$8,825
One course gravel or stone.....	1,153	749,741	650	49	124,313	2,562
Gravel or stone on existing surface.....	716	457,268	639	45	53,838	1,198
Gravel or stone stabilization.....	346	423,118	1,222	67	170,470	2,534
Bituminous surface treated.....	434	734,584	1,694	159	347,900	2,184
Bituminous surface treated (including base).....	174	708,865	4,073	91	434,974	4,774
Bituminous mix (on existing surface).....	5	14,060	2,923	11	57,848	5,381
Bituminous mix (including base) and pavement.....	22	112,922	5,080	10	123,040	12,170
Total.....	4,501	5,808,220	1,290	473	1,675,805	3,542
Grand total, county and contractor.....	4,974	7,484,025	1,505			
Total all costs for construction ²		9,039,094				

¹ State of Kansas, State Highway Commission of Kansas, Highway Planning Department, County Engineers' Annual Report: 1957, 137 pp.² Includes all other costs for road construction, right of ways, culverts, etc.³ State of Kansas, State Highway Commission of Kansas, Highway Planning Department, County Engineers' Annual Report: 1957, 137 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The mineral fuels—Petroleum, natural gas, natural-gas liquids, and coal—contributed the greatest share to the mineral wealth of Kansas. Mineral fuels furnished over 88 percent of the value of all minerals produced in 1957.

Carbon Black.—Production of carbon black in Kansas in 1957 decreased 28 percent from 1956. Natural-gas liquids and natural gas were used as feedstocks.

Coal.—Coal output decreased 15 percent in quantity and 14 percent in value from 1956. Production of 1,000 tons or more was reported from each of 17 mines, and about 98 percent of the total output came from strip mines. The average price per ton advanced from \$4.36 to \$4.45.

TABLE 5.—Production of coal, 1948–52 (average) and 1953–57

Year	Number of mines			Short tons	Value	
	Under-ground	Strip	Total		Total	Average per ton
1948–52 (average).....				2,136,768	\$8,298,460	\$3.88
1953.....	28	21	49	1,715,004	7,101,386	4.14
1954.....	10	30	40	1,372,294	5,602,808	4.08
1955.....	5	19	24	742,282	3,165,868	4.27
1956.....	4	15	19	883,877	3,856,330	4.36
1957.....	3	14	17	749,001	3,330,550	4.45

Helium.—The Otis helium plant, operated by the Federal Bureau of Mines in Rush County, shipped 36.7 million cubic feet of helium valued at \$570,000. The helium was extracted from natural gas.

TABLE 6.—Marketed production of natural gas, 1948–52 (average) and 1953–57

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1948–52 (average).....	346,675	\$24,047	1955.....	471,041	\$52,286
1953.....	420,607	36,172	1956.....	526,091	59,448
1954.....	412,369	43,711	1957 ¹	580,700	66,200

¹ Preliminary figures.

TABLE 7.—Marketed production of natural gas from the Kansas part of Hugoton gas area, 1941–57¹

Year	Thousand cubic feet	Year	Thousand cubic feet
1941.....	40,759,482	1950.....	320,545,480
1942.....	46,365,484	1951.....	371,002,475
1943.....	70,921,532	1952.....	375,081,748
1944.....	92,922,821	1953.....	387,635,243
1945.....	90,345,203	1954.....	346,732,192
1946.....	119,637,983	1955.....	394,257,153
1947.....	157,663,036	1956.....	381,874,779
1948.....	185,872,594	1957.....	396,889,199
1949.....	247,868,876		

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.

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 Finney, Grant, Hamilton, Haskell, Kearny, Morton, Seward, Stanton, and Stevens Counties, produced 68 percent of the State total. The estimated proved recoverable reserve of natural gas at the year end was 19,296 billion cubic feet—a 10-percent gain over 1956.⁶ Important new gas fields discovered during the year were:⁷

County:	Pool or field name	Initial production (thousand cubic feet per day)
Barber.....	Cedar.....	3,300
Do.....	Rhodes South.....	5,339
Harper.....	Hibbord.....	4,778
Kiowa.....	Glick.....	3,950
Meade.....	Hockett.....	3,000
Do.....	Stevens West.....	4,000
Morton.....	Patsy.....	8,227
Do.....	Sparks South.....	10,617
Pawnee.....	Snowberger.....	5,250

Natural-Gas Liquids.—Production of natural-gas liquids (223 million barrels) increased 14 percent in quantity and 9 percent in value over 1956. Of the total recovery, 54 percent was natural gasoline and the remainder LP-gases. Sixteen natural-gasoline plants reported output during the year—1 more than in 1956. The new Magnolia Petroleum Co. natural-gasoline plant near Attica in Harper County went on full production in February. The plant, with a processing capacity of 55 million cubic feet of gas daily, was processing 30 million cubic feet and extracting over 20,000 gallons of natural gasoline and 26,000 gallons of butane and propane a day.

TABLE 8.—Natural-gas liquids produced, 1948–52 (average) and 1953–57

Year	Natural gasoline		LP-gases		Total	
	Thousand gallons	Value	Thousand gallons	Value	Thousand gallons	Value
1948–52 (average).....	98,171	\$6,339,200	50,912	\$1,985,600	149,083	\$8,324,800
1953–54.....	(1)	(1)	(1)	(1)	(1)	(1)
1955.....	118,599	6,318,000	92,596	2,642,000	211,195	8,961,000
1956.....	105,482	5,928,000	90,287	3,843,000	195,769	9,771,000
1957.....	119,247	6,569,000	103,494	4,042,000	222,741	10,611,000

¹ Figure withheld to avoid disclosing individual company confidential data.

The proved recoverable reserve of natural-gas liquids was estimated at 7,945 million gallons, or 10 percent over 1956 estimates.⁸

Petroleum.—Kansas ranked fifth in the Nation in the production of crude petroleum. Output was nearly 122 million barrels, valued at \$366 million, a decline of 2 million barrels from 1956. Secondary recovery of oil increased slightly. The average price of crude petroleum in 1957 (\$3.01 a barrel) advanced 22 cents over 1956 and explained

⁶ American Petroleum Institute and American Gas Association, Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas: Vol. 12, 1957, p. 19.

⁷ Bull., Am. Assoc. Petrol. Geol., vol. 42, No. 6, June 1958, pp. 1211–1218.

⁸ Work cited in footnote 6.

a 6-percent gain in value. A decrease in indicated demand during the year contributed to the decline in crude-petroleum production. The leading counties producing crude petroleum were Barton, Ellis, Russell, Butler, Rooks, and Greenwood.

TABLE 9.—Natural gasoline and LP-gases processed in 1957, in barrels
[Conservation Division, Kansas Corporation Commission]

Company	Location		Natural Gasoline	Butane	Propane	LP-gases	Total
	Nearest town	County					
Cities Service Oil Co.....	Burton.....	Reno.....	55, 130	-----	11, 658	46, 106	112, 894
Do.....	Wichita.....	Sedgwick.....	458, 769	-----	263, 909	165, 615	888, 293
Colorado Interstate Gas Co.	Lakin.....	Kearney.....	91, 396	-----	-----	-----	91, 396
Drillers Gas Co.....	Cheney.....	Sedgwick.....	21, 820	-----	-----	8, 359	30, 179
Dunn-Mar Oil & Gas Co.	Otis.....	Rush.....	31, 550	4, 700	-----	-----	36, 250
Hugoton Production Co.	Ulysses.....	Grant.....	177, 639	113, 025	155, 331	-----	445, 995
Kansas-Nebraska Natural Gas Co.	Deerfield.....	Kearney.....	107, 185	-----	34, 322	-----	141, 507
Magnolia Petroleum Co.	Ulysses.....	Grant.....	190, 531	64, 586	89, 898	-----	345, 015
Do.....	Atitca.....	Harper.....	154, 289	58, 673	138, 318	-----	351, 280
Northern Natural Gas Co.	Holcomb.....	Finney.....	106, 475	-----	-----	-----	106, 475
Do.....	Sublette.....	Haskell.....	292, 585	-----	-----	-----	292, 585
Pan American Petroleum Corp.	Ulysses.....	Grant.....	412, 095	544, 674	371, 817	-----	1, 328, 586
Panhandle Eastern Pipeline Co.	Liberal.....	Seward.....	554, 911	218, 956	130, 294	-----	904, 161
Skelly Oil Co.....	Cunningham.....	Kingman.....	42, 087	-----	-----	38, 119	80, 206
Do.....	Medicine Lodge.....	Barber.....	93, 961	-----	7, 217	-----	101, 178
The Texas Co.....	Atlanta.....	Cowley.....	30, 315	-----	-----	37, 932	68, 247
Total.....	-----	-----	2, 820, 738	1, 004, 614	1, 202, 764	296, 131	5, 324, 247

TABLE 10.—Sales of LP-gases by uses, 1956-57

Use	Butane		Propane		Mixture		Total	
	1956	1957	1956	1957	1956	1957	1956	1957
Domestic.....	18, 528	24, 593	103, 193	106, 966	12, 139	7, 152	133, 860	138, 711
Gas manufacturing.....	-----	-----	15	16	-----	-----	15	16
Industrial.....	1, 275	1, 393	2, 166	2, 245	-----	2	3, 441	3, 640
Chemical plants.....	152	-----	635	-----	39	-----	826	-----
Internal combustion.....	5, 929	7, 216	20, 020	24, 005	8, 073	7, 703	34, 022	38, 924
All other.....	-----	12	1, 378	1, 620	213	203	1, 591	1, 835
Total.....	25, 884	33, 214	127, 407	134, 852	20, 464	15, 060	173, 755	183, 126

¹ Consumption of LP-gases, as refinery fuel, not included.

² Consumption of gases used in the secondary recovery of petroleum not included.

Drilling and Exploration.—Exploratory and development drilling totaling 15.3 million feet, accounted for 4,664 wells in 1957—a 7-percent decrease from 1956. Exploratory drilling alone resulted in 849 wells compared with 1,073 in 1956.⁹ Cable tools were used to drill approximately 7 percent of all wells in 1957, compared with 16 percent in 1956. No significant new exploratory trends were apparent in 1957.

⁹ Oil and Gas Journal, vol. 56, No. 4, Jan. 27, 1958, p. 149.

TABLE 11.—Production of crude petroleum, 1948–52 (average) and 1952–57

Year	Thousand barrels	Value		Year	Thousand barrels	Value	
		Total (thousands)	Average per barrel			Total (thousands)	Average per barrel
1948–52 (average)....	109,938	\$283,182	\$2.58	1955.....	121,669	\$340,670	\$2.80
1953.....	114,566	308,180	2.69	1956.....	124,204	346,529	2.79
1954.....	119,317	335,280	2.81	1957 ¹	121,705	366,332	3.01

¹ Preliminary figures.

TABLE 12.—Production, indicated demand, and stocks of crude petroleum, by months, 1957, in thousand barrels

Month	Production	Indicated demand	Stocks ¹	Month	Production	Indicated demand	Stocks ¹
January.....	10,339	11,332	9,473	August.....	10,177	10,626	10,651
February.....	9,387	9,467	9,393	September.....	9,602	10,531	9,812
March.....	9,640	9,654	9,379	October.....	10,974	11,424	9,362
April.....	10,076	8,030	11,425	November.....	9,802	9,123	10,041
May.....	10,605	10,429	11,601	December.....	10,625	10,514	10,152
June.....	9,999	10,400	11,000	Total.....	121,705	121,819	-----
July.....	10,389	10,289	11,100				

¹ End of month, originating in Kansas.

TABLE 13.—Production of crude petroleum, 1953–57, by fields, in thousand barrels

[Oil and Gas Journal]

Field	1953	1954	1955	1956	1957 ¹
Bemis-Shutts.....	3,526	3,549	3,263	3,076	5,628
Bloomer.....	2,067	1,589	1,456	1,268	1,162
Burnett-Southwest.....	2,303	2,170	2,464	2,230	-----
Burton-Haury.....	781	809	732	695	668
Chase ²	6,007	5,339	4,897	4,689	4,578
El Dorado.....	3,939	3,864	4,242	4,348	4,672
Fairport.....	834	823	903	964	1,054
Genesco-Edwards.....	3,061	2,869	2,941	2,734	2,222
Gladys.....	(³)	(³)	1,024	1,885	1,832
Gorham.....	1,793	1,692	1,589	1,543	1,308
Hall Gurney.....	4,640	4,528	4,064	3,587	3,580
Inka-Carmi.....	1,314	1,421	1,464	1,486	1,141
Kraft-Prusa.....	4,721	4,357	3,826	3,498	3,238
Marotte.....	1,831	1,681	1,712	1,621	2,061
Morel.....	1,798	1,654	1,470	1,461	1,623
Ray.....	1,393	1,280	1,312	1,225	1,320
Seeley-Wick.....	1,753	1,798	1,479	1,341	987
Silica-Raymond.....	(³)	(³)	(³)	(³)	(³)
Stoltenberg.....	1,270	1,119	1,043	951	1,205
Thrall-Agard.....	1,121	1,002	775	748	599
Trapp.....	6,081	5,461	4,943	4,427	3,883
Welch-Bornholdt.....	1,259	1,361	1,254	1,108	1,024
Other fields ⁴	63,767	70,951	74,816	79,319	77,920
Total Kansas.....	115,259	119,317	121,669	124,204	121,705

¹ Preliminary figures.² Silica included with Chase.³ Included with "Other fields."⁴ Bureau of Mines data.

TABLE 14.—Oil- and gas-well drilling in 1957, by counties ¹

County	Proved or development wells			Exploratory wells			Total proved and exploratory wells			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Barber.....	36	65	49	10	18	44	46	83	93	222
Barton.....	125		94	16		35	141		129	270
Brown.....						1			1	1
Butler.....	99		55	6		27	105		82	187
Chase.....	6		3			6	6		9	15
Clark.....	1	6	7		3	6	1	9	13	23
Clay.....	3		4	1		10	4		14	18
Cloud.....						2			2	2
Coffey.....	2		7			2	2		9	11
Comanche.....			3		1	4		1	7	8
Cowley.....	125	3	79	21		84	146	3	163	312
Decatur.....	12		9	1		11	13		20	33
Dickinson.....	13		4			6	13		10	23
Edwards.....	3	4	3	5		10	8	4	13	25
Ellis.....	190		124	40		107	230		231	461
Ellsworth.....	11		10			12	11		22	33
Finney.....	2	59	4	5	4	2	7	63	6	76
Ford.....			1			9			10	10
Graham.....	109		55	17		62	126		117	243
Grant.....		7						7		7
Greenley.....				1		3	1		3	4
Greenwood.....	118		47	4		32	122		79	201
Hamilton.....		4	2		1	4		5	6	11
Harper.....	34	5	12	10	2	25	44	7	37	88
Harvey.....	3	1	8	2	1	28	5	2	36	43
Haskell.....	2		2	1	3	2	3		4	7
Hodgeman.....	7		2			17	9		17	26
Kearny.....	1	13	1	2		1	3	13	2	18
Kingman.....	63	26	29	14	9	25	77	35	54	166
Kiowa.....	27	10	13	4	2	18	31	12	31	74
Lyon.....	6		4			7	6		11	17
Marion.....	111		30	15		48	126		78	204
Marshall.....						1			1	1
McPherson.....	99		33	8		28	107		61	168
Meade.....	13	22	25	6	2	11	19	24	36	79
Mitchell.....						2			2	2
Morris.....	6		3	1		5	7		8	15
Morton.....	28	38	21	2	3	12	30	41	33	104
Ness.....	3		4	3		16	6		20	26
Norton.....	19		4	1		15	20		19	39
Osborne.....				1		4	1		4	5
Ottawa.....						1			1	1
Pawnee.....	21	2	10	2	2	22	23	4	32	59
Phillips.....				3			3			3
Pratt.....	10	3	16	3		24	13	3	40	56
Reno.....	8		6	3		16	11		22	33
Rice.....	72	3	29	13	2	24	85	5	53	143
Riley.....						1			1	1
Rooks.....	50		46	7		29	57		75	132
Rush.....	20	5	13	3	1	18	23	6	31	60
Russell.....	75		40	12	1	28	87	1	68	156
Saline.....	6		4	3		4	9		8	17
Scott.....			1	1		4	1		5	6
Sedgwick.....	76		48	12		74	88		122	210
Seward.....		8	7		2	4		10	11	21
Stafford.....	61		55	19		34	80		89	169
Stanton.....		4	1		1	15		5	16	21
Stevens.....		11			1	2		12	2	14
Sumner.....	51	1	33	7	1	43	58	2	76	136
Trego.....	39		34	6		31	45		65	110
Wabaunsee.....			2			2			4	4
Wichita.....				1		2	1		2	3
Woodson.....	22		5			4	22		9	31
Total: 1957.....	1,788	300	1,099	294	57	1,126	2,082	357	2,225	4,664
1956.....	1,973	298	1,154	261	70	1,272	2,234	368	2,426	5,028

¹ National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 28, 1958.

TABLE 15.—Total crew-weeks spent in geophysical and core-drill oil and gas prospecting in 1957¹

Kansas					
County	1956 Total crew- weeks	1957			
		Total crew- weeks	Method		
			Reflection seismo- graph	Gravity meter	Magne- tometer	Core drill
Barber.....	13	2	2		
Barton.....	3	4	4		
Butler.....		28	28		
Chase.....	2 3	14	14		
Chautauqua.....		1	1		
Cherokee.....		1			1
Cheyenne.....	13	37	28	9	
Clark.....		2	2		
Comanche.....	9	17	17		
Cowley.....	49	20	13		7
Decatur.....	10				
Edwards.....	19	8	8		
Elk.....		1	1		
Ellis.....	10	5	5		
Finney.....		35	35		
Ford.....		2	2		
Gove.....	2	2	2		
Graham.....	9	2	2		
Gray.....		9	9		
Greeley.....		6	5	1	
Greenwood.....	8				
Hamilton.....		38	38		
Harper.....	3	37	33		4
Harvey.....	2	4	4		
Hodgeman.....	1				
Jackson.....	2 2	3	3		
Kearny.....		2	2		
Kingman.....	6	11	11		
Labelle.....		3			3
Lane.....	2 3	7	7		
Logan.....	19	17	2	15	
Lyon.....	4	6	6		
Marion.....		6	6		
Meade.....	19				
Morris.....	22	17	17		
Morton.....		10	10		
Ness.....	33	4	4		
Norton.....	3				
Ottawa.....	1	1	1		
Pawnee.....	23	5	5		
Pottawatomie.....	3	1	1		
Pratt.....	22	4	4		
Rawlins.....	23	3	3		
Reno.....	11	4	4		
Rice.....	2	1	1		
Rooks.....	6				
Rush.....	12	7	7		
Russell.....		1	1		
Saline.....	1	3	3		
Scott.....	6	14	10	4	
Sedgwick.....	1	2	2		
Sheridan.....	11	1	1		
Sherman.....	35	16	6	10	
Stafford.....	18	15	15		
Stanton.....		9	9		
Sumner.....	14	113	81		32
Thomas.....	27	12	12		
Trego.....	19	5	5		
Wabaunsee.....	22	19	19		
Wallace.....	2 2	34	25	9	
Wichita.....	26	23	19	4	
Woodson.....	2				
Total.....	547	654	555	52	43

¹ National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States; Vol. 28, 1958.² Crew-days.

TABLE 16.—Important new oilfields discovered in 1957¹

Field	County	Initial production (barrels per day)	Field	County	Initial production (barrels per day)
Cheyenne View East.....	Barton.....	962	Trenton South.....	Kingman.....	2,822
Elrick Northeast.....	Graham.....	331	Mohler.....	Meade.....	320
Evergreen Northwest.....	do.....	1,727	Mary Ida South.....	Rice.....	340
Holly Southeast.....	do.....	397	Kipp Southwest.....	Stafford.....	475
Gerber.....	Harper.....	930	Walz Northwest.....	Trego.....	349
Gish.....	do.....	617	Centennial (revived).....	Cowley.....	451

¹ Bull. Am. Assoc. Petrol. Geol., vol. 42, No. 6, June 1958, pp. 1211-1218.

Secondary Recovery.—Recovery of oil by stimulative methods increased for the fourth consecutive year and furnished 10 percent of Kansas oil output. These recovery methods included the injection of water, gas, and air.¹⁰

TABLE 17.—Secondary recovery of oil from selected counties in 1957¹

County	Number of projects	Total oil production (barrels)	Estimated secondary-recovery oil production (barrels)	Secondary recovery as a percentage of total production
Allen.....	12	969,335	617,324	63.7
Anderson.....	9	576,880	456,597	80.0
Butler.....	29	8,059,156	4,117,210	51.1
Franklin.....	5	306,151	274,794	89.8
Greenwood.....	40	6,977,957	5,874,961	84.2
Miami.....	9	602,594	396,013	65.7
Montgomery.....	15	599,154	297,993	49.7
Neosho.....	11	605,612	427,849	70.6
Total.....	130	18,690,839	12,462,741	66.7

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. 31.

Reserves.—According to the American Petroleum Institute and the American Gas Association the estimated proved recoverable reserve of crude petroleum decreased 44.7 million barrels to 947 million barrels; the estimated reserve of petroleum hydrocarbons, including petroleum, natural-gas liquids, and natural-gas equivalent, rose to 4.4 billion barrels in 1957.

Petrochemical Plants.—Cooperative Farm Chemicals Association produced ammonia at its plant near Lawrence in Douglas County. Methanol, nitric acid, ammonia, and fertilizer were produced by Spencer Chemical Co. at its plant in Crawford County near Pittsburg.

Legislation.—The 1957 Kansas Legislature passed a 1-percent severance tax on natural gas and oil produced in the State, to become effective July 1. Revenue officials estimated that it would yield about \$4 million annually in new revenue. On August 7 the Kansas Supreme Court challenged the constitutionality of the severance-tax law and gave the State 30 days to prepare an answer.

¹⁰ Goebel, E. D., Hilpman, P. L., Hornbaker, A. L., Beene, D. L., Oil and Gas Developments in Kansas during 1957: State Geol. Survey of Kansas, Univ. of Kansas Pub., Bull. 133, 1958, p. 30.

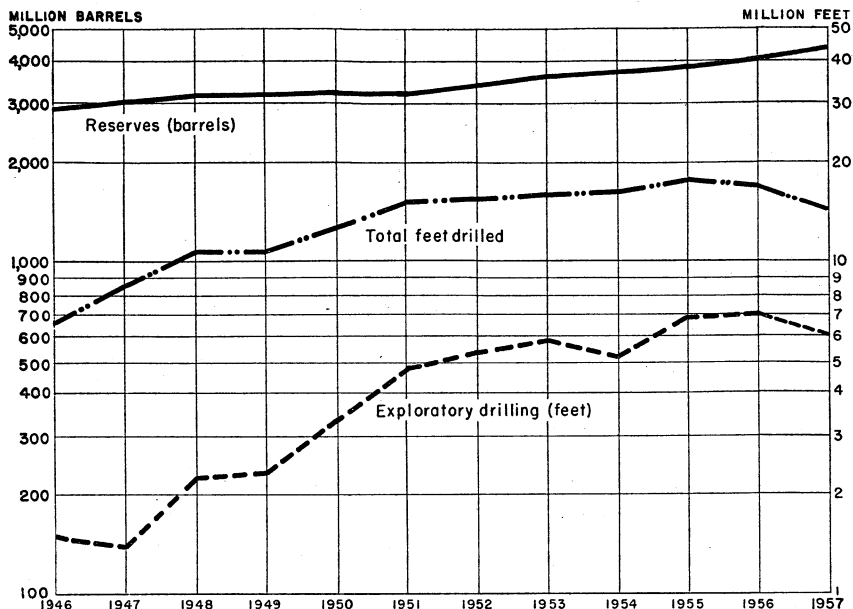


FIGURE 2.—Proved reserves of total hydrocarbons and footage drilled, 1946–57.

NONMETALS

Cement.—Kansas continued to produce portland, masonry, and natural cements. For the first time since 1950, the cement industry in 1957 reported a decline in production, both on the State and National front. This production loss resulted partly from a nationwide cement strike, which started in July and lasted 5 weeks. In Kansas, production of portland cement (8.1 million barrels) decreased 2.4 million barrels from 1956, and shipments (7.9 million barrels valued at \$23.6 million) decreased 23 percent in quantity and 20 percent in value from 1956. The production of masonry cement (305,000 barrels) decreased 76,000 barrels from 1956; shipments (314,000 barrels valued at \$1.2 million) decreased 13 percent in quantity and 8 percent in value from 1956. Natural cement was produced by Fort Scott Hydraulic Cement Co. at Fort Scott in Bourbon County.

A \$6.5 million expansion program, begun in 1956 by Monarch Cement Co. at Humboldt, was scheduled for completion in 1958. This expansion will increase the plant capacity by 50 percent to 2,250,000 barrels annually. Included were a new crushing plant at the quarry, a third kiln, and a new milling department.¹¹

Clays.—The 1957 tonnage of all clays produced in Kansas declined 7 percent from 1956; the total value rose 6 percent. Fire clay was produced in Barton, Cloud, Crawford, and Ellsworth Counties and miscellaneous clay in Allen, Cherokee, Crawford, Franklin, Jewell, Montgomery, Neosho, Wilson, and Wyandotte Counties. Lightweight aggregate was produced from miscellaneous clay by Buildex, Inc., in Franklin County and by Kansas Industries, Inc., in Wyandotte

¹¹ Pit and Quarry, vol. 50, No. 7, January 1958, p. 119.

County. Great Bend Brick & Tile Co. produced about 50,000 brick daily in a new \$500,000 plant at Kanopolis, Ellsworth County. A new sheet-metal building houses brick-forming equipment and a 275-foot tunnel kiln. The gas-fired kiln has automatic controls.¹²

TABLE 18.—Production and shipments of portland cement, 1948-52 (average) and 1953-57, in 376-pound barrels

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1948-52 (average).....	8,312,456	8,261,257	\$18,567,727	\$2.25
1953.....	8,766,206	8,546,250	21,428,536	2.51
1954.....	8,803,007	9,076,328	23,874,179	2.63
1955.....	9,219,533	9,071,747	24,520,533	2.70
1956.....	10,486,150	10,239,578	29,370,845	2.87
1957.....	8,117,799	7,863,624	23,593,482	3.00

TABLE 19.—Clays sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	664,634	\$607,670	1955.....	1,767,662	1,887,016
1953.....	670,694	749,579	1956.....	977,099	1,169,048
1954.....	1,697,832	1,777,847	1957.....	908,693	1,239,789

¹ Excludes fire clay.

Gypsum.—Production of crude and calcined gypsum decreased in tonnage and value from 1956. 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 Co. expanded perlite at its Kansas City plant from crude rock mined in the Western States and used it mainly as a lightweight aggregate. Both quantity and value of output of expanded perlite decreased in 1957.

Pumice.—Crude pumice produced in Lincoln and Norton Counties was crushed for use in abrasives and cleaning powders. The output and value were less than in 1956.

Salt.—Evaporated and rock salt was produced by five companies in Ellsworth, Reno, and Rice Counties. Brine was produced in Sedgwick County by Frontier Chemical Co. for manufacturing salt chemicals and petrochemicals (organic chlorides, acetylene, and other chlorine compounds). Meat packers, livestock raisers, and leather tanners were large consumers of salt. Salt production gained 1 percent in quantity and 13 percent in value over 1956.

Sand and Gravel.—Sand and gravel was produced in 70 counties at 109 commercial operations and 46 Government-and-contractor operations. Production decreased 25 percent in quantity and 23 percent in value from 1956. Sedgwick and Wyandotte Counties, the leading producers in 1957, supplied 35 percent of the total output

¹² Brick and Clay Record, vol. 130, No. 2, February, 1957, p. 41.

and 36 percent of its value. Sand and gravel was used mainly for construction and road building. Molding, blast, engine, and filter sands also were produced.

TABLE 20.—Salt sold or used by producers, 1948–52 (average) and 1953–57

Year	Evaporated salt		Rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	344, 169	\$4, 074, 500	520, 477	\$1, 842, 011	864, 646	\$5, 916, 511
1953.....	370, 569	5, 285, 805	534, 658	2, 194, 751	905, 227	7, 480, 556
1954.....	356, 045	5, 474, 151	520, 622	2, 304, 255	876, 667	7, 778, 406
1955.....	361, 612	5, 819, 536	549, 254	2, 612, 789	910, 866	8, 432, 325
1956.....	461, 418	6, 352, 290	542, 624	2, 815, 074	1, 004, 042	9, 167, 364
1957.....	521, 855	7, 784, 988	496, 172	2, 568, 131	1, 018, 027	10, 353, 119

TABLE 21.—Sand and gravel sold or used by producers, 1948–52 (average) and 1953–57

Year	Commercial		Government-and-contractor		Total sand and gravel		
	Short tons	Value	Short tons	Value	Short tons	Value	Average value per ton
1948–52 (average)....	5, 417, 237	\$3, 524, 132	2, 004, 338	\$1, 001, 890	7, 421, 575	\$4, 526, 022	\$0. 61
1953.....	6, 678, 241	4, 946, 934	2, 050, 050	721, 374	8, 728, 291	5, 668, 308	. 65
1954.....	8, 340, 949	6, 365, 965	2, 080, 605	828, 506	10, 421, 554	7, 194, 171	. 69
1955.....	9, 000, 242	6, 342, 242	1, 664, 744	567, 424	10, 664, 986	6, 909, 666	. 65
1956.....	10, 656, 464	7, 428, 877	1, 858, 700	593, 435	12, 515, 164	8, 022, 312	. 64
1957.....	7, 679, 555	5, 424, 703	1, 665, 353	750, 054	9, 344, 908	6, 174, 757	. 66

Stone.—Limestone, sandstone, and miscellaneous stone were quarried in Kansas. Greatest activity centered in Wyandotte, Allen, Wilson, Neosho, and Elk Counties, which produced 52 percent of the limestone in the State, including limestone for cement. Crushed limestone was produced in 39 counties and dimension limestone in 4 counties. Crushed sandstone was obtained in Lincoln County and dimension sandstone in Bourbon County. Miscellaneous stone (chats) was produced by five operators in Cherokee County. Crushed stone was used principally for concrete aggregate, roadstone, riprap, and agricultural lime.

TABLE 22.—Stone sold or used by producers, 1953–57, by kinds

Year	Limestone		Sandstone		Miscellaneous stone		Total stone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1953....	7, 026, 871	¹ \$10, 045, 111	591, 424	\$800, 008	1, 150, 857	\$458, 831	8, 769, 152	\$11, 303, 950
1954....	9, 161, 085	11, 956, 778	355, 430	687, 180	860, 493	297, 864	10, 377, 008	12, 941, 822
1955....	10, 859, 739	14, 340, 896	746, 414	1, 242, 626	877, 237	362, 668	12, 483, 390	15, 946, 190
1956....	11, 654, 354	14, 630, 304	314, 878	516, 242	1, 464, 620	556, 769	13, 433, 852	15, 703, 345
1957....	8, 871, 426	11, 278, 363	(²)	(²)	1, 540, 074	647, 875	³ 10, 411, 500	³ 11, 926, 238

¹ Excludes material used for cement.

² Figure withheld to avoid disclosing individual company confidential data.

³ Excludes sandstone.

Vermiculite.—Vermiculite was exfoliated at Wichita, Sedgwick County, from crude material shipped from the Western States. Production was 30 percent less than in 1956. Exfoliated vermiculite was used for insulation and as aggregate in plaster.

Water Pollution.—The Kansas Corporation Commission placed in effect new regulations on water pollution. Oil producers must obtain permits to store brine, oil, or refuse in surface ponds and must be able to prove that the ponds were not polluting fresh-water supplies. Surface pipe in an oil well must be at least as deep as the deepest fresh water within a mile radius.

METALS

The Kansas lead- and zinc-producing area 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.

TABLE 23.—Mine production of lead and zinc, by months, 1957, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January.....	538	2, 100	August.....	291	1, 051
February.....	531	1, 762	September.....	170	676
March.....	568	2, 232	October.....	161	623
April.....	538	1, 899	November.....	151	561
May.....	329	848	December.....	265	1, 234
June.....	334	1, 386			
July.....	381	1, 487	Total.....	4, 257	15, 859

TABLE 24.—Mine production of lead and zinc, 1948-52 (average), 1953-57, and total 1876-1957, in terms of concentrates and recoverable metals ¹

Year	Mines producing	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content ²			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average)		11, 190	\$2, 210, 825	54, 449	\$5, 402, 950	8, 502	\$2, 730, 449	38, 314	\$8, 692, 386
1953.....	58	4, 399	665, 189	28, 668	2, 064, 783	3, 347	876, 914	15, 515	3, 568, 450
1954.....	26	5, 390	916, 161	38, 896	2, 638, 102	4, 033	1, 105, 042	4, 19, 110	4, 127, 760
1955.....	36	7, 362	1, 352, 876	51, 252	3, 980, 849	5, 498	1, 638, 404	27, 611	6, 792, 306
1956.....	41	10, 130	1, 955, 278	53, 142	4, 688, 130	7, 635	2, 397, 390	28, 665	7, 854, 210
1957.....	43	5, 708	1, 026, 116	29, 189	2, 311, 401	4, 257	1, 217, 562	15, 859	3, 679, 288
1876-1957.....		836, 752	72, 571, 339	5, 467, 505	263, 080, 114	638, 130	87, 624, 564	2, 842, 293	412, 939, 126

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.

Mills and Smelters.—National Lead Co. operated its Ballard No. 8 mill throughout 1957. Eagle-Picher Co. operated its lead smelter at Galena and produced pigments. Both operations are in Cherokee County.

Lead.—Mine production of recoverable lead decreased 44 percent to 4,257 tons. The output was valued at \$1.2 million, or 49 percent less than in 1956. Production and price decreased owing to the depressed consumer market and to increases in imports and stocks. The price of lead dropped from 16 cents per pound, New York, on January 1 to 13 cents on December 2. Eagle-Picher Co. stopped all its Tri-State mining operations, including those in Kansas, from July 31 to November 27.

Zinc.—Zinc output dropped 45 percent to 15,859 tons, and its value decreased 53 percent to \$3.7 million. The unfavorable market affected both the production and price of zinc. The price of Prime Western slab zinc dropped from 13.5 cents per pound, East St. Louis, on January 1 to 10 cents by July 1.

REVIEW BY COUNTIES¹³

TABLE 25.—Value of mineral production in Kansas, 1956–57, by counties¹

County	1956	1957	Minerals produced in 1957 in order of value
Allen.....	\$11,425,963	\$10,754,168	Cement, petroleum, stone, clays, natural gas.
Anderson.....	2,043,103	1,862,184	Petroleum, stone, sand and gravel.
Atchison.....	287,725	187,168	Stone.
Barber.....	11,309,986	13,032,000	Petroleum, natural gas, gypsum, natural-gas liquids, sand and gravel.
Barton.....	41,774,952	39,735,727	Petroleum, clays, sand and gravel, natural gas.
Bourbon.....	1,140,544	773,394	Stone, cement, natural cement, petroleum, coal.
Brown.....	23,083	8,760	Sand and gravel, petroleum.
Butler.....	23,356,706	23,881,416	Petroleum, stone, sand and gravel.
Chase.....	347,909	186,146	Petroleum, stone, sand and gravel, natural gas.
Chautauqua.....	2,983,774	2,988,463	Do.
Cherokee.....	13,148,802	7,862,160	Zinc, coal, lead, stone, clays, natural gas.
Cheyenne.....	12,000	13,250	Sand and gravel.
Clark.....	1,398,307	1,308,473	Petroleum, natural gas, sand and gravel.
Clay.....	(?)	71,486	Sand and gravel, petroleum, stone.
Cloud.....	238,400	365,666	Sand and gravel, clays.
Coffey.....	531,892	494,238	Petroleum, stone, coal, natural gas.
Comanche.....	41,255	36,014	Natural gas, petroleum, sand and gravel.
Cowley.....	13,923,975	13,317,519	Petroleum, stone, natural gas, sand and gravel, natural-gas liquids.
Crawford.....	1,740,832	1,296,972	Coal, clays, petroleum, natural gas.
Decatur.....	1,097,517	1,385,263	Petroleum, sand and gravel.
Dickinson.....	737,343	752,467	Stone, petroleum, sand and gravel.
Doniphan.....	824,229	310,585	Stone.
Douglas.....	176,367	(?)	Stone, sand and gravel, petroleum.
Edwards.....	325,046	(?)	Natural gas, petroleum, sand and gravel.
Elk.....	1,994,613	1,588,542	Petroleum, stone, natural gas, sand and gravel.
Ellis.....	32,270,441	34,752,073	Petroleum, sand and gravel.
Ellsworth.....	9,200,574	8,664,785	Petroleum, salt, clays, sand and gravel.
Finney.....	5,554,236	6,342,692	Natural gas, petroleum, natural-gas liquids, sand and gravel.
Ford.....	141,611	214,110	Sand and gravel, natural gas, petroleum.
Franklin.....	1,108,732	1,056,446	Petroleum, clays, stone.
Geary.....	345,700	359,200	Stone, sand and gravel.
Gove.....	76,148	68,005	Petroleum, sand and gravel.
Graham.....	16,991,280	19,904,815	Do.
Grant.....	12,889,377	(?)	Natural gas, natural-gas liquids, sand and gravel.
Gray.....	(?)	(?)	Sand and gravel.
Greenwood.....	18,891,267	20,627,096	Petroleum, stone.
Hamilton.....	499,827	489,557	Natural gas, sand and gravel, petroleum.
Harper.....	2,436,329	2,549,019	Petroleum, natural gas, sand and gravel.
Harvey.....	724,364	(?)	Petroleum, sand and gravel, natural gas.
Haskell.....	4,424,706	4,595,287	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Hodgeman.....	335,646	503,668	Petroleum.
Jackson.....	(?)	68,334	Stone.

See footnotes at end of table.

¹³ 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 Pub., Bull. 133, 1958, 264 pp.

National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 28, 1958, pp. 230-299.

Bull. Am. Assoc. Petrol. Geol., vol. 42, No. 6, June 1958, pp. 1207-1218.

TABLE 25.—Value of mineral production in Kansas, 1956-57, by counties ¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value
Jefferson.....	\$362,504	\$474,000	Stone.
Jewell.....	(?)	(?)	Stone, sand and gravel, clays.
Johnson.....	280,689	273,274	Stone, petroleum, natural gas.
Kearny.....	7,558,474	7,882,181	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Kingman.....	6,457,401	(?)	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Kiowa.....	738,803	2,955,977	Petroleum, natural gas, sand and gravel.
Labette.....	371,448	445,447	Petroleum, stone, natural gas.
Leavenworth.....	931,084	472,219	Stone, sand and gravel, petroleum, natural gas.
Lincoln.....	(?)	(?)	Stone, pumicite.
Linn.....	403,144	360,635	Petroleum, stone, sand and gravel, natural gas.
Logan.....	45,208	2,400	Sand and gravel.
Lyon.....	1,158,196	973,802	Petroleum, sand and gravel.
Marion.....	4,062,554	6,686,880	Petroleum, stone, natural gas.
Marshall.....	650,740	574,010	Gypsum, sand and gravel, stone.
McPherson.....	11,665,845	12,306,096	Petroleum, natural gas, sand and gravel.
Morde.....	2,170,662	3,837,887	Petroleum, natural gas.
Miami.....	2,049,376	1,909,218	Petroleum, stone, natural gas, sand and gravel.
Montgomery.....	8,179,238	6,554,482	Cement, petroleum, natural gas, stone, clays.
Morris.....	846,601	1,143,240	Petroleum, stone, natural gas, sand and gravel.
Morton.....	9,040,467	12,479,688	Natural gas, petroleum.
Nemaha.....	116,696	65,590	Petroleum, stone.
Neosho.....	6,859,458	6,596,737	Cement, petroleum stone, natural gas.
Ness.....	1,348,779	1,595,913	Petroleum.
Norton.....	2,568,484	2,727,722	Petroleum, sand and gravel, pumicite.
Osage.....	356,002	117,760	Stone, coal.
Osborne.....	246,277	237,168	Petroleum, sand and gravel.
Ottawa.....	14,715	17,429	Sand and gravel.
Pawnee.....	10,063,216	9,796,346	Petroleum, natural gas, sand and gravel.
Phillips.....	5,115,976	5,841,342	Petroleum, sand and gravel.
Pottawatomie.....	169,540	103,297	Sand and gravel, stone.
Pratt.....	7,927,276	7,001,922	Petroleum, natural gas, sand and gravel.
Rawlins.....	2,511	11,489	Petroleum.
Reno.....	9,679,369	9,787,670	Salt, petroleum, natural-gas liquids, sand and gravel, natural gas.
Republic.....	(?)	(?)	Sand and gravel.
Rice.....	17,068,726	18,034,314	Petroleum, salt, sand and gravel, stone, natural gas.
Riley.....	160,449	100,172	Sand and gravel, stone.
Rooks.....	19,409,806	21,267,674	Petroleum.
Rush.....	2,999,145	2,892,451	Petroleum, helium, natural gas, natural-gas liquids, sand and gravel.
Russell.....	27,460,550	27,447,739	Petroleum, sand and gravel, natural gas.
Saline.....	2,565,077	2,156,637	Petroleum, sand and gravel.
Scott.....	205,519	106,899	Petroleum.
Sedgwick.....	11,012,401	12,818,416	Petroleum, natural-gas liquids, sand and gravel, salt, natural gas, stone.
Seward.....	5,171,677	5,285,696	Natural gas, natural-gas liquids, petroleum.
Shawnee.....	1,078,084	981,544	Stone, sand and gravel.
Sheridan.....	1,155,456	1,181,589	Petroleum, sand and gravel.
Sherman.....	44,972	(?)	Sand and gravel.
Smith.....	1,701	(?)	Do.
Stafford.....	17,450,385	(?)	Petroleum, natural gas, sand and gravel.
Stanton.....	1,872,891	2,328,535	Natural gas, petroleum.
Stevens.....	11,230,119	12,152,673	Natural gas.
Sumner.....	8,885,627	8,859,728	Petroleum, sand and gravel, natural gas.
Thomas.....	69,297	35,548	Sand and gravel, petroleum.
Trego.....	4,112,152	5,689,970	Petroleum, sand and gravel.
Wabaunsee.....	923,399	(?)	Petroleum, stone, sand and gravel.
Wallace.....	40,457	(?)	Stone, sand and gravel.
Washington.....	63,950	96,600	Sand and gravel.
Wichita.....	30,446	1,032	Petroleum.
Wilson.....	6,127,749	5,391,286	Cement, petroleum, stone, clays, natural gas.
Woodson.....	2,795,988	2,732,578	Petroleum, natural gas.
Wyandotte.....	9,318,822	6,040,867	Cement, stone, sand and gravel, clays.
Undistributed.....	4,899,831	43,795,202	
Total.....	493,770,000	505,084,000	

¹ The following counties are not listed because no production was reported in 1956 or 1957: Greeley, Lane, and Mitchell.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Mineral production was reported in 102 of the 105 counties in Kansas in 1957; no mineral production was reported in Greeley, Lane, and Mitchell Counties. Fifty-four counties reported mineral output valued at \$1 million or more each, and 5 principal producing counties—Barton, Ellis, Russell, Butler, and Rooks—contributed 29 percent of the total value of mineral production in the State.

Allen.—Production and shipments of both masonry and portland cements by Lehigh Portland Cement Co. (Iola) and Monarch Cement Co. (Humboldt) were the largest in Kansas in 1957. Almost 1 million barrels of crude petroleum was recovered from 10 fields, and 12 secondary-recovery projects contributed 64 percent of this total. Natural gas was produced from various fields. Limestone was crushed by Monarch Cement Co., Nelson Bros. Quarries, and the Allen County Highway Department for concrete aggregate, roadstone, and screening purposes. A small quantity of agricultural limestone was crushed. The United Brick & Tile Co. (at Iola) and Humboldt Brick & Tile Co. (near Humboldt) mined clay for manufacturing brick and tile.

Anderson.—Secondary recovery of oil yielded approximately 80 percent of Anderson County's total output of petroleum and was responsible for most of the drilling activity in 1957. Nearly 600,000 barrels of crude oil was produced from 21 areas in 8 fields. Crushed limestone was produced for concrete aggregate and roadstone by the Garnett Rock Co., Nelson Bros. Quarries, and Hunt Rock Co. Paving gravel was quarried by the Anderson County Highway Department for road construction.

Atchison.—Geo. W. Kerford Quarry Co. and Ralph Bromley crushed limestone for concrete aggregate, roadstone, screenings, riprap, and agricultural uses. The United States Army Corps of Engineers also quarried limestone for riprap.

Barber.—Over 2.1 million barrels of crude petroleum was produced from 44 fields in Barber County. The oil and gas industry spent 2 crew-weeks in geophysical and core-drill prospecting; 72 exploratory wells were drilled for a total depth of 335,946 feet. Ten of these wells proved oil productive, and 18 produced natural gas. New oil and gas fields numbered 7; of these, 5 were new Mississippian gasfields, of which the most important were the Rhodes South and Turkey Creek East gasfields. The Highway Northwest field was discovered and abandoned. The output of natural gas from Barber County was about 53 billion cubic feet in 1957. Natural gasoline was recovered by the Skelly Oil Co. plant near Medicine Lodge, recently purchased from the Kansas Power & Light Co. The capacity of the plant was enlarged from 10,000 gallons to 40,000 gallons a day. The mined tonnage and value of crude gypsum declined 6 percent. Paving gravel was mined by the Barber County Highway Department.

Barton.—The value of mineral production from Barton County in 1957, composed mostly of petroleum, was the largest in the State. Approximately 13 million barrels of crude oil was recovered from 154 fields. Of 270 wells drilled in 1957, 141 were oil productive, 35 were dry wildcats, and the remainder were dry development wells or service wells. Klug Northwest, Odin Northwest, and Phillips (producing from the Arbuckle stratum) and St. Peter Northwest and Cheyenne View East (producing from the Lansing-Kansas City stratum) were important new oilfield discoveries. About 550 million cubic feet of

natural gas was recovered from the Heizer Southwest, Pawnee Rock, and Unruh fields. Arkansas Sand & Gravel Co., Dubois Sand Co., Gruber Sand Plant, Moos Bros. Sand Co., and the Barton County Highway Department produced building and paving sand. Barton County ranked first in Kansas in clay production. Great Bend Brick & Tile Co. and Kansas Brick and Tile Co. mined fire clay for face brick and other structural-clay products.

Bourbon.—Fort Scott Hydraulic Cement Co., Inc., produced masonry and natural cements, the leading commodities in Bourbon County. Dimension sandstone was quarried by Bandera Stone Quarry at its plant near Fort Scott. Cullor Limestone Co., Inc., Fort Scott Hydraulic Cement Co., Inc., and the Bourbon County Highway Department quarried and crushed limestone for road construction, riprap, agricultural, and other purposes. One coal mine was operated in Bourbon County during the year; output declined from 1956. A small quantity of crude oil was produced from 10 areas in 4 fields.

Brown.—Gravel for paving was quarried by Ralph Mitchell and the Brown County Highway Department. A small quantity of crude petroleum was produced.

Butler.—Butler County ranked fourth in the total value of mineral and petroleum production in Kansas. The 7.9 million barrels of crude petroleum produced from 70 fields yielded \$23.8 million, or more than 99 percent of the value of all minerals produced in the county. Secondary-recovery operations supplied half of the petroleum output of the county. Geophysical and core-drilling crews spent 28 weeks in oil and gas prospecting. Fifty-one exploratory wells were drilled, for a total depth of 175,740 feet. Three new oilfields were discovered. Limestone used for road construction, building purposes, and agricultural lime was crushed by George M. Myers, Inc., at the Seglem and Duvanel plants. Butler County Highway Department produced a small amount of gravel for road construction.

Construction of a \$2-million Universal Oil Products Udex extraction unit was in progress at the 18,000-barrel Potwin refinery of Vickers Petroleum Co., Inc., of Wichita. The unit was expected to yield 357,140 barrels of chemicals a year, extracting aromatic hydrocarbons from a catalytic re-former. Products were to include benzene, toluene, xylene, and other aromatics.

Skelly Oil Co. was constructing a 3,500-barrel-per-day Phillips H-F alkylation unit at El Dorado, due to be completed by the spring of 1958.

Socony Mobil Oil Co., Inc., completed a 9,000-barrel-per-day catalytic re-forming unit at Augusta.

Chase.—Crews of the Chase County Highway Department obtained gravel for paving. Limestone for use as concrete aggregate, roadstone, and screenings was quarried and crushed by Riddle Quarries, Inc. Production of crude petroleum and natural gas was reported in the county.

Chautauqua.—Petroleum output in Chautauqua County decreased to less than 1 million barrels. Oil production was reported from 24 fields, of which the Ogle field was a new discovery. Natural gas was produced from several fields. Sedan Limestone Co. crushed limestone for concrete aggregate, roadstone, screenings, and fertilizer

filler. Gravel for paving was produced under contract for the Chautauqua County Highway Department.

Cherokee.—The State's entire production of lead and zinc originated in Cherokee County, where 17 mining companies operated 43 mines. The 3 largest producers were National Lead Co., St. Louis Smelting & Refining Division (10 mines), and Eagle-Picher Co. (6 mines). At Galena, Eagle-Picher Co. operated its lead smelter and pigment plant and produced sulfuric acid by the contact process. The county remained first in coal mined in Kansas, although output decreased 4 percent from 1956. Only 5 strip mines (1 less than in 1956) operated during the year. Important coal producers in the county were P & M Coal Mining Co. at Hollowell and Wilkinson Coal Co. at Weir. Chats were produced by Baxter Chat Co., Eagle-Picher Co., C. Y. Semple, Southwest Chat Co., Inc., and Southwest Rock & Chat Co. for railroad ballast, concrete aggregate, and road stone. Miscellaneous clay was stripped for manufacturing structural-clay products by United Brick & Tile Co. at Weir.

Clark.—The Harper Ranch field yielded most of the petroleum produced in Clark County. Crude petroleum and natural gas were produced from nine fields, and Tuttle West field was a new gas discovery. Clark County Highway Department mined sand and gravel for paving purposes.

Clay.—Structural sand and paving sand and gravel were mined by Gladys Alsop and Clay Center Concrete & Sand Co., Inc. The Riddle Quarries, Inc., crushed limestone for use in concrete aggregate, roadstone, and screenings. Petroleum was produced from the Griffith field, a new discovery.

Cloud.—Earl Beaver Sand Co. and Harry Henery, Inc., near Glasco, and Ross Sand Co., Inc., and Walker Sand Co., near Concordia, quarried sand and gravel for building, paving, and filter purposes. Plastic fire clay was mined at Concordia for use in face brick and other structural products by Cloud Ceramics.

Coffey.—Crude-petroleum recovery declined to 137,000 barrels from 161,000 barrels in 1956, but crude petroleum remained the leading mineral commodity in the county. No new fields were discovered; of 11 wells drilled, 2 were oil wells, and 9 were dry holes. A small quantity of natural gas was recovered. Coal production declined for the third consecutive year. Coal was strip-mined by S. L. Rogers Coal Co. at Arvonnia. Neosho Valley Rock Co., Jones Rock Co., and C. L. Daniels Stone Co. crushed limestone for concrete aggregate, roadstone, and agricultural uses.

Comanche.—The Comanche County Road Department produced sand for structural use and gravel for road construction. Petroleum and natural gas were produced from four fields; the Tuttle field was a new gas discovery.

Cowley.—Cowley County ranked 10th in the State in value of mineral production for 1957. The output of crude petroleum (the leading mineral commodity) declined 500,000 barrels from 1956; production of 4.1 million barrels was reported from 109 fields. Ten fields were discovered in 1957, and 125 development oil wells and 3 gas wells were productive out of 312 wells drilled. Fifteen gasfields produced natural gas; the Werner Northeast field was a new discovery. The oil and gas industry spent 20 crew-weeks in geophysical

and core-drilling activities, drilling 319,000 feet. Anderson-Prichard Oil Corp. increased its crude-oil capacity by 6,500 barrels per day and its straight-run asphalt capacity by 250 barrels per day at the Arkansas City refinery. The Texas Co. recovered natural gasoline and LP-gases at its plant near Burden. Dimension limestone for various uses was prepared by Silverdale Cut Stone Co., Silverdale Limestone Co., and John V. Elam. Sand and gravel was quarried for structural and paving uses by Cowley County Highway Department at Winfield; by Arkansas City Sand & Gravel Co., McFarland Gravel Co., and Wilson Bros., all of Arkansas City; by Phillips & Son Construction Co., of Winfield; and by Oxford Sand & Gravel Co. at Oxford. Blast, filter, and engine sands also were produced.

Crawford.—In tonnage of coal mined, Crawford County was second only to Cherokee County. Coal was mined by shaft and open-pit methods. Lucky Star Coal Co. (Pittsburg) and Blue Ribbon Coal Co. (Girard) operated shaft mines. Important strip operators of the six strip mines in the county were Apex-Compton Coal Co. at McCune and Clemens Coal Co. near Pittsburg. Small quantities of crude petroleum and natural gas were produced from six fields in Crawford County. The county ranked second in Kansas in the value of clay produced. W. S. Dickey Clay Manufacturing Co. mined miscellaneous clay and fire clay for face brick, building brick, building tile, and other structural products.

Decatur.—Production of crude petroleum from 13 fields was about 400,000 barrels, an increase of 16 percent over 1956. Two new fields, Jennings Southeast and Jording, both from the Lansing-Kansas City stratum were discovered. Paving gravel was produced by the Decatur County Highway Department at Oberlin.

Dickinson.—Limestone was quarried and crushed from 4 pits by Anderson-Oxandale and from 2 pits by Riddle Quarries, Inc., for building, paving, riprap, and agricultural uses. Sand and gravel was produced for paving and building by Shoffner Sand & Gravel Co. near Solomon. Approximately 101,000 barrels of crude petroleum was recovered from 7 fields in Dickinson County. Of 23 wells drilled, 13 were oil producers and 10 were dry holes.

Doniphan.—Limestone was crushed by Everett Quarries, Inc., at Wathena; by George W. Kerford Quarry Co., at Wathena; by Wolf River, at Troy and Iowa Point; by Wolf River Limestone, Inc., at Troy; and by the United States Army Corps of Engineers. The material was used mainly for riprap, concrete aggregate, roadstone, and agricultural lime.

Douglas.—Sand for paving and miscellaneous uses was produced by the Bowersock Mills & Power Co. near Lawrence. Clark Rock Quarry crushed limestone for agricultural use, concrete aggregate, roadstone, and screenings. Production of crude petroleum was reported from two fields. Callery Chemical Co. broke ground near Lawrence for a \$4 million plant to produce boron specialty chemicals for commercial use and high-energy fuels for jet aircraft and missiles. The Lawrence plant, expected to employ 150 persons, was scheduled for completion early in 1958.

Edwards.—Petroleum and natural gas were recovered from 19 fields in Edwards County. One field (Massey) was an oil discovery, and Edstaf Northwest and Embry East were gas discoveries. Produc-

tion of natural gas increased 131 percent over 1956 to 1,683 million cubic feet. Gravel was produced by Dave Showalter at Kinsley for paving and structural use.

Elk.—Elk County ranked second in the State in stone output for 1957. Limestone was quarried and crushed near Moline by Concrete Materials Construction Co. for concrete aggregate, roadstone, railroad ballast, agricultural lime, and riprap. Gravel for paving and road maintenance was mined by the Elk County Highway Department. Production of crude oil, from 31 fields, declined slightly from 1956; natural gas was produced from 3 fields in the county.

Ellis.—Ellis County ranked second in Kansas in value of mineral production and second in oil production. Over 11.5 million barrels of petroleum, valued at \$35 million, was produced from 125 fields in 1957. Fourteen new fields were discovered, of which the Solomon Southeast and the Scurlock were the most important. Of 461 wells drilled in 1957, 230 were productive oil wells. A small quantity of building sand was produced near Victoria by Lewis C. Schmidtberger.

Ellsworth.—The 1957 production of oil (2.5 million barrels from 18 fields) declined for the fourth consecutive year. Drilling activity also declined, as only 33 wells were drilled. Of these, 11 were oil productive, and 22 were dry holes. Rock salt produced near Kanopolis by the Independent Salt Co. was consumed mostly by the agricultural and chemical industries. Paving sand was produced by the Ellsworth County Highway Department. Henry Milberger, near Wilson, and San Ore Construction Co., at Great Bend, produced paving sand and gravel. Great Bend Brick & Tile Co. mined fire clay for building brick.

Finney.—The Finney County section of the Hugoton gas area produced nearly 44 billion cubic feet of natural gas—15 percent more than in 1956. Drilling of 76 wells in the county resulted in 63 new gas wells and 7 new oil wells. Oil and gas were produced from 12 fields. Geophysical and core-drilling crews spent 32 weeks in oil and gas prospecting. Eleven exploratory wells were drilled, for a total of 49,660 feet. Northern Natural Gas Co. recovered natural gasoline at its plant near Holcomb. Sam Alsop Construction Co., Smith Sand Co., and Finney County Highway Department, all of Garden City, produced sand and gravel for building, paving, and packing in wells.

Ford.—Davis Sand Co., Dodge City Sand Co., Miller Sand & Gravel Co., and San Ore Construction Co. produced sand and gravel for paving and structural uses and use as a filler. Natural gas and petroleum were produced from three fields in the county.

Franklin.—Secondary-recovery projects contributed 90 percent of the 306,000 barrels of crude petroleum produced in 1957; 13 areas in 5 fields reported production. Crushed limestone was produced by Anderson-Oxandale and Franklin County Highway Department. Lightweight aggregate, from miscellaneous clay mined near Ottawa, was expanded by the Haydite process by Buildex, Inc.

Geary.—Crushed and dimension limestone was quarried near Junction City by the Walker Cut Stone Co. Grosshans and Petersen, Inc., quarried and crushed limestone for concrete and road aggregate. Building and paving sands were produced by Junction City Sand & Gravel Co. and More Sand Co., near Junction City.

Gove.—Ray Bigbee produced structural sand and the Gove County Highway Department quarried gravel for paving. Petroleum was produced from seven fields.

Graham.—Graham County ranked seventh in the State in value of mineral production in 1957. Most of this value resulted from the production of crude petroleum. Seventy-three fields produced over 7 million barrels of oil. Twenty-three new fields were discovered, and the Holley Northwest field was revived. Initial daily production of the Evergreen Northwest field was 1,700 barrels. Government-and-contractor operators crushed sandstone for riprap. Gravel for paving was produced near Morland.

Grant.—Grant County ranked third in Kansas in production of natural gas, with a total of 78 billion cubic feet, a 1-percent gain over 1956. The entire output originated in the Hugoton gas area. The county was first in value of its natural-gasoline and liquefied-petroleum yield, with \$4.2 million. Paving sand and gravel was produced by Harry Henery, Inc., and paving gravel by the Grant County Highway Department.

Greenwood.—Secondary-recovery projects yielded 84 percent of the 7 million barrels of oil produced from 54 fields in the county. Two new field discoveries were Jackson Southwest and Zebold. Most of the drilling developed secondary-recovery projects. Greenwood County Highway Department crushed limestone for paving purposes.

Hamilton.—Natural gas was the leading commodity produced in Hamilton County. Production from 2 fields was 4 billion cubic feet of natural gas and a small quantity of petroleum. The Bradshaw field was a new discovery. The oil and gas industry spent 38 crew-weeks in geophysical and core drilling. Five exploratory wells were drilled for a total of 25,164 feet. Building and paving sand and gravel and other gravel were produced near Syracuse by Smith Sand Co., Syracuse Sand & Gravel Co., and M. W. Watson.

Harper.—The total value of mineral production increased 5 percent over 1956 and totaled about \$2.5 million. Petroleum production represented 91 percent of this value. Geophysical and core-drilling crews spent 37 crew-weeks in oil and gas prospecting. Thirty-seven wells were drilled for a total of 176,780 feet. Oil and gas were produced in 14 fields in the county. The Hibbard and Sharon Northeast fields were new gas discoveries. Six new oilfield discoveries were reported, the most important of which were the Gerber field, with an initial daily potential of 930 barrels, and the Gish field, reporting 617 barrels. Natural-gas liquids were recovered by the Magnolia Petroleum Co. at its new plant near Attica. Structural sand and paving gravel were produced by the Harper County Highway Department.

Harvey.—Production of petroleum in Harvey County gained slightly over 1956; natural-gas output decreased 59 percent. Oil and natural gas were recovered from 12 fields in the county. Two new oilfields—Gingrass and Sperling South—were discovered. Paving sand and structural gravel were mined near Burrton by Howard R. Thach.

Haskell.—The Haskell County section of the Hugoton gas area yielded over 32 billion cubic feet of natural gas. Crude-petroleum output dropped 17 percent from 1956, although 1 new oilfield discovery was reported. Of 7 wells drilled, 3 were oil wells and 4 were dry holes. Natural-gas liquids were recovered by the Northern Natural Gas Co.

Howard Mitchell produced building and paving sand near Satanta.

Jefferson.—Roy Baker and N. R. Hamm Quarry, Inc., crushed limestone for agricultural, concrete aggregate, roadstone, screenings, and miscellaneous uses.

Jewell.—Ideal Cement Co. obtained clay and limestone for use in cement. San Ore Construction Co. produced sand near Mankato for paving.

Johnson.—Limestone was quarried and crushed by Dietz Hill Development Co., Reno Construction Co., and Johnson County Highway Department for road construction, riprap, and agricultural purposes. Small outputs of crude petroleum and natural gas were reported in the county.

Kearney.—Approximately 62.5 billion cubic feet of natural gas valued at \$7 million was produced in 1957. One new oilfield (Lakin) was discovered. Kansas-Nebraska Natural Gas Co., with its plant near Deerfield, and Colorado Interstate Gas Co., Inc., with its plant near Lakin, recovered natural gasoline and liquefied petroleum gases. Paving sand and gravel was produced by the Kearney County Highway Department. Building and paving sand and gravel were quarried near Ulysses by Glen Popejoy.

Kingman.—Crude-petroleum production from 27 fields in Kingman County (over 2 million barrels) represented a 22-percent increase over 1956. Geophysical and core-drilling crews operated 11 weeks. Forty-eight wells were drilled, for a total depth of 205,400 feet. Fourteen of these wells proved oil productive, 9 were gas discoveries, and 25 were dry. The county ranked fourth in output of natural-gas liquids, which were recovered by Skelly Oil Co. at its plant near Cunningham. Recovery of natural gas increased 46 percent over 1956—to 10 billion cubic feet. Nine fields reported production, of which the Moorhouse field was a new discovery. Ray Wells produced building sand near Kingman.

Kiowa.—Seacot Sand & Excavating Co. produced structural and paving gravel. Over 3 billion cubic feet of natural gas was recovered from 13 fields in the county; 3 of these were new discoveries. Output of crude petroleum was reported from 14 fields, 2 of which were new discoveries.

Labette.—Limestone was quarried and crushed by the Labette County Highway Department at Oswego, for concrete aggregate, roadstone, and building rubble. About 100,000 barrels of petroleum was produced from 11 fields. Gas production, totaling 70 million cubic feet, decreased 24 percent from 1956.

Leavenworth.—Limestone was crushed for riprap, concrete aggregate, roadstone, railroad ballast, and agricultural uses by Wyandotte County Engineers, Loring Quarries, Inc. (near Coldspur), George W. Kerford Quarry Co. (near Lowemont), Kansas State Penitentiary (at Leavenworth), J. C. Haigwood, the United States Army Corps of Engineers, and the city of Leavenworth. Building sand was dredged by Missouri Valley Sand, Inc., near Leavenworth. Natural-gas and crude-petroleum production was reported from three fields.

Lincoln.—Quartzite Stone Co. produced quartzite for filter use and crushed sandstone for riprap, railroad ballast, concrete aggregate, roadstone, and screenings. Ernest Hanzlicek produced pumice.

Linn.—The value of the mineral output of Linn County dropped slightly for the third straight year. Six fields reported production of crude petroleum and natural gas. Limestone for concrete and road aggregate, riprap, and agricultural uses was crushed by Lee Giles near Greeley and by Murray Limestone Products Co. near Centerville. Paving sand was produced by the Linn County Highway Department.

Lyon.—Production of petroleum in Lyon County, originating from 8 fields, amounted to 264,000 barrels. Six crew-weeks were spent in geophysical and core-drill prospecting. Of seven exploratory wells drilled, all were dry holes. Sand and gravel for building and paving was produced near Hartford by Wesley Parks and near Emporia by Harry Waterman.

Marion.—Approximately 2.1 million barrels of crude petroleum was recovered from 38 fields in the county. Drilling was extensive in Marion County; 204 wells were drilled and 7 new fields discovered. Exploratory work, totaling 6 crew-weeks, resulted in 15 oil wells and 48 dry holes. Riddle Quarries, Inc., operated three crushing plants, at Florence, Marion, and Lost Springs, producing crushed limestone for riprap, railroad ballast, concrete aggregate, roadstone, and screenings. Walt Keeler Co., Inc., crushed limestone for road construction and agricultural uses. Natural-gas recovery increased about 100 percent over 1956.

Marshall.—Bestwall Gypsum Co. mined gypsum for processing at its Blue Rapids plant. Output was less than in 1956. Building and paving sand and gravel were produced by Blue River Sand & Gravel Co. at Blue Rapids, C. V. Garrett at Blue Rapids, and Heinzelman Construction Co. at Marysville. A small quantity of filter gravel also was produced. Hopper Bros. Quarries crushed limestone for riprap and agricultural use.

McPherson.—Crude petroleum valued at \$12 million was the leading mineral produced in McPherson County. Over 4 million barrels of crude petroleum was recovered from 37 fields. Wells drilled totaled 168; 107 were oil wells and the remainder dry holes. Four gasfields in the county reported a small output. Paving gravel was produced by McPherson County Highway Department.

Meade.—Recovery of petroleum (850,000 barrels) increased almost 75 percent over 1956. Drilling activity rose slightly above 1956, as 79 wells were completed. Five new fields (3 oil and 2 gas) were discovered as a result of exploration. The most important oilfield discovery was the Mohler field, with an initial daily potential of 320 barrels. Natural-gas recovery (about 11 billion cubic feet from 16 fields) rose 49 percent over 1956, making Meade an important gas-producing county.

Miami.—Crude petroleum, produced from 33 areas in 5 fields, was the leading mineral reported in Miami County for 1957. Nine water-flood projects yielded 66 percent of the 590,000 barrels of oil recovered. Small recoveries of natural gas were reported from several fields. Limestone for concrete aggregate and roadstone was produced by L. W. Hayes, Inc., A. J. Forster, and the Miami County Highway Department near Paola. Gravel for paving was produced by Miami County Highway Department.

Montgomery.—Montgomery County ranked second in Kansas in cement output. Portland and masonry cements were produced at

the Independence plant of Universal Atlas Cement Co. Production of crude petroleum, from 10 fields, declined 22 percent from 1956 to 587,000 barrels. Half of this production originated from 15 water-flood projects. Natural gas was produced in the county. Structural clay products were manufactured from miscellaneous clay at Coffeyville by the United Brick & Tile Co. Limestone for concrete aggregate and roadstone was produced by Montgomery County Highway Department. Ozark Smelting & Mining Co. processed zinc ores into zinc pigment at its Coffeyville plant.

Morris.—The value of petroleum production totaled over \$1 million. Seventeen crew-weeks were spent in geophysical and core-drill prospecting. Of 6 exploratory wells drilled, 1 was oil productive and 5 were dry holes. A small recovery of natural gas was reported. Anderson & Oxandale crushed limestone from five quarries in the county for agricultural uses, concrete aggregate, roadstone, and screenings. A small quantity of paving gravel was produced near Council Grove, and the Morris County Highway Department contracted for gravel for road construction.

Morton.—Only two minerals were reported as produced in Morton County—natural gas and petroleum. Recovery of natural gas, mainly from the Greenwood and Hugoton gas areas, increased approximately 32 percent to 96 billion cubic feet in 1957. Recovery of 428,000 barrels of petroleum was reported from 6 fields, of which the Taloga Northeast was a new discovery. Of 104 wells drilled during the year, 41 were gas producers, 30 oil producers, and 33 dry holes.

Nemaha.—Anderson & Oxandale quarried and crushed limestone for concrete aggregate and roadstone. Crude petroleum was produced from three fields in the county.

Neosho.—Shipments of cement, the County's leading mineral in 1957, declined from 1956. The quantity of crude petroleum (593,000 barrels) produced from 8 fields in Neosho County was slightly less than the preceding year. Secondary-recovery operations accounted for nearly 71 percent of total oil recovered. A small production of natural gas was reported. Harry Byers & Sons, Inc., and Joe O'Brien crushed limestone for concrete, roadstone, and agricultural uses. The Neosho County engineer quarried limestone for concrete aggregate and roadstone near Urbana. Harry Byers & Sons, Inc., quarried a small quantity of dimension limestone for rubble.

Ness.—The production of crude petroleum (541,000 barrels) from 14 fields in Ness County increased for the third consecutive year. Two new fields were discovered.

Norton.—The output of crude petroleum from Norton County decreased slightly from 1956. Exploration and development accounted for 20 oil wells and 15 dry wildcats. Pumicite was produced by the Wyandotte Chemical Corp. at Calvert for use in cleaning and scouring products.

Osage.—Osage County ranked third in the State in coal production. K. B. Dusenbury, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agricultural uses.

Osborne.—Crews of the Osborne County Highway Department produced gravel for paving. Crude-petroleum production was reported from 2 new fields, 1 of which was a new discovery.

Pawnee.—Approximately 3.1 million barrels of crude petroleum was produced from 36 fields in Pawnee County, a decrease of 9 percent from 1956. The oil and gas industry spent 5 crew-weeks in core-drill prospecting, and 4 new fields were discovered. Natural-gas recovery (3.3 billion cubic feet) declined from the preceding year. Paving gravel was produced by the Pawnee County Highway Department. Sand and gravel for building, paving, and other purposes was produced by Johnson Sand & Gravel Co. and Larned Sand & Gravel Co.

Phillips.—The value of petroleum produced in Phillips County (\$5.7 million) increased approximately 12 percent over 1956. Seventeen fields reported production. Three wells were completed, all of which were oil producers. The petroleum refinery of the Cooperative Refinery Association was operated at Phillipsburg. D. G. Hansen produced paving gravel at a portable plant near Logan.

Pottawatomie.—Paving sand and gravel was produced by the Pottawatomie County Highway Department. Sand and gravel for structural and paving uses was produced near Emmett by Anderson & Oxendale Co. and near Wamego by Wamego Sand Co. Manhattan Cut Stone Co. and Manhattan Stone Co. prepared dimension limestone for rough construction and dressed building stone.

Pratt.—Yield of crude petroleum, from 41 fields, was 2.3 million barrels. Four new oilfields were discovered. Four crew-weeks were spent in geophysical and core-drill prospecting. Natural-gas production was about 1.8 billion cubic feet. C. D. Hogard and the Pratt County Highway Department produced paving sand and gravel near Pratt.

Reno.—The value of the salt output (nearly \$7 million) from Reno County was the largest of the 3 counties reporting salt production and represented a 3-percent increase over 1956. Salt was evaporated by Barton Salt Co., Morton Salt Co., and Carey Salt Co. Rock salt was mined by the Carey Salt Co. All salt was produced near Hutchinson. Approximately 800,000 barrels of crude petroleum was produced from 25 fields. Drilling of 33 wells resulted in 11 oil producers and 22 dry holes. Natural-gas liquids were recovered near Burrton by the Cities Service Oil Co. Production of natural gas totaled 671 million cubic feet, an increase of 41 percent over 1956. J. N. Shears & Sons, Inc., dredged building and paving sand near Hutchinson. Building Sand was strip-mined by the J. E. Steele Sand & Gravel Co. near Hutchinson. Haven Sand Co. and San Ore Construction Co. produced structural and paving sand, also gravel for miscellaneous uses. The city of Hutchinson produced sand for paving.

Rice.—Rice County produced 5.3 million barrels of crude petroleum from 61 fields. Drilling of 143 wells resulted in the discovery of 3 new fields and revival of 1 field. Approximately 547 million cubic feet of natural gas was recovered from 11 fields in the county. Sand and gravel for structural and paving purposes was mined by Arensman Sand & Gravel Co. near Raymond; Rock Hill Stone & Gravel Co. and Sterling Sand & Gravel Co., Inc., both near Sterling; and Tobias, Wright & Birchenough, Inc., and A. L. Stapleton near Lyons. Riddle Quarries, Inc., crushed limestone near Little River for riprap, concrete aggregate, roadstone, and agricultural purposes. Evaporated and rock salt were produced near Lyons by the American Salt Corp.

Riley.—Walters Sand Co. dredged structural sand and paving gravel from a pit near Manhattan. Bayer Construction Co. and the post engineer at Fort Riley crushed limestone for concrete aggregate, roadstone, and agricultural uses.

Rooks.—Rooks County ranked fifth in the State in output of crude petroleum (the only mineral reported). Approximately 7.1 million barrels was recovered from 82 fields. Exploratory drilling included 7 oil wells and 29 dry holes and resulted in the discovery of 2 fields. Important producing fields included Marcotte, Plainville, Dopita, Dorr, Laton, and Trico.

Rush.—Petroleum recovery from 17 fields decreased 10 percent from 1956 to 635,000 barrels. Three new fields were discovered, and 1 was revived. Seven crew-weeks were spent in geophysical and core-drilling activities. Twenty-two exploratory wells were drilled, for a total of 84,000 feet. Output of helium, recovered from natural gas by the Federal Bureau of Mines plant at Otis, decreased from 1956. Production of natural gas (about 2.8 billion cubic feet) was slightly more than in 1956. Natural-gas liquids were recovered at Otis by Dunn-Mar Oil & Gas Co. Portable plants of Inland Construction Co., near Hargrave, and M. W. Watson, near Alexander, produced sand and gravel for paving.

Russell.—The value of mineral output in Russell County (\$27.4 million) declined for the third year, but the county maintained its position as third largest mineral producer in the State. Approximately 9.1 million barrels of crude oil was recovered from 40 fields. Four new oilfields were discovered. Of the 156 wells drilled, 115 were development oil wells. Paving gravel was produced near Russell by the Russell County Highway Department. A small quantity of natural gas was produced in conjunction with petroleum production.

Saline.—Production of two minerals—crude petroleum and sand and gravel—was reported for Saline County in 1957. Recovery of crude oil (636,000 barrels from 11 fields) declined 22 percent. Only 7 exploratory wells were drilled during the year, of which 3 produced oil, and 4 were dry. Salina Sand Co., Inc., dredged sand and gravel near Salina for building and paving.

Sedgwick.—The value of mineral production in Sedgwick County totaled \$13 million, an increase of 16 percent over 1956. Crude petroleum, natural-gas liquids, salt, and sand and gravel explained this rise. About 3.1 million barrels of crude petroleum was produced from 46 fields, including 5 new discoveries. Of 210 wells drilled during the year, 88 found oil. Derby Refining Co. of Wichita completed its second major expansion in the past 6 years by installing an Ultraformer and by increasing its daily crude capacity from 16,000 barrels to 20,000. The \$1.25 million program also included enlargement of asphalt capacity. Natural-gas production was reported from three fields in the county. Natural-gas liquids were processed at the natural-gasoline plants of Drillers Gas Co. at Cheney, and Cities Service Oil Co. at Wichita. Output from 12 sand and gravel operations was reported in 1957. Important producers were Inland Construction Co., Miles Sand Service, Dolese Bros. Co., Walt Keeler Co., and Superior Sand Co., Inc. Much of the production was for construction in Wichita. The city of Wichita quarried and crushed

limestone for road construction. Frontier Chemical Co. pumped brine from wells for manufacturing salt chemicals in Wichita.

Dodson Manufacturing Co. exfoliated vermiculite for use in insulation, plaster, concrete roof decks, and floors.

Seward.—Recovery of nearly 30 billion cubic feet of natural gas in Seward County came mainly from the Hugoton gas area. The county ranked third in Kansas in output of natural-gas liquids. Much of the natural gas was processed by the natural-gasoline plant of Panhandle-Eastern Pipeline Co., at Liberal. A small quantity of crude petroleum was produced.

Shawnee.—Shawnee County ranked third in the State in stone output. Crushed limestone was produced by Henry C. Luttjohann, Netherland Stone Co., Pattons Crushed Stone Co., and Anderson & Oxandale for concrete aggregate, roadstone, and screenings. Sand and gravel (used principally for building and paving) was mined near Topeka by Kansas Sand Co., Inc., River Sand Co., Shoffner Sand, Inc., Consumers Sand Co., and Victory Sand & Stone Co. Small quantities of engine sand and other sands also were produced.

Sheridan.—The total output of crude petroleum (391,000 barrels) decreased approximately 3 percent from 1956. Production was reported from 11 fields. The Sheridan County Highway Department produced gravel for road construction near Hoxie. Pit-run sand was produced by Carl Kaiser, near Grainfield, for paving.

Stafford.—Stafford County ranked ninth in Kansas in the total value of its mineral output in 1957. Recovery of petroleum from 166 fields was 5.7 million barrels—a slight decrease from 1956. Nine oilfields were discovered, 1 was revived, and 23 were abandoned during the year. An important discovery was the Kipp Southwest field, with a daily potential of 475 barrels of oil. Fifteen crew-weeks were spent in geophysical and core-drill prospecting. About 8 million cubic feet of natural gas was recovered from 3 fields in the county. Structural and paving sand and paving gravel were dredged by the Partin Sand & Gravel Co. near Stafford. Paving sand was stripped by the Stafford County Highway Department near Saint John.

Stanton.—Twenty billion cubic feet of natural gas was recovered in Stanton County from the Hugoton gas area and Sparks field, an 18-percent increase over 1956. The Sparks field also produced a small quantity of crude petroleum. Geophysical and core-drill prospecting reported 9 crew-weeks of work, resulting in the drilling of 16 exploratory wells for a total of 84,000 feet. One was a gas well and 15 were dry holes.

Stevens.—Stevens County continued as the leading producer of natural gas in Kansas with over 105 billion cubic feet, all from the Hugoton gas area. No other minerals were produced.

Sumner.—The 1957 value of mineral output totaled \$8.9 million. Production of about 3 million barrels of petroleum was reported from 49 fields. Drilling crews of the oil and gas industry spent 113 weeks in geophysical and core-drill prospecting for a total of 202,500 feet. Fifty-one exploratory wells were drilled; 7 were oil wells, 1 produced gas, and 43 were dry holes. A small quantity of natural gas was recovered. The Sumner County Highway Department quarried paving gravel near Wellington. Mulvane Sand Co., Inc., produced structural, paving, and other sands at a fixed plant near Mulvane.

Thomas.—Paving sand was produced and contracted for by the Thomas County Highway Department. A small amount of structural sand also was reported in the county. A small quantity of crude petroleum was produced.

Trego.—Approximately 1.9 million barrels of crude petroleum was produced from 34 fields, 28 percent more than in 1956. New fields discovered were Ogallah Northwest, Voda, Riga Northeast, and Walz Northwest (initial daily potential, 349 barrels). Seven fields were abandoned during the year.

Wabaunsee.—The Wabaunsee County Highway Department produced sand and gravel for road construction. G. W. Baker quarried and crushed limestone for concrete aggregate, roadstone, and screenings. Output of crude petroleum was reported in the county.

Wallace.—DeLore Division of National Lead Co. crushed diatomaceous marl for use as a flattening pigment in paint. The Wallace County Highway Department produced sand for paving.

Wilson.—Wilson County ranked fourth in Kansas in production and shipments of cement and fifth in output of stones and clays. Portland and masonry cements were produced by Consolidated Cement Co. at Fredonia. Limestone was crushed by Carr Rock Products Co., at Neodesha, and by Benedict Rock & Lime Co. at Benedict, for concrete aggregate, roadstone, screenings, and agricultural uses. Acme Brick Co. at Buffalo and Excelsior Brick Co. at Fredonia manufactured heavy clay products from miscellaneous clays. Recovery of crude petroleum, from 37 areas in 11 fields, increased 7 percent over 1956. Natural gas was produced in the county. Standard Oil Co. (Indiana) completed construction of a 6,000-barrel-per-day Ultraformer and a 6,000-barrel-per-day Hydrofining unit at its Neodesha refinery.

Woodson.—The quantity of crude petroleum recovered from 22 fields in Woodson County approximated 900,000 barrels, slightly less than in 1956. No new gas or oil fields were discovered. Four exploratory wells were drilled; all proved dry. A small quantity of natural gas was produced in the county.

Wyandotte.—Wyandotte County ranked first in Kansas in output of crushed limestone. Limestone was quarried and crushed near Turner and Kansas City by American Rock Crusher Co., Peerless Quarries, Inc., and Thompson Strauss Quarries, Inc., for riprap, concrete aggregate, roadstone, and asphalt filler. Eight operators produced sand in Wyandotte County for structural, paving, filter, engine, molding, and other uses. Small quantities of building, paving, and other gravels also were produced. Producers included Stewart Sand Material Co., Peck-Woolf Sand & Material Co., Holiday Sand & Gravel Co., Builders Sand Co., and American Sand Co. A \$30,000 permit was granted to Peck-Woolf Sand & Material Co. for preparatory grading and initial construction of sand-dredging apparatus. The yard office and equipment were expected to be completed within 2 years. Miscellaneous clay for lightweight aggregate was mined by Kansas Industries, Inc. Lone Star Cement Corp. produced portland and masonry cements. Production and shipments decreased from 1956. Natural gas was recovered from Rovers-Maywood field in Wyandotte and Leavenworth Counties. Panacalite Perlite, Inc., expanded perlite from crude ore imported from the Western States.

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. Rivers³



RECORD production of stone and decreased production of clays and sand and gravel highlighted Kentucky's mineral industry in 1957. In the Nation, Kentucky ranked second in ball-clay production, third in bituminous coal, and fourth in output of native asphalt and fluorspar.

The total value of mineral production increased 2 percent over 1956 and 15 percent above 1955 but was 11 percent below that in 1948, the record year.

Coal mining supplied 75 percent of the total value of output in the Kentucky mineral industry. Other fuels (natural gas, natural-gas liquids, and crude petroleum) furnished 18 percent. Leading companies were the large coal producers—Peabody Coal Co., Nashville Coal Co., and United States Steel Corp.

TABLE 1.—Mineral production in Kentucky, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays.....	905	\$4,079	894	\$3,915
Coal.....	74,555	331,358	74,667	338,109
Fluorspar..... short tons..	14,865	608	20,626	979
Lead (recoverable content of ores, etc.)..... do.....	228	72	411	118
Natural gas.....million cubic feet..	73,687	17,022	² 77,300	² 18,100
Natural-gas liquids:				
Natural gas..... thousand gallons..	35,275	2,414	34,956	1,935
LP-gases..... thousand gallons..	248,992	8,709	176,033	7,403
Petroleum (crude).....thousand 42-gallon barrels..	17,628	51,297	16,879	52,831
Sand and gravel.....	5,684	5,974	4,482	4,556
Silver (recoverable content of ores, etc.)..... troy ounces..	31	(³)	56	(³)
Stone.....	11,553	15,324	12,718	16,714
Zinc (recoverable content of ores, etc.)..... short tons..	417	114	837	194
Value of items that cannot be disclosed: Native asphalt, cement, and iron ore (1956).....		7,079		6,211
Total Kentucky ⁴		443,168		450,354

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Preliminary figure.

³ Less than \$1,000.

⁴ Total has been adjusted to eliminate duplicating the value of clays and stone.

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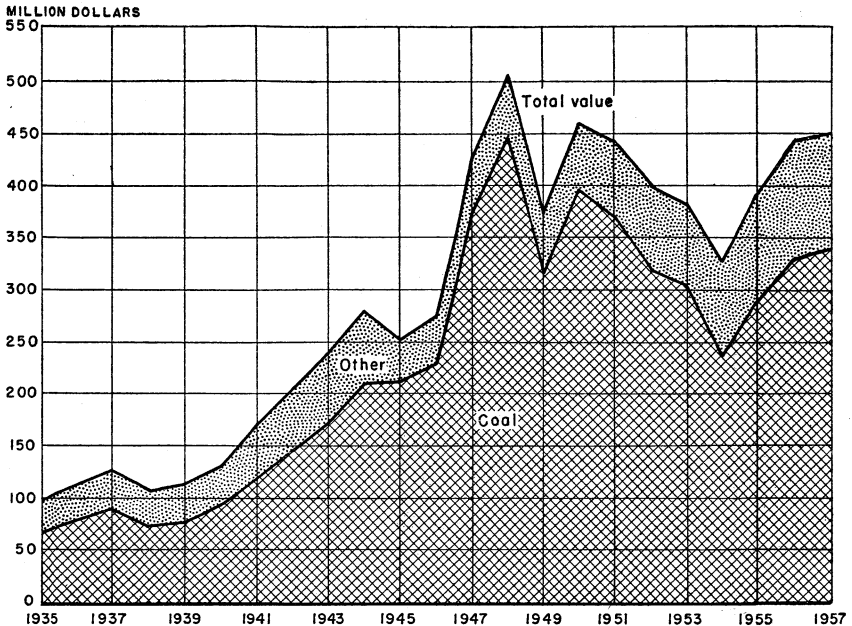


FIGURE 1.—Value of coal and total value of all minerals produced in Kentucky, 1935-57.

TABLE 2.—Average unit value of mineral commodities produced in Kentucky, 1948-52 (average) and 1953-57

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Clays:						
Ball.....short ton..	\$12.27	\$9.70	\$13.10	\$13.43	\$13.03	\$13.07
Fire.....do.....	5.42	5.20	6.67	6.77	6.30	5.96
Miscellaneous.....do.....	.96	1.40	1.50	1.42	1.37	1.33
Coal.....do.....	5.04	4.66	4.16	4.18	4.44	4.53
Fluorspar.....do.....	33.10	44.46	42.15	34.63	40.88	47.48
Lead.....do.....	322.00	262.00	274.00	298.00	314.00	286.00
Natural gas.....thousand cubic feet..	.20	.22	.23	.23	.23	.23
Natural-gas liquids:						
Natural gasoline.....gallon..	.07	.07	.06	.06	.07	.06
LP-gases.....do.....	.03	.03	.03	.03	.03	.04
Petroleum.....42-gallon barrel..	2.76	2.91	2.92	2.89	2.91	3.13
Sand and gravel:						
Sand.....short ton..	(¹)	.94	.91	1.08	1.06	1.02
Gravel.....do.....	(¹)	.95	.95	1.08	1.04	1.01
Stone:						
Limestone, crushed.....do.....	1.22	1.25	1.31	1.30	1.32	1.31
Sandstone, crushed.....do.....	(¹)	(¹)	2.78	2.21	2.23	2.14
Sandstone, dimension.....do.....	(¹)	7.98	16.45	13.29	12.89	16.12
Zinc.....do.....	298.80	230.00	216.00	246.00	274.00	232.00

¹ Figure withheld to avoid disclosing individual company confidential data.

EMPLOYMENT AND INJURIES

Total employment in the mineral industries in 1957 increased 4 percent over 1956 but was 12 percent below 1955. The increase was distributed among all industries as follows: Coal mines, 1 percent; oil and gas, 13 percent; quarries and mills, 16 percent; coke ovens and smelters, 3 percent; nonmetal mines, 58 percent; and sand and gravel mines, 2 percent. Most companies operated a regular 5-day

week; however, cement plants and coke ovens operated continuously, and many coal mines were idle part of the year.

Injury experience was not as good as in 1956, as the frequency rate increased 1 percent. The frequency rate increased for all industries except coke ovens and smelters, which decreased 51 percent, and oil and gas, which decreased 11 percent. The frequency rate increased 98 percent for nonmetal mines, 2 percent for coal mines, and 18 percent for quarries and mills. There were 58 fatalities, compared with 83 in 1956.

LEGISLATION AND GOVERNMENT PROGRAMS

Defense Minerals Exploration Administration (DMEA) activity consisted of a project for fluorspar in Livingston County amounting to \$45,890.

TABLE 3.—Employment in the mineral industries, 1956-57

Industry	1956			1957 ¹		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Coal mines.....	30,666	197	6,038,183	33,566	182	6,104,703
Oil and gas.....	4,366	244	1,065,520	4,639	260	1,206,720
Quarries and mills.....	1,685	238	400,796	1,991	234	466,478
Coke ovens and smelters.....	288	366	105,246	311	349	108,674
Nonmetal mines.....	475	162	76,804	559	217	121,159
Sand and gravel mines.....	² 350	² 263	² 92,036	371	253	93,827
Metal mines.....	11	34	380	-----	-----	-----
Total.....	37,841	206	7,778,965	41,437	196	8,101,561

¹ Preliminary figures.

² Excluding Government-and-contractor operations.

TABLE 4.—Injuries in the mineral industries, 1956-57

Industry	1956				1957 ¹			
	Fatal	Non-fatal	Total	Injuries per million man-days	Fatal	Non-fatal	Total	Injuries per million man-days
Metal mines.....	-----	-----	-----	-----	-----	-----	-----	-----
Coke ovens and smelters.....	-----	6	6	57	1	2	3	28
Oil and gas.....	4	114	118	111	1	119	120	99
Sand and gravel.....	(²)	(²)	(²)	(²)	-----	18	18	190
Nonmetal mines.....	-----	8	8	104	-----	25	25	206
Coal mines.....	77	2,190	2,267	375	55	2,288	2,343	384
Quarries and mills.....	2	137	139	347	1	190	191	410
Total.....	83	2,455	2,538	330	58	2,642	2,700	333

¹ Preliminary figures.

² Data not available.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt (Native).—Kentucky Rock Asphalt Co., the only producer of native asphalt in the State, abandoned its quarry but shipped a small quantity from stocks.

Coal.—Coal production was about the same as in 1956. Coal was mined at 2,167 mines in 40 counties, compared with 2,044 mines in 39 counties in 1956. The leading counties were Hopkins, Pike, and Harlan. The leading producing companies were Peabody Coal Co., Nashville Coal Co., and United States Steel Corp. In the Eastern Kentucky field 2,027 mines in 29 counties produced 45,662,000 tons, compared with 1,903 mines, 30 counties, and 45,000,000 tons in 1956; average production per mine decreased from 23,600 tons to 22,500. Of the total production, 91 percent was mined underground. In the Western Kentucky field 140 mines in 11 counties produced 29,005,000 tons, compared with 141 mines, 9 counties, and 29,600,000 tons in 1956; average production per mine decreased from 210,000 tons to 207,000. Of the total production, 47 percent was mined underground. Most Kentucky coal was shipped to out-of-State markets for metallurgical or electric-utility uses. Production had reached a peak of 84 million tons in 1947 and then declined to 57 million tons in 1954. The trend reversed in 1955 owing to increased demand by electric utilities, and output recovered to 75 million tons in both 1956 and 1957. During 1957 Peabody Coal Co. purchased the Ken strip mine from Ken Coal Co., the Alston strip mine from Alston Coal Co., and the Pond River strip and Vogue strip mines from Terteling Bros., Inc., opened the River Queen strip mine, and became the leading coal-producing company in the State. At the River Queen strip mine the company placed in operation one of the largest mobile land machines ever built in the United States, a 2,400-ton power shovel capable of moving a 100,000-ton mountain in 24 hours.

TABLE 5.—Coal production, 1948–52 (average) and 1953–57

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1948–52 (average)	72, 850	\$367, 508	1956	74, 555	\$331, 358
1953.....	65, 060	302, 872	1957	74, 667	338, 109
1954.....	56, 964	236, 737	Earliest record to date....	2, 515, 622	(1)
1955.....	69, 020	288, 665			

¹ Data not available.

Natural Gas.—Marketed production of natural gas increased 5 percent over 1956 but was 20 percent below 1947, the record year.

TABLE 6.—Marketed production of natural gas, 1948–52 (average) and 1953–57

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1948–52 (average)	68, 957	\$13, 935	1955	73, 214	\$17, 352
1953.....	71, 405	15, 638	1956.....	73, 687	17, 022
1954.....	72, 713	16, 579	1957.....	¹ 77, 300	¹ 18, 100

¹ Preliminary figure.

Natural-Gas Liquids.—*Natural Gasoline.*—Production of natural gasoline decreased 1 percent below 1956 and 1 percent below 1953, the record year.

LP-Gases.—Production of liquefied-petroleum gases declined 29 percent below 1956, the peak year.

Petroleum.—Production of crude petroleum was the second highest in history, but was 4 percent below 1956, the record year.

TABLE 7.—Production of natural gasoline, 1948-52 (average) and 1953-57

Year	Thousand gallons	Value (thousands)	Year	Thousand gallons	Value (thousands)
1948-52 (average).....	14, 108	\$1, 042	1955.....	34, 991	\$2, 492
1953.....	35, 406	2, 394	1956.....	35, 275	2, 414
1954.....	28, 224	1, 552	1957.....	34, 956	1, 935

TABLE 8.—Production of LP-gases, 1948-52 (average) and 1953-57

Year	Thousand gallons	Value (thousands)	Year	Thousand gallons	Value (thousands)
1948-52 (average).....	83, 164	\$2, 205	1955.....	189, 247	\$6, 451
1953.....	176, 232	4, 993	1956.....	248, 992	8, 709
1954.....	189, 966	5, 066	1957.....	176, 033	7, 403

TABLE 9.—Production of crude petroleum, 1948-52 (average) and 1953-57

Year	Thousand barrels	Value (thousands)	Year	Thousand barrels	Value (thousands)
1948-52 (average).....	10, 305	\$28, 482	1955.....	15, 518	\$44, 850
1953.....	11, 518	33, 520	1956.....	17, 628	51, 297
1954.....	13, 791	40, 270	1957.....	16, 879	52, 831

TABLE 10.—Production of crude petroleum by counties, 1956-57,¹ in barrels

County	1956	1957	County	1956	1957
Allen.....	71, 010	72, 517	Letcher.....	128	86
Barren.....	64, 356	59, 886	Lincoln.....		1, 771
Bath.....	5, 395	4, 791	Logan.....	4, 053	3, 726
Boyd.....	702	1, 239	McCreary.....	3, 637	1, 318
Breathitt.....	39, 332	32, 361	McLean.....	1, 137, 926	935, 049
Breckinridge.....	32, 554	85, 269	Magoffin.....	2, 064, 241	1, 852, 691
Butler.....	105, 471	113, 645	Martin.....	30, 248	27, 152
Christian.....	1, 833, 547	953, 110	Meade.....	77	67
Clinton.....	69, 306	61, 911	Menifee.....	503	74
Crittenden.....	1, 071	689	Metcalfe.....	29	136
Cumberland.....	22, 087	22, 777	Monroe.....	1, 097	176
Davies.....	1, 461, 657	1, 610, 982	Montgomery.....	76	125
Edmonson.....	207	30	Morgan.....	917	884
Elliott.....	114, 486	119, 991	Mublenberg.....	927, 183	1, 102, 383
Estill.....	157, 419	140, 371	Ohio.....	1, 243, 926	1, 186, 085
Floyd.....	17, 997	19, 102	Owsley.....	1, 383	1, 279
Grayson.....	67	48	Perry.....		43
Green.....	9, 464	32, 567	Pike.....	34, 527	50, 095
Greenup.....	1, 767	1, 852	Powell.....	59, 405	63, 524
Hancock.....	507, 609	442, 913	Robertson.....		82
Hart.....	33, 699	31, 390	Russell.....	267	375
Henderson.....	3, 053, 808	3, 009, 132	Simpson.....	12, 537	21, 003
Hopkins.....	40, 430	132, 695	Taylor.....		385
Jackson.....	1, 102	1, 278	Todd.....	29, 742	12, 339
Johnson.....	274, 139	248, 091	Union.....	1, 952, 599	1, 956, 291
Knott.....	20, 240	16, 311	Warren.....	48, 229	47, 324
Knox.....	2, 806	2, 768	Wayne.....	20, 356	16, 116
Laurel.....	216		Webster.....	1, 360, 158	1, 422, 431
Lawrence.....	155, 348	173, 969	Wolfe.....	57, 410	58, 364
Lee.....	537, 505	720, 211			
Leslie.....	899	2, 730	Total.....	17, 623, 000	16, 879, 000

¹ Data from Kentucky Geological Survey.

NONMETALS

Cement.—Kosmos Portland Cement Co., Kentucky's only cement producer, operated the Kosmosdale plant during the year. Ship-

ments of masonry cement decreased 8 percent below 1956, and shipments of portland cement decreased 10 percent below 1956, the record year. Raw materials used in cement included limestone (82 percent), clay (15 percent), gypsum (2 percent), and iron ore (1 percent).

Clays.—Four companies mined ball clay in Graves County for art pottery, enameling, floor and wall tile, firebrick and block, fire-clay mortar, saggars, plastics, and other uses. Leading producers were Kentucky-Tennessee Clay Co. and Old Hickory Clay Co. Production decreased 12 percent below 1956, the record year.

Eight companies mined fire clay at 13 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 increased 9 percent above 1956 but was 43 percent below 1951, the record year.

Fifteen companies mined miscellaneous clay in 11 counties for art pottery, floor and wall tile, heavy clay products, lightweight aggregate, and cement. The leading producers were Kenlite Division of Kentucky Light Aggregates, Inc., and Kosmos Portland Cement Co. Production was 5 percent below 1956, the record year.

TABLE 11.—Clays sold or used by producers, 1948–52 (average), and 1953–57

	Ball clay		Fire clay		Miscellaneous clay		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948–52 (average) ----	103	\$1,268	484	\$2,628	193	\$186	780	\$4,082
1953 -----	101	974	348	1,810	262	334	711	3,118
1954 -----	96	1,264	197	1,316	278	415	571	2,995
1955 -----	112	1,499	342	2,316	422	601	876	4,416
1956 -----	115	1,501	303	1,912	487	666	905	4,079
1957 -----	102	1,333	330	1,968	462	614	894	3,915

Fluorspar.—Eleven companies or individuals mined fluorspar in Caldwell, Crittenden, and Livingston Counties for hydrofluoric acid, glass manufacture, special fluxes, iron foundries, and steel manufacture. The leading producers were Calvert City Chemical Co. and J. Willis Crider Fluorspar Co. Marketable production increased 44 percent above 1956 but was 86 percent below 1941, the record year. Eight companies processed or blended fluorspar purchased from producers in Illinois, Kentucky, or Mexico for shipment to consumers; the leading shipper was Kentucky Fluorspar Co.

TABLE 12.—Marketable production of fluorspar, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average) -----	65,565	\$2,183,140	1956 -----	13,965	\$569,243
1953 -----	42,355	1,883,100	1957 -----	20,066	955,025
1954 -----	34,746	1,464,500			
1955 -----	9,706	333,255	Earliest record to date ...	2,840,000	(¹)

¹ Data not available.

Sand and Gravel.—Twenty-four companies mined sand and gravel at 30 mines in 20 counties. The leading producers were Louisville

TABLE 13.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956						1957					
	Sand		Gravel		Total		Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	2,024,359	\$2,189,029	1,430,238	\$1,615,376	3,454,597	\$3,804,405	1,008,215	\$1,905,750	1,164,546	\$1,226,100	3,072,761	\$3,131,850
Paving.....	805,850	805,079	1,258,516	1,231,204	2,064,366	2,030,283	608,744	653,473	589,617	589,591	1,198,361	1,243,064
Other.....	93,971	97,556	71,190	36,048	165,161	136,001	(1)	(1)	(1)	(1)	211,365	181,198
Total.....	2,924,180	3,091,664	2,759,944	2,882,628	5,684,124	5,974,292	(1)	(1)	(1)	(1)	4,482,487	4,556,112

1 Figure withheld to avoid disclosing individual company confidential data.

Sand & Gravel Co. and Bedford-Nugent Co., Inc. Production decreased 21 percent below 1956, the peak year.

TABLE 14.—Sand and gravel sold or used by producers, 1948–52 (average) and 1953–57

Year	Sand		Gravel		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948–52 (average).....	(1)	(1)	(1)	(1)	2,598	\$2,318
1953.....	1,400	\$1,323	1,652	\$1,577	3,052	2,900
1954.....	2,653	2,424	2,077	1,978	4,730	4,402
1955.....	(1)	(1)	(1)	(1)	4,899	5,298
1956.....	2,924	3,092	2,760	2,882	5,684	5,974
1957.....	(1)	(1)	(1)	(1)	4,482	4,556

¹ Figure withheld to avoid disclosing individual company confidential data.

Stone.—Seventy-two producers crushed limestone at 93 quarries in 59 counties. The leading producers were Kentucky Stone Co. (Anderson, Breckinridge, Hardin, Jessamine, Lee, Logan, Madison, Rockcastle, and Todd Counties) and Central Rock Co. (Fayette County). Production of crushed limestone increased 10 percent over 1956 and 7 percent over 1955, the previous record year.

TABLE 15.—Crushed and broken stone sold or used by producers, 1948–52 (average) and 1953–57

Year	Limestone		Sandstone		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948–52 (average).....	7,293	\$8,873	(1)	(1)	(1)	(1)
1953.....	7,430	9,268			7,430	\$9,268
1954.....	10,121	13,238	7	\$20	10,128	13,258
1955.....	11,922	15,521	9	20	11,931	15,541
1956.....	11,544	15,286	7	15	11,551	15,301
1957.....	12,709	16,663	7	15	12,716	16,678

¹ Figure withheld to avoid disclosing individual company confidential data.

TABLE 16.—Crushed limestone sold or used by producers, 1956–57, by uses

Use	1956		1957		Percent of change in—	
	Short tons	Value	Short tons	Value	Short tons	Value
Concrete and roads.....	8,959,279	\$12,121,944	10,278,302	\$13,654,894	Plus 15....	Plus 13.
Agstone.....	967,342	1,276,722	1,101,930	1,444,770	Plus 14....	Plus 13.
Railroad ballast.....	513,556	460,652	553,234	475,505	Plus 8....	Plus 3.
Riprap.....	372,540	373,287	(1)	(1)	(1).....	(1).
Asphalt filler.....	75,000	150,000	(1)	(1)	(1).....	(1).
Fertilizer filler.....	4,800	6,480	(1)	(1)	(1).....	(1).
Other uses.....	651,897	896,838	775,065	1,088,168	(2).....	(2).
Total.....	11,544,414	15,285,923	12,708,531	16,683,337	Plus 10....	Plus 9.

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

² Data not comparable.

Levi Polly crushed sandstone in Bell County for concrete aggregate and roadstone. Four companies quarried 2,200 tons of dimension sandstone in Livingston, Logan, and McCreary Counties for rubble and rough architectural building stone and for flagging, compared with 1,800 tons in 1956. The leading producers were Kentucky flagstone Co. and Kentucky-Kolar Stone Corp. in Logan County.

Vermiculite.—Zonolite Co. exfoliated, screened and cleaned vermiculite from South Carolina, Montana, and South Africa at its Wilder plant.

METALS

Ferroalloys.—Shipments of ferroalloys, including ferromanganese, silicomanganese, silvery pig iron, ferrosilicon, ferrochromium, and chromic silicide, was 1 percent less than in 1956.

Lead.—Byproduct recovery of lead from fluorspar milling was 80 percent more than in 1956.

Pig Iron and Steel.—Armco Steel Corp. produced foundry and basic pig iron at Ashland; shipments increased 28 percent over 1956. Steel was produced by Acme Steel Co. at Newport and by Armco Steel Corp. Iron ore consumed was 63 percent domestic and 37 percent imported. Total imports, mainly from Labrador and Brazil, more than doubled those in 1956 and exceeded any previous year.

Silver.—Recovery of a small quantity of silver from lead and zinc concentrates was reported.

Zinc.—Recovery of byproduct zinc from fluorspar milling doubled that in 1956.

REVIEW BY COUNTIES

Of 120 counties in the State, 96 reported mineral production compared with 94 in 1956. Leading counties were the large coal producers—Harlan, Pike, Hopkins, Letcher, Floyd, Perry, and Muhlenberg—which supplied 58 percent of the total State value.

Adair.—Shamrock Stone, Inc. (Butler quarry), crushed 103,000 tons of limestone for concrete aggregate, roadstone, and agstone.

TABLE 18.—Crushed limestone sold or used by producers in Adair County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	79,024	\$107,252	1955.....	108,936	\$153,910
1953.....	132,341	175,500	1956.....	92,715	138,330
1954.....	103,362	144,250	1957.....	102,647	145,065

Anderson.—Kentucky Stone Co. (Tyrone mine) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone.

Ballard.—The Kentucky State Highway Department mined 30,000 tons of paving gravel.

Barren.—J. F. Pace Construction Co. crushed 185,000 tons of limestone for concrete aggregate, roadstone, and agstone.

TABLE 17.—Value of mineral production in Kentucky, 1956-57, by counties

County	1956	1957	Minerals produced in 1957 in order of value *
Adair.....	\$138,330	\$145,065	Limestone.
Allen.....	144,000	(?)	Limestone.
Anderson.....	(?)	(?)	Sand and gravel.
Ballard.....	6,697	27,948	Limestone.
Barren.....	150,182	232,076	Coal, sandstone.
Bell.....	(?)	4,934,421	Limestone.
Boone.....	(?)	(?)	Sand and gravel.
Bourbon.....	119,277	149,546	Limestone.
Boyd.....	(?)	1,074,193	Coal, miscellaneous clay.
Boyle.....	315,784	351,444	Limestone.
Breathitt.....	3,776,169	4,678,155	Coal.
Breckinridge.....	(?)	(?)	Limestone, miscellaneous clay.
Bullitt.....	(?)	(?)	Do.
Butler.....	466,557	469,477	Coal.
Caldwell.....	148,108	(?)	Limestone, fluorspar.
Calloway.....	8,162	52,999	Sand and gravel.
Carlisle.....	1,500	5,231	Do.
Carroll.....	(?)	320,000	Do.
Carter.....	2,611,482	(?)	Fire clay, coal, limestone.
Casey.....	250,000	(?)	Limestone.
Christian.....	962,947	(?)	Limestone, coal.
Clark.....	227,125	(?)	Limestone.
Clay.....	5,220,798	4,636,227	Coal.
Clinton.....	259,724	164,706	Limestone, coal.
Crittenden.....	492,795	(?)	Limestone, fluorspar.
Cumberland.....	4,148	(?)	Coal, sand and gravel.
Daviess.....	3,752,757	3,003,864	Limestone.
Edmonson.....	108,000	(?)	Coal.
Elliott.....	50,150	84,596	Limestone.
Estill.....	(?)	(?)	Do.
Fayette.....	647,714	(?)	Limestone, sand and gravel.
Fleming.....	960,230	(?)	Coal.
Floyd.....	(?)	29,770,248	Limestone.
Franklin.....	346,295	374,222	Sand and gravel.
Fulton.....	(?)	(?)	Do.
Gallatin.....	875,834	(?)	Limestone.
Garrard.....	(?)	(?)	Ball clay, sand and gravel.
Graves.....	1,501,550	1,387,499	Limestone, coal.
Grayson.....	(?)	(?)	Fire clay, sand and gravel.
Greenup.....	138,448	(?)	Coal, miscellaneous clay, sand and gravel.
Hancock.....	106,120	224,835	Limestone.
Hardin.....	656,635	578,892	Coal, limestone.
Harlan.....	(?)	(?)	Limestone.
Harrison.....	(?)	(?)	Do.
Hart.....	147,500	144,235	Coal, sand and gravel.
Henderson.....	1,674,034	(?)	Sand and gravel.
Hickman.....	7,095	27,862	Coal, miscellaneous clay.
Hopkins.....	51,263,342	46,747,615	Coal, limestone.
Jackson.....	606,626	(?)	Cement, sand and gravel, limestone, miscellaneous clay.
Jefferson.....	10,471,782	10,269,886	Limestone.
Jessamine.....	(?)	(?)	Coal.
Johnson.....	1,918,077	1,499,040	Coal.
Kenton.....	19,950	16,200	Limestone.
Knott.....	3,971,623	5,193,871	Coal.
Knox.....	1,355,290	1,070,634	Do.
Laurel.....	641,743	786,812	Do.
Lawrence.....	134,402	122,378	Do.
Lee.....	(?)	(?)	Coal, limestone.
Leslie.....	11,787,827	12,896,398	Coal.
Letcher.....	33,195,739	(?)	Coal, limestone.
Livingston.....	(?)	(?)	Limestone, fluorspar, zinc, lead, sandstone, silver.
Logan.....	(?)	(?)	Limestone, sandstone.
Madison.....	(?)	(?)	Limestone, miscellaneous clay.
Magoffin.....	18,759	(?)	Coal.
Marion.....	219,000	(?)	Limestone.
Marshall.....	20,024	8,305	Sand and gravel.
Martin.....	138,168	(?)	Coal.
Mason.....	76,880	83,680	Sand and gravel.
McCracken.....	250,650	(?)	Do.
McCreary.....	2,333,665	(?)	Coal, sandstone.
Meade.....	(?)	(?)	Limestone.
Menifee.....	120,117	107,167	Do.
Mercer.....	114,236	(?)	Do.
Metcalfe.....	92,685	75,000	Do.
Monroe.....	(?)	(?)	Do.
Morgan.....	627,650	640,144	Coal, limestone.
Muhlenberg.....	(?)	(?)	Do.

* See footnotes at end of table.

TABLE 17.—Value of mineral production in Kentucky, 1956-57, by counties¹—Continued

County	1956	1957	Minerals produced in 1957 in order of value ²
Nelson.....	\$211, 000	(3)	Limestone.
Nicholas.....		(3)	Do.
Ohio.....	9, 177, 693	(3)	Coal, limestone.
Oldham.....	135, 000	(3)	Limestone.
Owsley.....	57, 062		
Pendleton.....	349, 550	(3)	Limestone.
Perry.....	27, 361, 638	\$29, 529, 520	Coal.
Pike.....	47, 114, 990	(3)	Coal, sand and gravel, limestone.
Powell.....	(3)	(3)	Limestone, miscellaneous clay.
Pulaski.....	(3)	(3)	Coal, limestone.
Rockcastle.....	(3)	(3)	Limestone, coal.
Rowan.....	(3)	(3)	Limestone, miscellaneous clay.
Simpson.....	111, 000	(3)	Limestone.
Todd.....	97, 822	(3)	Do.
Trigg.....		(3)	Do.
Union.....	8, 885, 814	(3)	Coal, sand and gravel, miscellaneous clay.
Warren.....	139, 100	(3)	Limestone.
Washington.....		(3)	Limestone.
Wayne.....	252, 195	281, 950	Coal, limestone.
Webster.....	3, 754, 972	5, 407, 695	Coal.
Whitley.....	1, 306, 618	(3)	Coal, miscellaneous clay, limestone.
Wolfe.....	21, 750	(3)	Coal.
Undistributed.....	199, 107, 384	282, 779, 464	
Total.....	443, 168, 000	450, 354, 000	

¹ County figures exclude native asphalt, natural gas, natural-gas liquids, and petroleum; included with "Undistributed." The following counties are not listed because no production was reported: Bath, Bracken, Campbell, Grant, Green, Henry, Larue, Lewis, Lincoln, Lyon, McLean, Montgomery, Owen, Robertson, Russell, Scott, Shelby, Spencer, Taylor, Trimble, and Woodford.

² Other than native asphalt, natural gas, natural-gas liquids, and petroleum.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Bell.—Seventy mines produced 1,087,000 tons of coal; leading producers were Crockett mine (Kentucky Ridge Coal Co.) and Fork Ridge strip mine (C. H. Groves Co.). Levi Polly (Pine Mountain quarry) crushed 7,000 tons of sandstone for concrete aggregate and roadstone.

Boone.—Belleview Gravel Co. and Kentucky Sand Co. mined sand and gravel for structural, paving, and other uses.

Bourbon.—Bourbon Limestone Co. (Snapp quarry) crushed 95,000 tons of limestone for concrete aggregate, roadstone, and agstone.

Boyd.—Three mines produced 240,000 tons of coal; the leading producer was the Coalton strip mine (Charles E. Yates). Big Run Coal & Clay Co., Inc. (Princess mine), mined miscellaneous clay for heavy clay products.

Boyle.—Boyle County Highway Department (Perryville quarry) and Caldwell Stone Co., Inc. (Danville quarry), crushed 280,000 tons of limestone for concrete aggregate, roadstone, and agstone.

TABLE 19.—Crushed limestone sold or used by producers in Boyle County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	171, 538	\$233, 443	1955.....	181, 661	\$275, 996
1953.....	143, 885	177, 010	1956.....	212, 195	315, 784
1954.....	176, 291	219, 441	1957.....	279, 159	351, 444

Breathitt.—Twenty-two mines produced 834,000 tons of coal; the leading producer was No. 3 Elkhorn mine (Island Creek Coal Co.).

Breckinridge.—Hardinsburg Stone Co. and Kentucky Stone Co. (Irvington quarry) produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, and agstone.

Murray Tile Co. (Cloverport mine) mined miscellaneous clay for heavy clay products.

Bullitt.—Toll Road Stone Co. and Breslin Construction Co. opened new quarries and crushed limestone for concrete aggregate and roadstone. Kentucky Light Aggregates, Inc. (Shepherdsville mine), mined miscellaneous clay for lightweight aggregates.

Butler.—Five mines produced 120,000 tons of coal; leading producers were the Williams South Hill mine (Williams Bros. Mining Co.) and Green River No. 2 mine (M. R. Melton Coal Co.).

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 14 tons of fluorspar.

Calloway.—The State highway department and Calloway County Highway Department mined paving gravel. Ford Construction Co. mined structural sand.

Carlisle.—The State highway department mined 5,000 tons of paving gravel.

Carroll.—Carrollton Gravel-Sand Co., Inc., and Standard Materials Co. mined 636,000 tons of structural sand and structural and railroad-ballast gravel.

Carter.—Eleven mines produced 267,000 tons of fire clay for fire-brick and block, fire-clay mortar, and heavy clay products. The leading producer was General Refractories Co. (Olive Hill mine). Coal production was 143,000 tons from 5 mines; the leading producers were Grayson Block mine (Fields Branch Coal Co.) and No. 1 mine (Gollihue & Kiser Coal Co.). Standard Slag Co. crushed limestone for concrete aggregate and roadstone.

TABLE 20.—Fire clay sold or used by producers in Carter County, 1953–57

Year	Short tons	Value	Year	Short tons	Value
1953.....	230,343	\$1,487,183	1956.....	286,643	\$1,862,120
1954.....	187,832	1,217,236	1957.....	266,762	1,659,585
1955.....	308,221	2,141,107			

Casey.—Casey Stone Co. (Bethel Ridge mine) produced limestone for riprap, concrete aggregate, roadstone, and agstone.

Christian.—Three quarries crushed limestone for concrete aggregate, roadstone, agstone, rock dust for coal mines, and other uses; the leading producer was Hopkinsville Stone Co., Inc. Coal production was 1,200 tons from the No. 1 Strip mine (Barnett Bros. Coal Co.).

Clark.—The Allen-Codell Co., Inc. (Boonesboro mine), produced limestone for riprap, concrete aggregate, roadstone, and agstone.

Clay.—Coal production was 1,207,000 tons from 52 mines. The No. 4 mine (Hacker Coal Co.) and No. 1 strip mine (Ikerd-Bandy Co., Inc.) were the leading producers.

Clinton.—Shamrock Stone, Inc. (Caldwell quarry), crushed 85,000 tons of limestone for concrete aggregate, roadstone, and agstone. Three mines produced 18,000 tons of coal; the leading producer was Gwinn mine (O. D. Gwinn Coal Co.).

Crittenden.—Alexander Stone Co. (No. 1 quarry) produced limestone for riprap, concrete aggregate, roadstone, and agstone. J. Willis Crider Fluorspar Co. operated the Pigmy mine and shipped 4,200 tons of fluorspar. Reynolds Metal Co. (Ben Belt mine) completed a DMEA contract. Kentucky Fluorspar Co., Roberts & Frazier, 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.

TABLE 21.—Crushed limestone sold or used by producers in Crittenden County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	218, 900	\$263, 671	1955.....	282, 127	\$346, 800
1953.....	217, 863	275, 929	1956.....	215, 910	275, 997
1954.....	171, 578	220, 723	1957.....	(¹)	(¹)

¹ Figure withheld to avoid disclosing individual company confidential data.

Daviess.—The output of coal from 6 mines totaled 1,050,000 tons. The K-9 strip mine (Green Coal Co.) was the leading producer. Owensboro River Sand & Gravel Co. and Daviess County Sand & Gravel Co. mined 203,000 tons of structural, paving, and engine sand and 83,000 tons of structural and paving gravel.

Edmonson.—McLellan Stone Co. (No. 4 quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Kentucky Rock Asphalt Co. shipped only from stock on hand.

Elliott.—Coal production was 25,000 tons; the leading producer was No. 2 mine (Copley Coal Co.).

Estill.—Estill County Stone Co. crushed limestone for concrete aggregate and roadstone.

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. Fleming County Highway Department mined 1,600 tons of paving gravel.

Floyd.—Floyd County ranked fifth in the State in total value of mineral production. Coal production totaled 5,212,000 tons, and 354 mines were active. The leading producers were Wheelwright mine (Inland Steel Co.) and No. 1 and No. 2 mines (Princess Elkhorn Coal Co.).

Franklin.—Blanton Stone Co., Inc. (Frankfort mine), and Frankfort Builders Supply Co., Inc. (Devil's Hollow mine), crushed 298,000 tons of 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) mined structural and paving sand and gravel.

Garrard.—Camp Nelson Stone Co. crushed limestone for concrete aggregate and roadstone.

TABLE 22.—Crushed limestone sold or used by producers in Franklin County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	251,710	\$297,599	1955.....	324,896	\$406,021
1953.....	312,248	375,699	1956.....	260,996	346,295
1954.....	266,031	323,474	1957.....	298,222	374,222

Graves.—Four mines produced 102,000 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 69,000 tons of 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, reporting 1,100 tons.

Greenup.—Harbison-Walker Refractories Co. (Riggs mine) and M. A. McCoy (Greenup mine) mined fire clay for firebrick and block. Worthington Sand & Gravel Co., Inc., mined 56,000 tons of structural and paving sand and gravel.

Hancock.—The output of coal from 2 mines was 34,000 tons; Mason-Dixon Corp. was the leading producer. Four mines produced 77,000 tons of miscellaneous clay for heavy clay products; Owensboro and Lewisport mines of Owensboro Sewer Pipe Co. were the leading producers. Tri-State Aggregate Corp. mined 35,000 tons of structural and paving sand and gravel.

Hardin.—Kentucky Stone Co. (Upton quarry and Lilmay mine), Osborne Bros., and Waters Construction Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Harlan.—Harlan County led the State in total value of mineral production. Coal production from 175 mines was 8,332,000 tons. The No. 32 mine (United States Steel Corp.) No. 2 mine (International Harvester Co.), and Harlan mine (Black Star Coal Corp.) were the principal producers. Sam Nally Co. crushed limestone for concrete aggregate and roadstone.

Harrison.—Genet Stone Co. (Cynthiana quarry) and Harrison County Highway Department crushed limestone for concrete, roadstone, and agstone.

Hart.—McLellan Stone Co. (Horse Cave quarry) crushed 107,000 tons of limestone for concrete aggregate, roadstone, and agstone.

TABLE 23.—Crushed limestone sold or used by producers in Hart County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	95,200	\$110,500	1955.....	126,000	\$126,000
1953.....	100,000	100,000	1956.....	118,000	147,500
1954.....	180,000	180,000	1957.....	107,483	144,235

Henderson.—Bedford-Nugent Co., Inc., mined structural, paving, engine, and other sand, and structural, paving, and railroad-ballast gravel. Seven mines produced 274,000 tons of coal; the leading producers were the Mike & Pat mine (Dolph Hazelwood Coal Co.) and No. 1 Henderson mine (Henderson Mining Co., Inc.).

Hickman.—The State highway department mined 32,000 tons of paving gravel.

Hopkins.—Hopkins County ranked third in the State in total value of mineral production. Coal production was 12,699,000 tons from 53 mines. The principal producers were the White City Strip mine (Peabody Coal Co.) and the Pleasant View and East Diamond mines (West Kentucky Coal Co.). Clarkes Clay Products Co. (Ashbyburg mine) mined 1,200 tons of miscellaneous clay for heavy clay products.

Jackson.—Nineteen mines produced 186,000 tons of coal. The leading producers were the Travis Creek mine (Travis Creek Fuel Co.) and the Blie Branch No. 1 and No. 2 mines (Sturgill Coal Co.). M. A. Walker & Co. (Clover Bottom and Indian Creek mines) produced limestone for riprap, concrete aggregate, roadstone, and agstone.

Jefferson.—Kosmos Portland Cement Co. produced masonry and portland cement. Five companies mined 1,424,000 tons of structural, paving, and other sand and 642,000 tons of structural, paving, and railroad-ballast gravel. The leading producers were Louisville Sand & Gravel Co. and Ohio River Sand Co., Inc. Five quarries crushed 1,310,000 tons of limestone 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., General Shale Products Co. (Coral Ridge mine), and Louisville Pottery Co. mined miscellaneous clay for art pottery, cement, and heavy clay products.

TABLE 24.—Sand and gravel sold or used by producers in Jefferson County, 1953-57

Year	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	785, 174	\$625, 370	670, 584	\$724, 414	1, 455, 758	\$1, 349, 784
1954.....	1, 094, 080	1, 132, 041	679, 424	753, 252	1, 773, 504	1, 885, 293
1955.....	914, 290	995, 140	485, 400	581, 856	1, 399, 690	1, 576, 996
1956.....	1, 141, 756	1, 244, 656	563, 793	682, 447	1, 705, 549	1, 927, 103
1957.....	1, 424, 313	1, 567, 477	641, 811	750, 374	2, 066, 124	2, 317, 851

TABLE 25.—Crushed limestone sold or used by producers in Jefferson County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	662, 227	\$872, 989	1955.....	1, 487, 040	\$2, 143, 760
1953.....	1, 334, 256	1, 750, 875	1956.....	1, 431, 695	2, 002, 099
1954.....	1, 824, 549	2, 682, 599	1957.....	1, 310, 416	1, 713, 418

Jessamine.—Kentucky Stone Co. (High Bridge mine) crushed limestone for concrete aggregate, roadstone, and agstone.

Johnson.—Ninety-three mines produced 432,000 tons of coal; the leading producers were the No. 1 mine (Sadler & Kennard Coal Co.), No. 1 mine (Daniels Bros. Coal Co.), and No. 4 mine (Albert Blanton Coal Co.).

Kenton.—Franxman Bros. (Covington quarry) crushed 9,300 tons of limestone for concrete aggregate and roadstone.

Knott.—Coal output totaled 1,351,000 tons from 149 mines. Leading producers were Knott mine (Knott Coal Corp.), No. 1 mine (Collins & Johnson), and No. 15 mine (Buck Branch Coal Corp.).

Knox.—Fifty mines produced 294,000 tons of coal. The outstanding producers were the Osborne No. 2 strip mine (Osborne Mining Co., Inc.), No. 2 mine (Fred T. Ore Coal Co.), and No. 1 strip mine (Callihan & Callihan Coal Co.).

Laurel.—Output of coal from 15 mines was 219,000 tons. The leading producer was the No. 1 strip mine (Laurel Mountain Coal Co.).

Lawrence.—Little Blain Coal Co., Inc. (No. 1 mine), and Black Colt Coal Co., Inc. (Vanhorn No. 1 mine), produced 24,000 tons of coal—the only output in 1957.

Lee.—Six mines produced 124,000 tons of coal; the leading producer was the Pacemaker mine (Congleton Bros., Inc.). Kentucky Stone Co. (Yellow Rock mine) and Central Engineering Co. crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone.

Leslie.—Coal production from 67 mines totaled 2,901,000 tons. The Deby No. 2 mine (Deby Coal Co.), No. 1 mine (Liberty Coal Co.), and Nos. 6, 4, 7, and 8 mines (Shamrock Coal Co.) were the leading producers.

Letcher.—Letcher County ranked fourth in the State in total value of mineral production. Coal production was 6,178,000 tons, and 282 mines were active. The principal producers were the Nos. 21 and 22 mines (Bethlehem Mines Corp.) and Lynch No. 31 mine (United States Steel Corp.). Levisa Stone Corp. (Jenkins quarry) and Hurricane Gap Quarries, Inc., crushed limestone for concrete aggregate, roadstone, and asphalt filler.

Livingston.—Reed Crushed Stone Co., Inc. (Grand Rivers quarry), and Franklin Limestone Co. (Barrett's quarry) produced limestone for riprap, concrete aggregate, roadstone, and agstone. Four mines produced fluorspar; the leading producers were Dyer's Hill mine (Calvert City Chemical Co.) and Nancy Hanks mine (Tinsley & Loyd). Reynolds Metal Co. began a DMEA project for exploration of fluorspar on the Kemper property, totaling \$45,890, of which the Government share was 50 percent. Salem Building Stone Co. opened a new quarry, production was 600 tons of dimension sandstone for rough architectural use. Small quantities of lead, silver, and zinc were recovered from milling 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) produced 1,600 tons of dimension sandstone for rough architectural building stone and for flagging.

Madison.—Kentucky Stone Co. (Boouesboro mine) crushed limestone for concrete aggregate, roadstone, and agstone. Cornelison Pottery Co. mined 110 tons of miscellaneous clay for art pottery.

Magoffin.—Three companies mined coal; the leading producer was the No. 1 Auger mine (Tip Top Coal Co.).

Marion.—Lebanon Stone Co. and Ward & Montgomery crushed limestone for concrete aggregate, roadstone, and agstone.

Marshall.—The State highway department mined 15,000 tons of paving gravel.

Martin.—Two companies mined coal; the leading producer was the No. 2 mine (Webbs Coal & Mining Co.).

Mason.—J. F. Hardymon Co. mined 35,000 tons of structural sand and 17,000 tons of structural gravel.

McCracken.—Federal Materials Co., Inc., mined structural, paving, and engine sand and railroad-ballast gravel.

McCreary.—Coal production came from 12 active mines; the leading producers were Nos. 16 and 18 mines (Stearns Coal & Lumber Co.) and Holly Hill & Hayes Creek strip mines (R. B. Campbell & Son Coal Co., Inc.). Thomas C. Mayne (Day Ridge quarry) quarried 52 tons of dimension sandstone for rubble and for flagging

Meade.—Kosmos Portland Cement Co. and Owensboro River Sand & Gravel Co. crushed limestone for concrete aggregate, roadstone, agstone, and cement.

Menifee.—A. W. Walker & Son (Frenchburg quarry) crushed 65,000 tons of limestone for concrete aggregate, roadstone, and agstone.

Mercer.—Three quarries produced crushed limestone for concrete aggregate, roadstone, and agstone; the leading producer was Mercer Stone Co.

Metcalfe.—Montgomery & Co. (Chapman quarry) crushed 50,000 tons of limestone for concrete aggregate, roadstone, and agstone.

Monroe.—Trico Stone Co. (Monroe quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Morgan.—Eight mines produced 133,000 tons of coal; the No. 1 mine (Walter Vest Coal Co.) and the Nos. 1 and 2 strip mines (Andrew Reed Coal Co.) were the leading producers. Licking River Limestone Co. (Zag quarry) crushed 76,000 tons of limestone for concrete aggregate, roadstone, agstone, and other uses.

Muhlenberg.—Muhlenberg County ranked seventh in the State in total value of mineral production. Coal output totaled 7,177,000 tons from 26 mines. The leading producers were the Gibraltar strip mine (Gibraltar Coal Corp.), Paradise strip mine (Pittsburgh & Midway Coal Mining Co.), and the Crescent mine (Nashville Coal Co., Inc.), Greenville Quarries, Inc., and Luzerne Limestone Quarry, Inc., crushed limestone for concrete aggregate, roadstone, and agstone.

Nelson.—Geoghegan & Mathis crushed limestone for concrete and roadstone.

Nicholas.—Nicholas County Fiscal Court crushed 25,000 tons of limestone for concrete aggregate and roadstone.

Ohio.—Fourteen mines produced 3,027,000 tons of coal. The Ken strip and Alston strip mines (Peabody Coal Co.) and the No. 1 strip mine (Riverview Coal Co.) were the leading producers. Fort Hartford Stone Co. and State Contracting & Stone Co. produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, and agstone.

Oldham.—W. T. Liter and Joe Clark crushed limestone for concrete aggregate and roadstone.

Pendleton.—Geoghegan & Mathis (Butler and Falmouth quarries) crushed limestone for concrete aggregate and roadstone.

Perry.—Perry County ranked sixth in the State in total value of mineral output. Coal production totaled 6,041,000 tons, and 140 mines were active. The Leatherwood Nos. 1 and 2 mines (Blue Diamond Coal Co.) and the Blair Fork mine (Jewel Ridge Coal Corp.) were the leading producers.

Pike.—Pike County ranked second in the State in total value of mineral output. Coal production totaled 9,210,000 tons from 391 mines. The principal producers were the Stone mine (Eastern Coal Corp.), Republic mine (Republic Steel Corp.), and Kentland No. 1 mine (Kentland-Elkhorn Coal Co.). W. H. Walters-Pike Sand Co. mined structural and engine sand. Johnson Bros. Limestone Co.

opened a new quarry and crushed limestone for concrete aggregate and roadstone.

Powell.—A. W. Walker & Son (Whiterock quarry) crushed 87,000 tons of limestone for concrete aggregate, roadstone, and agstone. H. B. Sipple Brick Co. (Faulkner No. 1 mine) mined miscellaneous clay for heavy clay products.

Pulaski.—Sixteen mines produced 174,000 tons of coal. The No. 1 strip mine (Callihan Coal Co., Inc.) and the Wildcat No. 1 mine (Foster Stokes Coal Co.) were the leading producers. Somerset Stone Co., Inc., and Strunk Construction Co. 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. Eleven mines produced 91,000 tons of coal; the leading producers were the No. 1 strip mine (Cumberland Mining Co.) and the No. 2 strip mine (B. H. Parsons Coal Co.).

Rowan.—Kentucky Road Oiling Co. (Christy quarry) and Morehead Limestone Co. crushed limestone for fluxing stone, concrete aggregate, roadstone, and agstone. Lee Clay Products Co., Inc., mined miscellaneous clay for heavy clay products.

Simpson.—Southern Stone Co., Inc. (Franklin quarry), crushed limestone for concrete aggregate, roadstone, and agstone.

Todd.—Kentucky Stone Co. (Todd quarry) and D. W. Dickinson (Gallatin quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Trigg.—Cedar Bluff Stone Co., Inc. (Cerulean quarry), crushed limestone for concrete aggregate, roadstone, and agstone.

Union.—Coal production totaled 2,908,000 tons from 6 mines; of these, the Uniontown mine (Nashville Coal Co., Inc.), De Koven mine (P & M Coal Mining Co.), and Poplar Ridge mine (Seneca Coal Co.) were the leading producers. Union Sand & Gravel Co. mined structural and paving sand and gravel. Clarks Clay Products Co. mined 4,000 tons of miscellaneous clay for heavy clay products.

Warren.—Gary Bros. Crushed Stone Co. and McLellan Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Washington.—Nally & Gibson crushed limestone for concrete aggregate and roadstone.

Wayne.—Five mines produced 37,000 tons of coal. The No. 2 strip mine (Hobart Barrier Coal Co.) had the largest output. Bassett Products Co. crushed 60,000 tons of limestone for concrete aggregate, roadstone, and agstone.

Webster.—Coal production totaled 1,714,000 tons from 19 mines. The Precision Washed strip mine (Hart & Hart Coal Co.) and the Choctaw strip mine (Russell Badgett Coal Co.) were the leading producers.

Whitley.—Output of coal from 62 mines was 630,000 tons. The Whitley strip mine (Whitley Strip Mining Co., Inc.) and the No. 3 mine (Reaves Dixie Gem Coal Co.) were the leading producers. Corbin Brick Co. mined miscellaneous clay for heavy clay products. Claiborne Construction & Supply Co. opened a new quarry and crushed limestone for concrete aggregate and roadstone.

Wolfe.—Two companies mined coal; the leading producer was the Miller mine (C. L. Thompson Coal Co.).

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, United States Department of the Interior, and the Louisiana Geological Survey.

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COMPLEX economic forces affected the mineral industries of Louisiana in 1957. National, international, and local events all influenced mineral production. These included the recession of 1957, the Middle East crisis, and Hurricane Audrey. The markets for some minerals were affected by essentially local economic influences; others responded to a combination of factors of local-national or national-international character.

Crude-petroleum output rose sharply with European demand for fuels following the upheaval in the Middle East that resulted from closing of the Suez Canal. As the canal reopened and the international situation stabilized, the peak production of the early months of the year declined in response to national supply-demand forces comparable to those existing before the crisis. Natural-gas output continued to climb with the ever-increasing national demand for this fuel.

The chemical raw materials—salt, sulfur, and lime—experienced moderate declines; this decrease was assessed to have resulted from a general leveling of business activity in the Nation. Sulfur shipments declined because of new and expanding competition from Mexican sulfur and reduction in demand.

Because of the hurricane, floods, prolonged rains and a decline in certain phases of construction, the production of construction raw materials decreased markedly. Sand and gravel recovery was 2.5 million tons lower than in 1956; clay output was 18 percent lower. The growing production and consumption of shell was held a little higher than 1956.

Expansion in Louisiana's alumina-aluminum industry continued during the year. A ninth potline was placed in operation at the Kaiser Aluminum & Chemical Corp. metal-reduction plant at Chalmette. At Burnside and Gramercy substantial progress was made in constructing new alumina plants.

Mineral production totaled \$1,525 million in value. The 18-percent increase over 1956 was due both to greater recovery of liquid and gaseous hydrocarbons and to price increases for a number of minerals.

Employment.—Employment in oil and gas fields, in quarries, pits, and mines and on dredges, increased 3 percent in 1957 compared with 1956. Nine-tenths of the total labor force in the mineral industry was producing petroleum, natural gas, and natural-gas liquids.

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TABLE 1.—Mineral production in Louisiana, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays ².....thousand short tons.....	785	\$785	642	\$642
Gypsum.....do.....	276	598	(³)	(³)
Natural gas.....million cubic feet.....	1,886,302	215,038	⁴ 1,943,900	⁴ 262,400
Natural-gas liquids:				
Natural gasoline and cycle products				
.....thousand gallons.....	773,949	62,394	775,009	63,956
LP-gases.....do.....	305,222	14,727	335,142	14,888
Petroleum (crude).....thousand 42-gallon barrels.....	299,421	877,951	⁴ 323,199	⁴ 1,072,101
Salt (common).....thousand short tons.....	3,704	17,695	3,461	18,944
Sand and gravel.....do.....	⁵ 15,074	18,640	12,579	14,730
Stone ⁶.....do.....	4,405	6,674	4,383	7,152
Sulfur (Frasch-process).....thousand long tons.....	2,239	59,330	2,156	52,690
Value of items that cannot be disclosed: Bentonite, cement, lime, sulfur (recovered elemental) and values indicated by footnote 3.....		16,563		19,110
Total Louisiana ⁷		1,288,331		1,524,928

¹ Production is measured by mine shipments, sales, or marketable production (including consumption by producers).

² Excludes bentonite included with "Value of items that cannot be disclosed."

³ Figure withheld to avoid disclosing individual company data.

⁴ Preliminary figure.

⁵ Final figure—Supersedes figure given in commodity chapter.

⁶ Includes 4,364,067 short tons of oystershell valued at \$6,633,385 in 1956; all shell in 1957.

⁷ Total value has been adjusted to avoid duplicating clays used for cement and oystershell used in producing lime and cement.

The number of workers in this activity increased 4 percent, while the number in nonmetallic production decreased 9 percent compared with 1956. In the 3-year period 1955-57 the increased mining activity created an economic gain of \$62 million to the State, and resulted in a total payroll of \$261 million in 1957.

Mining was an important part of nonagricultural employment in some areas. In Plaquemines Parish, for example, over half of the nonagricultural employment during 1957 was from mining. In Terrebonne Parish the figure was 31 percent; in St. Mary 29 percent; in Iberia 28 percent; and in Lafourche 23 percent.

The average annual wage for oil and gas labor advanced 9 percent to \$5,841. For nonmetallics the increase was 5 percent to an average of \$4,629.

TABLE 2.—Employment and wages in the mineral industries, 1956-57 ¹

Activity	Average number of workers		Total wages and salaries	
	1956	1957	1956	1957 ²
Crude-petroleum production (including associated natural gas production).....	19,660	20,208	\$113,334,000	\$128,874,666
Natural gas and natural-gas liquids.....	1,333	1,261	6,537,000	6,962,906
Oil- and gas-field contract services.....	18,993	20,139	93,742,000	107,184,149
Sand and gravel quarries, pits, and dredges.....	1,491	1,351	4,777,000	4,679,714
Salt mines.....	980	809	3,806,000	3,309,596
Nonmetallic minerals ³	1,911	1,809	10,650,000	10,384,002
Total.....	44,368	45,577	232,846,000	261,395,033

¹ Louisiana State Department of Labor, Division of Employment Security.

² Preliminary figures.

³ Mainly sulfur and shell production workers.

TABLE 3.—Total wage and salaried workers in petroleum production, refining, and related industries, 1953-57¹

Year	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 refining petroleum	Total
1953	28,450	15,900	1,500	4,900	3,500	6,250	10,350	70,850
1954	31,900	15,850	1,450	4,950	3,650	6,600	10,600	75,000
1955	35,900	15,800	1,450	5,100	3,900	7,400	11,350	80,900
1956	40,200	15,500	1,400	5,600	4,400	8,400	12,050	87,550
1957 ²	42,300	15,750	1,400	5,700	5,100	8,800	12,500	91,550

¹ Louisiana State Department of Labor, Division of Employment Security.

² Estimated.

In all phases of petroleum production, refining, and all related industries employment was 4,000 more than in 1956.

In all nonmetallic mining operations in Louisiana during 1957, 47 nonfatal injuries were incurred. The injury rate was 1 nonfatal injury for every 101,000 man-hours. In the mineral processing plants for barite, alumina, aluminum, lime, and cement there were 82 nonfatal injuries; the injury rate was 1 nonfatal injury for every 103,000 man-hours.

Consumption, Trade and Markets.—The output of minerals and mineral fuels in Louisiana depended upon the levels of activity of the chemical industry and construction and upon the demands for crude petroleum, natural gas, and natural-gas liquids. Because of different influences, the output of some minerals was increased; and for others, there was a decline.

Isolating the effect of the Middle East crisis and the heavy demand for crude petroleum in the beginning of the year, the mineral industry in general leveled off somewhat from the strong growth trends of 1955 and 1956. Weather was one of the causes. In 1957 weather was reported to have hindered construction in many areas to a greater extent than in many years. Lack of rain in the middle of the growing season cut into demand for fertilizers. The severe hurricane (Audrey) in the middle of the year caused extensive damage, interrupted production of construction materials, and interfered with drilling activity.

The boom of 1955 and 1956 was essentially a capital expenditure boom in Louisiana. Although capital expenditures in 1957 continued high, they were lower than in the preceding period. Postponing erection of the du Pont Chemical Co. plant at La Place and halting construction at the Kaiser Aluminum & Chemical Co. plant at Gramercy illustrated the pause in capital expansion. According to the Louisiana Department of Commerce and Industry, manufacturing expansion declined from \$563 million in 1956 to \$239 million in 1957. A large part of this expansion was in the chemical and petrochemical industries and in other mineral-processing industries. Construction contracts awarded in 1957 were 3 percent lower than in 1956. There was a sharp cutback in construction of public works and utilities that consume large quantities of mineral construction materials.

In August actual construction was begun on the first project on

the Federal Highway Program in Louisiana in St. Tammany Parish near the Mississippi line. A total of 600 miles was scheduled in Louisiana during the program.

TABLE 4.—Value of construction contracts awarded in Louisiana, 1956-57¹

Type	1956	1957	Percent change
Residential.....	\$189,241,000	\$235,943,000	+24.7
Nonresidential.....	206,844,000	205,035,000	-0.9
Public works and utilities.....	252,176,000	188,653,000	-25.2
Total.....	648,261,000	629,631,000	-2.9

¹ Louisiana Business Review, Dodge Statistical Research Service: Vol. 22, No. 2, February 1958, p. 14.

The economic recession appearing later in the year was not as bad in Louisiana as some areas because of strong growth factors in the State. According to the Division of Research of the College of Commerce of the Louisiana State University, only 9 out of 31 economic indicators of activity in Louisiana compared unfavorably with 1956. Notable among these were a 9-percent decrease in building permits and freight carloadings, a decrease in sales of building materials and an increase in unemployment benefit payments.

Legislation and Government Programs.—The United States Department of the Interior announced plans in 1957 for restricting leasing on Federal wildlife refuges, except where there was a possibility of drainage by adjacent oil wells. In Louisiana there were refuges in Cameron and Jefferson Parishes, as well as the Delta refuge at the mouth of the Mississippi River.

A committee of the Louisiana State Mineral Board began investigating the development of State-owned lands to determine if State leases had been developed for maximum oil, gas, and other mineral production. Leases found not to have been properly developed may be reclaimed for offering to other operators.

The crucial tideland issue between the State of Louisiana and the Federal Government over the extent of Louisiana jurisdiction of the rich offshore areas was not resolved during 1957. In May the Supreme Court heard arguments by the Federal Government to limit Louisiana to a 3-mile offshore boundary. On June 2 the Supreme Court accepted a "friend of the court" brief from the State of Texas concerning the dispute. The Court postponed a decision so that other Gulf Coast States might enter the dispute in an effort to solve the question of offshore ownership with all the States at once. A meeting was called in New Orleans between Louisiana, Alabama, Florida, Mississippi, and Texas. In the dispute Louisiana was claiming a boundary of 10.5 miles into the Gulf of Mexico; the Federal Government claimed that the boundary extended only 3 miles.

Meanwhile drilling continued under an interim agreement between the State and the Federal Government. Moneys for royalties and rentals in the disputed zone were being held in escrow.

The Louisiana Department of Conservation began studies of possible revisions in the systems of petroleum allowables. At that time allow-

ables were based on depth brackets of the producing wells. As a first step a study was concluded that showed costs of drilling wells under various conditions and locations.

REVIEW OF MINERAL COMMODITIES

MINERAL FUELS

Both production and exploratory activities were at high levels in 1957. The State played a major role in supplying crude petroleum to Europe during the early months of the year when shipments of Middle East oil ceased. In the offshore areas operators continued to tap the vast potential.

In the middle of the year Hurricane Audrey caused widespread damage—an estimated overall destruction of \$10 million. One offshore drilling barge was capsized and another beached. Damage to onshore installations, not designed to withstand severe weather, was perhaps even greater than that to offshore equipment.

The problem facing offshore operators in 1957 continued to be a combination of limited oil allowables and rising costs. Because production was restricted to market demand, the payout period for the heavy investments became extended. Exploration, however, was active. To avoid paying rentals on poor leases properties had to be evaluated as soon as possible. Cumulative production in the offshore areas by the end of 1957 was 164 million barrels of crude petroleum and 591 billion cubic feet of natural gas. During the year 53 million barrels of oil and 160 billion cubic feet of natural gas were recovered. Because the tidelands dispute between the Federal Government and Louisiana remained unsettled, leasing was curtailed. Bonuses for leases dropped from \$16 million in 1956 to \$1.5 million in 1957.

TABLE 5.—Production of crude petroleum and natural gas in the Louisiana offshore area, 1957 and cumulative total ¹

Offshore area	1957		Cumulative total	
	Crude petroleum (barrels)	Natural gas (million cubic feet)	Crude petroleum (barrels)	Natural gas (million cubic feet)
Bay Marchand.....	4,321,692	3,374,515	21,515,217	15,228,844
Breton Sound.....	523,403	8,540,121	2,288,901	26,571,969
Cameron East.....	175	2,624	175	2,624
Eloi Bay.....	31,097	97,010	152,498	180,831
Eugene Island.....	6,310,857	49,859,633	19,309,517	250,914,246
Grand Isle.....	3,301,347	2,261,616	9,223,534	5,801,808
Lake Athanasio.....			43,221	25,612
Main Pass.....	11,070,168	20,026,877	41,376,171	53,962,995
Ship Shoal.....	1,139,053	701,193	3,475,443	2,807,707
South Pass.....	21,318,699	25,878,256	56,709,238	59,437,420
South Pelto.....	91,060	153,074	243,993	363,990
South Timbalier.....	144,907	183,799	406,551	346,292
Vermillion.....	207,798	39,766,374	817,935	161,136,239
West Cameron.....	324,596	995,891	1,197,640	2,534,998
West Delta.....	4,049,307	8,626,160	7,708,352	11,687,065
Total offshore.....	52,834,164	160,472,143	164,468,376	591,302,140

¹ Louisiana State Department of Conservation, Annual Oil and Gas Report, 1957: Pp. 74-78.

TABLE 6.—Revenue from oil and gas mineral leases on Louisiana State submerged lands, 1948-57¹

Year	Rentals	Bonuses	Royalty	Year	Rentals	Bonuses	Royalty
1948.....	\$5, 573, 631	\$11, 866, 375	\$32, 524	1953.....	\$1, 300, 176	\$3, 766, 110	\$3, 576, 812
1949.....	7, 663, 728	-----	273, 814	1954.....	2, 091, 481	36, 302, 875	3, 983, 146
1950.....	3, 941, 764	1, 340, 590	941, 800	1955.....	1, 553, 069	44, 212, 535	5, 839, 623
1951.....	867, 455	4, 087, 286	319, 959	1956.....	1, 260, 145	15, 951, 512	6, 342, 202
1952.....	1, 026, 869	8, 933, 573	136, 890	1957.....	941, 055	1, 522, 310	13, 167, 242

¹ Louisiana State Land Office.

Of the 29 million land acres of Louisiana, 1.5 million was oil and/or gas productive, and an estimated 11 million additional acres was under lease.⁴

According to the Louisiana Department of Conservation, at the end of 1957 there were 823 oil and/or gas fields with approximately 27,000 wells capable of producing oil or gas. New wells drilled during the year added about 240,000 barrels per day from old and new reservoirs.

Drilling Costs and Allowables.—To reappraise the system of allowables based on the depth of producing wells, the Department of Conservation made a study of drilling costs for various depths and for different operating conditions. Table 8. is compiled from the data for wells drilled in Louisiana in 1955 in 41 of the 59 parishes producing oil or gas. The averages must be appraised critically because of wide variations in depth brackets in different and in the same areas.

TABLE 7.—Comparison of cost of producing wells drilled in Louisiana, 1955

Lower bracket depth	North Louisiana			South Louisiana—onshore			South Louisiana—offshore		
	Number of wells	Cost (thousands)		Number of wells	Cost (thousands)		Number of wells	Cost (thousands)	
		Range	Average		Range	Average		Range	Average
2,000.....	165	\$8-\$18	\$13	9	\$13-\$89	\$26	2	\$159-\$562	\$361
3,000.....	34	12- 36	16	7	31- 281	78	-----	-----	-----
4,000.....	18	22- 49	30	19	36- 94	51	-----	-----	-----
5,000.....	6	32- 46	38	14	37- 115	68	11	209- 911	354
6,000.....	29	48- 81	67	23	44- 131	77	20	161- 584	304
7,000.....	15	60- 94	65	35	48- 116	80	24	91- 573	267
8,000.....	5	79-146	106	55	66- 256	112	68	94- 823	232
9,000.....	10	106-119	114	131	73- 223	111	101	113-1, 018	234
10,000.....	27	90-232	131	145	86- 360	153	54	107- 574	207
11,000.....	19	182-200	224	120	99- 600	201	26	238-1, 150	586
12,000.....	1	253	257	108	122- 725	261	6	257-1, 124	630
13,000.....	-----	-----	-----	71	133- 710	300	9	359-1, 197	703
14,000.....	-----	-----	-----	65	162- 884	293	-----	-----	-----
15,000.....	-----	-----	-----	19	196-1, 460	576	-----	-----	-----
16,000.....	-----	-----	-----	7	261- 678	437	-----	-----	-----
17,000.....	-----	-----	-----	5	289- 775	477	-----	-----	-----
18,000.....	-----	-----	-----	3	520- 677	625	-----	-----	-----
23,000.....	-----	-----	-----	1	2, 600	2, 600	-----	-----	-----
Total wells.....	329	-----	-----	837	-----	-----	321	-----	-----

⁴ Independent Petroleum Association of America, The Oil Producing Industry in Your State: 1958 ed., p. 25.

Generally increased costs with depth were borne out, although the average cost of some wells was less than that for a well drilled at a shallower depth.

The variations in offshore drilling costs depended principally on the depth of water, the type of equipment employed, and depth.

Locational costs varied with the type of drilling equipment and the area of operation. In North Louisiana the average locational cost for a land rig in a group of 328 wells was \$2,000 per well. In South Louisiana onshore rigs used for 379 wells showed an average locational cost of \$7,000. In a group of 422 wells drilled with inland drilling barges brought to the site by canal, the average locational cost was \$10,000. Offshore, the average costs for locating on the drilling site were \$9,000 for offshore mobile drilling barges, \$86,000 for an offshore platform rig, and \$14,000 for inland drilling barges used offshore.

In September a group of engineers, attorneys, and geologists from oil companies and the Louisiana Department of Conservation met to study ways of revising well allowables. Some companies contended that allowables adjusted to reserves would be more equitable than those based on depth or cost of drilling. The formulas submitted, referred to as the "Humble formula," the "Atlantic formula," and the "Magnolia formula," take into account the per acre productive capacity of producing sands.

Exploration and Reserves.—Exploratory drilling remained about the same as in 1956. Of the 973 exploratory wells drilled, 701 were dry, 106 oil productive, and 166 gas productive. Sixty-seven new oil and/or gas fields resulted from the vast drilling program. Offshore and South Louisiana continued to be active prospecting areas. Offshore exploratory wells totaled 114, compared with 87 in 1956.

Thirty million feet of hole was drilled during the year; of this, 6.7 million feet was exploratory drilling. As shown in table 12, the 10,000- to 12,500-foot depth bracket contained the most wildcat wells drilled.

TABLE 8.—Relationship of production and additions to reserves of crude petroleum, natural gas, and natural-gas liquids, 1948-57¹

Year	Crude petroleum ²		Natural gas ³		Natural-gas liquids ²	
	Production	Net additions to reserves	Production	Net additions to reserves	Production	Net additions to reserves
1948.....	181	78	686	497	17	61
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	293	1,680	5,636	26	52
1956.....	299	420	1,886	2,618	26	79
1957.....	323	182	1,944	6,382	26	4
<i>Total proved reserves by December 31, 1957</i>						
	3,858		51,436		1,019	

¹ Reserves based on American Petroleum Institute statistics.

² Million barrels.

³ Billion cubic feet.

For offshore exploratory drilling, operators were reported showing a preference for mobile drilling barges rather than platforms and tenders or self-contained platforms. If the hole proved dry, expensive platform costs would be avoided.

TABLE 9.—Estimated reserves in offshore area ¹

Field	Estimated reserves (thousand barrels)	Number of wells	Acres ²
Bay Marchand ³	79,640	119	4,000
Belle Isle.....	7,710	9	360
Eugene Island:			
Block 18 and 32.....	26,911	32	1,320
Block 45.....	4,494	6	240
Block 110.....	2,808	3	120
Block 126.....	54,415	65	2,600
Block 128.....	23,480	26	640
Grande Isle:			
Block 16.....	18,806	20	360
Block 18.....	31,167	39	1,200
Block 47.....	18,452	19	400
Main Pass: Block 69 ³	103,099	157	4,200
Ship Shoal: Block 159.....	39,700	41	1,080
South Pass:			
Block 24 ³	113,854	137	7,480
Block 27.....	44,540	49	2,000
West Delta:			
Block 30.....	62,738	67	1,500
Block 53.....	11,908	12	480

¹ Oil and Gas Journal, vol. 56, No. 4, January 1958, p. 165.

² Figures under "Acres" apply to largest reservoir only.

³ Estimated ultimate recovery of 100 million barrels or more.

About 17 percent of the State's crude-petroleum reserves was developed in the offshore area. At the end of 1957, the ratio of crude oil reserves to production was 11.94 to 1.00; for natural gas it was 24.56 to 1.00. The reserve of crude oil was second largest in the Nation.

Of 40,000 wells drilled for oil and gas in Louisiana from 1937-56, 14.4 percent were wildcat wells. Of these wildcats, 7.7 percent in North Louisiana and 20.3 percent in South Louisiana were productive. In 1957, 14.0 percent of the wells drilled for oil and gas in North Louisiana and 18.6 percent in South Louisiana were wildcats. The percentage of wildcats in South Louisiana declined slightly compared with 1956. In 1957 16.1 percent in South Louisiana of wildcats were productive and 10.4 percent in North Louisiana.⁵

Exploratory drilling was most active in Terrebonne, Acadia, Lafourche, Vermilion, Plaquemines, Calcasieu, and Cameron Parishes. In the offshore area the largest number of wells was drilled in the Vermilion, East Cameron, West Cameron, South Timbalier, and West Delta areas.

Geophysical and core-drill prospecting was most intensive in Union, Claiborne, Tensas, Natchitoches, and Sabine Parishes in North Louisiana and in Terrebonne, Lafourche, St. Mary, Vermilion, Plaquemines, and Acadia Parishes in South Louisiana. Offshore activity was centered in the Eugene Island, West Cameron, Vermilion, South Timbalier, and South Marsh Island areas.

⁵ World Oil, vol. 146, No. 3, Feb. 15, 1958, p. 120.

TABLE 10—New oil and gas discoveries in 1957, by parishes 1

Parish	Field	Section	Township	Range	Total depth (feet)	Production depth (feet)	Production daily rate		Type of product
							Barrels	Thousand cubic feet	
NORTH LOUISIANA									
Bossier	Honor	8	18 N.	13 W.	6,461	5,651-5,656	72	36	Oil.
Caddo	Simpson Lake	9	22 N.	14 W.	2,975	2,838-2,837	165		Do.
Catahoula	Mean Lake	32	9 N.	7 E.	5,017	4,371-4,373			Do.
Concordia	Cross Concordie	17	6 N.	8 E.	6,407	5,511-5,525	26		Do.
Do	Varnicott	43	6 N.	9 E.	6,810	3,224-3,226	96	19	Do.
De Soto	Clear Lake	26	14 N.	12 W.	6,355	2,637-2,642	88		Do.
Do	Kingston	9	14 N.	13 W.	6,754	6,220-6,227	1	2,365	Gas condensate.
Do	Oxford	23	11 N.	12 W.	3,065	2,884-2,890	14		Oil.
Grant	Selma	32	9 N.	1 E.	2,785	3,042-3,048	98		Do.
LaSalle	Long Slough	12	5 N.	4 E.	6,010	5,110-5,114	110		Do.
Ouachita	West Monroe	5	17 N.	3 E.	9,931	9,366-9,379	56	1,213	Gas.
Tensas	Chamblee	26	10 N.	11 E.	9,062	9,389-9,400	115	1,000	Gas condensate.
Do	Saranac	9	12 N.	11 E.	8,480	9,032-9,040	146	120	Oil.
Union	Farmerville	8	20 N.	1 E.	11,118	8,896-8,400	230	967	Gas condensate.
Do	Mount Olive	4	21 N.	3 W.	11,100	10,354-10,368	304	975	Do.
Webster	Minden	21	19 N.	8 W.	7,460	7,460-7,466	7	9,600	Condensate.
Whit	Curry	7	10 N.	1 E.	1,456	1,414-1,416			Oil.
SOUTH LOUISIANA									
Allen	Gaster Creek	15	5 S.	3 W.	10,008	9,508-9,517	39	475	Gas.
Do	Northwest Oberlin	9	5 S.	4 W.	9,500	9,240-9,246	23	975	Do.
Do	Pilgrim Church	24	5 S.	5 W.	10,003	9,132-9,142	193	1,294	Do.
Baton Rouge E.	Alsien	71	5 S.	1 W.	12,100	10,104-10,109	113	37	Oil.
Beauregard	West DeQuincy	7	7 S.	11 W.	10,600	9,712-9,720	173	36	Do.
Calcasieu	Northwest Chalkley	30	7 S.	7 W.	11,523	11,274-11,283	100	3,000	Gas
Cameron	E. Cheniere Perdue	26	11 S.	10 W.	10,975	10,341-10,347	21	1,445	Do.
Do	Lower Mud Lake	19	14 S.	6 W.	11,435	11,509-11,416	65	1,850	Do.
Do	Point Blue	8	5 S.	1 E.	12,437	11,632-11,641	100	933	Do.
Evangeline	North Bayou Long	38	5 S.	11 E.	13,000	11,972-11,989	33	3,700	Gas condensate.
Iberia	West Addis	28	12 S.	11 E.	12,021	11,224-11,230	523	518	Oil.
Iberville		43	3 S.	11 E.					

See footnotes at end of table.

TABLE 10—New oil and gas discoveries in 1957, by parishes 1—Continued

Parish	Field	Sec- tion	Town- ship	Range	Total depth (feet)	Production depth (feet)	Production daily rate		Type of product	
							Barrels	Thousand cubic feet		
Jefferson Davis	North Jennings	41	9 S.	3 W.	11,400	10,592-10,667	11	1,850	Gas.	
	Do.	16	7 S.	3 W.	8,825	8,390-8,409	111	1,812	Oil.	
	Do.	38	11 S.	4 W.	14,825	12,808-12,810	173	69	Do.	
	Lafayette	24	10 S.	5 E.	12,415	11,448-11,454	200	1,640	Gas.	
	LaFourche	29	13 S.	17 E.	12,415	12,335-12,350	215	2,200	Condensate.	
Do	St. John	40	14 S.	15 E.	15,278	12,370-12,410	259	3,108	Do.	
	Livingston	49	8 S.	3 E.	10,080	15,204-15,210	76	3,108	Oil.	
Plaquemines	Felice Bayou	35	22 S.	31 E.	9,024	9,709-9,713	3	2,550	Gas.	
	Do.	21	19 S.	25 E.	11,250	6,082-6,094	198	192	Oil.	
St. Charles	Comba Island	36	14 S.	22 E.	10,385	10,364-10,370	123	96	Do.	
	Do.	42	13 S.	20 E.	11,250	7,928-7,944	(*)	2,600	Gas.	
	Do.	19	5 S.	5 E.	11,854	10,656-10,662	360	1,100	Oil.	
	Do.	46	16 S.	13 E.	17,772	9,964-9,970	61	2,238	Gas.	
	Do.	64	15 S.	11 E.	15,125	15,744-15,765	(*)	3,508	Do.	
Terrebonne	Six Mile Lake	64	18 S.	18 E.	12,835	14,672-14,852	141	3,668	Do.	
	Do.	State L.	2649	Isle	13,224	11,370-11,378	198	103	Oil.	
Do	Derieres	51	18 S.	19 F.	13,609	10,710-10,724	125	2,600	Gas.	
	Do.	14	23 S.	16 E.	12,438	12,179-12,184	83	83	Oil.	
	Do.	49	18 S.	18 E.	12,691	8,996-9,005	160	83	Oil.	
	Do.	23	20 S.	12 E.	15,556	12,545-12,556	1	4,020	Gas.	
	Do.	55	16 S.	17 E.	12,835	12,898-12,944	120	2,000	Gas condensate.	
Vermilion	Willow Woods	62	13 S.	3 E.	14,867	11,328-11,338	34	2,645	Gas.	
	Do.	6	11 S.	3 E.	16,002	10,617-10,623	175	20	Oil.	
Do	North Leroy	(White Lake)	6	11 S.	3 E.	12,620-13,690	13,570-13,576	296	526	Do.
	Do.	19	17 S.	14 E.	14,276	13,620-13,690	42	2,511	Gas condensate.	
	Do.	5	13 S.	3 E.	12,810	12,252-12,263	16	4,600	Gas.	
	Do.	32	18 S.	17 E.	12,521	12,248-12,259	20	3,210	Gas condensate.	
	Do.	32	18 S.	17 E.	12,521	11,973-11,983	59	4,450	Condensate.	

SOUTH LOUISIANA—Continued

OFFSHORE AREA

Cameron.....	East Cameron.....	13,316	10,294-10,306	75	16,000	Gas.
Do.....	do.....	8,355	8,166-8,193	147	288	Do.
Plaquemines.....	Main Pass.....	9,235	7,091-7,115	183	-----	Oil.
Do.....	South Pass.....	9,508	3,211-3,221	-----	540	Gas.
Do.....	Eugene Island.....	14,039	12,276-12,285	-----	4,500	Do.
St. Mary.....	Coon Point, Ship Shoal.....	18,002	16,828-16,842	46	4,150	Do.
Terbonne.....	Ship Shoal.....	12,002	9,414-9,425	310	-----	Oil.
Do.....	Ship Shoal.....	15,006	12,768-12,782	168	2,543	Gas.
Do.....	Ship Shoal.....	14,005	8,570-8,574	-----	1,270	Do.
Vermilion.....	Vermilion.....	14,025	8,624-8,629	192	142	Oil.
Do.....	do.....	-----	6,758-6,772	220	99	Do.
Do.....	Block 64.....	-----	-----	-----	-----	-----
Do.....	Block 126.....	-----	-----	-----	-----	-----
Do.....	Block 41.....	-----	-----	-----	-----	-----
Do.....	Block 26.....	-----	-----	-----	-----	-----
Do.....	Block 53.....	-----	-----	-----	-----	-----
Do.....	Block 39.....	-----	-----	-----	-----	-----
Do.....	Block 107.....	-----	-----	-----	-----	-----
Do.....	Block 138.....	-----	-----	-----	-----	-----
Do.....	Block 96.....	-----	-----	-----	-----	-----
Do.....	Block 120.....	-----	-----	-----	-----	-----
Do.....	Block 164.....	-----	-----	-----	-----	-----

1 Louisiana State Department of Conservation, Annual Oil and Gas Report, 1957: Pp. 8-11.

* Estimate.

† Spray dist.

‡ Shut in.

TABLE 11.—Depth of wells in 1957 drilling ¹

Feet	Wildcat			Field development		
	Oil	Gas	Dry	Oil	Gas	Dry
0-1,250.....		1	4	44	5	21
1,250-2,500.....	1		12	471	45	71
2,500-3,750.....	5	1	38	155	21	158
3,750-5,000.....	5		24	96	2	61
5,000-7,500.....	5	1	30	224	27	125
7,500-10,000.....	9	10	99	420	65	184
10,000-12,500.....	31	22	147	332	59	191
12,500-15,000.....	26	26	78	157	66	97
15,000 plus.....	11	13	30	30	16	34

¹ Oil and Gas Journal, vol. 56, No. 4, Jan. 27, 1958, pp. 246-249.

TABLE 12.—Field and wildcat footage ¹

Footage	Field			Wildcat		
	Oil	Gas	Dry	Oil	Gas	Dry
North.....	2,281,465	485,127	1,351,667	150,062	40,756	976,066
South.....	7,803,217	1,616,367	4,395,165	681,355	561,366	3,203,216
Offshore.....	3,202,248	637,490	1,519,422	198,274	313,432	581,227

¹ Oil and Gas Journal, vol. 56, No. 4, Jan. 27, 1958, p. 245.

TABLE 13.—Average depth of wildcat wells, 1948-57 ¹

Year	Feet	Year	Feet
1948.....	4,703	1953.....	6,763
1949.....	5,262	1954.....	6,074
1950.....	5,933	1955.....	6,490
1951.....	6,334	1956.....	7,339
1952.....	6,567	1957.....	7,779

¹ Oil and Gas Journal, vol. 55, No. 4, Jan. 28, 1957, p. 143; vol. 56, No. 4, Jan. 27, 1958, p. 151.

Adverse market conditions led to sharp curtailment in drilling activity by the end of the year. By December the number of rotary rigs operating in the area declined to 381 compared with 478 in 1956.

Deeper drilling was the pattern both on and off shore. The average depth of wildcat wells increased 60 feet offshore—196 feet in South Louisiana and 218 feet in North Louisiana. The average depth of development wells increased 80 feet offshore—78 feet in North Louisiana and 97 feet in South Louisiana. Below are average depths of wells completed in 1957:

	Wildcat wells, feet	Development wells, feet
North Louisiana.....	5,530	3,332
South Louisiana.....	11,792	10,150
Louisiana Offshore.....	12,010	9,240

Success in areas previously neglected by shallower drilling programs was the reason for the trend.

TABLE 14.—Oil- and gas-well drilling in 1957, by parishes ¹

Parish	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Acadia.....	18	12	17	5	8	48	23	20	65	108
Allen.....	2	5	5	3	7	28	5	12	33	50
Ascension.....	1	3	2			1	1	3	3	7
Assumption.....	13	10	9	4	3	5	17	13	14	44
Avoyelles.....	1		1			3	1		4	5
Beauregard.....	22	5	17	4	1	27	26	6	44	76
Bienville.....	16	3	23			9	17	3	32	52
Bossier.....	46	1	35	2		15	48	1	50	99
Caddo.....	384	16	55		1	5	385	17	60	462
Calcasieu.....	20	11	21	2	6	27	31	17	48	96
Cameron.....	43	18	19	2	6	23	45	24	42	111
Catahoula.....	11	9	32	1	2	26	12	1	58	71
Claborne.....	51		23	2		8	53	11	31	95
Concordia.....	18		16	2		20	20		36	56
De Soto.....	64	13	58	2	1	13	66	14	71	151
East Baton Rouge.....	1		2			4			6	8
East Carroll.....						1			1	1
East Feliciana.....						1			1	1
Evangeline.....	4	2		1	1	18	5	3	13	26
Franklin.....	13		10			15	14		34	48
Grant.....	6	2	2	1		1	7		3	10
Iberia.....	30	11	10		6	9	31	17	19	67
Iberville.....	39		5	2		13	41		18	59
Jackson.....						2			2	2
Jefferson.....	22	5	6	1		17	23	5	26	54
Jefferson Davis.....	10	12	2	1	10	20	11	22	22	55
Lafayette.....		5	1	2	1	5	2	6	6	14
Lafourche.....	105	16	25	6	11	38	111	27	63	201
La Salle.....	32		27	3		8	35		35	70
Lincoln.....		2				1		2	2	4
Livingston.....				1					2	2
Madison.....			1			1			2	2
Natchitoches.....	23		3			1	23		4	27
Orleans.....						1			1	1
Ouachita.....	1	3	1		2	2		5	3	9
Plaquemines.....	137	11	24	6	12	33	143	23	57	223
Pointe Coupee.....			1			7			8	8
Rapides.....	1		2			2	1		4	5
Red River.....	10	5	10		1	6	10	6	16	32
Richland.....	2					3	2	1	3	6
Sabine.....	29	3	26			2	29	3	28	60
St. Bernard.....						2			2	2
St. Charles.....	14		7		3	10	14	3	17	34
St. James.....	2	1	1			4	2	1	5	8
St. John the Baptist.....						5		2	5	7
St. Landry.....	20	8	9	1	1	10	21	9	19	49
St. Martin.....	51	24	25		5	17	51	29	42	122
St. Mary.....	53	6	15	4	7	12	57	13	27	97
Tensas.....	22	4	15	2	1	15	24	5	30	59
Terrebonne.....	88	20	25	11	19	43	99	48	68	215
Union.....	2	32	4	1	1	6	6	33	10	49
Vermilion.....	19	15	9	4	5	18	24	33	38	95
Webster.....	42	8	32		3	5	42	11	37	90
West Baton Rouge.....	1					1			1	2
West Carroll.....						2			2	2
West Feliciana.....						1			1	1
Winn.....	12		4	1		3	13		7	20
Offshore:										
Bay Marchand.....	38	4	2		2	7	38	6	9	53
Breton Sound.....						1			1	1
East Cameron.....	2	11	6		4	9	2	15	15	32
Eugene Island.....	29	6	21	2	2	4	31	8	25	64
Grand Isle.....	33	2	9	2	2	6	35	4	15	54
Main Pass.....	45	5	12	5	2	1	50	7	13	70
Ship Shoal.....	15	4	22	2	3	2	17	7	24	48
South Pass.....	61	2	11		1	7	61	3	18	82
South Pelto.....							1		1	2
South Timbalier.....	10		12	3	2	6	13	2	18	33
West Cameron.....	5	13	6	1	3	9	6	16	15	37
West Delta.....	47	8	9	2	2	7	49	10	16	75
Vermilion.....		5	4	3	4	8	3	9	12	24
Total: 1957.....	1,797	370	765	106	166	701	1,903	536	1,466	3,905
1956.....	1,654	376	555	141	146	674	1,795	522	1,229	3,546

¹ National Oil Scouts & Landmen's Association, Oil- and Gas-Field Development in the United States: Austin, Tex., vol. 28, 1958.

TABLE 15.—Total crew-weeks spent in geophysical and core-drill oil and gas prospecting in 1957¹

NORTH LOUISIANA

Parish	1956		1957	
	Total crew-weeks	Total crew-weeks	Method	
			Reflection seismograph	Gravity meter
Bienville.....	26	38	24	14
Bossier.....	80	43	43	—
Caldwell.....	28	22	22	—
Caldwell.....	28	1	1	—
Catahoula.....	24	29	28	1
Claiborne.....	91	73	69	4
Concordia.....	—	2	1	1
De Soto.....	2	—	—	—
East Carroll.....	8	1	1	—
Franklin.....	21	8	8	—
Franklin.....	—	1	1	—
Grant.....	—	—	—	—
Jackson.....	7	10	10	—
La Salle.....	10	1	1	—
Lincoln.....	22	26	25	1
Madison.....	34	29	25	4
Madison.....	85	2 34	32	—
Morehouse.....	—	63	52	—
Natchitoches.....	50	17	17	11
Ouachita.....	33	—	—	—
Red River.....	10	1	1	1
Richland.....	—	52	52	—
Sabine.....	9	60	42	18
Tensas.....	—	64	33	31
Union.....	165	121	121	—
Webster.....	107	56	44	12
West Carroll.....	13	39	39	—
Winn.....	32	40	24	16
Total North Louisiana.....	956	831	715	114

SOUTH LOUISIANA

Acadia.....	290	306	306	—
Allen.....	128	135	135	—
Ascension.....	27	49	49	—
Assumption.....	159	123	110	13
Avoynes.....	19	30	24	6
Beauregard.....	177	111	111	—
Calcasieu.....	198	231	231	—
Cameron.....	206	269	246	23
East Baton Rouge.....	30	5	5	—
East Feliciana.....	—	6	6	—
Evangeline.....	114	82	80	2
Iberia.....	300	178	163	15
Iberville.....	134	153	140	13
Jefferson.....	154	172	170	2
Jefferson Davis.....	172	132	132	—
Lafayette.....	133	190	190	—
Lafourche.....	305	474	458	16
Livingston.....	23	—	—	—
Orleans.....	27	11	11	—
Plaquemines.....	340	356	356	—
Pointe Coupee.....	56	19	19	—
Rapides.....	—	1	1	—
St. Bernard.....	52	47	47	—
St. Charles.....	61	42	42	—
St. Helena.....	5	2	2	—
St. James.....	40	5	5	—
St. John the Baptist.....	81	12	12	—
St. Landry.....	133	118	118	—
St. Martin.....	239	211	204	7
St. Mary.....	479	459	401	58
St. Tammany.....	—	52	52	—
Tangipahoa.....	14	3	3	—
Terrebonne.....	651	535	529	6
Vermilion.....	499	417	381	36
Vernon.....	11	35	17	18

See footnotes at end of table.

TABLE 15.—Total crew-weeks spent in geophysical and core-drill oil and gas prospecting in 1957¹—Continued

SOUTH LOUISIANA—Continued

Parish	1956		1957	
	Total crew-weeks	Total crew-weeks	Method	
			Reflection seismograph	Gravity meter
Washington.....		52	52	
West Baton Rouge.....	14	2	2	
West Feliciana.....		6	6	
Total South Louisiana.....	5,421	5,081	4,816	215

OFFSHORE AREA

Bay Marchand.....	1	6	6	
Breton Sound.....	36	8	8	
Chandeleur Sound.....	14			
East Cameron.....	107	41	28	18
Eugene Island.....	160	118	65	53
Grand Isle.....	27	58	28	30
Main Pass.....	54	47	46	1
Ship Shoal.....	109	58	49	9
South Marsh Island.....	81	88	52	36
South Pass.....	17	18	11	7
South Pelto.....	4	2	2	
South Timbalier.....	121	89	81	8
Vermilion.....	155	98	29	69
West Cameron.....	263	105	88	17
West Delta.....	31	8	8	
Total Offshore.....	1,180	744	496	248

¹ National Oil Scouts and Landmen's Association.² Includes 2 crew-weeks by magnetometer method.

Carbon Black.—Although sales of carbon black increased during 1957, production in Louisiana was cut back about 4 million pounds to a total of 534 million pounds. The average value of carbon black increased from 5.8 to 6.4 cents per pound. About half of the carbon black was made from natural gas and the rest from liquid hydrocarbons. Eight furnace-black plants and one contact-black plant were in operation during the year. The following table shows the trend in the 5-year period, 1953–57:

Year:	Production, million pounds
1953.....	377
1954.....	368
1955.....	503
1956.....	538
1957.....	534

Natural Gas.—The strong upward trend in production and consumption of Louisiana natural gas continued unabated in 1957. National demand for natural gas as a fuel and as a raw material continued to grow rapidly. Supplies of natural gas from Louisiana grew at double the national rate, so that in 1957 the State furnished 18.4 percent of all marketable gas. In 1950 the proportion was only 13.2 percent.

Efforts were made to tap the growing offshore potential for natural gas. By fall over half of the largest offshore gathering system had been completed in Cameron Parish. Sixty miles of the system, belonging to The Tennessee Gas Transmission Co., was under water. The Federal Power Commission granted Southern Natural Gas Co. a permit to build pipeline facilities for transmitting gas from 10 fields in Jefferson, St. Bernard, Plaquemines, and adjacent offshore areas.

TABLE 16.—Marketed production of natural gas, 1948-52 (average) and 1953-57¹

Year	Million cubic feet	Value at wells (thousand dollars)	Value (cents per thousand cubic feet)
1948-52 (average).....	908, 404	49, 325	5. 4
1953.....	1, 293, 644	106, 079	8. 2
1954.....	1, 399, 222	124, 531	8. 9
1955.....	1, 680, 032	189, 844	11. 3
1956.....	1, 886, 302	215, 038	11. 4
1957 ²	1, 943, 900	262, 400	13. 5

¹ Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

² Preliminary figures.

The average value of natural gas advanced to 13.4 cents per thousand cubic feet as several new contracts were being written at higher rates. An agreement between Tennessee Gas Transmission Co. and 4 independent producers for a price of 21.4 cents per thousand cubic feet finally was approved by the Federal Power Commission. The Commission, in an earlier decision, had limited the price to 17 cents per thousand cubic feet, but the operator for the group of companies rejected the 17-cent contract. The Commission stated that urgency of need for the gas, as well as price was considered in the decision.

Natural-Gas Liquids.—Natural gasoline or cycle products were produced at 63 plants in 23 parishes in the State. Output of all liquids increased about 3 percent over 1956. This growth was attributed largely to added recovery of LP-gases. The continued growth of LP-gas sales comes from expanding markets in home heating and petrochemicals. Prices remained substantially the same as in 1956, as the average value of natural gasoline rose slightly and the average value of LP-gases declined slightly. New plants going on stream during 1957 were Runnells Gas Products Corp. Eunice plant in

TABLE 17.—Natural-gas liquids produced, 1948-52 (average) and 1953-57

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1948-52 (average).....	611, 063	\$46, 828	249, 837	\$11, 835	860, 900	\$58, 663
1953.....	665, 532	55, 421	287, 280	12, 654	952, 812	68, 075
1954.....	665, 070	54, 330	292, 226	11, 620	957, 296	65, 950
1955.....	782, 328	59, 178	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

Acadia Parish, Esperance Point Gasoline Corp. plant at Esperance Point in Concordia Parish, and Anchor Gasoline Corp. Krotz Springs plant in St. Landry Parish.

TABLE 18.—Production of LP-gases and natural gasoline and cycle products by plants, 1956-57^{1 2}

(42-gallon barrels)

Company and plant	LP-gases		Natural gasoline and cycle products	
	1956	1957	1956	1957
Acadia Corp.: Egan Plant.....	313,856	416,681	849,907	844,072
Amerada Petroleum Corp.:				
Lake Chicot Plant.....			16,504	16,984
Lelux Plant.....			9,045	30,516
Anchor Gasoline Corp.:				
Easton Plant.....	39,851	41,949	36,785	29,092
Eola Plant.....	81,513	72,186	76,730	73,491
Krotz Springs Plant.....			8,590	2,775
Tepetate Plant.....	86,173	87,506	42,690	40,011
Anse LaButte Gasoline Co.: Anse LaButte Plant No. 1.....			37,412	34,593
Arkansas Fuel Oil Co.: Langston Plant.....			32,123	32,336
Arkansas Louisiana Gas Co.:				
Bisteneau Plant.....			247,635	240,201
North Ruston Plant.....	220	14,844	208,135	302,721
Rodessa Plant.....			68,137	66,839
Sligo Plant.....			116,893	190,078
The Atlantic Refining Co.:				
Bayou Sale Plant.....			164,990	71,835
Merryville (Neale) Plant.....	86,115	92,521	111,821	123,401
Bayou State Oil Corp.: Gilliam Plant.....			406	17,044
Bel Oil Corp.: North Elton Plant.....	8,381	12,248	369,622	369,637
Caddo-Pine Island Corp.: Vivian Plant.....	12,611		71,741	72,557
The California Co.:				
Hico Knowles Plant.....	281,159	242,339	330,026	270,562
Waterproof (Lake St. John) Plant.....	450,308	406,937	799,422	703,977
The Carter Oil Co.: Stiles-Trees Plant.....			13,130	14,539
Claiborne Gasoline Co.: Lisbon Plant.....			476,466	436,775
Continental Oil Co.:				
Gillis Plant No. 29.....	558,075	1,833,974	254,661	244,981
Ville Platte Plant.....	430,410	421,684	294,912	294,635
Cotton Valley Operators Committee: Cotton Valley Plant.....	767,498	750,841	3,042,897	2,800,005
Esperance Point Gasoline Corp.: Esperance Point Plant.....		11,883		37,474
Gulf Natural Gas Corp.: Pine Island (Belcher) Plant.....		25,357	50,709	149,065
Gulf Oil Corp.:				
Homer Plant.....			47,147	44,382
Krotz Springs Plant.....	520,674	580,706		
Haynesville Operators Committee: Haynesville Plant.....	3 (195)	7,838	206,403	146,008
Humble Oil & Refining Co.: Opelousas Plant.....	644,814	567,245	481,026	488,909
H. L. Hunt: Clear Creek Plant.....			578	1,577
Hunt Oil Co.: Lisbon Plant.....	82,781	67,529	241,511	231,824
Jones-O'Brien, Inc.:				
North Keatchie Plant.....				8,968
South Keatchie Plant.....				4,439
George C. McGhee: Mowata Plant.....			7,900	
Magnolia Petroleum Co.:				
Hurricane Creek Plant.....	21,686	29,881	71,427	70,712
Mamou Plant.....	42,705	40,128	60,965	56,694
Opelousas Plant.....			69,006	80,555
The Ohio Oil Co.: Garrett Plant.....	7,100	6,726	35,097	31,423
Pan American Petroleum Corp.: South Jennings Plant.....	67,113	67,717	266,045	236,642
Runnells Gas Products Corp.:				
Eunice Plant.....		7,457		4,222
South Lewisburg Plant.....			74,961	52,883
Welsh Plant.....			49,673	26,036
Shell Oil Co.:				
Burtville Plant.....			31,824	24,415
Iowa Plant.....			155,512	175,962
Southwest-Feazel: Dubach Plant.....	277,933	375,887	1,677,766	1,952,190
Sun Oil Co.: Delhi Plant.....	295,869	282,989	223,383	219,700

See footnotes at end of table.

TABLE 18.—Production of LP-gases and natural gasoline and cycle products by plants, 1956-57^{1 2}—Continued

Company and plant	LP-gases		Natural gasoline and cycle products	
	1956	1957	1956	1957
(42-gallon barrels)				
Sunray Mid-Continent Oil Co.:				
Benton Plant.....	392,947	334,165	918,279	766,875
Northwest Branch Plant.....	129,098	110,112	54,254	-----
Rodessa Plant ⁴	23,328	23,611	53,209	43,312
Sarepta Plant.....	73,438	91,194	93,225	143,317
West Tepestate Plant.....	47,825	34,812	70,878	45,254
The Texas Co.:				
Bateman Lake Plant.....	76,780	76,169	380,234	344,611
Erath Plant.....	562,977	502,711	1,619,727	1,475,038
Lafitte Plant.....	-----	-----	103,772	81,545
Paradis Plant.....	340,396	386,033	197,407	251,293
Tidewater Oil Co.: Venice Plant.....	78,058	229,571	32,119	96,354
United Gas Pipe Line Co.:				
Koran Plant.....	51,776	60,482	195,334	230,532
Rodessa Plant.....	9,745	10,769	30,743	24,855
Sugar Creek Plant.....	7,390	³ (14)	16,714	³ (8)
E. A. Whitton: Shreveport Plant.....	-----	-----	17,751	14,424
Stanolind Oil and Gas Co.: Gilliam Plant.....	-----	-----	3,533	-----

¹ Louisiana Department of Conservation.² Data not available for plants at: South Lewisburg, Shreveport, Chalmette, Tepestate, Jeems Bayou Plant, West Gueydan, Cameron Meadows, Iowa, West Hackberry, Antioch, Egan Plant, Lowery Gas Plant, N. Tepestate Plant.³ Negative adjustment.⁴ Prior to July 1, 1957, this plant was owned by Arkla Oil Co.**TABLE 19.—Sales of LP-gases by uses, 1956-57, in thousand gallons¹**

Use	Butane		Propane		B-P mixture		All other mixtures		Total	
	1956	1957	1956	1957	1956	1957	1956	1957	1956	1957
Domestic uses.....	7,886	10,178	20,332	22,304	47,879	36,434	-----	-----	76,097	68,916
Gas manufacturing.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Industrial.....	3,830	4,109	8,897	9,171	3,787	1,339	-----	-----	16,514	14,619
Synthetic rubber.....	22,037	37,005	-----	-----	-----	-----	² 14,314	-----	36,351	37,005
Chemical plants.....	5,137	-----	1,919	-----	7,292	2,800	169,726	141,998	184,074	144,798
Internal combustion.....	2,128	3,584	6,396	6,855	18,337	16,656	-----	-----	26,861	27,095
All other.....	-----	14	9	20	192	190	-----	-----	201	224
Total.....	41,018	54,890	37,553	38,350	77,487	57,419	184,040	141,998	340,098	292,657

¹ Data include LR-gases.² Isobutane.

Petroleum.—The accelerated production of crude oil during the closing of the Suez Canal in the early months of 1957 was not fully offset by cutbacks later in the year. The result was increased recovery (8 percent). During peak production daily allowables were raised to nearly 1 million barrels.

When normal channels of supply from the Middle East to Europe were reopened, domestic economic forces caused a downturn in the production and consumption of petroleum and petroleum products. Consumption of gasoline and fuel oil was below predicted levels. Later in the year cutbacks were made at several Louisiana refineries in the face of decreased demand. Stocks began accumulating and

eventually brought a further reduction in crude production. Nevertheless, Louisiana fared better than most other petroleum-producing States; Louisiana was the only one of the top five producers that had an overall increase by the end of the year.

TABLE 20.—Production of crude petroleum, 1948-52 (average) and 1953-57 and cumulative

Year	Thousand barrels	Value		Year	Thousand barrels	Value	
		Total (thousands)	Average per barrel			Total (thousands)	Average per barrel
1948-52 (average)---	211,492	\$561,594	\$2.66	1956-----	299,421	\$877,951	\$2.93
1953-----	256,632	721,150	2.81	1957-----	323,199	1,072,101	3.32
1954-----	246,558	722,370	2.93	1902-57-----	4,433,000	9,456,323	2.13
1955-----	271,010	793,280	2.93				

TABLE 21.—Indicated demand, production, and stocks of crude petroleum by months, 1956-57

(Thousand barrels)

Month	1956			1957		
	Indicated demand	Production	Stocks ¹	Indicated demand	Production	Stocks ¹
January-----	24,819	24,636	16,290	30,952	30,906	18,651
February-----	23,684	23,346	15,952	27,863	28,723	19,511
March-----	25,426	25,463	15,969	32,769	31,041	17,783
April-----	23,657	24,842	16,993	28,558	29,147	18,372
May-----	26,049	24,757	15,595	28,569	29,148	18,951
June-----	24,496	24,044	15,223	25,356	24,896	18,191
July-----	23,122	24,297	16,282	26,464	26,545	18,272
August-----	23,780	24,619	16,898	24,929	24,453	17,796
September-----	23,684	23,563	16,981	23,076	23,761	18,481
October-----	24,102	24,667	17,164	23,388	24,660	19,753
November-----	24,737	25,543	17,533	23,242	23,985	20,496
December-----	28,162	29,644	18,697	27,186	25,934	19,244
Total-----	295,718	299,421		322,352	323,199	

¹ End-of-month figures.

TABLE 22.—Midyear and end-of-year allowable schedules ¹

(Barrels)

Depth, in thousand feet	Onshore allowables		Offshore allowables		Depth, in thousand feet	Onshore allowables		Offshore allowables	
	July	December	July	December		July	December	July	December
0-2-----	33	28	80	67	11-12-----	142	121	229	195
2-3-----	39	33	88	74	12-13-----	157	134	248	212
3-4-----	47	40	98	84	13-14-----	176	151	273	234
4-5-----	55	47	109	93	14-15-----	198	169		
5-6-----	65	56	121	104	15-16-----	228	195		
6-7-----	76	65	135	116	16-17-----		238		
7-8-----	88	75	156	133	17-18-----	276	269		
8-9-----	98	84	171	146	18-19-----		302		
9-10-----	112	96	189	162	19-20-----		343		
10-11-----	127	108	210	178					

¹ Louisiana State Department of Conservation, Petroleum Activity Report: Vol. 9, No. 6, June 1957; vol. 9, No. 11, November, 1957.

The average price of petroleum increased from \$2.93 per barrel in 1956 to \$3.32 in 1957. The rise in purchase price occurred during the period of peak demand.

In order of output, major producing fields during the year were Caillou Island, Lake Washington, Main Pass, South Pass, Weeks Island, Timbalier Bay, Caddo, Hackberry, Delhi, and Venice. Production was concentrated in the Gulf Coast area, where 6 barrels of crude oil was produced to 1 barrel in the rest of the State.

TABLE 23.—Number of producing oil wells and average production per well, 1948-57

Year	Number of producing wells as of Dec. 31	Average production per well per day (barrels)	Year	Number of producing wells as of Dec. 31	Average production per well per day (barrels)
1948.....	9,770	53.7	1953.....	14,220	49.4
1949.....	10,890	50.6	1954.....	15,980	44.6
1950.....	11,860	50.4	1955.....	18,800	42.7
1951.....	12,490	52.3	1956.....	20,905	41.2
1952.....	13,290	51.7	1957.....	21,945	41.3

TABLE 24.—Production of crude petroleum, 1953-57, by districts and fields

(Thousand barrels)

District and field	1953	1954	1955	1956	1957 ¹
Gulf Coast:					
Anse la Butte.....	2,165	1,699	1,719	1,890	2,065
Avery Island.....	3,111	2,724	3,499	3,303	3,240
Bateman Lake.....				1,718	2,120
Barataria.....	2,351	1,628	1,358	1,103	1,023
Bay de Chene.....	1,302	1,208	1,456	1,609	1,794
Bay Marchand.....	1,560	2,430	2,933	3,539	3,791
Bay St. Elaine.....	3,194	3,130	3,315	3,188	3,376
Bayou Blue.....	1,158	1,060	955	931	1,133
Bayou Choctaw.....	893	1,171	1,293	1,176	1,204
Bayou Mallett.....	1,796	1,413	1,140	1,043	823
Bayou Sale.....	4,710	3,589	3,090	2,825	2,712
Bully Camp.....	1,640	1,353	1,767	1,623	1,582
Caillou Island.....	8,540	8,398	9,017	9,626	11,298
Charenton.....	1,278	1,223	1,234	1,426	1,391
Cox Bay.....	2,700	3,413	3,113	2,762	2,303
Delta Farms.....	6,480	5,456	4,810	4,493	4,010
Dog Lake.....	1,530	1,270	1,072	947	887
Duck Lake.....	2,935	3,199	3,329	2,916	2,477
East White Lake.....	1,479	1,179	1,390	1,390	1,463
Egan.....	2,017	2,117	2,225	2,529	2,263
Erath.....	1,370	1,152	964	919	1,310
Garden Island.....	1,590	1,419	1,343	1,340	1,429
Gibson.....	1,410	1,140	1,020	919	910
Golden Meadows.....	3,918	3,974	3,784	3,452	3,032
Good Hope.....	2,045	1,446	1,208	1,087	1,058
Grand Bay.....	3,768	3,519	3,403	4,030	4,113
Gueydan.....	1,570	1,298	1,076	963	961
Hackberry.....	4,512	4,215	4,451	5,927	6,903
Horseshoe Bayou.....	1,394	1,097	871	836	807
Iberia.....				800	814
Iowa.....	2,842	2,701	2,465	2,214	2,006
Jeanerette.....	1,137	1,228	1,193	1,148	1,271
Jennings.....				1,024	1,247
Lafitte.....	4,650	3,686	3,323	2,935	3,058
Lake Arthur South.....				1,097	1,024
Lake Barre.....	599	1,056	1,363	1,723	2,066
Lake Chicot.....	1,072	1,021	1,031	1,009	954
Lake Fausse Point.....	576	823	1,344	1,499	1,750
Lake Pelto.....	2,697	2,324	2,421	2,652	2,951
Lake Salvador.....	1,831	1,415	1,370	1,391	1,641
Lake Washington.....	951	1,947	4,697	7,849	11,089
La Rose.....				1,095	1,009

See footnotes at end of table.

TABLE 24.—Production of crude petroleum, 1953–57, by districts and fields—Con.

(Thousand barrels)

District and field	1953	1954	1955	1956	1957 ¹
Gulf Coast:—Continued					
Leeville.....	3,251	3,556	4,088	4,094	4,033
Little Lake.....	823	1,582	2,147	2,353	2,453
Lockport.....				908	920
Main Pass.....	4,287	4,981	6,354	8,417	11,064
North Crowley.....	1,504	1,273	1,299	1,168	1,107
Paradis.....	3,445	3,379	3,172	2,843	2,625
Phoenix Lake.....	1,781	1,778	1,533	1,367	1,228
Pine Prairie.....	955	864	885	927	826
Point-a-La Hache.....	2,689	2,451	2,168	1,999	1,884
Port Barre.....	1,327	1,056	925	852	763
Quarentine Bay.....	3,151	2,649	3,151	3,964	3,536
Romere Pass.....	4,570	4,719	3,913	3,485	3,488
St. Gabriel.....	1,778	1,278	1,047	825	731
Section 28.....	1,244	1,335	1,359	1,396	1,336
Shuteston.....				1,025	905
South Pass.....				8,208	9,301
Tepetate.....	2,149	1,722	1,692	1,706	1,580
Timbalier Bay.....	2,514	2,289	3,935	6,120	8,600
University.....	1,534	1,391	1,073	934	822
Valentine.....	1,252	1,379	1,684	1,802	1,688
Venice.....	5,728	5,364	4,903	5,117	5,514
Ville Platte.....	1,333	1,402	1,249	1,150	996
Vinton.....	3,618	2,712	2,352	2,203	2,061
Weeks Island.....	11,258	9,029	8,210	8,668	8,602
West Bay.....	3,132	2,525	2,423	3,326	4,016
West Cote Blanche.....	2,865	2,380	2,016	1,891	2,022
West Lake Verrett.....	1,757	1,517	1,332	1,361	1,333
White Castle.....	1,343	941	763	786	966
Other Gulf Coast ²	56,071	58,048	77,694	77,653	90,314
Total Gulf Coast.....	214,130	204,721	227,409	252,494	277,072
Northern:					
Big Creek.....	1,279	900	750	679	587
Caddo.....	5,438	8,251	9,111	8,417	7,305
Cotton Valley.....				1,407	945
Delhi.....	5,916	4,880	5,377	6,301	6,411
Esperance Point.....				1,684	1,621
Haynesville.....	4,445	3,694	3,234	2,859	2,695
Lake St. John.....	4,015	3,162	2,788	2,430	2,258
Nebo ³	2,268	2,270	2,193	1,905	1,746
Olla ⁴	2,106	1,934	1,709	1,626	1,432
Rodessa.....	868	784	793	751	710
Sligo.....	879	966	1,030	1,043	1,340
Urania.....				786	765
Other Northern ²	15,288	14,996	16,616	17,039	18,312
Total Northern.....	42,502	41,837	43,601	46,927	46,127
Total Louisiana.....	256,632	246,558	271,010	299,421	323,199

¹ Preliminary figures.² Includes crude oil consumed on leases and net change in stocks held on leases for entire district.³ Includes Hemphill, Trout Creek, and Jena.⁴ Includes Little Creek and Summerville.

Since the first discovery of petroleum in the State, an estimated 4.4 billion barrels of oil valued at \$9.5 billion, had been produced to the end of 1957.

A deep underwater pipeline connecting offshore platforms with onshore gathering lines in the Grand Isle area neared completion in 1957. The Marine Gathering Co. laid the 25-mile line for a group of operators under water deeper than 100 feet.

Refineries.—Crude runs to stills in 1957 declined 18 million barrels to a total 237 million barrels. At the beginning of the year there were 4 inland refineries and 11 Gulf Coast refineries with a combined operating capacity of 730,650 barrels of crude oil per day and a cracked gasoline capacity of 202,910 barrels per day. In December, 72 percent of total refinery receipts was from intrastate shipments of

Louisiana crudes. By method of delivery, 38 percent was shipped by intrastate pipeline, 33 percent by intrastate boats, and 27 percent by interstate pipelines. The remaining 2 percent was receipts by tank cars and trucks.

TABLE 25.—Crude runs to stills, in Louisiana Gulf Coast refineries, 1956-57

(Thousand barrels)

Month	1956	1957	Month	1956	1957
January.....	21,591	21,840	August.....	22,129	20,333
February.....	20,067	19,171	September.....	20,960	18,371
March.....	22,112	20,654	October.....	20,138	19,040
April.....	20,337	19,930	November.....	20,004	18,450
May.....	22,015	20,228	December.....	21,044	18,555
June.....	22,205	19,576	Total.....	254,700	236,849
July.....	22,098	20,701			

TABLE 26.—Crude runs to stills and refinery receipts of crude oil by method of transportation in Louisiana

(Thousand barrels)

	December	
	1956	1957
Crude runs to stills.....	21,239	18,645
Fuel and losses.....	37	29
Origin of domestic crude receipts:		
Total.....	26,992	24,032
Daily average.....	871	775
Total receipts by method of transportation:		
Intrastate:		
Pipelines.....	7,521	7,447
Tank cars and trucks.....	219	103
Boats.....	7,082	6,349
Interstate:		
Pipelines.....	6,853	5,129
Tank cars and trucks.....	27	25
Boats.....	575	316
Foreign: Boats.....		

TABLE 27.—Sales of petroleum products, 1953-57

(Thousand barrels)

Product	1953	1954	1955	1956	1957
Gasoline ¹	16,742	17,572	19,961	20,872	(²)
Kerosine.....	1,425	1,348	1,228	1,207	971
Range oil.....	664	675	648	742	538
Distillate fuel oil.....	6,212	6,242	7,385	7,653	7,877
Residual fuel oil.....	9,929	9,710	10,601	10,804	11,359

¹ Gasoline consumption from American Petroleum Institute.

² Not available.

TABLE 28.—Sales of distillate and residual fuel oils, 1956-57, by uses

(Thousand barrels)

Use	Distillate fuels		Residual fuels	
	1956	1957	1956	1957
To railroads.....	1,270	1,269	11	12
To vessels (including tankers).....	2,131	2,328	8,834	9,154
To gas and electric powerplants.....	54	47	23	22
Industrial (excluding oil-company use).....	640	628	671	692
Oil-company fuel.....	240	267	391	395
Light heating oils.....	689	700	-----	-----
Heavy heating oils.....	-----	-----	625	593
To military.....	494	535	142	394
Miscellaneous uses.....	1,986	2,002	107	97
Range oil No. 1.....	99	101	-----	-----
Total.....	7,653	7,877	10,804	11,359

Petrochemicals.—The growth of chemical and petrochemical industries in Louisiana was one of the most important economic developments in the 1956-57 period. The strong expansive forces were expected to continue for several years. Chemical growth is self-stimulating because “the chemical industry is its own best customer.” Clusters of plants had begun to evolve and enlarge in 1957. A complex of pipelines began reaching from one plant to another, carrying waste gases, by products or primary chemicals. Many of the plants under construction in 1957 were to utilize products or “waste” materials from established plants. All, however, were based primarily on the ultimate raw material—crude petroleum and natural gas.

Illustrative of the expected self-generated economic growth was the estimated \$494 million to be spent by the chemical industry in construction during the period 1957-59. Data compiled by Manufacturing Chemists' Association, Inc., showed only Texas to be ahead with \$865 million in predicted capital expenditures. About 36 percent of all expenditures for new construction in the chemical industry was planned in the Gulf Coast area. Of the total construction cost, \$58 million was to be expended by the end of 1957; \$396 million would be expended in 1958, and \$40 million more was planned for 1958-59.

The concentrations of plants were in the Baton Rouge-New Orleans area and at Lake Charles. Table 32 shows the locations and types of products produced at chemical plants in Louisiana.

New developments in the petrochemical and chemical industries during 1957 included opening of the new Monsanto Chemical Co. adipic acid unit at the Luling plant. The product was for use in nylon, vinyl plastics, and foamed resin materials. At Norco, Shell Chemical Corp. began operating facilities for hydrogen peroxide and secondary butyl alcohol. Construction continued on the Ethyl Corp. vinyl chloride monomer unit at Baton Rouge. The product is an intermediate chemical for production of plastics. At Baton Rouge W. R. Grace & Co. continued constructing a polyethylene plant that would use refinery ethylene as the basic raw material. Shipment was expected to begin early in 1958. Nagatuck Chemical Division of U. S. Rubber Co. began building a kralastic plastic plant at Baton Rouge at an estimated cost of \$7 million. At Sterlington, Commercial Solvents Corp. went on stream with expanded facilities for making

TABLE 29.—Petrochemical plants in Louisiana ¹

Location	Plant	Product	Capacity	Remarks
Baton Rouge...	Copolymer Rubber and Chemical Corp.	Butadiene.....	35,000 short tons per year.	Total plant investment—\$10 million.
Do.....	Dow Chemical Co.	Propylene.....	(²)	Completion of \$50 million plant in 1958.
Do.....	Esso Standard Oil Co.	Benzene, butadiene, ethanol, propylene, propylene trimer and tetramer.	(²)	
Do.....	W. R. Grace & Co.	Polyethylene....	(²)	Total plant investment—\$18 million.
Fortier.....	American Cyanamid Co.	Acetylene, acrylonitrile, ammonia.	(²)	Total plant investment—\$50 million. Started \$39 million program to double acrylonitrile in April 1956—completion late in 1957.
Geismar.....	Wyandotte Chemical Corp.	Ethylene oxide....	60 million pounds per year.	Total plant investment—\$8 million, completion due in late 1957.
Lake Charles...	Continental Oil Co.	Benzene.....		Total plant investment—\$2.7 million.
Do.....	Olin Mathieson Chemical Corp.	Ammonia, nitric acid.	95,000 tons per year.	
Do.....	Petroleum Chemicals, Inc.	Ammonia, butadiene.	100,000 tons, 80,000 tons per year.	Completion due fall of 1957; total plant investment—\$22.5 million.
Luling.....	Monsanto Chemical Co., Lion Oil Co. Division.	Ammonia, nitric acid.		Total plant investment—\$31 million.
Norco.....	Shell Chemical Corp.	Glycerine.....	30 million pounds per year.	Capacity includes plant in Houston.
Shreveport....	Atlas Processing Co.	Benzene.....	602 barrels per day.	Total plant investment—\$6 million. Plans isomerization unit, construction to begin September 1957; tentative completion date, March 1958.
Sterlington....	Commercial Solvents Corp.	Ammonia, methanol.	135,000 tons per year.	Total plant investment—\$45 million. \$10 million to increase production of methanol and petrochemicals to be completed this year.

¹ Chemical Week, vol. 18, No. 13, Sept. 28, 1957, pp. 53-59.² Not available.

synthetic methanol from natural gas and air. American Cyanamid Co. began constructing a \$39 million addition to the chemical plant at Avondale for expanded production of acrylonitrile.

NONMETALS

Barite.—Production and shipments of ground barite from mills in Louisiana increased substantially over 1956. This was due to opening of new mills of the Baroid Division of National Lead Co. at New Orleans. The first of these mills began operations March 23, 1957; the second began grinding December 16, 1957. A storage terminal adjoining the plant on deep water on the Industrial Canal served bagging and bulk shipping facilities. Most of the crude barite came from the island of Camamu in Brazil and from the company's affiliate, Perubar, in Peru. This plant was the second such expansion in 2 years. The needs of expanding offshore drilling were largely influential for the new developments, as an estimated 90 percent of all barite used in drilling mud was consumed in the Gulf Coast area of Texas

and Louisiana. Other grinding plants were located at Lake Charles and New Orleans. Another plant was being constructed on the Industrial Canal in New Orleans.

Cement.—Consumption of cement in Louisiana decreased for the first time since 1953, yet it was the second greatest year in history. Part of the decline was due to inclement weather and part to a reduction in heavy construction. As a result of increased production during the year State needs were met to a greater extent by cement plants within Louisiana. The remaining shipments came from plants in Mississippi, Texas, and Arkansas. Only a small percentage came from noncontiguous areas. A substantial increase in cement prices followed industry trends. Demand for cement in the area was expected to resume growth because of expanding industrial construction. In 1957, effects of the Federal Highway Program had not yet reached the cement industry. Demands for cement by the highway program were expected to expand with construction over the next decade.

Official opening in the fall of the new Lone Star Cement Co. wet-process cement plant at Lake Charles was a step nearer self-sufficiency in the industrially growing Lake Charles area of western Louisiana. Construction on the new modern plant was begun in 1955. The plant, reported to cost \$14 million, had a capacity of 2 million barrels of cement a year. Raw materials used were clays mined locally and oystershell dredged in adjacent Texas oystershell reefs. The plant included 2 rotary kilns, 3 raw mills, 3 finish mills, 90,000-barrel covered clinker storage, 20 storage silos with a combined capacity of 160,000 barrels, and docks and rail lines for shipping the finished product. As the plant was designed to permit expansion from 2 to 6 kilns, the grinding mills, slurry tanks, clinker grinders were adequate for the ultimate six kilns.

TABLE 30.—Shipments of finished portland cement to Louisiana from mills, 1948-52 (average) and 1953-57

Year	Louisiana	Change (percent)		Year	Louisiana	Change (percent)	
	(Thousand barrels)	In Louisiana	In United States		(Thousand barrels)	In Louisiana	In United States
1948-52 (average)---	4,702	+13.2	+6.4	1955-----	7,340	+16.7	+6.4
1953-----	5,759	-1.9	+4.1	1956-----	8,305	+13.1	+5.7
1954-----	6,292	+9.2	+5.7	1957-----	7,584	-8.7	-6.6

¹ Revised figure.
² Preliminary figure.

Ideal Cement Co. began building a \$1.5 million cement terminal at Lake Charles, scheduled for completion in the spring of 1958.

Clays.—There were four major categories of uses for clays produced in 1957. Clays were used for producing lightweight aggregate, heavy clay products, and cement and for use in filtering and decolorizing mineral and vegetable oils. The sharp 18-percent reduction in output of clays during the year resulted from declines in each of the 4 types of uses. Lightweight aggregate was produced at plants at Erwinville and Alexandria. Structural clay products were manufactured from local clays at 12 brick plants in 11 parishes. Clay was

mined as a raw material for cement at plants at Baton Rouge, New Orleans, and Lake Charles.

In July the brick plant at Slidell of Schneider Brick and Tile Co. was sold to Slidell Brick & Tile, Inc. An expansion program was reported at Norman Brick Co. plant at Ringgold. At New Iberia the Conrad Brick Co. plant was dismantled to make room for a naval base.

TABLE 31.—Miscellaneous clay sold or used by producers, 1948-52 (average) and 1953-57¹

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average)-----	304, 505	\$280, 385	1955-----	651, 268	\$659, 099
1953-----	614, 427	901, 612	1956-----	785, 283	785, 283
1954-----	713, 940	940, 940	1957-----	641, 939	641, 939

¹ Excludes bentonite.

Gypsum.—At Winnfield, Anderson & Dunham, Inc., produced crude gypsum for use as a cement retarder and for road construction and maintenance. Production of this sole source of crude gypsum in the State was above that in 1956.

Gypsum products for the construction industry were made from imported crude gypsum at Westwego and at a new plant in New Orleans.

Lime.—At Lake Charles and Baton Rouge lime was burned for use by the producers in manufacturing chemicals. Olin Mathieson Chemical Corp. used oystershell as raw material; the Solvay Process Division of Allied Chemical & Dye Corp. at Baton Rouge used limestone from outside the State.

Perlite.—Lightweight plaster and concrete aggregate were manufactured at Bossier City and New Orleans from crude perlite shipped into the plants from Western States.

Salt.—About two-thirds of the salt recovered in Louisiana in 1957 was consumed within the State. The largest part of this salt consumption was in the form of brines pumped from wells to chemical plants for the production of chlorine, soda ash and other industrial chemicals. The 7-percent decrease in production during the year was entirely due to reduction in recovery of brines. Brines constituted about three-fifths of the total tonnage of salt. These brines were used at Lake Charles by Olin Mathieson Chemical Corp. for manufacturing soda ash and by Columbia-Southern Chemical Corp. for producing chlorine. At North Baton Rouge the Solvay Process Division of Allied Chemical & Dye Corp. made soda ash, chlorine, and other chemicals from brines from wells near Plaquemine.

TABLE 32.—Salt sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average)-----	2, 364, 547	\$6, 930, 968	1955-----	3, 562, 636	\$15, 406, 993
1953-----	3, 061, 234	9, 189, 526	1956-----	3, 703, 500	17, 695, 270
1954-----	3, 088, 686	11, 101, 456	1957-----	3, 460, 921	18, 943, 861

TABLE 33.—Production of salt, 1956–57, by types

Type	1956		1957	
	Short tons	Value	Short tons	Value
Evaporated salt.....	121, 900	\$1, 995, 188	128, 220	\$2, 691, 921
Rock salt.....	1, 293, 784	8, 515, 502	1, 334, 558	9, 802, 373
Brine.....	2, 287, 816	7, 184, 580	1, 998, 143	6, 449, 567

Eight mines operating during 1957 produced rock salt, evaporated salt, and brines. Production was concentrated in the vicinity of Weeks, Avery, and Jefferson Island on the coastal waterway and at Winnfield in Winn Parish. A ninth source was being established at the Sorrento Dome in Ascension Parish by Kaiser Aluminum & Chemical Co. to furnish brines for shipment to the company alumina plant at Gramercy. The brines were raw materials for producing caustic soda and chlorine by the diaphragm-cell-type electrolytic reduction process. The caustic was for use in the alumina plant and the chlorine was for other markets. Wyandotte Chemicals Corp. began erecting another large electrolytic chlorine-caustic plant at Geismar that would use salt from several nearby salt domes.

Sand and Gravel.—The 17-percent decline in sand and gravel production was due as much to unfavorable construction weather as to adverse business conditions and a decline in construction. The year was reported to have been one of the worst for heavy construction in a decade. Highway repair and new construction were especially impeded by the rainy conditions.

In all, there were 47 sand and gravel operations in 21 parishes. Most production was from areas north of an east-west line across Louisiana from Baton Rouge.

Prices varied according to location and quality or degree of processing. Molding and blasting sands were many times costlier than paving and structural sands. Sand in the vicinity of Shreveport cost \$1.71 per ton as compared with \$1.39 around Lake Charles. Below are résumés of the average values of sand and gravel in 1957. Price variations depended on the economics of recovery and the degree of processing as well as on normal supply-demand forces.

Type of sand:	<i>Average value per ton</i>	Type of gravel:	<i>Average value per ton</i>
Structural sand.....	\$1. 02	Structural gravel.....	\$1. 37
Paving sand.....	. 94	Paving gravel.....	1. 20
Engine sand.....	. 40	Railroad ballast.....	. 80
Railroad ballast.....	. 72	Other gravel.....	. 54
Other sands.....	1. 60		

Listed below are average values of sand and gravel for production in parishes surrounding or adjacent to major marketing areas. These are estimates based on the average value of shipments of three or more producers in the vicinity or in adjacent areas.

Marketing area:	<i>Average value per ton</i>	
	<i>Sand</i>	<i>Gravel</i>
Shreveport.....	\$1. 71	\$1. 91
Lake Charles.....	1. 39	1. 76
Alexandria.....	. 86	1. 40
Monroe.....	1. 53	1. 93
Baton Rouge-New Orleans.....	. 73	1. 07

Stone.—Eleven producers supplied shell for construction, cement, poultry grit, and miscellaneous uses. The shell recovered was about half clamshell and half oystershell. Of the apparent consumption exceeding 5 million tons, 4,383,000 tons was dredged from bays, lakes, and coastal reefs of Louisiana. Unfavorable weather and depressed business conditions temporarily interrupted the growing consumption rate of this useful construction and chemical raw material. Tonnage was about 1 percent lower than in the preceding year. Because the State lacks suitable stone, it has had to rely strongly on shell as a substitute. Shell not only served as road base and concrete aggregate for construction but its chemical purity meets the highest chemical specifications. Because of the unique river and canal "highway" system the shell was moved economically to many important consuming centers in the State.

At New Orleans artificially colored roofing granules were produced by the Flintkote Co.

Sulfur.—The continued rise in production and shipments of sulfur from Louisiana was interrupted in 1957. Price cuts, decreased demand, and growing competition from Mexican sulfur all affected Louisiana industry. Cutbacks in fertilizer, steel, paper, and rayon production resulted in decreased consumption. In the fall sulfur producers reduced the price of sulfur \$3.00 per ton to compete with Mexican sulfur more effectively.

Despite the temporary setback, plans for constructing new sulfur-producing facilities for meeting the long-run demand for sulfur continued. Preliminary development began during 1957 on the Freeport Sulphur Co. Grand Isle property. The Grand Isle deposit was considered one of the largest discoveries in recent years. Development continued on the Freeport Lake Pelto operation. The U. S. Department of the Interior and the Louisiana State Mineral Board approved assignment of the Grand Isle lease of Humble Oil and Refining Co. to Freeport Sulphur Co. The State and Federal Governments had to agree to the assignment under conditions of an interim agreement, pending settlement of the tidelands dispute. Assignment by the Interior Department called for completion of a testing program and beginning of construction by November 1, 1958.

Freeport purchased land near Grand Isle to provide an onshore base for the sulfur-mining operation under development 6 miles offshore in 40 feet of water. Sulfur will be produced from a steel platform to be constructed over the deposit. The island will contain living quarters,

TABLE 34.—Sulfur produced and shipped from Frasch mines, 1948–52 (average) and 1953–57

Year	Production (long tons)	Shipments		
		Long tons	Value	
			Total	Average per ton
1948–52 (average).....	1,239,743	1,195,068	\$23,845,106	\$19.95
1953.....	1,640,571	1,609,364	43,453,000	27.00
1954.....	2,009,553	1,853,563	49,222,394	26.56
1955.....	2,081,261	2,072,418	58,027,704	28.00
1956.....	2,429,490	2,238,852	59,329,579	26.50
1957.....	2,124,835	2,155,567	52,689,664	24.44

a heliport, a boiler installation, and facilities for injecting superheated water into the formation and for recovery of the liquid sulfur.

Vermiculite.—Zonolite Co. exfoliated vermiculite in New Orleans from crude material shipped to Louisiana from other States. This mineral was used as a lightweight construction material.

Water.—Abundant supplies of water have been a factor in attracting industry to the State. The combination of water and mineral resources was responsible for the surge of construction in the chemical and aluminum industries in the 1956-57 period. Although over 300 billion gallons of water per day in the Mississippi River passes such places as Baton Rouge, some areas of the State still face periodic shortages. Industrial development in some areas was hindered by such shortages. The Federal Geological Survey, the Louisiana Geological Survey, and the Louisiana Department of Public Works continued their program of gathering data and information on ground water, surface water, and quality of water. According to the Louisiana Department of Public Works, requests for ground-water data by industry led to a study of ground water in the Baton Rouge-New Orleans area in 1957.

During 1957 five oil operators were directed by the Louisiana Department of Health, Education and Welfare to stop discharging wastes into north Louisiana rivers. The action was part of a new Federal program for pollution control. A board found that oil-well waste waters were making the Corney Creek water supply unfit for irrigation, stock watering, and municipal and industrial uses.

This waste originated in Arkansas and entered Louisiana through the Corney Creek. Because of this interstate feature the Federal Government acted to have the situation corrected. The Louisiana Stream Control Commission regulates pollution control in Louisiana.

METALS

Aluminum.—On October 15, 1957, Kaiser Aluminum & Chemical Corp. began to operate a ninth potline at the aluminum-reduction plant at Chalmette, La., near New Orleans. The new facilities increased plant capacity by 27,500 tons to a total of 247,500 tons. The installation, costing about \$15 million, made the plant the largest such reduction works in the Nation.

Construction continued on the two alumina plants under development at Burnside and Gramercy. Ores for the Ormet Corp. plant at Burnside were to be imported from Surinam. Alumina capacity was rated at 350,000 tons a year. The alumina from this plant was scheduled for shipment to a reduction plant at Clarington, Ohio. In December construction work at Kaiser Aluminum & Chemical Corp. plant at Gramercy was halted pending improvements in price and market conditions. Caustic soda for the operation at Gramercy would be furnished by a plant (under construction at the same site) for manufacturing caustic soda and chlorine. Bauxite for the Kaiser plant was to come from Jamaica. Kaiser continued operating the Baton Rouge alumina plant that supplied the Chalmette plant.

Nickel and Cobalt.—Preliminary design and development work was undertaken at the Cuban-American Nickel Co. plant to be constructed at Braithwaite, La. The annual plant capacity was 50 million pounds of nickel and 4.5-5.0 million pounds of cobalt. Plans called for a specially designed ship to carry molten sulfur to Cuba and a nickel-cobalt chemical concentrate slurry on the return trip. The

sulfur was to be used to make sulfuric acid to treat the ore at Moa Bay.

Anhydrous ammonia necessary for reducing the concentrate was to be obtained from petrochemical plants in Louisiana. Natural gas for fuel was another factor for establishing the plant in Louisiana.

REVIEW BY PARISHES

Minerals were produced in all but 1 parish, gaseous and liquid hydrocarbons in 57 parishes, and other minerals in 36 parishes. In terms of value of production, however, mineral production was concentrated. About one-third of the 1957 total value was produced from Plaquemines, Lafourche, and Terrebonne Parishes; nearly two-thirds of the total value was produced in the top 10 parishes.

Acadia.—The quantity of petroleum recovered in Acadia Parish, compared with 1956, was 6 percent higher; natural-gas production was 5 percent greater. This parish ranked second in the number of exploratory wells drilled. Eight proved gas productive, five produced oil, and forty-eight were dry. The production of natural-gas liquids (1.6 million barrels) was slightly higher than in 1956. Runnels Gas Products Corp. opened the new Eunice gasoline plant and also assumed control of the South Lewisburg gasoline plant formerly owned by the Union Oil and Gas Corp.

Ascension.—Construction continued during 1957 on Ormet Corp.'s new alumina plant at Burnside. The expected annual capacity of this plant was 350,000 tons. The alumina, to be produced from South American bauxite, was to be shipped to a metal-reduction plant in Ohio. At Geismar construction continued on the Wyandotte Chemicals Corp. ethylene oxide and electrolytic chlorine-caustic soda plant. Petroleum and natural gas were produced in the parish during the year.

Beauregard.—Two natural-gasoline and cycle plants recovered 317,000 barrels of natural gasoline and liquefied petroleum products in the parish, one at Merryville using the absorption process and one at Longville using the compression process. The 13.8 billion cubic feet of natural gas and 3.7 million barrels of crude petroleum recovered represented gains of 30 and 8 percent, respectively, from the preceding year. Exploratory drilling resulted in discovery of the West De Quincy oilfield.

Bossier.—Bossier Parish ranked sixth in the production of natural-gas liquids. Natural-gasoline and cycle products produced at the Benton, Koran, and Sligo plants amounted to 1.6 million barrels—a 1-percent decrease from 1956. Crude-petroleum recovery increased 12 percent to 3.9 million barrels. The Honore oilfield, discovered in May, produced 72 barrels of oil daily from the Pettit Sligo formation. The natural-gas output of 104 billion cubic feet was 3 percent higher than in the preceding year. Calumet Refining Co. operated a lube-asphalt refinery at Princeton which had a daily capacity of 950 barrels of crude oil. Expanded perlite was manufactured at Bossier City by Southwestern Perlite Co. for plaster and other lightweight structural uses.

Caddo.—Near Shreveport the Meriwether Sand & Gravel Co., Inc., operated a dredge to produce washed and screened sand for use in building and highway construction. Building brick was manufactured by the Arklatex Face Brick Co. near Mooringsport from clays

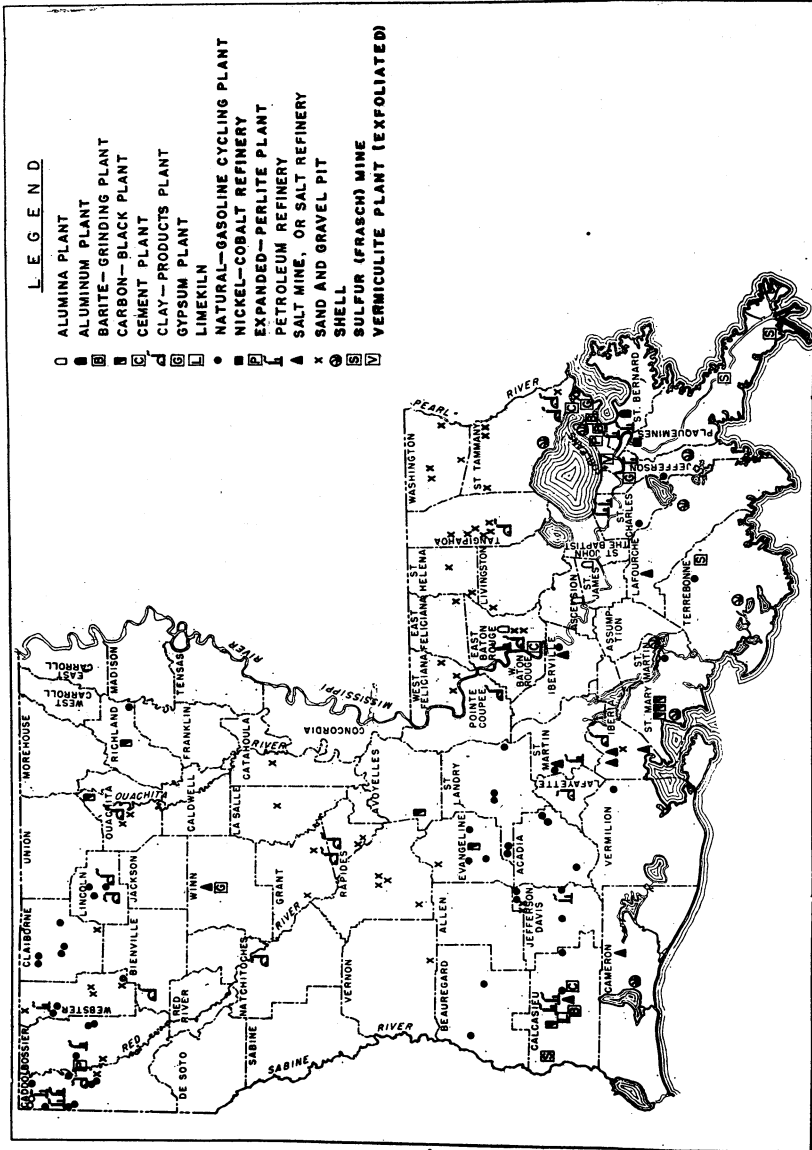


FIGURE 1.—The mineral production and processing industries of Louisiana, 1957.

TABLE 35.—Value of mineral production in Louisiana, 1956-57, by parishes ^{1 2}

Parish	1956	1957	Change (per-cent)	Average mining employment ³	Minerals produced in 1957, in order of value
Acadia.....	\$48,815,704	\$51,996,170	7	540	Petroleum, natural gas, natural-gas liquids.
Allen.....	6,425,890	8,771,790	37	178	Petroleum, natural gas.
Ascension.....	620,419	809,960	31	96	Do.
Assumption.....	4,788,213	10,367,220	117	74	Do.
Avoyelles.....	3,302,576	3,186,100	-4	57	Petroleum, natural-gas liquids, natural gas.
Beauregard.....	12,967,393	14,764,630	14	171	Petroleum, natural gas, natural-gas liquids.
Bienville.....	4,794,971	4,439,500	-7	21	Natural gas, petroleum, clays.
Bossier.....	25,913,404	29,960,395	16	428	Petroleum, natural gas, natural-gas liquids.
Caddo.....	38,511,466	38,434,282	-----	5,857	Petroleum, natural gas, natural-gas liquids, sand and gravel, clays.
Calcasieu.....	42,251,350	45,907,071	9	2,059	Petroleum, natural gas, natural-gas liquids, salt, sulfur, lime, cement.
Caldwell.....	311,954	321,145	3	7	Natural gas, petroleum.
Cameron.....	53,504,104	68,102,610	27	712	Petroleum, natural gas, salt.
Catahoula.....	3,389,504	4,085,680	21	118	Petroleum, sand and gravel, natural gas.
Clalborne.....	25,913,705	26,826,155	4	618	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Concordia.....	15,490,115	16,915,775	9	346	Petroleum, natural gas, natural-gas liquids.
De Soto.....	7,561,434	9,489,555	25	50	Natural gas, petroleum, natural-gas liquids.
East Baton Rouge.....	12,828,342	14,984,297	17	1,133	Cement, petroleum, natural gas, sand and gravel, sulfur, natural-gas liquids, clays.
East Feliciana.....	(⁴)	509,939	-----	(⁵)	Sand and gravel.
Evangeline.....	13,257,838	12,693,242	-4	307	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Franklin.....	2,823,163	3,240,015	15	49	Petroleum, natural gas.
Grant.....	952,554	630,235	-34	31	Sand and gravel, petroleum, natural gas.
Iberia.....	59,750,389	69,937,361	17	2,100	Petroleum, salt, natural gas, clays, sand and gravel.
Iberville.....	21,223,185	26,777,417	26	255	Petroleum, salt, natural gas.
Jackson.....	54,652	32,935	-40	1	Natural gas.
Jefferson.....	35,437,118	41,818,265	18	2,542	Petroleum, natural gas, natural-gas liquids, shell.
Jefferson Davis.....	27,355,476	29,781,421	9	696	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Lafayette.....	2,525,973	2,621,009	4	2,532	Petroleum, natural gas, clays.
Lafourche.....	100,513,925	133,821,625	33	1,694	Petroleum, natural gas, sulfur.
La Salle.....	16,081,583	17,346,196	8	459	Petroleum, natural gas, sand and gravel.
Lincoln.....	18,233,772	19,970,460	10	82	Natural-gas liquids, natural gas, petroleum, clays.
Livingston.....	400,367	388,426	-3	38	Petroleum, sand and gravel, natural gas.
Madison.....	1,449,896	1,654,150	14	1	Petroleum, natural gas.
Morehouse.....	1,815,936	1,525,875	-16	62	Natural gas, petroleum.
Natchitoches.....	273,702	308,945	13	4	Petroleum, natural gas, clays.
Orleans.....	7,554,511	7,129,801	-6	4,361	Cement, shell, sand and gravel.
Ouachita.....	3,325,549	2,723,887	-18	820	Natural gas, sand and gravel, petroleum, clays.
Plaquemines ⁶	260,398,432	320,581,367	23	3,285	Petroleum, sulfur, natural gas, natural-gas liquids.
Pointe Coupee.....	6,864,429	7,111,605	4	86	Petroleum, natural gas, clays.
Rapides.....	2,815,667	2,599,034	-8	195	Petroleum, sand and gravel, natural gas, clays.
Red River.....	529,034	605,750	15	17	Petroleum, natural gas.
Richland.....	18,506,549	21,181,910	14	219	Petroleum, natural-gas liquids, natural gas.
Sabine.....	388,823	618,810	59	36	Petroleum.
St. Bernard.....	438,584	188,345	-57	1	Petroleum, natural gas.
St. Charles.....	23,560,585	26,712,285	13	204	Petroleum, natural gas, natural-gas liquids.
St. Helena.....	(⁴)	(⁴)	-----	-----	Sand and gravel.
St. James.....	4,807,564	4,971,710	3	45	Petroleum, natural gas.
St. John the Baptist.....	264,427	159,595	-40	7	Natural gas, petroleum.
St. Landry.....	36,372,640	32,081,715	-12	1,358	Petroleum, natural gas, natural-gas liquids.
St. Martin.....	40,394,993	43,896,239	9	376	Petroleum, natural gas, salt, natural-gas liquids.
St. Mary.....	65,302,139	79,762,980	22	2,683	Petroleum, natural gas, shell, natural-gas liquids.

See footnotes at end of table.

TABLE 35.—Value of mineral production in Louisiana, 1956-57, by parishes^{1 2}—Continued

Parish	1956	1957	Change (per-cent)	Average mining employment ³	Minerals produced in 1957, in order of value
St. Tammany.....	\$1,820,551	\$690,522	-62	20	Sand and gravel, natural gas, petroleum, clays.
Tangipahoa.....	782,385	713,262	-9	142	Sand and gravel, clays.
Tensas.....	8,020,206	10,644,830	33	29	Petroleum, natural gas.
Terrebonne ⁴	94,780,432	119,929,995	27	2,427	Petroleum, natural gas, natural-gas liquids, shell, sulfur.
Union.....	9,572,932	7,303,405	-24	117	Natural gas, petroleum.
Vermilion.....	42,311,729	48,645,005	15	665	Petroleum, natural gas, natural-gas liquids.
Vernon.....		119,567		3	Sand and gravel.
Washington.....	1,041,305	943,510	-9	66	Sand and gravel, natural gas, petroleum.
Webster.....	29,666,620	36,763,480	24	384	Natural-gas liquids, petroleum, natural gas, sand and gravel.
West Baton Rouge.....	930,986	950,280	2	7	Petroleum, natural gas.
West Carroll.....	473,796	499,050	5	1	Natural gas.
West Feliciana.....	907,028	940,954	4	24	Sand and gravel.
Winn.....	2,291,546	2,157,196	-6	105	Salt, gypsum, petroleum, natural gas.
Undistributed.....	14,667,930	31,881,733		4,588	
Total ⁷	\$1,288,331,000	1,524,928,000		45,589	

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, 1957.

³ Louisiana State Department of Labor, Division of Employment Security.

⁴ Figure withheld to avoid disclosing individual company confidential data; value included with "Undistributed."

⁵ Not available.

⁶ Terrebonne Parish shipments of sulfur included with Plaquemine Parish.

⁷ Total adjusted to eliminate duplicating value of clays, stone, and shell.

⁸ Revised.

produced locally. The 9.7 million barrels of crude petroleum recovered in 1957 constituted over four-fifths of the total mineral value of the parish. The output of natural gasoline and cycle products from the parish's 8 plants amounted to 297,000 barrels. In July 1957 Sunray Mid-Continent Oil Co. assumed control of the Rodessa natural-gasoline plant, formerly operated by the Arkla Oil Co. In February 1957 the Shreveport gasoline plant, formerly operated by the Arkansas Louisiana Gas Co., was acquired by E. A. Whitton. Natural-gas recovery of 49 billion cubic feet in 1957 represented a 20-percent increase over 1956. A new oilfield (Simpson Lake) was discovered in May. The parish ranked first in the State in the total number of wells drilled. Of 462 exploratory and development wells drilled during the year, 385 proved oil productive, 17 produced gas, and 60 were dry.

Calcasieu.—Frash sulfur was produced by Jefferson Lake Sulphur Co. near Starks, La. Sulfur also was recovered by the contact method by Cities Service Refining Corp., both as sludge sulfur from refining and from hydrogen sulfide in the purification of gas. Olin Mathieson Chemical Corp. produced quicklime from oystershell for manufacturing alkalies at its plant near Lake Charles. The company also used salt brines for manufacturing soda ash. Salt brines for manufacturing chlorine were produced by Columbia-Southern Chemical Corp. from wells near Sulphur.

The parish ranked third in Louisiana as a producer of natural-gas liquids. The 1957 output of natural gasoline and cycle products recovered by absorption plants at Gillis and Iowa, was 2.3 million barrels. Natural-gas production decreased 3 percent, and that of

crude petroleum declined 6 percent. The Northwest Chalkley gasfield was discovered during 1957. Ground barite for use as a weighting material in oil-well drilling muds was produced by the Magnet Cove Barium Corp. Lake Charles plant. Carbon black was produced at a furnace-black plant at West Lake.

Lake Charles Chemical Corp. completed a \$6 million coking unit at its Lake Charles refinery. The unit will produce approximately 85,000 tons of coke annually for industrial use and 4,200 barrels daily of refinery stock for manufacturing motor gasoline. Also in the Lake Charles vicinity, the new Lone Star Cement Co. plant began producing in July.

Cameron.—The parish ranked sixth in total value of mineral production. Natural-gas production increased 36 percent to a total of 208 billion cubic feet, making the parish second high in State production. Crude-petroleum recovery was 16 percent higher. Four new gasfields, drilled at an average depth of 11,000 were discovered in 1957.

Near Hackberry, Olin Mathieson Chemical Corp. produced salt for making soda ash.

Claiborne.—Petroleum, natural gas, natural-gas liquids, and sand and gravel were produced in Claiborne Parish in 1957. Over 1 million barrels of natural gasoline and cycle products was recovered by 7 plants. The output of crude petroleum declined 3 percent for a total of 5.5 million barrels; natural-gas production of 44 billion cubic feet represented a 2-percent increase. At a pit near Arcadia, George H. Owens produced gravel used for road construction.

Concordia.—Over 5 million barrels of crude petroleum and 4.2 billion cubic feet of natural gas were obtained in 1957. Quantitatively, this was a 3-percent decrease and a 14-percent gain, respectively, compared with 1956. The Cross Cocodrie and Warnicott oilfields were discovered in the latter part of the year. The Experance Point gasoline plant for recovering natural gasoline and cycle products began operations in March 1957.

East Baton Rouge.—During the year 1.6 million barrels of crude petroleum and 3.4 billion cubic feet of natural gas were produced. Alsen field was an oil discovery, drilled at a depth of 12,100 feet. Alumina was processed from imported Jamaican bauxite ore by Kaiser Aluminum & Chemical Corp. at the plant at North Baton Rouge. Nagatuck Chemical Division of U. S. Rubber Co. began building a kralastic plastic plant at Baton Rouge. Construction continued on the W. R. Grace Co. polyethylene plant at Baton Rouge. Clays were produced by Acme Brick Co. for manufacturing brick and by Ideal Cement Co. for the manufacture of cement. Oystershell also was used as a basic material for producing general-use, high-early strength, and masonry cements at the Ideal plant. Consolidated Chemical Industries, Division of Stauffer Chemical Co., recovered sulfur as a byproduct in the liquid purification of gas by the Claus process at its Baton Rouge plant. Sand and gravel was produced near Baton Rouge for construction and paving uses.

Evangeline.—Recovery of natural-gas liquids by plants at Easton, Ville Platte, and Mamou amounted to 37 million gallons in 1957. The 2.2 million barrels of crude petroleum and 21 billion cubic feet of natural gas recovered during the year represented a 9-percent and 4-percent decrease, respectively. Point Blue field (a gas discovery) had a rated daily production of 933 million cubic feet. Car-

bon black was produced by a furnace-type plant at Ville Platte. Gifford-Hill & Co., Inc., continued dredging and washing sand and gravel for structural uses, paving, road construction, and railroad ballast.

Iberia.—In terms of total value of mineral production, Iberia was the fifth largest producing parish in the State. Over one-third of the salt yield in Louisiana came from three of the world's largest salt deposits in this parish. Evaporated salt (produced by the vacuum-pan method), rock salt, and pressed blocks were produced at the underground mine and refinery of International Salt Co., Inc. Similar operations were conducted by the Morton Salt Co. at Weeks and by Jefferson Island Division of Diamond Crystal Salt Co. at New Iberia. Iberia Sand & Gravel Co. dredged sand for building purposes. Clay used for building brick was mined by Mike Baker Brick Co. near New Iberia. The company installed an additional kiln.

Sixteen million barrels of crude petroleum and fifty-six billion cubic feet of natural gas were recovered in 1957. One oilfield, North Bayou Long, drilled at a depth of 12,000, was discovered in November.

Iberville.—The West Addis oilfield, discovered in Iberville Parish in November, had a daily average production of 528 barrels. Petroleum and natural-gas output in 1957 amounted to 7 million barrels and 18 billion cubic feet, respectively. Solvay Process Division of Allied Chemical & Dye Corp. continued producing salt brines, mostly for manufacturing soda ash. At Plaquemine, Dow Chemical Co. began work on a large basic chemical plant.

Jefferson.—Recovery of natural-gas liquids at the absorption-type plants at Lafitte and Pine Island totaled 11 million gallons. The 11.7 million barrels of crude petroleum produced was 6 percent higher than in 1956; natural-gas production gained 1 percent to a total of 23.6 billion cubic feet in 1957. The Clark Oil & Refining Corp. operated a petroleum refinery that had a crude-oil capacity of 7,500 barrels daily and a cracked-gasoline capacity of 975 barrels daily. National Gypsum Co. calcined gypsum imported from Jamaica at the Westwego plant. Southern Shell Fish Co. of Harvey sold shell for use in concrete.

Freeport Sulphur Co. purchased land on Grand Isle as an onshore base for its proposed sulfur-mining operations in the Gulf of Mexico. The plans call for construction of a heliport, a small dock, a seaplane ramp, a small operations building and dispatcher's office, and a parking lot. Preliminary development began for the construction of an offshore production structure. American Cyanamid Co. began constructing a \$39 million addition to the chemical plant at Avondale for producing acrylonitrile.

Jefferson Davis.—Near Kinder, Gifford-Hill & Co., Inc., and Witte Gravel Co. dredged sand and gravel for road paving, construction, railroad ballast, and other purposes. The combined output of natural gasoline and other liquefied petroleum gases from plants at Jennings, Welsh, and Elton was 33 million gallons. Over 97 billion cubic feet of natural gas was produced—5 percent more than that of the previous year; the 4.3 million barrels of crude petroleum recovered was 5 percent higher. There were 2 gasfields and 1 oilfield discovery during the year.

Lafourche.—Lafourche Parish was the second-ranking petroleum producer. Natural gas and sulfur were other commodities produced. The total value of these minerals was 33 percent higher than in 1956.

Petroleum production, which gained 19 percent, totaled 35.6 million barrels in 1957; natural-gas output was up 47 percent. The Chegby and Saint John gasfields were discovered during the year by exploratory drilling.

The total of 55 exploratory wells drilled in Lafourche was the third largest in the State. Of these, 11 proved gas productive, 6 produced oil, and 38 were dry. The parish ranked fourth in geophysical and core-drilling prospecting. At Thibodaux Freeport Sulphur Co. recovered sulfur at its Chacahoula mine.

La Salle.—Near Jena, Quality Gravel Co. produced paving sand and gravel. Petroleum recovery in 1957 was 5.2 million barrels; the natural-gas yield totaled 2.8 billion cubic feet. The Long Slough field was discovered in September 1957.

Lincoln.—Lincoln Parish ranked second in the State as a producer of natural-gas liquids. The output of natural-gas liquids recovered by plants in Ruston, Hico, and Dubach amounted to 3 million barrels. The 67 billion cubic feet of natural gas produced during the year was 9 percent higher than in 1956. Filtrol Corp. mined bentonite clay to be used for filtering and bleaching. Building and face brick was manufactured by Ruston Brick Works from locally mined clays.

Orleans.—Most of the barite ground in the State was processed in Orleans Parish from imported ores. Baroid Division of National Lead Co. (at its new plant near New Orleans) and Magnet Cove Barium Corp. mill and grinding plant at New Orleans ground barite for weighting material in oil-well drilling mud. Lone Star Cement Corp. used limestone shipped into Louisiana for manufacturing portland and masonry cements. Crude perlite from Western States was used by the Alalex Construction Service, Inc., to manufacture expanded perlite. The finished material was used in plasters and concrete aggregate. The Flintkote Co. produced artificially colored roofing granules. Vermiculite was exfoliated by the Zonolite Co. at its New Orleans plant, using crude vermiculite imported from other States. Jahncke Service Co., Inc., dredged sand and shell for concrete and other construction. Shell also was dredged by Sand and Shell, Inc., for use in concrete. Gypsum products were made at New Orleans from imported ores by U. S. Gypsum Co.

Plaquemines.—Plaquemines Parish was credited with approximately one-fifth of the total value of minerals produced in the State in 1957. Petroleum production for the year was 79.4 million barrels, a 19-percent increase over 1956. Production of 135 billion cubic feet of natural gas was reported. Felice Bayou and Block 26 of the South Pass area, offshore gasfields and the Saturday Island and Block 41 of the Main Pass area, offshore oilfields were discovered. Prospecting was particularly active during the year. The parish ranked second in all wells drilled, and fifth in Louisiana in exploratory wells drilled. Of the 51 exploratory wells, 6 proved oil productive, 12 were gas productive, and 33 were dry. Most of the Frasch sulfur produced in the State came from this parish. Grande Ecaille mine near Port Sulphur and Garden Island Bay mine near Venice made Plaquemine Parish one of the most prolific sulfur-producing areas in the Nation. The Cuban American Nickel Co. was building a refinery to produce nickel and cobalt from Cuban concentrate.

The world's second deepest producing well was completed near the deepest well in Plaquemines Parish. The new well was down to 20,186 feet.

Rapides.—At Alexandria clay from a canal soil bank was obtained for production of lightweight aggregate by the Louisiana Lightweight Aggregate Co.; Acme Brick Co. produced clay for manufacturing structural clay products. Five commercial sand and gravel producers operated in the parish during 1957. Two dredges operated near Woodworth and another at Alexandria. A portable plant produced paving gravel at Glenmora. Paving gravel also was produced by the National Forest Service. Nearly one-half million barrels of crude petroleum and small quantities of natural gas also were produced.

Richland.—In 1957 production of natural-gas liquids from the absorption-type plant at Delhi was over one-half million barrels. Output gains of 14 percent for petroleum and 33 percent for natural-gas liquids resulted in an overall gain of 14 percent for the value of the parish's mineral production. A contact-type carbon-black plant was operated at Rayville.

St. Charles.—Over one-half million barrels of natural-gas liquids was recovered at the Paradis plant of The Texas Co. The Couba Island oilfield and the Taft gasfield were found in 1957. Two refineries at Norco and Destrehan had a combined straight-run capacity of 130,500 barrels of crude oil daily and a cracking capacity of 35,000 barrels of gasoline daily. Monsanto Chemical Co. began operating the new adipic acid unit at its Luling plant. Adipic acid is used in manufacturing nylon, vinyl plastics, and foamed resin materials. At Norco, Shell Chemical Co. began operating new facilities for hydrogen peroxide and secondary butyl alcohol.

St. James.—Kaiser Aluminum & Chemical Corp. continued constructing the Gramercy alumina plant. The total cost of the plant was estimated at \$70 million. At the same location Kaiser was building a caustic soda-chlorine plant. The caustic was to be used in producing alumina. Although the value of mineral production in the parish increased 3 percent over that in 1956, the production of natural gas declined 15 percent. Petroleum production gained 2 percent.

St. Landry.—The output of crude petroleum and natural gas increased 9 and 6 percent, respectively. About 6.7 million barrels of petroleum and 51 billion cubic feet of natural gas were recovered. Over 1.7 million barrels of natural-gas liquids was recovered by natural-gasoline plants at Krotz Springs and Opelousas and by a new plant in Krotz Springs recently opened by Anchor Gasoline Corp. The Washington South oilfield, discovered in June 1957, had a daily average production rate of 360 barrels.

St. Martin.—Evaporated salt and pressed blocks for many chemical and industrial uses were produced from wells and a mill near Breaux Bridge by the Gordy Salt Co., Inc. The existing facilities were enlarged. Ninety-seven billion cubic feet of natural gas and ten million barrels of petroleum were produced in the parish during 1957. Natural gasoline and cycle products were recovered from gas at Anse La Butte and Lake Chicot natural-gasoline plants.

St. Mary.—This parish ranked fourth in the State in value of mineral production. Over 19.8 million barrels of petroleum and 101 billion cubic feet of natural gas were produced. Exploratory drilling crews discovered 4 gasfields, 1 of which was later shut in. Natural gasoline and cycle products were recovered from natural gas by The Texas Co. cycle plant at Batemen Lake and by the Bayou Sale plant operated by the Atlantic Refining Co. Shell for road material was dredged near Morgan City by the Leftwich Co., Inc. Shell for concrete and

road material was dredged from Atchafalaya Bay by Oyster Shell Products Corp. and near Morgan City by the Grizzaffi Dredging Co. Three furnace-type carbon-black plants were operated at Franklin.

St. Tammany.—Production of petroleum and of natural gas increased 11 and 10 percent, respectively, over that in 1956. Jahnce Service, Inc., Kivett and Reel, Inc., and Mississippi Valley Silica Co. produced blast, ground, and molding sands, as well as paving sand and gravel. On July 1, Slidell Brick and Tile, Inc., acquired the clay operation of Schneider Brick and Tile Co. at Slidell. North of Slidell, St. Joe Brick Works, Inc., produced heavy clay products.

Terrebonne.—The parish ranked third in the State in total value of mineral production. Large quantities of petroleum, natural gas, and natural-gas liquids were recovered during 1957. The total value of minerals produced was 27 percent higher than in 1956. Petroleum production gained 18 percent and natural-gas yields were up 7 percent. Over 1 million barrels of natural-gas liquids was recovered at Water-proof by the cycling plant of The California Co. Terrebonne Parish again was the leading natural-gas producer. Both onshore and offshore exploratory drilling discovered 6 gas and 4 oil fields. There were 73 exploratory wells drilled in 1957—a record high for the State. Frasch sulfur was recovered from wells in the Bay Ste. Elaine dome near Houma. At the Lake Peltó sulfur deposit on the fringe of the Louisiana Gulf coast, Freeport Sulphur Co. continued preparing the mining-plant site and drilled a number of additional wells. It was anticipated that the Lake Peltó facilities will be ready for production within the next 2 years.

Vermilion.—In 1957, 168 billion cubic feet of natural gas and 6.9 million barrels of crude petroleum were produced. The cycle plant at Erath had the largest capacity of natural-gas liquids, compared with any plant in the State. The Leleux plant also recovered natural gasoline and cycle products from natural gas. Two million barrels of natural-gas liquids was recovered. Five gasfields and four oilfields were discovered in the parish in 1957. Vermilion Parish ranked fourth in total exploratory wells drilled during the year.

Webster.—Over one-half million short tons of sand and gravel was produced in Webster Parish in 1957 from plants at Bogalusa, Franklinton, and Price. Natural-gas liquids recovered by the Bisteneau, Cotton Valley, and Sarepta gasoline plants totaled 4 million barrels—the highest in the State. The production of petroleum increased 6 percent, and natural gas gained 15 percent to give a yearly total of 4 million barrels of petroleum and 65 billion cubic feet of natural gas. The Minden gasfield, discovered in May 1957, had a daily average production rate of 9,000 million cubic feet.

Winn.—Minerals produced in Winn Parish during 1957, in order of value, were salt, gypsum, petroleum, and natural gas. Gypsum, produced from an open pit near Winnfield by Anderson & Dunham, Inc., was used as a portland-cement retarder and for road construction. The Carey Salt Co. produced rock salt and pressed blocks from an underground mine near Winnfield. During the year 111,000 barrels of crude petroleum was produced. In January 1957 exploratory drilling discovered the Curry oilfield.

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. Metcalf¹ and Mary E. Otte²



MINING companies in Maine spent over one-half million dollars in 1957 for mineral exploration, according to John R. Rand, Maine State geologist. The Federal and State Geological Surveys also undertook mineral exploration projects on a more modest scale. Exploration was principally for copper, nickel, lead, and zinc; search was made also for limestone, lithium minerals, slate, beryl, quartz sand, and feldspar.

The exploration projects of the Geological Survey of Maine include the contract for aeromagnetic and geologic reconnaissance of 1 million acres in south central Maine, let to the James W. Sewall Co., consulting engineers, Old Town, Maine. The aeromagnetic survey was subcontracted to Aerogeophysics, Inc., Los Angeles, Calif. The survey includes three widely spaced groups of long flight lines, fill-in in anomalous areas, compilation of published and unpublished data from various sources, and correlation of ground and air reconnaissance.

TABLE 1.—Mineral production in Maine, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate.....	12	\$6,696	4	\$2,202
Clays.....	26,162	23,045	29,924	27,636
Feldspar (crude)..... long tons..	22,219	143,495	14,330	91,795
Gem stones.....	(2)	500	(2)	500
Lime.....	11,997	179,162	(2)	(2)
Mica:				
Scrap.....	114	3,213	6	168
Sheet..... pounds..	19,913	146,437	25,453	202,086
Peaf.....	(3)	(3)	3,770	175,173
Sand and gravel.....	7,196,019	3,085,417	8,036,756	3,098,967
Stone.....	⁴ 946,825	⁴ 2,786,783	889,491	3,076,044
Value of items that cannot be disclosed: Cement, columbium-tantalum concentrate (1956), slate, and value indicated by footnote 3.....		6,913,327		6,617,662
Total Maine ⁵		⁴ 12,728,000		12,711,000

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 figure.

⁵ Total has been adjusted to eliminate duplicating the value of stone.

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To facilitate the location of mineral occurrences in the State, the Maine Geological Survey (a division of the Maine Department of Economic Development) also issued the first of a new mineral-resources reference-map series, Bangor Sheet, Mineral Resources of Maine.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Maine's leading mineral product, measured by value, was cement. The output in 1957 decreased 10 percent in quantity and 4 percent in value, owing mostly to a month-long strike in July and wage and price increases. The only producer was Dragon Cement Co., Division of American-Marietta Co., which operated a 2-million-barrel-capacity wet-process plant at Thomaston. Portland and masonry cements were produced mostly for general-use and moderate-heat cement.

Clays.—Clays produced in Maine increased 14 percent over 1956 to nearly 30 thousand short tons in 1957, but about 8 percent under 1955. The output consisted wholly of miscellaneous or common clay and was used in making heavy clay products, mostly structural brick. Seven open-pit mines adjacent to brick plants were producing in 1957—2 in Androscoggin County, 4 in Cumberland County, and 1 in Penobscot County. The leading producers were Morin Brick Co., Androscoggin County, and Lachance Bros. Brick Co., Cumberland County. In 1957 Androscoggin County led in production of clay, followed in order by Cumberland and Penobscot.

TABLE 2.—Clays sold or used by producers, 1948–52 (average) and 1953–57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948–52 (average) ...	26,935	\$24,723	\$0.92	1955.....	32,598	\$32,598	\$1.00
1953.....	29,661	27,476	.93	1956.....	26,162	23,045	.88
1954.....	26,872	26,872	1.00	1957.....	29,924	27,636	.92

Feldspar.—The output and value of crude feldspar in 1957 declined 36 percent to the lowest point since 1945, chiefly because of a sharp drop in pottery production. The average value per ton declined slightly from \$6.46 to \$6.41. Production in 1957 was reported only from Oxford and Sagadahoc Counties. Four producers at 6 active mines furnished the output of feldspar in Oxford County; 12 producers at 13 mines were active in Sagadahoc County. In addition, grinding mills reported purchases from several other small producers in each county—mostly potash feldspar. The principal producers were Bell Minerals Co. and R. C. Benson, West Paris; Alex Cunningham, Georgetown; White's Service and Cesare Trusiani, Topsham; and James Russo, Brunswick. Three mills ground feldspar in Maine in 1957—1 at West Paris (Oxford County) ground company-mined and purchased feldspar, and 2 at Topsham (Sagadahoc County) used purchased feldspar only. Maine-ground feldspar was used mostly for

pottery manufacture, including ceramic tile, electrical porcelain, and sanitary ware. Other uses included soaps and abrasives.

Gem Stones.—A small quantity of gem stones was recovered by a New York mineral specimens collector from two mines in Oxford County. Gems also were collected from several other mines in the same county.

Lime.—High-calcium quicklime for use in paper manufacture was produced by Rockland-Rockport Lime Co., Inc., Rockland, Knox County. A small quantity of hydrated lime also was used for experimental purposes. Output was higher in 1957 than in 1956 because of the continuing active demand for paper products.

Mica.—Sheet-mica output in 1957 rose 28 percent in quantity and 38 percent in value compared with 1956. Hand-cobbed material has been converted to full-trim basis. Most all of the sheet mica was sold through the Government General Services Administration (GSA) Franklin (N. H.) Materials Purchase Depot for the national strategic stockpile. The average value per pound in 1957 rose to \$7.94 from \$7.35 in 1956 and \$6.09 in 1955, reflecting increasing costs of mining, including higher wages. Scrap production almost ceased and was reported by only one producer. About 20 miners produced mica at 15 mines in Oxford County, and only 2 mined in Sagadahoc County. A small quantity of punch and circle and some half-trim mica were produced, but the bulk of the reported output was hand-cobbed and full-trim material.

Nitrogen Compounds.—A 125-ton-per-day plant at Searsport in Waldo County produced anhydrous ammonia for fertilizer.

Sand and Gravel.—Stimulated by the increased roadbuilding program, the output of sand and gravel in Maine in 1957 rose 12 percent to over 8 million short tons valued at more than \$3 million. Owing to a substantially larger Government-and-contractor tonnage, however, the average value per ton of all sand and gravel in 1957 dropped 9 percent compared with 1956.

Commercial sales of sand and gravel dropped 10 percent in quantity, because of slow business activity. However, Government-and-contractor tonnage, used mostly for paving, rose 18 percent, and comprised 81 percent of the total output of sand and gravel in 1957 compared with 76 percent in 1956. The Maine State Highway Commission was by far the leading producer and either mined or produced sand and gravel under contract in all counties in the State. Combined commercial and Government-and-contractor tonnage came chiefly from Aroostook, Cumberland, Penobscot, Androscoggin, and York Counties.

Slate.—The Portland-Monson Slate Co., Piscataquis County, mined slate underground and processed it at Monson. Products sold were electrical slate, including switchboard panels, and flagging. The output in 1957 declined compared with 1956.

Stone.—Stone production in Maine totaled nearly 900 thousand short tons valued at over \$3 million. The tonnage was 6 percent less than in 1956; but the value rose 10 percent, owing chiefly to increased valuation of limestone and Government-and-contractor granite. The tonnage of crushed limestone and quartzite both declined in 1957 compared with 1956. Thirteen commercial quarries were active—8 for granite, 3 for limestone, and 2 for quartzite. In addition, the Maine

TABLE 3.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Uses	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Structural.....	220,749	\$165,900	\$0.75	180,839	\$132,265	\$0.73
Paving.....	326,907	143,529	.44	208,305	97,113	.47
Filter.....				124	43	.35
Railroad ballast.....	383	273	.71			
Gravel:						
Structural.....	406,825	438,108	1.08	250,052	277,151	1.11
Paving.....	601,938	345,380	.57	557,526	426,738	.77
Railroad ballast.....	32,067	8,939	.28	(1)	(1)	(1)
Other.....	84,208	35,167	.42	(1)	(1)	(1)
Undistributed ²	18,398	9,379	.51	327,700	162,440	.50
Total.....	1,691,475	1,146,675	.68	1,524,546	1,095,750	.72
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving.....	331,436	189,500	.57	419,466	134,430	.32
Gravel:						
Structural.....	16,835	5,892	.35	4,500	450	.10
Paving.....	5,156,273	1,743,350	.34	6,088,244	1,868,337	.31
Total.....	5,504,544	1,938,742	.35	6,512,210	2,003,217	.31
Grand total.....	7,196,019	3,085,417	.43	8,036,756	3,098,967	.39

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

² Includes engine sand, other sand, and values indicated by footnote 1.

State Highway Commission quarried miscellaneous stone in 1 county and granite in 8 counties for use as roadstone. Of the commercial granite quarries, 1 produced crushed or broken stone only, 2 produced both dimension and crushed stone, and the other 5 yielded dimension stone only. Dimension stone included rough and dressed architectural and dressed construction stone, curbing stone, and monumental stone. Crushed and broken quartzite and granite were used principally for road construction and as riprap; limestone was used for agricultural purposes, making cement and lime, and as riprap. The leading stone-producing counties were Knox, Cumberland, Kennebec, and York and, in order of value—Knox, Hancock, York, and Cumberland.

MINERAL FUELS

Peat.—Peat from bogs in Hancock and Washington Counties was sold for agricultural use.

METALS

Beryllium.—The output of beryllium concentrate was less than one-third that in 1956 and came mostly from Oxford County; a small quantity was produced in Sagadahoc County. W. Phillips Cole (Mt. Adams mine at Stoneham) and William Pechnik (Pelletier mine at North Norway) were the leading producers. The entire output was purchased through the Government General Services Administration

Materials Purchase Depot at Franklin, N. H., for the strategic materials stockpiling program.

Columbium-Tantalum.—No columbium-tantalum concentrate was produced for sale in 1957.

Manganese.—Further results of the investigation of Maine manganese deposits were published.³ This study consisted of bulk sampling by diamond drilling at the Dudley manganese project in northern Aroostook County.

REVIEW BY COUNTIES

Androscoggin.—Androscoggin County led in value of sand and gravel output and ranked fourth in sand and gravel production in the State. Output totaled over 710 thousand short tons valued at over \$520 thousand. Commercial production largely was centered in the southern part of the county near Lewiston, Auburn, Lisbon, and Poland, although some output came from Leeds and Livermore in the northern part of the county. Eleven commercial producers, the Maine State Highway Commission, and several town governments were active producers of sand and gravel. Two producers mined clay in Androscoggin County—Dennis Brick Co. (Auburn) and Morin Brick Co. (Danville). This clay was made into building brick at nearby plants.

Aroostook.—Aroostook County led in output of sand and gravel and ranked fourth in value of total output among Maine counties in 1957. Bull Bros. (Washburn near Presque Isle) and Quint Bros. (Houlton) produced building and paving sand and gravel. The Bangor & Aroostook Railroad Co. also produced railroad-ballast gravel and other gravel near Wallagrass, Houlton, and Presque Isle. The Maine State Highway Commission produced sizable quantities of sand and gravel, both with its own crews and under contract.

TABLE 4.—Value of mineral production in Maine, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Androscoggin.....	\$538, 454	(1)	Sand and gravel, clays.
Aroostook.....	466, 408	\$341, 480	Sand and gravel.
Cumberland.....	830, 689	817, 312	Stone, sand and gravel, clays.
Franklin.....	(1)	(1)	Sand and gravel.
Hancock.....	(1)	(1)	Stone, sand and gravel, peat.
Kennebec.....	214, 446	(1)	Sand and gravel, stone.
Knox.....	6, 927, 121	(1)	Cement, stone, lime, sand and gravel.
Lincoln.....	68, 716	90, 261	Sand and gravel.
Oxford.....	383, 475	388, 942	Mica, sand and gravel, feldspar, beryl, gem stones.
Penobscot.....	498, 869	464, 458	Sand and gravel, stone, clays.
Piscataquis.....	(1)	(1)	Slate, sand and gravel, stone.
Sagadahoc.....	(1)	(1)	Sand and gravel, feldspar, mica, beryl.
Somerset.....	155, 494	227, 235	Sand and gravel, stone.
Waldo.....	118, 208	(1)	Do.
Washington.....	(1)	(1)	Sand and gravel, peat, stone.
York.....	(1)	(1)	Stone, sand and gravel.
Undistributed.....	² 2, 526, 284	10, 381, 198	
Total.....	² 12, 728, 000	12, 711, 000	

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

² Revised figure.

³ Ellertsen, N. A., and Earl, K. M., Bulk Sampling by Diamond Drilling; Dudley Manganese Deposit, Northern District, Aroostook County, Maine: Bureau of Mines Rept. of Investigations 5303, 1957, 26 pp.

Cumberland.—Cumberland County ranked second in tonnage and third in value of sand and gravel, which output came from seven producers, mostly near Cumberland, Portland, and Scarborough in the southern part of the county. The Maine State Highway Commission produced paving sand and gravel under contract and with its own crews. Miscellaneous clay for building brick was mined by Roger R. Blais, formerly Joseph A. Blais, Jr. (Portland); Lachance Bros. Brick Co. (Gorham); Fred S. Liberty & Son (North Yarmouth); and Royal River Brick Co. (Cumberland Center). The State highway commission produced crushed miscellaneous stone (gneiss) for paving. Blue Rock Quarry (Westbrook) quarried quartzite for concrete aggregate, roadstone, and riprap.

Franklin.—Three commercial producers at Jay, New Sharon, and Weld, and the Maine State Highway Commission supplied the output of sand and gravel, which increased nearly 70 percent compared with 1956. The Highway Commission produced sand and gravel both with its own crews and under contract. Farmington Brick Co. (West Farmington) did not operate during the 1957 season.

Hancock.—Sand and gravel was produced in the southern part of Hancock County at Blue Hill, Winter Harbor, Hancock, and South West Harbor by four commercial producers, the National Park Service, the town of Blue Hill, and the Maine State Highway Commission. Bradbury & Perkins, Franklin, produced monumental granite. Deer Island Granite Corp. produced rough and dressed architectural, dressed construction, and monumental granite. This stone was used for exterior work in the Cleveland Museum of Art, Cleveland, Ohio, and the Lumberman Mutual Casualty Building, Los Angeles, Calif., and in a new base for the Houdon statue of George Washington at Valley Forge, Pa. Joseph Musetti quarried granite and sold dressed dimension stone for construction use and for curbing. The Main State Highway Commission quarried granite for its own use in road construction and maintenance. Richland Peat Mines, Inc., recovered peat from bogs near Penobscot.

Kennebec.—Sand and gravel for structural purposes, paving, and fill was produced at Augusta, Gardiner, and Waterville. The value of output ranked fifth among Maine counties. Granite was quarried, crushed, and sold by H. E. Sargent, Inc. (Hallowell), for road construction.

Knox.—Chester R. Wallace & Son produced sand and gravel at Warren. This firm was clearing off overburden and enlarging its pits during 1957. Competition in this area was reported to be keen. The Maine State Highway Commission produced mostly bank-run gravel for paving. Rockland-Rockport Lime Co., Inc., operated 11 shaft kilns and prepared both quick and hydrated lime at Rockland, using as raw material high-calcium limestone from its own quarries. The quicklime was used in manufacturing paper and the hydrated lime for agricultural purposes and papermaking. This firm also marketed some riprap and a sizable tonnage of high-magnesium limestone for agricultural use. Knox Lime Co., Union, quarried and crushed limestone for use in making paper. Granite was quarried and crushed or broken by Hocking Granite Industries, Inc. (Clark Island), for riprap; dimension granite also was produced for construction and architectural use as well as for curbing and flagging.

Dragon Cement Co., Division of American-Marietta Co., burned cement at its two-kiln plant at Thomaston. Production decreased because of lessened demand, particularly in the latter part of the year. A price increase of 15 cents per barrel was put into effect April 1, 1957, followed by a 6-percent wage increase on May 1. A strike from July 1 through July 30 also contributed to a smaller output in 1957. General-use and moderate-heat cement comprised the bulk of the output, although some high-early-strength cement also was produced. Limestone was quarried near the plant. Both portland and masonry cements were manufactured.

Lincoln.—Building, paving, and fill gravel were produced at Newcastle by Howard R. Wright. The Maine State Highway Commission produced paving sand and gravel at various places in Lincoln County.

Oxford.—Beryllium concentrate was processed by four producers: William Pechnik near North Norway, Bell Minerals Co. near West Paris, W. Phillips Cole near Stoneham, and Winfield Knight near North Waterford. Sales were to the GSA Materials Purchase Depot at Franklin, N. H. Mineral-specimen gem stones were collected by Ken Carr, Round Lake, N. Y., from the Phillips Mine and Tamminen quarry near West Paris. The variety of gem stones was not reported. Charles Bragg, Buckfield, also collected gems and gem materials from near Stoneham, Waterford, Hewry, Hebron, Greenwood, and Lovell. Gem materials collected included, among others, triphylite, beryl, amblygonite, apatite, aquamarine, topaz, tourmaline, and zircon.

Sand and gravel in Oxford County was produced mostly near Rumford, Ridlonville, and Mexico. Some sand and gravel also was mined near Norway. The Maine State Highway Commission obtained sand and gravel for paving at various localities, both with its own crews and under contract.

Feldspar was mined from open pits by R. C. Benson (Conant and Tamminen mines), Buck & Baker (Perham mine, subleased from Bell Minerals in early part of 1957), Pechnik Bros. (Pelletier Mine, formerly the Dunn mine), Bell Minerals Co. (Perham mine), and unidentified producers who sold to Bell Minerals Co. Operations at the Whitehall Co., Inc., Newry mine at Newry (leased from International Paper Co.) were discontinued in 1956, and the lease was canceled later. Bell Minerals Co. ground feldspar for ceramic use, including tile, pottery, electrical porcelain, and sanitary ware, and for soaps and abrasive purposes. Ground feldspar was shipped largely to Ohio, New York, New Jersey, Pennsylvania, and Wisconsin.

Mica was sold largely through the GSA (Franklin, N. H.) Materials Purchase Depot, although some material was sold to industry and through the Spruce Pine (N. C.) and Custer (S. Dak.) Government Purchase Depots. Sales in the county increased appreciably over 1956 and consisted of hand-cobbed and full-trimmed mica and a very small quantity of scrap. The leading suppliers were Maine Mica Co. (Hibbs mine at Hebron, Pelletier mine at North Norway, and Wardwell mine at Albany); Pechnik Bros. (Pelletier mine at North Norway); John Maderic (Wheeler mine at Gilead); Paul Carpenter (Pechnik mine at Norway); Robert C. Tibbetts (Pine Mountain mine at Mason); and Lawrence Anderson (Wheeler mine

at Gilead). In all, 20 producers mined at 15 locations; more than 1 miner often worked the same mine at various times.

Penobscot.—Penobscot County ranked third in quantity of sand and gravel produced and second in value of mineral output in the State in 1957. Sand and gravel was produced largely from the southern part of the county near Brewer, Bangor, Stillwater, and Orono. Sizable output also was obtained near Lincoln in central Penobscot County. Nine companies or individuals, one municipality, and the Maine State Highway Commission (the leading producer), contributed to the county output. The Maine State Highway Commission produced sand and gravel both with its own crews and under contract. G. E. Goding & Sons completed its first year of operation and produced mostly building sand and gravel.

Brooks Brick Co. (Brewer) produced miscellaneous clay for use in manufacturing heavy clay products. Bridge Construction Corp. quarried and crushed quartzite at its Read quarry near Orono. The Maine State Highway Commission produced crushed miscellaneous stone and crushed granite for roadstone.

Piscataquis.—Commercial sand and gravel, mostly for paving and fill, was produced in southern Piscataquis County (the nearest town was Dexter, Penobscot County). Government-and-contractor tonnage was obtained from various localities in the county by the Maine State Highway Commission, which also produced crushed granite for road construction. Slate was mined at Monson by Portland-Monson Slate Co., milled at the company plant, and sold as electrical and flagging slate. Production decreased in 1957 owing to a 6-week recognition strike in July and August and the effects of the recession in the last 2 months of the year.

Sagadahoc.—Sand and gravel in 1957 was mined near Topsham and north of Brunswick by three commercial producers and by the Maine State Highway Commission, which mined sand and gravel, both with its own crews and under contract.

Feldspar was produced in Sagadahoc County mostly near Topsham and Georgetown in the central part of the county. Of the 11 principal producers, the leading ones were Alex Cunningham, James Russo, White's Service, and Cesare Trusiani. The Consolidated Feldspar Division, International Minerals & Chemical Corp., purchased and ground at its Topsham mill the output of these miners and the smaller production of others in the area. The Topsham Feldspar Co., Topsham, also crushed feldspar for poultry grits, abrasives, and other uses. Ground feldspar was distributed mainly to Ohio, Pennsylvania, the New England States; small quantities went to other States.

Punch, circle, and half-trim mica from Sagadahoc County was sold to industry and hand-cobbed and full-trim material to the GSA Franklin (N. H.) Materials Purchase Depot. The producers were Cesare Trusiani (Coombs mine at Bowdoinham) and Earl Williams (Trott Cove mine at Woolwich). A small quantity of beryllium concentrate also was produced by Cesare Trusiani.

Somerset.—Sand and gravel mined from pits at Fairfield and Smithfield was processed for building and paving use at a portable plant at Smithfield. The Maine State Highway Commission produced sand and gravel with its own crews and under contract at a

number of places. The commission also quarried granite for road construction and maintenance.

Waldo.—The Bangor & Aroostook Railroad Co., produced railroad ballast gravel and the Maine State Highway Commission, paving sand and gravel. Grenci & Ellis, Inc., produced dressed architectural granite from its Mount Waldo quarry near Frankfort. The Maine State Highway Commission quarried granite for its own use in roadbuilding. Northern Chemical Industries produced anhydrous ammonia at Searsport.

Washington.—Building and paving sand and gravel were mined by 3 producers, 2 at Machias and 1 at Jonesport and railroad ballast, by 1 railroad company at East Machias and Ellsworth. Paving sand and gravel and crushed granite were prepared by the Maine State Highway Commission for road construction and maintenance. Maine Peat Moss, Inc., recovered peat from bogs near Jonesport.

York.—The Maine State Highway Commission mined paving sand and gravel with its own crews and paving gravel under contract at several locations in the county. Rough construction dimension and dressed architectural granite and granite curbing were produced at High Pine Granite quarry by the John Swenson Granite Co., Inc. The firm's pink granite was used in constructing the Seal Harbor, Maine, Museum, the Seagram Building, New York, N. Y., and the State Mutual Life Assurance Co. Building, Worcester, Mass. Crushed granite also was sold by this firm for concrete, roadstone, and other purposes. The Maine State Highway Commission quarried and crushed granite for road construction and maintenance.

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, United States Department of the Interior, and the Maryland Department of Geology, Mines, and Water Resources.

By James R. Kerr ¹ and Geraldine C. Slaypoh ²



MARYLAND'S mineral production dropped 2 percent in value in 1957 compared with the preceding year. The biggest factor in the decreased value was the 14-percent decline in output of sand and gravel, as both the structural and paving markets for the sand and gravel industry were depressed. Coal production increased 12 percent, partly offsetting the sand-and-gravel decline. Most commodities with smaller production depended on the construction industry for their chief market. For example, clay for manufacturing building brick, sand and gravel for concrete aggregate, crushed stone for roadstone and concrete aggregate, and cement for general construction all reported decreased output in 1957.

Baltimore and Washington Counties ranked first and second in value of mineral products, followed by Prince Georges and Carroll Counties.

TABLE 1.—Mineral production in Maryland, 1956-57 ¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays ²	636	\$1,047	631	\$963
Coal.....	669	2,685	748	3,082
Lime.....	53	581	(3)	(3)
Natural gas..... million cubic feet.....	4,619	41,169	4,300	41,200
Sand and gravel.....	10,147	12,395	8,679	11,594
Stone.....	6,229	13,305	6,140	13,392
Value of items that cannot be disclosed: Ball clay, beryllium concentrate (1957), portland and masonry cement, gem stones, greensand marl, mica (sheet) (1957), potassium salts, talc and soapstone and values indicated by footnote 3.....		10,729		10,663
Total Maryland ⁴		40,534		39,607

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 Figure withheld to avoid disclosing individual company confidential data.

⁴ Preliminary figure.

⁵ Total adjusted to eliminate duplicating value of clays and stone.

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² Statistical clerk, Bureau of Mines, Region V, Pittsburgh, Pa.

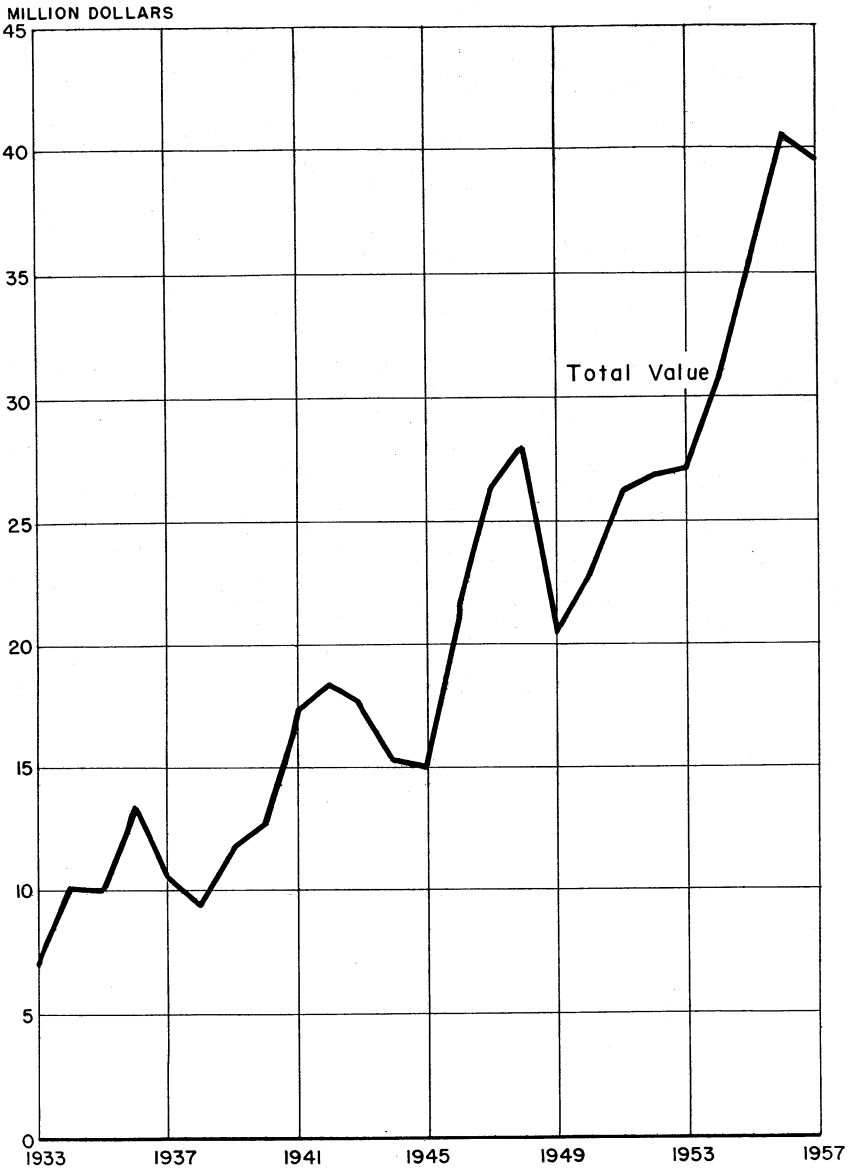


FIGURE 1.—Value of mineral production in Maryland, 1933-57.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland and hydraulic cement in Maryland decreased 6 and 20 percent, respectively, as a strike stopped production during July. Although output in 1957 was only 54 percent of the rated capacity, the figure is misleading, as Lehigh Portland Cement Co. more than tripled its capacity during the year in a complete renovation of the Union Bridge plant. Three modern kilns, 400 feet in length and 11½ feet in diameter, replaced 5 smaller obsolete ones. The two active cement-producing companies mined most of the required raw material at quarries adjacent to the plants.

Output was consumed chiefly in Maryland, but considerable quantities were shipped to the District of Columbia, Virginia, and Pennsylvania.

Clays.—Miscellaneous clay, the leading type of clay produced in Maryland again in 1957, decreased 3 percent in tonnage and 6 percent in value compared with 1956. Fire clay production, although increasing 20 percent in tonnage during the year, decreased 11 percent in value, as the average per ton assigned by producers decreased 28 percent. Fire clay, which was mined from 2 underground mines and 6 open pits, was used chiefly for manufacturing refractories—fire-brick and block. Miscellaneous clay, produced at 10 opencut mines, was used for manufacturing heavy clay products—chiefly building brick—and for cement manufacturing. Ball clay mined from an open pit in Baltimore County was used for refractories, floor and wall tile, and stoneware.

The market for miscellaneous clay decreased slightly, as the demand for building brick was down. The demand for fire clay was good, as the market for refractory products increased during the year. Ball-clay output decreased slightly in 1957.

Gem Stones.—Williamsite and siderite were collected as gem material, chiefly by hobbyists, from deposits near Frostburg and Line Pitts in 1957.

Gypsum.—The National Gypsum Co. calcined crude imported gypsum at a plant near Baltimore to produce gypsum wallboard and lath (chiefly ¾ inch thick) and base-coat plasters. A significant tonnage was sold without calcining for use as portland-cement retarder. The addition of a fifth calcining kettle raised the daily capacity 26 percent to 840 short tons.

Lime.—The major portion of lime production in Maryland in 1957 again was used for agricultural purposes. The lime market remained relatively stable during the year. Average prices increased slightly to cover increased production costs.

Marl, Greensand.—The Kaylorite Corp., the only producer of greensand marl in the State, operated an open pit near Dunkirk and processed the product for use as soil conditioner.

Mica.—The Government purchased mica through the General Services Administration (GSA) from producers in Howard County. This marked a renewal of mica mining in Maryland following cessation of mining in 1955 and 1956.

Perlite.—Crude perlite from producers in the West, chiefly at No Aqua and Socorro, N. Mex., and Caselton, Nev., was processed at plants in Baltimore and Prince Georges Counties. The expanded product was used chiefly as plaster and concrete aggregate. Reported costs increased in 1957, but selling prices remained stable. Demand was less, and production dropped 12 percent during the year.

Potassium Salts.—Potassium sulfate was prepared from cement clinker of the North American Cement Corp. Security plant in Washington County as a byproduct of cement-mill operations.

Sand and Gravel.—The production of sand and gravel in Maryland decreased 14 percent in 1957, but the value of production dropped only 6 percent, as the average price per ton increased from \$1.22 to \$1.34 during the year. The overall price rise was due chiefly to an increase of 22 and 13 percent, respectively, in the prices of structural and paving sand. Decreased output was general throughout the industry, as decreased markets were noted for all major uses of the product.

Government-and-contractor operators reported pits active in 5 counties in 1957, compared with 13 in 1956, reflecting diminished road-construction activity. Output dropped 36 percent. Talbot County was the exception to the statewide trend, as Government-and-contractor production increased 68 percent during the year.

Fifty-four commercial sand-and-gravel operations were reported active in 1957, 13 less than in 1956, as a generally unfavorable business atmosphere and a highly competitive market forced some borderline operations out of business. Commercial pits averaged over 230 active days in 1957. Prince Georges County remained the largest producing area, followed by Baltimore, Anne Arundel, Harford, and Cecil Counties.

TABLE 2.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural.....	2,564,383	\$2,869,436	\$1.12	2,032,641	\$2,789,502	\$1.37
Paving.....	2,869,200	3,215,498	1.12	2,504,826	3,175,393	1.27
Gravel:						
Structural.....	2,013,973	3,532,198	1.75	1,739,119	2,956,809	1.70
Paving.....	2,454,693	2,448,635	1.00	1,896,473	2,138,115	1.13
Undistributed ¹	244,656	329,454	1.35	506,330	534,097	1.05
Total.....	10,146,905	12,395,221	1.22	8,679,389	11,593,916	1.34

¹ Includes glass, grinding and polishing (1957), fire or furnace, engine (1956), filter, railroad ballast (1957), and other sands and gravel, which cannot be shown separately.

Stone.—The output of stone continued at virtually the same rate as in the preceding year, decreasing 1 percent below 1956. Crushed limestone was again the leading type of stone produced, comprising 85 percent of the total stone production. As in past years, the bulk of limestone production was consumed as concrete aggregate and road-

stone and in manufacturing cement and lime; but in 1957, for the first time, considerable tonnages were consumed as flux, chiefly in blast furnaces. Oystershell was produced again in 1957 for poultry grit and agstone.

Basalt production dropped 17 percent as the demand for traprock for roadstone dropped sharply. Marble, dimension and crushed granite, crushed sandstone, and miscellaneous stone were also produced in 1957.

Baltimore County ranked first in stone production, followed by Washington, Frederick, and Allegany Counties.

Talc and Soapstone.—Soapstone was mined at Marriottsville in Carroll County. Most of the crude material was ground at a plant near the mine for roofing material; but some was shipped crude to foundries, and some was sent to a company-owned plant at Sykesville, where it was pulverized for asphalt filler. Talc was mined in Harford County for use in foundry facings and ceramics and as asphalt filler. Production increased slightly over the previous year, although adverse weather conditions and decreased markets were reported.

Vermiculite, Exfoliated.—The Zonolite Co. processed crude vermiculite at a plant at Beaver Heights in Prince Georges County.

MINERAL FUELS

Coal.—Coal production increased 12 percent in 1957, continuing the upward trend in Maryland coal-mining activity. Strip mining, which rose 28 percent over 1956, comprised the entire State increase, as underground mining decreased 4 percent during the year. The number of active underground mines dropped from 68 to 52, while the number of strip pits increased to 31 from 25. Strip mining (comprising 56 percent of the total production) became more important than underground mining in the State. Relative economics favoring strip mining in reduced production costs enabled the producer to sell strip coal at prices more attractive to consumers. For example, in 1957 the price of strip coal was \$3.28 per ton, or 37 percent less than the \$5.21 charged for underground production.

Maryland underground production was characterized by small hand-loading operations. In 1957, 37 percent of the underground production was hand-loaded onto face or room conveyors; the remainder was hand-loaded into mine cars. Machines undercut 65 percent of the underground production, and 62 percent was power-drilled. Of the total State output 34 percent was crushed and 5 percent was treated before shipment. There was no mechanical cleaning in Maryland.

Coke and Coal Chemicals.—Bethlehem Steel Corp. added another battery of 65 slot-type ovens to the Sparrows Point plant and increased production of coke 12 percent to 3,431,000 tons. Associated coproducts yielded were coke breeze, 242,000 tons; coke-oven gas, 53,048 million cubic feet; ammonium sulfate, 95,472,000 pounds; tar, 41 million gallons; and crude light oil, 16.3 million gallons. Light-oil derivatives included benzene (10.6 million gallons), toluene (2.5 million gallons), xylene (771,000 gallons), and solvent naphtha (10,000 gallons).

TABLE 3.—Production of coal, 1948-52 (average) and 1953-57

Year	Thou- sand short tons	Value		Year	Thou- sand short tons	Value	
		Total (thou- sands)	Average per ton ¹			Total (thou- sands)	Average per ton ¹
1948-52 (average)....	831	\$4, 170	\$5. 02	1955.....	512	\$2, 002	\$3. 91
1953.....	531	2, 442	4. 60	1956.....	669	2, 685	4. 01
1954.....	422	1, 879	4. 46	1957.....	748	3, 082	4. 12

¹ Value received or charged for coal f. o. b. mine, selling cost. (Includes 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.—Although the output of natural gas dropped 7 percent in 1957, the value of production increased 3 percent, as the average price at the wellhead increased to \$2.79 from \$2.53 per thousand cubic feet. Production came from Garrett County in the Mountain Lake Park field and the Accident field.

METALS

Beryllium.—GSA reported purchasing beryl for the Government from Fred S. Taylor in Howard County in 1957. This was the first beryl mining reported since 1954.

Iron and Steel.—Bethlehem Steel Corp., with the addition of a new blast furnace at the Sparrows Point plant, increased pig-iron capacity 24 percent to 5,316,000 tons per year. Steel capacity increased 32 percent to 8,382,000 tons per year, owing chiefly to Bethlehem's expansion program—7 additional 350-ton open-hearth furnaces were added. Armco Steel Corp. and Eastern Stainless Steel Corp. operated six and five electric and crucible furnaces, respectively, to produce specialty steels.

REVIEW BY COUNTIES

Production of Government-and-contractor sand and gravel declined 35 percent in 1957. Output was reported from only five counties, compared with 13 in 1956. This paralleled a trend established by commercial production toward decreased output for structural and paving purposes. The State Roads Commission reported production of chiefly paving gravel, by its own crews, in Caroline, Cecil, Kent, Queen Annes, and Talbot Counties. The Talbot County Highway Commission also reported production of paving gravel by its own crews.

Allegany.—Valuewise, stone replaced coal as the most important mineral commodity produced in Allegany County. This was due to the increased production of limestone at two continuing operations and to the opening of a new quarry near Flintstone by Cumberland Cement & Supply Co. Fry Coal & Stone Co., in the second year of operating the Corriganville quarry, increased production significantly and added a stabilized base plant to meet State requirements for road material. A considerable portion of the county total of crushed limestone was diverted to consumption as metallurgical flux in 1957, in contrast to 1956, when it was used entirely for roadstone and concrete aggregate.

TABLE 4.—Value of mineral production in Maryland, 1956-57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Allegany.....	\$2, 438, 328	\$2, 791, 690	Stone, coal, sand and gravel, clays.
Anne Arundel.....	(1)	1, 095, 844	Sand and gravel, clays.
Baltimore.....	11, 268, 004	10, 289, 027	Stone, sand and gravel, clays.
Calvert.....	(1)	(1)	Greensand marl, sand and gravel.
Caroline.....	17, 243	1, 093	Sand and gravel.
Carroll.....	(1)	3, 643, 138	Cement, stone, soapstone, sand and gravel.
Cecil.....	1, 200, 542	1, 134, 441	Stone, sand and gravel, clays.
Charles.....	(1)	170, 963	Sand and gravel.
Dorchester.....	(1)	(1)	Sand and gravel, stone.
Frederick.....	2, 083, 948	(1)	Stone, lime, clays.
Garrett.....	3, 222, 251	3, 597, 635	Coal, natural gas, stone, sand and gravel.
Harford.....	1, 337, 927	1, 090, 105	Sand and gravel, stone, talc.
Howard.....	(1)	(1)	Sand and gravel, mica, beryl.
Kent.....	(1)	29, 160	Sand and gravel, clays.
Montgomery.....	80, 732	(1)	Stone.
Prince Georges.....	(1)	4, 947, 691	Sand and gravel, clays.
Queen Annes.....	(1)	(1)	Sand and gravel.
St. Marys.....	(1)	(1)	Do.
Somerset.....	886	-----	-----
Talbot.....	(1)	17, 989	Sand and gravel, clays.
Washington.....	8, 157, 052	(1)	Cement, stone, clays, potassium salts.
Wicomico.....	(1)	(1)	Sand and gravel, clays.
Worcester.....	(1)	(1)	-----
Undistributed ²	10, 667, 313	10, 798, 389	-----
Total ³	40, 534, 000	39, 607, 000	-----

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes values indicated by footnote 1 and value for gem-stone production, which is not specified by counties.

³ Excludes value of clay and limestone used in manufacturing cement and lime.

Total coal production remained stable in 1957, as an 11-percent increase in underground production offset an 8-percent decrease in strip-mined coal. Paradoxically, the number of underground mines decreased from 32 to 26 and the number of strip operations from 11 to 15. Coal production was concentrated in the extreme western edge of the county bordering on Garrett County.

Sand and gravel output in the county increased slightly (2 percent) during the year. Cumberland Cement & Supply Co., chief producer, operated a fixed plant near Cumberland to produce mainly glass, building, and grinding and polishing sands. This company also operated a fixed plant on a sand-and-gravel island in the Potomac River and produced building and paving sand and gravel.

The only two underground clay mines in the State were operated near Barrelville and Frostburg by Mount Savage Refractories Co. and Big Savage Refractories Division, Mexico Refractories Co., respectively. Both companies use a room-and-pillar mining plan. Output was used entirely for manufacturing firebrick and block. Pen Mar Brick and Supply Co., a former miscellaneous clay producer, was out of business.

Anne Arundel.—Although sand and gravel production dropped 51 percent, the county remained third in the State in value of production. Output, which was concentrated in the northern tip of the county near Baltimore and near Annapolis, was used chiefly for structural and paving purposes, although considerable tonnages were consumed as fire and furnace sand. R. T. Mohre & A. V. Hare, a major producer in 1956, sold their property in 1957; no production was reported for 1957.

The Severn Clay Co. operated an open-pit mine near Glen Burnie and sold fire clay for manufacturing floor and wall tile and stoneware.

Baltimore and Baltimore City.—The value of mineral production in Baltimore County declined 9 percent in 1957, but the county remained in first place among the State's 21 mineral-producing counties.

Stone was the leading mineral produced, comprising over two-thirds of the county's mineral wealth. The output of limestone, by far the leading type of stone produced, was reported by Harry T. Campbell's Sons Corp. (only reporting producer) for use chiefly as concrete aggregate and roadstone. Oystershell was produced near Baltimore and crushed for poultry grit and agstone by Oyster Shell Corp.

The output of basalt dropped as the roadbuilding market, which consumed large quantities of basalt traprock in 1956, was depressed in 1957. Carl B. Temple sold the Recordville basalt quarry in December to Hugh E. Dooley of Delta, Pa.

Miscellaneous stone (serpentine) was quarried near Reistertown and crushed for use chiefly as concrete aggregate and roadstone.

The market for dimension and crushed granite decreased in 1957, except for dressed construction stone, which increased 35 percent. Rough construction, rubble, and curbing and flagging uses for dimension granite declined. Crushed and broken granite was used for concrete aggregate and roadstone and as riprap. The Loch Raven quarry of Harry T. Campbell's Sons Corp., was closed in 1957.

Baltimore County again ranked second in sand and gravel production in 1957. Production, which was centered in an area surrounding metropolitan Baltimore, declined 8 percent in 1957. The chief reason for the drop was decreased structural uses (17 percent), as output of paving sand increased 30 percent and output of paving gravel remained stable. Nottingham Farms, Inc., reported installation of new equipment and replacement of a revolving gravel washer by a log washer.

Baltimore was the leading clay-producing county and the only area in the State in which ball clay was produced. Ball clay was mined near Baltimore (United Clay Mines Corp.) and sold for use in manufacturing firebrick and block, floor and wall tile, and stoneware. Miscellaneous clay was mined at three open pits near Baltimore and processed for manufacturing building brick. Output decreased slightly (3 percent) in 1957, owing to a decreased demand for building brick.

Imported gypsum was calcined at a plant near Baltimore by National Gypsum Co., for manufacturing base-coat plasters, gypsum wallboard, and lath. A portion of the tonnage was sold without calcining for use as portland-cement retarder.

Crude perlite purchased from No Aqua, N. Mex., was expanded for use chiefly as a lightweight plaster aggregate by Perma Rock Products at a plant near Baltimore.

Calvert.—Greensand marl for soil conditioner was mined by the Kaylorite Corp., the only producer in the State, from an open pit near Dunkirk.

Only a small tonnage of paving gravel was reported in 1957, contrasted with a large output in 1956. Lesser roadbuilding activity in the county caused the sharp drop in gravel output.

Caroline.—The Maryland State and Roads Commission produced gravel for road construction and maintenance in 1957.

Carroll.—Portland cement was the leading commodity, valuwewise, produced in Carroll County in 1957. Lehigh Portland Cement Co. (the only cement producer) was also the only limestone producer in the county and operated a quarry at Union Bridge to produce crushed limestone for cement manufacture. The company installed 3 new kilns, 400 feet in length and 11½ feet in diameter, and also installed a new crusher and mixing mills. Cement was consumed chiefly in Maryland, although considerable quantities were shipped to Virginia, the District of Columbia, Florida, and Pennsylvania. A strike during July curtailed production in 1957.

Soapstone was mined at an open pit near Marriotsville. Most of the crude mined was ground and sold for roofing material, asphalt filler, and foundry facings. Output increased during the first full year of operation of the Marriotsville mine by Liberty Stone Co., although marketing conditions were reported as unfavorable.

Cecil.—Crushed quartzite for silica brick was produced by Harbison-Walker Refractories Co., North East. Port Deposit Quarries Co., Inc., quarried dimension granite for rough construction uses and broken stone for riprap.

Sand and gravel output in Cecil County decreased 17 percent in 1957, as the bottom fell out of the structural market (decreasing 72 percent). Work on major highways in the area created a huge demand for paving sand, and output of this commodity increased over 8½ times the 1956 total. Paving-gravel output did not parallel this increase, however, and contrary to the trend decreased 24 percent. Most sand-and-gravel deposits worked were close to the shoreline of Chesapeake Bay, at the mouth of the Susquehanna River, and near the source of the Elk River.

Fire clay was produced from two open-pit mines near North East for use in manufacturing firebrick and block.

A small quantity of williamsite (gem stone) was collected by hobbyists from a deposit near Line Pitts.

Charles.—Sand and gravel production was from two fixed plants in 1957. Structural uses comprised the major portion of output (68 percent).

Dorchester.—Sand and gravel (washed and pit run) was produced by J. Edwin Rosser, Inc., from a fixed plant near Federalsburg. Building and paving uses consumed the major portion of output.

J. M. Clayton of Cambridge operated a crusher and produced poultry grit and byproduct agstone from oystershell. Production decreased in 1957, as marketing conditions were reported as poor.

Frederick.—Limestone-production value increased 7 percent in 1957, even though the second-ranking producer in 1956 did not report to the Bureau of Mines in 1957. Concrete aggregate and roadstone uses consumed 83 percent of the total limestone production. Three of the four limestone producers calcined a portion of the crushed product to produce lime chiefly for agricultural uses. Some mason's lime was also produced. Limestone and lime production was centrally located in the county. M. J. Grove Lime Co., reported that its calcining facilities were permanently discontinued at the end of the year.

Miscellaneous clay was produced at an open-pit mine near Frederick by Hudson Supply & Equipment Co. The output decreased in 1957, as demand for building brick was poor during the last half of the year. Adverse weather conditions also cut back production.

Garrett.—Bituminous-coal production increased 18 percent. Greatly increased strip-mining activity (54 percent) offset decreased underground production (9 percent). There were 10 less underground mines but 2 more strip pits active in 1957. Increased strip mining in Garrett County, although opposed to decreased strip tonnage in Allegany County, caused stripping to replace underground mining as more important in the State in 1957.

Limestone was quarried near Oakland and crushed for use entirely as concrete aggregate and roadstone.

Sand for building and paving uses was produced at two fixed plants near Oakland.

Harford.—Sand and gravel was produced at 6 fixed and 4 portable plants in 1957 from the area around Bel Air and Abingdon. Total production decreased 22 percent, as producers almost unanimously reported a depressed market for structural sand and gravel. Paving-sand output increased to almost 10 times that in 1956, but the output of paving gravel did not increase proportionally—in fact, it decreased 8 percent in 1957.

Basalt was produced at a quarry near Churchville by Thomas B. Gatch & Sons, Inc. The output, which was used entirely as concrete aggregate and roadstone, decreased in 1957. The Maryland Green Marble Co., the only marble producer in the State, operated a quarry near Cardiff and produced sawed, cut, and dressed marble for building interiors and broken stone for byproduct terrazzo.

Talc was mined near Dublin by Harford Talc & Quartz Co., Inc.

Howard.—Sand for paving was produced near Laurel. Cosca Sand & Gravel Co. of Jessup was out of business in 1957.

Kent.—Sand and gravel for structural uses was produced by the Kent Concrete Co., Inc., at Chestertown. Output decreased 73 percent, as the company worked only 5 men an average of 125 days in 1957, compared with 7 men an average of 200 days in 1956.

Miscellaneous clay for manufacturing building brick was mined near Chestertown by the Chestertown Brick Co. Business conditions remained stable in 1957.

Montgomery.—Mica schist for rough-building and rubble dimension uses and for flagging was quarried near Bethesda and Cabin John by Stoneyhurst Quarries and Shuff and Sons Co., respectively.

Prince Georges.—This county again ranked first among the 18 sand-and-gravel-producing counties in Maryland. Eleven companies produced sand and gravel (concentrated) in an area surrounding the District of Columbia and in the northeastern section of the county near Laurel and Bowie. Production decreased 3 percent from 1956. A depressed market was noted for all classes of sand and gravel, as road construction and home building decreased. Over 400 men working an average of 260 days were employed by this industry in Prince Georges County in 1957. Over three-fourths of the county output of sand and gravel was prepared by washing. Smoot Sand & Gravel Corp., operators of a dredge on the Potomac River, was the leading producer of sand and gravel.

Clay production decreased 6 percent, but the county remained in third position in the State. Miscellaneous clay and fire clay were produced in the northern tip of the county near Muirkirk and Laurel, and miscellaneous clay was mined near Washington, D. C. Fire clay was used chiefly for foundry refractories, and the miscellaneous clay was used for building brick, draintile and flowerpots.

Perlite from the West was expanded at the Atlantic Perlite Co. plant near Washington, D. C., for use chiefly as a lightweight plaster aggregate.

The Zonolite Co. processed crude vermiculite at a plant near Beaver Heights.

The Mineral Pigments Corp. reported sales of finished natural and manufactured pigments. Mixtures of natural and pure red-iron oxides predominated.

Queen Annes.—Structural and paving sand was produced near Queenstown.

St. Marys.—Structural sand and gravel was produced by Leonardtown Sand & Gravel Co. at a fixed plant near Leonardtown.

Talbot.—Government-and-contractor gravel was produced in large quantities in 1957 by State roads-commission crews.

Miscellaneous clay was mined at an open pit near Easton by New Brick & Tile Co. for manufacturing building brick.

Washington.—Washington County ranked second in mineral production in Maryland again in 1957. The value of portland- and masonry-cement shipments comprised 77 percent of the total value of minerals produced in the county. North American Cement Corp., produced cement and in addition quarried and crushed limestone near its Security plant at Hagerstown for cement manufacture, for concrete aggregate and roadstone, and for railroad ballast. Fry Coal & Stone Co., operated a limestone quarry near Williamsport, producing crushed stone for concrete aggregate and roadstone, inert dust for preventing propagation of mine explosions, and stone sand and agstone. This company enlarged facilities in 1957 with the addition of a hammermill and a stabilized-base plant to meet new State requirements for road material. The Schetrompf Lime Co. was out of business in 1957.

Miscellaneous clay for manufacturing building brick and as an ingredient in cement manufacture was mined by Victor Cushwa & Sons, Inc., from an open pit near Williamsport.

Wicomico.—Sand for paving and fill, and gravel for structural and fill uses were produced at 1 portable and 2 fixed plants near Hebron. Basic Materials Supply Co., and Howard Sand & Gravel, Inc., reported marketing conditions unchanged in 1957, but still favorable.

The Salisbury Brick Co., Inc., mined miscellaneous surface clays near Salisbury for manufacturing building brick. The mine operated on a seasonal basis from April to December.

The Mineral Industry of Massachusetts

By Robert W. Metcalf¹ and James R. Kerr¹



MASSACHUSETTS mineral production in 1957 was valued at \$24.8 million, the second highest on record and only 1 percent under the peak year, 1956. Values of lime and sand and gravel production increased moderately but were offset by declines in values of clays and stone. Tonnage of sand and gravel and stone, the chief mineral commodities produced, decreased 3 and 10 percent, respectively.

The leading minerals in value produced in Massachusetts were stone, sand and gravel, and lime. The tonnage of sand and gravel, a heavy, low-priced commodity, however, was nearly twice that of stone. Basalt, granite, limestone, and sandstone were quarried in the State. Middlesex County led in value of mineral production, followed in order by Berkshire, Norfolk, Essex, and Bristol. Stone was the chief mineral produced in Middlesex, Norfolk, and Essex Counties, lime in Berkshire, and sand and gravel in Bristol.

Among the new or expanded plants that affected the mineral industries of Massachusetts in 1957 were uranium, refractories and marble facilities. In Plainville, Norfolk County, D. E. Makepeace Co. began constructing a plant, designed to produce atomic fuel fillers, clad fuel elements, and related reactor components by melting, forging, rolling, annealing, and machining uranium. This plant will supplement the existing Makepeace facility at Attleboro, Bristol County. Norton Co. began constructing a new \$1.5 million refractories plant at Worcester to supply heavy refractories for high-temperature

TABLE 1.—Mineral production in Massachusetts, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays.....	127, 547	\$213, 682	77, 577	\$97, 577
Lime.....	134, 248	2, 093, 195	137, 284	2, 232, 731
Peat.....	300	(²)	600	(²)
Sand and gravel.....	10, 189, 425	9, 519, 831	9, 899, 626	9, 691, 588
Stone.....	5, 441, 878	13, 752, 920	4, 876, 707	13, 165, 125
Value of items that cannot be disclosed: Mineral fuels and nonmetals.....		2, 800		5, 600
Total Massachusetts ¹		25, 085, 000		24, 789, 000

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.

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use. Completion of the 124-mile Massachusetts Turnpike in mid-1957 reduced the overall State demand for sand and gravel and stone aggregates. The detailed location of more than 75 percent of the Massachusetts part of the National System of Interstate and Defense Highways had been determined by early 1957, and continued construction of these roads was expected to affect favorably the aggregates industry in the State.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Owing to curtailed building in Massachusetts, caused largely by the business recession, output of miscellaneous or surface clay in 1957 dropped 39 percent in quantity and 54 percent in value. One firm discontinued brick manufacture and two others sharply reduced output, contributing to this sharp decrease in production. Four companies in 3 counties mined clay for brickmaking. Hampden County led in quantity of clay produced in 1957, followed in order by Plymouth and Bristol.

Lime.—The value of lime produced in Massachusetts totaled over \$2.2 million—the highest on record and 4 percent more than in 1953, the next highest year. The quantity of lime produced was the largest since 1951. The average value per ton increased 4 percent from 1956 to \$16.26 in 1957. Both quick and hydrated lime was produced. Most of the lime burned was consumed for chemical and industrial purposes, although sizable quantities were used in construction and agriculture. Production was confined to Berkshire County.

TABLE 2.—Lime (quick and hydrated) sold by producers, 1948–52 (average) and 1953–57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948–52 (average)...	127,002	\$1,684,595	\$13.26	1955.....	134,952	\$1,957,346	\$14.50
1953.....	135,383	2,156,205	15.93	1956.....	134,248	2,093,195	15.59
1954.....	127,836	1,709,341	13.37	1957.....	137,284	2,232,731	16.26

Perlite.—Perlite mined in the Southwest was expanded at Roslindale, Suffolk County. Building plaster and concrete aggregate were the largest markets. Slackened building activity caused decreased sales of expanded perlite, compared with 1956.

Roofing Granules.—Granules for roofing shingles were prepared at East Walpole, Norfolk County. Lower production of granules in 1957 was due partly to less building activity and partly to a 3-month strike.

Sand and Gravel.—The value of output of sand and gravel increased 2 percent, and tonnage decreased 3 percent. The road-building program continued to be a vital factor in the sand and gravel industry, resulted in increased output of paving sand and gravel, and comprised 44 percent of total sand and gravel production. In contrast, an

11-percent decline in output of structural sand and gravel resulted in the displacement of structural sand and gravel as the leading type produced. Other types of sand and gravel produced in 1957 included blast, fire or furnace, and filter sands and railroad-ballast gravel. Production of Government-and-contractor sand and gravel rose by almost one-fourth (24 percent) and comprised 8 percent of the total, compared with 6 percent in 1956. The average value of both commercial and Government-and-contractor shipments rose slightly compared with 1956.

The leading sand- and gravel-producing counties in Massachusetts in 1957 were Middlesex, Essex, Worcester, Norfolk, and Bristol. Over 70 percent of the total output was supplied from the aforementioned 5 counties.

TABLE 3.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Commercial operations:						
Sand:						
Structural.....	2,427,389	\$2,415,922	\$1.00	2,214,379	\$2,384,931	\$1.08
Paving.....	1,582,281	1,288,516	.81	1,491,244	1,290,255	.86
Filter.....	8,000	10,000	1.25	(1)	(1)	-----
Blast and fire or furnace.....	(1)	(1)	-----	2,773	4,023	1.45
Other.....	301,042	259,108	.86	438,137	244,953	.56
Gravel:						
Structural.....	2,274,967	2,890,757	1.27	1,962,566	2,664,927	1.36
Paving.....	2,016,390	1,434,671	.71	2,134,886	1,699,801	.80
Railroad ballast.....	13,878	5,138	.37	39,253	14,334	.36
Other.....	804,429	575,198	.72	749,545	509,551	.68
Undistributed ²	158,414	350,073	2.21	117,678	306,791	2.61
Total.....	9,586,790	9,229,383	.96	9,150,461	9,119,566	1.00
Government-and-contractor operations:						
Sand:						
Structural.....	581	215	.37	-----	-----	-----
Paving.....	85,284	55,000	.64	137,977	32,676	.24
Gravel:						
Paving.....	516,770	235,233	.46	611,188	539,346	.88
Total.....	602,635	290,448	.48	749,165	572,022	.76
Grand total.....	10,189,425	9,519,831	.93	9,899,626	9,691,588	.98

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

² Includes molding sand, railroad ballast sand (1956), ground sand, and uses indicated by footnote 1.

Stone.—Production of stone declined 10 percent in quantity and 4 percent in value from the peak year, 1956. Dimension and crushed and broken stone were produced.

Production of dimension stone in Massachusetts increased slightly, although the total value was somewhat less than in 1956. Sales of curbing and flagging were higher in 1957; output of architectural stone decreased. Dimension stone was mostly granite, plus a small quantity of sandstone. The bulk of dimension stone produced was curbing and flagging, which also furnished nearly half the value of all dimension stone. The next largest use was for dressed construction

stone. Other types of granite dimension stone marketed in 1957 included rough and dressed monumental stone, rubble, and paving blocks. The sandstone produced was sold for architectural purposes.

Owing to the overall decrease in road building and construction in the State in 1957, the output of crushed and broken stone declined 10 percent in tonnage and 4 percent in value compared with 1956. Substantial increases in sales of railroad ballast and agricultural limestone were offset by a 14-percent drop in tonnage of stone used for concrete aggregate and roadstone. Fifty-nine percent of the crushed and broken stone sold was basalt, and 29 percent was granite, compared with 64 and 20 percent, respectively, in 1956. Crushed and broken limestone also was produced in Massachusetts in 1957.

Twenty-seven companies produced stone at 32 commercial quarries. Basalt was quarried by 10 firms at 12 quarries, granite by 13 companies at 15 quarries, limestone by 4 companies at 4 quarries, and sandstone by 1 company at 1 quarry (1 firm quarried both basalt and limestone). Dimension stone was produced mostly in Middlesex and Worcester Counties, and crushed and broken stone in Essex, Norfolk, Hampden, Middlesex, and Berkshire Counties.

Vermiculite.—Two companies in Middlesex County exfoliated vermiculite chiefly as plaster and concrete aggregate and for insulation. South African and domestic vermiculite was processed. Production and sales were each appreciably larger than in 1956.

MINERAL FUELS

Peat.—Peat was produced in 1957 near Lawrence, Essex County, for local use as a soil conditioner.

REVIEW BY COUNTIES

Government-and-contractor sand and gravel for road building and maintenance was produced by the Massachusetts Department of Public Works in Dukes, Nantucket, Plymouth, Suffolk, and Worcester Counties. In addition, a number of towns and municipalities mined sand and gravel for paving use in Berkshire, Bristol, Essex, Middlesex, and Norfolk Counties. Government-and-contractor output of stone in Massachusetts was confined to Norfolk, where the State of Rhode Island Highway Department quarried basalt for road construction and maintenance.

Barnstable.—Paving sand and gravel was produced at Provincetown on the extreme northern tip of the county, and molding and structural sands were produced near Falmouth. Three producers were active in 1957.

Granite for riprap was quarried near Falmouth by Turner & Breivogel.

Berkshire.—Berkshire County was the only lime-producing area in the State. The lime-producing companies, New England Lime Co. (Adams), United States Gypsum Co. (Farnams), and Lee Lime Corp. (Lee) burned limestone produced at their own quarries to produce quick and hydrated lime chiefly for chemical and other industrial uses. Lime consumption was mostly in the New England area. In addition

to producing limestone for lime, the aforementioned companies, plus John S. Lane & Son, Inc. (West Stockbridge), reported output of crushed limestone for agstone, roadstone, flux, whiting, and other uses.

TABLE 4.—Value of mineral production in Massachusetts, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Barnstable.....	\$193,296	\$199,721	Sand and gravel, stone.
Berkshire.....	3,951,069	3,795,517	Lime, stone, sand and gravel.
Bristol.....	1,514,527	1,637,293	Sand and gravel, stone, clays.
Dukes.....	21,197	(1)	Sand and gravel.
Essex.....	2,410,110	2,820,047	Stone, sand and gravel, peat.
Franklin.....	188,927	(1)	Stone, sand and gravel.
Hampden.....	(1)	(1)	Stone, sand and gravel, clays.
Hampshire.....	(1)	(1)	Sand and gravel, stone.
Middlesex.....	7,245,141	(1)	Stone, sand and gravel.
Nantucket.....	463	2,172	Sand and gravel.
Norfolk.....	2,040,721	(1)	Stone, sand and gravel.
Plymouth.....	987,336	695,192	Sand and gravel, stone, clays.
Suffolk.....	1,200,307	985,837	Sand and gravel, stone.
Worcester.....	1,819,831	(1)	Do.
Undistributed ²	3,512,394	14,653,362	
Total.....	25,085,000	24,789,000	

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

² Includes values indicated by footnote 1.

Fourteen sand and gravel operations, mostly fixed plants, were active during the year. Most pits paralleled the Housatonic and Hoosic Rivers. The output of sand and gravel decreased 31 percent; every major company reported slackened output. Decreased highway construction and less home building were given as reasons for decreased demand. Pettinos New England, Inc., produced special industrial sand from quartz deposits near Cheshire. Berkshire Gravel, Inc., at fixed plants in Pittsfield and Lee, was the leading producer of sand and gravel.

Otis Chester Granite Co. sold dimension granite for monuments and mausoleums. The company did not quarry during the year but processed and sold yard stock.

Bristol.—Bristol County ranked second in the State in sand and gravel production. Overall sand and gravel production decreased, but the total value increased 11 percent owing to an increase to \$1.19 per ton from \$0.99 in 1956. Slackened highway construction caused a 31-percent decrease in county output of paving sand and gravel. Increased output was noted only for structural sand (18 percent) in 1957. Fourteen widely scattered sand and gravel pits, mostly fixed plants, were active. Morse Sand & Gravel Co. (Attleboro), Jas Borge & Sons (Swansea), and Tri-City Concrete Co., Inc. (Raynham), were leading producers. Tri-City Concrete Co., Inc., installed new crushing equipment during the year.

Warren Bros. Roads Co. produced crushed granite chiefly for use as roadstone at the Blue Stone Quarry at Acushnet. Miscellaneous clay was mined by Stiles & Hart Brick Co. from an open pit near Taunton for building brick.

Dukes.—Colby Construction Co. produced paving sand and structural gravel at a fixed plant near Oak Bluffs. Paving sand was produced by the Goodale Construction Co. at an unspecified place.

Essex.—The output of basalt was centered in the extreme southern tip of the county. Lynn Sand & Stone Co. quarried at Swampscott, a few miles north of Lynn, and produced traprock, chiefly for concrete aggregate and roadstone and railroad ballast. Essex Sand & Gravel Co. (Peabody) and Trimount Bituminous Products Co. (Saugus) produced trap for concrete aggregate and roadstone only. Business was good, with increased markets, particularly in road construction.

Karl A. Person quarried dimension granite near Rockport for rough construction and rubble.

Twenty sand and gravel producers were active chiefly in the southern and northwestern sections of the county, as total sand and gravel output increased 44 percent. The output of paving gravel increased over 5 times that of 1956 and supplied 40 percent of total production. Paving-sand output also increased (60 percent), but structural uses did not show corresponding increases. Yemma Bros., Inc., at a fixed plant near Haverhill was by far the leading producer. During the year Topsfield Sand & Gravel Co. and Videtta Construction Co. merged and named the new organization Videtta Corp.

Peat humus for soil conditioning was recovered from bogs near Lawrence by Massachusetts Peat Humus Co.

Franklin.—Greenfield Massachusetts Broken Stone Co. traprock quarry near Deerfield produced basalt for railroad ballast, concrete aggregate, roadstone, and riprap. The Boston & Maine Railroad was the major customer in 1957. There was no Federal or State road-building activity in that area. The output of four producers of paving and other sand and gravel came from scattered localities in the county.

Hampden.—The value of stone output (principally basalt) in Hampden County dropped 48 percent in 1957 compared with 1956. The John S. Lane & Sons, Inc., basalt quarries at West Springfield and Westfield reported decreased output as road construction, the chief market for the product, was depressed. McCormick Longmeadow Stone Co., Inc., quarried dimension sandstone near East Longmeadow for use in building exteriors, including the Aetna Life Insurance Building wing in Hartford, Conn., and a bank in Allentown, Pa.

Westfield Clay Products Co. and Hampshire Brick Co. mines at Westfield and Chicopee, respectively, produced miscellaneous clay for building brick.

Eleven sand and gravel companies produced building and paving material from the area generally paralleling the Chicopee River and near Granville. Hampden County output dropped 24 percent in the year, as home-building and road-construction activity decreased. E. A. Jensen & Sons, Inc. (Granville Center), was the leading producer in the county. Western Massachusetts Sand & Gravel, Inc., dismantled its plant near Westfield as the deposit was depleted. The excavated area was refilled and graded.

Hampshire.—Sand and gravel for structural and paving uses was produced by five operators at scattered places throughout the county but centered chiefly near Northampton and Westhampton. Production dropped 40 percent when Omasta Bros. went out of business early in 1957. Hampshire Sand & Gravel, Inc., reported enlarged facilities for crushing and screening.

John S. Lane & Son, Inc., quarried basalt near Amherst for concrete aggregate and roadstone.

Middlesex.—Middlesex County led in output of sand and gravel and stone in the State and also in total valuation of mineral output.

Stone was the most important mineral produced in the county. Near Westford, H. E. Fletcher Co., the leading producer, and Morris Bros. quarried both rough and dressed dimension granite for a wide variety of construction and architectural work. H. E. Fletcher Co. also crushed granite. Basalt for concrete aggregate and roadstone was produced by Rowe Contracting Co. (Malden), B & M Crushed Stone Co. (Ashland), and John P. Condon Corp. (Dracut). Economic conditions were reported as poor in the traprock industry, as road construction in the area declined.

Output of sand and gravel increased slightly (1 percent) during the year. Building activity and road construction declined in certain areas and increased in others; activity was about the same as in the preceding year. Twenty-four companies were active in 1957; nearly all output came from the central part of the county or near Boston. Sanvel Construction Co. and J. J. Cronin Sand & Gravel were leading producers. Lexington Sand & Gravel Co. at South Acton added a new portable plant, increasing its capacity considerably.

A. D. Hews & Co., Inc., went out of business early in the year and reported no output of miscellaneous clay.

The Zonolite Co. and California Stucco Products, Inc., exfoliated vermiculite at plants at North Billerica and Cambridge, respectively. The product was chiefly used as lightweight aggregate for plaster and concrete and for insulation purposes.

Nantucket.—Commonwealth of Massachusetts, Department of Public Works, produced paving sand and gravel for road construction and repair.

Norfolk.—Dimension granite was produced by J. S. Swingle, Inc., and Bates Bros. Seam Face Granite Co. from quarries at Quincy and Weymouth, respectively. Output was used for monuments and mausoleums and for architectural and rough construction work. Crushed granite for concrete aggregate and roadstone and for stone dust was produced by Old Colony Crushed Stone Co. (Quincy) and Stroughton Crushed Stone Co. (Wrentham). Business conditions were reported as favorable although some drop in construction was noted.

Sand and gravel chiefly for structural and paving work was produced in 1957 by 10 companies, chiefly in the area adjacent to Boston. The value of output increased 11 percent during the year, owing chiefly to increased usage of paving sand and gravel.

Roofing granules were produced by the Bird & Son, Inc., plant at Norwood.

Plymouth.—Bridgewater Brick Co. (East Bridgewater) and the Stiles & Hart Brick Co. (South Bridgewater) produced clay in Plymouth County but mined less miscellaneous or common clay from their open pits compared with 1956. Production was centered in the western part of the county south of Brockton and was used for building brick.

Sand and gravel was produced by 17 commercial operators. Output dropped 41 percent compared with 1956, owing to declining housing

and road construction in this area. Production consisted chiefly of structural and paving sand and gravel. Output centered chiefly near Hingham, Greenbush, Marshfield, and Bridgewater in the northern part of the county and the extreme southern edge near Onset and Marion. The leading producers were Boston Sand & Gravel Co. (Greenbush) and Marshfield Sand & Gravel Co. (Marshfield). Whitehead Bros. Co. (Onset and Marion) produced molding sand.

Bradford Weston, Inc. (Hingham), quarried granite for riprap and roadstone.

Suffolk.—Perlite from Western States was expanded and marketed by Permalite Division, The Whittemore Co., Roslindale. The expanded perlite was used chiefly for building plaster and concrete aggregate; smaller quantities were used for soil conditioning. D. B. Raymond, Burlington, produced sand and gravel fill and Acme Sand & Gravel Co., paving sand; the location of the deposit was not indicated. West Roxbury Crushed Stone Co. (West Roxbury) quarried and crushed granite for concrete and roadstone.

Worcester.—Worcester County ranked third in tonnage of sand and gravel and fifth in the State in value of production. Paving and building sand and gravel were by far the leading uses, but small quantities of molding sand and railroad-ballast gravel and some tonnage of undesignated use also were produced. Production was centered principally in and near Worcester in the central part of the county. The leading producers were Worcester Sand & Gravel Co., Inc. (Shrewsbury), P. J. Keating Co. (Lunenburg), and Joseph Rosenfeld (Hopedale).

H. E. Fletcher Co. (Milford) and Uxbridge Granite Co. (Uxbridge) quarried granite and sold both rough and dressed construction and architectural stone. Concrete aggregate and roadstone were produced by Holden Trap Rock Co. (Holden) from its basalt quarry.

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, United States Department of the Interior, and the Michigan Department of Conservation, Geological Survey Division, State of Michigan.

By Donald F. Klyce¹



VALUE of Michigan mineral production in 1957 reached a record high of \$404 million, although output of minerals was slightly less than in 1956. Unit values of all mineral commodities, except clays, copper, and natural-gas products increased. The price of silver, fixed by the Federal Government, remained unchanged.

Fifty-six percent of the minerals produced were nonmetals—cement, clays, gem stones, gypsum, lime, salt, sand and gravel, stone, sulfur, and salines—which were used chiefly in the construction and chemical industries. Mineral fuels—natural gas, natural-gas liquids, peat, and petroleum—represented 8 percent of the total, and metals—copper, iron ore, manganiferous ore, and silver—made up the remaining 36 percent.

Michigan continued to lead the Nation in production of gypsum, peat, and salt and ranked second in output of iron ore and sand and gravel.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

The only DMEA contract for minerals exploration in effect in Michigan in 1957 was the contract with Calumet & Hecla, Inc., for copper exploration in Ontonagon County. This project, begun in March 1955, was still in progress at the end of 1957. Total proposed cost was \$113,000, with Government participation of 50 percent. Actual cost to the Government, as of December 31, 1957, was \$31,842.

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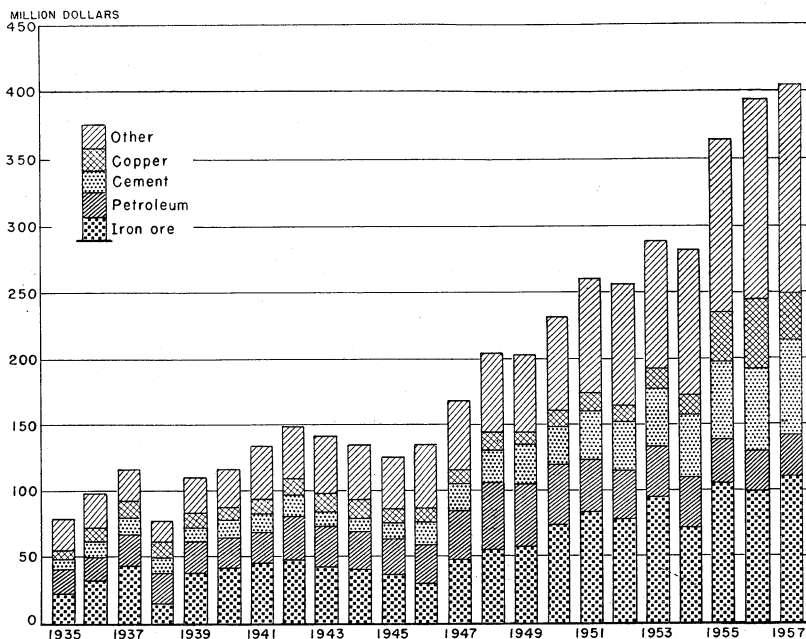


FIGURE 1.—Value of iron ore, petroleum, cement, copper, and total value of minerals produced in Michigan, 1935-57.

TABLE 1.—Mineral production in Michigan, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)
Cement:				
Portland.....thousand 376-pound barrels..	20,237	\$61,749	20,590	\$65,996
Masonry.....do.....do.....	1,643	6,049	1,455	5,610
Clays.....thousand short tons..	2,110	2,401	1,842	1,982
Copper (recoverable content of ores, etc.).....	61,526	52,297	58,400	35,157
Gem stones.....	(²)	1	(²)	1
Gypsum.....thousand short tons..	1,716	5,861	1,386	4,823
Iron ore (usable).....thousand long tons, gross weight..	12,536	98,111	13,123	111,484
Manganiferous ores (5 to 35 percent Mn).....gross weight..			123,547	(³)
Marl, calcareous.....	157,246	95	(⁴)	(⁴)
Natural gas.....million cubic feet..	10,911	1,451	\$ 9,900	\$ 1,300
Peat.....	31,111	475	80,271	1,406
Petroleum (crude).....thousand 42-gallon barrels..	10,740	30,824	\$ 10,169	\$ 31,117
Salt (common).....thousand short tons..	5,548	35,644	5,225	41,073
Sand and gravel ⁶.....do.....do.....	42,150	35,146	41,838	35,144
Silver (recoverable content of ores, etc.).....	380	344	430	389
Stone.....thousand short tons..	33,999	31,010	34,495	34,176
Value of items that cannot be disclosed: Bromine, calcium chloride and calcium-magnesium chloride, lime, magnesium compounds, natural-gas liquids, potassium salts, sulfur, and value indicated by footnote 3.....		38,737		40,441
Total Michigan ⁷.....		394,556		404,377

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 Beginning with 1957, calcareous marl included with stone.

⁵ Preliminary figure.

⁶ Includes friable sandstone.

⁷ Total has been adjusted to eliminate duplicating value of clays and stone.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—Copper production in Michigan declined 5 percent in 1957. The average annual weighted price dropped from 42.5 cents per pound in 1956 to 30.1 cents per pound in 1957, decreasing valuation by one-third. Production, valued at \$35.2 million, totaled 58,400 tons. Output came from 14 underground mines and 3 tailing-reclamation plants.

Calumet & Hecla, Inc., operated 11 mines and 1 reclamation plant in Houghton and Keweenaw Counties. Other active operations in Houghton County were the tailing-reclamation plant and smelter of Quincy Mining Co. and the Champion mine and concentrator of Copper Range Co. White Pine Copper Co. (subsidiary of Copper Range Co.) operated the White Pine mine, mill, and smelter in Ontonagon County.

The quoted market price of copper per pound, delivered, declined from 36 cents at the beginning of 1957 to 27 cents near the end of the year.

TABLE 2.—Mine production of copper in 1957, by months, in terms of recoverable metal

Month	Short tons	Month	Short tons
January.....	5,005	August.....	5,600
February.....	4,810	September.....	4,220
March.....	5,180	October.....	2,630
April.....	4,875	November.....	5,020
May.....	5,450	December.....	5,330
June.....	5,890		
July.....	4,390	Total.....	58,400

TABLE 3.—Mine production of copper, 1948-52 (average) and 1953-57, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (short tons)	Tailing (short tons)	Short tons	Value
1948-52 (average).....	9	3	1,982,178	2,170,041	23,914	\$10,597,132
1953.....	9	2	2,314,420	1,878,297	24,097	13,831,678
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

Iron Ore.—Excluding ore containing over 5 percent natural manganese, usable iron ore shipped from Michigan mines totaled 13.1 million long tons in 1957—a 5-percent increase over 1956. The chief reason for the increase was the full operating season, compared with work stoppages caused by steel and shipping strikes in the summer of 1956. Direct-shipping grades constituted 95 percent of the total, compared with 96 percent in 1956. Shipments included approximately 658,000 long tons of beneficiated ore.

Iron ore was shipped by 10 companies operating a total of 25 underground mines and 8 open pits in Gogebic range (Gogebic County), Marquette range (Baraga and Marquette Counties), and Menominee range (Dickinson and Iron Counties).

Underground mines furnished 85 percent of the crude ore mined in 1957. Average iron content of the usable ore produced in 1957 was 52.16 percent, natural. The average weighted mine value of Michigan iron ore, without respect to grade, was \$8.50 per long ton in 1957, compared with \$7.83 in 1956.

Although a small quantity of crude ore was used to manufacture iron oxide pigments, most of the iron ore shipped from Michigan in 1957 was used to manufacture pig iron and steel.

TABLE 4.—Production, shipments, and stocks of crude iron ore in 1957, by counties and ranges, in long tons ¹

County and range	Stocks of crude ore, Jan. 1, 1957	Production		Shipments		Stocks of crude ore, Dec. 31, 1957
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Baraga.....			295,850		295,850	
Dickinson.....	23,809		26,074	45,975		3,908
Gogebic.....	361,558	2,711,852	156,620	2,832,865		397,165
Iron.....	787,061	4,413,414	106,713	4,115,120	382,449	809,619
Marquette.....	980,264	5,618,566	1,693,319	5,471,111	1,403,267	1,417,771
Total.....	2,152,692	12,743,832	2,278,576	12,465,071	2,081,566	2,628,463
Range:						
Gogebic.....	361,558	2,711,852	156,620	2,832,865		397,165
Marquette.....	980,264	5,618,566	1,989,199	5,471,111	1,699,117	1,417,771
Menominee.....	810,870	4,413,414	132,787	4,161,095	382,449	813,627
Total.....	2,152,692	12,743,832	2,278,576	12,465,071	2,081,566	2,628,463

¹ Exclusive of iron ore containing 5 percent or more manganese.

TABLE 5.—Usable iron ore shipped from mines, 1948-52 (average) and 1953-57, by ranges, in long tons ¹

Year	Marquette range	Menominee range (Michigan portion)	Gogebic range (Michigan portion)	Total
1948-52 (average).....	4,853,813	4,146,728	2,419,868	12,420,409
1953.....	5,571,501	4,552,915	3,188,350	13,312,766
1954.....	3,675,429	3,655,995	2,377,743	9,709,167
1955.....	6,639,992	4,325,786	3,177,731	14,143,509
1956.....	5,688,720	3,889,213	2,958,076	12,536,009
1957.....	5,993,332	4,296,678	2,832,865	13,122,875

¹ Exclusive of iron ore containing 5 percent or more manganese, natural.

Approximately 95 percent of the iron ore shipped from Michigan mines in 1957 was transported by rail to ore docks at Ashland, Wis., Escanaba, Mich., and Marquette, Mich.; thence, by vessel, to lower Lake ports. The remainder was transported entirely by rail to consuming districts.

Dates of first and last shipments of iron ore in 1957 from Michigan and Wisconsin ports were: Ashland (C&NW and Soo Line dock), April 28–November 23; Escanaba (C&NW dock), April 1–November

29; Marquette (DSS&A dock), May 17–October 21; and Marquette (LS&I dock), April 27–November 26. Shipments ended earlier than normal because of large accumulation of ore stocks at lower Lake ports.

TABLE 6.—Usable iron ore produced, 1948–52 (average), 1953–57, and total 1854–1957, by ranges, in long tons ¹

Year	Marquette range	Menominee range (Michigan portion)	Gogebie range (Michigan portion)	Total
1948–52 (average).....	4,919,012	4,171,183	3,411,017	12,501,212
1953.....	5,785,118	4,539,638	3,468,585	13,813,341
1954.....	4,670,603	3,640,320	2,439,763	10,750,686
1955.....	5,412,956	4,018,298	2,879,357	12,310,611
1956.....	5,869,171	4,264,407	2,909,686	13,043,264
1957.....	6,557,010	4,200,831	2,888,472	13,626,313
Total 1854–1957.....	295,855,239	² 245,085,323	² 239,055,050	779,995,612

¹ Exclusive of iron ore containing 5 percent or more manganese, natural.

² Distribution by ranges partly estimated before 1906.

Manganiferous Ore.—Manganiferous ore (containing 5 to 35 percent manganese, natural) was shipped from Michigan in 1957 for the first time since 1954. Approximately 124,000 short tons was shipped from the Cannon mine, operated by Hanna Iron Ore Division of the National Steel Corp. in Iron County.

TABLE 7.—Manganiferous iron ore (containing 5 to 10 percent manganese natural) and ferruginous manganese ore (containing 10 to 35 percent manganese, natural) shipped from mines, 1948–52 (average) and 1953–57

Year	Long tons	Year	Long tons
1948–52 (average).....	¹ 37,382	1955–56.....	
1953.....	68,081	1957.....	110,310
1954.....	13,715		

¹ No shipments during 1948–49.

Silver.—Silver recovered from electrolytically refined copper concentrate and copper blister totaled 430,000 fine ounces, valued at \$389,172. Only part of the Michigan copper output was refined electrolytically, most was fire-refined.

NONMETALS

Cement.—Shipments of cement from Michigan plants in 1957 increased less than 1 percent over 1956. Portland cement, comprising the bulk of the material shipped, increased 2 percent over 1956; masonry cement declined 11 percent. Barrel prices of both types increased over 1956—portland cement from \$3.05 to \$3.21 per barrel and masonry cement from \$3.68 to \$3.85 per barrel.

Portland cement was produced in 8 plants—3 in Wayne County and 1 each in Alpena, Bay, Emmet, Lenawee, and St. Clair Counties. Masonry cements made from portland cement or cement clinker and other materials, were manufactured at five plants.

Road construction assisted materially to maintain a high-consumption rate of portland cement. There was less demand for masonry cement because of decreased building construction.

Raw materials used in manufacturing cement (clays, gypsum, and iron sinter) were procured locally. Limestone for cement was quarried in northern Michigan and transported by ship to the plants.

TABLE 8.—Finished portland cement produced, shipped and in stock, 1948-52 (average) and 1953-57

Year	Active plants	Production (barrels)	Shipped from mills			Stocks at mills on Dec. 31 (barrels)
			Barrels	Value		
				Total	Average per barrel	
1948-52 (average)-----	7	13,265,775	13,118,509	\$30,783,238	\$2.35	1,386,477
1953-----	7	15,532,853	15,853,096	41,860,464	2.64	1,307,666
1954-----	7	16,671,383	16,711,710	45,691,867	2.73	1,266,340
1955-----	7	18,204,826	18,128,068	52,352,794	2.89	1,525,000
1956-----	8	20,485,159	20,236,933	61,749,391	3.05	¹ 1,778,977
1957-----	8	21,015,341	20,589,858	65,995,656	3.21	2,204,460

¹ Revised figure.

Clays.—Production of miscellaneous clay declined nearly 13 percent in 1957. Although clays used in cement increased over 1956, clays used in manufacturing lightweight aggregate and heavy clay products declined approximately 305,000 tons because of less demand for brick, tile, and other building materials manufactured from clays.

Nearly seven-eighths of the clays mined were used in manufacturing cement. The rest was used principally for manufacturing brick, tile, and lightweight aggregate.

Production was reported from 11 counties by 15 producers. Alpena, Wayne, and Saginaw Counties reported the largest production. Output also came from Clinton, Eaton, Emmet, Gratiot, Lenawee, Monroe, St. Clair, and Shiawassee Counties. No fire clay was produced in Michigan in 1957.

Gem Stones.—Hobbyists collected small quantities of semiprecious stones, chiefly agates, on the Michigan shores of Lake Superior, chiefly for collections; few were marketed.

Gypsum.—Gypsum production decreased over 19 percent in 1957, again reflecting the effect of the decline in home construction on the mineral industries. The value was \$4.8 million, \$1 million less than in 1956, although the average unit value increased from \$3.35 to \$3.42 per ton.

Gypsum was mined by 4 companies—2 each in Kent and Iosco Counties. Crude gypsum was processed in plants at Alabaster, Detroit, Grand Rapids, and National City; plasterboard, lath, exterior sheathing, and plaster were manufactured.

Lime.—Lime production was reported by 3 companies—1 each in Bay, Mason, and Menominee Counties. Two companies produced only quicklime, the other produced both quicklime and hydrated lime. Output was used principally for chemical and paper manufacturing,

metallurgical plants, and water purification. Smaller quantities were used in sugar refining, tanneries, sewage disposal, and ore concentration.

Natural Salines.—The value of natural salines derived from Michigan brine wells was virtually unchanged from 1956 (\$37 million). Output was 4 percent lower, but increased prices offset the decline. The following products were obtained: Bromine and bromine compounds, calcium chloride, calcium-magnesium chloride, magnesium compounds, and potassium salts, as well as salt (see section on Salt). Wells were operated in Gratiot, Lapeer, Manistee, Mason, and Midland Counties.

Perlite.—Perlite was expanded at two plants in Grand Rapids and at a new plant in National City operated by National Gypsum Co. Output was used as lightweight aggregate in plaster and concrete. The crude perlite came from mines in Colorado and New Mexico.

Salt.—Like several other mineral commodities, salt decreased in volume (6 percent) but, due to higher prices, increased in value of production (15 percent). As in 1956, about three-quarters of the output was used in producing chlorine and soda ash and for de-icing highways, and the rest was used for a wide variety of chemical and industrial purposes.

Except for one underground mine in Wayne County that produced rock salt, all salt production came from well brines in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties.

Sand and Gravel.—Overall production of sand and gravel in 1957 was virtually unchanged from the previous year. The decline in building construction resulted in a 27-percent decrease in sand and gravel used by this industry. However, increased demand for materials used in road construction and industrial uses offset this decline.

The trend toward increased beneficiation of sand and gravel continued during the year. The upgraded material sold for premium prices and indications were that the processes were economically feasible. Two methods of beneficiation were reported—dense medium separation and elastic fractionation. Output of material so treated was relatively small in relation to total State production. Specialized treatment was concentrated in areas where depletion of high-grade deposits was increasing and where glacial deposits contained considerable quantities of chert, shale, and sandstone.

The 10 leading commercial producers of sand and gravel were: American Aggregates Corp., Kalamazoo, Livingston, and Oakland Counties; Construction Aggregates Corp., Ottawa County; Grand Rapids Gravel Co., Kent County; Sand Products Corp., Manistee and Muskegon Counties; Michigan Silica Co., Wayne County; Sargent Sand Co., Mason and Tuscola Counties; Walker Sand & Gravel Co., Oakland County; and O. E. Gooding & Co., Pickitt & Schreur, John G. Yerington, all operating portable plants throughout the State.

TABLE 9.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand: ¹						
Molding.....	1,753,195	\$1,875,766	\$1.07	2,237,004	\$3,002,990	\$1.34
Building.....	6,145,545	4,710,610	.77	4,334,624	3,326,107	.77
Paving.....	5,157,927	4,044,540	.78	4,779,676	4,004,562	.84
Engine.....	80,782	92,597	.77	74,809	67,644	.90
Railroad ballast.....	72,928	36,464	.50	63,636	31,818	.50
Fill.....				1,515,008	481,813	.32
Other.....	423,578	224,799	.53	60,685	55,856	.92
Undistributed ²	600,860	1,154,472	1.92	612,742	1,409,824	2.30
Total.....	14,234,815	12,109,248	.85	13,678,184	12,380,614	.91
Gravel:						
Building.....	5,218,563	5,391,239	1.03	3,770,659	4,409,145	1.17
Paving.....	15,185,556	13,552,530	.89	15,779,056	13,807,840	.88
Railroad ballast.....	233,721	226,509	.97	324,256	255,795	.79
Fill.....				249,738	138,384	.55
Other.....	355,417	230,993	.65	202,419	181,742	.90
Total.....	20,993,257	19,401,271	.92	20,326,128	18,792,906	.92
Total commercial sand and gravel.....	35,228,072	31,510,519	.89	34,004,312	31,173,520	.92
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	1,620	405	.25	43,265	10,664	.25
Paving.....	809,456	310,066	.38	1,112,183	356,115	.32
Total.....	811,076	310,471	.38	1,155,448	366,779	.32
Gravel:						
Building.....	8,897	2,669	.30	103,641	40,553	.39
Paving.....	6,101,901	3,322,294	.54	6,574,493	3,563,500	.54
Total.....	6,110,798	3,324,963	.54	6,678,134	3,604,053	.54
Total Government-and-contractor sand and gravel.....	6,921,874	3,635,434	.53	7,833,582	3,970,832	.51
ALL OPERATIONS						
Sand.....	15,045,891	12,419,719	.83	14,833,632	12,747,393	.86
Gravel.....	27,104,055	22,726,234	.84	27,004,262	22,396,959	.83
Grand total.....	42,149,946	35,145,953	.83	41,837,894	35,144,352	.84

¹ Includes friable sandstone.² Includes blast sand (1957) and glass, grinding and polishing, filter, and ground sand (1956-57)

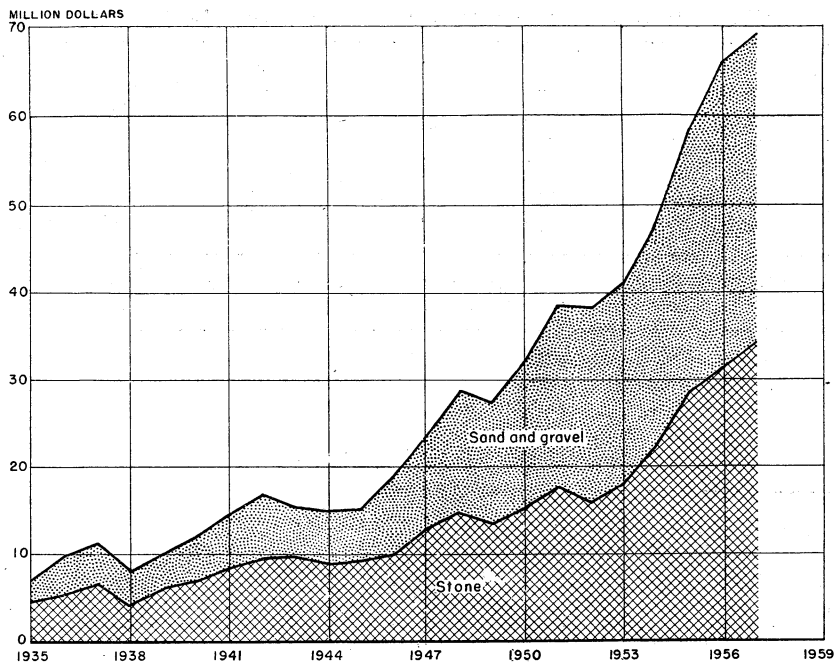


FIGURE 2.—Value of stone and sand and gravel in Michigan, 1935-57.

Stone.—Stone production in 1957, valued at \$34 million, was 1 percent more than in 1956. Over 90 percent of the production was reported from 5 counties: Alpena, Chippewa, Mackinac, Monroe, and Presque Isle. Limestone quarried in these areas was crushed and used principally for flux, concrete aggregate, and roadstone and in manufacturing cement, lime, and chemicals. Limestone for flux and cement increased while that for chemical manufacture, concrete aggregate, and roadstone declined.

Marl was included in the total stone production for the first time in 1957. Michigan continued to be a leading State in the production of marl with a reported output of 137,000 tons in 1957. It was sold chiefly for agricultural use in neutralizing acid soils. Production came from 13 counties, over half from Calhoun, Kalamazoo, and Isabella Counties.

The principal producers of limestone in 1957 were: Drummond Dolomite, Inc., Chippewa County; The France Stone Co. and The Michigan Stone Co., Monroe County; Inland Lime & Stone Co., Mackinac County; Michigan Foundry Quarry, Wayne County; Michigan Limestone Division of U. S. Steel Corp., Mackinac and Presque Isle Counties; Penn-Dixie Cement Corp., Emmet County; Presque Isle Corp. (Chemstone Corp.), Presque Isle County; The Wallace Stone Co., Huron County; and Wyandotte Chemicals Corp., Alpena County.

TABLE 10.—Dimension stone sold or used by producers, 1953–57, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	4,849	\$53,425	369	\$2,624	5,218	\$56,049
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

TABLE 11.—Crushed and broken stone sold or used by producers, 1956–57, by kinds and uses

Kind and use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Basalt:						
Concrete aggregate, roadstone:						
Noncommercial.....				40,593	\$60,138	\$1.48
Total basalt.....				40,593	60,138	1.48
Granite:						
Concrete aggregate, roadstone:						
Noncommercial.....				700	1,375	1.96
Total granite.....				700	1,375	1.96
Limestone:						
Riprap.....	(¹)	(¹)	(¹)	24,715	26,463	1.07
Flux.....	14,098,821	\$12,954,583	\$0.92	14,687,374	15,368,555	1.05
Concrete aggregate, roadstone:						
Commercial.....	5,315,862	5,781,629	1.09	4,673,168	5,803,226	1.24
Noncommercial.....	229,605	213,664	.93	256,069	266,848	1.04
Railroad ballast.....	204,210	241,157	1.18	(¹)	(¹)	(¹)
Agriculture.....	538,439	657,919	1.22	586,558	740,042	1.26
Other ²	13,526,186	10,871,362	.80	14,031,219	11,657,377	.83
Total commercial.....	33,633,518	30,506,650	.91	34,003,034	33,595,663	.99
Total noncommercial... ..	229,605	213,664	.93	256,069	266,848	1.04
Total limestone.....	33,913,123	30,720,314	.91	34,259,103	33,862,511	.99
Marl, calcareous:						
Agriculture.....				137,020	70,635	.52
Total marl, calcareous..				137,020	70,635	.52
Miscellaneous stone:						
Concrete aggregate, roadstone:						
Noncommercial.....	38,420	88,342	2.30			
Total miscellaneous stone.....	38,420	88,342	2.30			
Sandstone:						
Riprap.....				5,000	5,000	1.00
Filler.....	1,080	540	.50			
Total sandstone.....	1,080	540	.50	5,000	5,000	1.00
Total commercial.....	33,634,598	30,507,190	.91	34,145,054	33,671,298	.99
Total noncommercial... ..	268,025	302,006	1.13	297,362	328,361	1.10
Grand total.....	33,952,623	30,809,196	.91	34,442,416	33,999,659	.99

¹ Included with "Other" to avoid disclosing individual company confidential data.

² Includes limestone for chemical uses (1956), refractory (1957), whitening or whitening substitutes, asphalt filler, dust for coal mines, mineral food, poultry grit, stone sand, cement, lime, and other miscellaneous purposes.

Sulfur.—Production of byproduct sulfur was reported for the first time in 1957. Aurora Gasoline Co. of Detroit recovered sulfur from crude petroleum using a Parson design of the Claus process.

MINERAL FUELS

Natural Gas and Natural-Gas Products.—Preliminary data indicated production of 9,900 million cubic feet of natural gas valued at \$1.3 million in 1957. The largest production, as in 1956, came from Northville field in Wayne and Washtenaw Counties.² Production of natural gasoline was slightly less than in 1956.

Peat.—Peat, for use as a soil conditioner, was produced in Kalamazoo, Lapeer, St. Clair, and Sanilac Counties. Output exceeded 80,000 tons in 1957.

Petroleum.—Petroleum production declined 5 percent in 1957, but higher prices raised the value of output to 1 percent more than in 1956.

The Michigan Department of Conservation reported³ 171 producing oilfields at the end of 1957. During the year, 176 producing wells were completed, compared with 196 in 1956. Production of over 1 million barrels was reported from Isabella County. Fifteen refineries, with a rated capacity of 167,300 barrels daily, were operated in Michigan during 1957.

REVIEW BY COUNTIES

Eighty-three Michigan counties reported mineral production in 1957.

Sand and gravel was produced in 80 counties by 259 commercial and 109 noncommercial or Government-contract operators; in 13 counties this was the only mineral commodity produced. Petroleum data were available by county totals only; individual operations were not mentioned. Petroleum was the only mineral commodity produced in Oceana County. In 18 counties, only sand and gravel and petroleum were produced.

TABLE 12.—Value of minerals produced in Michigan, 1956–57, by counties¹

County	1956	1957	Minerals produced in 1957 in order of value
Alcona.....	\$34,763	\$65,610	Sand and gravel.
Alger.....	72,921	(?)	Do.
Alegan.....	797,373	982,962	Petroleum, sand and gravel, stone.
Alpena.....	31,435,872	35,531,423	Cement, stone, clays, sand and gravel.
Antrim.....	159,437	(?)	Sand and gravel.
Aretnac.....	3,811,363	2,983,196	Petroleum, stone, sand and gravel.
Baraga.....	963,138	984,329	Iron ore, sand and gravel.
Barry.....	725,691	630,563	Sand and gravel, petroleum, stone.
Bay.....	11,187,626	(?)	Cement, petroleum, lime.
Benzie.....	10,011	2,160	Sand and gravel.
Berrien.....	356,229	265,514	Do.
Branch.....	367,790	(?)	Sand and gravel, stone.
Calhoun.....	184,037	294,593	Do.
Cass.....	148,600	(?)	Do.
Charlevoix.....	20,935	16,850	Stone, sand and gravel.
Chesboygan.....	66,838	42,637	Sand and gravel, stone.
Chippewa.....	(?)	(?)	Stone, sand and gravel.
Clare.....	3,023,732	2,444,238	Petroleum, sand and gravel.

See footnotes at end of table.

¹ Michigan Department of Conservation, Geological Survey Division, Summary of Operations, Oil and Gas Fields, 1957: Lansing, 1958, 39 pp.

² Work cited in footnote 2.

TABLE 12.—Value minerals produced in Michigan, 1956–57, by counties—Continued

County	1956	1957	Minerals produced in 1957 in order of value
Clinton	\$434, 107	\$401, 941	Sand and gravel, clays.
Crawford	675, 448	(2)	Petroleum, sand and gravel.
Delta	312, 591	323, 428	Sand and gravel, stone.
Dickinson	362, 226	270, 863	Stone, iron ore, sand and gravel.
Eaton	431, 880	382, 743	Stone, sand and gravel, clays.
Emmet	8, 091, 239	6, 906, 000	Cement, stone, clays, sand and gravel.
Genesee	639, 706	549, 472	Sand and gravel, petroleum.
Gladwin	1, 242, 317	(2)	Petroleum, sand and gravel.
Goebic	23, 271, 399	23, 964, 081	Iron ore, sand and gravel, stone.
Grand Traverse	105, 556	(2)	Sand and gravel.
Gratiot	(2)	(2)	Salines, salt, sand and gravel, petroleum, clays.
Hillsdale	591, 707	816, 459	Sand and gravel, petroleum.
Houghton ²	20, 420, 105	35, 875, 776	Copper, sand and gravel, stone.
Huron	991, 701	907, 025	Stone, sand and gravel, petroleum.
Ingham	754, 219	657, 065	Sand and gravel, stone.
Ionia	(2)	(2)	Sand and gravel, petroleum.
Iosco	(2)	(2)	Gypsum, sand and gravel.
Iron	28, 348, 290	35, 979, 274	Iron ore, manganiferous ore, sand and gravel, stone.
Isabella	3, 648, 878	3, 420, 435	Petroleum, sand and gravel, stone.
Jackson	545, 386	512, 118	Sand and gravel, stone.
Kalamazoo	977, 413	783, 431	Sand and gravel, petroleum, stone, peat
Kalkaska	203, 606	(2)	Petroleum, sand and gravel.
Kent	3, 519, 850	3, 292, 099	Sand and gravel, gypsum, petroleum.
Lake	68, 832	135, 500	Sand and gravel, petroleum.
Lapeer	396, 825	707, 206	Peat, salines, sand and gravel.
Leelanau	41, 439	(2)	Sand and gravel.
Lenawee	(2)	3, 647, 353	Cement, sand and gravel, clays.
Irvington	3, 995, 526	3, 524, 001	Sand and gravel.
Luce	24, 869	19, 431	Do.
Mackinac	(2)	(2)	Stone, sand and gravel.
Macomb	1, 425, 795	1, 413, 951	Sand and gravel.
Manistee	9, 552, 643	11, 261, 619	Salt, salines, sand and gravel.
Marquette	46, 216, 560	52, 104, 695	Iron ore, sand and gravel.
Mason	4, 822, 617	5, 732, 846	Salines, lime, petroleum, sand and gravel.
Mecosta	445, 636	405, 157	Petroleum, sand and gravel, stone.
Menominee	(2)	1, 063, 470	Lime, sand and gravel.
Midland	(2)	(2)	Salines, salt, petroleum, sand and gravel.
Missaukee	1, 542, 465	1, 458, 635	Petroleum, stone.
Monroe	1, 266, 333	1, 656, 279	Stone, petroleum, clays, sand and gravel.
Montcalm	2, 184, 555	3, 257, 409	Petroleum, sand and gravel.
Montmorency	20, 957	33, 576	Sand and gravel, petroleum.
Muskegon	1, 422, 666	1, 866, 742	Sand and gravel, salt, petroleum.
Newaygo	1, 003, 224	(2)	Petroleum, sand and gravel.
Oakland	7, 071, 834	5, 970, 354	Sand and gravel, petroleum.
Oceana	1, 674, 262	1, 426, 022	Petroleum.
Ogemaw	2, 479, 529	2, 227, 166	Petroleum, sand and gravel.
Ontonagon	(2)	(4)	Copper, silver, sand and gravel.
Oseola	1, 961, 210	2, 178, 732	Petroleum, sand and gravel, stone.
Oscoda	16, 025	(2)	Sand and gravel, petroleum.
Otsego	59, 112	101, 019	Sand and gravel.
Ottawa	2, 260, 676	2, 318, 681	Sand and gravel, petroleum, stone.
Presque Isle	(2)	(2)	Stone, sand and gravel.
Roscommon	1, 328, 178	(2)	Petroleum, sand and gravel.
Saginaw	121, 353	(2)	Clays, petroleum, sand and gravel.
St. Clair	12, 583, 692	13, 281, 160	Salt, cement, peat, clays, sand and gravel, petroleum.
St. Joseph	364, 157	255, 218	Sand and gravel, stone.
Sanilac	193, 653	160, 055	Sand and gravel, peat.
Schoolcraft	3, 991, 616	68, 029	Sand and gravel.
Shiawassee	225, 624	474, 389	Sand and gravel, clays.
Tuscola	1, 602, 496	1, 920, 049	Sand and gravel, petroleum.
Van Buren	222, 725	319, 817	Do.
Washtenaw	1, 749, 961	1, 552, 106	Do.
Wayne	33, 827, 736	40, 359, 675	Cement, salt, sand and gravel, stone, clays, sulfur, petroleum.
Wexford	53, 674	100, 141	Sand and gravel.
Undistributed ⁵	100, 041, 558	89, 811, 243	
Total ⁶	394, 556, 000	404, 377, 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) and Keweenaw County (1956).

⁴ Value indicated by footnote 3.

⁵ Includes value of items referenced in footnotes 1 and 2 and value of production of petroleum (1956) and sand and gravel (1956–57) not assignable to specific counties.

⁶ Total has been adjusted to eliminate duplicating value of clays and stone.

Allegan.—Small quantities of marl, sold for agricultural use, were dug from pits in the Fennville area by Cleo L. Arndt and near Hopkins by Gerald Arnsman and Emil Pavlak. Sand and gravel production was reported from 8 pits. Petroleum valued at nearly \$750,000 was produced.

Alpena.—Cement, clays, limestone, and sand and gravel were produced. Huron Portland Cement Co. of Detroit used much of the clay and limestone to manufacture cement at Alpena. The Alpena cement plant, with 26 kilns in operation, was one of the largest in the country. Limestone, quarried by Wyandotte Chemicals Corp., was also used to produce alkali.

Arenac.—Limestone for road construction was quarried by the Arenac County Road Commission and the Bay County Road Commission. Petroleum valued at \$2,788,000 was produced. Sand and gravel was mined at five pits.

Baraga.—Cleveland-Cliffs Iron Co. produced iron ore from the Ohio open-pit mine. Sand and gravel production was also reported.

Barry.—Most of the mineral production came from seven sand and gravel operations. A small quantity of petroleum was produced. Marl for agricultural use was dug from a pit in Orangeville Township by Schau Bros.

Branch.—Case Bros. of Sherwood produced marl from leased pits. Four producers reported sand and gravel operations.

Calhoun.—Case Bros. of Sherwood operated 4 marl pits and Carl Avery, Arnie Delebaugh, and Clyde M. Reed, all of Union City, each operated 1 pit. Six sand and gravel operations were active.

Cass.—Marl was produced from Frank R. Hixon's pit near Marcellus. Three sand and gravel pits were operated.

Charlevoix.—Charlevoix Lime & Stone Co. quarried limestone near Vanderbilt for agricultural use and flux. A small amount of sand and gravel was produced.

Cheboygan.—Afton Stone & Lime Co. quarried limestone near Afton for roadstone production. Sand and gravel was produced at two pits.

Chippewa.—Drummond Dolomite, Inc. (Sheboygan, Wis.), operated a large quarry near Drummond producing limestone for flux, agricultural use, concrete aggregate, and road construction. Four operators reported sand and gravel output.

Clinton.—Grand Ledge Clay Products Co. mined clay for use in manufacturing heavy clay products at Grand Ledge. Sand and gravel was produced at five pits.

Delta.—Most of the county's mineral production came from five sand and gravel pits. Bichler Bros., Escanaba, quarried limestone for road use.

Dickinson.—Iron ore was mined by Jackson Iron & Steel Co. at the Bradley mine. Pickands Mather & Co. shipped ore from the Cornell mine stockpile.

Metro-Nite Co. (Milwaukee, Wis.) and Superior Rock Products Co. quarried limestone, the output was used for paint, putty filler, roadstone, and other purposes. Sand and gravel was produced at two operations.

Eaton.—Clay for use in heavy clay products was mined by American Vitrified Products Co. (Cleveland, Ohio) and Grand Ledge Clay Products Co. (Grand Ledge). Cheney Limestone Co. of Bellevue quarried limestone for agricultural, paving, and rubble use. Sand and gravel was mined at four pits.

Emmet.—Penn-Dixie Cement Corp. (Nazareth, Pa.) produced portland and masonry cements from five kilns at Petoskey. Shale and limestone used in cement manufacture were produced. Output of sand and gravel was reported by one operator.

Gogebic.—Iron ore was produced by Pickands Mather & Co. and North Range Mining Co. from underground mines and by Pittsburgh Pacific Co. from an open pit. After 70 years of production the Anvil-Palms mine at Ramsay operated by Pickands Mather & Co. was closed.

Granite was quarried and crushed for concrete aggregate, and sand and gravel was produced by six operators.

Gratiot.—Bromine compounds, calcium chloride, magnesium compounds, and salt were produced from natural well brines by Michigan Chemical Corp. at St. Louis. Clay Products Co. mined clay for heavy clay products at St. Louis. Sand and gravel was produced from seven pits. Petroleum production was also reported.

Houghton.—Copper was produced by Calumet & Hecla, Inc., Calumet; Copper Range Co., Painesdale; and Quincy Mining Co., Hancock. The county road commission produced crushed stone for concrete aggregate and road construction and maintenance. Sand and gravel was produced at three sites.

Due to decreased demand for copper and the sharp drop in its price, Calumet & Hecla, Inc., instituted a 5-day workweek early in 1957. During the year, employment was reduced approximately 25 percent by Calumet & Hecla, Inc. Mining of the Osceola No. 6 shaft, Osceola No. 13 shaft, and the Iroquois lode was terminated on September 30 because of the low grade of ore and low price of copper.

The Tamarack reclamation plant produced less copper than in 1956 because of a lower recovery grade, although input of tailings from the Ahmeek sandbank was only slightly lower than in 1956.

Test stoping of the Knowlton lode at the Caledonia adit near Mass, Mich., continued. Unwatering was completed, a crosscut was driven to the Butler lode, and a crosscut was started to the Evergreen lode. In 1958, there will also be test stoping of these lodes. Exploration work continued in the Calumet area also.

The Copper Range Co. Champion mine operated throughout the year. The Freda concentrator milled the output of the Champion mine and a large tonnage of tailings from the Redridge sands.

The Quincy Mining Co. reclamation plant at Torch Lake operated continuously during 1957, treating nearly 1 million tons of stamp sands. The smelter at Hancock, also in continuous operation, treated and refined company concentrates and concentrates from the Freda mill of Copper Range Co. However, during the latter part of 1957, the price of copper fell below production cost, and plans were made to discontinue both operations early in 1958.

Huron.—The Wallace Stone Co. quarried limestone near Bay Port. Some of the output was sold for building purposes (rough construction stone and finished cut stone), but most of it was crushed for concrete aggregate, railroad ballast, and agricultural use. Two sand and gravel operations were active, and a small amount of petroleum was produced.

Ingham.—Limestone and sand and gravel were produced. Most of the production came from six sand and gravel pits. The Michigan State Highway Department crushed limestone for use as concrete aggregate and road construction.

Iosco.—Gypsum and sand and gravel were produced. National Gypsum Co. at National City and United States Gypsum Co. at Alabaster mined gypsum and manufactured plaster, wallboard, and portland-cement retarder at plants in the area. National Gypsum Co. was developing a large gypsum deposit near Tawas City; production was scheduled for 1958.

Iron.—Iron ore was produced from underground mines by M. A. Hanna Co., Inland Steel Co., North Range Mining Co., Pickands Mather & Co., and Republic Steel Corp. Manganiferous iron ore was shipped from the Cannon mine by Hanna Iron Ore Division of the National Steel Corp., these were the first reported shipments from the State since 1954. A new surface plant and a 2,000-foot circular shaft, 20 feet in diameter, were proposed by M. A. Hanna Co. to replace existing facilities made inadequate by deeper mining and serve the Homer and Wauseca mines in the Mineral Hills area.

Caspian Lumber & Coal Co. and Iron River Lumber & Fuel Co. quarried limestone. Sand and gravel was produced at 2 pits.

Isabella.—Isabella County ranked first in the State in oil production with an output of over 1 million barrels of petroleum. Three sand and gravel pits were operated, and marl was dug near Mount Pleasant by William R. Stuart.

Jackson.—Limestone, marl, sandstone, and sand and gravel were produced. Quarries near Napoleon were the State's only source of sandstone in 1957. Output was sold chiefly for flagging, rubble, rough construction, and finished building stone. Producers in the area were: The Original Sandstone Quarry, Ray's Stone Quarry, and Star Stone Co.

Barnes & Van Antwerp dug marl from a pit near Horton. John C. Jeffrey quarried and crushed limestone for concrete aggregate and agricultural use near Parma. Sand and gravel was produced at seven pits.

Kalamazoo.—Sand and gravel production reported by seven operators accounted for nearly all of the mineral production in the county. Marl pits were operated near Vicksburg by Lawrence Hayward and near Kalamazoo by Dan Slack. Craven's Peat Moss, Kalamazoo produced peat for horticultural purposes. A small production of petroleum was reported.

Kent.—Crude gypsum was mined and processed for use as wallboard, lath, sheathing, and plaster by Bestwall Gypsum Co. and Grand Rapids Plaster Co., both in the Grand Rapids area. A large quantity of sand and gravel was produced at 18 pits. Petroleum production was also reported.

Lapeer.—Calcium chloride was produced from a brine well near Mayville by Wilkinson Chemical Co. Kenneth J. Anderson & Sons mined peat from bogs. Three sand and gravel operations reported production.

Lenawee.—Consolidated Cement Corp. (Cement City) produced portland and masonry cements. Comfort Brick & Tile Co. (Tecumseh) mined clay and manufactured heavy clay products. Sand and gravel was produced at six sites.

Mackinac.—Large limestone quarries were operated by Inland Lime & Stone Co. and Michigan Limestone Division of U. S. Steel Corp. Production was sold for flux, concrete aggregate, cement, agricultural use, mineral foods, and a variety of chemical and industrial purposes. Sand and gravel production was reported by three operators.

Manistee.—County mineral production was valued at over \$11 million. In the Manistee area, well brines, yielding bromine compounds, calcium chloride, magnesium compounds, and salt, were processed by Great Lakes Chemical Corp., Manistee Salt Works, Morton Salt Co., and Standard Lime & Cement Co. Sand and gravel was produced at five sites.

Marquette.—Marquette County had the largest mineral production in the State. County iron-ore shipments totaled nearly 7 million tons, over half of the State's production. Iron ore was mined by Cleveland-Cliffs Iron Co., Inland Steel Co., Jones & Laughlin Steel Corp., North Range Mining Co., and Pickands Mather & Co. Production came from underground and open-pit mines.

In 1957, Cleveland-Cliffs Iron Co.'s operations at Republic and Eagle Mills were transferred to Marquette Iron Mining Co. These operations pertain to the mining and beneficiation of jaspilite, a low-grade hematitic iron ore. Because this iron ore is nonmagnetic, the flotation method of concentration was used. The finely ground concentrate was made into pellets in a plant at Eagle Mills. Cleveland-Cliffs Iron Co., with 47.5 percent ownership of Marquette Iron Mining Co., continued as operator of the properties; the remaining interest in the new company was held by Jones & Laughlin Steel Corp., Inland Steel Co., Wheeling Steel Corp., and International Harvester Co.

Cleveland-Cliffs Iron Co., in its research laboratory at Ishpeming, conducted experiments designed to produce artificial magnetite by the partial reduction of hematite in a fluosolids reactor.

A new plant for upgrading of Cleveland-Cliffs Iron Co.'s underground ores from the Marquette range was being constructed near Negaunee. Kiln drying, screening, and dense-medium methods of improvement will be used.

A large tonnage of sand and gravel was produced from six sites in the county.

Mason.—Chemicals, lime, petroleum, and sand and gravel were produced. Dow Chemical Co. produced bromine compounds, calcium chloride, and magnesium compounds from well brines at Ludington and quicklime. The quicklime was used in chemical processing by paper manufacturers, sewage disposal, and water purification plants, and metallurgical plants. Sand and gravel was produced at three pits. Petroleum production was also reported.

Mecosta.—Marl for agricultural use was produced by Wilson Frost of Blanchard. Sand and gravel was mined at four sites. Petroleum production was reported.

Menominee.—Limestone Products Co. (Menominee) produced quick and hydrated lime for industrial and chemical uses. Sand and gravel was produced by two operators.

Midland.—The Dow Chemical Co. produced bromine compounds, potash, and salt at Midland. Petroleum and sand and gravel were also produced.

Missaukee.—A marl pit was operated by C. Stanley Hooker near Cadillac. A substantial amount of petroleum was produced.

Monroe.—Limestone was quarried by The France Stone Co. (Toledo, Ohio), Kraemer & Sons (Plain, Wis.), Michigan Stone Co. (Ottawa Lake), and the county highway commission. It was used for riprap, flux, concrete aggregate, railroad ballast, and agricultural purposes. Clays for manufacturing pottery were mined by F. W. Ritter Sons Co. at South Rockwood. Sand and gravel and petroleum production were also reported.

Muskegon.—Hooker Electrochemical Co. produced salt from brine wells at Montague; it was used for manufacturing chlorine and other chemicals. Sand and gravel production was reported by four operators. Petroleum was produced.

Oakland.—Nearly 6 million tons of sand and gravel, used mostly for building and road construction, was produced at 23 operations. As Detroit extends into Oakland County, the county serves this large industrial area. A small amount of petroleum production was reported.

Ontonagon.—White Pine Copper Co. operated its mine, mill, and smelter during 1957 at about the same rate as in 1956. Installation of two rod mills was completed early in the year, and additional flotation cells and two-stage cyclones were put into operation during the last quarter of 1957. In addition to copper, some byproduct silver was recovered by the company. Sand and gravel production was reported at three operations.

Osceola.—C. Stanley Hooker (Cadillac) operated marl pits near Marion and Tustin. Sand and gravel and petroleum were also produced.

Ottawa.—Over 2 million tons of sand and gravel was produced at 8 sites. Marl for agricultural use was produced by Ralph Meyers of West Olive. Petroleum production was also reported.

Presque Isle.—Large limestone quarries and crushing plants were operated near Rogers City by Michigan Limestone Division of United States Steel Corp. and near Presque Isle by Presque Isle Corp. (operated by Chemstone Corp.). The crushed limestone was used for flux, cement, concrete aggregate, lime, and agricultural, chemical, and industrial purposes. Onaway Stone Co. quarried dimension limestone near Onaway. Sand and gravel was produced at two sites.

Saginaw.—Clay was mined by Aetna Portland Cement Co. (Bay City) for use in cement manufacture and by Minco Products Corp. (Saginaw) for use in foundry refractories and as fertilizer filler and oil-well drilling mud. Petroleum and sand and gravel were also produced.

St. Clair.—Peerless Cement Corp. (Detroit) produced portland cement at Port Huron and mined clay used in manufacturing cement. At St. Clair, the Diamond Crystal Salt Co. produced salt from well brines. Morton Salt Co. operated a plant at Marysville. Green Thumb Peat Humus Co. and Michigan Peat, Inc., produced peat from bogs near Capac. Other minerals produced were sand and gravel, at four sites in the county, and petroleum.

St. Joseph.—Case Bros. operated a marl pit near Colon. Sand and gravel was produced from four pits.

Sanilac.—Peat was produced by the Great Lakes Peat Moss Co. and sold for horticultural use. Sand and gravel production was reported by three operators.

Shiswassee.—Michigan Vitrified Tile Co. mined clay for heavy clay products at Corunna. Sand and gravel was produced at seven sites.

Washtenaw.—Over 1.7 million tons of sand and gravel was produced. Beneficiation to upgrade material was used at two plants. Killins Gravel Co. at Ann Arbor used a dense medium process; Whittaker & Gooding Co. at Ypsilanti used elastic fractionation. Petroleum was also produced.

Wayne.—The value of mineral production—cement, clay, limestone, petroleum, salt, sand and gravel, and sulfur—exceeded \$40 million. In Detroit, the Peerless Cement Corp., operating 5 kilns, produced portland and masonry cements at 2 plants. The company also mined part of the clay it needed for cement manufacture.

Wyandotte Chemicals Corp. (Wyandotte), mined clay for cement and produced portland cement and salt. Clay was also mined by Flat Rock Products Co. (Flat Rock) for heavy clay products and at Livonia by Light Weight Aggregate Corp. for lightweight aggregate.

Limestone, used mostly for concrete aggregate, was quarried by Kraemer & Sons and Michigan Foundation Quarry.

Salt was produced from well brines by the Solvay Process Division of Allied Chemical & Dye Corp., Pennsylvania Salt Manufacturing Co., and Wyandotte Chemicals Corp., and from an underground mine by The International Salt Co. Salt production was used for chlorine, soda ash, and many chemical, industrial, and miscellaneous purposes.

Nearly 2.3 million tons of sand and gravel was produced by 11 operators. Although most of the output was used for building and road construction, a considerable tonnage of industrial sand (glass, molding, and blast) was produced. Byproduct sulfur was produced from crude petroleum by Aurora Gasoline Co. A small quantity of petroleum was produced.

The Mineral Industry of Minnesota

By Matthew G. Sikich¹



SUBSTANTIALLY greater shipments of iron ore and a rise in iron ore prices in 1957 were the chief reasons for attainment of an alltime high in the total value of mineral production in Minnesota. The new mark (\$584.5 million) surpassed the previous record (\$542.5 million) set in 1953 and represented a 17-percent increase over 1956.

Minnesota continued to be the leading iron-ore-producing State in the Nation, furnishing 64 percent of total domestic shipments in 1957. Iron-ore shipments from mines in the State were 5 million tons greater than in 1956, mainly because of the 5-week labor strike in the steel industry in the summer of that year. Iron-bearing ores (including those containing 5 to 35 percent manganese, natural) comprised approximately 93 percent of the total value of the State mineral output in 1957. Minnesota's second large-scale taconite plant, operated by Erie Mining Co. at Hoyt Lakes, began breaking-in operations in the latter part of 1957. Reserve Mining Co. shipped over 5 million long tons of pelletized taconite concentrate from its Silver Bay plant, which was operated throughout the entire year. However, the company taconite plant at Babbitt, the "pilot" plant for the major plant at Silver Bay, was shut down in October because of lessened demand for iron ore.

In 1957 the high rate of iron-ore shipments from the Lake Superior district plus decreasing consumption of ore by the steel industry in the latter part of the year, led to large accumulations of stocks of ore at lower Lake ports by the end of 1957.

Two bills important to the taconite industry in Minnesota were passed by the State legislature in 1957 and signed into law. One bill permitted the taconite industry to deduct certain taxes in computing the occupation tax; the other extended State taconite leases 25 years.

Production of sand and gravel in the State in 1957 reached a record high because of increased road construction. The decreased production of cement, lime, and stone reflected the decline in building.

¹ Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

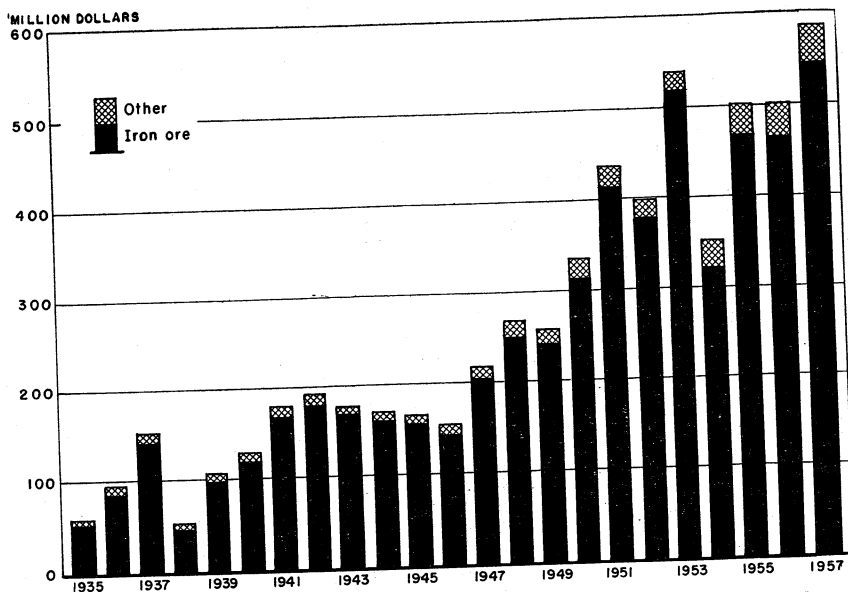


FIGURE 1.—Value of iron-ore shipments and total value of all minerals produced in Minnesota, 1935-57.

TABLE 1.—Mineral production in Minnesota, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays.....	² 80	² \$91	² 97	² \$113
Gem stones.....	(³)	(⁴)	(³)	(³)
Iron ore (usable)..... long tons, gross weight...	62, 637	461, 904	67, 656	541, 474
Manganiferous ore (5 to 35 percent Mn)..... gross weight...	634	(⁵)	692	(⁶)
Peat.....	(⁶)	(⁶)	1	(⁶)
Sand and gravel.....	28, 197	18, 254	28, 493	19, 385
Stone.....	3, 084	7, 552	2, 968	8, 175
Value of items that cannot be disclosed: Abrasive stones (grinding pebbles, tube-mill liners), cement, fire clay, gem stones (1957), lime, manganese ore, manganiferous ore, marl (calcareous), peat, quartzite, and elemental sulfur (1957).....		13, 443		15, 571
Total Minnesota ⁸		501, 027		584, 501

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 Weight not recorded.

⁴ Less than \$1,000.

⁵ Figure withheld to avoid disclosing individual company confidential data.

⁶ Less than 1,000 short tons.

⁷ Excludes certain stone, value of which is included with "Items that cannot be disclosed."

⁸ Total has been adjusted to eliminate duplicating the value of stone.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Iron-ore shipments from mines in the State (excluding ore containing over 5 percent manganese, natural) were 67.7 million long tons—an increase of 8 percent over 1956. The chief reason for the rise in output was the uninterrupted operating season, compared with the strike-affected year of 1956.

Minnesota mines supplied 66 percent of the total crude ore mined and 64 percent of the total usable ore produced and shipped in the United States in 1957. Included as "usable" ore are direct-shipping grades and all forms of concentrate. Direct-shipping grades constituted 55 percent of the total usable iron ore shipped from the State in 1957, compared with 56 percent the preceding year. Over 64 percent of the 106.1 million tons of crude ore mined in Minnesota in 1957 was beneficiated. Open-pit mines furnished nearly 98 percent of the crude ore mined during the year.

Iron ore was shipped by 26 companies operating mines in Crow Wing, Fillmore, Itasca, and St. Louis Counties. Ore from the Mesabi range (in Itasca and St. Louis Counties) constituted 95 percent of the total usable iron ore shipped from the State in 1957.

Of major interest in 1957 was the beginning of operations at the Erie Mining Co. commercial taconite plant, the Hoyt Lakes plant, in the eastern Mesabi range. Late in the year 2 concentrator sections and 2 pelletizing units were put in operation. The complete plant was expected to be operating early in 1958. By the end of 1957 approximately 268,000 tons of pellets had been produced at the plant from 1,115,000 tons of crude taconite mined near Hoyt Lakes. The initial planned capacity of the Hoyt Lakes plant was 7.5 million tons of finished product. Erie Mining Co. continued to produce taconite concentrate at its Erie preliminary taconite plant near Aurora. This plant, which produced over 1 million tons of concentrate from 1948 (its first year of operation) through 1957, was used principally to develop processes and test equipment for the company large-scale plant. At the end of 1957 it was announced that the preliminary plant would be shut down and placed in standby status. The first shipment of taconite pellets from Taconite Harbor, the Erie Mining Co. new shipping port on the north shore of Lake Superior, was loaded in September. Nearly 113,000 tons of taconite concentrate was shipped from Taconite Harbor by the end of the year.

In 1957 Reserve Mining Co. continued full-scale operations at its E. W. Davis works, the first major taconite-processing plant in the State. This plant is at Silver Bay, on Lake Superior, approximately 50 miles northeast of Duluth. During the year the company produced over 5 million tons of taconite concentrate pellets at the plant, which had an initial rated annual capacity of 3.75 million tons of finished product. In 1957 the company expanded storage facilities for concentrate. Raw material for the plant was supplied from Reserve's Peter Mitchell taconite mine at Babbitt, 47 miles inland from Silver Bay. Reserve Mining Co. mined over 15.5 million tons of crude taconite; some of the material was processed at its Babbitt plant, the pilot plant for the larger one at Silver Bay. Annual

capacity of the Babbitt plant was about 300,000 tons of pellets. In October the Babbitt plant was shut down, reportedly because of decreased demand for iron ore.

The Pilotac mine and mill of the Oliver Iron Mining Division of United States Steel Corp., near Mountain Iron produced concentrate that had been agglomerated by sintering and nodulizing at its Extaca plant near Virginia.

Jones & Laughlin Steel Corp. began treating tailing from the Hill-Annex mine tailing pond at its new spiral and flotation plant near Calumet. The plant was the first of its type in the State.

Several new open-pit mines were under development by various companies in the Minnesota iron ranges. New ore-sizing plants were put into operation in the Mesabi range. Construction of new beneficiating facilities was also in progress during the year.

Shipments of iron ore were resumed from the Stephens open-pit mine, operated by Oliver Iron Mining Division near Aurora. The property, from which ore was last shipped in 1905, was estimated to contain approximately 47 million tons of direct-shipping ore.

First shipments of iron ore from an open-pit mine in the Vermilion range since 1942 were made from the South Chandler mine, operated by Pacific Isle Mining Co. Most of the product was beneficiated before shipment to consumers.

The 1957 navigation season for ports shipping Minnesota iron ore opened on April 9 at Duluth and Two Harbors. The final boatload of the season left the Superior, Wis., harbor on December 3. The Erie Mining Co. new port, Taconite Harbor, became a Great Lakes port on September 26. The season ended earlier than usual because of the high inventory at lower Lake ports.

In 1957 the average weighted mine value for Minnesota iron ore, irrespective of grade, was \$8.00 per long ton compared with \$7.37 the preceding year. Throughout entire 1957, the following Lake Erie base prices for iron ore were in effect: Mesabi Non-Bessemer and High Phosphorus, \$11.45 per ton; Mesabi Bessemer, \$11.60; Old Range Non-Bessemer, \$11.70; Old Range Bessemer, \$11.85; and Open-Hearth Lump, \$12.70. These prices were for ore delivered at lower Lake ports and were based on the following guaranteed-base analyses: Non-Bessemer grades, 51.50 percent iron (natural); and Bessemer grades, 51.50 percent iron (natural) and 0.045 percent phosphorus (dry). Premiums and penalties were applied for variations in analyses and physical structure.

Virtually all of the ore shipped from Minnesota mines was consumed in manufacturing pig iron and steel. Usually small quantities of crude ore have been sold for manufacturing iron oxide pigments. Some magnetite concentrate ore in 1957 was reported used as a dense medium for mineral concentration. Over 98 percent of the shipments was transported by rail from the mines to Lake Superior harbors, by Lake vessel to lower Lake ports, and thence to consuming districts. The remainder was shipped entirely by rail to the final destination. Quantities of Minnesota iron ore were consumed at Duluth in blast and steel furnaces operated by Interlake Iron Corp. and the American Steel & Wire Division of United States Steel Corp. Coke ovens were also operated by these companies at Duluth.

TABLE 2.—Dates of first and final cargoes of iron ore at United States upper Lake ports, 1955-57¹

Port and dock	1955		1956		1957	
	First	Final	First	Final	First	Final
Ashland, Wis.:						
C&NW.....	Apr. 24	Nov. 20	Apr. 25	Nov. 28	Apr. 28	Nov. 23
Soo Line.....	Apr. 24	Nov. 28	Apr. 23	Nov. 25	Apr. 28	Nov. 23
Duluth, Minn.: DM&IR.....	Apr. 13	Nov. 26	Apr. 8	Dec. 15	Apr. 9	Nov. 11
Escanaba, Mich.: C&NW.....	Apr. 7	Dec. 8	Apr. 7	Dec. 3	Apr. 1	Nov. 29
Marquette, Mich.:						
DSS&A.....	Apr. 22	Nov. 13	Apr. 26	Nov. 11	May 17	Oct. 21
LS&I.....	Apr. 18	Dec. 3	Apr. 9	Dec. 5	Apr. 27	Nov. 26
Silver Bay, Minn.: Reserve.....			Apr. 6	Dec. 14	Apr. 10	Nov. 19
Superior, Wis.:						
G. N.....	Apr. 14	Dec. 3	Apr. 5	Dec. 8	Apr. 17	Dec. 3
NP-Soo Line.....	Apr. 21	Nov. 26	Apr. 8	Nov. 25	Apr. 21	Oct. 30
Taconite Harbor, Minn.: Erie.....					Sep. 26	Nov. 19
Two Harbors, Minn.: DM&IR.....	Apr. 13	Nov. 26	Apr. 8	Dec. 19	Apr. 9	Nov. 23

¹ Source: Skillings' Mining Review, Dec. 14, 1957, p. 2.

In 1957 the Minnesota Legislature passed two laws that affected the taconite industry. Provisions of one act permit the taconite industry to deduct special taxes, imposed for construction of schools and Government buildings, in computing the occupation tax. The other law extended State taconite leases for an additional 25 years. This act authorized the State conservation commissioner, with the approval of the Minnesota Executive Council, to extend leases under terms and conditions negotiated between owners of the leases and the commissioner.

TABLE 3.—Total usable iron ore produced (direct-shipping and all forms of concentrate), 1884-1957, by ranges, in long tons¹

Year	Cuyuna	Mesabi	Vermilion	Spring Valley district	Total
1884-1944.....	32,807,310	1,376,030,818	75,704,578	279,645	1,484,822,351
1945.....	1,784,010	58,355,320	1,481,007	-----	61,620,337
1946.....	1,380,130	46,678,679	1,232,008	-----	49,290,807
1947.....	2,100,846	58,772,404	1,471,879	147,787	62,492,916
1948.....	2,030,281	64,071,983	1,580,497	352,979	68,035,740
1949.....	1,826,711	52,551,346	1,381,327	102,158	55,861,542
1950.....	2,480,843	60,838,025	1,580,217	335,470	65,234,555
1951.....	2,651,724	73,574,908	1,806,818	452,405	78,485,855
1952.....	2,369,180	59,370,538	1,573,748	476,242	63,789,708
1953.....	2,900,579	75,324,236	1,643,039	217,760	80,085,614
1954.....	1,497,296	45,724,827	1,371,967	157,681	48,751,771
1955.....	2,770,738	64,860,493	1,454,365	270,670	69,356,266
1956.....	2,242,216	59,346,091	1,284,536	349,568	63,222,411
1957.....	2,018,136	64,536,795	1,349,291	382,119	68,286,341
Total.....	60,859,990	2,160,036,463	94,915,277	3,524,484	2,319,336,214

¹ Exclusive after 1905 of iron ore containing 5 percent or more manganese.

This section omits statistical data for iron ores containing 5 percent or more manganese, natural. These are treated separately under "Manganiferous ore."

Manganese Ore.—During 1957 Manganese Chemicals Corp. produced manganese carbonate, manganese dioxide, and smaller quantities of other oxides of manganese at its plant near Riverton. The

company used the Dean-Leute ammonium carbamate leaching process to recover manganese from Cuyuna range manganiferous ores. Total sales of manganese products increased over 1956.

Manganiferous Ore.—In 1957 shipments of manganiferous ore (containing 5 to 35 percent manganese, natural) were 692,000 short tons—a 9-percent increase over 1956. Shipments during the year consisted of 193,000 short tons of direct-shipping grade and 499,000 short tons of concentrate. All production of manganiferous ore in the State in 1957 came from seven mines in Crow Wing County in the Cuyuna range. Companies producing during the year were Hanna Coal & Ore Corp., Pickands Mather & Co., and Zontelli Bros. Division of Pittsburgh Pacific Co.

TABLE 4.—Production, shipments, and stocks of usable iron ore in 1957, by counties and ranges, in long tons¹

County or range	Stocks Jan. 1, 1957	Production	Shipments	Stocks Dec. 31, 1957	Iron content of production (in long tons)
County:					
Crow Wing	121,083	2,018,136	1,920,783	218,436	1,018,249
Fillmore	-----	382,119	382,119	-----	180,104
Itasca	1,172,988	16,393,437	16,544,279	1,022,146	8,752,343
St. Louis	979,506	49,492,649	48,808,859	1,663,296	25,891,646
Total	2,273,577	68,286,341	67,656,040	2,903,878	35,842,342
Range:					
Cuyuna	121,083	2,018,136	1,920,783	218,436	1,018,249
Mesabi	2,021,724	64,536,795	64,040,304	2,518,215	33,892,014
Vermilion	130,770	1,349,291	1,312,834	167,227	751,975
Spring Valley district (Fillmore County)	-----	382,119	382,119	-----	180,104
Total	2,273,577	68,286,341	67,656,040	2,903,878	35,842,342

¹ Exclusive of ore containing 5 percent or more manganese.

TABLE 5.—Production, shipments, and stocks of crude ore, 1957, by counties and ranges, in long tons¹

County or range	Stocks Jan. 1, 1957	Production		Shipments		Stocks Dec. 31, 1957
		Under- ground	Open pit	Direct to consumers	To benefi- cation plants	
County:						
Crow Wing	30,821	313,240	2,539,780	921,059	1,901,552	61,230
Fillmore	-----	-----	583,570	-----	583,570	-----
Itasca	-----	-----	35,456,644	784,533	34,672,111	-----
St. Louis	628,332	2,285,789	64,949,269	35,575,498	31,282,177	1,005,715
Total	659,153	2,599,029	103,529,263	37,281,090	68,439,410	1,066,945
Range:						
Cuyuna	30,821	313,240	2,539,780	921,059	1,901,552	61,230
Mesabi	497,562	939,862	100,394,045	35,049,838	65,943,143	838,488
Vermilion	130,770	1,345,927	11,868	1,310,193	11,145	167,227
Spring Valley district (Fill- more County)	-----	-----	583,570	-----	583,570	-----
Total	659,153	2,599,029	103,529,263	37,281,090	68,439,410	1,066,945

¹ Exclusive of ore containing 5 percent or more manganese.

Manganiferous iron ore (containing 5 to 10 percent manganese, natural) constituted 71 percent of the total shipments. Ferruginous manganese ore (containing 10 to 35 percent manganese, natural) provided the remainder. The average manganese content of the total shipments in 1957 was 7.94 percent, compared with 7.37 percent the preceding year.

TABLE 6.—Salient statistics of iron ore shipped from mines, 1948-57, in long tons¹

Year	Crude ore to concentrators	Beneficiated			Total usable ore ²	Proportion of beneficiated to total usable ore (percent)
		Agglomerates	Other	Total		
1948.....	28, 176, 320	256, 000	15, 997, 641	16, 253, 641	67, 923, 237	23. 93
1949.....	24, 941, 064	260, 403	14, 091, 248	14, 351, 651	55, 943, 714	25. 65
1950.....	36, 334, 262	253, 452	18, 525, 065	18, 778, 517	64, 538, 759	29. 10
1951.....	43, 972, 058	194, 971	21, 575, 427	21, 770, 398	73, 164, 527	27. 85
1952.....	36, 812, 301	781, 459	18, 326, 238	19, 107, 697	63, 906, 069	29. 90
1953.....	49, 924, 037	1, 080, 413	25, 097, 519	26, 177, 932	80, 533, 670	32. 51
1954.....	38, 469, 805	1, 335, 379	17, 859, 191	19, 194, 570	48, 613, 338	39. 48
1955.....	50, 733, 839	1, 793, 125	23, 987, 939	25, 781, 064	69, 419, 334	37. 14
1956.....	59, 425, 280	5, 308, 990	21, 948, 216	27, 257, 206	62, 637, 317	43. 52
1957.....	68, 439, 410	6, 835, 830	23, 539, 120	30, 374, 950	67, 656, 040	44. 90

¹ Exclusive of ore containing 5 percent or more manganese.

² Direct-shipping and beneficiated ore.

TABLE 7.—Shipments, with average iron and manganese contents, of usable¹ 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, 1948-52 (average) and 1953-57, 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	
1948-52 (average).....	874, 453	37. 19	5. 97	11, 771	32. 67	11. 09	886, 224
1953.....	795, 001	37. 79	5. 69	179, 545	33. 73	11. 62	974, 546
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	31. 82	11. 93	565, 999
1957.....	438, 820	39. 58	6. 28	179, 301	34. 20	12. 02	618, 121

¹ Direct-shipping and beneficiated ore.

² Partly estimated.

The total value of manganiferous ore produced in Minnesota in 1957 increased 16 percent over 1956. 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.

Research continued at the North Central Experiment Station of the Federal Bureau of Mines in Minneapolis in developing methods of using low-grade, manganese-bearing materials of the Cuyuna range. A report of experimental work by the Bureau of Mines was published in 1957.²

² Prasky, Charles, Differential High-Temperature Sulfatization of Cuyuna Manganese Ore: Jour. Metals, vol. 9, No. 3, March 1957, p. 377.

NONMETALS

Abrasives.—The Jasper Stone Co. of Sioux City, Iowa, quarried materials for abrasive use from a quartzite deposit near Jasper in Rock County. Output was sold as grinding pebbles and tube-mill liners. Production volume in 1957 was substantially larger than in 1956. Unit value was higher than in 1956, so the value of shipments was correspondingly greater. Minnesota was 1 of the 5 States producing grinding pebbles and 1 of 3 producing tube-mill liners. Sales were principally to cement, ceramic, and silica-sand producers.

Cement.—Universal Atlas Cement Co. of New York, N. Y., operated the only cement plant in Minnesota at Duluth. During the year the company acquired a tract of limestone-bearing land near Rochester in southern Minnesota, as a site for a possible cement plant. The Duluth plant produced portland and masonry cements in 1957. The total shipments in 1957 were slightly less than in 1956.

Portland-cement output consisted of types I and II (general use and moderate heat) and portland-slag cement. Raw materials used were limestone, slag, gypsum, iron dust, as well as small quantities of air-entraining compounds and grinding aids.

Clays.—Fire- and miscellaneous-clay production in 1957 was 22 percent greater in quantity than in 1956. The total output was used by the producers, principally for heavy clay products. Six companies reported production in Beltrami, Brown, Carlton, Goodhue, Polk, Ramsey, and Redwood Counties.

Gem Stones.—Semiprecious gem stones were found in small quantities along the north shore of Lake Superior, in Cook and Lake Counties, and in the Hiawatha Valley, along the Mississippi River in Winona County. The material collected was chiefly agate and a few pounds of thomsonite. Gem-stone collection in Minnesota is a hobby rather than an industry; most of the material collected went into personal gem collections or for use in handmade jewelry.

Lime.—Cutler-Magner Co. shipped quick and hydrated lime from the only lime plant in Minnesota at Duluth. Output was sold for building, agricultural, chemical, and industrial uses. Production in 1957 was about 23 percent lower than in 1956.

Perlite.—Crude perlite mined in Colorado, Nevada, and Wyoming was expanded at the plants of Minnesota Perlite Corp. and Western Mineral Products Co. Output was used as lightweight aggregate in plaster and concrete and for other purposes.

Sand and Gravel.—Production of sand and gravel in Minnesota in 1957 totaled 28.5 million short tons and exceeded the alltime high established in 1956 by 1 percent. The million-ton increase in paving and road materials more than offset declines in production for building and industrial use. Sand and gravel was produced in every county in the State in 1957. Major producing areas were in Hennepin, St. Louis, Stearns, and Washington Counties, which furnished nearly 30 percent of the State total.

Consumption and distribution were the same as in previous years. Over nine-tenths of the output was used by the building- and road-construction industries, and a similar proportion of the material was moved to market by truck transportation.

The 10 leading commercial producers in 1957 were: Anderson Aggregates, Barton Contracting Co., Industrial Aggregate Co., Minneapolis; Becker County Sand & Gravel Co. and Hallett Construction Co., Crosby; Cemstone Products Co. and J. L. Shiely Co., St. Paul; Gopher State Silica, Inc., Le Sueur; Megarry Bros., St. Cloud; and Ulland Bros., Inc., Austin. No appreciable trend toward beneficiation of sand and gravel was noted although the Owatonna Aggregate Corp. in Steele County, one of the Nation's first users of dense-medium separation for sand and gravel, continued to process a high-quality product.

TABLE 8.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand:						
Glass.....	20,332	\$83,026	\$4.08	(1)	(1)	(1)
Building.....	3,335,880	2,771,103	.83	2,927,872	\$2,452,046	\$0.84
Paving.....	1,228,132	746,262	.61	1,215,594	1,004,980	.83
Railroad ballast.....	6,300	3,568	.57	(1)	(1)	(1)
Fill.....				240,321	180,579	.75
Other.....	220,132	464,601	2.11	97,635	391,956	4.01
Undistributed ²	43,330	73,285	1.69	201,315	305,889	1.52
Total.....	4,854,106	4,141,845	.85	4,682,737	4,335,450	.93
Gravel:						
Building.....	2,430,843	3,558,361	1.46	2,376,614	3,552,497	1.49
Paving.....	4,292,588	2,822,249	.66	7,484,389	5,065,797	.68
Railroad ballast.....	1,366,553	604,865	.44	1,025,477	532,546	.52
Fill.....				155,329	52,117	.34
Other.....	379,094	212,364	.56	127,497	95,334	.75
Total.....	8,469,078	7,197,839	.85	11,169,306	9,298,291	.83
Total sand and gravel.....	13,323,184	11,339,684	.85	15,852,043	13,633,741	.86
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	4,050	1,215	.30	4,050	1,013	.25
Paving.....	344,125	112,883	.33	626,257	159,819	.26
Total.....	348,175	114,098	.33	630,307	160,832	.26
Gravel:						
Building.....	70,000	21,000	.30			
Paving.....	14,455,533	6,779,519	.47	12,011,067	5,590,913	.47
Total.....	14,525,533	6,800,519	.47	12,011,067	5,590,913	.47
Total sand and gravel.....	14,873,708	6,914,617	.46	12,641,374	5,751,745	.45
ALL OPERATIONS						
Sand.....	5,202,281	4,255,943	.82	5,313,044	4,496,282	.85
Gravel.....	22,994,611	13,998,358	.61	23,180,373	14,889,204	.64
Grand Total.....	28,196,892	18,254,301	.65	28,493,417	19,385,486	.68

¹ Figures withheld to avoid disclosing individual company confidential data; included with "Undistributed."

² Includes glass and railroad ballast (1957), molding and engine sand (1956-57) to avoid disclosing individual company confidential data.

Stone.—The total production of stone in Minnesota in 1957 decreased 2 percent, whereas the value was 9 percent higher. Stone products included granite, limestone, basalt, quartzite, and marl. Most of the gain in value was realized from increased shipments of dimension granite and crushed limestone. Unit prices of both dimension and crushed stone were generally higher in 1957 than in 1956. In 1957 granite was quarried in 10 counties in the central, western, and northeastern parts of the State. Rough granite was processed at plants in Cold Spring, Delano, and St. Cloud. Dimension granite was used chiefly for building and monumental use.

The demand for Minnesota granite for building purposes continued, despite the declining use of stone for building facings. The Minnesota product was used largely for interior-finish and exterior-base trim, uses relatively unaffected by the trend toward curtain-wall construction.

The tonnage of limestone, dimension and crushed, produced in 1957 was slightly more than in 1956, but the value of the output was 10 percent higher. The bulk of the crushed material was used in concrete aggregate, as roadstone, and for agricultural purposes.

Dimension limestone, quarried primarily for building use and flagging, totaled 24,084 tons valued at \$1,017,955. Basalt was

TABLE 9.—Granite sold or used by producers in 1956–57, by uses

Use	1956			1957		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension:						
Rough construction:						
Commercial.....short tons.....						
Noncommercial.....do.....				332	\$12,000	\$36.14
Rubble:						
Commercial.....do.....	24,665	\$15,610	\$0.63	23,677	16,127	.68
Noncommercial.....do.....	5,200	26,000	5.00	125	3,000	24.00
Rough architectural.....cubic feet.....	¹ 149,492	¹ 1,654,009	¹ 11.06	¹ 203,618	¹ 1,979,700	¹ 9.72
Rough monumental.....do.....	57,089	217,015	3.80	64,056	197,259	3.08
Dressed architectural.....do.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Dressed monumental.....do.....	79,151	1,014,176	12.81	131,268	1,120,149	8.53
Total dimension equivalent short tons ²	53,581	2,926,810	54.62	57,246	3,328,235	58.14
Crushed and broken:						
Riprap:						
Commercial.....short tons.....	12,084	10,288	.85			
Noncommercial.....do.....	1,800	700	.39	(³)	(³)	(³)
Concrete aggregate and roadstone.....short tons.....	(³)	(³)	(³)	125,646	226,067	1.80
Railroad ballast.....do.....	(³)	(³)	(³)	346,921	336,393	.97
Other.....do.....	³ 630,002	³ 806,761	³ 1.28	³ 39,268	³ 161,828	³ 4.12
Total crushed and broken.....do.....	643,886	817,749	1.27	511,835	724,288	1.42
Grand total.....do.....	697,467	3,744,559	5.37	569,081	4,052,523	7.12

¹ Figures for dressed and rough architectural use are combined to avoid disclosing individual company confidential data.

² Average weight of 166 pounds per cubic foot used to convert cubic feet to short tons.

³ Figures for concrete aggregate and roadstone and railroad ballast for 1956 and noncommercial riprap for 1957 are combined with "Other" to avoid disclosing individual company confidential data.

TABLE 10.—Crushed and broken limestone sold or used by producers in 1956-57, by uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Crushed and broken:						
Riprap.....	83, 511	\$94, 353	\$1. 13	29, 670	\$20, 099	\$0. 68
Flux.....	250	883	3. 53	150	525	3. 50
Concrete aggregate and roadstone:						
Commercial.....	1, 909, 287	2, 058, 947	1. 08	1, 526, 713	1, 818, 696	1. 19
Noncommercial.....	45, 297	45, 642	1. 01	321, 943	352, 103	1. 09
Railroad ballast.....	5, 530	8, 140	1. 47	(1)	(1)	(1)
Agriculture.....	223, 708	329, 109	1. 47	327, 747	518, 491	1. 58
Other uses.....	42, 038	196, 712	4. 68	138, 586	350, 003	2. 53
Total.....	2, 309, 621	2, 733, 786	1. 18	2, 344, 809	3, 059, 917	1. 30

¹ Figure combined with "Other uses" to avoid disclosing individual company confidential data.

quarried and crushed for use as roadstone by the Zenith Dredge Co. in St. Louis County.

The New Ulm Redstone Quarry Co. opened up a new quartzite deposit in Nicollet County. Output in 1957 was crushed for use as concrete aggregate and roadstone. Quartzite riprap was also produced in Rock County from waste material resulting chiefly from manufacturing grinding pebbles and tube-mill liners.

Calcareous marl is considered a stone product for the first time in 1957. Production of this material increased slightly in quantity and total value over 1956. Marl pits were operated by two companies in Chisago and Crow Wing Counties. Output was used for agricultural purposes.

Sulfur.—Elemental sulfur was recovered by the Great Northern Oil Co. as a byproduct at its Pine Bend Refinery in Dakota County.

Vermiculite.—Crude vermiculite mined in Montana was exfoliated at plants in Minneapolis and St. Paul for use principally as insulating material and as lightweight aggregate in plaster and concrete.

MINERAL FUELS

Peat.—Minnesota peat output in 1957 increased considerably over that in 1956. The Colby Pioneer Peat Co. of Hanlontown, Iowa, produced moss peat in Itasca County. Output in 1957 was used in horticulture.

REVIEW BY COUNTIES

Mineral production was reported in all Minnesota counties in 1957; eight counties reported value of mineral output exceeding \$1 million. St. Louis County led the State because of the predominance of iron mining, which furnished 68 percent of Minnesota's total output value. Increases in Crow Wing, Fillmore, and Itasca Counties were also chiefly attributable to increased shipments of iron ore, accompanied by a rise in iron-ore prices. The economy in some counties was affected by declining home construction; other counties benefited by increased commercial building and road construction.

Becker.—The Becker County Sand & Gravel Co. fixed sand and gravel plant at Detroit Lakes reported output for building and road construction, engine use, and railroad ballast. The market for the product was increased by the Grand Forks, N. Dak., airbase. Sand and gravel for road use was also produced by and under contract for the State and county highway departments.

Big Stone.—Dimension granite for architectural and monumental purposes was produced in the county during the year. Cold Spring Granite Co. operated the Agate quarry near Ortonville and the Delano Granite Works, Inc., its quarry near Odessa. Both companies processed the rough granite at their finishing plants—one at Cold Spring in Stearns County, and the other at Delano in Wright County. The Minnesota Highway Department produced gravel for road use.

TABLE 11.—Value of mineral production in Minnesota, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Aitkin	(1)	\$90,420	Sand and gravel.
Anoka	\$13,500	15,293	Stone, sand and gravel.
Becker	263,694	(1)	Sand and gravel.
Beltrami	106,726	11,818	Sand and gravel, clays.
Benton	39,706	(1)	Sand and gravel.
Big Stone	(1)	(1)	Stone, sand and gravel.
Blue Earth	547,510	646,519	Sand and gravel, stone.
Brown	325,156	323,881	Sand and gravel, clays.
Carlton	201,949	218,183	Do.
Carver	(1)	136,100	Sand and gravel.
Cass	49,534	(1)	Do.
Chippewa	271,357	(1)	Sand and gravel, stone.
Chisago	47,969	158,002	Do.
Clay	337,364	466,919	Sand and gravel.
Clearwater	8,693	15,303	Do.
Cook	2,888	6,761	Do.
Cottonwood	125,992	90,448	Do.
Crow Wing	21,909,552	22,223,989	Iron ore, manganese ore, manganese ore, sand and gravel, stone.
Dakota	606,216	993,700	Sulfur, stone, sand and gravel.
Dodge	86,632	63,220	Stone, sand and gravel.
Douglas	101,756	128,380	Sand and gravel.
Faribault	(1)	287,870	Do.
Fillmore	(1)	3,108,570	Iron ore, stone, sand and gravel.
Freeborn	171,823	215,677	Sand and gravel.
Goodhue	342,378	280,824	Stone, clays, sand and gravel.
Grant	137,720	35,802	Sand and gravel.
Hennepin	3,074,647	3,185,651	Sand and gravel, stone.
Houston	113,622	119,312	Stone, sand and gravel.
Hubbard	163,195	46,091	Sand and gravel.
Isanti	21,962	(1)	Do.
Itasca	117,965,312	135,486,623	Iron ore, sand and gravel, peat.
Jackson	126,595	110,454	Sand and gravel.
Kanabec	69,716	(1)	Sand and gravel, stone.
Kandiyohi	384,655	445,293	Sand and gravel.
Kittson	90,618	(1)	Do.
Koochiching	129,561	100,247	Do.
Lac qui Parle	731,535	695,843	Stone, sand and gravel.
Lake	25,662	23,029	Sand and gravel.
Lake of the Woods	16,287	24,908	Do.
Le Sueur	1,300,649	1,529,490	Sand and gravel, stone.
Lincoln	40,973	48,110	Sand and gravel.
Lyon	64,868	(1)	Do.
McLeod	51,764	(1)	Do.
Mahnomen	113,685	147,571	Do.
Marshall	229,683	73,384	Do.
Martin	45,051	71,876	Do.
Meeker	104,761	204,112	Do.
Mille Lacs	(1)	(1)	Stone, sand and gravel.
Morrison	123,354	196,281	Sand and gravel.
Mower	104,673	287,785	Stone, sand and gravel.
Murray	20,782	129,953	Sand and gravel.
Nicollet	97,236	154,191	Sand and gravel, stone.
Nobles	125,968	137,387	Sand and gravel.

See footnote at end of table.

TABLE 11.—Value of mineral production in Minnesota, 1956–57, by counties—
Continued

County	1956	1957	Minerals produced in 1957 in order of value
Norman.....	\$75,350	\$482	Sand and gravel.
Olmsted.....	312,170	251,259	Sand and gravel, stone.
Otter Tail.....	177,092	122,368	Sand and gravel.
Pennington.....	23,938	11,390	Do.
Pine.....	59,833	50,675	Do.
Pipestone.....	225,804	(1)	Do.
Polk.....	390,014	287,285	Sand and gravel, clays.
Pope.....	102,118	81,594	Sand and gravel.
Ramsey.....	180,907	140,387	Sand and gravel, clays.
Red Lake.....	85,307	1,608	Sand and gravel.
Redwood.....	209,107	69,286	Sand and gravel, stone, clays.
Renville.....	529,024	428,558	Stone, sand and gravel.
Rice.....	606,426	526,540	Sand and gravel, stone.
Rock.....	180,619	259,582	Abrasives, sand and gravel, stone.
Roseau.....	81,596	88,387	Sand and gravel.
St. Louis.....	334,973,928	397,818,478	Iron ore, cement, sand and gravel, lime, stone.
Scott.....	649,084	793,131	Sand and gravel, stone.
Sherburne.....	37,965	69,215	Sand and gravel.
Sibley.....	63,030	(1)	Do.
Stearns.....	2,273,420	3,340,825	Stone, sand and gravel.
Steele.....	363,045	428,994	Sand and gravel, stone.
Stevens.....	353	50,762	Sand and gravel.
Swift.....	111,478	80,058	Do.
Todd.....	176,253	222,975	Do.
Traverse.....	116,774	983	Do.
Wabasha.....	156,250	74,009	Stone, sand and gravel.
Wadena.....	230,831	(1)	Sand and gravel.
Waseca.....	(1)	(1)	Do.
Washington.....	1,518,949	1,986,297	Sand and gravel, stone.
Watonwan.....	36,022	62,577	Sand and gravel.
Wilkin.....	31,495	48,706	Do.
Winona.....	493,293	563,185	Stone, sand and gravel.
Wright.....	193,705	168,964	Sand and gravel.
Yellow Medicine.....	353,269	255,407	Stone, sand and gravel.
Undistributed.....	4,968,772	3,482,114	
Total.....	501,027,000	584,501,000	

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

Blue Earth.—Limestone and sand and gravel were the mineral products of the county in 1957. Limestone output by several producers was used for riprap, concrete aggregate and roadstone, and agricultural purposes. One company reported that its products were being used in a wider area and demand was increasing.

Sand and gravel production was centered chiefly in the Mankato area. Hallett Construction Co., Jeffries Construction Co., and Ed Swartout operated portable plants; Hiniker Gravel Co. and North Star Concrete Co. operated fixed plants. Output was chiefly for building and road purposes. Economic conditions were generally favorable; however, one company reported that its sales were decreasing, and it was troubled by rising costs.

Brown.—The sand and gravel produced in the county was used for buildings and roads. Wallner Construction Co. and M. M. Youngmann operated fixed plants near New Ulm and Sleepy Eye, respectively. Portable plants were operated by Carlson Construction Co. and Roberts Bros. Sand and gravel produced under contract for the county highway department was mined on the watersheds of the Big Cottonwood and Little Cottonwood rivers.

Ochs Brick & Tile Co. produced miscellaneous clay near Springfield for building brick. In 1957 the company built a new tunnel kiln for burning brick.

Carlton.—Sand and gravel was produced chiefly near Carlton, Cloquet, and Moose Lake for use in building and road construction, railroad ballast, and other purposes.

Fire clay was produced by the Nemadji Tile & Pottery Co. of Moose Lake for use in art pottery and floor tile.

Chippewa.—Sand and gravel for building and road construction and other uses were produced at the Hallett Construction Co., fixed plant south of Montevideo. The State highway department produced road gravel. Dimension granite for monumental use was quarried near Montevideo by the Melrose Granite Co. The rough stone was dressed at the company plant in St. Cloud. Quarrying was discontinued in October.

Chisago.—The P. O. Pederson, Inc., portable sand and gravel plant near North Branch reported output for road use. Road gravel was also produced by and for the State highway department and under contract for the county highway department. William Danner produced marl for agricultural purposes.

Cook.—Erie Mining Co. completed construction of Taconite Harbor, its shipping port for taconite-concentrate pellets produced at its new Hoyt Lakes plant. The harbor is connected to the plant by a 73-mile company-owned railroad. The new port is about 75 miles northeast of Duluth on the north shore of Lake Superior. On September 26, the first cargo of pellets was loaded on the vessel, *J. A. Campbell*. The final cargo of the 1957 season left the harbor November 19. The ore dock is approximately 1,800 feet long and has a 100,000-ton storage capacity. Instead of the conventional chute arrangement, traveling-belt conveyors are used for loading pellets into ore boats. Approximately 113,000 tons of taconite pellets was shipped from Taconite Harbor in 1957.

Sand and gravel for road use was produced by the State and county highway departments and under contract for the county.

Cottonwood.—Sand and gravel for building use and fill was produced at the Windom Sand & Gravel Co. fixed plant southwest of Cottonwood Lake near Windom. The State and county highway departments produced and contracted for road gravel.

Crow Wing.—Shipments of iron and manganiferous ores from mines in the county increased over 1956. Operating companies and mines from which iron and/or manganiferous ores were shipped in 1957 included:

Company:	<i>Mines</i>
Dates Mining Co.-----	Pennington.
M. A. Hanna Co.-----	Portsmouth group and Rowe Tailings.
Hanna Coal & Ore Corp.-----	Alstead group, Feigh, Huntington, Maroco, Section 6, and South Hillcrest.
Inland Steel Co.-----	Armour No. 1.
Pickands Mather & Co.-----	Mahnomen, Rabbit Lake, and Sagamore.
Rhude & Fryberger-----	Carlson-Nelson.
Zontelli Bros. Division of Pittsburgh Pacific Co.	Mangan-Joan, Mangan-Stai, Manuel, Merritt stockpile, and West Airport.

The Pennington mine of Dates Mining Co. was operated by both underground and open-pit mining methods in 1957. The Armour No. 1 mine of Inland Steel Co. was mined solely by underground

methods. All other mines in the county were open pits. Approximately 48 percent of the iron ore shipped from Crow Wing County in 1957 was direct-shipping grade; the remainder was concentrate, including sinter produced at the Portsmouth plant. Shipments were made from the Section 6 mine, which was idle in 1956. Two open-pit mines were being developed by M. A. Hanna Co. during the year. These were the Robert mine near Rabbit Lake and the Musser mine, about 4 miles northwest of Crosby. Shipments from the Musser mine were expected to begin in 1958. Inland Steel Co. was preparing a new production shaft to serve its Armour No. 2 property, from which ore has been hoisted through the Armour No. 1 shaft for several years. The ultimate depth of the new shaft was to be about 500 feet. On August 1, 1957, Pittsburgh Pacific Co. of Hibbing, Minn., purchased the properties of Zontelli Bros., Inc., and designated them as Zontelli Bros. Division of Pittsburgh Pacific Co.

Manganese Chemicals Corp. continued producing manganese carbonate, manganese dioxide, and other manganese products from Cuyuna-range ores. The capacity of the processing plant was about 200 long tons of crude material daily.

The county highway department produced sand and gravel for road use. The Minnesota Highway Department produced and contracted for road gravel.

Tweed Bros. produced marl for agricultural use from a pit near Pequot Lakes.

Dakota.—J. L. Shiely Co. produced 153,000 short tons of limestone from its Mendota quarry for rubble, architectural stone, flagging, riprap, railroad ballast, agricultural stone, concrete aggregate, and roadstone. Sales increased over the preceding year.

Sand and gravel was produced by several commercial operators and the State and county highway departments for use in building and road construction, manufacturing glass, and other purposes.

The Great Northern Oil Co. recovered elemental sulfur at its refinery at Pine Bend.

Dodge.—The Ulland Bros., Inc., portable sand and gravel plant near Blooming Prairie produced material for road surfacing. The State highway department produced road gravel. Crushed limestone was produced by Stursky Construction Co. and the county highway department, chiefly for maintaining county roads.

Fillmore.—Hanna Coal & Ore Corp. shipped 300,579 long tons of iron-ore concentrate from its group of open-pit mines at Spring Valley. Schroeder Mining Co. operated its Krueger iron-ore mine near Chatfield and shipped 81,540 tons of concentrate during 1957. Both companies shipped their ores entirely by rail to Granite City, Ill.

Crushed limestone for roadstone and agricultural use was produced near Harmony, Fountain, and Cherry Grove. Demand was greater for material for resurfacing county roads.

Sand and gravel was produced near Lanesboro, Fountain, and Peterson chiefly for building and road purposes.

Goodhue.—Crushed limestone for agricultural use and roadstone was produced at four quarries by the Mann Construction Co. and at the Hader quarry by the Valley Limestone Co., Inc., near Zumbrota. The Mann Construction Co. also produced and sold gravel for paving

use to the city of Red Wing. The Hallett Construction Co. fixed sand and gravel plant near Frontenac produced material for building use and fill. Harry M. Berkold sold a small quantity of sand and gravel for building use.

The Red Wing Sewer Pipe Corp. produced clay near Goodhue chiefly for use in manufacturing vitrified sewer pipe. The market for minerals of construction decreased because of a decline in building activity in the county.

Hennepin.—Production of nearly 2.7 million tons of sand and gravel was reported in Hennepin County in 1957. Output was used for various purposes, chiefly for building and road construction. Commercial producers near Minneapolis included: Craig J. Alexander, Anderson Aggregates, Barton Contracting Co., Concrete Service, Inc., Consolidated Materials Co., Chas. M. Freidheim Co., Glacier Sand & Gravel Co., J. V. Gleason, Great Northern Railway Co., Hedberg & Sons, Hopkins Sand & Gravel Co., Industrial Aggregate Co., Keller Bros. Gravel Co., Landers-Norblom-Christenson Co., Mapco Sand & Gravel Co., and Oscar Roberts Co., Inc. Road gravel was also produced by and under contract for the State and Hennepin County. The Barton Contracting Co., mining a pit near Osseo, enlarged plant facilities by adding a vibrator screen to its two-barrel rotary washing plant. Competition was keen in the area. Most of the operators reported market conditions in the area remained about the same as in 1956 or improved slightly. However, a few companies reported decreases in markets because of the decline in building activity in their local areas.

Landers-Norblom-Christenson shipped crushed limestone from stockpile for use chiefly as asphalt filler. The company did not operate its quarry in 1957 because a blasting permit was denied. The quarry is in the northeast section of Minneapolis.

Lithium minerals produced in North Carolina, Canada, and Southern Rhodesia were processed into lithium compounds and metal by Lithium Corp. of America at its plant in St. Louis Park.

The Minnesota Perlite Co. and Western Mineral Products Co. expanded perlite at plants in Minneapolis from crude perlite mined in Western States. The expanded product was used chiefly as a lightweight aggregate in plaster and concrete. Western Mineral Products Co. also exfoliated vermiculite for use chiefly as insulation and lightweight aggregate from crude material mined in Montana.

Houston.—Crushed limestone for agricultural and road purposes was produced at portable plants near Houston and Caledonia. Sand and gravel for road construction was also produced near Houston.

Itasca.—Iron ore was the chief mineral product of the county. Shipments from mines in the county increased nearly 9 percent in 1957. About 95 percent of the total shipments consisted of beneficiated ore; the remainder was direct-shipping grades. Companies and mines that shipped ore in 1957 were:

Company:	<i>Mines</i>
Butler Bros.....	Aromac, Harrison group, Patrick group, Patrick "C", and Wyman.
Cleveland-Cliffs Iron Co.....	Canisteo, Hawkins, Hill-Trumbull, Holman-Cliffs, Sally, and Sargent.
M. A. Hanna Co.....	Buckeye, Hunner, and Mississippi group.
Hanna Coal & Ore Corp.....	Carlz No. 2, and Perry.
Jessie H. Mining Co.....	Jessie.
Jones & Laughlin Steel Corp.....	Hill Annex.
Oliver Iron Mining Division, U. S. Steel Corp.	Arcturus group, King group, and Plummer.
Pacific Isle Mining Co.....	Mississippi No. 1, St. Paul, St. Paul-Day, and Shada.
Pickands Mather & Co.....	Bennett, Danube, Tioga No. 2, and West Hill.

All mines in the county were open pits in 1957.

Shipments were resumed from the Sally mine (formerly called the South Judd) operated by Cleveland-Cliffs Iron Co., 1 mile northeast of Coleraine. In 1957 the entire output of crude ore from this mine was hauled 1 mile west to its Canisteo plant for processing.

Jones & Laughlin Steel Corp. began treating material from the Hill Annex tailing basin at its new reclamation plant. This material was mined by a hydraulic dredge and pumped to the plant for treatment by spirals and flotation.

Pacific Isle Mining Co. shipped the first iron ore since 1945 from the Shada mine near Nashwauk; approximately 48,000 long tons of this crude ore was beneficiated at its North Uno concentrator in St. Louis County. Nearly 21,000 tons of concentrate was recovered from the crude material. Pacific Isle Mining Co. also shipped a small quantity of ore from the St. Paul-Day mine, which was operated in conjunction with the St. Paul mine 1 mile west of Keewatin.

A new ore-sizing plant was completed in 1957 at the Hunner mine, operated by M. A. Hanna Co., 1 mile northwest of Coleraine. Ore-sizing facilities were also installed or improved at the Butler Bros. Patrick and Harrison concentrating plants.

In 1957 Oliver Iron Mining Division of United States Steel Corp. completed constructing a new dense-medium plant at the Trout Lake concentrator at Coleraine. The Trout Lake plant, built in 1910, was the first iron-ore washing plant in the Mesabi range. The company added spirals for fine-ore recovery at its Plummer concentrator near Taconite.

The Mac Killican and Snyder mines were inactive during 1957.

The Colby Pioneer Peat Co. of Hanlontown, Iowa, produced moss peat for agricultural use.

Gravel was produced for road construction.

Kanabec.—The Cold Spring Granite Co. produced granite for architectural and monumental purposes at its Mora Grey quarry; the rough stone was finished at its plant in Cold Spring.

The Minnesota Highway Department produced and contracted for road gravel.

Lac qui Parle.—Cold Spring Granite Co. produced granite at the Cold Spring Red quarry near Odessa and shipped the rough material to its processing plant in Cold Spring. The output was used for architectural and monumental purposes. The North Star Granite Corp. No. 9 quarry near Odessa produced granite for monumental purposes. Output was processed at the company finishing plant in St. Cloud. The Dakota Granite Co. of Milbank, S. Dak., quarried granite near Bellingham for monumental use. The Liberty Granite Co., Inc., also produced granite for monumental purposes.

The Hallett Construction Co. portable plant south of Odessa near the Minnesota river produced sand and gravel for building and road construction and fill. The State and county highway departments produced and contracted for road gravel.

Lake.—The Reserve Mining Co. processed taconite at the E. W. Davis Works plant at Silver Bay. During 1957 over 5 million long tons of taconite-concentrate pellets were produced at the plant from about 14.5 million tons of crude taconite. The crude material was mined and crushed to 3-inch size at the company Peter Mitchell mine near Babbitt in St. Louis County. It was hauled by interdepartmental railroad to Silver Bay for further processing. In 1957 the company began expanding storage facilities for pellets, which are stockpiled during the winter months when Lake shipping is closed. Previous storage capacity was 1.8 million tons. The first cargo of pellets shipped from Silver Bay in 1957 was loaded on April 10, and the final boatload of the 1957 season left the harbor on November 19. Most of the pellets were shipped to blast furnaces of Armco Steel Corp. and Republic Steel Corp., joint owners of Reserve Mining Co.

Road gravel was produced by the county highway department and under contract for the Minnesota Highway Department.

Le Sueur.—The Babcock Co. produced dimension limestone at Kasota for rough construction, architectural use, and flagging and broken limestone for riprap. Most of the stone is a fine-grained, dolomitic, yellow and yellowish-pink limestone. Part of the output was marketed as "marble," actually a highly polished limestone for interior trim and facings.

Gopher State Silica, Inc., formerly Silica Sand Corp., produced silica sand from the Jordan Sandstone formation near Le Sueur. Output was used for glass manufacture, molding, building, engine use, and oilfield fracturing sand. The Glander Washed Sand & Gravel Co. fixed plant near Le Sueur reported output for building and road construction. The Chicago & North Western Railway Co. produced gravel for railroad ballast. Road gravel was produced by Ed Swartout and under contract for the State highway department.

Lincoln.—Tyler Concrete Products, formerly Tyler Cement Tile & Silo Works, produced sand and gravel at its fixed plant near Lake Benton. Output was used for building purposes. The State and county highway departments produced gravel for road use.

Lyon.—Output from the Marshall Sand & Gravel Co. and McLaughlin & Schultz, Inc., fixed and portable plants, respectively, near Marshall produced sand and gravel for use in building and road construction and railroad ballast. The State highway department produced road gravel.

McLeod.—The Bullert Construction Co. fixed sand and gravel plant northwest of Glencoe reported output for building and road purposes. Ahles & Lush, at a portable plant in the county, and the State highway department produced road gravel. The county highway department contracted for gravel for road use.

Mille Lacs.—Dimension granite for architectural and monumental purposes was produced from the Diamond Grey quarry by Cold Spring Granite Co. near Isle. The company processed the rough stone at its sawing and finishing plant in Cold Spring.

The Mille Lacs Sand & Gravel Co. fixed sand and gravel plant north of Milaca reported output for building use. The State highway department produced road gravel.

Mower.—Martin Bustad crushed limestone for agricultural and road purposes at a quarry near Austin. The various quarries of Osmundson Bros. in the county crushed limestone chiefly for roadstone. Hickok Calcium White Rock Co. crushed and ground limestone near Le Roy for use as blast-furnace flux, mineral food, poultry grit, agricultural use, and roadstone. The county highway department produced crushed limestone for road use.

The Austin Ready-Mix Concrete Co. portable plant near Lyle produced sand and gravel for building and road construction. The Minnesota Highway Department produced paving gravel. The State and county highway departments contracted for gravel for road use. The market for sand and gravel in the area improved because of increased commercial building.

Nicollet.—The Hallett Construction Co. fixed plant near St. Peter produced sand and gravel for building and road construction. Road gravel was produced by A. H. & J. H. Massopust northwest of New Ulm. A portable sand and gravel plant was operated by the Wilkinson Estate near St. Peter. Output was sold to Nicollet County for road use. Road gravel was also produced by the county highway department.

The New Ulm Red Stone Quarry Co. produced quartzite chiefly for use as concrete aggregate and roadstone at a quarry near New Ulm. The rock averages more than 97 percent silica and is suitable for the base and finish layers and the seal coat of asphalt pavement.

Nobles.—Worthington Sand Co. produced sand and gravel at a fixed plant near Rushmore for building and road construction. The State and county highway departments produced and contracted for road gravel. Markets were about the same as in 1956; however, competition in the general area was keen.

Olmsted.—Sand and gravel and limestone were produced, chiefly near Rochester, for building purposes, fill, and road use.

Universal Atlas Cement Co. acquired about 1,000 acres of limestone-bearing land 15 miles southeast of Rochester. It was considered probable that the company planned to construct a cement plant on the site.

Ramsey.—The Ford Motor Co. mined silica sand from the St. Peter sandstone formation underlying its property in St. Paul. The entire output was used by the company for manufacturing glass. Sand and gravel was produced at St. Paul by the East Side Stone Co., which reported an increase in sales. The city of St. Paul and the Minnesota Highway Department produced gravel for road mainte-

nance. The United States Corps of Engineers and the State highway department contracted for road gravel.

Miscellaneous clay produced by the Twin City Brick Co. was used in manufacturing heavy clay products.

Redwood.—Chapman Gravel Co. and Buterbaugh Sand Co. produced sand and gravel at fixed plants near Belview and Walnut Grove, respectively, for building purposes, fill, and road use. Road gravel was produced by the State highway department. The market for sand and gravel decreased because of declining farm trade.

Dimension granite was produced near Belview for monumental use.

The output of miscellaneous clay from Ochs Brick & Tile Co. near Morton was hauled 25 miles to its brick plant in Springfield for processing. Market for the product increased because of the demand for brick.

Renville.—The Cold Spring Granite Co. produced dimension granite for architectural and monumental purposes at its Rainbow quarry near Morton. The Melrose Granite Co. also produced granite near Morton from the Melrose Tapestry quarry. Output was for monumental use. Rough stone quarried in the county was processed at plants in Cold Spring by the Cold Spring Granite Co., and at St. Cloud by the Melrose Granite Co.

Sand and gravel for building and road construction was produced at a fixed plant near Danube by the Danube Sand & Gravel Co. Fairway Construction Co. produced road gravel. The Minnesota Highway Department produced and contracted for gravel for road use.

Rice.—The Bryan Rock Products, Inc., portable plant near Northfield crushed limestone for agricultural use, railroad ballast, and roadstone. The county highway department produced limestone for road use.

Sand and gravel for building, road use, fill, and other purposes was produced chiefly near Faribault and Northfield.

Rock.—The Jasper Stone Co. produced grinding pebbles and tube-mill liners from a quartzite deposit near Jasper; some waste quartzite was sold for riprap.

Hallett Construction Co. produced sand and gravel near Luverne for building use, fill, and road construction. C. H. Hatting Gravel Co., Inc., produced sand and gravel for building and paving use. The county highway department contracted for paving sand. Demand for sand and gravel in the area decreased because of declining building activity.

St. Louis.—The total value of mineral output in St. Louis County rose 19 percent over 1956, chiefly because shipments and prices of iron ore increased. Mines in St. Louis County furnished 72 percent of the total iron ore shipped from the State in 1957. Nearly 73 percent of the shipments from the county were of direct-shipping grade; the remainder was beneficiated. Companies and mines that shipped iron ore in 1957 were:

Company:	<i>Mines</i>
Butler Bros.....	Agnew No. 2—South Agnew, and Weggum.
Charleson Iron Mining Co.....	Various LOSP.
Cleveland-Cliffs Iron Co.....	Agnew and Wanless.
Haley-Young Mining Co.....	Elbern.
M. A. Hanna Co.....	Brunt, Douglas, Duncan, East Alpena, Enterprise, Morton-South Eddy, Norpac-Impro B, and South Longyear.
Jones & Laughlin Steel Corp.....	Columbia, Missabe Mountain, Longyear, and Schley-Pettit.
W. S. Moore Co.....	Alice, Gilbert-Sliver, Graff, Judson, Judson Extension, Margaret, Mariska, Norman, and Stubler.
North Range Mining Co.....	Leonidas.
Oglebay Norton Co.....	St. James.
Oliver Iron Mining Division, U. S. Steel Corp.	Canton, Canton (St. James), Gilbert, Hopewell, Hull-Rust, Kosmerl, Leonidas stockpile, Mariska Extension, Monroe group, Morris, Niles-Pillsbury-Brown, Pillsbury, Pilotac, Pioneer, Rouchleau group, Rouchleau Prospect, Sherman group, Soudan, Spruce group, and Stephens.
Pacific Isle Mining Co.....	Croxton-Syme, Cyprus-Rust, DM&IR LOSP, Drew, Graham No. 2, Holland, Iroquois, Kerr East Lease, Kerr West Lease, Lambertson, Missabe Mountain South Lease, Missabe Mountain LOSP, Pacific, South Chandler, South Stevenson, South Uno NP, Stevenson, Wacootah "A," Wacootah "B," Winifred, and W'sstar.
Pickands Mather & Co.....	Albany, Bennett Annex, Carmi-Carson Lake, Embarrass, Erie Preliminary Taconite Plant, Erie Commercial Pit, Mahoning, Scranton, and Zenith.
Pioneer Mining Co.....	Mary Ellen.
Pittsburgh Pacific Co.....	Alpena LOSP, Bradford, Chataco, Commodore, Meadow, Union, Union stockpile, and Victoria.
Republic Steel Corp.....	Susquehanna.
Reserve Mining Co.....	Peter Mitchell.
Rhude & Fryberger.....	Boeing and Troy.
Rhude-Gilbert Corp.....	Alworth.
Snyder Mining Co.....	Godfrey, Webb-Sellers-Triangle, and Whiteside.
E. A. Young, Inc.....	Grant and Minnewas.

All mines in the county in 1957 were in the Mesabi range, except the following: The Pioneer and Soudan mines, operated by Oliver Iron Mining Division of United States Steel Corp.; the Zenith, operated by Pickands Mather & Co.; and the South Chandler, operated by Pacific Isle Mining Co. The latter mine was an open pit, the first in the Vermilion range since 1942; the others were underground.

Erie Mining Co. at Hoyt Lakes began producing taconite at the second large-scale plant in Minnesota in the latter part of the year. Two concentrator sections and two pelletizing furnaces were put in operation at a reduced tonnage rate. The complete plant was expected to be in operation early in 1958. Plant capacity at Hoyt Lakes was 7.5 million tons of pellets annually. In 1957 Erie Mining

Co. produced about 268,000 tons of taconite-concentrate pellets, averaging nearly 61 percent iron. Raw material for the plant was supplied from the nearby Erie Commercial Pit. In 1957 the company installed a 1,400-foot-long, 42-inch-wide, extra-heavy, rayon and rubber conveyor belt at the Hoyt Lakes plant. The belt can carry over 2,000 tons of taconite pellets per hour at temperatures up to 250° at 525 feet per minute. A huge stacker, which was to be fed by the conveyor, was erected. The conveyor and stacker will be capable of stockpiling 4 million tons of pellets during winter months in an area 800 by 1,300 feet and 90 feet high. Taconite concentrate was also produced by the company at its preliminary plant near Aurora. The annual capacity of this plant was 200,000 tons of pellets. Erie Mining Co. planned to shut down the preliminary plant and place it in full standby status. Work was completed on the 73-mile company-owned railroad connecting the Hoyt Lakes plant with Taconite Harbor, the company shipping port in Cook County. Owners of Erie Mining Co. were: Bethlehem Steel Corp., Youngstown Sheet & Tube Co., Interlake Iron Corp., and the Steel Co. of Canada. Operating agent was Pickands Mather & Co.

Reserve Mining Co. mined crude taconite at its Peter Mitchell mine near Babbitt. Approximately 15.5 million tons was produced at the open-pit mine in 1957, compared with 11 million in 1956. Jet piercing was used for sinking blastholes in the hard taconite. Broken material was loaded into 45-ton side-dump trucks with electric shovels. A large gyratory crusher, capable of handling 3,500 tons per hour, reduced the rock to 8-inch size. Secondary crushing to 3-inch size was performed in 3 smaller gyratory crushers. In 1957 the crude material was treated at the large-scale company plant at Silver Bay and the pilot plant at Babbitt, which the company had operated since 1952. The company closed down its Babbitt plant in October.

The Oliver Iron Mining Division of United States Steel Corp. Pilotac taconite mine and plant near Mountain Iron produced concentrate that was hauled about 6 miles by rail to Oliver's Extaca plant at Virginia for agglomeration. Taconite concentrate was first shipped from the Pilotac plant in 1953.

Oliver Iron Mining Division shipped ore from the Stephens and Sauntry open-pit mines, which had been under development for a year. The Stephens property near Aurora, containing approximately 47 million tons of direct-shipping ore, had been held in reserve since the last shipment was made in 1905. The ore body is 70 to 80 feet thick and covered by 20 to 30 feet of overburden. Ore was hauled by truck to a dump pocket and processed in a crushing and screening plant before being carried to a railroad loading pocket. The Sauntry mine near Virginia was operated as part of Oliver's Rouchleau group. Two new ore-sizing plants were put into operation by Oliver in the Mesabi range. One of the plants near Virginia treated direct-shipping ores from the Rouchleau group. The other plant processed direct-shipping ores from the Sherman and Monroe groups near Chisholm. Separating the coarse from the fine material helps to control the structure of ores shipped and results in a more uniform product.

A new dense-medium and washing plant was constructed to treat ores from mines in the Mahoning group, operated by Pickands Mather

& Co. near Hibbing, and from the old Mahoning pit from which over 100 million tons of direct-shipping ore had been shipped. The Mahoning mine converted from rail haulage to truck haulage.

M. A. Hanna Co. began developing the Pierce group near Hibbing. This group consists of the Norpac, Impro B, and the Pillsbury (re-named the Roy). Hanna's 30-cubic-yard dragline, which was used in stripping the South Agnew and Morton mines, was moved 4 miles to the Pierce group. Ore shipped in past years from mines in the group was mined in conjunction with properties operated by other companies.

Snyder Mining Co. began operating the Godfrey underground mine near Chisholm, formerly mined by the Oliver Iron Mining Division of United States Steel Corp. A new washing plant with capacity to treat 200 tons per hour was constructed in 1957 at the Webb mine of Snyder Mining Co.

First shipments since 1914 from the Iroquois mine near Mountain Iron were made in 1957 by the Pacific Isle Mining Co. The company also operated the Meadow mine for the Pittsburgh Pacific Co. near Aurora. Last shipments from this mine were in 1922. In 1957 both mines were open pits. Ores from the properties were beneficiated at the Coons-Pacific plant near Eveleth.

Shipments from the Agnew mine of Cleveland-Cliffs Iron Co. were made by Butler Bros., which mined ore from the property in conjunction with its own South Agnew mine.

Charleson Iron Mining Co. shipped ore direct from various lean-ore stockpiles near Virginia. The company jig plant was closed permanently at the end of the 1956 season.

Blast furnaces and coke ovens were operated at Duluth by the American Steel & Wire Division of United States Steel Corp. and the Interlake Iron Corp. Basic open-hearth steel furnaces were also operated by the former company.

Portland and masonry cements were produced by the Universal Atlas Cement Co. at Duluth. The company was the only producer of cement in the State.

The Cutler-Magner Co. produced quick and hydrated lime at the State's only lime plant at Duluth. Shipments were chiefly for building, chemical, and other industrial uses. Total production, and value thereof, decreased below 1956.

The Mesaba Granite Co. quarried granite for monumental use near Mountain Iron. The United States Army Corps of Engineers produced granite, chiefly for constructing breakwaters.

Basalt was produced by the Zenith Dredge Co. near Duluth for use as roadstone.

Sand and gravel was produced at various places in the county. Output was used for building and road construction, railroad ballast, engine use, and fill.

Scott.—Bryan Rock Products, Inc., produced crushed and broken limestone at its Merriam Junction quarry, about 25 miles south of Minneapolis. Output in 1957 was used for agriculture, roadstone, and riprap. Much of the roadstone was used on a section of a new interstate highway near Owatonna. The fertile farmland in the area provided a ready market for agricultural stone.

Sand and gravel was produced mainly near Shakopee, Belle Plaine, and Chaska. Production in 1957 was principally for building and road use.

Stearns.—The Cold Spring Granite Co. produced granite for architectural and monumental purposes at various quarries near St. Cloud, St. Joseph, and Rockville and operated its large sawing and finishing plant in Cold Spring. Some waste granite was reclaimed at the plant by crushing it to small size for use as poultry grit. Granite for monumental use was produced near St. Cloud by the Melrose Granite Co. from the Melrose Red and Melrose Gray quarries, and by the North Star Granite Corp. from its No. 4 and No. 5 quarries. Both companies operated finishing plants in St. Cloud. Rough granite for monumental use was produced near St. Cloud by the Royal Granite Co. Shiely-Petters Crushed Stone Co. produced crushed granite near St. Cloud for railroad ballast, concrete aggregate, and roadstone. Granite for rough construction and rubble was produced by the Minnesota State Reformatory at St. Cloud.

Sand and gravel for building and road purposes was produced by A. C. Petters Co., Inc., near St. Cloud and by Megarry Bros. The State highway department produced and contracted for road gravel.

Steele.—Owatonna Aggregates Corp. produced sand and gravel at its fixed plant near Medford, chiefly for building and road construction. The company was one of the first to use dense-medium separation in processing sand and gravel. Impurities in the pit material are principally shale and iron oxide. Since the iron oxide does not float in the dense-medium plant, hand picking from a conveyor belt is necessary. Geo. Kohlmier, Inc., produced building and paving sand near Owatonna. The Medford Washed Sand & Gravel Co. produced sand and gravel for building and road use and for manufacturing glass. The Ulland Bros. portable plants near Medford and Owatonna reported output of road gravel. The State and county highway departments contracted for gravel for road construction.

Washington.—Nearly 1.7 million tons of sand and gravel was produced in the county in 1957. The leading producer was J. L. Shiely Co.; its fixed plant at Grey Cloud Island near St. Paul produced sand and gravel, chiefly for building and road construction. The Cemstone Products Co. fixed plant near Lakeland produced sand and gravel for building and road purposes, fill, and engine use. The Jay W. Craig Co. portable plant near White Bear produced gravel for road use and other purposes. Moelter Construction Co. produced building gravel near Stillwater. Road gravel was produced by David Johnson, Shalander & Shaleen, and the Minnesota Highway Department. The State and county highway departments contracted for sand and gravel for road use.

The Bryan Rock Products, Inc., portable crushing plant near Stillwater produced limestone for agricultural use. The company usually operates the plant during the winter months, stockpiling agricultural stone. Nienaber Contracting Co. crushed limestone for agricultural use and roadstone near Stillwater.

Winona.—The Biesanz Stone Co. produced dimension limestone for architectural use near Winona. In 1957 the company began using diamond-tipped gang saws. Crushed limestone for agricultural use

and roadstone was produced in the area by Fred Fakler and Patterson Quarries.

The Winona Sand & Gravel Co. produced sand and gravel for building, road construction, and railroad ballast at its dredging operation near Winona. The State highway department produced and contracted for road gravel.

Wright.—The Delano Granite Works, Inc., sawing and finishing plant at Delano processed rough granite quarried in Big Stone County.

Sand and gravel was produced in the county by several companies for building and road construction. Output in 1957 decreased slightly below 1956.

Yellow Medicine.—The Great Northern Railway Co. produced granite for railroad ballast and other uses near Granite Falls.

Road gravel was produced by Burdett C. Long at a portable plant near Granite Falls and by the Minnesota Highway Department. The State and county highway departments contracted for gravel for road purposes.

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 Robert S. Sanford ¹ and William C. Morse ²



MINERAL production in Mississippi in 1957 reached a record total value of \$149 million—more than 12 percent greater than the 1956 peak—principally because the value of petroleum and natural gas, and the production and value of clays increased.

Petroleum represented 76 percent and natural gas 14 percent of the value of the State total mineral production. Other minerals, in the order of value of output, were sand and gravel, cement, clays, natural-gas liquids, stone, and iron ore.

The State-sponsored program to attract new industries, known as "Balance Agriculture With Industry" (BAWI) progressed with marked success during the year. Bayou Casotte, Coastal Chemical Corp., and H. K. Porter Co., Inc., were examples of the program in operation. The BAWI program permits a political subdivision to vote full faith and credit bonds to acquire land and erect buildings for lease to a manufacturing enterprise to stimulate industrial growth in the State. Bonds may be amortized over a period of 20 to 25 years by the industry in the form of rent. Because the buildings and land are owned by the political subdivision, they are not subject to a property tax.

Bayou Casotte, a planned industrial district of 7,200 acres owned by Jackson Board of Supervisors (Jackson County, Miss.), was one of the most important developments along the Gulf coast of the State. The site, east of Pascagoula where a deep-water channel was being dredged at a cost of \$6.5 million by the Jackson County Port Authority, will form a second deep-water harbor in the Pascagoula area. Material dredged from the new deep-water channel will be used to elevate the entire 7,200-acre site an average of 8 feet above sea level. A railroad, access highway, electric-power connections, and natural-gas facilities were being constructed. Since 1956, Casotte has gained more than \$30 million in new industries, and more were in prospect.

Coastal Chemical Corp. was building a new plant on Bayou Casotte for manufacturing three grades of phosphate fertilizer. It also planned to build a plant to manufacture anhydrous ammonia.

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² Director, Mississippi Geological Survey, University, Miss.

H. K. Porter Co., Inc., was building a new plant on Bayou Casotte to manufacture basic refractories.

TABLE 1.—Mineral production in Mississippi, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays.....	612, 617	\$3, 590	616, 097	\$3, 635
Iron ore..... long tons, gross weight..	183	(²)	120	1
Natural gas..... million cubic feet..	185, 137	18, 143	³ 182, 411	³ 21, 047
Natural-gas liquids:				
Natural gasoline and cycle products				
thousand gallons..	24, 829	1, 751	25, 152	1, 469
do.....	10, 698	590	10, 044	472
LP-gases..... thousand 42-gallon barrels..	40, 824	100, 019	³ 39, 202	³ 114, 078
Sand and gravel.....	5, 314, 676	4, 701	5, 171, 537	4, 344
Stone.....	655, 764	656	⁴ 60, 000	⁴ 54
Value of items that cannot be disclosed: Nonmetals.....		4, 174		4, 693
Total Mississippi ⁵		133, 098		149, 305

¹ Production as measured by mine shipments, mine sales, or marketable production (including consumption by producers).

² Figure withheld to avoid disclosing individual company confidential data.

³ Preliminary figure.

⁴ Incomplete data; part not included is combined with "Undistributed."

⁵ The total has been adjusted to eliminate duplicating the value of clays and stone.

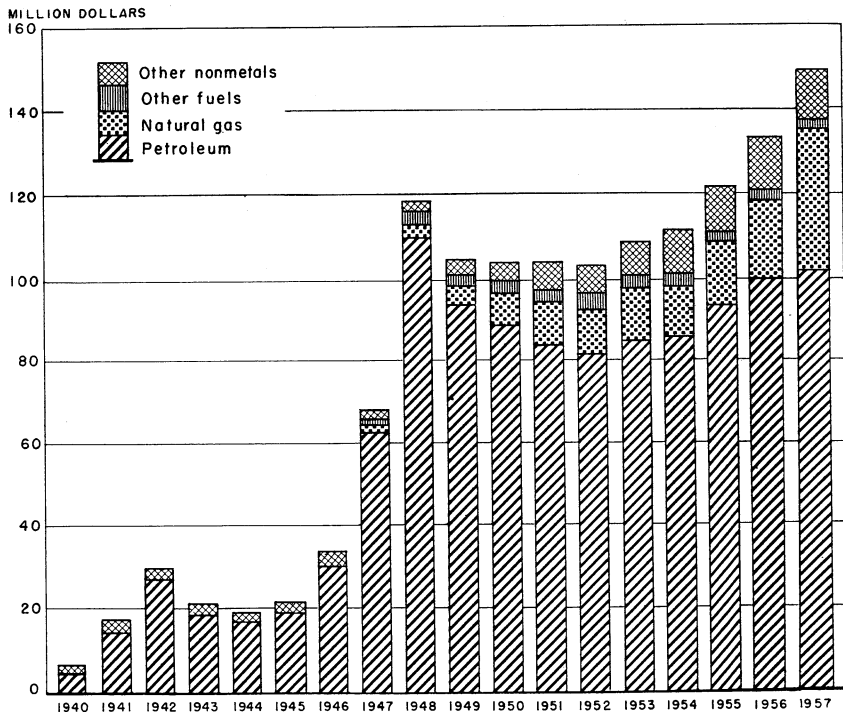


FIGURE 1.—Value of petroleum, natural gas, and total value of mineral production in Mississippi, 1940-57.

TABLE 2.—Average unit value of mineral commodities produced in Mississippi, 1953-57

Commodity	1953	1954	1955	1956	1957
Cement:					
Portland.....376-pound barrel.....	\$2.71	\$2.69	\$2.76	\$3.02	\$3.07
Masonry.....do.....				3.64	3.56
Clays:					
Ball clay, bentonite, fire clay, fuller's earth and miscellaneous clay.....short ton.....	5.64	5.55	5.59	5.86	5.90
Natural gas.....thousand cubic feet.....	.08	.083	.096	.098	1.115
Natural-gas liquids:					
Natural gasoline and cycle products.....gallon.....	.071	.07	.07	.07	.058
LP-gases.....do.....	.04	.035	.032	.054	.047
Petroleum (crude).....42-gallon barrel.....	2.36	2.50	2.46	2.45	2.91
Sand and gravel.....short ton.....	.82	.79	.82	.88	.84
Stone: Limestone (crushed).....do.....	1.15	1.00	1.00	1.00	.90

¹ Estimated.

EMPLOYMENT AND INJURIES

According to the Mississippi Employment Security Commission, an average of 4,058 men was employed in petroleum and natural-gas production, and 760 men worked in the nonmetallic mining and processing industries. Nine temporary injuries were reported in non-metal industries; 125 days was lost. Injury data for the petroleum industry for 1957 were not available.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of liquid- and gaseous-fuel production in 1957 reached an alltime high of \$137 million—a gain of \$16.5 million (14 percent) over 1956.

According to the Mississippi State Oil and Gas Board 165 oil pools and 40 gas pools were producing in 135 fields in the State at the year end; there were 2,313 producible wells (2,374 wells in 1956). Thus, an upward trend that had continued for over 11 years was reversed. The 390 wells drilled represented 3 million feet of drilled holes (compared with 2.9 million feet in 1956 and 3.3 million feet in 1955), an average depth of 7,680 feet per well in 1957 (compared with 7,168 feet in 1956 and 7,509 feet in 1955). Ten petroleum discoveries and 1 gas discovery were made during the year as follows: 2 each in Adams and Wilkinson Counties, 1 each in Franklin, Jefferson, Jones, Simpson, Smith, Walthall (gas), and Wayne Counties. Despite these discoveries, reserves of crude oil, natural-gas liquids, and natural gas declined for the third successive year.

Natural Gas.—Although the quantity of marketed production of natural gas decreased 1 percent, the value attained the alltime high of \$21 million—a 16-percent gain from 1956. Mississippi ranked eighth in the Nation as a natural-gas producer. Counties leading in natural-gas production in 1957, in order of value, were: Forrest, Jefferson Davis, Pearl River, Lamar, and Monroe.

Natural-Gas Liquids.—About 26 percent of the gross production of natural gas was processed in the State's two natural-gasoline and cycle plants, Brookhaven Gas Cycling Plant in Lincoln County and Cranfield Gas Cycling Operations in Adams and Franklin Counties.

TABLE 3.—Total well completions in 1957, by counties ¹

County	Proved field or development wells			Exploratory wells			Total			Grand total
	Oil	Gas ²	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Adams.....	20		30	2		40	22		70	92
Amite.....						2			2	2
Calhoun.....						1			1	1
Carroll.....						1			1	1
Chickasaw.....		1				2			2	2
Claiborne.....			4			5	5		9	14
Clarke.....	5					1			1	2
Clay.....						2			2	2
Covington.....						1	5	15	4	24
Forrest.....	5	15	3			6	5		10	15
Franklin.....	4		4	1		1			1	6
George.....						6			6	1
Greene.....						1			1	1
Grenada.....						2		1	2	3
Hancock.....		1				1		1	1	1
Harrison.....						3	7		3	10
Hinds.....	7					2			2	2
Holmes.....						2			2	2
Issaquena.....						2			2	1
Itawamba.....			1						1	6
Jasper.....	7	1	1			5	7	1	6	14
Jefferson.....	2		5	1		19	3		24	27
Jones.....	4		3	1		3	5		6	11
Kemper.....						3			3	3
Lamar.....	2					3	2		3	5
Leflore.....						1			1	1
Lincoln.....	3		2			2	3		4	7
Madison.....			4			1			5	5
Marion.....		1						1	3	3
Monroe.....			2			1			2	2
Newton.....						4	17	3	10	30
Pearl River.....	17	3	6			2			2	2
Perry.....						2			2	1
Pontotoc.....						1			1	1
Rankin.....						3			3	3
Scott.....						5			5	5
Sharkey.....	1					1	1		1	2
Simpson.....	1		1	1		1	2		2	4
Smith.....	5			1		4	6		4	10
Walthall.....						1		1	1	1
Warren.....						1			1	1
Wayne.....	9		3	1		9	10		12	22
Wilkinson.....	9		8	2		25	11		33	44
Yazoo.....						4			4	4
Total: 1957.....	101	22	77	10	1	179	111	23	256	390
1956.....	105	13	83	12	1	188	117	14	271	402

¹ Mississippi State Oil and Gas Bulletin, Jackson, Miss., vol. 57, No. 1, March 1957 through No. 12, February 1958.

² Includes condensate.

TABLE 4.—Estimated proved reserves of crude oil, natural-gas liquids, and natural gas ¹

	Proved reserves, Dec. 31, 1956	Changes in proved reserves, due to extensions and new discoveries in 1957	Proved reserves, Dec. 31, 1957 (production was deducted)	Percent change from 1956
Crude oil.....thousand barrels.....	368, 205	28, 287	359, 550	-2
Natural-gas liquids ².....do.....	56, 003	1, 414	54, 401	-3
Natural gas.....million cubic feet.....	2, 403, 326	99, 792	2, 297, 740	-4

¹ American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 12, Dec. 31, 1957, pp. 9, 10, 19.

² Includes condensate, natural gasoline, and LP-gases.

³ Proved recoverable reserves.

Petroleum.—Only 11 percent (9 percent in 1956) of the State crude-petroleum production was processed in its 3 petroleum refineries during 1957. A processing gain of about 1 million barrels resulted from completion of Pontiac Eastern Corp. refinery at Purvis. Shutdown runs were begun in August, and by December the plant was nearing capacity production. Southland Oils, Inc., continued normal refining at Sandersville and Paluxy Asphalt Co. at Crupp Station.

Pontiac Eastern Corp., a wholly owned subsidiary of Pontiac Refining Corp., Corpus Christi, Tex., completed the Black Creek refinery, the first complete oil refinery designed for refining the heavy, viscous oil produced from several South Mississippi fields. This new refinery had a capacity of 10,000 barrels per day of crude petroleum. The plant included a 3,700-barrel-per-day fractionation unit for purchased distillate, a 4,350-barrel-per-day fluid-coking unit (coke capacity, 225 tons per day), a 23,370-barrel-per-day T. C. C. unit (8,546 barrels of fresh feed, the remainder recycle), a 2,500-barrel-per-

TABLE 5.—Marketed production of natural gas, 1948-52 (average) and 1953-57

Year	Quantity (million cubic feet)	Value (thousands)	Year	Quantity (million cubic feet)	Value (thousands)
1948-52 (average).....	115, 012	\$7, 071	1955.....	163, 167	\$15, 664
1953.....	154, 254	12, 340	1956.....	185, 137	18, 143
1954.....	140, 448	11, 657	1957.....	1 182, 411	1 21, 047

¹ Preliminary figure.

TABLE 6.—Gross withdrawals and disposition of natural gas 1953-57, in million cubic feet.

Year	Withdrawals ¹			Disposition		
	From gas wells	From oil wells	Total	Marketed production ²	Repressuring	Vented and wasted ³
1953.....	180, 000	75, 000	255, 000	154, 254	53, 223	47, 523
1954.....	167, 000	70, 000	237, 000	140, 448	58, 645	37, 907
1955.....	193, 000	73, 000	266, 000	163, 167	62, 598	40, 235
1956.....	206, 000	82, 000	288, 000	185, 137	66, 654	36, 209
1957 ⁴	179, 000	70, 000	249, 000	182, 411	61, 202	5, 387

¹ Marketed production plus quantities used in repressuring, vented, and wasted.

² Comprises gas sold or consumed by producers, including 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 (partly estimated).

⁴ Mississippi State Oil and Gas Bulletin, Jackson, Miss., vol. 57, Nos. 11-12

TABLE 7.—Natural-gas liquids produced, 1948-52 (average) and 1953-57

Year	Natural gasoline		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Total (thousands)
1948-52 (average).....	31, 746	\$2, 292	20, 151	\$797	51, 897	\$3, 089
1953.....	32, 214	2, 295	17, 724	713	49, 938	3, 008
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

day sulfuric acid alkylation unit, and a 2,500-barrel-per-day Plattermer. This new \$20-million refinery is on U. S. Route 11, 3½ miles north of Purvis in Lamar County.

TABLE 8.—Production of crude petroleum, 1948–52 (average) and 1953–57

Year	Production (thousand barrels)	Value	
		Thousands	Average per barrel
1948–52 (average).....	39,062	\$91,190	\$2.33
1953.....	35,620	84,060	2.36
1954.....	34,240	85,600	2.50
1955.....	37,741	92,840	2.46
1956.....	40,824	100,019	2.45
1957.....	1 39,202	1 114,078	2.91

¹ Preliminary.

TABLE 9.—Indicated demand, production, and stocks of crude petroleum in 1957, by months

(Thousand barrels)

Month	Indicated demand	Production	Stocks originating in Mississippi
January.....	3,259	3,487	3,125
February.....	4,133	3,285	2,277
March.....	3,586	3,417	2,108
April.....	2,624	3,506	2,990
May.....	4,185	3,561	2,366
June.....	2,769	3,236	3,033
July.....	3,475	3,167	2,725
August.....	3,205	2,896	2,416
September.....	2,774	2,951	2,593
October.....	4,044	3,884	2,433
November.....	2,912	2,866	2,387
December.....	2,872	2,946	2,461
Total: 1957.....	39,838	39,202	-----
1956.....	40,587	40,824	-----

TABLE 10.—Production of crude petroleum, 1953–57, by fields

(Thousand barrels)

Field	1953	1954	1955	1956	1957 ¹
Baxterville.....	5,940	5,137	5,301	5,874	4,955
Bolton.....	-----	-----	-----	842	1,164
Brookhaven.....	4,211	3,724	3,511	3,019	2,542
Cranfield.....	2,398	1,776	1,497	1,299	1,199
Eucutta.....	1,542	1,352	1,355	1,484	1,412
Heidelberg.....	3,336	3,098	3,253	3,641	3,329
La Grange.....	2,701	2,269	2,128	2,137	1,953
Mallalieu.....	1,484	1,252	1,117	1,021	1,030
Soso.....	316	748	3,110	4,289	4,218
Tinsley.....	4,545	4,326	4,475	4,399	3,949
Yellow Creek.....	1,652	1,526	1,433	1,494	1,475
Other fields.....	7,495	9,032	10,561	11,325	11,976
Total.....	35,620	34,240	37,741	40,824	39,202

¹ Preliminary figures.

NONMETALS

Cement.—Mississippi Valley Portland Cement Co. was constructing the second multimillion-dollar cement plant in Mississippi at Redwood, approximately 15 miles north of Vicksburg. Construction of the new \$4-million plant was begun in August and scheduled for completion in August 1958. It will be equipped with a 10- by 400-foot kiln and have a rated annual capacity of approximately 750,000 barrels of cement. Design and machinery were by Kennedy-Van Saun Manufacturing & Engineering Corp. of Allentown, Pa.

Marquette Cement Manufacturing Co. at Brandon continued to be the only facility in the State producing cement. Production and shipments of portland cement decreased slightly, but masonry cement increased, compared with 1956.

TABLE 11.—Clays sold or used by producers, 1948–52 (average) and 1953–57, by kinds

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average) ..	248,780	\$1,700,205	44,995	\$497,703	248,212	\$239,294	541,987	\$2,437,202
1953	189,211	2,028,040	71,235	814,516	299,601	315,829	560,047	3,158,385
1954	185,554	1,998,052	57,779	770,265	316,068	334,815	559,401	3,103,132
1955	226,852	2,558,399	79,922	959,373	393,841	395,341	700,615	3,913,113
1956	219,216	2,360,031	93,787	930,699	299,614	299,614	612,617	3,590,344
1957	220,313	2,372,249	100,942	967,976	294,842	294,842	616,097	3,635,067

Clays.—The production of clays from 19 counties in Mississippi increased to 616,000 short tons valued at \$3.6 million. Ball-clay production, all from Panola County, decreased 5 percent in quantity but gained in value from the preceding year. Bentonite production, reported from Monroe, Itawamba, Smith, and Pearl River Counties—in order of output—increased in quantity and total value. Production of fuller's earth, all from Tippah County, used for absorbents, increased in quantity and value. Fire-clay production and value increased 10 percent.

Jackson Ready-Mix Concrete Co. was building the first lightweight-aggregate-producing plant in Mississippi. Clay will be mined from an adjacent open pit. The new plant, a few miles north of Jackson, Hinds County, was scheduled for production by early 1958.

The Misceramic Tile Co. new plant at Cleveland was completed. During the dedication the first batch of ceramic floor and wall tile was run through the two kilns.

Magnesium Compounds.—H. K. Porter Co., Inc., was constructing a new sea-water-magnesia and basic-refractories plant in the Bayou Casotte industrial district near Pascagoula. The plant, scheduled for completion late in 1958, will manufacture a complete line of basic-refractory brick—burned, unburned, and steel-encased bodies—along with chromite and periclase-refractory specialties.

Nitrogen Compounds.—Coastal Chemical Corp. was building a new fertilizer plant at Bayou Casotte, a few miles east of Pascagoula, Jackson County. Atmospheric nitrogen and natural gas from Mississippi, sulfur from Louisiana, phosphate rock from Florida, and potash from New Mexico will be used to manufacture sulfuric acid, oleum, anhydrous ammonia, phosphoric acid, phosphate, high-analysis fertilizer, and carbon dioxide. The first section of the plant was scheduled for completion early in 1958 at an estimated cost of \$8.5 million, with future expansions of \$6 million.

Mississippi Chemical Corp., Yazoo City, was constructing new facilities at a cost of \$2 million that will add 150 tons per day to its nitric-acid capacity and 30 tons per day to its ammonia capacity. During the 1956-57 fertilizing year, the plant produced and sold 29,176 tons of anhydrous ammonia and 159,496 tons of ammonium nitrate. It also produced argon, carbon dioxide, and nitric acid.

Sand and Gravel.—The production and total value of sand and gravel decreased 3 percent and 8 percent, respectively, from 1956. Production, 5.2 million tons valued at \$4.3 million was distributed between commercial, 4.5 million tons (\$3.9 million), and Government-and-contractor, 688,000 tons (\$424,000). A gain of over 110 percent was reported in Government-and-contractor sand and gravel used for paving, but this increase failed to offset declines in structural, molding, railroad ballast, and other miscellaneous uses. Sand and gravel production was reported from 21 of the 82 counties in the State; the leading counties, in order of value, were: Copiah, Forrest, Carroll, Adams, and De Soto.

TABLE 12.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Commercial		Government-and-contractor		Total		Average per ton
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average)---	2, 148, 312	\$1, 553, 480	579, 776	\$288, 283	2, 728, 088	\$1, 841, 763	\$0. 68
1953-----	2, 070, 123	1, 713, 362	583, 523	460, 509	2, 653, 646	2, 173, 871	. 82
1954-----	5, 208, 459	4, 179, 421	233, 378	107, 450	5, 441, 837	4, 286, 871	. 79
1955-----	5, 027, 127	4, 335, 799	597, 682	267, 233	5, 624, 809	4, 603, 032	. 82
1956-----	4, 990, 499	4, 554, 103	324, 177	147, 193	5, 314, 676	4, 701, 296	. 88
1957-----	4, 483, 763	3, 919, 999	687, 774	423, 983	5, 171, 537	4, 343, 982	. 84

Stone.—Production of crushed limestone, used entirely as a soil conditioner, decreased during the year. Before 1957 all the crushed limestone produced in the State was used in manufacturing cement and for agricultural limestone. During 1957 calcareous marl was used for cement.

METALS

Aluminum.—Dixie Aluminum Corp. completed a new aluminum-extrusion plant at Hattiesburg. Production of a complete line of aluminum extrusions was begun during December on a 1-shift basis, requiring about 100 employees.

Assets of Mississippi Aluminum Corp., a subsidiary since December 1955 of Olin Mathieson Chemical Corp., were transferred to the parent company. The extrusion plant of Mississippi Aluminum Corp. at Gulfport was to be operated as a unit of Olin Aluminum Division of Olin Mathieson. The plant produced commercial, industrial, and architectural aluminum extrusions. Olin Mathieson invested nearly \$1 million in new machinery, buildings, and equipment after acquiring the plant in 1955.

Iron Ore.—Kilmichael Ore Corp. was organized to operate the Stewart iron-ore mines. The company completed installing a 54-inch crusher, twin-log washers 30 feet long by 9 feet wide, and a belt conveyor to a 200-ton concentrate bin. Access roads to the new washer and to several company leases were completed. The iron ore commanded a premium price at Pittsburgh, Birmingham, and Granite City because of its high iron and low phosphorus content.

Steel.—Mississippi Steel Corp. completed constructing a steel mill near Jackson in June. The plant had an electric furnace with a rated capacity of 10 tons a day and equipment for rolling light shapes and concrete reinforcing rods. The electric furnace operated one 16-hour night shift to use the off-peak-load power.

REVIEW BY COUNTIES

Minerals were produced in 53 of the 82 counties. Petroleum was produced in 28 (26 in 1956) counties, natural gas in 24 (25 in 1956), natural-gas liquids in 2, clay in 19, and sand and gravel in 21 (23 in 1956).

Adams.—Adams County continued to lead in the value of minerals produced and ranked first in petroleum, natural-gas liquids, and sand and gravel. The drilling of 42 exploratory holes resulted in discoveries of two fields—Ellis Cliffs and Glendale. Fifty development holes resulted in 20 petroleum producers and 30 dry holes.

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.—A new plant for manufacturing ceramic wall and floor tile was built by Misceramic Tile Co. at Cleveland.

Carroll.—Leflore County engineer produced pit-run sand and gravel for highway construction. Carroll County ranked fifth in the production of sand and gravel. One dry exploratory hole was drilled.

Clay.—West Point Gravel Co. produced sand and gravel for structural and paving purposes and for other uses at its portable plant. The State of Mississippi Lime Plant Board continued to produce agricultural limestone from its quarry. One dry exploratory hole was drilled.

Copiah.—Petroleum production was reported from Copiah County for the first time. This county ranked second in the value of sand and gravel produced. The Traxler Gravel Co., Inc., and Green Bros. Gravel Co. portable plants produced paving sand and gravel; Gatesville Gravel Co. produced railroad-ballast gravel.

TABLE 13.—Value of mineral production in Mississippi, 1956–57, by counties¹

County	1956	1957	Percent change	Minerals produced in 1957 in order of value
Adams.....	\$23,352,204	\$25,412,325	+9	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Alcorn.....	50,480	(²)	-----	Sand and gravel, clays.
Amite.....	43,721	55,739	+27	Petroleum, natural gas.
Attala.....	2,813	4,800	+71	Clays.
Carroll.....	75,000	338,000	+351	Sand and gravel.
Chickasaw.....	58,403	70,300	+20	Natural gas, petroleum.
Clarke.....	408,864	485,432	+19	Petroleum, natural gas.
Clay.....	130,901	(²)	-----	Sand and gravel, stone.
Coahoma.....	-----	20,004	-----	Sand and gravel.
Copiah.....	460,609	546,213	+19	Sand and gravel, petroleum.
De Soto.....	(²)	396,459	-----	Sand and gravel.
Forrest.....	4,452,086	10,923,140	+145	Natural gas, petroleum, sand and gravel, clays.
Franklin.....	1,834,167	2,923,004	+59	Petroleum, natural gas.
George.....	(²)	74,250	-----	Sand and gravel.
Greene.....	8,812	7,398	-16	Petroleum.
Grenada.....	10,800	10,800	-----	Sand and gravel.
Hancock.....	195,812	448,194	+129	Petroleum, natural gas, sand and gravel.
Harrison.....	94,000	4,872	-95	Sand and gravel.
Hinds.....	2,396,040	4,007,544	+67	Petroleum, sand and gravel, clays, natural gas.
Holmes.....	(²)	(²)	-----	Sand and gravel.
Issaquena.....	2,445	1,972	-19	Petroleum, natural gas.
Itawamba.....	(²)	(²)	-----	Clays, sand and gravel.
Jasper.....	15,593,048	15,847,315	+2	Petroleum, natural gas.
Jefferson.....	5,770,006	7,904,295	+37	Do.
Jefferson Davis.....	7,358,483	6,569,577	-11	Natural gas, petroleum.
Jones.....	2,913,341	4,289,202	+47	Petroleum, natural gas, clays.
Lamar.....	13,232,643	10,682,328	-19	Petroleum, natural gas.
Lauderdale.....	13,300	(²)	-----	Clays.
Lee.....	(²)	19,175	-----	Clays.
Leflore.....	(²)	-----	-----	-----
Lincoln.....	12,766,739	13,253,671	+4	Petroleum, natural-gas liquids, natural gas, clays.
Lowndes.....	401,137	261,700	-35	Sand and gravel, clays.
Madison.....	1,053,803	1,321,874	+25	Petroleum, natural gas.
Marion.....	3,720,803	2,437,527	-34	Petroleum, natural gas, sand and gravel.
Marshall.....	(²)	66,000	-----	Clays.
Monroe.....	1,971,429	2,718,136	+38	Natural gas, clays, petroleum, sand and gravel.
Montgomery.....	(²)	-----	-----	-----
Noxubee.....	70,000	27,000	-61	Stone.
Panola.....	(²)	(²)	-----	Clays.
Pearl River.....	1,508,550	3,451,244	+129	Natural gas, petroleum, clays.
Perry.....	35,916	62,112	+73	Petroleum.
Pontotoc.....	(²)	3,500	-----	Clays.
Prentiss.....	7,500	8,200	+17	Do.
Rankin.....	(²)	(²)	-----	Cement, stone.
Sharkey.....	-----	1,033	-----	Petroleum.
Simpson.....	554,366	544,232	-2	Petroleum, natural gas.
Smith.....	2,876,587	3,678,789	+28	Petroleum, clays, natural gas.
Sunflower.....	22,400	22,400	-----	Clays.
Tippah.....	(²)	(²)	-----	Do.
Washington.....	(²)	(²)	-----	Sand and gravel.
Wayne.....	7,896,352	7,476,572	-5	Petroleum, natural gas.
Webster.....	(²)	720	-----	Iron ore.
Wilkinson.....	2,394,105	3,725,174	+62	Petroleum, natural gas.
Yalobusha.....	(²)	(²)	-----	Sand and gravel.
Yazoo.....	11,512,075	12,144,041	+5	Petroleum, sand and gravel, natural gas.
Undistributed.....	7,948,756	7,059,359	-----	-----
Total.....	133,098,000	149,305,000	+12	-----

¹ The following counties are not listed because no production was reported: Benton, Bolivar, Calhoun, Choctaw, Claiborne, Covington, Humphreys, Jackson, Kemper, Lafayette, Lawrence, Leake, Neshoba, Newton, Oktibbeha, Pike, Quitman, Scott, Stone, Tallahatchie, Tate, Tishomingo, Tunica, Union, Waltham, Warren, Winston.

² Value included with "Undistributed."

De Soto.—The county ranked fourth in the value of sand and gravel produced. Memphis Stone & Gravel Co. produced sand and gravel for building and paving.

Forrest.—The county led in producing natural gas (third during 1956) and ranked third in sand and gravel and fifth in the total value of minerals produced. Hattiesburg Brick Works has periodic kilns and manufactures face brick and hollow structural tile from mis-

cellaneous clay. Drilling of 23 development wells resulted in 5 oil producers, 15 gas producers, and 3 dry holes. One dry exploratory hole was drilled.

Franklin.—Exploratory drilling of 7 holes resulted in the discovery of the Richardson Creek field; development drilling resulted in 4 oil producers and 4 dry holes. Petroleum and natural gas were produced in the county.

Hancock.—Petroleum and natural gas were produced in the county. Two exploratory wells were dry; development drilling of one hole resulted in a gas producer. Jahneke Service, Inc., operated a dragline to produce molding sand.

Harrison.—One dry exploratory hole was drilled. Bell Gravel Co. produced building sand and gravel. Olin Mathieson Chemical Corp. modernized its aluminum-extrusion plant at Gulfport.

Hinds.—Petroleum, natural gas, clays, and sand and gravel were produced in the county. Jackson Ready-Mix Concrete Co. was building a lightweight-aggregate plant north of Jackson; first production was scheduled for the spring of 1958. The Traxler Gravel Co., Inc., produced paving sand and gravel at a portable plant. Three dry exploratory wells were drilled. Seven development wells were completed; all were oil productive. Johnson-Cone Brick Co. and Tri-State Brick & Tile Co. manufactured brick and heavy clay products from miscellaneous clay.

Holmes.—Two dry exploratory holes were drilled. Hammett Gravel Co. produced paving sand and gravel at a portable plant.

Issaquena.—Two dry exploratory holes were drilled. Petroleum and natural gas were produced.

Itawamba.—The county continued to rank second in the value of clays produced. American Colloid Co. quarried bentonite for use in refractories and insecticides and as animal feed. Filtrol Corp. mined bentonite for filtering mineral oils and greases, vegetable or animal oils and fats, and other materials. Fulton Sand & Gravel Co. dredged to produce structural sand and gravel and paving gravel. One dry development well was drilled.

Jackson.—Although no mineral production was reported from Jackson County, it soon will become the center for manufacturing fertilizers, chemicals, and refractories. Bayou Casotte, a planned industrial district, was being built on the Gulf coast east of Pascagoula. At this site Coastal Chemical Corp. was building a new fertilizer plant, and H. K. Porter Co., Inc., was building a new basic refractory plant.

Jasper.—This county ranked second in the State as a petroleum producer, as well as in the value of minerals produced. Natural gas was also produced. Five exploratory holes were drilled; all were dry. Nine development wells resulted in 7 oil producers, 1 gas producer, and 1 dry hole.

Jefferson.—Jefferson County was an important producer of petroleum and natural gas. Exploratory drilling during the year resulted in 19 dry holes and discovery of the Red Lick field; development drilling resulted in 2 oil producers and 5 dry holes.

Jefferson Davis.—This county ranked second in producing natural gas. Petroleum also was produced.

Jones.—Laurel Brick Works manufactured common and face brick from clay produced by B. A. Schneider (deceased). Exploratory drilling resulted in three dry holes and discovery of the Gitano field. Petroleum, natural gas, and clays were produced.

Lamar.—Lamar County ranked fourth in output of natural gas and fifth in petroleum production. Three dry exploratory holes were drilled. Two development wells were completed as oil producers. Black Creek Refinery, built by Pontiac Eastern Corp. north of Purvis, was the first complete refinery designed to refine the heavy crude oils produced in Mississippi.

Lauderdale.—Meridian Brick Co. mined miscellaneous clay and manufactured building brick.

Lee.—Tupelo Brick & Tile Co. mined miscellaneous clay and manufactured building brick.

Leflore.—One dry exploratory hole was drilled.

Lincoln.—Lincoln County ranked second in the output of natural-gas liquids, third in value of minerals produced, and third in petroleum production. Two dry exploratory holes were drilled. Drilling of 5 development wells resulted in 3 oil producers and 2 dry holes. Brookhaven Pressed Brick & Manufacturing Co. mined miscellaneous clay for manufacturing brick and heavy clay products.

Lowndes.—Columbus Gravel Co. operated a fixed plant and dredge, and Smith Gravel Co. operated a dredge. Sand and gravel was produced for building and paving, railroad-ballast gravel, ready-mixed concrete, concrete block, and concrete pipe. Columbus Brick Co. mined clay for heavy clay products and building brick.

Monroe.—Monroe County continued to lead in the value of clay produced; the entire output was bentonite. The county ranked fifth in producing natural gas. American Colloid Co. produced bentonite for refractories, steel foundries and steel works, insecticides, fungicides, drilling mud, etc. Eastern Clay Products Department of International Mining & Chemical Co. produced bentonite for bonding clay in manufacturing refractories. Nash Contracting Co. operated a dredge for producing building and paving sand and gravel.

Noxubee.—The State of Mississippi Lime Plant Board produced limestone for use as a soil conditioner.

Panola.—Panola County ranked fifth in the value of clay produced. Kentucky & Tennessee Clay Co. produced ball clay for use as refractories.

Pearl River.—The county ranked third in the value of natural gas produced. Four dry exploratory holes were drilled. Development drilling of 26 holes resulted in 17 oil producers, 3 gas producers, and 6 dry holes. Pearl River Clay Co. quarried montmorillonite for use in drilling mud, insecticides, and fungicides.

Pontotoc.—Pontotoc Brick Co. mined miscellaneous clay for building brick. One dry exploratory hole was drilled.

Prentiss.—Baldwyn Brick & Tile Co. manufactured brick.

Rankin.—Marquette Cement Manufacturing Co. continued producing and shipping portland and masonry cement during the year. Three dry exploratory holes were drilled.

Simpson.—Exploratory drilling of 2 holes resulted in 1 dry hole and the discovery of the Martinsville field; development drilling resulted in 1 oil producer and 1 dry hole. Crude oil and natural gas were produced in the county.

Smith.—Oilfield crews drilled 4 dry exploratory holes and discovered the Raleigh field; also, 5 oil-productive development wells were completed. Filtrop Corp. mined 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.—Tippah County ranked third in the value of clays produced. Howell Southern Products, Inc., mined fuller's earth for use as an absorbent. Wyandotte Chemical Corp. mined montmorillonite for absorbent uses.

Walthall.—One exploratory well was completed, with the discovery of 2 gas-producing formations (at 9,622–32 and 13,516–30 feet), named the Dexter field. As a result, Walthall County will soon become a mineral producer.

Warren.—A new cement plant was being built 15 miles north of Vicksburg by the Mississippi Valley Portland Cement Co. Production was scheduled to begin in August 1958.

Washington.—Greenville Gravel Co. produced paving sand and gravel and also sand and gravel for the Army Corps of Engineers for use in concrete. Pesticides were manufactured by Olin Mathieson Chemical Corp. at its plant near Leland.

Wayne.—The county was an important producer of petroleum. Nine dry exploratory wells were drilled, and the Diamond field was discovered; also 9 development wells were oil productive, and 3 were dry holes.

Webster.—Kilmichael Ore Corp. built a log washer and began to mine iron ore from deposits in Webster County and to develop iron deposits in Montgomery and Choctaw Counties.

Wilkinson.—With a total of 44 holes drilled, Wilkinson County was second in drilling activity in the State. Twenty-seven exploratory holes resulted in 25 dry holes and the discovery of Tar Creek and Rose Hill fields; development drilling resulted in 9 oil producers and 8 dry holes.

Yalobusha.—Grenada Gravel Co. operated a fixed plant to produce building and paving sand and gravel.

Yazoo.—Yazoo County ranked fourth in the value of minerals produced and in quantity of petroleum in 1957. Four dry exploratory holes were drilled. Anderson Sand & Gravel Co. produced pit-run paving gravel for highway-base course. Mississippi Chemical Corp. was constructing new facilities, costing \$2 million, to increase its plant capacity.



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, United States 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 G. A. Muilenburg ²



MINERAL production in Missouri in 1957 totaled \$153 million, a 7-percent decrease from the record high of \$164 million in 1956. Missouri ranked first in lead production in the Nation for the 50th consecutive year, second in lime and barite, and third in fire clay. Mineral production was reported from 109 of the 114 counties. The leading counties, in order of production value, were St. Francois, St. Louis, Ste. Genevieve, Cape Girardeau, and Jackson. The five principal minerals, in order of value, were lead, cement, stone, lime, and coal. Nonmetals supplied 63 percent of the total mineral value, metals 29 percent, and mineral fuels 8 percent.

TABLE 1.—Mineral production in Missouri, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite.....	381,642	\$4,462	317,350	\$3,938
Cement—(portland)..... 376-pound barrels..	12,013,773	36,888	10,794,362	34,307
Clays.....	2,657,815	8,016	2,648,003	7,648
Coal.....	3,282,978	13,223	2,975,722	12,691
Copper—(recoverable content of ores, etc.).....	1,890	1,606	² 1,604	² 966
Iron ore—(usable)..... long tons, gross weight..	364,981	(³)	529,989	4,625
Lead—(recoverable content of ores, etc.).....	123,783	38,868	126,345	36,135
Lime.....	1,481,611	15,814	1,392,780	16,475
Natural gas..... million cubic feet.....	12	2	.....	.....
Petroleum—(crude)..... thousand 42-gallon barrels..	65	176	4 53	4 144
Sand and gravel.....	9,585,268	10,117	8,480,327	8,942
Silver—(recoverable content of ores, etc.)..... troy ounces..	295,111	267	183,427	166
Stone.....	24,578,243	33,577	22,097,639	29,836
Zinc—(recoverable content of ores, etc.).....	4,380	1,200	2,951	685
Value of items that cannot be disclosed: Native asphalt, masonry cement, cobalt, gem stones (1957), iron ore (1956), iron oxide pigments (1956), manganese (1957), and nickel.....	.....	5,897	.....	2,617
Total ⁵.....	.....	163,693	.....	152,879

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Final figure; supersedes figure given in commodity chapter.

³ Included with "Value of items that cannot be disclosed."

⁴ Preliminary figure.

⁵ Total adjusted to eliminate duplicating value of clays and stone.

¹ Commodity-industry economist, Region IV, Bureau of Mines, Bartlesville, Okla.

² Assistant State geologist, Geological Survey and Water Resources, Rolla, Mo. (Retired 1958).

TABLE 2.—Average unit value of certain mineral commodities produced in Missouri, 1953-57¹

Commodity	1953	1954	1955	1956	1957
Barite..... short ton.....	\$10.69	\$9.74	\$11.01	\$11.69	\$12.41
Cement (portland)..... 376-pound barrel.....	2.66	2.76	2.85	3.07	3.18
Coal..... short ton.....	4.12	3.99	3.95	4.03	4.26
Copper..... pound.....	.287	.295	.373	.425	.301
Gravel..... short ton.....	.74	.93	.85	.90	.87
Lead..... pound.....	.131	.137	.149	.157	.143
Lime..... short ton.....	9.97	9.92	9.84	10.67	11.83
Sand..... do.....	1.02	1.13	1.15	1.20	1.24
Silver..... troy ounce.....	.905	.905	.905	.905	.905
Stone:					
Granite:					
Dimension..... short ton.....	59.64	57.40	71.20	108.73	78.66
Crushed..... do.....	1.69	2.32	3.58	5.08	1.76
Marble:					
Dimension..... do.....	121.50	154.35	135.30	82.88	103.76
Crushed..... do.....	9.44	4.91	12.00	5.00	8.96
Limestone:					
Dimension..... do.....	5.21	2.68	6.59	3.12	3.92
Crushed..... do.....	1.47	1.29	1.34	1.34	1.30
Sandstone:					
Dimension..... do.....	2.14	17.31	19.57	19.62	15.11
Crushed..... do.....	1.48				
Miscellaneous:					
Crushed..... do.....	.61	.67	.36	.59	.67
Zinc..... pound.....	.115	.108	.123	.137	.116

¹ For greater detail on prices, by grades and markets, see vol. I, Minerals Yearbook, 1957.

EMPLOYMENT AND INJURIES

Employment.—Average annual employment in the Missouri mining industries in 1957 approximated that for 1956. The decrease in nonmetals employment was offset by increases in metal-mining and coal-mining employment, according to the Division of Employment Security, Department of Labor and Industrial Relations of Missouri.

Injuries.—Seven fatal accidents and one causing permanent total disability occurred in Missouri metal and nonmetal industries in 1957, 1 in iron-ore mining, 3 in lead-zinc mining, and 3 fatal and 1 permanent total injury in stone mining. The fatal injuries were caused by fall of roof (underground); rolling, shifting, or sliding material from bins, platforms, etc.; handling materials; and operating machinery. The permanent total injury was caused by a haulage accident involving quarry trucks, tractors, etc.

DEFENSE MINERALS EXPLORATION ADMINISTRATION PROJECTS

Government participation in financing exploration projects in search of reserves of strategic minerals through the program of the Defense Minerals Exploration Administration (DMEA) continued during 1957. The program in 1957 included the investigating of lead and copper sources in Madison, Bollinger, and Perry Counties by the National Lead Co. and the investigation of lead, zinc, and copper sources in Crawford, Washington, and Iron Counties by the St. Joseph Lead Co.

TABLE 3.—Average annual employment of mining industries, 1953-57¹

Industry	1953	1954	1955	1956	1957
Metal mining.....	3,800	3,527	3,371	3,458	3,470
Nonmetal mining.....	3,863	3,909	3,999	3,956	3,848
Coal mining.....	1,098	962	970	921	981
Total.....	8,761	8,398	8,340	8,335	8,299

¹ Letter from Henry J. St. Clair, Division of Employment Security, Department of Labor and Industrial Relations, State of Missouri, to Bureau of Mines.

² Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—The production of barite in Missouri, second highest in the Nation for the 14th consecutive year, totaled 317,000 tons—a 17-percent decrease from 1956. Missouri led in value of shipments, \$3.9 million. Barite was produced in Washington and Jefferson Counties. Grinding plants were operated in Washington and St. Louis Counties. The oil and chemical industries consumed Missouri barite.

TABLE 4.—Barite sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948-52 (average)....	252,735	\$2,290,660	\$9.06	1955.....	363,692	\$4,003,842	\$11.01
1953.....	330,763	3,338,395	10.09	1956.....	381,642	4,461,955	11.69
1954.....	312,791	3,047,436	9.74	1957.....	317,350	3,938,486	12.41

Cement.—Production of portland cement in 1957 totaled 10.9 million barrels, a decrease of 1.6 million barrels from 1956. A nationwide cement strike, which started in July and lasted 5 weeks, contributed to the decreased production. Plants in St. Louis, Cape Girardeau, Ralls, and Jackson Counties produced 46 percent of the total manufactured by dry-process methods and 54 percent by wet-process methods. Shipments totaled 10.8 million barrels. Nearly 98 percent of the shipments was transported by railroad and 2 percent by boat. Bulk shipments comprised 78 and bag shipments 22 percent.

Alpha Portland Cement Co. completed an improvement program at its St. Louis plant, which increased its capacity by 500,000 barrels at a cost of \$7 million. Marquette Cement Manufacturing Co. in February 1957, started its new 1,250,000-barrel, \$7-million wet-process plant, which is alongside the plant at Cape Girardeau. Missouri Portland Cement Co. completed an expansion program at its Sugar Creek plant (near Independence), increasing the capacity to 2.4 million barrels.³

³ Pit and Quarry, vol. 50, No. 7, January 1958, pp. 115-119.

TABLE 5.—Production and shipments of portland cement, 1948–52 (average) and 1953–57, in 376-pound barrels

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1948–52 (average).....	9,462,174	9,406,181	\$22,258,762	\$2.37
1953.....	10,281,230	9,860,179	26,238,460	2.66
1954.....	11,201,697	11,379,257	31,425,190	2.76
1955.....	12,001,304	12,255,346	34,912,186	2.85
1956.....	12,440,825	12,013,773	36,888,178	3.07
1957.....	10,866,433	10,794,362	34,307,377	3.18

Masonry cement also was manufactured at each of the cement plants.

Clays.—Fire clay and high-alumina clay for refractories were produced in Missouri in 1957. Missouri fire clay is especially suitable for producing superduty refractories, enabling the State to be a leader in refractory production. Companies producing refractories were Harbison-Walker Refractories Co., A. P. Green Fire Brick Co., Mexico Refractories Co., Laclede-Christy Co., Walsh Refractories Corp., Wellsville Fire Brick Co., General Refractories Co., and North American Refractories Co. Most of the clay was mined by contractors. Fire clay for use in horizontal zinc retorts in Oklahoma and Texas was mined in Monroe County by Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. Carter-Waters Corp. mined miscellaneous clay and produced lightweight aggregate in Platte County. Miscellaneous clay also was used in manufacturing heavy clay products and cement. Clays were produced in 21 counties.

TABLE 6.—Clays sold or used by producers, 1948–52 (average) and 1953–57, by kinds

Year	Fire clay		Diaspore		Burley	
	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	1,370,932	\$5,543,601	43,628	\$572,386	53,922	\$434,708
1953.....	1,392,022	8,562,318	50,144	962,384	53,971	563,043
1954.....	1,170,305	4,460,438	3,322	16,610	9,285	50,835
1955.....	1,486,253	5,692,467	11,546	134,298	31,460	208,259
1956.....	1,699,416	6,498,644	24,637	292,898	41,868	325,279
1957.....	1,672,057	6,205,686	9,870	123,447	50,153	397,872

Year	Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value
1948–52 (average).....	781,160	\$816,473	2,249,642	\$7,367,168
1953.....	735,459	1,094,351	2,231,596	11,182,096
1954.....	744,393	1,330,873	1,927,285	5,858,756
1955.....	873,142	867,299	2,402,401	6,902,323
1956.....	891,894	899,399	2,657,815	8,016,220
1957.....	915,923	920,878	2,648,003	7,647,883

The Bureau of Mines and companies manufacturing refractories in Missouri were cooperating in a research project aimed at developing economic processes for recovering commercial-quality refractory clay from subgrade deposits. Such impurities as quartz, pyrite, and alkali must be removed.

Gem Stones.—Gem varieties of agate and jasper were recovered in Jefferson and St. Louis Counties in 1957.

Lime.—Production of lime in 1957 decreased 6 percent from 1956, but value increased 4 percent. The unit value rose from \$10.67 per ton in 1956 to \$11.83 in 1957. Approximately 85 percent of the lime was used for chemical and industrial purposes, 10 percent for refractory material, and 5 percent for building purposes. Quick lime comprised 84 percent and hydrated lime 16 percent of lime production. Six lime plants continued to be active in 1957—2 in Green County and 1 each in Marion, Newton, St. Francois, and Ste. Genevieve Counties.

TABLE 7.—Lime (quick and hydrated) sold and used by producers, 1948–52 (average) and 1953–57

Year	Quick lime (short tons)	Hydrated lime (short tons)	Total lime	
			Short tons	Value
1948–52 (average).....	853,044	182,356	1,035,400	\$9,818,859
1953.....	1,006,393	205,714	1,212,107	12,084,130
1954.....	917,684	208,235	1,125,919	11,165,381
1955.....	1,241,051	223,777	1,464,828	14,408,279
1956.....	1,254,447	227,164	1,481,611	15,813,573
1957.....	1,172,118	220,662	1,392,780	16,475,404

Nitrogen Compounds.—Atmospheric nitrogen (anhydrous ammonia) plants were operated by Hercules Powder Co. at Louisiana and Mississippi River Chemical Co., Division of Mississippi River Fuel Corp., at Crystal City.

Perlite.—Crude perlite, mined in Western States, was expanded at a plant in St. Louis and used mainly as lightweight aggregate.

Sand and Gravel.—Sand and gravel production was reported from 80 counties, primarily from stream deposits. Almost 86 percent of total was used for building and highway construction. St. Louis, Jefferson, Franklin, Jackson, and Lewis Counties led in value of production. Quality silica sand was obtained in St. Louis County and used in glass and ceramic industries. Commercial operations furnished 85 percent of the total tonnage and 89 percent of the total value; Government-and-contractor operations supplied 15 percent of the tonnage and 11 percent of the value.

Stone.—Limestone, marble, granite, sandstone, and miscellaneous stone were quarried in 1957. Limestone production was reported in 79 counties and supplied 95 percent of the total tonnage and 91 percent of the total value. Dimension and crushed granite was produced in Iron County. Dimension marble was quarried in Jasper, Greene, and Ste. Genevieve Counties and crushed marble in Jefferson County. Shannon, Dent, Wayne, and Camden Counties supplied dimension sandstone. Miscellaneous stone (chats) was produced in Jasper, St. Francois, and Newton Counties. Crushed stone was used mainly for concrete aggregate, roadstone, riprap, and railroad ballast;

dimension stone was used for monumental and building purposes. Commercial producers furnished 95 percent of total stone production and noncommercial producers 5 percent.

TABLE 8.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Commercial		Government and contractor		Total sand and gravel		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average per ton
1948-52 (average)---	5,157,525	\$4,690,415	825,070	\$490,502	5,982,595	\$5,180,917	\$0.87
1953-----	4,932,617	4,770,451	859,441	463,548	5,792,058	5,233,999	.90
1954-----	8,822,467	9,555,223	1,068,838	648,258	9,891,305	10,203,481	1.03
1955-----	8,352,467	8,789,439	1,631,157	1,191,439	9,983,624	9,980,878	1.00
1956-----	8,160,792	8,872,944	1,424,476	1,244,407	9,585,268	10,117,351	1.06
1957-----	7,197,572	8,000,436	1,282,755	941,840	8,480,327	8,942,276	1.05

TABLE 9.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953-----	5,882	\$164,792	12,132	\$708,794	12,727,029	\$18,924,418
1954-----	3,827	169,935	22,893	1,067,742	17,770,749	22,913,657
1955-----	2,821	179,483	² 8,500	² 102,000	21,283,587	28,850,387
1956-----	3,456	301,857	² 5,000	² 25,000	23,152,644	31,051,285
1957-----	5,369	231,623	(¹)	(¹)	20,936,499	27,269,420

Year	Sandstone		Miscellaneous stone ³		Total stone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953-----	10,972	\$23,413	1,191,819	\$731,423	13,947,834	\$20,552,840
1954-----	633	10,957	874,137	589,319	18,672,239	24,751,610
1955-----	3,036	59,407	1,070,824	389,137	² 22,368,768	² 29,580,414
1956-----	(¹)	(¹)	1,395,776	820,022	24,578,243	33,577,211
1957-----	(¹)	(¹)	1,117,339	750,900	22,097,639	29,836,199

¹ Figure withheld to avoid disclosing individual company confidential data.

² Excludes dimension marble.

³ Chats; also includes small quantity of stone.

Bar-Co Roc, Inc., produced asphaltic sandstone from its pit in Barton County.

Tripoli.—The American Tripoli Division of The Carborundum Co. processed tripoli at its Seneca plant in Newton County from ore quarried in Oklahoma. Production and value increased slightly over 1956. 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.

Vermiculite.—Crude vermiculite was shipped from Western States and exfoliated in St. Louis and Jackson Counties.

METALS

Missouri reported production of eight metals in 1957—cobalt, copper, iron ore, lead, manganese, nickel, silver, and zinc.

Mine Mills and Smelters.—St. Joseph Lead Co. operated its Herculaneum (Mo.) lead smelter and refinery throughout 1957. Three new centrifugal blowers for the blast furnaces were installed to provide better furnace operation, according to the company 1957 Annual Report. At Fredericktown National Lead Co. refined cobalt-nickel ore. Seven mine mills were operated in Southeastern Missouri in 1957. Mine La Motte Corp. and National Lead Co. operated mills in Madison County. St. Joseph Lead Co. operated its Indian Creek mill in Washington County and its Federal, Bonne Terre, Desloge, and Leadwood mills in St. Francois County.

Cadmium, Gallium, Germanium, and Indium.—These minor metals were recovered from Missouri lead-zinc ores. No assignment of State of origin was made for these byproduct metals because no designation of source was given for all the concentrates smelted in Missouri.

Cobalt.—National Lead Co. recovered cobalt from the complex lead-copper-cobalt-nickel ores in Madison County at the cobalt-nickel refinery in Fredericktown

Columbium-Tantalum and Uranium.—Mallinckrodt Chemical Works processed domestic euxenite concentrate at St. Louis to separate columbium-tantalum and uranium products. Most of the concentrate came from a placer mine in Idaho. The Government purchased the products under contract.

Copper.—Missouri produced a small quantity of copper from lead-copper ore in Madison County and lead ore in St. Francois County. Production in 1957 was less than in 1956, and the average metal price dropped to 30.1 cents per pound compared with 42.5 cents in 1956.

Iron Ore.—Iron-ore output in 1957 totaled 530,000 long tons of usable ore, an increase of 45 percent over 1956 and 103 percent over 1955. Production of brown ore (limonite) in 1957 increased 121 percent over 1956 and furnished a large part of the increased tonnage. Brown ore was used by iron and steel plants in Alabama, Tennessee, and Illinois. Hematite-ore production was slightly greater than in 1956 and originated mainly at the Iron Mountain deposit. Additional drilling at the Pea Ridge iron-ore deposit confirmed earlier estimates of the size of the deposit, according to the St. Joseph Lead Co. 1957 Annual Report. The Meramec Mining Co., owned jointly by St. Joseph Lead Co. and Bethlehem Steel Corp., was formed during the year to develop and mine the ore body. Shaft sinking and clearing the millsite were started during 1957. A second shaft will be started in 1958. Initial production was scheduled for the latter part of 1962, with an eventual capacity of 2 million tons of iron ore annually. A conservative estimate is that the deposit will supply operations at this capacity for several decades.

A joint iron-ore-exploration project was conducted in the Bourbon and Boss-Bixby areas by American Zinc, Lead and Smelting Co. and Granite City Steel Co. The cost was shared equally by the two

companies, according to the American Zinc, Lead and Smelting Co. 1957 annual report.

Mining and milling methods and costs of the Ozark Ore Co. Iron Mountain Iron-Ore Mine were discussed.⁴ The Iron Mountain operation was notable for its successful transition from open-pit to underground mining, for underground use of large earth-moving equipment, and for development of a multilevel room-and-pillar

TABLE 10.—Mine production of silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	15,510	135	10,636	249
February.....	14,670	128	10,098	307
March.....	14,900	130	10,266	314
April.....	16,000	142	11,256	434
May.....	15,440	135	10,673	341
June.....	13,830	121	9,520	274
July.....	15,130	132	10,361	210
August.....	15,510	136	10,674	202
September.....	14,400	126	9,951	192
October.....	18,370	161	12,411	193
November.....	14,000	122	9,702	133
December.....	15,667	136	10,797	102
Total: 1957.....	183,427	¹ 1,604	126,345	2,951
1956.....	295,111	1,890	123,783	4,380

¹ Final figure; supersedes that in commodity chapter.

TABLE 11.—Mine production of silver, copper, lead and zinc, 1948-52 (average), 1953-57, and total 1860-1957, in terms of recoverable metals

Year	Mines pro- ducing	Material sold or treated		Silver		Copper	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value	Short tons	Value
1948-52 (average).....		6,092,645	1,391,410	235,146	\$212,819	2,804	\$1,226,821
1953.....	28	6,674,300	1,483,157	359,781	325,620	2,374	1,362,676
1954.....	16	6,598,647	1,579,068	352,971	319,457	1,925	1,135,750
1955.....	18	6,734,346	1,546,126	268,620	243,115	1,722	1,284,612
1956.....	19	6,996,696	1,223,575	295,111	267,090	1,890	1,606,500
1957.....	16	6,874,008	1,271,684	183,427	166,011	² 1,604	965,608
1860-1957.....		(¹)	(¹)	6,891,236	5,376,396	44,968	18,734,532

Year	Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	
1948-52 (average).....	123,465	\$39,536,572	9,205	\$2,866,276	\$43,842,488
1953.....	123,895	32,984,490	9,981	2,295,630	36,968,416
1954.....	123,250	34,318,500	5,210	1,125,360	36,899,067
1955.....	123,412	37,372,776	4,476	1,101,096	40,001,599
1956.....	123,783	38,967,862	4,380	1,200,120	41,941,572
1957.....	126,345	36,134,670	2,951	684,632	37,950,921
1860-1957.....	9,575,973	1,353,032,178	3,707,434	492,579,917	1,869,723,023

¹ Data not available.

² Final figure; supersedes figure given in commodity chapter.

⁴ Pettit, Robert F. Jr., Calhoun, Willis A., and Reynolds, Burton M., Mining and Milling Methods and Costs, Ozark Ore Co., Iron Mountain Iron-Ore Mine, St. Francois County, Mo.: Bureau of Mines Inf. Circ. 7807, 1957, 46 pp.

mining method. Milling methods went from hand sorting and log washing in the early days to gravity concentration. All ore was concentrated in the plant, which consisted of jig and table units and an experimental flotation unit to treat the table tailing.

Lead.—The mine production of recoverable lead in Missouri in 1957 totaled 126,000 tons—37 percent of the Nation's total lead production. The Southeastern Missouri region produced over 99 percent of the State's recoverable lead. Value of lead production declined in 1957 as a result of the drop in the price of lead from 16 cents per pound, New York, on January 1, to 13 cents by December 20.

St. Joseph Lead Co. began developing an important lead discovery near Viburnum in Washington County, according to the company 1957 Annual Report. Work on the first shaft was begun in September.

Manganese.—A small quantity of manganese was produced in Iron County in 1957.

Nickel.—Nickel was recovered with cobalt by National Lead Co. at the cobalt-nickel refinery in Fredericktown.

Silver.—Silver was recovered from refining pig lead obtained in smelting lead and lead-copper ores from Madison and St. Francois Counties.

Zinc.—The decline in production of recoverable zinc continued for the fifth consecutive year. Production in Southwestern Missouri dropped from 24 percent of the State total in 1956 to 3 percent in 1957. Production was reported from St. Francois, Washington, Newton, and Jasper Counties. The price of Prime Western slab zinc dropped from 13.5 cents per pound, East St. Louis, on January 1 to 10.0 cents by July 1.

TRI-STATE DISTRICT

The Tri-State district of Southwestern Missouri, Kansas, and Oklahoma produced 1.8 million tons of crude ore that yielded 15,900 tons of lead concentrate containing 11,500 tons of recoverable lead and 57,000 tons of zinc concentrate containing 30,900 tons of recoverable zinc. Less than 1 percent of the district lead and zinc concentrates came from Southwestern Missouri. (See Oklahoma chapter for further details on Tri-State activity.)

TABLE 12.—Mine production of silver, copper, lead, and zinc in 1957, by classes of ore or other sources of material, in terms of recoverable metals

Source	Number mines	Material sold or treated (short tons)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lead ore ¹	12	7,619,787	183,427	1,604	114,109	2,006
Zinc ore.....	3	2,900	-----	-----	-----	85
Zinc-lead.....	1	523,005	-----	-----	12,236	800
Total.....	16	8,145,692	183,427	1,604	126,345	2,951

¹ Includes lead-copper ore from 1 mine; also 1,271,684 tons of old tailing remilled, concentrate, from which was mixed with that from crude ore.

TABLE 13.—Mine production of lead and zinc in Southeastern and Central Missouri, 1948–52 (average) and 1953–57, 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 ⁴	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	174,408	\$31,478,895	2,912	\$308,509	121,180	\$38,790,267	1,893	\$602,200
1953.....	182,418	26,622,152	5,369	347,482	125,273	32,821,526	3,180	731,400
1954.....	181,790	29,680,857	6,069	480,412	125,173	34,297,402	3,169	634,504
1955.....	180,262	32,428,093	7,507	700,022	125,357	37,356,386	3,934	987,764
1956.....	174,131	33,266,135	6,484	542,000	123,395	38,746,030	3,345	916,530
1957.....	179,312	31,506,936	5,903	447,706	126,323	36,128,378	2,866	664,912

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 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 noted 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.

⁴ Values given are to a certain extent arbitrary, as part of the lead concentrate is smelted by the producer.

⁵ Includes zinc recovered from byproduct matte from lead smelting as follows: 1953, 327 tons; 1954, 427 tons.

TABLE 14.—Mine production of lead and zinc in Southwestern Missouri, 1948–52 (average) and 1953–57, 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
1948-52 (average).....	³ 2,967	³ \$631,036	⁴ 13,697	⁴ \$1,400,380	2,296	\$746,197	7,301	\$2,261,122
1953.....	791	135,603	12,257	849,141	622	162,984	6,801	1,564,230
1954.....	103	16,826	3,713	378,782	77	21,098	2,041	440,876
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	4,270	22	6,292	85	19,720

¹ Based upon Southwestern Missouri ore "dirt" and old tailing treated at mills during the 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 noted 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.

³ Includes lead carbonate.

⁴ Includes zinc silicate.

Iron and Steel Scrap.—Consumption of iron and steel scrap in Missouri in 1957 totaled 976,000 tons, slightly more than 1 percent of the national total. Nineteen tons of scrap was consumed for each ton of pig iron consumed in 1957, compared with ratios of 23:1 in 1956 and 20:1 in 1955.

TABLE 15.—Tenor of lead and zinc ore, old tailing, and slimes milled and concentrate produced in 1956–57, by districts

	Southeastern Missouri		Southwestern Missouri	
	1956	1957	1956	1957
Total material, milled.....short tons	1 8,065,092	1 8,142,292	155,179	3,400
Total concentrate produced:				
Lead.....do	174,131	179,312	496	29
Zinc.....do	6,484	5,903	1,862	161
Ratio of concentrate to ore, etc.:				
Lead.....percent	2.16	2.20	.32	.85
Zinc.....do	.08	.07	1.20	4.74
Metal content of ore, etc. 2				
Lead.....do	1.53	1.55	.25	.65
Zinc.....do	.04	.04	.67	2.50
Average lead content of galena concentrate.....do	72.26	71.90	79.77	75.86
Average zinc content of sphalerite concentrate.....do	57.33	54.11	61.82	59.00
Average value per ton:				
Galena concentrate.....	\$191.04	\$175.71	\$205.84	\$192.28
Sphalerite concentrate.....	83.59	75.84	86.74	79.14

¹ Includes lead-copper ore and old tailing remilled: 1956, 1,223,575 tons; 1957, 1,271,684 tons.

² Figures represent metal content of crude ore only insofar as it is recovered in the concentrate; data on tailing losses not available.

TABLE 16.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1957

[E&MJ Metal and Mineral Markets]

Zinc concentrate		Lead concentrate	
Period	Price per short ton	Period	Price per short ton
Jan. 1–May 3.....	\$84.00	Jan. 1–May 8.....	\$201.32
May 6–May 12.....	72.00	May 9–May 15.....	192.12
May 13–June 3.....	68.00	May 16–June 10.....	184.92
June 4–June 23.....	64.00	June 11–Oct. 13.....	170.52
June 24–July 7.....	60.00	Oct. 14–Dec. 11.....	163.32
July 8–Dec. 31.....	56.00	Dec. 12–Dec. 31.....	156.12

MINERAL FUELS

Coal.—Production of bituminous coal in Missouri in 1957 decreased 9 percent in tonnage and 4 percent in value from 1956. Production of 1,000 tons or more each was reported by 43 mines in 17 counties; 97 percent of the tonnage was supplied by 29 strip mines, and 3 percent by 14 underground mines. Production was valued at more than \$1 million in 5 counties—Henry, Macon, Bates, Barton, and St. Clair.

Natural Gas.—Gasfields are in several Northwestern Missouri counties. No production was reported for 1957.

Petroleum.—Crude petroleum was recovered in the St. Louis area and near Tarkio in Atchison County. Output and value declined in 1957 for the third consecutive year. Standard Oil Co. (Ind.) began operating a new alkylation unit at its refinery in Sugar Creek, near Kansas City. Capacity of the new unit is 3,800 barrels daily.⁵

⁵ Oil and Gas Journal, vol. 55, No. 39, Sept. 30, 1957, p. 67.

TABLE 17.—Consumption of ferrous scrap and pig iron in 1955-57

(Short tons)

Year	Total scrap	Pig iron	Total scrap and pig iron
1955.....	1, 017, 473	51, 864	1, 069, 337
1956.....	1, 039, 866	45, 722	1, 085, 588
1957.....	976, 266	51, 932	1, 028, 198

TABLE 18.—Coal production, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	3, 371, 352	\$13, 685, 847	1955.....	3, 232, 485	\$12, 771, 570
1953.....	2, 393, 304	9, 843, 903	1956.....	3, 282, 978	13, 222, 780
1954.....	2, 513, 593	10, 028, 293	1957.....	2, 975, 722	12, 690, 857

REVIEW BY COUNTIES

Mineral production was reported in 109 of the 114 counties in Missouri in 1957; 20 counties reported production of \$1 million or more. The 5 principal producing counties—St. Francois, St. Louis, Ste. Genevieve, Cape Girardeau, and Jackson—contributed 59 percent of the total mineral-production value. No mineral production was reported in Chariton, Mississippi, New Madrid, Schuyler, and Scotland Counties.

Adair.—Billy Creek Coal Co., Inc., and Blacksmith Coal Co., Inc., mined coal underground. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural uses by Bailey Limestone Quarry.

Andrew.—Limestone was quarried and crushed by the United States Army Corps of Engineers for riprapping the banks of the Missouri River and by George W. Kerford Quarry for concrete aggregate, roadstone, and agricultural uses.

Atchison.—Petroleum was produced near Tarkio, Atchison County, in 1957.

Audrain.—Audrain County produced more than one-fourth of the State's fire clay for refractories and a sizable portion of the total for the Nation. Producers included Mexico Refractories Co., A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., Laclede-Christy Co., Wellsville Fire Brick Co., Walsh Refractories Corp., and North American Refractories Co. Molino Lime Co. mined paving gravel.

Barry.—Douthitt Lime Co. produced crushed limestone for soil conditioner. The United States Army Corps of Engineers and Missouri State Highway Department contracted for paving gravel.

Barton.—Barton County ranked fourth in the State in coal production. Strip-coal mines were operated by Clemens Coal Co., N. Coal Co., and John Zibert Coal Co. Asphaltic sandstone was produced by Bar-Co Roc, Inc.

TABLE 19.—Value of mineral production in Missouri, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Adair.....	\$337,135	\$303,988	Coal, stone.
Andrew.....	(2)	202,288	Stone.
Atchison.....	(2)	(2)	Petroleum.
Audrain.....	1,357,854	1,618,698	Clays, stone, sand and gravel.
Barry.....	(2)	(2)	Stone, sand and gravel.
Barton.....	(2)	(2)	Coal, asphaltic sandstone.
Bates.....	2,794,933	1,615,787	Coal, stone, sand and gravel.
Benton.....	(2)	(2)	Sand and gravel.
Bollinger.....	(2)	(2)	Do.
Boone.....	655,614	735,526	Stone, sand and gravel, clays, coal.
Buchanan.....	302,444	254,059	Sand and gravel, stone, clays.
Butler.....	(2)	(2)	Sand and gravel.
Caldwell.....	161,103	122,319	Stone.
Callaway.....	1,988,183	2,220,142	Clays, coal, stone, sand and gravel.
Camden.....	(2)	(2)	Sand and gravel, stone.
Cape Girardeau.....	6,708,961	9,078,817	Cement, stone, sand and gravel, clays.
Carroll.....	8,169	15,495	Stone, sand and gravel.
Carter.....	400	(2)	Sand and gravel.
Cass.....	349,587	356,626	Stone, clays.
Cedar.....	(2)	(2)	Stone.
Christian.....	8,000	(2)	Sand and gravel, stone.
Clark.....	(2)	(2)	Stone, coal.
Clay.....	966,994	780,991	Do.
Clinton.....	117,627	106,059	Stone.
Cole.....	175,228	96,853	Sand and gravel, stone.
Cooper.....	116,890	74,500	Do.
Crawford.....	30,875	56,774	Clays, iron ore, stone, sand and gravel.
Dade.....	(2)	(2)	Coal, sand and gravel.
Dallas.....	10,400	(2)	Sand and gravel.
Daviess.....	(2)	(2)	Stone.
De Kalb.....	80,584	81,688	Do.
Dent.....	12,900	39,600	Stone, sand and gravel, iron ore.
Douglas.....	101,100	177,285	Sand and gravel, iron ore, stone.
Dunklin.....	(2)	(2)	Sand and gravel.
Franklin.....	643,867	880,687	Sand and gravel, stone, clays.
Gasconade.....	2,555,923	2,280,342	Clays, sand and gravel.
Gentry.....	136,893	115,150	Stone, sand and gravel.
Greene.....	2,549,655	2,495,902	Lime, stone, sand and gravel, iron ore.
Grundy.....	(2)	(2)	Stone.
Harrison.....	244,845	243,155	Stone, coal, sand and gravel.
Henry.....	3,904,361	4,900,365	Coal, stone.
Hickory.....	(2)	(2)	Sand and gravel.
Holt.....	362,492	73,601	Stone, sand and gravel.
Howard.....	238,481	180,686	Do.
Howell.....	430,740	771,177	Iron ore, sand and gravel.
Iron.....	369,557	284,575	Stone, manganese, sand and gravel.
Jackson.....	8,773,826	7,860,749	Cement, stone, sand and gravel, clays.
Jasper.....	2,749,101	2,246,226	Stone, sand and gravel, lead, zinc.
Jefferson.....	1,088,656	1,491,587	Sand and gravel, stone, barite, gem stones.
Johnson.....	185,319	138,537	Stone.
Knox.....	(2)	(2)	Stone, sand and gravel.
Laclede.....	36,258	53,775	Sand and gravel, stone.
Lafayette.....	225,621	253,165	Stone, coal, sand and gravel.
Lawrence.....	(2)	49,079	Stone, sand and gravel.
Lewis.....	(2)	(2)	Sand and gravel, stone.
Lincoln.....	231,326	241,791	Clays, stone, sand and gravel.
Linn.....	(2)	(2)	Stone, sand and gravel.
Livingston.....	260,490	230,941	Stone, clays, sand and gravel.
Macon.....	(2)	(2)	Coal, stone.
Madison.....	6,257,522	6,180,716	Lead, copper, cobalt, nickel, silver, sand and gravel.
Maries.....	196,066	388,221	Clays, stone, sand and gravel.
Marion.....	658,131	705,308	Lime, stone.
McDonald.....	1,600	(2)	Sand and gravel.
Mercer.....	36,500	(2)	Stone.
Miller.....	79,128	55,534	Sand and gravel, stone, iron ore.
Moniteau.....	39,550	32,900	Stone, sand and gravel.
Monroe.....	281,007	293,035	Clays, stone, sand and gravel.
Morgan.....	41,488	14,900	Sand and gravel, stone.
Montgomery.....	679,064	599,755	Do.
Newton.....	432,379	550,656	Lime, stone, zinc.
Nodaway.....	(2)	280,581	Stone, sand and gravel.
Oregon.....	290,482	627,381	Iron ore, stone, sand and gravel.
Osage.....	293,017	382,295	Clays, sand and gravel.
Ozark.....	14,074	41,650	Sand and gravel, iron ore.
Pemiscot.....	(2)	(2)	Sand and gravel.
Perry.....	(2)	(2)	Stone, sand and gravel.
Pettis.....	(2)	(2)	Stone.
Phelps.....	202,110	150,681	Clays, stone, sand and gravel.
Pike.....	182,429	209,022	Stone, sand and gravel.

See footnotes at end of table.

TABLE 19.—Value of mineral production in Missouri, 1956-57, by counties¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value
Platte.....	\$231,780	\$244,348	Stone, clays.
Polk.....	26,550	36,700	Sand and gravel.
Putnaski.....	54,100	84,200	Do.
Putnam.....	135,839	338,542	Coal.
Ralls.....	6,912,724	5,797,201	Cement, stone, coal, sand and gravel.
Randolph.....	1,728,423	346,665	Stone, coal.
Ray.....	191,539	249,427	Stone.
Reynolds.....	(²)	(²)	Iron ore, sand and gravel.
Ripley.....	(²)	41,143	Sand and gravel, iron ore.
St. Charles.....	1,349,592	1,256,844	Stone, sand and gravel.
St. Clair.....	1,340,505	1,089,511	Coal, stone.
St. Francois.....	40,038,036	35,918,538	Lead, iron ore, lime, stone, zinc, silver.
St. Genevieve.....	13,379,958	13,360,014	Lime, stone, sand and gravel.
St. Louis.....	27,022,267	23,223,090	Cement, stone, sand and gravel, clays, petroleum, gem stones.
Saline.....	263,952	292,187	Stone, sand and gravel.
Scott.....	(²)	(²)	Sand and gravel.
Shannon.....	125,702	42,450	Stone, sand and gravel.
Shelby.....	(²)	(²)	Stone.
Stoddard.....	(²)	(²)	Sand and gravel.
Stone.....	47,300	(²)	Do.
Sullivan.....	369,021	150,463	Stone.
Taney.....	513,800	713,200	Stone, sand and gravel.
Texas.....	31,125	43,321	Sand and gravel, stone.
Vernon.....	312,246	362,774	Coal, stone, sand and gravel.
Warren.....	324,964	269,932	Clays, stone, sand and gravel.
Washington.....	8,154,007	7,610,672	Barite, lead, zinc, sand and gravel.
Wayne.....	213,247	316,961	Iron ore, stone, sand and gravel.
Webster.....	4,100	(²)	Sand and gravel.
Worth.....	(²)	(²)	Stone.
Wright.....	17,500	(²)	Sand and gravel.
Undistributed.....	9,949,422	7,819,198	
Total.....	163,693,000	152,879,000	

¹ The following counties are not listed because no production was reported in 1956 or 1957: Chariton, Mississippi, New Madrid, Schuyler, and Scotland.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Bates.—Coal was strip-mined by Peabody Coal Co. and Mullies Coal Co. Bates County ranked third in the State in coal production. Fuller Lime Co. produced paving gravel and Clyde S. Miller building gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Alvis Limestone & Concrete Co., and Frank Underwood.

Benton.—Missouri State Highway Department contracted for paving gravel.

Bollinger.—Mayfield Gravel Co. and Penzel Construction Co. obtained gravel for building and road construction.

Boone.—Adrian Materials Co., N. R. Garrett, Boone Quarries, Inc., Central Stone Co., and the United States Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, and riprap. Sand for building and paving was obtained by Columbia Sand & Towing Co., N. R. Garrett, and Columbia Special Road District. Missouri State Highway Department contracted for paving gravel. Columbia Brick & Tile Co. mined shale and fire clay and manufactured heavy clay products. William R. Carter and Earl S. Hussey strip mined coal.

Buchanan.—Limestone was quarried and crushed for concrete aggregate, roadstone, and riprap by L. S. Stafford, George W. Kerford Quarry, Everett Quarries, Inc., and the United States Army Corps of Engineers. Pioneer Sand Co. prepared building, paving, and

engine sands. Shale for common building brick and tile was quarried by Moorhead Brick & Tile Co.

Butler.—Kittredge Gravel Co. and Grobe & Sons produced building and paving sand and gravel.

Caldwell.—Farmers Rock & Lime Co., A. L., Houghton Stone Co., Kingston Stone Co., and the city of Braymer quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Callaway.—The county ranked third in the State in clay production. Fire clay was mined for use in refractories by Harbison-Walker Refractories Co., Walsh Refractories Corp., Laclede-Christy Co., Mexico Refractories Co., Clayton & Crawson, and North American Refractories Co. Marriott-Reed Coal Co. mined coal at its strip mine. Auxvasse Stone & Gravel Co. and Sulgrove Mining & Quarry Co. quarried and crushed limestone for concrete aggregate, roadstone, railroad ballast, and agricultural stone. Paving gravel was obtained by Callaway County Highway Department and Missouri State Highway Department.

Camden.—Trio Stone Co. quarried sandstone for use as undressed building stone. Missouri State Highway Department contracted for paving gravel.

Cape Girardeau.—This county ranked fourth in the value of Missouri mineral production in 1957. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by Federal Materials Co., Inc., and Farmers Limestone Co. Cape Girardeau Sand Co., Inc., produced building and paving sand. Penzel Construction Co. produced paving gravel. Common red clay was mined by Ceramo Co., Inc., and Kasten Bros. Brick Co. for building brick, pottery, and stoneware. Marquette Cement Manufacturing Co. quarried clay and limestone for use in the manufacture of portland and masonry cements. The company started its new 1,250,000-barrel, wet-process plant, built alongside the existing plant at Cape Girardeau.

Carroll.—Trager Quarries, Inc., quarried and crushed limestone for concrete aggregate and roadstone. Missouri State Highway Department contracted for paving sand.

Carter.—Missouri State Highway Department contracted for paving gravel.

Cass.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Deitz Hill Development Co., Peculiar Rock & Lime Co., Emmet Brosnahan Rock Co., Midwest Pre Cote Co., and S & W Quarries. United Brick & Tile Co. mined miscellaneous clay for brick and tile.

Cedar.—Alvis Limestone & Concrete Co. produced crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Christian.—Missouri State Highway Department contracted for paving gravel. Joe Howard quarried and crushed limestone near Billings for soil conditioner.

Clark.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Myron Baker Construction Co. operating near Kahoka and by Brooks Construction Co. Hamlin Bros. Coal Co. strip-mined coal.

Clay.—Clay County ranked sixth in the State in value of stone production. Limestone was quarried and crushed by Midwest Pre

Cote Co., J. H. Oldham Stone Co., Tobin Quarries, Inc., Kansas City Quarries Co., and Everett Quarries, Inc., and used mainly for concrete aggregate, roadstone, and riprap. Mosby Coal Co. mined coal underground.

Clinton.—Everett Quarries, Inc., produced crushed limestone for concrete aggregate, roadstone, riprap, and agricultural uses.

Cole.—Sand and gravel, used mainly for building and paving, was obtained along the Osage and Missouri Rivers by Jefferson City Sand Co., Thompson Sand Co., Cole County Highway Department, and Missouri State Highway Department. The United States Army Corps of Engineers quarried limestone for riprap.

Cooper.—Missouri River Sand & Gravel Co., Ralph V. Reuter, and the Missouri State Highway Department obtained building and paving sand and gravel. Castle Bros. Quarry Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Crawford.—Fire clay was mined for use in refractories by A. P. Green Fire Brick Co. and Laclede-Christy Co. H & M Equipment Co. mined iron ore in Crawford County. Crushed limestone was produced for concrete aggregate, roadstone, and agricultural purposes by Domenic Ramori and Francis J. Strothkamp. Missouri State Highway Department contracted for paving gravel.

Dade.—Tyler & Claypool Coal Co. strip mined coal in the county. Missouri State Highway Department contracted for paving gravel.

Dallas.—Missouri State Highway Department contracted for paving gravel.

Daviess.—Limestone was quarried and crushed by Snyder Quarries, Inc., for concrete aggregate, roadstone, and agricultural purposes.

De Kalb.—Everett Quarries, Inc., produced broken and crushed limestone for concrete aggregate, roadstone, riprap, and soil conditioner.

Dent.—Salem Stone Co. quarried sandstone for rough architectural uses. Missouri State Highway Department contracted for paving gravel. Iron ore was mined by H & M Equipment Co.

Douglas.—Paving sand and gravel was produced by Welton & Gray and the Missouri State Highway Department. Brown iron ore was mined by Patillo Mining Co. and Bennett Quarries, Inc. S. P. Johnson quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purpose.

Dunklin.—Paving gravel was obtained by Wilkey & Lankford, Inc.

Franklin.—Franklin County ranked third in the State in value of sand and gravel production. Producers included Meramec Sand & Gravel Co., Pacific Pebbles, Inc., St. Louis Material & Supply Co., Washington Sand Co., and Missouri State Highway Department. Sand and gravel was used mainly for building and paving. A small quantity was used for grinding and polishing. Limestone and dolomite were quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes. Leading producers were United States Army Corps of Engineers, Oliver L. Taetz Co., Inc., Fennell Brown, Edwin Bebermeyer, and Tourville Limestone Quarry. Mexico Refractories, Rousset Bros. Clay Co., and Hugo Meyer mined fire clay for use in refractories.

Gasconade.—Gasconade County ranked first in value of clay production. Flint, diaspore, and burley fire clays were mined for use in

refractories; leading producers were Harbison-Walker Refractories Co., A. P. Green Fire Brick Co., Mexico Refractories Co., Laclede-Christy Co., and Walsh Refractories Corp. Fire clay was mined by the General Chemical Division of Allied Chemical & Dye Corp. for chemical uses. Two Rivers Sand & Gravel Co. obtained building sand in the County. Missouri State Highway Department contracted for paving gravel.

Gentry.—Gentry County Quarry, Albany Gravel Co., Inc., and H. V. Windsor quarried and crushed limestone for concrete aggregate, roadstone, riprap, and agricultural purposes. Albany Gravel Co., Inc., obtained paving gravel from local deposits.

Greene.—Greene County ranked third in the State in value of lime production. Ash Grove Lime & Portland Cement Co. quarried limestone for use in manufacturing quick lime and hydrated lime. Joseph J. Griesemer and Garrett Construction Co. produced crushed limestone for concrete aggregate, roadstone, soil conditioner, and filter beds. Carthage Marble Corp. dressed rough marble obtained from its quarry in Greene County. Missouri State Highway Department contracted for paving gravel. Brown iron ore was mined by Craig & Segrist Mining Co.

Grundy.—Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by Jay Wilcox Limestone Quarry Co. and E. E. Trenary.

Harrison.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Snyder & Davis, L. W. Hayes, Inc., and Mathes Quarries. Mathes Quarries produced paving gravel. New Black Diamond Coal Co. mined coal underground in Harrison County.

Henry.—Henry County continued to lead in coal production; 7 strip mines each produced 1,000 tons or more. Producers included Peabody Coal Co., Windsor Coal Co., A. G. Pence Coal Co., Clary Coal Co., W. W. Coal Co., Inc., and Redding Coal Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Williams Rock Co., Davis Rock Co., and O. A. Knisley.

Hickory.—Missouri State Highway Department contracted for paving gravel in Hickory County.

Holt.—Limestone was quarried for use as riprap by George W. Kerford Quarry and the United States Army Corps of Engineers. Missouri State Highway Department contracted for paving sand.

Howard.—Crushed limestone was produced for concrete aggregate, roadstone, and agricultural purposes by Glasgow Quarries. The United States Army Corps of Engineers produced limestone riprap. Glasgow Sand Co. produced building sand.

Howell.—The value of iron ore produced increased 78 percent over 1956. A total of 24 mines was operated during the year. Leading producers included Shook & Fletcher Supply Co., Four Mining Co., Murrell & Rogers, J. L. Powell and E. E. & E. H. Carroll. Missouri State Highway Department produced paving gravel.

Iron.—Heyward Granite Co. produced dimension granite for building and monumental purposes and granite for riprap. Duncan Bros. quarried and crushed dolomite for use as agstone. Manganese ore was mined by A. T. Utley. Missouri State Highway Department contracted for paving gravel.

Jackson.—Jackson County ranked second in the State in value of stone production, fourth in value of cement, fifth in total value of minerals, and sixth in value of sand and gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by 11 operators. Leading producers included Beyer Crushed Rock Co., Stewart Sand & Material Co., Union Construction Co., Centropolis Crusher Co., and Rock Acres Lime Co., Inc. Undressed dimension limestone for use as rubble was produced by Gerald Hodgins Building Rock Co., McClain Stone Co., Dick Carson, Rove & Son, and Strongs Quarries. Missouri Portland Cement Co. quarried limestone and shale near Independence for portland and masonry cements. Stewart Sand & Material Co. dredged sand from the bed of the Missouri River for use in ready-mix concrete and for engine sand. Miscellaneous clay was mined by United Brick & Tile Co. for use in heavy clay products. Vermiculite was exfoliated by Zonolite Co. Crude vermiculite was shipped from Western States.

Jasper.—Jasper County ranked third in the value of stone and fifth in value of sand and gravel production. Carthage Marble Corp. quarried marble for sale as undressed rough building stone, and also processed dressed building stone, and dressed monumental stone. Limestone was quarried and crushed by Independent Gravel Co., Carthage Marble Corp., and Carthage Crushed Limestone Co. for concrete aggregate, roadstone, agricultural, mineral food, filter beds, glass, and other purposes. Miscellaneous stone (chats) was produced by Independent Gravel Co., American Zinc, Lead & Smelting Co. and McFerron Chat Co. for concrete aggregate, roadstone, railroad ballast, and other purposes. Independent Gravel Co. produced blast, furnace, molding, grinding and polishing, filter, glass, engine, building, and paving sands. American Smelting & Refining Co. obtained lead and zinc from ores mined in the county.

Jefferson.—Jefferson County ranked second in the State in value of sand and gravel produced. Pittsburgh Plate Glass Co., Aubuchon Silica Mining Division of Portage-Manley Sand Co. and Masters Bros. Silica Sand Co. quarried high-purity silica sand for use in plate glass and for molding, grinding, and polishing. Building and paving sand and gravel were produced by Monarch Building Materials Corp., Ficken Material Co., Jefferson County Highway Department, Missouri State Highway Department, and Linus Miller. Kitson Bros. Quarry, Henry Trautman, Paul H. Giudicy, and Hess Bros. produced crushed limestone and dolomite for concrete aggregate, roadstone, and agstone. Giudicy Marble Terrazzo & Tile Co. produced crushed marble for terrazzo. Barite was mined by Burford Mining Co., Magnet Cove Barium Corp., and Ronald E. Wood, Sr. Robert Kissick recovered gem stones in the County. Mississippi River Chemical Co., Division of Mississippi River Fuel Corp., operated its atmospheric nitrogen (anhydrous ammonia) plant at Crystal City.

Johnson.—Deitz Hill Development Co. and Marr Bros. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Knox.—Crushed limestone was produced by Knox County Stone Co., Inc., and McSorley Lime Co. for concrete aggregate, roadstone, and agricultural purposes. Missouri State Highway Department contracted for paving sand.

Laclede.—Missouri State Highway Department contracted for

paving gravel. Richard Lillard Quarry and Wissbaum Quarry produced crushed limestone for concrete aggregate, roadstone, and agstone.

Lafayette.—Earl Ashford Coal Co., Hughes Coal Co., and H. S. Peek Coal Co. mined coal underground; the entire output was shipped to consumers by truck. Limestone was quarried for riprap by the United States Army Corps of Engineers and for concrete aggregate and roadstone by Deitz Hill Development Co. Sand was dredged for building and paving by Waverly Sand Co. and Lexington Sand & Gravel Co.

Lawrence.—Floyd Rose produced crushed limestone for use as a soil conditioner. Dressed dimension limestone was produced by E. L. Britain. Missouri State Highway Department contracted for paving gravel.

Lewis.—Lewis County ranked seventh in the State in value of sand and gravel production. Building and paving sand and gravel were obtained near LaGrange by Missouri Gravel Co. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and soil conditioner by Hamill Lime Co. and Missouri Gravel Co.

Lincoln.—Harbison-Walker Refractories Co. mined fire clay for refractories. Columbia Quarry Co., Watson Quarry, and Gessman Quarry produced broken and crushed limestone for concrete aggregate, roadstone, riprap, and agricultural purposes. Missouri State Highway Department contracted for paving gravel.

Linn.—Bailey Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Missouri State Highway Department contracted for paving sand.

Livingston.—Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by Cooper Contracting Co. and Fred McVey. Miscellaneous clay for use in brick and tile was mined by Midland Brick & Tile Co. Paving and railroad ballast sands were produced by Cooley Gravel Corp.

Macon.—Macon County ranked second in coal production in Missouri in 1957. Peabody Coal Co. strip-mined coal. Trager Quarries, Inc., quarried and crushed limestone for concrete aggregate and roadstone.

Madison.—National Lead Co. mined ores containing lead, copper, silver, cobalt, nickel, and iron at its Madison mine near Fredericktown. It recovered cobalt and nickel from iron rejects of the lead-copper circuit of its Madison mill at the refinery near Fredericktown. Mine La Motte Corp. mined ores containing lead, copper, and silver near Mine La Motte. Missouri State Highway Department contracted for paving gravel.

Maries.—Diaspore, burley, and fire clays were mined by A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., General Refractories Co., Laclede-Christy Co., and Wallace Bros. for use in refractories. Virgil Smith produced crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Missouri State Highway Department contracted for paving gravel.

Marion.—Quick and hydrated lime were produced by Marblehead Lime Co. from limestone quarried near Hannibal. S. D. Fessenden & Sons, and Marblehead Lime Co. produced crushed limestone for soil conditioner, mineral food, and asphalt filler.

McDonald.—Missouri State Highway Department contracted for paving gravel.

Mercer.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Wilcox Quarries.

Miller.—C. W. Roweth Co. produced railroad-ballast gravel. Missouri State Highway Department contracted for paving gravel. Crushed limestone was produced for concrete aggregate, roadstone, and agricultural purposes by Franklin Groose. Brown iron ore was mined by Mimco, Inc.

Moniteau.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Moniteau County Agricultural Association, Inc. Missouri State Highway Department contracted for paving gravel.

Monroe.—Fire clay for use in horizontal zinc retorts and condensers was mined by Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. Walsh Refractories Corp. mined fire clay for refractories. Hamilton Lime Co., Central Stone Co., and the Monroe County Highway Department produced crushed limestone for concrete aggregate, roadstone, and agstone. Missouri State Highway Department and Monroe County Highway Department contracted for paving gravel.

Montgomery.—Montgomery County ranked fifth in the State in value of clays produced. Wellsville Fire Brick Co., A. B. Carter, A. P. Green Fire Brick Co., General Refractories Co., and North American Refractories Co. mined fire clay for refractories. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by Danville Stone Co., McClain Lime Quarry, and the United States Army Corps of Engineers. Paving gravel was obtained by Hessterburg & Adams and the Missouri State Highway Department.

Morgan.—Missouri State Highway Department contracted for paving gravel. Limestone was quarried and crushed at the Morgan County Lime Crusher for soil conditioning.

Newton.—Newton County ranked fifth in the State in value of lime produced. Southwest Lime Co. produced quicklime from limestone quarried locally; a small quantity of limestone was sold for agstone and rubble. Independent Gravel Co. produced miscellaneous stone. Ores containing zinc were mined by various producers. Tripoli for polishing and buffing compounds was processed at Seneca by the American Tripoli Division of The Carborundum Co. from ore quarried in Ottawa County, Okla.

Nodaway.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Concrete Materials & Construction Co. and Gendler Stone Products Co. Earl Wilson dredged sand for paving purposes.

Oregon.—Brown iron ore was mined by Miller & Reynolds, A. T. Utley, R. D. Pointer, Plateau Mining Co., Oresco, Inc., and Ozark Mining Corp. O. O. Mainprize produced crushed limestone for concrete aggregate, roadstone, and agstone. Missouri State Highway Department obtained paving gravel.

Osage.—Osage County ranked fourth in the State in value of clays produced. Fire, diasporic, and burley clays were mined by A. P. Green Fire Brick Co., Mexico Refractories Co., Hugo Meyer, and

Walsh Refractories Corp. for manufacturing refractories. Osage County Highway Department obtained gravel for paving.

Ozark.—Missouri State Highway Department and Ozark County Highway Department obtained paving gravel. Brown iron ore was mined by Wayne Gunther.

Pemiscot.—Building and paving sand and gravel were produced by Taylor Sand & Gravel Co. and Caruthersville Sand & Gravel Co.

Perry.—Gibbar Bros. produced crushed limestone for concrete aggregate, roadstone, and agstone, and gravel for paving.

Pettis.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Howard Construction Co. and T & O Rock & Lime Co.

Phelps.—Fire clay for refractories was mined by Dillon Bros., Laclede-Christy Co., and Mexico Refractories Co. Bray Construction Co., Jessie Nivens, Brown, Lenox & Schafer, and St. James Limestone Quarry produced crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Newton Grisham and the Missouri State Highway Department obtained building and paving sand and gravel.

Pike.—Magnesium Mining Co., Galloway Limestone Co., and Midwest Pre Cote Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Missouri State Highway Department contracted for paving gravel. Hercules Powder Co. operated its atmospheric nitrogen (anhydrous ammonia) plant at Louisiana.

Platte.—Miscellaneous clay for manufacturing lightweight aggregate was mined by Carter-Waters Corp. Midwest Pre Cote Co. and Everett Quarries, Inc., quarried and crushed limestone for concrete aggregate and roadstone. The United States Army Corps of Engineers used broken and crushed limestone for stabilizing the banks of the Missouri River.

Polk.—Missouri State Highway Department contracted for paving gravel. H. F. Butcher obtained paving gravel from deposits near Humansville.

Pulaski.—Building and paving sand and gravel was produced by J. H. Walser Construction Co. near Waynesville and by the Missouri State Highway Department.

Putnam.—Kirkville Coal Co. and Husted Bros. Coal Co. strip-mined coal; Clark Coal Co. and Rowland & Shrake mined coal underground.

Ralls.—Ralls County ranked third in the value of cement production. Universal Atlas Cement Co. produced portland and masonry cements at its plant near Ilasco. Limestone and shale for cement were obtained near the plant. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Central Stone Co. Couch Coal Co. and Clarence D. Day strip-mined coal. Edward B. Cooper mined paving gravel.

Randolph.—Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by N. J. Cooksey Co., Trager Quarries, Inc., Ralph Potter Quarry Co., Alfred Vanskike Lime Quarry, and the Moberly Special Road District. Coal was mined underground by D. L. Bradley Coal Co., Inc., Fately Coal Co., Moberly Coal Co., Nejedly Coal Co., and Eastside Coal Co.

Ray.—Limestone was quarried and crushed near Richmond by Steva Stone Co. and near Orrick by Orrick Stone Co. The United States Army Corps of Engineers produced limestone riprap.

Reynolds.—Reynolds County ranked fifth in the State in value of iron-ore production. Brown iron ore was mined by General Mining Co. Paving gravel was produced by Penzel Construction Co. and the Missouri State Highway Department.

Ripley.—Building and paving sand and gravel were produced by Wright Gravel Co. and the Missouri State Highway Department. Iron ore also was produced.

St. Charles.—St. Charles County ranked fourth in the State in value of sand and gravel and seventh in value of stone production. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by St. Charles Quarry Co., O'Fallon Quarry, United States Army Corps of Engineers, Joerling Bros. Quarry, and Schiermeier Limestone Quarry. Undressed dimension limestone for rubble was produced by O'Fallon Quarry. Glass, molding, and other sands were produced by Tavern Rock Sand Co. and St. Charles County Highway Department and Missouri State Highway Department obtained paving gravel.

St. Clair.—This county ranked fifth in the State in coal production. Pioneer Mining Corp., Coones Coal Co., and Osage Coal Co. recovered coal from strip mines. Hunt Limestone Co. produced crushed limestone for concrete aggregate, roadstone, and agstone.

St. Francois.—St. Francois County led Missouri in the value of total minerals produced and also in value of lead, iron ore, silver, and zinc; it ranked second in lime-production value and fifth in stone-production value. Hematite iron ore was mined at Iron Mountain by Ozark Ore Co. and shipped to steel furnaces. St. Joseph Lead Co. mined and milled lead ore yielding zinc and silver as byproducts. Chats from lead and iron milling were used for concrete aggregate, roadstone, and railroad ballast. Valley Dolomite Corp. produced crushed dolomite for use as flux, as refractory material, concrete aggregate, and agstone. (The company also produced dead burned dolomite for refractory uses.) St. Joseph Lead Co. quarried and crushed dolomite for agricultural and fluxing purposes.

Ste. Genevieve.—Ste. Genevieve County was the leading lime producer, ranked third in the State in total value of mineral production, and ranked fourth in value of stone produced. Mississippi Lime Co. quarried and crushed limestone used to produce quick and hydrated lime at its plant near Ste. Genevieve. Lime was used for chemical building, and industrial purposes. The company sold limestone for glass, whiting, asphalt filler, coal-mine rock dust, poultry grit, chemical, concrete aggregate, and various purposes. DeLore Division of National Lead Co. produced crushed limestone for paint whiting. Cliffdale Quarry & Manufacturing Co. quarried and crushed limestone for riprap, concrete aggregate, and roadstone. Ste. Genevieve Building Stone Co. produced dimension and crushed limestone. Weiler Marble Co. and Tennessee Marble Co. produced dimension marble for use as undressed building stone. Bauman Bros. obtained building and paving sand and gravel.

St. Louis.—St. Louis County ranked first in value of cement, stone, and sand and gravel production, and second in value of total mineral

production. Crushed and dimension limestone were produced from quarries near Lemay, Maplewood, and Clayton. Crushed stone was used for cement, roadstone, riprap; and agricultural purposes; dimension stone was used for curbing, flagging, and rough architecture. West Lake Quarry & Material Co., F. Ruprecht & Sons, and River-view Stone & Material Co. produced crushed and dimension limestone. Crushed limestone was also supplied by Vigus Quarries, Inc., Rock Hill Quarries Co., Des Peres Quarry, Bussen Quarries, Inc., George A. Janssen, Inc., and Orth Bros. Quarry. Portland and masonry cements were manufactured near Lemay by Alpha Portland Cement Co. and near Prospect Hill by Missouri Portland Cement Co. Sand was obtained from local deposits for glass, molding, grinding and polishing; and sand and gravel for building and paving uses. Leading producers, in terms of value, were Winter Bros. Materials Co., Inc., Missouri Aggregates, Inc., Dennis Materials Co., Pioneer Silica Products Co., and St. Charles Sand Co. Shale and plastic fire clay for use in manufacturing heavy clay products and refractory brick were mined by Alton Brick Co., Hydraulic Press Brick Co., Thomas Mining Corp., Laclede-Christy Co., Evens & Howard Sewer Pipe Co., and Gũth & Sons. Petroleum was produced in St. Louis County. Zonolite Co. exfoliated vermiculite at its plant in this county. Crude vermiculite was shipped from Western States. Crude barite was shipped in and ground by DeLore Division of National Lead Co.

Saline.—Limestone was quarried and crushed for concrete aggregate and roadstone by Howard Construction Co., Duderstadt Construction Co., and Scott Quarries. The United States Army Corps of Engineers obtained limestone from four quarries in Saline County for riprapping the banks of the Missouri River. The Missouri State Highway Department contracted for paving sand.

Scott.—Building sand and paving gravel were produced by Sikeston Concrete Products Co., Inc., and Penzel Construction Co.

Shannon.—Dimension sandstone for rubble was quarried by Ozark Stone Products, Inc. Crider Bros. quarried and crushed limestone for use as a soil conditioner. The Missouri State Highway Department obtained paving gravel.

Shelby.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Central Stone Co. and Turner Lime & Rock Quarry.

Stoddard.—Hill & Stuart, Inc., Brown Sand & Gravel Co., and Lee R. Warren produced building and paving sand and gravel.

Stone.—United States Army Corps of Engineers and the Missouri State Highway Department produced paving gravel.

Sullivan.—Partin Lime & Rock Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Taney.—The United States Army Corps of Engineers produced crushed limestone and paving gravel. The Missouri State Highway Department contracted for paving gravel. Limestone was used for riprap, concrete aggregate, and roadstone.

Texas.—Paving gravel was obtained by the Missouri State Highway Department. Earl Duke and Long Bros. quarried and crushed limestone for use as a soil conditioner.

Vernon.—M. L. Schooley Coal & Construction Co., Ellis Coal Co., Thornhill Coal Co., and K & M Coal Co. produced coal from strip mines. Limestone was quarried and crushed for concrete aggregate and roadstone by Alvis Limestone & Concrete Co., R. E. Jones, and Trager Quarries, Inc. Paving gravel for road maintenance was produced by Blue Mound Township.

Warren.—Fire clay for refractories was mined by Harbison Walker Refractories Co., Walsh Refractories Corp., and Mexico Refractories Co. Sprick Quarry produced crushed limestone for concrete aggregate, roadstone, and agricultural purposes. The Missouri State Highway Department contracted for paving gravel.

Washington.—Washington County was the leading barite producer in Missouri in 1957. Barite production was reported from 21 operations by 15 companies. Leading producers included Magnet Cove Barium Corp., Baroid Division of National Lead Co., Milwhite Mud Sales Co., Hornsey Bros., and General Barite Co. St. Joseph Lead mined and milled lead ore containing small quantities of zinc at its Indian Creek plant. Quantities of lead were recovered in mining and washing barite. A. M. Mount produced building sand and gravel. The Missouri State Highway Department contracted for paving gravel.

Wayne.—Brown iron ore was mined by Wayne County Mining Co., Sam's Mining Co., Wm. Harris & Son, and Reichert Mining Co. Williamsville Stone Co. quarried dimension sandstone and limestone for use as building stone and flagging. Wm. Harris & Son quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purpose.

Webster.—The Missouri State Highway Department contracted for paving gravel.

Worth.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Grand River Limestone Co.

Wright.—The Missouri State Highway Department contracted for paving gravel.

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, United States Department of the Interior, and the Montana Bureau of Mines and Geology.

By Kenneth D. Baber,¹ Frank B. Fulkerson,¹ Norman S. Petersen,¹ and Albert J. Kauffman, Jr.²



MONTANA mineral production dropped to \$192 million in value or 10 percent below the record \$214 million of 1956. Metal-mine closures and cutbacks during 1957 at Butte, Silver Bow County, to adjust to reduced demand and prices, were the primary factors in the decline. The value of copper, zinc, lead, silver, and gold at Butte dropped to \$73 million compared with \$111 million in 1956. Copper output alone declined \$27 million (33 percent) as a result of lower prices that depressed the value, despite a tonnage that was only 5 percent under 1956. Tungsten mining in Beaverhead County was stopped after a Government stockpile-purchase program was ended. Chromite concentrate, produced in Stillwater County, was the only major product of metal mines with increased output, and this gain was small. The total value of metals declined from \$130 million to \$87 million.

Production values for mineral fuels and nonmetals gained substantially, in contrast to the depression in metal mining. The mineral-fuels value increased 28 percent and nonmetals, 13 percent. Crude petroleum rose from \$56 million to \$73 million and replaced copper as the leading product in the State in value. Natural gas increased \$0.5 million, partly offsetting a decline of \$1.3 million in the depressed coal-mining industry. Several nonmetals, including sand and gravel, stone, lime, and sulfur increased in output for the year.

Consumption, Trade, and Markets.—Lower national requirements for copper, lead, zinc, and manganese had severe effects on the mining industry of Butte. Employment was reduced 2,600 or about one-third, and overtime was eliminated. Mining of lead and zinc in other areas in the State was nearly nonexistent, due to the almost continuous depression since 1953 in markets for the two metals. Gold-silver mining also was almost abandoned, but some interest was reported in reopening various long-idle gold mines in Montana during the year.

As the Butte-Philipsburg purchase program of the General Services Administration (GSA) for low-grade manganese ore approached fulfillment of its quota, the depots were flooded with shipments. Re-

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ceipts in 1957 were by far the greatest since this program for low-grade ore began in 1951.

Purchasing of tungsten concentrates under GSA ended when the agency funds for this purpose were exhausted.

Increased activity in the construction industry in 1957 stimulated the production of nonmetal products. As measured by employment, the gain in construction in the State was only 4 percent; how-

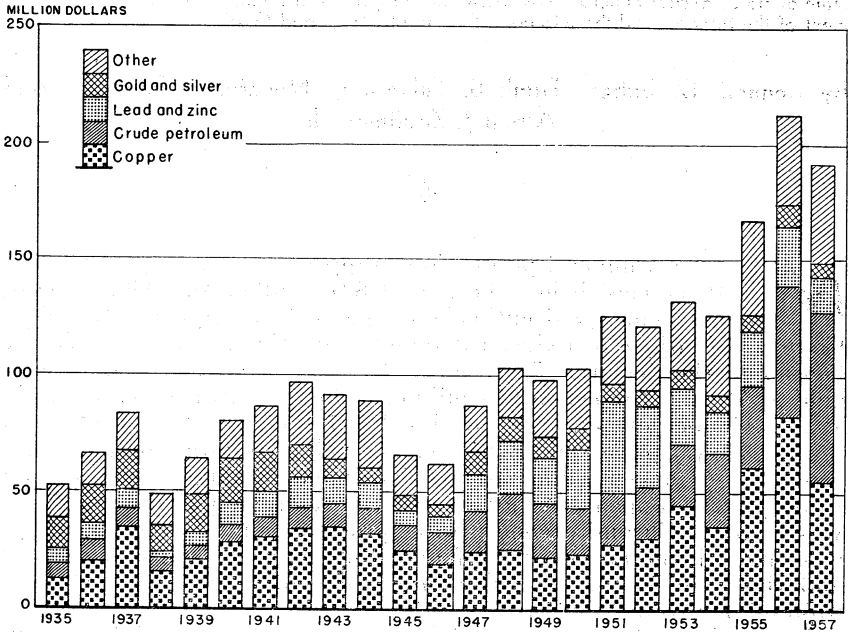


FIGURE 1.—Value of copper, crude petroleum, lead and zinc, gold and silver, and total value of mineral production in Montana, 1935-57.

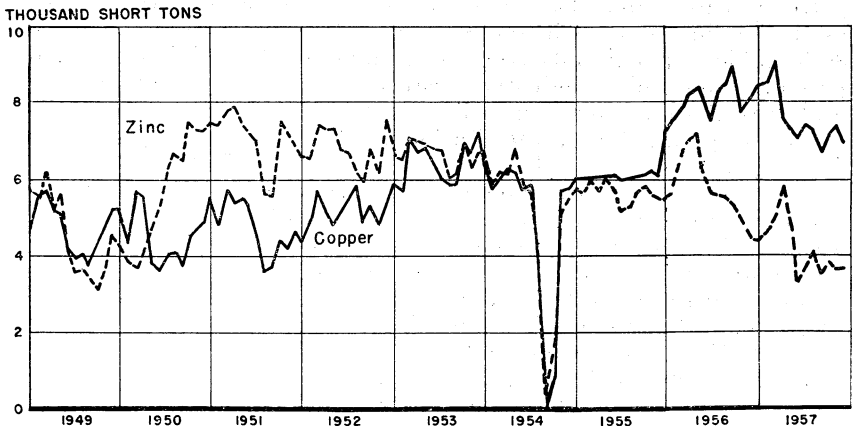


FIGURE 2.—Mine production of copper and zinc in Montana, 1949-57, by months, in terms of recoverable metals.

TABLE 1.—Mineral production in Montana, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromium ore and concentrate.....gross weight..	118,780	\$3,807	119,149	\$3,921
Clays.....thousand short tons..	233	31	232	24
Coal (bituminous and lignite).....do.....	846	3,468	413	2,161
Copper (recoverable content of ores, etc.).....	96,426	81,962	91,512	55,090
Fluorspar.....	59,775	(²)	64,339	(³)
Gem stones.....	(⁴)	35	(⁴)	(⁵)
Gold (recoverable content of ores, etc.)...troy ounces..	38,121	1,334	32,766	1,147
Iron ore (usable).....long tons, gross weight..	11,643	(⁶)	35,538	(⁷)
Lead (recoverable content of ores, etc.).....	18,642	5,854	13,300	3,804
Manganese ore and concentrate (35 percent or more Mn).....gross weight..	80,553	(⁸)	68,298	(⁹)
Manganiferous ore and concentrate (5 to 35 percent Mn).....gross weight..	4,752	(⁹)	4,547	(⁹)
Mica (sheet).....pounds.....	56	(⁹)	13	(⁷)
Natural gas.....million cubic feet.....	25,847	1,758	\$30,200	\$2,200
Petroleum (crude).....thousand 42-gallon barrels..	21,760	56,141	\$27,215	\$73,481
Phosphate rock.....thousand long tons.....	557	3,957	534	3,825
Sand and gravel.....thousand short tons.....	10,024	7,174	11,108	8,150
Silver (recoverable content of ores, etc.).....	7,386	6,685	5,558	5,030
Stone.....thousand short tons.....	1,247	1,816	2,567	3,654
Tungsten ore and concentrate (60 percent WO ₃ basis).....	1,230	(⁹)	661	(⁹)
Uranium ore and concentrate (oxide content).....pounds..	11,866	53	(⁹)	(⁹)
Zinc (recoverable content of ores, etc.).....	70,520	19,322	50,520	11,721
Value of items that cannot be disclosed: Barite, cement, clays (fire clay and bentonite), gypsum, lime, natural-gas liquids, pumice (1956), pyrites, sulfur, talc, vanadium (1957), vermiculite, and values indicated by footnote 3.....		21,290		18,256
Total Montana ⁹		213,781		191,728

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Excludes fire clay and bentonite.

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Weight not recorded.

⁵ Production figures on manganiferous ores (less than 35 percent) mined and shipped to Government stock-pile depots not included in State totals (see text—section on manganese).

⁶ Less than \$1,000.

⁷ Less than \$500.

⁸ Preliminary figure.

⁹ Total adjusted to eliminate duplicating the value of stone; 1956 total has been revised.

ever, a sharp decline in building was more than offset by work on engineering projects, including highways, streets, electric-power projects, and airbase facilities. The steep decline in building was revealed in the value of building permits (down 18 percent), the number of new dwelling units authorized by permits (down 25 percent), and employment by building-construction contractors (down 2 percent). Power dams were being constructed at Noxon Rapids and Great Falls; a steam-electric plant, at Sidney; a second powerplant, at Fort Peck; airbases, at Glasgow and Great Falls; and construction of streets, highways, and schools was being expanded over the State.

A total of 17.6 million barrels of crude petroleum was exported, an increase of 43 percent over the 1956 figure, and plans were made for expanding refinery capacity in the State, owing to increased demand for refined products.

Trends and Developments.—Full-scale copper production was reached at the new Berkeley pit at Butte in midyear, and output from the Kelley underground block-caving mine continued at capacity throughout 1957. In contrast, production was curtailed from the

deep levels of the Mountain Con and Leonard mines—both high-grade but high-cost ore producers. The Mountain Con mine was closed and the Leonard mine was placed on a shorter work week when ore produced at depths up to 4,400 feet apparently could not compete on a cost basis with production by open-pit and block-caving methods, owing in part to hoisting facilities, which company officials described as inadequate. The Kelley and Berkeley mines produced 37 and 35 percent, respectively, of the Butte copper output as compared with 33 and 14 percent in 1956.

Some progress was made in the use of Montana undeveloped mineral resources in 1957. Iron ore was shipped to eastern steel-makers from a new open-pit mine in Judith Basin County, and exploration of an iron deposit discovered in 1955 in Beaverhead County was continued. The Beaverhead County deposit was the largest known in the Pacific Northwest. Full development of these properties might be handicapped by lack of steel-industry demand in the immediate future. Research on chromite ore was continued, and a pilot-plant smelter was to be constructed at the Mouat mine, Stillwater County, for commercial-scale smelting that would produce ferrochrome when satisfactory results could be obtained in the pilot-plant tests. The commercial plant would be built to operate after the end of a Government chromite-concentrate purchase contract in 1961. Deposits of chromite ore in Stillwater and Sweet Grass Counties are the largest in the United States.

Employment.—Metal-mining employment, comprising two-thirds of the total in the mining industry, was sharply reduced in 1957. The December average was 35 percent lower than in January. Most of the curtailment did not take place until the latter half of the year; as a result, the annual average was only 14 percent less than in 1956.

TABLE 2.—Employment in mining, primary metals, and petroleum refining, 1948-52 (average) and 1953-57¹

	Total mining	Metal mining	Non-metallic, including coal	Petroleum and natural gas	Processing	
					Primary metals	Petroleum refining
1948-52 (average).....	10,400	7,600	1,300	1,500	4,000	(²)
1953.....	11,600	8,200	1,000	2,400	3,600	1,200
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:						
January.....	12,600	8,900	800	2,900	5,100	1,200
February.....	12,800	9,000	900	2,900	5,100	1,200
March.....	12,800	9,100	800	2,900	5,100	1,200
April.....	12,300	8,600	800	2,900	5,100	1,300
May.....	11,900	8,300	800	2,800	4,900	1,200
June.....	11,800	8,000	900	2,900	4,900	1,200
July.....	11,400	7,600	900	2,900	5,100	1,200
August.....	10,700	6,900	900	2,900	5,000	1,200
September.....	10,200	6,400	900	2,900	4,800	1,200
October.....	9,700	5,900	1,000	2,800	4,500	1,100
November.....	9,600	5,900	1,000	2,700	4,400	1,100
December.....	9,600	5,800	1,000	2,800	4,300	1,100
Year (average).....	11,300	7,500	900	2,900	4,900	1,200

¹ Montana State Employment Service. Estimates in this series, which was begun in 1947, are published monthly in the Montana Labor Market and revised annually on the basis of more complete data. Data include all full- and part-time wage and salary workers who worked or received pay during the pay period ending the 15th of the month. Excludes proprietors and self-employed.

² Figures not published before 1953.

Primary-metals manufacturing (copper, lead, zinc, and aluminum) increased over 1956 through the first 9 months, but layoffs in the last quarter brought the employment averages well below comparable 1956 figures. For the year average employment in primary metals was up 7 percent and at a record high since World War II. Increased production in the petroleum and natural-gas industries was not reflected in the employment statistics; the number of workers remained about the same as in 1956.

TABLE 3.—Average weekly earnings, weekly hours, and hourly earnings of workers in mining, metal mining, and primary metals, 1953-57¹

	1953	1954	1955	1956	1957
Mining:					
Average weekly earnings.....	\$90.81	\$81.93	\$91.63	\$102.77	\$97.12
Average weekly hours.....	41.6	38.1	40.3	41.7	38.9
Average hourly earnings.....	\$2.18	\$2.15	\$2.28	\$2.47	\$2.50
Metal mining:					
Average weekly earnings.....	\$91.23	\$77.43	\$90.77	\$103.41	\$92.96
Average weekly hours.....	42.6	37.1	40.3	42.2	38.3
Average hourly earnings.....	\$2.14	\$2.09	\$2.25	\$2.45	\$2.43
Primary metals processing:					
Average weekly earnings.....	\$87.64	\$75.69	\$84.95	\$98.89	\$90.53
Average weekly hours.....	45.1	39.4	41.5	44.1	39.9
Average hourly earnings.....	\$1.95	\$1.92	\$2.05	\$2.24	\$2.27

¹ Montana State Employment Service. Estimates in this series, which were begun in 1950, are published monthly in the Montana Labor Market and revised annually on the basis of more complete data. 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, fiscal years 1951-57¹

Fiscal year	Average number of employers	Average number of wage earners	Wages	Average wage level
1951.....	458	10,561	\$41,470,947	\$3,927
1952.....	474	10,562	46,941,121	4,444
1953.....	517	11,406	53,308,193	4,674
1954.....	528	11,635	54,105,365	4,650
1955.....	524	10,710	49,036,402	4,578
1956.....	528	12,193	65,154,932	5,344
1957.....	526	12,021	65,017,069	5,409

¹ Unemployment Compensation Commission of Montana. Data on a fiscal-year basis beginning July 1 and ending June 30 are published annually in the Montana Labor Market in a report that deals only with industries and employment covered under unemployment insurance laws of Montana. All mining establishments are subject to the State system of unemployment insurance.

As the result of a shorter workweek, average weekly earnings of production workers in metal mining fell below those of production employees in the mining industry as a whole. Average weekly hours in metal mining dropped to 38.3 compared with 42.2 in 1956, and average weekly earnings declined to \$93 compared with \$103 in the preceding year. These averages in primary-metals processing decreased sharply also.

Government Programs.—Projects of the Defense Minerals Exploration Administration (DMEA) to assist in exploration of strategic and critical mineral occurrences were as follows: Manganese 6, and copper, lead, lead-zinc, mica, tungsten, and uranium 1 each.

TABLE 5.—Defense Minerals Exploration Administration contracts active during 1957

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
BROADWATER					
Hogan and Pohl.....	Silver Saddle....	Lead.....	June 6, 1955	\$16,460	50
CARBON					
Midland Mining Co.....	Sandra Group...	Uranium.....	June 3, 1957	27,008	75
CASCADE					
Boss Mines, Inc.....	Boss & Atlantus..	Lead, zinc.....	Dec. 7, 1954	157,208	50
DEER LODGE					
Tip Top Mining Co.....	Tip Top.....	Tungsten.....	Aug. 28, 1956	16,540	75
GALLATIN					
Daniel T. Barham, et al....	Thumper Lode..	Mica.....	Sept. 15, 1955	14,000	75
GRANITE					
American Machine & Metals, Inc.	Mullen.....	Manganese.....	Dec. 15, 1953	189,460	75
Echols and Collier.....	Whitehorse.....	do.....	Feb. 20, 1957	23,560	75
Jennie M. Moore.....	Mystery Manganese.	do.....	Apr. 12, 1955	183,240	75
Taylor-Knapp Co.....	True Fissure and Durango.	do.....	Feb. 1, 1954	1648,727	75
JEFFERSON					
Uranium Corp. of America..	Dailey Copper..	Copper.....	Oct. 18, 1957	85,172	50
MISSOULA					
Pioneer Corp. of Idaho.....	Cook Prospect..	Manganese.....	Jan. 29, 1957	21,580	75
SILVER BOW					
Umont Mining, Inc. (assignee of Irving and Nelson).	Plutus and Norwich.	do.....	Sept. 19, 1956	106,010	75

¹ Amended.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—Owing to declining demand for aluminum, production at the Anaconda Aluminum Co. reduction plant in Columbia Falls was below the capacity rate of approximately 121 million pounds of metal annually. Output for the year totaled 104,112,000 pounds. A full production schedule was maintained until June 1, when output was curtailed 12.5 percent, and an additional cutback of 12.5 percent was made July 1. For the remainder of the year output was at 75 percent of capacity or 7,550,000 pounds per month.

New equipment to decrease the cost of rebuilding carbon potlining was placed in service, and two 750-ton steel silos were constructed to provide additional storage capacity for anode briquets. Sheet ingots were added to the line of shapes produced in the casting plant.

The Anaconda Co. was constructing a pilot plant at Anaconda to test the workability of a new alumina-from-clay process, which it de-

veloped. The company, holding extensive deposits of aluminous clays near Moscow, Idaho, hoped to develop the process to the point of supplying the needs for alumina as raw material at the Columbia Falls plant. Anaconda Aluminum Co., a wholly owned subsidiary, obtained alumina produced from bauxite mined in the Caribbean. About 7,500 tons of clay was stockpiled at Anaconda, and the runs of the alumina-from-clay pilot plant were to begin in early 1958.

Chromite.—The production at the American Chrome Co. Mouat mine in Stillwater County continued the same as in 1956. The company delivered 114,300 tons of chromite concentrate to the national stockpile and passed the halfway mark of a 900,000-ton, 8-year contract that was to be effective through 1961. At the end of 1957, 486,600 tons had been delivered. The firm was continuing its extensive exploration and development by sinking a 3-compartment shaft 500 feet below the present workings and, in cooperation with the Federal Bureau of Mines, by investigating production of ferrochromium at the mine site. The results of the tests indicated that ferrochromium of a grade acceptable to the steel industry and with impurities below 0.03 percent each of phosphorus and sulfur could be produced from the Mouat ore. The company planned to begin constructing a pilot-plant smelter near the mine to establish the costs of commercial production after the company chromite-concentrate contract with the Government expires. The pilot plant was to be completed late in 1958 at a cost of \$500,000.

Copper.—Production of copper, although down 5 percent compared with 1956, was the second highest since 1944. The monthly rate of production at the Butte mines, Silver Bow County, reached a high of 9,100 tons of recoverable metal in March but declined throughout the rest of the year. The Anaconda Co. and other major United States producers of copper curtailed mine output and reduced prices (from 36 cents at the beginning of 1957 to 27 cents at year end) in an effort to bring supplies in line with reduced demand. Copper prices had reached a 90-year high of 46 cents per pound in February 1956.

At high-grade underground Butte copper mines, the Mountain Con mine was shut down on April 1, and the Leonard mine was placed on a 5-day-week basis in September. Reduced output for the year from the vein mines was offset partly by production from the new Berkeley pit. A capacity of 17,500 tons of ore daily was reached at the Berkeley in mid-1957, and this rate was maintained the remainder of the year. Production from the Kelley mine (a block-caving project) was maintained near the full-scale rate of 15,000 tons of ore per day; however, development was reduced because of the depressed copper market. Production from both the Berkeley open pit and the Kelley underground mine was continued on a 6-day week; each employee worked 5 days a week.

Work on the Northwest project was discontinued temporarily in the middle of the year, pending improvement in copper and zinc prices. This project involved sinking two new shafts to develop low-grade copper and zinc ores in the outlying areas of Butte Hill and to provide expanded hoisting capacity from the lower levels of mines in the northwest part of the Butte district.

The Anaconda Co. announced that a drilling program in the Continental area at the eastern margin of the Butte district was completed in the first quarter of 1957. Churn-drill holes disclosed 50 million tons of complex low-grade copper ore that could be mined by open-pit methods. Metallurgical testing of this material was to be continued.

At the Berkeley pit the new crushing plant, conveyor system, and ore bins were nearing completion and were to begin operating in the first quarter of 1958. An incline-conveyor tunnel was driven 600 feet to connect the bottom of the pit with an overhead conveyor system to deliver crushed ore from the pit to ore bins at a nearby railroad spur.

Gold.—Lower recovery from gold mines and curtailed Butte copper and lead-zinc operations because of the drop in base-metal prices State gold output reduced 14 percent. Silver Bow County produced 83 percent of the metal. Montana Gold & Chemical Co. operated a small bucketline dredge on the Reservoir placer near Gold Creek, Powell County. This was the only active bucketline dredge in the State. Several small gold-lode mines were active in Beaverhead, Broadwater, Jefferson, Lewis and Clark, and Phillips Counties.

Iron Ore.—Young-Montana Corp. shipped iron ore from the Willow Creek open-pit mine 17 miles southwest of Stanford, Judith Basin County, by rail to Duluth, Minn., for transshipment to lower Great Lakes ports. The ore averaged 63 percent iron. The Great Northern Railway Co. completed a spur line to loading docks in Stanford, and trucks hauled the ore from the crusher, which was one-half mile

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total 1862-1957, 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		Fine ounces	Value	Fine ounces	Value
1948-52(average)	228	29	3,563,180	46,448	\$1,625,694	6,476,088	\$5,861,187
1953-----	142	7	6,101,348	24,768	866,880	6,689,556	6,054,386
1954-----	113	11	5,104,288	23,660	828,100	5,177,942	4,686,299
1955-----	100	12	7,259,917	28,123	984,305	6,080,390	5,503,060
1956-----	152	7	9,535,789	38,121	1,334,235	7,385,908	6,684,620
1957-----	125	13	10,790,009	32,766	1,146,810	5,558,228	5,030,477
1862-1957-----	-----	-----	(³)	17,521,925	397,720,587	818,748,478	610,066,030

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52(average)	57,739	\$25,603,257	19,721	\$6,359,379	69,741	\$21,361,233	\$60,810,730
1953-----	77,617	44,552,158	19,949	5,226,638	80,271	18,462,330	75,162,392
1954-----	59,349	35,015,910	14,820	4,060,680	60,952	13,165,632	57,756,621
1955-----	81,542	60,830,332	17,028	5,074,344	68,588	16,872,648	89,264,689
1956-----	96,426	81,962,100	18,642	5,853,588	70,520	19,322,480	115,157,023
1957-----	91,512	55,090,224	13,300	3,803,800	50,520	11,720,640	76,791,951
1862-1957-----	7,331,394	2,331,585,684	893,452	137,719,584	2,587,522	486,827,056	3,963,918,941

¹ Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings re-treated; and ore, old slag, and copper precipitates shipped to smelters during the calendar year indicated.

² Does not include grave washed.

³ Figure not available.

from the deposit, to the loading docks. The ore was of the Bessemer-lump type. From May to October 26,300 tons was produced—several times the 1956 output.

Minerals Engineering Co. continued to explore its Carter Creek iron property in the Dillon area, Beaverhead County, by deep drilling. The measured and indicated reserve totaled more than 200 million tons; some 50 million tons was blocked out and ready for open-pit mining. The company considered establishing a mill to produce 65-percent-grade concentrate if steel-industry demand was forthcoming and financial arrangements could be worked out. At the close of the year an agreement was announced between Minerals Engineering Co. and North American Utilities Corp., Montreal, Canada, providing for construction of an \$8-million iron-ore concentrating plant near Dillon. The concentrate was to be exported to a steelworks to be constructed in Canada.

Ralls & Harris Bros. continued to ship magnetite ore to a cement plant from the Iron Cross mine, Broadwater County.

Lead.—Production of lead declined 29 percent to the lowest point since 1946. The Butte lead-zinc mines continued to supply most of the State total lead; in 1957 these mines produced 72 percent of the State output compared with 80 percent in 1956. In other areas the Maulden mine (Beaverhead County), Trout-Algonquin mine (Granite County), East Helena slag dump (Lewis and Clark County), and the Jack Waite mine (Sanders County) supplied the principal tonnages. The domestic price of lead was stabilized at 16 cents throughout 1956 but decreased from 16 cents to 13 cents per pound during 1957, because Government acquisitions of foreign lead under the barter program declined; worldwide production was excessive, and demand in industry decreased.

Manganese.—Production of manganese ore and concentrate (35 percent or more manganese) decreased for the second consecutive year. Shipments declined 15 percent in 1957. The Anaconda Co. Emma and Niagara mines in Silver Bow County supplied the bulk of the output. Another high-grade manganese mine at Butte, the Travona, was closed most of the year because of declining demand in the steel industry and competition from foreign crude ore. The Butte ore was concentrated, sintered, and nodulized at Anaconda, Deer Lodge County, and the nodules were used mainly in making ferromanganese at the Anaconda Reduction Works.

Near Philipsburg, Granite County, Trout Mining Division of American Machine & Metals, Inc., consigned Battery-grade concentrate to commercial users and manganiferous ore or mill products (under 35 percent manganese) to the Government low-grade stockpile and to commercial users. Also in the Philipsburg area Taylor-Knapp Co. shipped sinter analyzing 40 to 45 percent manganese under the "carlot" buying program and crude manganiferous ore to the low-grade stockpile.

Shipments to the low-grade stockpiles at Butte and Philipsburg were to be included in State mineral-production totals after the material was removed from the stockpiles for commercial use. In 1957 shipments to the depots totaled 108,029 short tons of ore valued at \$2,907,751, compared with 69,952 short tons valued at \$1,869,231 in 1956. Larger shippers included: Granite County—Trout Mining

TABLE 7.—Gold produced at placer mines, 1948-52 (average) and 1953-57, by classes of mines and methods of recovery

Class and method	Mines producing ¹	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	
				Total	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1948-52 (average).....	1	1,451,423	4,927	\$172,452	\$0.119
1953.....					
1954.....					
1955.....	1	447,000	1,784	61,740	.138
1956.....	1	36,800	339	11,865	.322
1957 ²	3	151,891	530	18,550	.122
Dragline dredges:					
1948-52 (average).....	1	150,100	268	9,387	.062
1953.....					
1954.....	2	82,500	1,394	48,790	.591
1955.....	4	123,000	1,443	50,505	.411
1956 ³	2	219,150	1,025	35,875	.164
1957.....					
Nonfloating washing plants: ⁴					
1948-52 (average).....	5	242,059	864	30,233	.125
1953.....	3	42,500	1,216	42,500	1.001
1954.....	2	3,950	79	2,765	.700
1955.....	2	10,700	84	2,940	.275
1956.....					
1957.....	1	11,500	140	4,900	.426
Gravel hydraulically handled:					
1948-52 (average).....	1	1,170	27	959	.820
1953.....					
1954.....					
1955.....	1	200	4	140	.700
1956.....	2	11,000	119	4,165	.379
1957.....	4	6,300	54	1,890	.300
Small-scale hand methods: ⁵					
1948-52 (average).....	19	5,369	97	3,409	.635
1953.....	4	400	7	245	.613
1954.....	6	1,350	53	1,855	1.374
1955.....	4	50	57	1,995	39.900
1956.....	2	437	13	455	1.041
1957.....	5	1,455	78	2,730	1.876
Underground placers: Drift:					
1948-52 (average).....	1	53	6	196	3.698
1953.....					
1954.....	1	200	3	105	.525
1955.....					
1956.....					
1957.....					
Grand total placers:					
1948-52 (average).....	28	1,850,174	6,189	216,636	.117
1953.....	7	42,900	1,223	42,805	.998
1954.....	11	88,000	1,529	53,515	.608
1955.....	12	580,970	3,352	117,320	.202
1956.....	7	267,387	1,496	52,360	.196
1957.....	13	171,146	802	28,070	.164

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

² Includes bucketline dredges and dragline dredges for which production cannot be individually published.

³ Includes dragline dredges and nonfloating washing plants for which production cannot be individually published.

⁴ Includes all placer operations using power excavators and washing plants, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

⁵ Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, and so forth. "Wet" method used exclusively in Montana.

Division (Trout-Algonquin mine), Taylor-Knapp Co. (Moorlight group), Peter Antonioli (Scratch All mine); Meagher County—Feusner Mining Co. (Little Belt mine); and Silver Bow County—Umont Mining Co. (Norwich mine). The 1957 totals were the highest since

the low-grade program began 6 years ago. From 1951 through 1957 the Government purchased from Montana mines 315,600 short tons of ore (recoverable manganese content 68,900 short tons) valued at \$7,851,000 at the Butte and Philipsburg depots.

Prospects were dim for low-grade-ore producers because of the lack of milling facilities. Stockpiling of low-grade ore at Butte and Philipsburg was scheduled to stop not later than June 30, 1958.

The domestic "carlot" purchase program for Metallurgical-grade ore and concentrate was scheduled to end January 1, 1961, or earlier if the tonnage limitation was reached. Taylor-Knapp Co. was the only Montana shipper under this program in 1957.

Silver.—Production of silver totaled 5.6 million ounces, compared with 7.4 million ounces in 1956. The Butte mines, producing by-product silver from copper and lead-zinc mining, supplied over 90 percent of the State output. Silver was recovered from ore produced at the Trout-Algonquin manganese-zinc mine in Granite County. The Alta silver mine in Jefferson County produced part of the year. Boss Mines, Inc., stopped operating the Boss silver-lead mine near Neihart, Cascade County.

Tungsten.—In Beaverhead County Minerals Engineering Co. ceased tungsten mining after Government purchases were completed. About 90 men, including work crews and the engineering staff, were affected by the shutdown. The company produced from the Ivanhoe mine near Glen and the Red Button property in the Wise River area. High-grade concentrate from the company mill was shipped to the national stockpile, and low-grade concentrate was shipped to the Salt Lake Tungsten Co., Salt Lake City, Utah, for conversion to a high-grade synthetic scheelite.

Uranium.—Small tonnages of uranium ore were shipped to out-of-State ore-buying stations from seven properties in the Pryor Mountains of Carbon County and from the Alhambra group, Jefferson County. Midland Mining Co. of Billings obtained a DMEA loan for a uranium-exploration project at the Sandra group, Carbon County.

A report was published on uranium and thorium deposits in Montana.³

Zinc.—Zinc output dropped 28 percent; the annual total was the lowest in 11 years. At Butte the Lexington mine was shut down on June 1, and the Anselmo mine was placed on a 5-day week in September. At year end the Anselmo was the only active lead-zinc mine at Butte. Over 95 percent of zinc in the State was produced by The Anaconda Co. from the Butte operations and from old smelter slag treated at the company East Helena fuming plant. Combined production at Butte and East Helena declined 29 percent. Output from other sources declined 19 percent; the Trout-Algonquin mine and the Scratch All mine (both in Granite County) and the Jack Waite mine (Sanders County) produced the largest tonnages from these sources.

³ Jarrad, Leonard D., Some Occurrences of Uranium and Thorium in Montana: Montana Bureau of Mines and Geol., Misc. Contribution 15, 1957, 90 pp.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Beaverhead.....	19		1,133	\$30,655	14,536	\$13,156
Broadwater.....	15	1	407	14,245	4,974	4,502
Granite.....	7		328	11,480	344,234	311,549
Jefferson.....	20		1,543	54,005	51,682	46,757
Judith Basin.....	2		1	35	448	405
Lewis and Clark.....	14		206	7,210	13,677	12,378
Liberty.....	1	1		455	457	414
Lincoln.....	1	2	13	140	154	139
Meagher.....	3	2	4	140	811	734
Missoula.....	5	1	30	1,050	1,423	1,288
Park.....	1			105	466	422
Ravalli.....	1		3	105	986	892
Silver Bow.....	19	2	27,312	955,920	5,068,834	4,537,551
Undistributed ¹	27	6	1,786	62,510	55,566	50,290
Total.....	128	13	32,766	1,146,810	5,558,228	5,030,477

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaverhead.....	6	\$3,612	379	\$108,394	44	\$10,208	\$175,025
Broadwater.....	1	602	41	11,726	19	4,408	35,483
Granite.....	26	15,652	377	107,822	1,619	375,608	822,111
Jefferson.....	14	8,423	261	74,646	76	17,632	201,468
Judith Basin.....			8	2,288	2	464	3,192
Lewis and Clark.....	9	5,418	761	217,646	5,139	1,192,248	1,434,900
Liberty.....	2	1,806					2,220
Lincoln.....			1	286			880
Meagher.....	4	2,408	18	5,148	1	232	8,662
Missoula.....	6	3,612	4	1,144			7,094
Park.....			5	1,430			1,852
Ravalli.....							997
Silver Bow.....	91,393	55,018,586	9,617	2,750,462	43,169	10,015,208	73,327,727
Undistributed ¹	50	30,180	1,828	522,808	451	104,632	770,340
Total.....	91,512	55,090,224	13,300	3,803,800	50,520	11,720,640	76,791,951

¹ Includes values and quantities that cannot be shown separately for Cascade, Fergus, Flathead, Gallatin, Madison, Mineral, Phillips, Powell, and Sanders Counties.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc, in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	2,932	500,172	8,463	1,110	4,421
February.....	3,034	565,997	8,583	1,071	4,622
March.....	3,431	600,773	9,081	1,160	5,012
April.....	3,306	540,363	7,698	1,469	5,826
May.....	3,215	507,102	7,318	1,299	4,889
June.....	2,704	423,480	7,131	1,113	3,316
July.....	2,034	441,836	7,473	1,006	3,735
August.....	2,318	413,650	7,343	1,176	4,119
September.....	2,716	401,585	6,708	1,109	3,501
October.....	2,566	403,549	7,260	996	3,816
November.....	2,515	385,627	7,438	892	3,641
December.....	1,995	374,094	7,016	899	3,622
Total.....	32,766	5,558,228	91,512	13,300	50,520

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1937, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	26	7,873	2,498	12,663	26,900	22,400	25,000
Dry gold-silver.....	13	13,791	1,488	84,360	23,800	442,300	140,000
Dry silver.....	17	92,023	1,982	370,234	62,347	51,800	21,300
Total.....	56	118,787	5,968	467,257	113,047	516,500	186,300
Copper.....	12	9,576,968	16,964	2,480,760	176,471,681	1,852,300	228,500
Lead.....	37	7,003	706	29,107	25,800	3,681,100	3,281,700
Lead-zinc.....	10	32,964	336	336,200	108,000	1,120,300	87,147,100
Zinc.....	8	² 1,007,289	7,957	2,243,989	3,515,076	19,412,400	87,147,100
Total.....	67	10,624,224	25,963	5,060,056	180,121,457	24,945,800	90,657,300
Other "lode" material:							
Dry gold:							
Mill cleanings.....	1	7	10	76	100	900	1,500
Old slag.....	1	(*)	22	73	-----	-----	-----
Copper: Precipitates.....	1	-----	-----	-----	2,788,396	-----	-----
Lead-zinc:							
Mill cleanings.....	1	93	1	667	1,000	16,100	14,700
Old tailings.....	1	10	-----	22	-----	400	100
Zinc: Old slag.....	1	51,838	-----	-----	-----	1,120,300	10,180,100
Total.....	6	51,996	33	838	2,789,496	1,137,700	10,196,400
Total "lode" material.							
Gravel (placer operations).....	13	(*)	802	77	-----	-----	-----
Total, lode and placer.....	138	10,790,009	32,766	5,558,223	183,024,000	26,600,000	101,040,000

¹ Figures do not necessarily add to total, because some mines produce more than 1 class of material.

² Includes 374,892 tons of manganese ore containing lead and zinc.

³ Less than 1/2 ton.

⁴ 171,146 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1937, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation.....	64	10	-----	-----	-----
Cyanidation.....	635	4,825	-----	-----	-----
Concentration, and smelting of concentrates:	-----	-----	-----	-----	-----
Ore.....	25,834	5,056,152	180,081,737	23,065,000	90,357,000
Old tailings.....	-----	22	-----	400	100
Total.....	26,533	5,061,009	180,081,737	23,065,400	90,357,100
Direct smelting:					
Ore.....	5,398	490,326	152,747	2,397,300	486,600
Mill cleanings.....	11	743	1,100	17,000	16,200
Old slag.....	22	73	-----	1,120,300	10,180,100
Copper precipitates.....	-----	-----	2,788,396	-----	-----
Total.....	5,431	497,142	2,042,243	3,534,600	10,682,900
Placer.....					
-----	802	77	-----	-----	-----
Grand total.....	32,766	5,558,223	183,024,000	26,600,000	101,040,000

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Material sold or treated (short tons)	Gold, lode and placer (fine ounces) ¹	Silver, lode and placer (fine ounces) ²	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Beaverhead County:									
Ajax.....	1	—	10	—	58	—	2,200	—	\$387
Argenta.....	8	—	4,911	1,132	11,099	11,500	736,400	87,300	168,556
Blue Wing and Bryant.....	3	—	411	1	3,379	500	19,400	—	6,069
Broadwater County:									
Backer, Cedar Plains, and Winston.....	5	1	117	144	184	—	8,800	1,300	6,617
Beaver.....	6	—	587	47	3,334	1,700	67,400	30,200	18,858
Park or Indian Creek.....	4	—	242	216	856	300	5,800	6,500	10,008
Granite County:									
Boulder Creek and Flint Creek.....	6	—	25,417	327	344,227	50,300	754,000	3,238,000	821,558
Dunkleburg.....	1	—	21	1	7	1,700	—	—	553
Jefferson County:									
Basin.....	1	—	2,044	568	5,542	4,300	20,000	16,100	31,988
Boulder, Cardwell, Clancy and Lump Gulch, and Elk Horn.....	6	—	716	414	6,012	7,200	104,800	26,800	40,194
Cantrac.....	6	—	127	48	1,877	1,100	1,900	2,200	3,850
Colorado.....	4	—	10,988	481	37,967	16,400	387,700	104,000	123,656
Goleruda.....	1	—	17	1	66	—	2,200	2,500	700
Whitehall.....	2	—	22	1	178	—	6,000	—	1,100
Judith Basin County: Barker.....	2	—	73	1	443	—	16,000	4,000	3,192
Lewis and Clark County:									
Canyon Ferry, Heddlston, and Scratch Gravel.....	7	—	2,156	43	9,337	11,000	352,300	72,600	72,066
Madison Gulch.....	1	—	11	2	—	—	—	—	70
Rimml.....	5	—	555	161	4,340	7,000	49,400	25,300	21,669
Sme'ter.....	1	—	51,883	—	—	—	1,120,800	10,180,100	1,341,095
Liberty County: East Butte.....	1	—	34	—	437	6,000	—	—	2,220
Lincoln County:									
Libby.....	1	—	—	4	134	—	—	—	140
Sylvanite.....	1	—	2	9	—	—	2,000	—	740
Meagher County:									
Beaver.....	1	—	101	4	809	100	36,000	2,000	140
Castle Mountain.....	1	—	34	—	2	7,900	—	—	6,142
Musselshell (Copperopolis).....	1	—	—	—	—	—	—	—	2,380
Missoula County:									
Clinton and Potomac.....	3	—	37	13	318	3,300	4,700	—	2,408
Copper Cliff.....	1	—	1	—	4	—	1,300	—	190
Nine Mile.....	1	—	—	13	—	—	—	—	455
Wallace.....	1	—	300	4	1,101	8,700	2,000	—	4,041
Park County: New World.....	1	—	11	—	466	—	10,000	—	1,852

Ravalli County:	1	22	3	986			892
Curlew	(1)						105
Overwich							
Silver Bow County:							
German Gulch	1	140	13				4,912
Highland and Summit Valley ¹	17	10,673,175	5,068,821		19,234,000	86,338,000	73,323,815
Undistributed ²	27	15,979	56,566		100,000	802,000	770,340
Total	125	10,790,009	32,766	5,558,228	183,024,000	26,600,000	76,791,951

1 Source of gold: 31,984 ounces from lode mines; 902 ounces from placers.
 2 Source of silver: 5,558,151 ounces from lode mines; 77 ounces from placers.
 3 Combined to avoid disclosing many confidential data.
 4 Includes gold recovered in 1937, many reported during the year.
 5 Includes values and quantities that cannot be shown separately for Montana districts, Cascade County, Cone Butte, Gilledge, and Warm Springs districts, Fergus County; Hog Heaven district, Flathead County; Deer Park district, Gallatin County; Alder Gulch, Pony or South Boulder, Sheridan, Silver Star, Tidal Wave (Twin Bridges) and Virginia City districts, Madison County; Cedar or Trout Creek and Saltese districts, Mineral County; Little Rockies district, Phillips County; Emery (Zosell), Finn, Nigger Hill, and Pioneer districts, Powell County; and Eagle and Prospect Creek (Burns) districts, Sanders County.

TABLE 13.—Mine production of uranium ore July 1–December 31, 1955, 1956, and 1957, by counties¹

County	July 1–December 31, 1955					1956					1957				
	Number of mines	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ‡	F. o. b. mine value ‡	Number of mines	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ‡	F. o. b. mine value ‡	Number of mines	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value ‡	F. o. b. mine value ‡
Broadwater.....	1	(⁴)	(⁴)	(⁴)	(⁴)	13	1,299	11,811	\$52,630	7	801	7,349	\$32,762	(⁴)	
Carbon.....	1	(⁴)	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	
Chouteau.....	1	(⁴)	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	(⁴)	
Fallon.....	1	(⁴)	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	(⁴)	
Jefferson.....	1	(⁴)	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	(⁴)	
Madison.....	1	(⁴)	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	1	(⁴)	(⁴)	(⁴)	(⁴)	
Total.....	3	(⁴)	(⁴)	(⁴)	(⁴)	15	1,318	11,866	52,800	8	(⁴)	(⁴)	(⁴)	(⁴)	

¹ Based on data supplied to the Bureau of Mines by the Atomic Energy Commission.

² Includes base price, grade premiums, and exploration allowance.

³ Figure withheld to avoid disclosing individual company confidential data.

The East St. Louis price of zinc dipped from 13.5 to 10 cents per pound during the year after remaining steady at the 13.5-cent quotation since January 1956. The price of zinc decreased because industrial demand decreased, particularly in the steel industry, the world overproduced and Government activity in connection with the barter program, under which foreign-produced zinc was acquired for supplemental stockpiling was curtailed.

Miscellaneous Metals.—Cadmium production from domestic and foreign base-metal ore totaled 1,548,100 pounds compared with 1,518,250 pounds in 1956, according to The Anaconda Co. annual stockholders' report.

NONMETALS

Barite.—The output of barite was slightly below that in 1956. Baroid Sales Division, National Lead Co., continued to be the only producer in the State. The company ground barite at its Greenough (Missoula County) plant mainly for use in rotary-drilling mud.

Cement.—The advances in cement production during the preceding 3 years ended, as output in 1957 declined about 12 percent in both volume and value. Ideal Cement Co., Montana Division, at Trident, Gallatin County, again was the only producer in the State. Limestone, gypsum, and silica rock were mined by the company, and iron ore was purchased. All these commodities were used in the manufacturing process. Most of the portland cement produced (84 percent) was used within the State; some was shipped to North Dakota (9 percent) and Wyoming (6 percent); the remainder went to Washington, Colorado, and Idaho.

Clays.—The combined production of bentonite, fire clay, and miscellaneous clay exceeded 1956 output and value by 2 and 9 percent, respectively. Bentonite, mainly for use as a bonding agent in refractories and for rotary-drilling mud, was dug near Alzada, Carter County, and fire clay for making refractories was mined in Cascade and Deer Lodge Counties. Miscellaneous clay from Fergus, Powell, and Yellowstone Counties furnished material for heavy clay products. The possibility of using shale from the Great Falls area for expanding to lightweight aggregate was discussed in an article.⁴

Fluorspar.—The output of fluorspar continued the climb begun in 1954; production which increased from 60,000 tons in 1956 to 64,000 in 1957, was accompanied by a substantial rise in value brought about by marketing a higher grade product. Cummings-Roberts (Darby, Ravalli County) the principal producer, completed installing a heavy-media plant for preparing high-grade concentrate to replace the washed-sized product derived from ore mined selectively. Finlen & Sheridan Mining Co. completed mining its Fish Creek deposit in southern Mineral County near the Idaho-Montana border. This deposit was discovered and developed in 1956.

Of the total State production, 61 percent was shipped to the GSA stockpile, 38 percent was consumed by the steel industry, and the remainder was used at metallurgical and cement plants.

Gem Stones.—Discovery of two sapphires, each weighing more than 4 carats, at the reactivated Yogo sapphire mine in Judith Basin

⁴ Sahinen, Uuno M., Expandable Shale in the Great Falls Area, Montana: Montana Bureau of Mines and Geol., Inf. Circ. 18, February 1957, 14 pp.

County was viewed optimistically by the new owners and operators. The deposit was worked intermittently during 1890-1927 but had been inactive since. Work on reopening the mine was begun in May, and crews made about 6,000 tons of material available for processing. A mill was planned for construction in 1958, according to Thomas P. Sidwell and Commercial Uranium Mines, the new owners.

Gypsum.—Tonnage and value of gypsum mined in the State declined about 30 and 28 percent, respectively, compared with 1956. Production was the lowest in over 10 years. United States Gypsum Co. (Shoemaker mine) and Ideal Cement Co. (Hanover mine) both in Fergus County produced the only gypsum in the State. Ground gypsum, wallboard, and lath were marketed by the former company, and the cement company consumed the commodity in the manufacturing process.

Lime.—Two companies (Deer Lodge and Powell Counties) contributed to the lime output that reached a new high, 17 percent above the 1956 total and almost 4 times greater than 1946. Most of the production was quicklime for use at metallurgical plants and ore concentrators. Chemical works, petroleum refineries, and plants for water purification and softening used small quantities of quick and hydrated lime.

Mica.—A small quantity of hand-cobbed mica was recovered from the Thumper Lode near Gallatin Gateway, Gallatin County. The output was shipped to the GSA stockpile at Custer, S. Dak.

Phosphate Rock.—The upward trend in output of marketable phosphate rock of the preceding 6 years was reversed, at least temporarily, in 1957; tonnage and value were slightly less than in 1956. Producers included: Montana Phosphate Products Co. (Powell County), Victor Chemical Works (Beaverhead and Silver Bow Counties), J. R. Simplot Co. (Beaverhead County), and George A. Relyea (Powell County). Phosphate rock produced in the State was converted to elemental phosphorus, phosphoric acid, and phosphate fertilizers. Some of the output was exported to British Columbia. Rock mined at Conda, Idaho, was processed to triple superphosphate and phosphoric acid by The Anaconda Co. at Anaconda, Deer Lodge County. The company announced that its ammonium phosphate plant being constructed at Anaconda would be completed and put into operation early in 1958.

Pyrite.—The quantity of pyrite converted to sulfuric acid by The Anaconda Co. (Deer Lodge County) for use at its chemical-fertilizer plant and metallurgical works increased 15 percent. The product was recovered from Silver Bow County base-metal ores.

According to The Anaconda Co. annual report to shareholders, in March a fluosolids roaster-reactor and a 200-ton-per-day contact sulfuric acid plant unit were completed and put into production at Anaconda. The installation of this third unit marked the completion of a long-range program to modernize the acid plant by replacing the chamber process that had been in operation since World War I.

Sand and Gravel.—Production of this commodity rose from 10 million tons (\$7.2 million) in 1956 to 11.1 million tons (\$8.2 million) in 1957, principally because an expanded program by the city of Great Falls (Cascade County) required large quantities of paving sand and gravel. Road construction and maintenance by the State

highway department and Bureau of Public Roads also contributed to this increase. Sand and gravel production was reported from 33 of the 56 counties in the State.

Sand and gravel was distributed by use as follows: Road material, 83 percent; building purposes, 14 percent; and railroad ballast and miscellaneous, 3 percent. Some engine sand was also produced. Compared with 1956, sand and gravel for use as building and road material increased 18 percent in each category, and railroad ballast and miscellaneous applications declined about 60 percent each.

Eighty-four percent of the sand and gravel produced in 1957 was reported crushed, washed, screened, or otherwise processed before marketing, and 16 percent was used as pit-run material. Ninety-four percent of all sand and gravel was shipped by truck; the remaining 6 percent was transported by rail.

TABLE 14.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

	1956			1957			Change in tonnage (percent)
	Short tons	Value	Average	Short tons	Value	Average	
COMMERCIAL OPERATIONS							
Sand and gravel:							
Building.....	942,214	\$1,297,885	\$1.38	1,393,040	\$1,426,423	\$1.02	+48
Road material.....	1,136,057	1,196,700	1.05	968,319	1,232,751	1.27	-15
Railroad ballast.....	598,032	523,895	.88	243,762	201,158	.82	-59
Other.....	293,894	144,278	.49	118,802	87,988	.74	-60
Total.....	2,970,197	3,162,758	1.06	2,723,923	2,948,320	1.08	-8
GOVERNMENT-AND-CONTRACTOR OPERATIONS							
Sand and gravel:							
Building.....	347,585	180,875	.52	131,516	139,893	1.06	-62
Road material.....	6,706,588	3,830,177	.57	8,252,105	5,062,224	.61	+23
Total.....	7,054,173	4,011,052	.57	8,383,621	5,202,117	.62	+19
ALL OPERATIONS							
Sand and gravel:							
Building.....	1,289,799	1,478,760	1.15	1,524,556	1,566,316	1.03	+18
Road material.....	7,842,645	5,026,877	.64	9,220,424	6,294,975	.68	+18
Railroad ballast.....	598,032	523,895	.88	243,762	201,158	.82	-59
Other.....	293,894	144,278	.49	118,802	87,988	.74	-60
Grand total.....	10,024,370	7,173,810	.72	11,107,544	8,150,437	.73	+11

¹ Includes engine and ballast sand and sand and gravel used for miscellaneous unspecified purposes.

Stone.—The output of stone more than doubled in both quantity (2.6 million tons) and value (\$3.7 million) compared with 1956. The largest advances were made by basalt and sandstone; miscellaneous stone output increased about 30 percent; and granite and limestone declined 25 and 23 percent, respectively. Construction work at the Washington Water Power Co. Noxon Rapids Dam (Sanders County) accounted for most of the basalt consumed (riprap), and road requirements of the city of Great Falls (Cascade County) caused the surge in sandstone use.

Stone was quarried in 17 of the 56 counties in the State. The

principal uses, in order of tonnage, were riprap (basalt, granite, limestone, sandstone), roadstone (basalt, sandstone, limestone, miscellaneous), railroad ballast (basalt, sandstone), and others, including limestone for manufacturing cement and lime and for use at metallurgical plants and sugar refineries. The output of crushed limestone increased to 783,000 tons in 1957, a 2-percent increase over the preceding year. Limestone was quarried in Broadwater, Carbon, Cascade, Deer Lodge, Gallatin, Jefferson, and Park Counties. The Ideal Cement Co. plant at Trident, Gallatin County, continued as the leading consumer of limestone in the State, using 2-percent more compared with 1956. Limekilns, metallurgical plants, and sugar refineries also used limestone. Quartzite was quarried near Melrose, Beaverhead County, for use at the Victor Chemical Works electric-furnace elemental-phosphorus facility at Silver Bow. A quantity of dimension granite was quarried in Jefferson County.

Sulfur.—Recovery of high-purity elemental sulfur from refinery gases by Montana Sulphur & Chemical Co. increased about fourfold. The sulfur-recovery plant (the only source of elemental sulfur in the State) near Billings, Yellowstone County, completed in June 1956, used residual gases from two nearby oil refineries.

Talc.—Talc output and value decreased 16 and 8 percent, respectively, compared with 1956. Production was reported from 4 operations in Madison County and 1 in Beaverhead County. Part of the output was processed at the new grinding plant at Barratts, Beaverhead County, and the rest was shipped out of State for grinding. The use of talc compared with 1956 changed; its distribution was as follows (1956 tonnages in parentheses): Paint, 49 percent (46 percent); ceramics, 30 percent (44 percent); asphalt filler, 8 percent; and miscellaneous, including paper, rice polishing, and textiles, 13 percent (10 percent).

Vermiculite.—Zonolite Co. was the only producer of crude vermiculite in Montana and the principal source of the commodity in the Nation. Its output, which was slightly below the 1956 total, came from an open pit near Libby, Lincoln County. Some of the mined product was expanded by a company in Great Falls, Cascade County; however, the bulk of the output was exfoliated outside the State. The uses of locally expanded vermiculite remained virtually unchanged—insulation, lightweight aggregate, and soil conditioning.

MINERAL FUELS

Coal.—The output and value of bituminous coal and lignite declined for the 13th consecutive year; decreases of 51 percent in quantity and 38 percent in value were recorded. The production came from 27 mines in 11 counties. Musselshell and Rosebud Counties furnished 85 percent of the output. Bituminous coal was also mined in Blaine, Carbon, Cascade, and Hill Counties; lignite was produced in Custer, Dawson, Powder River, Richland, and Sheridan Counties.

At Red Lodge, Carbon County, the Koal Krudes, Inc., plant for making char, creosote, and other byproducts from bituminous coal was completed.

Petroleum and Natural Gas.⁵—Crude-oil production reached a new

⁵ Production figures for crude oil and natural gas, by fields, were obtained from Montana Oil and Gas Statistical Bulletin, a monthly publication of State Oil and Gas Conservation Commission.

high of 27.2 million barrels in 1957, a 25-percent increase compared with the preceding year. The value of production, \$73.5 million, ranked this commodity first in Montana and constituted 38 percent of the total value of mineral output in the State. The principal producing fields were Pine, Poplar East, Cabin Creek, Elk Basin, Cut Bank, and Sumatra. The combined production from these fields supplied 73 percent of the crude petroleum produced. There were 3,792 producing wells in Montana at the end of the year compared with 3,640 wells at the end of 1956. The average daily production in 1957 was 74,300 barrels—an increase of 14,700 barrels per day over the 59,600 barrels in 1956. New oilfield discoveries during the year were Clark's Fork North, Carbon County; Delphia, Musselshell County; Line Coulee, Daniels County; Outlook, Sheridan County; and Pennel, Fallon County. Certain fields mentioned had previously produced; however, oil in other geologic formations of these fields was newly discovered during the year.

In 1957, 10 refineries in the State refined 23.0 million barrels of crude oil. Montana wells supplied 9.2 million barrels or about 40 percent of the total; Wyoming, 59 percent; and Canada, under 1 percent. Shipment of 17.6 million barrels was reported for 1957, an increase of 43 percent over the 12.3 million barrels of crude petroleum shipped in 1956. Drilling activity decreased from 493 wells drilled in 1956 to 432 wells during 1957, when the total footage was 2.1 million feet. Of the 432 wells drilled, 256 were development wells and 176 exploratory ventures.

The Carter Oil Co. in November announced its plans for expanding the capacity of the company refinery at Billings from 24,000 to 34,000 barrels per day (36 percent) because of the increased demand for various refinery products.

Marketed production of natural gas in 1957 was 30.2 billion cubic feet, an increase of 17 percent over the 25.8 billion cubic feet produced in 1956. The Cut Bank (including Reagan) field in Glacier and Toole Counties produced 14.5 billion cubic feet and continued to lead in production. It was followed, in order of output, by Cedar Creek, Keith Block, Dry Creek, Bowdoin, Whitlash, Kevin-Sunburst, and Pine; each of these fields yielded over 1 billion cubic feet of gas.

REVIEW BY COUNTIES

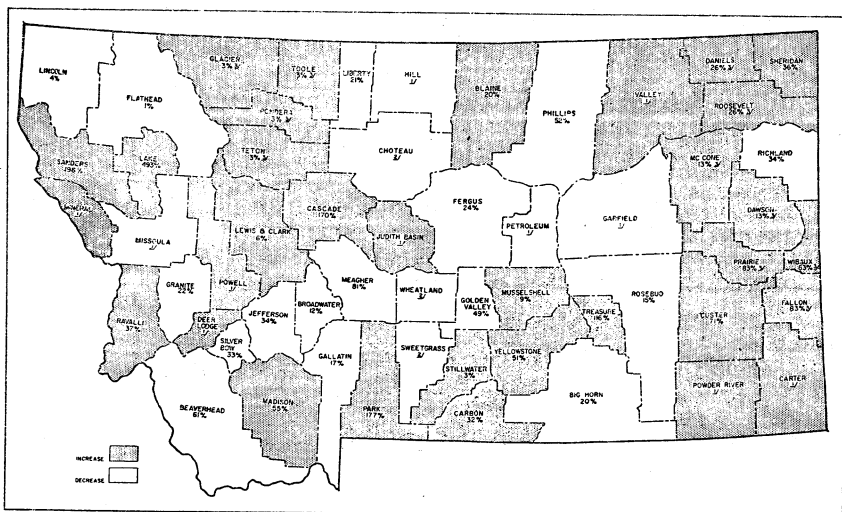
The 11-county area west of the Continental Divide produced virtually all the metals mined in the State and a variety of nonmetals as well, including phosphate rock, fluorspar, vermiculite, and barite. Petroleum, natural gas, and coal were recovered east of the divide; counties in the Williston Basin along the eastern Montana border supplied the major share of the petroleum output.

Chouteau, Sweet Grass, and Wheatland Counties reported no mineral production; Lake, Treasure, and Valley Counties produced only sand and gravel. All other counties are listed in the following review for 1957.

Beaverhead.—Minerals Engineering Co. suspended tungsten mining at the Ivanhoe mine near Glen and the new Red Button property in the Wise River district following completion of the Government purchase program for tungsten. The same company explored a huge

deposit of iron ore in the Dillon area. Preliminary work indicated that the deposit exceeded 200 million tons. Shipments to the Government low-grade stockpile were made from the Blue Ore and Gob manganese mines.

Except for Minerals Engineering Co. tungsten operations, the Ida B. Hand Maulden mine in the Argenta district was the principal metal producer in the county. The mine shipped 2,700 tons of crude lead ore with a gross metal content of 500 ounces of gold, 4,700 ounces of silver, and 700,000 pounds of lead, well below comparable totals for 1956. Five other lead mines were active in the Argenta district, and gold ore from the Yellowband mine was treated by cyanidation by French Creek Mining Co. In the Blue Wing district the Charter Oak lead mine produced. Lively Mining Co. constructed a 100-ton mill at the Hecla mine, Bryant district, and made a test run of 400 tons of lead ore from the Franklin open-pit mine.



¹ Figure withheld to avoid disclosing individual company confidential data.

² No production in 1957.

³ Percentage for Daniels and Roosevelt; Dawson and McCone; Fallon, Prairie, and Wibaux; and Glacier, Pondera, Teton, and Toole represents combined county totals because of joint oilfield production.

FIGURE 3.—Change in value of county mineral production, 1956 to 1957.

Near Melrose the Victor Chemical Works Canyon Creek mine produced a substantially increased tonnage of phosphate rock, which was shipped to its elemental-phosphorus plant at Silver Bow. Quartzite for fluxing was mined in the vicinity. The production of phosphate rock by J. R. Simplot Co. at the Centennial open pit in the Centennial Mountains near Lakeview also increased sharply. The rock was shipped to a chemical-fertilizer plant in Alberta, Canada. Talc, mined by Tri-State Minerals Co. at its Smith-Dillon operation, was ground at its plants near Barratts and at Ogden (Utah).

Big Horn.—Recovery of crude petroleum, the principal mineral industry in the county, was 87,000 barrels less than 1956. This production came from the Soap Creek, Ash Creek, and Hardin fields.

Natural gas recovered from the Hardin field totaled 52.2 million cubic feet. Two commercial concerns marketed sand and gravel.

Blaine.—Crude-oil production again declined; recovery from the Bowes field was 306,000 barrels (about 33,000 less than 1956). The

TABLE 15.—Value of mineral production in Montana, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Beaverhead.....	\$5,424,390	\$2,137,751	Tungsten, phosphate rock, lead, gold, stone, silver, zinc, copper, talc.
Big Horn.....	469,661	377,407	Petroleum, sand and gravel.
Blaine.....	498,792	600,835	Petroleum, coal.
Broadwater.....	147,292	129,493	Iron ore, sand and gravel, gold, lead, silver, zinc, stone, copper.
Carbon.....	5,707,187	7,541,080	Petroleum, stone, coal, uranium, sand and gravel, vanadium.
Carter.....	(2)	336,117	Clays, petroleum.
Cascade.....	1,011,508	2,735,421	Sand and gravel, stone, silver, coal, lead, zinc, clays, gold.
Chouteau.....	(2)		
Custer.....	93,695	159,930	Sand and gravel, coal.
Daniels and Roosevelt ²	10,541,491	13,320,054	Petroleum.
Dawson and McCone ³	3,007,459	3,395,036	Petroleum, sand and gravel, coal.
Deer Lodge.....	645,498	(2)	Lime, stone, sand and gravel, clays.
Fallon, Prairie, and Wibaux ⁴	14,518,923	26,531,841	Petroleum, sand and gravel.
Fergus.....	(2)	(2)	Gypsum, stone, clays, sand and gravel, gold, lead, zinc, silver.
Flathead.....	373,071	367,607	Stone, sand and gravel, gold, silver.
Gallatin.....	(2)	(2)	Cement, stone, sand and gravel, lead, mica, silver.
Garfield and Petroleum ⁵	(2)	444,121	Petroleum.
Glacier, Pondera, Teton, and Toole ⁶	12,774,203	13,109,168	Petroleum, sand and gravel, stone.
Golden Valley.....	(2)	(2)	Petroleum.
Granite.....	1,656,671	1,286,166	Zinc, silver, manganese ore, sand and gravel, lead, manganese ore, copper, gold.
Hill.....	(2)	68,080	Sand and gravel, coal.
Jefferson.....	444,779	293,054	Stone, lead, gold, silver, zinc, copper, uranium.
Judith Basin.....	38,877	(2)	Iron ore, sand and gravel, lead, zinc, silver, gold.
Lake.....	(2)	(2)	Sand and gravel.
Lewis and Clark.....	(2)	(2)	Zinc, sand and gravel, lead, stone, silver, gold, copper.
Liberty.....	(2)	(2)	Petroleum, copper, silver.
Lincoln.....	(2)	(2)	Vermiculite, gold, sand and gravel, lead, silver.
Madison.....	(2)	(2)	Talc, copper, gold, silver, lead.
Meagher.....	44,904	8,662	Lead, copper, silver, zinc, gold.
Mineral.....	87,912	(2)	Fluorspar, sand and gravel, gold, lead, silver.
Missoula.....	371,299	(2)	Barite, sand and gravel, stone, copper, silver, lead, gold.
Musselshell.....	2,855,828	3,121,795	Petroleum, coal, stone.
Park.....	90,065	249,169	Stone, sand and gravel, lead, silver.
Phillips.....	239,940	114,924	Sand and gravel, gold, silver, zinc.
Powder River.....		(2)	Coal.
Powell.....	(2)	2,517,354	Phosphate rock, lime, sand and gravel, gold, stone, clays, lead, silver.
Ravalli.....	(2)	(2)	Fluorspar, sand and gravel, silver, gold.
Richland.....	105,978	69,733	Petroleum, coal.
Rosebud.....	(2)	(2)	Petroleum, coal, sand and gravel.
Sanders.....	537,105	1,598,560	Stone, lead, zinc, copper, silver, gold.
Sheridan.....	303,868	412,734	Petroleum, coal, sand and gravel.
Silver Bow.....	118,213,646	79,428,266	Copper, zinc, manganese, silver, lead, gold, phosphate rock, pyrite, sand and gravel, stone.
Stillwater.....	3,814,883	3,925,431	Chromite, petroleum.
Sweet Grass.....	1,755		
Treasure.....	9,000	19,440	Sand and gravel.
Valley.....		(2)	Do.
Yellowstone.....	1,431,345	2,158,708	Petroleum, sand and gravel, sulfur, clays.
Undistributed ⁴	29,225,762	26,006,000	
Total ⁵	213,781,000	191,728,000	

¹ Wheatland County is 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, and sand and gravel that cannot be assigned to specific counties and values indicated by footnote 2.

⁵ Total adjusted to eliminate duplicating value of stone. 1956 total has been revised.

field also yielded about 835 million cubic feet of natural gas. A small quantity of bituminous coal was mined at one operation.

Broadwater.—The Iron Cross mine continued to supply iron ore to a cement plant at Trident, Gallatin County. Small values in gold, silver, and lead were recovered in Backer, Beaver, Cedar Plains, Park (Indian Creek), and Winston districts. The leading producer was the Klineschmidt lead mine, Beaver district, which shipped 500 tons of ore. The mine was closed down by the end of the year as a result of high costs and declining metal prices. Dance & Anders produced from the Marietta gold mine in Park (Indian Creek) district.

Carbon.—Small tonnages of uranium ore were shipped from mines in the Pryor Mountains to AEC ore-buying stations at Riverton, Wyo., and Grand Junction, Colo.

Carbon County ranked fourth in the State in output value of non-metals and fuels and dropped from third to fourth as a source of petroleum, despite an increase of 500,000 barrels in output. The Elk Basin field continued to be the major producing area. Natural gas was recovered at the Dry Creek, Golden Dome, and Elk Basin fields. Limestone produced at the Warren quarry by Bighorn Limestone Co. (Denver, Colo.) was used at sugar refineries. Bituminous coal was mined by two companies. Sand and gravel production was reported by two companies, and the Northern Pacific Railway Co. used gravel for maintenance.

Carter.—Bentonite was produced at the Alzada pit by Baroid Sales Division, National Lead Co.; Carter County led the State in clay output. The quantity mined was larger than in 1956. Recovery of crude oil from the Repeat field dropped about 11,000 barrels compared with the preceding year.

Cascade.—The completion of 1 of 3 new electrolytic-tank systems at the Great Falls copper refinery of The Anaconda Co. resulted in improving both technical and labor efficiency. At the zinc plant a new zinc-casting conveyor was placed in operation, and equipment for handling concentrate from railroad cars to the zinc roaster was being modernized. Anaconda Wire & Cable Co. operated copper and aluminum rod and wire mills adjacent to the Great Falls plant of The Anaconda Co. and produced many types and sizes of aluminum and copper wire and cable.

The Boss Mines, Inc., Rochester-Boss-Atlantus silver-lead mine, Montana district, the only active metal mine in the county, was shut down after midyear.

Cascade County continued to lead in sand and gravel production and in stone output in Montana—the first production of stone, at least in recent years. Sandstone was the principal product; basalt for rubble and limestone for riprap also were quarried. The city of Great Falls road department used all of the sandstone output and the bulk of the sand and gravel prepared. Four commercial concerns produced structural and paving sand and gravel; the United States Army Corps of Engineers and the county highway department used paving gravel; and the Great Northern Railway Co. employed gravel for railroad ballast. Bituminous coal was mined at one place. Fire clay from the Armington pit was made into refractories for use at the Anaconda metallurgical works (Deer Lodge County). Vermiculite

from Libby, Lincoln County, was expanded at the Great Falls plant of Robinson Insulation Co.

Custer.—Mineral activity in the county was limited to producing sand and gravel and lignite. Two commercial operators prepared structural and paving sand and gravel. Gravel for structural and paving purposes was used by the Bureau of Reclamation and the county highway department, respectively. Great Northern Railway Co. and Chicago, Milwaukee, St. Paul & Pacific Railroad Co. were furnished gravel for ballast. One company mined lignite.

Daniels and Roosevelt.—Bredette-North, an oilfield brought into production in 1956, extends over the Roosevelt County line into Daniels County, making it desirable to consider these counties as a unit for the purposes of this report. The total production of 4.8 million barrels was valued at \$13.3 million; this area ranked second as a source of petroleum in the State in 1957. The recovery from the 3 fields within Roosevelt County rose from 4.1 million barrels (\$10.4 million) in 1956 to 4.6 million barrels (\$13.0 million) in 1957. Daniels County first field (Line Coulee) came into production. Poplar East in Roosevelt County continued as the major field in the State; recovery increased almost 1 million barrels to 4.6 million barrels (\$12.8 million) compared with 1956. Production from Bredette-North almost tripled the 1956 total (52,000 barrels to 145,000).

Dawson and McCone.—These counties were combined for purposes of reporting petroleum production, because the Richey field extends from McCone County into Dawson County. The output from the area was higher than in 1956. In McCone County recovery from the Richey Southwest field declined substantially. Conversely, the output from fields in Dawson County increased significantly. Deer Creek, Gas City, Glendive, Woodrow, and Yellowstone fields contributed to the yield. Three mines in Dawson County produced lignite. Sand and gravel was processed for structural and paving purposes.

Deer Lodge.—At the Anaconda Reduction Works, The Anaconda Co. continued on a reduced scale the program of modernizing and expanding the copper concentrator. The changes resulted in lowering the costs of concentrating as well as improving the grade of concentrate, which in turn benefited smelter operations. The last of three new grinding units was placed in operation in September. A leach-precipitation-float process developed by the company to recover oxide copper from Kelley-mine ore was suspended, as the lower oxide copper values of the ore made it more economical to treat it by direct flotation.

The company began constructing storage bins to improve handling methods at the East Anaconda crushing and conveying plant. The bins were to provide ore blending and surge facilities to improve the rate of concentrator operation.

A new electric furnace for melting zinc cathodes was completed. Installation of an electric furnace for treating Yerington (Nev.) copper precipitate was postponed temporarily. A 50-ton pilot plant to extract alumina from domestic clays was to be completed early in 1958. The plant was being constructed to confirm operating methods

and costs of the new process, which had been demonstrated previously in a small test plant.

Small tungsten mines in the county were inactive.

Limestone from Brown's quarry was burned to quicklime by The Anaconda Co. for use in its ore-processing and metallurgical operations. A small quantity of the stone also was employed by the company for road metal and railroad ballast. Sand and gravel was produced by one company for structural and paving purposes.

The Anaconda Co. processed various nonmetals from sources outside the county for use at the Anaconda Reduction Works. Included were pyrite from Silver Bow County base-metal ores, converted to sulfuric acid for use at the phosphate plant; phosphate rock from Conda, Idaho, converted to triple superphosphate fertilizer and phosphoric acid; and clay from Cascade County for use at the reduction works refractory plant.

Fallon, Prairie, and Wibaux.—Production of petroleum in Fallon County (leading source in the State) combined with output of the Pine field (the largest producing field in the State—it underlies parts of Fallon, Prairie, Wibaux, and Dawson Counties) represented 38 percent of the State crude-oil total. This area was the major source of petroleum in Montana. The recovery from the Pine field increased from 3.8 million barrels (\$9.1 million) in 1956 to 5.4 million barrels (\$14.2 million) in 1957. Six fields in Fallon County yielded over twice the combined output in 1956. A total of 4.8 million barrels valued at \$12.4 million was recovered. The Cabin Creek field, the second ranking producer in the State within 1 county, yielded 3.7 million barrels (\$9.7 million) also more than double the 1956 output. Withdrawals of natural gas were made from the Cedar Creek field, second ranking producer in the State (4.5 billion cubic feet), and from the Plevna field and the Cabin Creek field, which began producing in April. One billion cubic feet of natural gas came from the Pine field.

Fergus.—The Black Bull gold mine produced in the Warm Springs district.

Gypsum was mined at the Shoemaker mine near Heath by the United States Gypsum Co. and by the Ideal Cement Co. at the Hanover mine. Work of the United States Army Corps of Engineers required sandstone for riprap and gravel for paving. Building brick was made from clay dug near Lewistown.

Flathead.—Anaconda Aluminum Co. reduced its output at the Columbia Falls aluminum-reduction plant in midyear after demand for the metal declined. Beginning July 1, operations were at 75 percent of capacity.

Gallatin.—The county led the State in dollar value of nonmetal commodities and ranked fifth when compared with counties producing petroleum. Ideal Cement Co., Montana Division, continued to be the principal mineral industry in the county and the only cement producer in the State. Limestone from the Trident quarry was used at the plant. Granite and limestone for riprap and paving gravel were used by the county highway department. Three commercial concerns processed structural and paving sand and gravel. A small quantity of hand-cobbed mica was sent to the GSA stockpile at Custer, S. Dak.

Garfield and Petroleum.—Production of crude oil from the Cat

Creek field (underlying Garfield and Petroleum Counties) reversed a 9-year decline and increased modestly—from 164,000 barrels (\$423,000) in 1956 to 165,000 barrels (\$443,000) in 1957. Recovery from the Rattlesnake Butte field in Petroleum County was a little less than half of the 1956 total.

Glacier, Pondera, Teton, and Toole.—These counties were combined because Cut Bank, the oilfield ranking fifth in Montana and the principal gasfield (including Reagan), is partly within Glacier, Pondera, and Toole Counties; the Pondera field is under part of Pondera and Teton Counties. Recovery from the area was 3.1 million barrels worth \$9.3 million—a small decrease in quantity and a slight increase in value compared with 1956. The Cut Bank field furnished 58 percent of the 4-county total crude-oil production and 14.5 billion cubic feet of natural gas. This compared favorably with 41 percent and 13.8 billion cubic feet, respectively, in 1956. The Pondera field, with 588,000 barrels, continued to place third in the county grouping.

Toole County production was the largest of any single county in the group. Kevin-Sunburst, the major field in the county, ranked second in the area, and yielded 956,000 barrels compared with 1 million in 1956. This field also contributed 1.2 billion cubic feet of natural gas. In Glacier County the Blackfoot field came into production. Reagan, the principal field, declined slightly in output.

Sand and gravel for structural and paving purposes was produced in Teton, Toole, and Glacier Counties. The Bureau of Reclamation used sandstone for riprap in Teton County.

Golden Valley.—A very small quantity of crude oil was recovered from the Woman's Pocket field. The Big Coulee gasfield, which extends into Stillwater County, yielded 424 million cubic feet of natural gas.

Granite.—Large tonnages were shipped to the GSA low-grade manganese-ore stockpile by Trout Mining Division (Trout-Algonquin mine), Taylor-Knapp Co. (Moorlight mine), Peter Antonioli (Scratch All mine), James Hunter (Climax mine), and Jennie M. Moore (Mystery mine). Trout Mining Division also consigned lead and zinc concentrate and manganese concentrate through commercial channels, Taylor-Knapp Co. shipped a small tonnage of sinter under the carlot program, and Peter Antonioli marketed zinc ore.

Hill.—Sand and gravel was produced by one concern, and one company mined bituminous coal. A small quantity of natural gas was recovered from the Box Elder field that extends into Blaine County. No production of crude oil was reported for the Rudyard field (opened in 1955).

Jefferson.—The number of metal mines producing dropped from 30 in 1956 to 20 in 1957. Mining was on a small scale, and the value of gold, silver, copper, lead, and zinc totaled only \$201,000. In Basin district Basin Jib Gold Mines, Inc., terminated gold mining in December. The mill was closed throughout 1957; about 2,100 tons of dump ore was shipped crude to a smelter. Clancy and Lump Gulch district output was principally lead ore from the Nellie Grant mine (Central Mines, Inc.) and gold cleanup material from the Mammoth property (Huckaba and Payne). Lahey Leasing Co. continued to operate the Alta silver-lead mine in Colorado district.

The Alhambra group shipped a small tonnage of uranium ore to Salt Lake City.

Limestone for fluxing purposes was obtained from the McClellan Creek quarry by Maronick Limestone Co. A small quantity of monumental granite also was quarried and dressed.

Judith Basin.—Iron ore was shipped to eastern metallurgical centers from the Willow Creek mine of Young-Montana Corp. southwest of Stanford. Operations were active from May to October.

Lewis and Clark.—American Smelting & Refining Co. treated ore and concentrate from Montana, Idaho, and foreign sources and zinc-plant residue from Great Falls and Anaconda at its East Helena lead smelter throughout the year. Coke breeze used in sintering, silica in the form of low-grade ore, limestone, and scrap iron were purchased locally. Blast-furnace coke was obtained from British Columbia, Canada. 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 tonnage recovered from the old dump slag was credited by the Bureau of Mines to current metal-production statistics, supplying most of the metal output of Lewis and Clark County. Active lode mines included Nick & Dick (lead ore, Canyon Ferry district), Mike Horse (lead ore, Heddeleston district), and Silver Crescent (gold-silver ore, Rimini district).

Liberty.—The Anaconda Co. shipped a small tonnage of copper ore from the Sweetgrass prospect in East Butte district.

Crude-oil output in the county declined from 134,000 barrels (\$316,000) in 1956 to 120,000 barrels (\$313,000) in 1957. Whitlash continued to be the major field. The Keith Block (ranking third in the State), Whitlash, Utopia, Flat Coulee, and Bears Den gasfields yielded 4.8 billion cubic feet of natural gas.

Lincoln.—Zonolite Co. continued as the leading producer of crude vermiculite in the Nation. A small quantity of sand and gravel was processed by one company.

Madison.—Ruby Valley Development Co. began to rehabilitate the Red Pine gold mine, consisting of seven claims in the Sheridan district. Yellowstone Uranium Co. shipped ore containing gold, silver, and copper from the Shamrock No. 1 mine, Silver Star district. Farnsworth & Brooks produced gold-silver ore from the El Fleeda mine, Virginia City district.

The bulk of the talc output in the State came from the Sierra Talc & Clay Co. Yellowstone mine near Norris and Beaverhead mine near Alder, the Tri-State Minerals Co. Treasure State and Keystone mines near Dillon, and American Chemet Corp. Sweetwater mine near Dillon. Tri-State Minerals Co. ground a quantity of the output at its Barratts mill and shipped some crude and coarsely ground talc to its Ogden (Utah) plant for reduction to micron sizes. The output from the Sierra Talc company mines was shipped to the company grinding plant at Grand Island, Nebr. American Chemet Corp. maintained a mill at East Helena, Lewis and Clark County.

Meagher.—Feusner Mining Co. shipped manganiferous ore from the Little Belt mine, 22 miles east of White Sulphur Springs, to the Government low-grade stockpile.

H. O. Mining Co. opened 80 feet of an old shaft, drove 100 feet of new development drift, and sank 50 feet of winze at the Cumber-

land lead mine, Castle Mountain district. The Copper Duke copper mine was developed by Ben Rux in Musselshell (Copperopolis) district.

Mineral.—Finlen & Sheridan Mining Co. mined fluorspar at a deposit on Fish Creek in the southern part of the county. The Bureau of Public Roads and the county highway department used gravel for roadwork.

Missoula.—Pioneer Corp. ended operations at the Arrowhead manganese mine. Hera Exploration Co. completed a 50-ton flotation mill at the Hera mine and made several test runs. A small quantity of bulk concentrate containing values in silver, copper, and lead was shipped. A bulletin describing the mines and mineral deposits in Missoula and Ravalli Counties was published.⁶

Barite mining by Baroid Sales Division, National Lead Co., was the principal mineral industry in the county. Three commercial operations prepared sand and gravel. Chicago, Milwaukee, St. Paul & Pacific Railroad Co. used gravel for railroad ballast and granite for riprap, and Northern Pacific Railway Co. utilized stock-car sand and sandstone for ballast. The Bureau of Public Roads used basalt for roadwork.

Musselshell.—Petroleum and bituminous coal were the major minerals produced in the county. Crude-oil output increased 338,000 barrels over 1956 and reached a total value of \$2 million. Bituminous-coal yield led the State. The Roundup mine of Roundup Mining Co. was the largest of 10 mines contributing to the total tonnage. A small quantity of sandstone for riprap was used by the Chicago, Milwaukee, St. Paul & Pacific Railroad Co.

Park.—The Hudson lead mine (Mus Bros., New World district) was active.

Phillips.—Northern Mining & Milling Co. produced from the Hawkeye gold mine and 100-ton flotation mill in Little Rockies district, and Little Rockies Mining & Development Co. shipped gold-silver ore from the Little Ben mine in the same district.

Natural-gas withdrawals from the Bowdoin field, which extends into Valley County, totaled 1.8 billion cubic feet, slightly less than 1956. In 1957 this field ranked fifth in the State as a source of natural gas. Two companies provided sand and gravel, and Great Northern Railway Co. used gravel for ballast and other purposes.

Powder River.—One mine furnished a small tonnage of lignite.

Powell.—Montana Gold & Chemical Co. produced from March to December by bucketline dredging at the Reservoir gold placer near Gold Creek.

Phosphate rock for export to Trail and Kimberley, British Columbia, was mined by Montana Phosphate Products Co. near Garrison. The Anderson and Luke mines were active; most of the output came from the Anderson. An improved phosphate-rock planer was designed by the Federal Bureau of Mines and test-operated at the Anderson mine. An earlier model was in operation at the mine in 1956. The objective of the project was to develop a low-cost, high-recovery, underground-mining method applicable to western phosphate deposits. The planer has a vibrating pneumatic blade patterned after a fixed-

⁶ Sahinen, Uno M., Mines and Mineral Deposits, Missoula and Ravalli Counties, Montana: Montana Bureau of Mines and Geol. Bull. 8, 1957, 63 pp.

blade device used for continuous longwall mining of narrow seams of friable coal. George Relyea also produced phosphate rock in the Garrison area.

Limestone was burned to lime by Elliston Lime Co., 18 miles west of Helena. Both quick and hydrated lime were marketed for building, chemical, and other industrial purposes. Sand and gravel was produced by one company, and the Chicago, Milwaukee, St. Paul & Pacific Railroad Co. used gravel for ballast. Clay for making building brick was dug west of Blossburg by Western Clay Manufacturing Co.

Ravalli.—A bulletin delineating mines and ore deposits in the county was published.⁷

Fluorspar mining at the Crystal Mountain open pit by Cummings-Roberts was the principal mineral industry in the county during 1957. Work at the mine, 15 miles east of Darby at an elevation of 7,000 feet, was in progress from May to December. Ore from the pit was trucked to the mill at Darby. Although production was seasonal, output was shipped throughout the year from the company stockpile. During the summer large steel plants as far east as Chicago were furnished with this important commodity; winter shipments went to smaller consumers with limited storage facilities in the West and Midwest. The county highway department used gravel for road construction and maintenance.

Richland.—Crude-oil production from the Brorson field, the only producing area in the county, declined 42 percent compared with 1956—the third consecutive year of decreasing output.

Rosebud.—The county continued to rank sixth in production of fuels and nonmetals, owing to the output of petroleum and coal. Recovery of crude oil from the Sumatra field (the only producer) was 1.3 million barrels (\$3.3 million) compared with 1.5 million barrels (\$3.4 million) in 1956. The county ranked second as a source of coal; the Northern Pacific Railway Co. Rosebud mine continued to be the major producer. Paving gravel was used by the Bureau of Public Roads.

Sanders.—The Jack Waite lead-zinc mine, Eagle district, was operated throughout 1957 by American Smelting & Refining Co. under profit-sharing agreement, and ore output was increased from 7,900 tons in 1956 to 10,400, according to the Jack Waite Mining Co. annual report. The 1957 ore total was the largest since 1943. Most of the output was processed in a 250-ton flotation mill; high-grade ore was shipped crude to a smelter. The mine was the largest lead producer in Montana, except for Silver Bow County operations. The Montana Standard mine, Prospect Creek (Burns) district, produced lead-zinc ore. Hecla Mining Co., Wallace, Idaho, planned to explore and develop the property under an agreement entered into late in 1957 with Montana Standard Mining Co. No other metal production was reported from the county.

Basalt for riprap at Noxon Rapids Dam and granite, also for riprap were produced; Sanders County ranked second in stone production in Montana. In the past, very little nonmetal mining has been done in this county.

⁷ Work cited in footnote 6.

Sheridan.—Crude-oil output from the Outlook field boomed from a modest first-year production of 2,800 barrels in 1956 to 163,000 barrels in 1957 to become the leading mineral industry in the county. Three mines (2 open pit and 1 underground) in the county were the major source of lignite in the State. Great Northern Railway Co. used gravel for roadbed maintenance.

Silver Bow.—The Butte metal mines, supplemented by a comparatively small output in other areas of Silver Bow County, supplied 41 percent of the value of Montana mineral production, compared with 55 percent in 1956. The county value, \$79.4 million, was \$38.8 million less than the near-record total of 1956. The steep decline resulted chiefly from production curtailments and lower prices owing to decreased demand for the principal products, copper and zinc. Recovery of manganese and byproduct lead, silver, and gold also dropped. Ore tonnage mined continued to increase to record totals because of expanded output in 1957 from the new Berkeley pit.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in Silver Bow County, 1948-52 (average), 1953-57, and total, 1882-1957, in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Gold, lode and placer (fine ounces)	Silver, lode and placer (fine ounces)
1948-52 (average).....	19	3,305,776	18,137	5,865,747
1953.....	19	5,998,457	19,871	6,289,415
1954.....	22	4,987,849	17,395	4,663,439
1955.....	22	7,159,693	22,262	5,577,999
1956.....	21	9,394,981	31,132	6,772,380
1957.....	19	10,673,175	27,312	5,068,834
1882-1957.....		(¹)	2,254,657	608,737,794

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value
1948-52 (average).....	57,188	14,637	64,117	\$55,708,312
1953.....	77,520	16,767	75,170	72,566,257
1954.....	59,240	11,516	53,527	54,498,289
1955.....	81,428	14,331	62,588	86,240,115
1956.....	96,292	14,989	63,375	111,133,462
1957.....	91,393	9,617	43,169	73,327,727
1882-1957.....	7,292,818	385,902	2,229,896	3,318,104,298

¹ Data not available.

Phosphate rock was mined at the Maiden Rock operation near Melrose by Victor Chemical Works. Rock from this mine and from the Canyon Creek mine (Beaverhead County) was processed to elemental phosphorus at the company Silver Bow plant. Byproduct pyrite recovered from base-metal ores mined in the county was converted to sulfuric acid at Anaconda (Deer Lodge County). Sand and gravel for structural and paving purposes was produced by two companies, and the county used gravel for roadwork. Granite riprap was produced by the Chicago, Milwaukee, St. Paul & Pacific Railroad Co.

Summit Valley (Butte) District.—Mining at Butte was characterized by an increased output of low-grade copper ore from open-pit and block-caving projects; curtailment of schedules or closing of the older

mines producing high-grade copper, zinc, and manganese ore; and suspension of long-range development programs because of adverse economic conditions.

The Kelley block-caving mine (originally known as the Greater Butte Project) became the principal source of copper at Butte in 1957. The output of recoverable copper from this mine totaled 66.4 million pounds compared with 63.9 million pounds in 1956. The producing vein mines (Mountain Con and Leonard) yielded 45.3 million pounds, compared with 92.6 million pounds in the preceding year. The Belmont mine was idle. Production from the new Berkeley pit totaled 62.3 million pounds, compared with 26.7 million pounds in 1956.

The Kelley mine supplied 4.3 million tons of ore; approximately 55 percent was derived from the 600 level; the rest came from the 1,300 level. Some development was done on the 1,100 level, and mining on the 800 and 1,100 levels was planned to begin in 1958, according to The Anaconda Co. annual report to shareholders. Transfer of ore from these levels to the 1,300 level was supplied by completion of a vertical ore path. Main haulageways were completed on the 1,600 and 2,000 levels between the Kelley and Leonard shafts. The Kelley shaft had reached a depth of 2,475 feet; 2,200 feet had been lined with concrete. The Kelley service shaft also reached 2,475 feet; 1,861 feet was concrete-lined. A new exhaust ventilation system was under construction from the 1,300 level of the Kelley mine to the surface. This system featured a circular, concrete-lined shaft, 16 feet in diameter and 980 feet deep.

Ore production from the Berkeley pit reached the planned rate of 17,500 tons per day by July 1. All auxiliary facilities, including a garage, shops, crushing plant, conveyor system, ore bins, and railroad spur were either completed or nearing completion by the end of the year.

Work on the Northwest Project was suspended in July. Progress included completing the hoist, headframe, and surface plant and sinking of the Missoula shaft to a depth of 571 feet. Temporary hoists and related equipment for sinking were installed at the Ryan shaft. This project was to develop large reserves of low-grade copper and zinc ore in outlying areas of the Butte Hill and also to provide expanded hoisting facilities for high-grade copper and zinc mines in the northwest part of the hill.

Zinc-ore shipments, mainly from the Lexington and Anselmo mines, were 627,000 tons compared with 1,060,000 in 1956.

Manganese-ore production (375,000 tons) came largely from the Emma and Niagara mines. The Travona mine was closed early in the year. The ore was converted to nodules at the company concentrating and sintering plant in Deer Lodge County, and the nodules were shipped direct to eastern metallurgical consumers or processed to ferromanganese at the Anaconda ferromanganese plant. The Anaconda Co. annual report disclosed output of 65,223 short tons of nodules and 22,407 short tons of ferromanganese, compared with 72,834 short tons and 39,671 short tons, respectively, in 1956.

Crude ore was shipped to the reduction works at Anaconda, Deer Lodge County, on the company-owned-and-operated Butte, Anaconda & Pacific Railway Co. New railroad equipment, consisting of four

1,750-hp. diesel locomotives, two 125-ton electric locomotives, and 200 75-ton ore cars, was purchased to facilitate shipping the increased tonnage of ore being produced from the Berkeley and Kelley mines.

Thirty operators in the Butte area consigned 50,000 short tons of manganiferous ore valued at \$1.2 million to the Government stockpile at Butte. Umont Mining Co. (Norwich mine) was the leading shipper.

Stillwater.—American Chrome Co. continued to produce chromite concentrate at the Mouat mine to meet the requirements of a company contract with the Government. Concentrate was delivered to the GSA stockpile at Nye. The company produced 251,300 tons of ore at capacity rate, and 114,300 tons of stockpile concentrate, containing 43,900 tons of Cr_2O_3 was delivered.

Output of crude oil from the Lake Basin field dropped to 1,500 barrels, less than half of the 1956 total.

Yellowstone.—Crude-oil recovery from both the Wolf Springs and Mosser fields increased the county total to 592,000 barrels (\$1.4 million). This was about 40 percent above 1956. Near Billings, Montana Sulphur & Chemical Co. obtained sulfur from the waste hydrogen sulfide gases of the petroleum refinery. The plant was in its second year of operation. Sand and gravel was produced by four firms. Paving gravel was used by the county highway department for roadwork. Lovell Clay Products Co. (Billings) completed an expansion and modernization program. Enlarged driers doubled the capacity for drying. New products to be made by the company included textured face tile, flue linings, and draintile.

The Mineral Industry of Nebraska

By D. H. Mullen¹



THE VALUE of minerals produced in Nebraska reached a new high in 1957 and continued a trend that has been steadily upward for the 10th consecutive year. Mineral production was valued at \$83.3 million in 1957, a 17-percent increase over 1956. The mineral fuels (petroleum, natural gas, and natural-gas liquids) furnished the entire increase and represented 76 percent of the total mineral value compared with 70 percent in 1956. Declines were recorded in the value of all of the nonmetallic mineral products except cement.

EMPLOYMENT

Employment in the mineral industries during 1957 averaged 2,100 and included workers in oilfields, sand and gravel pits, clay pits, and stone quarries. General contractors, except for building and special trade contractors, employed an average of 3,700 workers. This category includes some contractors engaged in heavy construction, such as highways, and involves production of substantial quantities of sand and gravel and crushed stone. In comparison, employment in all nonagricultural occupations averaged 353,400.

TABLE 1.—Mineral production in Nebraska, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays.....	153,137	\$154	133,713	\$135
Gem stones.....	(²)	3	(²)	2
Natural gas..... million cubic feet.....	13,541	2,844	³ 12,500	³ 2,700
Petroleum (crude)..... thousand 42-gallon barrels.....	16,204	45,209	³ 19,586	³ 53,368
Sand and gravel.....	10,350,000	7,404	7,944,300	5,889
Stone.....	3,062,691	4,142	3,065,084	3,749
Value of items that cannot be disclosed: Cement, natural-gas liquids, and pumice.....		⁴ 12,771		13,670
Total Nebraska ⁴		⁴ 71,311		83,290

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Weight not recorded.

³ Preliminary figure.

⁴ Revised figure.

⁵ Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement.

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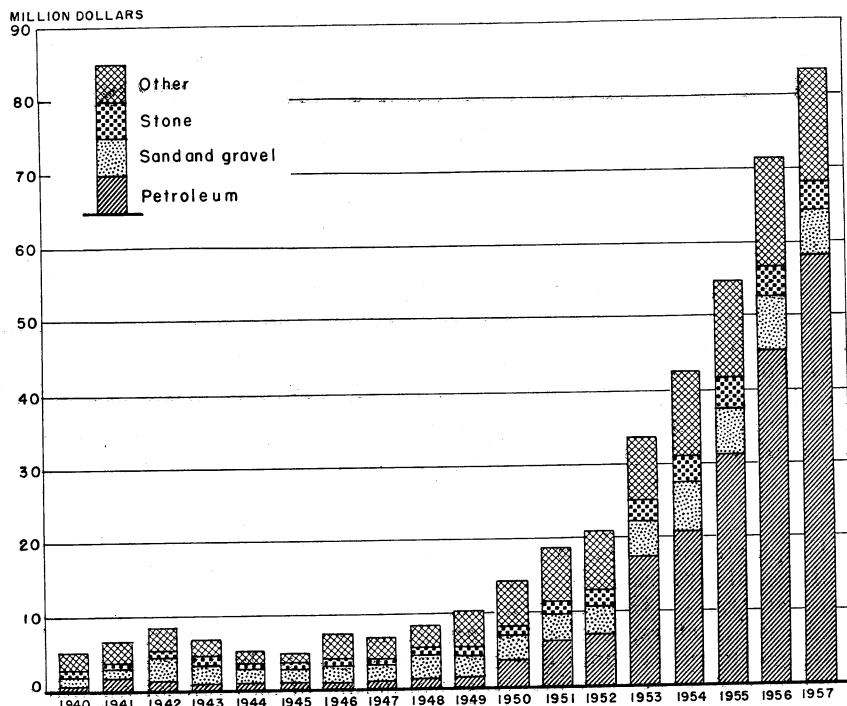


FIGURE 1.—Value of petroleum, sand and gravel, and stone, and total value of mineral production, in Nebraska, 1940-57.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Natural Gas.—Marketed production of natural gas in 1957 was estimated at 12,500 million cubic feet—an 8-percent decrease compared with 1956. Production came from the Huntsman and S. W. Sidney fields in Cheyenne County and the Big Springs field in Deuel County. The Oshkosh field, $3\frac{1}{2}$ miles south of the McCord field in Garden County, discovered in 1957, test-flowed 3.5 million cubic feet a day at the depth of 3,306 feet in the "D" sandstone member of the Dakota formation; the well was shut in. One successful development well was completed in the Big Springs field in Deuel County and flowed 3 million cubic feet a day. Natural gas produced in other fields was flared or repressured.

Natural-Gas Liquids.—Production of natural-gas liquids in 1957 at the cycle plant at Huntsman field in Cheyenne County decreased 1 percent compared with 1956. The natural gas processed was from the Huntsman and S. W. Sidney fields. Kansas-Nebraska Gas Co., Inc., announced plans to build a natural-gas-processing plant at Big Springs, Deuel County.

Petroleum.—Petroleum was produced in 1957 from fields in Banner, Cheyenne, Kimball, Garden, Morrill, Red Willow, Richardson, and Scotts Bluff Counties. Kimball County led all other counties in the State, with production from 84 fields, followed by Cheyenne with

50 fields, and Banner with 30 fields. Scotts Bluff County began petroleum production with output from one field. Total production in 1957 was estimated at 19,586,000 barrels—a 21-percent increase compared with 1956.

Exploration and development drilling was slightly lower in 1957; 886 wells were completed compared with 935 in 1956. Exploration drilling was done at 474 holes; 44 were oil wells and 1 a gas well, and 429 were dry. The success ratio was 1:10.5 compared with 1:11.3 in 1956. In all, 412 development holes were drilled; 247 were oil wells, 1 a gas well, and 164 were dry—a success ratio of 1:1.6 compared with 1:1.8 in 1956.

Major exploration was done in Kimball County, with 138 completions, followed by Banner County with 132 and Cheyenne County with 53. Banner County led with 17 new fields discovered, followed by Kimball County with 16, Morrill County with 2, and 1 each in Dundy, Red Willow, and Scotts Bluff Counties. The successful exploration in Dundy and Red Willow Counties was of some importance. Discoveries in these counties, in the Pennsylvanian formations along the Cambridge arch, generated new interest in the area in 1957. Previous explorations in 1955 had only limited success. Exploration toward and along the Chadron arch north and east of the Denver-Julesburg basin were, except for Sioux County, more scattered than in previous years. Because of the lack of successful wells in the area in 1957, interest in further exploration declined.

TABLE 2.—Production of crude petroleum, 1956–57, by counties
(Thousand barrels)

County	1956	1957 (preliminary)	Leading fields in order of 1957 production
Banner.....	2,842	2,774	Vedene, Hackberry, Harrisburg, Petroleum State.
Cheyenne.....	4,589	4,637	Juelfs, Cook, Maley, Doran Farms, Dorman.
Garden.....	13	11	Richards, McCord.
Kimball.....	7,627	11,123	Sloss State, Kimball, Travis, Baltensperger, Zoller State.
Morrill.....	903	894	Olsen, Craig, Lindberg.
Red Willow.....	11	12	Barger.
Richardson.....	219	126	Dawson, Falls City.
Scotts Bluff.....	-----	9	Vessels.
Total.....	16,204	19,586	

Field development in 1957 was concentrated in Kimball, Banner, and Cheyenne Counties; Kimball County had the most activity, with 153 successful completions, followed by Banner County, with 57, and Cheyenne County, with 32. Successful development wells also were completed in Morrill, Garden, and Harlan Counties, and a successful gas well was completed in Deuel County.

The 2,200 barrel-a-day refinery at Scottsbluff operated the entire year. The refinery at Salem in Richardson County remained idle.

A proposal to create an oil- and gas-conservation commission was rejected by the Nebraska State Legislature's Judiciary Committee. A similar proposal was defeated in the 1955 session. The proposal would have provided for appointment of a commission to supervise

TABLE 3.—Wildcat- and development-well completions in 1957, by counties
[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage
Wildcat:					
Banner.....	17		115	132	811,600
Box Butte.....			2	2	8,500
Chase.....			2	2	8,600
Cheyenne.....	6		47	53	280,000
Dawes.....			7	7	24,000
Deuel.....			1	1	3,600
Dundy.....	1		1	2	10,100
Furnas.....			3	3	10,800
Garden.....		1	12	13	46,700
Harlan.....			5	5	20,600
Hayes.....			3	3	13,600
Kimball.....	16		122	138	899,500
Lincoln.....			1	1	4,400
Morrill.....	2		30	32	155,800
Red Willow.....	1		5	6	23,200
Richardson.....			10	10	30,200
Scotts Bluff.....	1		29	30	167,100
Sioux.....			34	34	174,800
Total wildcat.....	44	1	429	474	2,693,100
Development:					
Banner.....	57		45	102	634,900
Cheyenne.....	32		26	58	308,400
Deuel.....		1	1	2	6,800
Garden.....	2		4	6	24,900
Harlan.....	1		1	2	4,000
Hitchcock.....			1	1	4,000
Kimball.....	153		75	228	1,454,300
Morrill.....	2		5	7	35,600
Red Willow.....			1	1	3,700
Richardson.....			2	2	5,800
Scotts Bluff.....			4	4	23,100
Total development.....	247	1	164	412	2,505,500
Total all drilling.....	291	2	593	886	5,198,600

the production of oil and gas at a maximum efficient rate. Such regulations as are required by the State in producing oil and gas were the responsibility of the State geologist.

NONMETALS

Cement.—Portland and masonry cements were produced at plants in Cass and Nuckolls Counties, operating at 83 percent of capacity. Shipments of portland cement increased 2 percent, but shipments of masonry cement decreased 17 percent compared with 1956. Limestone and shale used in manufacturing cements were obtained from quarries near the plants, and from deposits in Kansas. The 8 kilns at the 2 plants operated an average of 344 days and used 64.8 million kilowatts of electricity. The bulk of the shipments went to places in Nebraska (65 percent), followed by Iowa (21 percent) and North Dakota (8 percent). Shipments also were made to South Dakota, Minnesota, Colorado, Kansas, Wyoming, Missouri, and New Mexico. The price of portland cement was \$3.15 a barrel, compared with \$3.03 in 1956.

Clays.—Miscellaneous clay was produced in six counties for manufacturing building brick, drain tile, other heavy clay products, and portland cement. Stoneware clay was produced at one pit in Cass County for art pottery and flowerpots. Production in 1957 decreased 13 percent in quantity and 12 percent in value compared with 1956.

Gem Stones.—Gem stones, estimated at \$2,000 in value, were collected in 1957 by individuals in the State.

Perlite.—Crude perlite from deposits in Western States was expanded at a plant in Omaha and used in building plasters, as a light-weight aggregate in concrete, for soil conditioning, in fillers, and as a filter aid.

Pumice.—Pumicite was produced from pits in Custer County. A small quantity was sold in crude form; the remainder was washed, dried, sized, and used for scouring soaps and powders and for abrasives. Sales in 1957 decreased 22 percent compared with 1956.

Sand and Gravel.—Sand and gravel was produced in 61 of the State's 93 counties. Commercial output was reported by 143 producers in 57 counties, and Government-and-contractor output was reported in 19 counties by 18 producers. Dodge County led the State in quantity followed by Douglas, Cass, Sarpy, and Platte Counties. Production exceeding 100,000 tons was reported in 20 counties.

Production in 1957 declined 23 percent in quantity and 20 percent in value compared with 1956. Commercial operations supplied 89 percent of the total output; of this, 65 percent was used for paving and road construction. Contracts by the Nebraska State Department of Roads represented 36 percent of Government-and-contractor production. The principal commercial producers included Lyman-Richey Sand & Gravel Corp., Western Sand & Gravel Co., Christensen Sand & Gravel Co., Lincoln Sand & Gravel Co., and Gerhold Co. Eight other operators produced over 100,000 tons each. Of the total produced, 84 percent was washed, screened, or otherwise prepared. Trucks transported 85 percent.

TABLE 4.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Glass.....				1	\$1	\$1.00
Building.....	3,295	\$2,311	\$0.70	1,578	1,322	.84
Paving.....	1,948	1,373	.70	1,627	1,123	.69
Engine.....	7	5	.75	46	32	.70
Filter.....	1	1	.75			
Railroad ballast.....	96	72	.75	23	15	.64
Other.....	7	5	.75	149	65	.44
Gravel:						
Building.....	714	562	.79	565	424	.75
Paving.....	3,524	2,591	.74	2,979	2,219	.74
Other.....	29	23	.79	92	63	.69
Total.....	9,621	6,943	.72	7,060	5,264	.75
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Paving.....	138	76	.55	235	106	.45
Gravel:						
Building.....				47	45	.94
Paving.....	591	385	.65	602	474	.79
Total.....	729	461	.63	884	625	.71
Grand total.....	10,350	7,404	.72	7,944	5,889	.74

Progress of the National System of Interstate and Defense Highways in Nebraska, according to a report by the Federal Department of Commerce, Bureau of Public Roads, showed 11.6 miles of highway programed between July 1956 and December 31, 1957. Of this, 11.2 miles was under construction. There remains a total of \$47.6 million for future programing and construction.

Stone.—Dimension and crushed limestone and sandstone were produced in 12 counties and comprised 4 percent of the value of Nebraska's mineral production in 1957. Dimension limestone (rubble) was produced in Lancaster and Cass Counties. Crushed limestone for riprap, road construction, concrete aggregate, railroad ballast, agriculture, cement, lime, and other uses was produced in nine counties; Cass was the leading county, followed by Nemaha, Sarpy, and Otoe. Government-and-contractor producers crushed limestone in 7 counties and crushed sandstone in 1 county. The entire production was used as riprap and in road construction; output in 1957 decreased 28 percent compared with 1956.

Principal producers of commercial limestone included Ash Grove Lime & Portland Cement Co., Hopper Bros. Quarries, Nelson Quarries, Inc., and Stone Products Co. Major contractors producing crushed stone for Government agencies were Costa Co., Inc., Cunningham-Kiewit Co., Eugene Luhr & Co., and Pine Bluff Sand & Gravel Co.

TABLE 5.—Stone sold or used by producers, 1953–57, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	1 1,407,158	1 \$2,069,984			1 1,407,158	1 \$2,069,984
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

¹ Excludes limestone for cement.

TABLE 6.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Dimension stone:				
Rough construction and rubble.....	1,134	\$4,796	(1)	(1)
Crushed and broken stone:				
Riprap.....	932,905	993,923	1,160,253	\$1,228,950
Metallurgical.....			(1)	(1)
Concrete and roadstone.....	1,136,531	1,722,674	820,900	1,231,200
Railroad ballast.....			(1)	(1)
Agricultural.....	192,237	315,344	99,200	166,200
Other stone.....	² 799,884	² 1,105,076	³ 984,731	³ 1,132,171
Total.....	3,062,691	4,141,813	3,065,084	3,748,521

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

² Includes cement, feed, paint, putty, and tires.

³ Includes rough construction and rubble, asphalt filler, cement, feed, metallurgical, mineral food, paint, putty, railroad ballast, and tires.

Talc.—Crude talc from California and Montana was ground at a plant in Grand Island. The ground product was used in ceramics, paint, paper, textiles, and toilet preparations.

Vermiculite.—Crude vermiculite from mines in Montana was exfoliated at a plant in Omaha for use as loose-fill insulation and as an admixture in plaster and concrete.

REVIEW BY COUNTIES

Banner.—Banner County produced petroleum from 30 fields and ranked third in the State in value. Major producing fields were the Vedene, Hackberry, Harrisburg, and Petroleum State. The county ranked second in development- and wildcat-well completions. Exploration drilling resulted in the discovery of 17 new fields—the highest in the State. All were in the “D” and “J” sandstone members of the Dakota formation. Development drilling was most successful in the Willson Ranch field (a 1957 discovery)—8 successful completions—and the Fink field (also a 1957 discovery)—7 successful completions. Successful development drilling in other 1957 discoveries included Edwards and McDaniel fields, with 5 completions each; and Indian Springs field, with 4 completions.

Cass.—Cass County led the State in value of nonmetallic mineral production and in output of crushed stone, ranked third in production of sand and gravel; it was the leading producer of portland and masonry cements. A fifth kiln was placed in operation at the Ash Grove Lime & Portland Cement Co. plant at Louisville. The Kahler Pottery Co., Inc., produced 2,500 tons of stoneware clay for manufacturing art pottery and flowerpots. Ash Grove Lime & Portland Cement Co. produced crushed limestone and shale for manufacturing cement. Lyman-Richey Sand & Gravel Corp. produced 251,700 tons of sand and gravel at plants 5 and 6. Western Sand & Gravel Co. produced at its Cedar Creek and South Bend plants.

TABLE 7.—Value of mineral production in Nebraska, 1956–57, by counties¹

County	1956	1957 ²	Minerals produced in 1957 in order of value
Adams.....	\$112,885	\$82,747	Sand and gravel, clays.
Antelope.....		19,500	Sand and gravel.
Banner.....	(³)	8,270,740	Petroleum, sand and gravel.
Boone.....	(³)	(³)	Sand and gravel.
Box Butte.....	2,000		
Boyd.....	11,000	19,000	Sand and gravel.
Brown.....	40,750	40,200	Do.
Buffalo.....	326,750	131,700	Do.
Butler.....	39,500	50,700	Do.
Cass.....	11,006,580	10,589,425	Cement, stone, sand and gravel, clays.
Cedar.....	89,500	126,000	Sand and gravel.
Chase.....		23,500	Do.
Cheyenne.....	(³)	(³)	Natural-gas liquids, petroleum.
Clay.....	101,375	(³)	Sand and gravel.
Collax.....	75,400	58,200	Do.
Cuming.....	99,250	87,900	Do.
Custer.....	(³)	(³)	Pumice.
Dawes.....	200		
Dawson.....	214,250	175,600	Sand and gravel.
Dixon.....	18,250	32,500	Do.
Dodge.....	639,750	389,400	Do.
Douglas.....	895,287	692,119	Sand and gravel, stone, clays.
Dundy.....	12,000	7,400	Sand and gravel.
Fillmore.....	21,000	35,200	Do.
Franklin.....	81,275	(³)	Sand and gravel, stone.

See footnotes at end of table.

TABLE 7.—Value of mineral production in Nebraska, 1956-57, by counties ¹—Con.

County	1956	1957 ²	Minerals produced in 1957 in order of value
Frontier.....		\$10,700	Stone.
Furnas.....	(³)	37,400	Sand and gravel.
Gage.....	\$91,638	178,100	Sand and gravel, stone.
Garden.....	(³)	32,780	Petroleum.
Garfield.....		400	Sand and gravel.
Hall.....	255,000	226,800	Do.
Hamilton.....	51,250	59,500	Do.
Harlan.....	61,000	50,200	Do.
Hayes.....	16,750	24,900	Do.
Hitchcock.....	39,250	67,200	Do.
Holt.....	64,000	75,000	Do.
Howard.....	14,250	(³)	Do.
Jefferson.....	208,355	175,218	Sand and gravel, clays.
Kearney.....	(³)	58,200	Sand and gravel.
Keith.....	75,000	104,400	Do.
Kimball.....	(³)	33,183,240	Petroleum, sand and gravel.
Knox.....	50,250	133,100	Sand and gravel.
Lancaster.....	240,808	225,761	Stone, clays.
Lincoln.....	17,250	59,900	Sand and gravel.
Loup.....	62,625	27,200	Do.
Madison.....	95,625	188,000	Do.
Merrick.....	9,000	61,200	Do.
Morrill.....	(³)	2,767,420	Petroleum, sand and gravel.
Nance.....		45,500	Sand and gravel.
Nemaha.....	439,617	849,700	Stone.
Nuckolls.....	(³)	(³)	Cement, sand and gravel.
Otoe.....	7,646	(³)	Stone, clays.
Pawnee.....	534,304		
Perkins.....	24,250	15,900	Sand and gravel.
Phelps.....	(³)	107,400	Do.
Pierce.....	346,750	8,900	Do.
Platte.....	40,500	356,600	Do.
Polk.....	87,629	74,560	Sand and gravel, petroleum.
Red Willow.....	648,841	654,380	Petroleum, stone, sand and gravel.
Richardson.....	65,500	40,400	Sand and gravel.
Saline.....	1,326,314	1,021,100	Stone, sand and gravel.
Sarpy.....	(³)	(³)	Sand and gravel.
Saunders.....	96,000	121,400	Do.
Scotts Bluff.....	361,000	(³)	Stone.
Seward.....	(³)	47,520	Petroleum, sand and gravel.
Sioux.....	(³)	75,000	Sand and gravel.
Stanton.....	(³)	(³)	Do.
Thayer.....		2,700	Do.
Thomas.....	(³)		
Thurston.....	38,750	19,000	Sand and gravel.
Valley.....		(³)	Stone.
Washington.....		68,800	Sand and gravel.
Webster.....	20,500	5,000	Do.
Wheeler.....	(³)	(³)	Do.
York.....			
Undistributed ⁴	⁵ 53,349,332	22,420,780	
Total ⁶	⁵ 71,311,000	83,290,000	

¹ The following counties are not listed because no production was reported: Arthur, Blaine, Burt, Cherry, Dakota, Deuel, Gosper, Grant, Greeley, Hooker, Johnson, Keya Paha, Logan, McPherson, Rock, Sheridan, Sherman, and Wayne.

² Petroleum and natural gas values are preliminary.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Includes value of gem stones, natural gas, and sand and gravel (1956) that cannot be assigned to specific counties and value indicated by footnote 3.

⁵ Revised figure.

⁶ Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement.

Twelve operators produced 1.4 million tons of dimension and crushed limestone in 1957—a 26-percent decline from 1956.

Cheyenne.—Petroleum, natural gas, and natural-gas liquids were produced from 50 fields in Cheyenne County, which ranked second in the State in petroleum production. Principal producing fields were Juelfs, Cook, Maley, Doran Farms, and Dorman. Natural gas came from the S. W. Sidney, Sunol, and Wood fields. Natural gasoline, butane, and other liquid-petroleum gases were recovered from natural

gas from the Huntsman field processed at the natural-gasoline plant of Ohio Oil Co. Natural gas from other fields was flared or repressured.

Exploration drilling was at a lower rate than in 1956; however, six new fields were discovered near the western edge of the county adjoining the area of intense activity in Kimball County. All of the discoveries were in the "J" and "D" sandstone members of the Dakota formation.

Development drilling was most active in Juelfs field during 1957 and extended the field more than 1 mile east of the area of previously established production. By the end of the year Juelfs field was the largest field in the county in total number of producing wells and in average daily production. Chambers field, discovered in 1952, had no successful development wells until 1957, when five producers were completed south and west of the discovery. Two failures were completed at the southwest edge of the field. Other fields in the county had only a few successful development completions and a number of the larger fields had no successful development wells.

Of some significance was the deepening of the Mary Egging No. 1 well in the Gurley field. This first successful well in the Denver-Julesburg basin was discovered in May 1949 and produced 138,000 barrels from the Dakota formation before its shutdown in November 1952. It is planned to test for pools near the Precambrian granite.

Deuel.—Production of natural gas at the Big Springs field continued in 1957 at approximately the preceding year's rate. One successful development well and one failure were completed. The natural-gas plant planned by Kansas-Nebraska Gas Co., Inc., at its compression plant in the Big Springs field will process 35 million cubic feet of gas to recover 25,000 gallons of propane, 8,000 of butane, and 6,000 of natural gasoline daily.

Dodge.—Dodge County was the leading producer of sand and gravel in the State. Lincoln Sand & Gravel Co., Christensen Sand & Gravel Co., Lyman-Richey Sand & Gravel Corp. (2 plants), and Lux Sand & Gravel Co. were the principal producers. Production in 1957 was 679,300 tons—a 20-percent decline from 1956.

Douglas.—Douglas County ranked second in the State in production of sand and gravel. Lyman-Richey Sand & Gravel Corp. operated plants 9, 10, and 11 and was the major producer. Acme Sand & Gravel Co., Hartford Sand & Gravel Co., and J. W. McCann Co. also produced substantial quantities. Principal uses were for building, paving, fill, and engine sand and for stock-car bedding. Production in 1957 was 670,600 tons compared with 1,118,000 tons in 1956.

Dundy.—The first discovery of petroleum in the county was recorded in 1957, when the No. 1 Jones well was completed at 4,600 feet in the Lansing-Kansas City formation. The well pumped 60 barrels of oil a day on test. Walter A. Fries produced 8,400 tons of building and paving sand and gravel.

Garden.—Petroleum production from two fields was approximately the same as in 1956. Exploration drilling continued at about the same rate as in 1956. One successful completion, an Oshkosh field gas well, which flowed 3.5 million cubic feet a day, was shut in. Six development wells were completed; 2 were successful.

Kimball.—Kimball County continued as the major source of petroleum in the State, producing more than half of the total. Output

came from 84 fields; the Sloss State, Kimball, Travis, and Balten-sperger fields produced over 500,000 barrels each. Eight other fields produced over 300,000 barrels each.

Kimball County led in the number of exploration wells completed and in the number of successful development wells and was second in the number of discoveries. Sixteen new fields were discovered, and 153 successful development wells were completed. The Sloss State field was the most active in development drilling with 50 successful completions and 2 failures. The field became the largest in Nebraska, the second largest in the Denver-Julesburg basin and was exceeded in size by the Adena field in Colorado. The Griffith field 24 successful development wells were completed and at year end became second to the Sloss State field in daily average production. At the Heidemann field, northwest of the Sloss State field, 17 successful development wells were completed. Five other fields completed from 1 to 8 successful development wells.

L. R. Olson & Sons and Wilson Bros. Ready Mix produced 38,000 tons of building, paving, and fill gravel.

Lancaster.—Yankee Hill Brick Manufacturing Co., produced miscellaneous clay for building brick, draintile, and other heavy clay products. It was the leading producer of clay in the State. Schwarcz Quarries, Inc., produced dimension limestone (rubble) and crushed limestone for road construction, concrete aggregate, and agricultural use. Production increased from 85,400 tons in 1956 to 99,300 in 1957. Production of riprap by the county highway department decreased sharply from 1956.

Morrill.—Petroleum production came from 8 fields; 2 were discovered during the year. Exploration drilling was less in 1957; 32 wells were completed. Two new fields were discovered compared with 4 in 1956. Development drilling also declined to 7 completions, 2 of which were successful, compared with 22 completions and 16 successes in 1956. Lyman-Richey Sand & Gravel Corp. operated plant No. 23, producing building, paving, engine, ballast, and fill sands.

Dolson Gravel Co. produced building gravel, and L. R. Olson & Sons produced sand and paving gravel. H. W. Johnson produced paving gravel for the State highway department. Production in 1957 decreased slightly from 1956.

Nemaha.—The Nemaha County quarries produced crushed limestone for riprap, road construction, concrete aggregate, and agricultural use. Major producers were Heebner Quarries, Hopper Bros. Quarries, and Nelson Quarries, Inc., Costa Co., Inc., and Eugene Luhr & Co. produced riprap for Government agencies. Production increased from 359,600 tons in 1956 to 613,000 in 1957.

Nuckolls.—The Ideal Cement Co., Nebraska Division plant at Superior produced portland and masonry cements at near capacity for 350 days. It mined limestone at a quarry in Jewell County, Kans. Portland-cement clinker was used in masonry cement. C. F. Bondgard produced paving gravel. George K. Werner produced paving sand and gravel for the county highway department. Sand and gravel production increased from 65,000 tons in 1956 to 84,300 in 1957.

Platte.—Platte County ranked sixth in the State in output of sand and gravel. Gerhold Co., Lyman-Richey Sand & Gravel Corp., and

Ace Sand & Gravel Co. were the principal producers. Building and paving were the major uses. Production in 1957 decreased to 415,700 tons compared with 559,000 in 1956.

Red Willow.—Petroleum production was approximately the same as in 1956. Six exploration wells were completed, of which 1 was successful. One development well completed during the year was unsuccessful. Davidson-Merritt Sand & Gravel Co., Gillen Sand & Gravel Co., and Midwest Sand & Gravel Co. produced building, paving, bedding and fill sand and building and paving gravel. Production was slightly below that of 1956.

Richardson.—Richardson County, the first to produce petroleum in the State, continued its output from three fields. The Searll Petroleum Corp. refinery at Salem was idle in 1957. Ten exploratory wells and 2 development wells were completed as dry holes and abandoned. George W. Kerford Quarry Co. and Harmon Gravel Co. produced crushed limestone for riprap and road construction. Harmon Gravel Co. and the county highway department produced paving gravel. Pine Bluff Sand & Gravel Co. produced limestone riprap for the United States Army Corps of Engineers.

Sarpy.—Sarpy County ranked third in the State in production of crushed stone and fourth in output of sand and gravel. Lyman-Richey Sand & Gravel Corp. at two plants and Richfield Sand & Gravel Co. produced building, paving, engine, and fill sand and building and paving gravel. The county highway department produced paving sand. Production in 1957 declined to 532,300 tons compared with 1,389,500 tons in 1956. City Wide Rock & Excavating Co., Meadow Rock Co., and Stone Products Co. produced riprap and crushed stone for road construction. Eugene Luhr & Co. produced riprap for the United States Army Corps of Engineers. Production for all uses in 1957 increased to 426,900 tons compared with 208,900 tons in 1956.

Scotts Bluff.—Scotts Bluff County became a petroleum producer in 1957 when the No. 1 State A well was completed, 109 barrels of oil a day were pumped from this oil well. The discovery was 1 of 30 wells completed during the year. Development drilling in the newly discovered Vessels field, consisting of four wells, was not successful. The skimming and cracking plant of the Consumers Cooperative Refinery Association at Scottsbluff operated the entire year. L. R. Olson & Sons, Trettenoro Sand & Gravel Co., and Platte Valley Cement Tile Manufacturing Co. produced building and paving sand and gravel. Albert H. Niedfelt produced paving sand and gravel for the State highway department. Production for all uses increased from 128,000 tons in 1956 to 165,200 in 1957.

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 E. J. Matson,¹ G. C. Branner,¹ and R. Y. Ashizawa²



NEVADA mineral production, lowest since 1953, declined more than 30 percent in value below the alltime high of 1956. Over 97 percent of the more than \$40 million decrease was due directly to a drop in the price of copper and to closing of the Government Tungsten Purchase Program. The end of the stockpiling program affected tungsten production so adversely that its 1957 value was 91 percent below the 1956 figure. Although metal mining suffered the greatest monetary slump, values of the nonmetallic minerals and petroleum outputs decreased 4 and 32 percent, respectively. Declines were offset somewhat by increased output of diatomite, magnesite, sand and gravel, gem stones, sulfur, and salt. The major decreases in

TABLE 1.—Mineral production in Nevada, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate..... gross weight.....	(²)	(²)	29	\$9
Barite.....	178, 440	\$1, 067	109, 663	721
Clays.....	13, 960	32	12, 428	20
Copper (recoverable content of ores, etc.).....	³ 80, 824	³ 68, 700	77, 750	46, 806
Gem stones.....	(⁴)	50	(⁴)	100
Gold (recoverable content of ores, etc.)..... fine ounces.....	³ 68, 040	³ 2, 381	76, 752	2, 686
Gypsum.....	790, 356	2, 701	674, 422	(²)
Iron ore (usable)..... long tons, gross weight.....	916, 592	⁴ 5, 021	904, 455	5, 841
Lead (recoverable content of ores, etc.).....	6, 384	2, 004	5, 979	1, 710
Manganese ore (35 percent or more Mn) ⁶ gross weight.....	121, 482	(²)	129, 046	(²)
Mercury..... 76-pound flasks.....	5, 859	1, 523	6, 313	1, 559
Petroleum (crude)..... thousand 42-gallon barrels.....	64	111	44	76
Pumice.....	11, 534	34	(²)	(²)
Sand and gravel.....	4, 686, 513	4, 569	5, 233, 000	5, 190
Silver (recoverable content of ores, etc.)..... fine ounces.....	³ 993, 716	³ 899	958, 477	868
Stone.....	1, 401, 169	2, 281	925, 000	1, 585
Talc and soapstone.....	10, 540	98	7, 467	57
Tungsten concentrate..... 60-percent WO ₃ basis.....	5, 400	19, 263	1, 196	1, 676
Zinc (recoverable content of ores, etc.).....	7, 488	2, 052	5, 292	1, 228
Value of items that cannot be disclosed: Brucite, diatomite, fluorspar, lime, magnesite, marl (1956), molybdenum, perlite, salt, sulfur ore, uranium ore, and values indicated by footnote 2.....		14, 446		16, 756
Total Nevada ⁷		126, 681		86, 023

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Figure withheld to avoid disclosing company confidential data.

³ Revised figure.

⁴ Weight not recorded.

⁵ 1956 value revised, based on average value f. o. b. railhead.

⁶ Shipments to Government low-grade depots and custom mills not included, but quantity and value of this material are as follows: 1956—manganese ore, 612 short tons, \$39,411, and low-grade manganese ore, 3,142 short tons, \$140,270; 1957—manganese ore, 118 short tons, \$6,306, and low-grade manganese ore, 4,444 short tons, \$190,300.

⁷ Total has been adjusted to eliminate duplicating the value of stone.

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nonmetal production were those commodities directly related to a depressed building industry both in Nevada and California; namely, gypsum, lime, stone, pumice (volcanic cinder), and clays.

Nevada's only smelter, at McGill, operated throughout the year and received a relatively small tonnage of copper, gold, and silver fluxing ores (principally from Nevada mines) in addition to company-produced copper concentrates. Base-metal ores and concentrate were shipped to Utah, Montana, and California smelters. The Caselton mill, Lincoln County, received some locally mined lead-zinc ores for custom milling and was Nevada's only active custom mill during 1957. All manganese ore and concentrate produced in Nevada were shipped to Government stockpiles. Mercury was sold directly to consumers, distributors, and the Government stockpile—all of which were outside Nevada. Although important tonnages of iron ore and concentrate were marketed in the Eastern United States and California, by far the larger tonnages were exported to Japan.

Many producers of nonmetal minerals shipped direct to California processing plants or sold their output direct to the consumer after primary crushing; marl and sulfur ore were examples of the latter. Much of the brucite, diatomite, limestone, magnesite, and perlite was processed before shipments, and some was sent to Nevada consumers. A large portion of the crude gypsum production was converted to finished products at plants in the State. All Nevada's modest yield of crude petroleum was shipped to a California refinery.

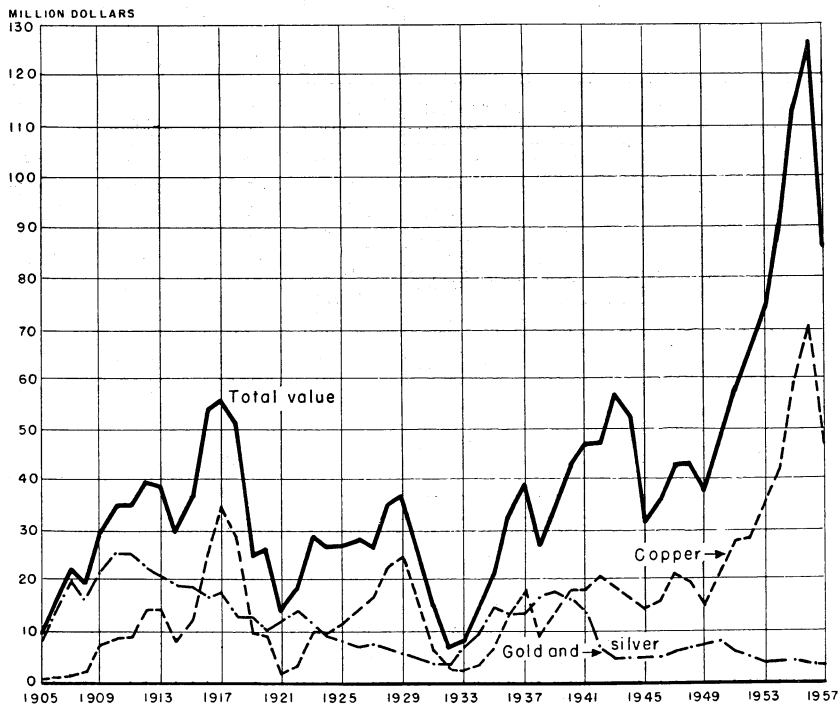


FIGURE 1.—Value of gold and silver, copper, and total value of mineral production in Nevada, 1905-57.

TABLE 2.—Defense Minerals Exploration Administration contracts active during 1957

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
HUMBOLDT					
Apollo Mines, Inc.....	Saddle.....	Tungsten.....	Sept. 14, 1955	14, 520	75
LINCOLN					
Combined Metals Reduction Co.....	Black Prince.....	Lead-zinc.....	Mar. 2, 1955	98, 200	50
Comet Mines, Inc.....	Comet.....	do.....	Apr. 16, 1952	190, 000	50
Milbank & Jones.....	Bristol.....	Copper-lead-zinc.....	Aug. 13, 1956	82, 250	50
Raymond Combined Mines Co.	Prince Henry.....	Lead-zinc.....	Oct. 29, 1952	108, 466	50
Wah Chang Mining Corp.....	Lincoln.....	Tungsten.....	Mar. 17, 1955	76, 300	75
MINERAL					
Nevada Scheelite Corp.....	Leonard.....	Tungsten.....	June 12, 1956	68, 800	75
NYE					
The Climax Tungsten Co.....	Climax.....	do.....	Oct. 30, 1956	66, 320	75
PERSHING					
C. A. Coppin.....	Redbird.....	Mercury.....	July 5, 1955	31, 310	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					
Mount Wheeler Mines, Inc.....	Mount Wheeler.....	Lead-zinc.....	Mar. 15, 1955	282, 893	50
Robert E. Salvi.....	Valley View.....	Tungsten.....	Nov. 2, 1955	16, 400	75

TABLE 3.—Contracts for purchase of minerals and metals under the Defense Production Act, as of Dec. 31, 1957

Contractor	County	Commodity	Contingent purchase commitment (short tons)	Financing	
				Amount	Type
Titanium Metals Corp. of America.	Clark.....	Titanium-sponge metal.	1, 500	\$15, 000, 000	Advance.
Manganese, Inc.....	do.....	Manganese nodules.....	1 27, 500, 000	.....	.....
Contractor		Tax amortization (percent)	Approximate term of contract (years)	Date production starts	Commitment purchase price
Titanium Metals Corp. of America.....		90	5	May 1, 1952	\$5.00 or market a pound. ²
Manganese, Inc.....		.....	9	Jan. 1, 1952	\$1.50 a long-ton unit of contained Mn. ³

¹ Long-ton units.² Contract has clause to allow for differential between ingot and sponge purchased.³ Includes escalator clause.

Legislation and Government Programs.—Exploration activity under the Defense Minerals Exploration Administration (DMEA) program in 1957 was at its lowest point in Nevada since the program was started in 1951. Although 15 projects in 8 counties, totaling over \$1 million, were active during all or part of the year, 6 (3 each for lead-zinc and tungsten) were terminated by December 31, 1957. Only 3 new contracts were executed during the calendar period, 1 each for copper, mercury, and tungsten. A field team comprised of Bureau of Mines and Geological Survey personnel, with headquarters at Reno, Washoe County, provided technical assistance in administering the program.

The two production contracts for manganese nodules and titanium-sponge metal, negotiated in 1952 under the Defense Materials Procurement Act of 1950, were still in effect during the entire year. Although the Government maintained no purchase depots in Nevada important quantities of mercury, manganese ore and concentrate, and low-grade manganese ore were purchased in Nevada by the General Services Administration (GSA) and stockpiled at out-of-State depots.

TABLE 4.—Number of operations and employees in Nevada mines, mills and smelters, 1953-57¹

County	1953		1954		1955		1956		1957	
	Number of operations	Number of employees	Number of operations	Number of employees	Number of operations	Number of employees	Number of operations	Number of employees	Number of operations	Number of employees
Churchill.....	3	26	5	27	4	28	5	51	4	61
Clark.....	22	1,346	17	1,795	19	1,795	14	1,942	14	1,911
Douglas.....	3	6	1	9	2	12	1	25	1	42
Elko.....	7	27	10	60	10	40	12	71	9	49
Esmeralda.....	9	77	6	42	5	75	6	77	6	51
Eureka.....	2	28	3	42	3	68	2	121	2	97
Humboldt.....	7	215	10	277	11	387	8	252	5	172
Lander.....	12	151	8	130	7	167	8	199	5	142
Lincoln.....	12	518	10	276	8	368	9	409	7	331
Lyon.....	3	256	4	526	3	607	5	564	5	504
Mineral.....	15	210	8	181	6	216	7	242	1	10
Nye.....	16	311	15	287	12	259	11	333	17	295
Ormsby.....	1	5								
Pershing.....	12	308	13	293	11	320	10	366	7	298
Storey.....	4	52	4	49	3	49	4	52	4	49
Washoe.....	3	196	4	193	6	214	3	230	3	166
White Pine.....	24	2,031	19	2,080	15	2,391	15	2,896	9	2,279
Total.....	155	5,763	137	6,267	125	6,996	120	7,830	99	6,457

¹ All figures as of June 30 in each year reported by Nevada State Inspector of Mines.

The Bureau of Mines Electrometallurgical Experiment Station, Boulder City, Clark County, had several cooperative agreements in effect with private industry and other Government agencies during 1957; these were: Wah Chang Corp., research and development of an improved process for production of titanium sponge (terminated May 4, 1957); American Chrome Co., development of a process for beneficiating chromite ore (begun September 20, 1957); Atomic Energy Commission, electrorefining of zirconium and hafnium from scrap, alloys, and offgrade primary metal by fused-salt electrolysis; General Services Administration, sampling and analysis of titanium

sponge purchased on GSA contracts with private industry, research and development on the electrochemical production of ultra-high-purity titanium metal, and development of a process for producing titanium tetrachloride from slags produced from domestic ilmenites. (Some of this latter work was done in conjunction with the Bureau of Mines Northwest Electrodevelopment Experiment Station, Albany, Oreg.)

TABLE 5.—Fatal and lost-time nonfatal injuries in Nevada mines, mills and smelters, 1953-57¹

County	1953		1954		1955		1956		1957	
	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal
Churchill		1				1				7
Clark	36		1	64	1	56		20	1	30
Douglas				4		2		2		8
Elko		11				2		3	1	8
Esmeralda		6		1		7		19		6
Eureka		13		4	1	2		7	1	10
Humboldt	1	69	3	48		41		38	1	51
Lander		29		30		29		31		26
Lincoln	2	107	4	76	2	77		59	1	103
Lyon		10		32		40		37		35
Mineral		46		42		2		2		13
Nye		39	1	23		9	1	13		32
Ormsby										
Pershing	2	65		30	1	81	1	90	1	57
Storey	1	7		2				1		2
Washoe		13		4		5		7		4
White Pine	3	62	5	65	2	91	5	36		41
Total	9	514	14	475	7	443	7	365	6	433

¹ Fiscal years as reported to the office of Nevada State Inspector of Mines.

Employment and Injuries.—According to the office of the Nevada State Inspector of Mines, employment in the mineral industries declined by 2,138 workers during 1957. On a calendar-year basis, although fatal injuries remained unchanged at 6 in 1956 and in 1957, nonfatal lost-time injuries decreased by 17 percent. The average weekly earnings per employee, as reported by the Bureau of Labor Statistics, increased from \$93.60 in 1956 to \$95.74 in 1957 for a work week that remained virtually unchanged.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—No antimony ore was mined, but 13 tons of ore mined in prior years at the Last Chance mine in the Toiyabe Range east of Round Mountain, Nye County, was concentrated in a mill at Austin, Lander County. The concentrate was shipped to an out-of-State buyer. Antimonial-lead ore mined in Mineral County was shipped to smelters in California and Utah and antimony was contained in other base-metal ores and concentrate shipped to smelters outside the State.

Copper.—The output of copper in Nevada dropped 4 percent in quantity and 32 percent in value below that in 1956. The decrease reflected the continued price decline of the metal begun in the latter

part of 1956. The depressed price and lower demand encouraged production cutbacks by most producers through curtailment of operations to a 5-day week, a reduction in working force, or both. Most of the copper came from three mines: The open pit and underground workings of the Nevada Mines Division, Keanecott Copper Corp.; the open-pit operation of Consolidated Coppermines Corp., in the Robinson district, White Pine County; and the Yerington open-pit mine of The Anaconda Co. in the Yerington district, Lyon County. The contiguous holdings of Kennecott and Consolidated Coppermines contributed 63 percent of the State total. These two companies ranked first and third, respectively, as individual producers. Both companies made extensive studies in 1957 to combat rising production costs. Plans were projected for installing Rockover skip-haulage systems in their open-pit operations to eliminate some heavy-duty truck use in ore and waste haulage. Due to the close proximity of the properties and for economy of operation, negotiations were in progress for the Kennecott Copper Corp. to purchase Consolidated Coppermines' White Pine County holdings. Other economies accomplished in the Robinson district included use of prilled ammonium nitrate for blasting, installation of a new-type car dumper at the Kennecott concentrator, and improved metallurgy for making a higher grade concentrate, which permitted fewer operating days at the McGill smelter to obtain the same quantity of blister copper.

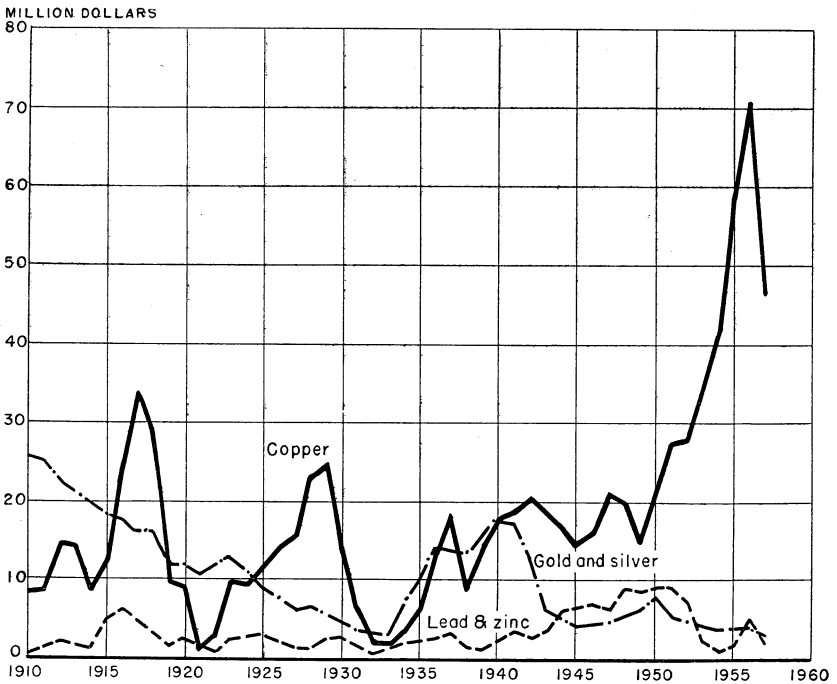


FIGURE 2.—Value of mine production of gold and silver, copper, and lead and zinc in Nevada, 1910-57.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total, 1859-1957, in terms of recoverable metals ¹

Year	Mines producing ²		Material sold or treated ³ (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1948-52 (average)	266	25	7,080,435	131,723	\$4,610,319	1,410,062	\$1,276,177
1953	125	9	8,027,402	101,799	3,562,965	697,086	630,898
1954	119	17	9,843,202	79,067	2,767,345	560,182	506,993
1955	134	10	10,760,337	72,913	2,551,955	845,397	765,127
1956	132	5	12,300,484	68,040	2,381,400	993,716	899,363
1957	107	9	11,769,834	76,752	2,686,320	958,477	867,470
1904-57 ⁴			(⁵)	14,836,376	367,292,263	313,673,610	214,865,825
1859-1957			(⁵)	26,663,252	611,775,496	602,086,459	552,024,048

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average)	49,976	\$22,335,982	8,750	\$2,811,546	19,027	\$5,610,070	\$36,644,094
1953	61,850	35,501,900	4,371	1,145,202	5,812	1,336,760	42,177,725
1954	70,217	41,428,030	3,041	833,294	1,035	223,560	45,759,162
1955	78,925	58,878,050	3,291	980,718	2,670	656,820	63,832,670
1956	80,824	68,700,400	6,384	2,004,576	7,488	2,051,712	76,037,451
1957	77,750	46,805,500	5,979	1,709,994	5,292	1,227,744	53,297,028
1904-57 ⁴	2,449,791	888,883,942	383,365	60,404,777	481,892	93,142,204	1,624,589,011
1859-1957	2,451,717	889,530,570	621,156	83,041,339	481,892	93,142,204	2,229,513,657

¹ Includes recoverable metal content of gravel, washed (placer operations); or milled; old tailing 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 1957, inclusive.

⁶ Data not available.

The Anaconda Co., at its Yerington open-pit mine, Lyon County, was second in quantity of copper produced. Substantial copper sulfide-ore reserves were developed by exploratory drilling beneath the oxide zone. The company planned construction of a sulfide concentrator at Weed Heights, Yerington district, for operation in 1959. Most of the remaining Nevada copper output was credited to the Bristol Silver mine, Jack Rabbit district, Lincoln County; the Copper Canyon and Copper Basin mines, Battle Mountain district, Lander County; the Good Hope and Copper King mines, Maggie Creek district, Eureka County; and the Marshall mine, Contact district, Elko County.

Gold.—The quantity of gold produced in 1957 increased more than 12 percent above that in 1956; over half was byproduct recovery from ores of the State's copper mines. The Goldacres mine, operated by the London Extension Mining Co., in the Bullion district, Lander County, was Nevada's only major lode-gold operation in 1957. The lead ores of Eureka County and lead-zinc ores of Lincoln County also yielded significant quantities of gold. A total of 107 lode mines in 16 counties contributed to the State's total gold output, most of which came as a byproduct from ores treated chiefly for recovering other metals.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals

County	Mines producing ¹		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Churchill.....	2	-----	4	\$140	2, 162	\$1, 957
Clark.....	8	-----	26	910	2, 588	2, 342
Elko.....	9	(²)	134	4, 690	62, 546	56, 607
Esmeralda.....	4	1	39	1, 365	25, 425	23, 011
Eureka.....	7	1	9, 583	335, 405	257, 348	232, 913
Humboldt.....	5	1	18	630	458	415
Lander.....	11	1	16, 274	569, 590	34, 937	31, 620
Lincoln.....	7	-----	911	31, 885	375, 610	339, 946
Lyon.....	2	1	(³)	(³)	4 11	4 10
Mineral.....	10	-----	566	19, 810	16, 595	15, 019
Nye.....	9	3	245	8, 575	5, 040	4, 561
Ormsby.....	(²)	-----	(³)	(³)	(³)	(³)
Pershing.....	2	1	6 37	1, 295	6 17	6 15
Storey.....	2	-----	548	19, 180	4, 493	4, 067
Washoe.....	2	(²)	41	1, 435	18	16
White Pine.....	19	-----	48, 259	1, 689, 065	170, 046	153, 900
Undistributed ³	8	-----	67	2, 345	1, 183	1, 071
Total.....	107	9	76, 752	2, 686, 320	958, 477	867, 470

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill.....	-----	-----	54, 500	\$7, 793	-----	-----	\$9, 890
Clark.....	39, 600	\$11, 920	1, 781, 200	254, 712	232, 600	\$26, 982	296, 866
Elko.....	322, 300	97, 012	794, 900	113, 671	75, 100	8, 712	280, 692
Esmeralda.....	-----	-----	2, 300	329	5, 200	603	25, 308
Eureka.....	279, 600	84, 160	6, 005, 300	858, 829	514, 800	59, 717	1, 571, 024
Humboldt.....	16, 900	5, 087	-----	-----	-----	-----	6, 132
Lander.....	967, 800	291, 308	15, 000	2, 145	4, 600	533	895, 196
Lincoln.....	1, 419, 400	427, 239	2, 821, 100	403, 417	9, 712, 600	1, 126, 662	2, 329, 149
Lyon.....	54, 068, 600	16, 274, 649	-----	-----	-----	-----	4 16, 274, 659
Mineral.....	13, 200	3, 973	325, 500	46, 546	6, 200	719	86, 067
Nye.....	-----	-----	5, 200	744	700	81	13, 961
Ormsby.....	-----	-----	-----	-----	-----	-----	(³)
Pershing.....	(³)	(³)	(³)	(³)	(³)	(³)	4 1, 310
Storey.....	-----	-----	-----	-----	-----	-----	23, 247
Washoe.....	-----	-----	-----	-----	-----	-----	1, 451
White Pine.....	98, 369, 200	29, 609, 129	126, 700	18, 118	32, 100	3, 724	31, 473, 936
Undistributed ³	3, 400	1, 023	25, 800	3, 690	100	11	8, 140
Total.....	155, 500, 000	46, 805, 500	11, 958, 000	1, 709, 994	10, 584, 000	1, 227, 744	53, 297, 028

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

² From property not classified as a mine.

³ Lyon County placer combined with "Undistributed" to avoid disclosing individual company confidential data.

⁴ Excludes placer output, included with "Undistributed."

⁵ Ormsby County and Pershing County lode combined with "Undistributed" to avoid disclosing individual company confidential data.

⁶ Exclusive of lode output, which is included with "Undistributed."

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	6,777	100,384	7,057	498	745
February.....	6,437	79,483	6,855	417	751
March.....	6,914	92,735	7,006	463	820
April.....	5,867	98,320	6,525	468	743
May.....	5,805	76,307	6,490	363	671
June.....	5,610	65,930	6,699	452	607
July.....	7,548	96,775	5,758	870	610
August.....	7,093	77,927	6,232	572	149
September.....	5,698	67,997	6,393	423	81
October.....	7,144	63,638	6,220	587	26
November.....	5,867	58,346	6,228	343	45
December.....	5,992	80,635	6,287	523	44
Total.....	76,752	958,477	77,750	5,979	5,292

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	26	161,591	15,865	6,183	100	200	-----
Dry gold-silver.....	3	1,278	627	27,643	1,100	600	-----
Dry silver.....	13	4,243	87	44,294	1,000	-----	5,200
Total.....	42	167,112	16,579	78,120	2,200	800	5,200
Copper.....	34	11,514,197	48,872	408,441	155,401,000	301,000	237,000
Copper-lead.....	1	33	-----	231	2,400	4,900	-----
Lead.....	24	23,055	10,058	328,566	18,100	7,332,200	606,900
Lead-zinc.....	10	60,438	580	140,233	73,600	2,561,700	9,507,000
Zinc.....	1	1,003	-----	1,498	2,000	24,100	208,300
Total.....	70	11,598,726	59,510	878,969	155,497,100	10,223,900	10,559,200
Other "lode" material:							
Old tailings ²	4	442	60	896	100	16,900	-----
Slag (gold).....	1	5	222	99	-----	-----	300
Lead residue.....	1	3,549	5	278	600	1,716,400	19,300
Total.....	6	3,996	287	1,273	700	1,733,300	19,600
Total "lode" material.....	107	11,769,834	76,376	958,362	155,500,000	11,958,000	10,584,000
Gravel (placer operations).....	9	(³)	376	115	-----	-----	-----
Total, all sources.....	116	-----	76,752	958,477	155,500,000	11,958,000	10,584,000

¹ Details will not necessarily add to totals, because some mines produce more than 1 class of material.

² Metal recovered, by class of old tailings, as follows: Gold, 306 tons—58 ounces gold, 57 ounces silver lead, 136 tons—2 ounces gold, 839 ounces silver, 100 pounds copper, 16,900 pounds lead.

³ 14,930 cubic yards.

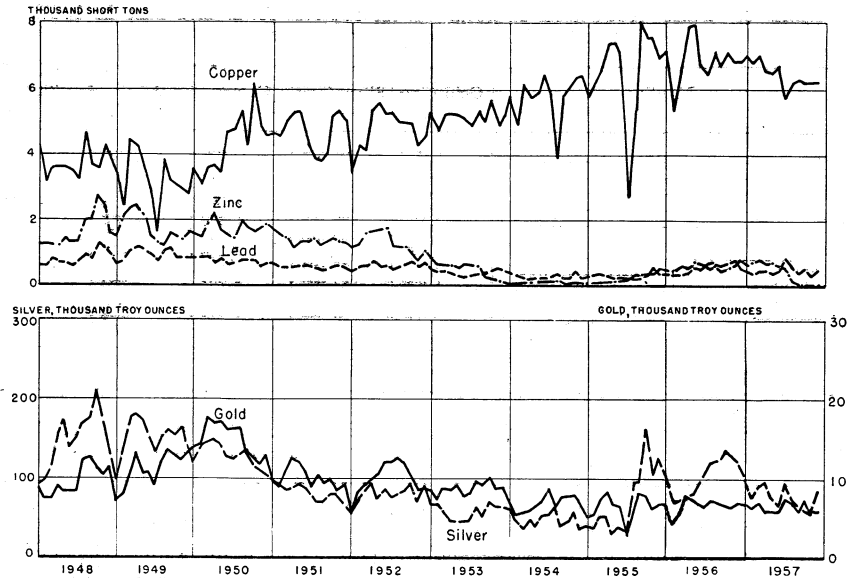


FIGURE 3.—Mine production of gold, silver, copper, lead, and zinc, in Nevada, 1948-57, by months, in terms of recoverable metals.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Material shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Dry gold.....	22	159	447	128	361	3
Dry silver.....	37	13	6,605		21	
Copper.....	239,547	47,386	156,030	100,247,649	4,174	
Lead.....	2,967	307	86,047	13,699	2,252,335	257,815
Zinc.....	7,767	268	53,280	50,545	370,738	9,499,222
Copper precipitates.....	32,668			56,320,696		
Total: 1957.....	283,008	48,133	302,409	156,632,717	2,627,629	9,757,040
1956.....	302,396	42,182	368,522	161,144,481	3,453,587	11,053,533
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold:						
Crude ore.....	141	48	255	89	6	
Slag.....	5	222	99	6	99	426
Dry gold-silver: Crude ore.....	1,278	627	27,685	1,138	944	
Dry silver: Crude ore.....	1,243	74	37,889	1,167	58	6,567
Copper: Crude ore.....	92,488	1,486	254,160	4,343,266	332,993	358,490
Copper-lead: Crude ore.....	33		231	3,185	5,088	
Lead:						
Crude ore.....	22,605	10,058	325,974	22,416	7,545,695	1,026,308
Old tailings.....	136	2	839	112	18,833	
Residue.....	3,549	5	278	723	1,767,149	24,380
Lead-zinc: Crude ore.....	227	5	3,498	15,280	96,929	44,496
Zinc: Crude ore.....	1,003		1,656	3,917	26,709	232,265
Total: 1957.....	122,708	12,527	652,564	4,391,299	9,794,503	1,692,932
1956.....	168,182	16,692	565,012	6,331,418	9,687,785	4,563,430

¹ Revised figure.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters ¹ and recoverable metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Churchill.....	5	2	5						
Clark.....	100	12	5						
Elko.....	450	53	6						
Humboldt.....	330	6	3						
Lander.....	154,317	14,973	1,048	60	26	519	7,600	2,500	
Lincoln.....	60,211			10,699	575	136,735	60,700	2,468,100	9,475,600
Lyon.....	3,875,668			32,668			54,067,900		
Mineral.....	4,760			54	149	6,849			
Nye.....	475	64	32	5		104		4,200	
Ormsby.....	1	1	30						
Pershing.....	150	47	20	2	6	17	100	200	
Storey.....	4,240	538	4,385	1	10	108			
Washoe.....	48	20	7						
White Pine.....	7,546,341			239,517	47,360	156,358	97,232,500	19,800	9,000
Undistributed.....	30			2	7	11			
Total: 1957.....	11,647,126	15,716	5,541	283,008	48,133	300,701	151,368,800	2,494,800	9,484,600
1956.....	12,132,302	18,816	70,122	302,396	42,182	362,454	155,656,500	3,368,700	10,745,400
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore.....	161,450	15,658	5,484	22	159	446	100	200	
Old tailings.....	306	58	57						
Dry silver:									
Crude ore.....	3,000			37	13	6,539			
Copper: Crude ore.....	11,421,709			272,215	47,386	154,389	151,307,600	2,500	
Lead: Crude ore.....	450			35		2,592	400	24,000	9,000
Lead-zinc: Crude ore.....	60,211			10,699	575	136,735	60,700	2,468,100	9,475,600
Total: 1957.....	11,647,126	15,716	5,541	283,008	48,133	300,701	151,368,800	2,494,800	9,484,600
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS ¹									
Dry gold.....				22	159	446	100	200	
Dry silver.....				37	13	6,539			
Copper.....				239,547	47,386	154,389	97,239,700	2,500	
Lead.....				2,967	307	86,047	11,600	2,140,000	203,800
Zinc.....				7,767	268	53,280	49,500	352,100	9,280,800
Copper precipitates.....				32,668			54,067,900		
Total: 1957.....				283,008	48,133	300,701	151,368,800	2,494,800	9,484,600

¹Excludes concentrate treated only by amalgamation and/or cyanidation.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Churchill.....	51	2	2,157	-----	54,500	-----
Clark.....	4,909	14	2,583	39,600	1,781,200	232,600
Elko.....	7,074	80	62,539	322,300	794,900	75,100
Esmeralda.....	587	6	25,411	-----	2,300	5,200
Eureka.....	21,791	9,569	257,347	279,600	6,005,800	514,800
Humboldt.....	231	10	455	16,900	-----	-----
Lander.....	16,913	1,119	33,349	960,200	12,500	4,600
Lincoln.....	10,709	336	238,875	1,358,700	353,000	237,000
Lyon.....	43	-----	11	700	-----	-----
Mineral.....	2,187	417	9,746	13,200	325,500	6,200
Nye.....	235	72	4,888	-----	1,000	700
Pershing.....	6	1	83	-----	1,000	100
White Pine.....	57,720	899	13,688	1,136,700	106,900	23,100
Undistributed.....	252	2	988	3,300	24,600	-----
Total: 1957.....	122,708	12,527	652,120	4,131,200	9,463,200	1,099,400
1956.....	163,182	* 6,692	* 561,086	* 5,991,500	9,399,300	4,230,600
BY CLASSES OF MATERIAL						
Dry gold:						
Crude ore.....	141	48	253	-----	-----	-----
Slag.....	5	222	99	-----	-----	300
Dry gold-silver: Crude ore.....	1,278	627	27,643	1,100	600	-----
Dry silver: Crude ore.....	1,243	74	37,755	1,000	-----	5,200
Copper: Crude ore.....	92,488	1,486	254,052	4,093,400	298,500	237,000
Copper-lead: Crude ore.....	33	-----	231	2,400	4,900	-----
Lead:						
Crude ore.....	22,605	10,058	325,974	17,700	7,308,200	597,900
Old tailings.....	136	2	839	100	16,900	-----
Residue.....	3,549	5	278	600	1,716,400	19,300
Lead-zinc: Crude ore.....	227	5	3,498	12,900	93,600	31,400
Zinc: Crude ore.....	1,003	-----	1,498	2,000	24,100	208,390
Total: 1957.....	122,708	12,527	652,120	4,131,200	9,463,200	1,099,400

* Revised figure.

TABLE 12.—Gold and silver produced at placer mines, 1948-52 (average) and 1953-57, in fine ounces, in terms of recoverable metals

Year	Material handled (cubic yards)	Gold (fine ounces)	Silver (fine ounces)	Total value	Average gold value per cubic yard
1948-52 (average).....	3,835,912	23,217	7,593	\$819,474	\$0.240
1953.....	2,670,110	16,310	2,412	573,033	.214
1954.....	3,014,130	17,246	2,475	605,850	.200
1955.....	685,802	6,768	883	237,679	.345
1956.....	11,817	350	54	12,299	.895
1957.....	14,930	376	115	13,264	.869

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation and cyanidation:					
Ore.....	15,658	5,484			
Old tailings.....	58	57			
Total recoverable in bullion.....	15,716	5,541			
Concentration and smelting of concentrates: Ore.....	48,133	300,701	151,368,800	2,494,800	9,484,600
Direct smelting:					
Ore.....	12,298	650,904	4,130,500	7,729,900	1,079,800
Old tailings.....	2	839	100	16,900	
Slag.....	222	99			300
Lead residue.....	5	278	600	1,716,400	19,300
Total.....	12,527	652,120	4,131,200	9,463,200	1,099,400
Placer.....	376	115			
Grand total.....	76,752	958,477	155,500,000	11,958,000	10,584,000

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals.¹

County and district	Mines producing, ²		Lode material (short tons)	Gold (fine ounces)			Silver lode and placer, ³ (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Churchill County:											
Chalk Mountain.....	1		51	2		2, 157		54, 500			\$9, 815
Eastsafe.....			5	2		5					75
Clark County:											
Goodsprings.....	6		1, 333	5		2, 230	37, 400	63, 200	213, 300		47, 231
Las Vegas.....	(4)		3, 549	5		5	600	1, 716, 400	19, 300		248, 292
Elko County:											
Boulder Creek.....	1		450	53		38, 191	2, 700	530, 900	65, 700		1, 860
Delano.....	1		2, 491	12		38, 27	2, 400				119, 338
Ferber.....	1		8			1					175
Gold Circle.....				1		16					36
Island Mountain.....	2		580	16		18, 037	300	258, 700	8, 700		54, 978
Spruce Mountain.....	1		55			175		3, 700			687
Esmeralda County: Lida (Tule Canyon).											1, 168
Bureka County:											
Cortez.....	1			33		33					
Maggie Creek.....	2		4, 627	13		13	3, 662				3, 769
Humboldt County:											
Awakening.....	1		330	6		6	938	266, 700			81, 931
Gold Run.....	1			2		2					213
Lander County:											
Battle Mountain.....	7	1	16, 833	898	1, 054	33, 684	965, 900	14, 900	4, 300		360, 697
Birch Creek.....	1		10	33		16					1, 169
Lincoln County: Tem Piute.....	1		15			568					1, 505
Lyon County: Yerington.....	1		3, 875, 668				54, 067, 900				16, 274, 438
Mineral County:											
Aurora.....	1		1, 760	121		121	300				4, 506
Candelaria.....	3		4, 432	425		425	14, 418	273, 100			66, 977
Cedar Mountain.....	1		440	4		4	1, 607	52, 400	6, 200		9, 806
Garfield.....	1		8				171				155
Pilot Mountain.....	1		209				7, 700				2, 318
Silver Star.....	1		41			41	10				611
Whiskey Flat.....	1		5			5	14	2, 000			163
Nye County:											
Bullfrog.....	1		4	11		11	37				418
Reveille.....	1		150				104	4, 200			695
Tonopah.....	1		203	48		48	4, 713				5, 940
Troy.....	1		1	5		5	2				177
Pershing County:											
Trinity.....		(4)		5		5	1				176
Willow Creek.....				32		32	16				1, 134

Storey County:	2	4,240	548	4,493	23,247
Comstock Lode.....					
Washoe County:	2	48	20	7	706
Olinghouse.....			21	11	745
Peavine.....	(1)				
White Pine County:	1	44	1	1,244	1,161
Aurum (Silver Canyon).....					
Granite.....	1	6			1,276
White Pine.....	3	177	3	2,940	21,681
Undistributed *.....	57	7,851,812	74,122	828,452	35,946,653
Total.....	107	11,769,834	76,376	958,477	53,297,028

* Includes the following: Searchlight in Clark County; Contact and Lorys in Elko County; Klondyke, Montezuma, Silver Peak, and Tokop in Esmeralda County; Eureka, Lynn, and Union in Eureka County; Battle Mountain and Galeonda in Humboldt County; Bullion, Hilltop, and Lewis in Lander County; Jack Rabbit (Bristol) and Pioche (Ely) in Lincoln County; Pine Grove and Silver City in Lyon County; Hawthorne and Santa Fe in Mineral County; Fairplay, Johnnie, Lodi (Mammoth), Manhattan, and Washington in Nye County; Delaware in Ormsby County; Antelope, Mill City (Central), and Sierra in Pershing County; Cherry Creek, Newark, Robinson and Tungstonia in White Pine County.

¹ Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts are listed in footnote and their output grouped as "Undistributed."
² Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
³ Source of silver as follows: 958,462 ounces from lode mines and 115 ounces from placer mines.
⁴ From property not classed as a mine.

Nine placer mines—6 small-scale hand operations, 2 nonfloat washing plants, and 1 drift mine—yielded only 376 ounces of gold or less than 1 percent of the total gold output in the State. Properties in Lander and Nye Counties were the chief sources of placer gold. Pershing, Esmeralda, Eureka, Lyon, and Humboldt Counties contributed to a smaller degree, in the order named. Prospecting in Washoe and Elko Counties produced a few ounces of gold sold to bullion buyers. Extensive stripping operations were started at the placer property of Nevada Porphyry Gold Mines, Inc., in the Round Mountain district, Nye County, by the Round Mountain Gold Dredging Corp., which had obtained a new and amended lease on the property. Mining operations had been suspended in 1952 due to technical difficulties; the former practice of mining the entire bank from top to bottom had proved too costly. The remodeled milling plant, which had a planned capacity of 250,000 cubic yards of gravel per month, was expected to begin operating early in 1958.

Iron Ore.—Nevada iron-ore production during 1957 exceeded 970,000 tons, up 11 percent from 1956. More than 365,000 tons of concentrate was produced from ore upgraded by magnetic separation; there was no output in 1956. Although the tonnages of direct-shipping ore produced and shipped were down 38 and 41 percent, respectively, the total shipments of ore and concentrate were actually less than 2 percent below 1956. Approximately 190,000 tons of direct-shipping ore and 364,000 tons of concentrate were exported. An estimated 330,000 tons of ore and concentrate produced in Nevada was consumed in making pig iron and steel at eastern furnaces and California steel plants during 1957. Minor tonnages of ore and concentrate were used in the preparation of dead-burned magnesia and in atomic shielding. Standard Slag Co., the State's largest individual producer, worked properties in Douglas and Nye Counties and furnished all the iron-ore output in these two counties. The unit price of iron ore produced in Nevada increased slightly in 1957, based upon a higher average grade. The iron content of all shipments averaged 60.15 percent as compared with 58.62 percent in 1956.

Iron and Steel Scrap.—A spot check on shipments of iron and steel scrap by Nevada dealers indicated that the 1957 pattern approximates that of California shipments, which declined somewhat during the year. Military bases provided a substantial part of the scrap generated. Four dealers were active in Reno, 2 in Las Vegas, and 1 each in Henderson, Fallon, Ely, Elko, and Winnemucca. Of the automobile wreckers, 7 were active in Reno, 2 in Ely, and 1 each in Carson City, Fallon, Las Vegas, and Winnemucca. The Anaconda Co. continued consuming detinned cans for producing cement copper from copper sulfate. Cans were obtained principally from the Los Angeles, Calif., area.

Lead.—The continued drop in the price of lead during 1957 caused a production decline of 6 percent, compared with 1956. Eureka County led the State in total output, most of which was credited to lead ore mined at the Richmond-Eureka and Consolidated Eureka (Diamond-Excelsior) mines in the Eureka district. Despite closing down of lead-zinc mining operations in the Pioche district, Lincoln

County ranked second in lead output. Clark County dropped from first place to third in lead production, as smelter shipments of lead residue, obtained in the treatment of manganese ores of the Las Vegas district, were not made at production rates. Lead ore mined in the Delno and Island Mountain districts was responsible for placing Elko County fourth in order of production. The remaining yield was derived from various mining operations in 7 other counties, most of which came from Mineral County where there were 10 producers. The State's leading individual producers, in the order named, were: Eureka Corp., Ltd., Eureka County (lead ore); Manganese, Inc., Clark County (manganese ore); Combined Metals Reduction Co., Lincoln County (lead-zinc ore); and Consolidated Eureka Mining Co., Eureka County (lead ore).

Manganese.—Nevada production of manganese ore, nodules, and low-grade manganese ore supplied about one-third of the national output and was more than 5 percent above 1956 figures. Although the State's principal producer only worked its Three Kids mine 4 months during 1957, the concentrator and nodulizing plant operated throughout the year, primarily on stockpiled ores previously mined. All mine and plant facilities were in the Las Vegas district, Clark County, a few miles east of Henderson. The nodulized product was shipped to a Government stockpile. One company prepared electrolytic battery-active manganese dioxide at its Henderson plant, Clark County, using manganese nodules produced in Montana and ore mined in Mexico. An attempt to use manganese ore and concentrate from the Pioche area (Lincoln County) was unsuccessful because of the high iron content. The entire plant output was sold to the Government under contract. Three producers in the Ely area, White Pine County, and one in the Hiko area, Lincoln County, shipped low-grade ore to a Government purchase depot. There was no activity in manganese exploration or development under the DMEA during 1957.

Mercury.—Nevada mercury production in 1957 increased about 8 percent above the 1956 figure despite a lower average market price of more than \$10 per flask. End stocks rose appreciably above those of the previous year in that producers held back shipments waiting a price recovery that did not materialize. As in 1956, 8 counties contributed to the State's output, with Humboldt and Pershing Counties supplying more than 97 percent of the total. The Cordero mine near McDermitt, Humboldt County, continued as Nevada's leading individual producer but dropped to third place nationally, although the output was only slightly less than that of 1956. At two operations the Red Ore mine in the Bottle Creek district, Humboldt County, and the Pershing Group in the Relief district, Pershing County, mined ore was concentrated by flotation before retorting. Production from these two mines contributed substantially to the State's total mercury output. Although there were 45 producers during the year, only 5 had an output of more than 40 flasks. Two mercury-ore exploration contracts were in effect in Pershing County under DMEA; one was executed late in 1957.

TABLE 15.—Mercury production by methods of recovery

Year	Direct furnaced		Retorted		Unclas- sified, ¹ 76-pound flasks	Total		Oper- ating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks		76-pound flasks	Value *	
1948-52 (average)	14, 015	2, 171	202	24	1	2, 196	\$294, 893	6
1953	91, 134	13, 467	3, 388	509	2	3, 254	628, 120	12
1954						4, 974	1, 315, 076	21
1955						5, 750	1, 669, 512	33
1956						5, 859	1, 522, 871	51
1957	73, 429	10, 344	16, 744	1, 816	12	6, 313	1, 559, 185	45

¹ Includes mercury recovered from miscellaneous dump material.

* Value calculated at average price at New York.

Molybdenum.—The porphyry-copper ores mined in the Robinson district (White Pine County) were the source of the State's molybdenum output, recovered as byproduct molybdenite concentrate at the McGill copper concentrator. The ores were mined by the two major copper companies operating in this district. The entire production of concentrate was sold to a domestic consumer outside the State. At the Last Chance mine in the Pine Grove district, Lyon County, several hundred tons of molybdenum ore was mined and stockpiled, but none shipped. At the Getchell mine, Humboldt County, some molybdenite concentrate was produced as a byproduct in the treatment of tungsten ores, but the output was not shipped.

Silver.—The quantity of silver recovered from all ores treated, decreased nearly 4 percent below the 1956 figure, owing principally to the curtailed production at the State's copper, lead, and zinc mining operations from which silver was recovered as a byproduct. All Nevada counties except Douglas contributed to the total output; most was recoverable metal contained in copper ore from the Jack Rabbit district and lead-zinc ores from the Pioche district, Lincoln County; lead ores from the Eureka district, Eureka County; and porphyry-copper ores from the Robinson district, White Pine County. Important quantities of silver were also recovered in treating lead ores mined in Elko County, gold-silver and copper ores from Lander County, silver ores produced in Esmeralda County, and the ores of lead and silver mines in Mineral County. A small tonnage of direct-smelting silver ore was mined and shipped from the Tempiute Silver mine (a new producer) in the Tem Piute district, Lincoln County. Modest quantities of silver were recovered in the treatment of oxidized zinc ore stockpiled at Jean (previously mined in the Goodsprings district) and lead residue from kilned manganese ore of the Henderson area, Clark County. The number of ounces of silver produced as a coproduct of gold at placer mines in 9 counties was minor.

Titanium.—Although no titanium minerals were produced in Nevada during 1957, exploration, development, and assessment work was done at the Rainbow prospect in an unsurveyed area 80 miles

north of Tonopah, Nye County. Work at the property included sinking a 30-foot vertical shaft. The owner had no plans for production because of unfavorable conditions for marketing titanium minerals.

Titanium Metals Corp. of America chlorinated rutile, imported from Australia, to form titanium tetrachloride at its Henderson plant, Clark County. This compound was reacted with magnesium metal to produce titanium sponge. The magnesium chloride produced in the sponge plant was treated to recover magnesium, and the chlorine was reused in the process. The titanium-metal products at Henderson were sponge, powder, and ingot. Although some metal was sold in sponge form, most of it was melted in arc furnaces to produce large ingots of titanium or titanium alloys, which were shipped to eastern fabricating plants. T. M. C. A. had three reductions in its working force during 1957, accompanied by corresponding drops in metal production rate. These cutbacks were credited to reduced expenditures by the Department of Defense for military aircraft, the manufacture of which consumed a high percentage of titanium metal production. The T. M. C. A. expansion program was continued in 1957. The melt-shop capacity was increased about 50 percent, and acid-storage facilities greatly improved early in the year. New administration and technical-research buildings were completed and occupied before the end of 1957.

Tungsten.—Although Nevada mines yielded more than one-fifth of the tungsten production of the Nation in 1957, the closing of the Government domestic-tungsten purchase program in January brought about almost complete collapse of the industry by September. The number of producers dropped from 139 in 1956 to 2 by the end of 1957, yet 30 properties were in production at some time during the year. A mining and milling operation near Gabbs, Nye County, and one near Mill City, Pershing County, were producing on a very limited basis at the end of the year. The major producer in Mineral County converted to an experimental tungsten carbide operation during the latter half of the year, but the plant was operated on a pilot basis only. Production and shipments of tungsten concentrate dropped 64 and 78 percent, respectively, below 1956. Over 97 percent of the State tungsten output came from 6 operating properties in 5 counties, 3 of which furnished over 85 percent of the total. In the order of their production, they were: The Tungsten group, Pershing County; the Lincoln mine, Lincoln County; the Getchell and Riley mines, Humboldt County; the Victory mine, Nye County; and the Leonard mine, Mineral County. Exploration activities under DMEA contracts were: Three continuing projects—1 each in Mineral, Nye, and Pershing Counties; 1 new contract in Churchill County, executed in December; and 3 projects—1 each in Humboldt, Lincoln, and White Pine Counties—terminated in August, October, and November, respectively.

TABLE 16A.—Tungsten concentrate produced from ores in 1957, by counties

County	Producing mines and prospects	Ore ¹			Concentrate produced ¹ (pounds)	Contained WO ₃ ¹ units
		Mined (short tons)	To mills (short tons)	Milled ² (short tons)		
Churchill.....	3	(³)	(³)	(³)	(³)	(³)
Clark.....	1	(³)	(³)	(³)	(³)	(³)
Douglas.....	1	(³)	(³)	(³)	(³)	(³)
Elko.....	3	(³)	(³)	(³)	(³)	(³)
Humboldt.....	2	72,941	72,941	72,932	759,480	25,350
Lander.....	1	(³)	(³)	(³)	(³)	(³)
Lincoln.....	1	122,045	129,077	129,077	1,166,820	34,788
Lyon.....	1	(³)	(³)	(³)	(³)	(³)
Mineral.....	5	(³)	(³)	(³)	(³)	(³)
Nye.....	5	5,486	5,486	4,006	146,311	4,379
Pershing.....	3	169,330	169,330	169,330	1,361,951	48,370
Storey.....	1	(³)	(³)	(³)	(³)	(³)
White Pine.....	3	1,115	1,115	1,281	77,069	2,614
Undistributed ³		3,502	2,602	3,916	61,376	2,039
Total.....	30	374,419	380,551	380,542	3,573,007	117,540

TABLE 16B.—Production and shipments of tungsten concentrate in 1957 credited to Nevada counties in which ore was mined

County	Concentrate				
	Produced ¹		Shipped		
	Pounds	Units	Pounds	Contained WO ₃ units	Value ⁴
Humboldt.....	762,285	25,450	231,711	8,260	\$213,273
Lincoln.....	1,166,820	34,788	1,196,000	35,707	921,955
Nye.....	162,398	4,897	63,810	1,473	41,952
Pershing.....	1,361,951	48,370	667,751	24,074	434,368
White Pine.....	75,238	2,556	1,238	40	2,186
Undistributed ³	47,120	1,579	64,575	2,199	62,420
Total.....	3,575,812	117,640	2,225,085	71,753	1,676,154

¹ Partly estimated.² Ore actually milled in county including material from other counties.³ Included with "Undistributed" to avoid disclosing individual company confidential data.⁴ Based upon values reported by GSA, San Francisco, Calif.⁵ Includes Churchill, Clark, Douglas, Elko, Lander, Lyon, Mineral, and Storey Counties.

Uranium.—Although uranium activity declined somewhat from 1956 there were 2 new shippers of ore in 1957, 1 each in Mineral and Washoe Counties. The producing properties of 1956 from which ore was shipped in 1957 were: The Early Day, Lander County; the Glacier King and River Road, Lyon County; and the Lowary Group, Washoe County. Total shipments to concentrators in Utah and Colorado were off 40 percent from 1956 figures, and the average grade of ore shipped dropped 9 percent. There was no activity in uranium exploration and development under DMEA during the year; however, there was some exploration activity by individuals in the Mountain City area, Elko County, near Panaca, Lincoln County; and on Millers Flats in the Tonopah district, Nye County.

The cooperative agreement between the Bureau of Mines and the Atomic Energy Commission, whereby the Rare and Precious Metals

Experiment Station at Reno tested ore samples for radioactivity, was terminated July 1, 1957.

Zinc.—The output of zinc in Nevada dropped 29 percent from that of 1956, primarily because of the closing of mining operations by the Combined Metals Reduction Co. in the Pioche area, Lincoln County, on August 1, 1957. The company had been a major lead-zinc producer in the State for the past 30 years. The shutdown was due to declining market prices for lead and zinc. The company continued operating its Caselton mill on stockpile ore for the remainder of the year. Despite this curtailment, Lincoln County had the highest zinc production in the State, followed by Eureka County where Eureka Corp., Ltd. stepped up activity at its Richmond-Eureka mine. Modest shipments were made from the stockpiled oxidized zinc ores at Jean in Clark County (mined previous to 1944 in the Goodsprings district) to a Utah smelter-fuming plant. A small quantity of zinc was recovered from the lead residue resulting from kilned manganese ores in the Henderson area, Clark County. The Delno and Railroad districts in Elko County and the White Pine and Newark districts in White Pine County were other areas that yielded moderate quantities of zinc.

Other Metals.—Zinc concentrate produced from ores of the Pioche district, Lincoln County, and lead and lead-zinc ores mined in Mineral and Eureka Counties contained appreciable quantities of cadmium. The tonnage of metal recovered at out-of-State smelters was undetermined. Selenium, contained in blister copper produced at the McGill smelter, White Pine County, and in residues resulting from the copper leaching process operation, Lyon County, was recovered at refineries outside the State in undisclosed quantities.

A nickel prospect in Pershing County east of Lovelock reported exploration work during 1957. Two other nickel prospects—1 each in Eureka and Lander Counties—completed assessment work only. Work done at a placer-tin prospect on a military reservation in Pershing County was restricted to assessment work and drilling for water. A columbium-tantalum prospect in Humboldt County near Denio was inactive the entire year.

NONMETALS

Barite.—The production of crude and ground barite declined 64 and 21 percent, respectively, in 1957. The shipments of crude ore declined only 39 percent, as end stocks were appreciably reduced. Although 5 deposits in Lander County supplied 91 percent of the total output, crude barite mined at properties in Elko, Humboldt, Mineral, and Nye Counties contributed to the Nevada yield. Production declined below 1956 figures, primarily because large tonnages normally shipped to the Gulf States by one of the major producers in Nevada did not materialize in 1957. A grinding mill operated by this company near Battle Mountain, Lander County, operated at only about 25 percent capacity during the year. There was also a marked drop in the quantity of crude barite shipped to California grinders for ultimate consumption in well-drilling fluids and in manufacturing barium chemicals.

Brucite and Magnesite.—The Gabbs area (Nye County) was the source of all brucite and magnesite mined—by two producers—in 1957. Magnesite production increased about 8 percent above 1956 figures, but brucite output was down 71 percent. This decline was attributed to the drop in basic open-hearth-steel production; most of the brucite was processed for magnesia grain refractory used in basic-steel furnace bottoms. One company upgraded crude brucite by dense-medium separation. Except for a few hundred tons sold direct to consumers, the upgraded product was shipped to a company plant in Ohio and used in manufacturing refractories. Although several hundred tons of crude magnesite was shipped to California consumers, a high percentage of the output of both producers was fired to produce caustic-calcined magnesia and refractory magnesia. A moderate tonnage of magnesia was exported to Japan.

Clays.—Nevada production of clays in 1957 declined 11 percent in tonnage and 37 percent in value compared with 1956. The comparatively larger tonnages of lower grade material mined in 1957 rather than a decrease in unit price explained the major drop in total value. Semi-fire and miscellaneous clays were mined at pits near the Geiger grade a few miles south of Reno, Washoe County. The output was used in manufacturing heavy clay products. The El Dorado pit near Nelson, Clark County, yielded miscellaneous clay used to produce common brick. In Lyon County bentonitic clay was mined at the Jupiter pit near Weeks. This material was shipped to a California processing plant, where it was prepared for use by the chemical, ceramic, and building industries.

Diatomite.—Three open-pit operations, one each in Churchill, Esmeralda, and Storey Counties, were the source of all diatomite mined in 1957. Preparation plants were operated on crude mineral from these pits at Fernley (Lyon County), east of Basalt, in Esmeralda County, and Clark Station (Storey County). Production of crude and prepared diatomite increased 20 percent above that in 1956. Although a large tonnage of the prepared material was sold for use as filler in rubber, paint, and paper and as a carrier in insecticides, an important quantity was exported to Canada, where a high percentage was used for special-purpose dusting at ammonium nitrate fertilizer plants. A moderate tonnage of crude diatomite was shipped to California, where it was prepared for use as poultry litter. During the year, Eagle-Picher Co. was developing a deposit in the Velvet district, Pershing County, and constructing a preparation plant near Lovelock; both were expected to be producing late in 1958. In view of the type of diatoms found in the Velvet deposit, the diatomite will be prepared primarily for filtration uses.

Fluorspar.—The output of crude and finished fluorspar decreased in 1957; the value was 13 percent below 1956. Shipments of both Metallurgical and Acid grades declined. Near the end of the year the State's leading producer closed the Kaiser (Baxter) mine near Gabbs, Mineral County, and the company mill near Fallon, Churchill County, because ore meeting the specification grade was depleted. A producer near Stillwater, Churchill County, had a small output, which was shipped to the Fallon plant. The Crowell property near Beatty, Nye County, yielded Metallurgical-grade spar, which was shipped to California steel plants; a small tonnage was sold to a Lin-

coln County producer of Acid-grade spar. Most of the Lincoln County output was a byproduct of a tungsten operation and was purchased by GSA for stockpiling.

Gem Stones.—The value of gem minerals collected in Nevada during 1957 doubled that in 1956. Major items mined or collected were turquoise, agate, opal, and opalite (some with cinnabar). Humboldt County was the source of more than 80 percent of the State total in terms of value. Deposits in Virgin Valley, Humboldt County, supplied good fire opal, which brought the highest unit price of any gem stone collected in the State. The Lone Mountain Turquoise mine, Esmeralda County, was the source of most of the turquoise. The Copper King mine, Eureka County, was credited with all the azurite reported in 1957. The Battle Mountain area, Lander County, yielded amethystine agate and cinnabar crystals, in addition to considerable turquoise. Obsidian was collected in Lincoln and Mineral Counties; agate in Humboldt, Lyon, and Nye Counties; and opalized wood in Washoe County.

Gypsum.—During 1957 the production of crude gypsum continued to decline and was 15 percent lower in tonnage and 22 percent lower in value than in 1956. Two quarries were active in Clark County and one in Pershing County. Of the total crude produced, 71 percent was calcined. Of the uncalcined, all but a minor tonnage sold as soil conditioner was sold as portland-cement retarder. The tonnage of calcined gypsum was estimated to be 21 percent below that in 1956.

These decreases in production apparently were caused by a 4-percent decrease in the total valuation of building permits in California from 1956 to 1957, since that State is the principal market for Nevada gypsum and gypsum products.

The Blue Diamond Corp., with a quarry and calcining plant at Blue Diamond, Clark County, was the chief producer of crude gypsum and manufacturer of calcined products, including wallboard, lath, and plaster. The United States Gypsum Co. with a quarry at Empire, Pershing County, produced calcined products at its nearby plant in Washoe County. The Fiberboard Paper Products Corp., with a quarry near Henderson, Clark County, crushed and shipped crude gypsum to its California wallboard plants at South Gate, Los Angeles County, and Newark, Alameda County.

Lime.—The total quantity of quick and hydrated lime sold and used from Nevada production in 1957 declined 8 percent below 1956. Requirements by the building trades dropped 6 percent, and the demand for use in chemicals and for other industrial needs decreased 10 percent. All Nevada lime output was by 2 producers: United States Lime Products Corp. operated 2 plants in Clark County and produced both quick and hydrated lime, most of which was shipped to consumers in California; Kennecott Copper Corp., in White Pine County, produced only enough hydrated lime to meet its metallurgical requirements. Major-use declines, other than in the building trades, were in water purification and industrial waste-water treatment.

Marl.—Nevada's modest calcareous marl production in 1957 came from the Double Check open-pit mine in Washoe County near Flanigan. The entire output of this raw material (about 7 percent

below that in 1956) was shipped to a California milling company in the San Francisco Bay area, where it was processed for filler in poultry and livestock feeds.

Perlite.—Although the output of crude perlite in 1957 rose 10 percent above 1956, the quantity used and sold declined about 8 percent. Production was limited to deposits in two Nevada counties. The Pershing County crude perlite was expanded for use in plasterboard at the producer's plant in Washoe County, while Lincoln County production was shipped to out-of-State consumers. A Clark County plant expanded California-produced crude perlite, most of which was used for plaster and concrete aggregate.

Pumice and Volcanic Cinder.—The tonnage of volcanic cinder produced in 1957 was appreciably less than in 1956; most of it was quarried near Lathrop Wells, Nye County, and used in manufacturing building block at Las Vegas, Clark County. A modest tonnage was quarried by the Nevada Highway Department in Nye County for

TABLE 17.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Glass.....	(1)	(1)	(1)	(1)	(1)	(1)
Molding.....	46,409	\$87,142	\$1.88	77,042	\$258,402	\$3.35
Building.....	(1)	(1)	(1)	184,201	221,979	1.21
Paving.....	(1)	(1)	(1)	75,218	90,550	1.20
Engine.....	115	200	1.74			
Other.....	121,377	168,387	1.39	(1)	(1)	(1)
Gravel:						
Building.....	226,004	312,264	1.38	164,424	216,785	1.32
Paving.....	709,761	415,846	.59	685,500	596,040	.87
Railroad ballast.....	(1)	(1)	(1)			
Other.....	51,016	103,040	2.02	328,328	353,604	1.08
Undistributed sand and gravel.....	595,787	912,334	1.53	176,812	473,266	2.68
Total sand and gravel.....	1,750,469	1,999,213	1.14	1,691,525	2,210,626	1.31
GOVERNMENT-AND-CONTRACTOR OPERATION ²						
Sand:						
Building.....	10,015	18,143	1.81	5,540	3,040	.55
Paving.....	28,347	42,009	1.48	29,576	17,154	.58
Total.....	38,362	60,152	1.57	35,116	20,194	.58
Gravel:						
Building.....	144,162	78,537	.54	13,560	13,932	1.03
Paving.....	2,753,520	2,430,791	.88	3,492,764	2,945,250	.84
Total.....	2,897,682	2,509,328	.87	3,506,324	2,959,182	.84
Total sand and gravel.....	2,936,044	2,569,480	.88	3,541,440	2,979,376	.84
ALL OPERATIONS						
Sand.....	731,841	1,217,814	1.66	548,389	1,064,391	1.94
Gravel.....	3,954,672	3,350,879	.85	4,684,576	4,125,611	.88
Grand total.....	4,686,513	4,568,693	.97	5,232,965	5,190,002	.99

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

² Includes figures for State, counties, municipalities, and other Government agencies.

use in paving roads. A token quantity of pumice was produced near Mina in Mineral County for concrete aggregate.

Salt.—Nevada's entire output of salt in 1957, from an operation in Churchill County, was produced by solar evaporation and surface mining a dry-lake bed. Most of the production, which was 600 percent above that in 1956, was shipped to the company California plant in the San Francisco Bay area to help offset a production loss brought on by a labor strike there. Only a small tonnage was used locally.

Sand and Gravel.—The output of sand and gravel in 1957 was 12 percent above that in 1956—more than 5 million tons. Washoe and Clark Counties, the State industrial centers, produced about 43 percent of the total. Increased road-construction activity, aided by the extensive use of portable plants, was the chief reason for the higher output. The production of molding sand in the Overton area of Clark County rose nearly 66 percent; however, glass-sand production in the same area dropped appreciably, as the market was shared with a California sand producer. Due to the general decline in the building industry, sand and gravel produced and used in construction work was considerably less than in the preceding year.

Stone.—A general decline prevailed throughout the stone industry of Nevada in 1957 compared with 1956. A considerable decrease was reported in the output of limestone produced in Clark and Washoe Counties for industrial use. Production of crushed stone in the State for commercial and Government-and-contractor building and road projects declined because major construction work in Clark and Douglas Counties, which used considerable quantities of granite during 1956, was completed and there was a general increase in the use of readily accessible unconsolidated rock and gravel in lieu of quarried stone. The Mineral County marble operation was idle during 1957, and the production of dimension and crushed sandstone in Clark, Humboldt, and White Pine Counties for building, flagging, and roofing granules was lower in 1957 than in 1956.

TABLE 18.—Stone, commercial and Government-and-contractor, sold or used by producers in 1956-57, by uses¹

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rubble..... short tons.....			(?)	(?)
Rough architectural..... cubic feet.....			3, 154	\$6, 223
Approximate equivalent in short tons.....			246	
Sawed stone and cut block..... cubic feet.....	23, 501	\$57, 420	21, 512	\$ 46, 373
Approximate equivalent in short tons.....	1, 833		* 1, 693	
Flagging..... cubic feet.....	11, 487	20, 025	4, 551	9, 754
Approximate equivalent in short tons.....	896		355	
Total dimension stone (quantities approximate, in short tons).....	2, 729	57, 445	2, 294	62, 350
Crushed and broken stone..... short tons.....	1, 398, 440	2, 223, 333	922, 928	1, 522, 172
Grand total (quantities approximate, in short tons).....	1, 401, 169	2, 280, 778	925, 222	1, 584, 522

¹ Includes basalt, granite, limestone, marble, calcareous marl (1957), sandstone, and miscellaneous stone.

* Figure withheld to avoid disclosing individual company confidential data.

² Includes "rubble."

Sulfur.—The Western Sulphur Corp. operated its open-pit mine near Sulphur, Humboldt County, during the year and produced soil sulfur for sale in Nevada and neighboring States. A crushing, grinding, screening, and sacking plant was operated at Sulphur. Products were sold as containing 25 and 35 percent native sulfur.

Talc and Soapstone.—Production of talc and soapstone in 1957 was confined to deposits in Esmeralda County. The combined output of these minerals (nearly 30 percent less than in 1956) was sold to California grinding plants for ultimate consumption as filler in paint, rubber, and stucco. The drop in production was credited to the demand for specification grades not available at the Nevada deposits.

MINERAL FUELS

Nevada's crude-petroleum production in 1957 was limited to the Shell Oil Co. Eagle Springs Unit, Nye County. The entire output, about 30 percent less than in 1956, was shipped to a refinery at Bakersfield, Calif. Although there was drilling activity in Clark, Elko, Lander, and White Pine Counties, no new discoveries were made, and exploration programs by petroleum companies were reduced appreciably. Continental Oil Co. closed its Nevada office late in the year, leaving Shell Oil Co. the only major company with offices in the State. Future limited programs in Nevada by Standard Oil of California and Continental Oil Co. were to be directed from their offices in Salt Lake City, Utah.

The proposal that would supply the Reno area of Washoe County with Canadian-produced natural gas by feeder pipeline from Mountain Home (Idaho) had not been passed on by the Federal Power Commission. A second proposal, whereby the pipeline would bypass Nevada, was under consideration by the commission.

REVIEW BY COUNTIES

Although all 17 counties contributed to Nevada's mineral production, 72 percent of the total value came from mineral deposits in 3 counties—White Pine, Lyon, and Clark. Considering the value of the 14 major commodities produced, the leading counties in the State were: White Pine, in copper and gold; Clark, in manganese, lime, sand and gravel, gypsum, and stone; Lincoln, in zinc and tungsten; Pershing, in iron ore; Humboldt, in mercury; Nye, in magnesite; Eureka, in lead; and Storey, in diatomite.

Churchill.—Crews and contractors of the Nevada Highway Department produced and utilized nearly 383,000 tons of paving sand and gravel in 1957, compared with 27,000 tons in 1956. Several pits near Fallon were worked for structural sand and gravel and paving gravel. Aquafil Co. removed diatomite at the Section 20 mine, formerly referred to as the Chickbed mine, near the county road between U. S. Highway 40 and Nightingale. A portion of the material, crushed at the mine, was screened and marketed for use as poultry litter under the trade name "Chickbed Kleenest." Shipments were also made to and prepared at the company plant at Fernley in Lyon County for use as filler.

TABLE 19.—Value of mineral production in Nevada, 1956-57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Churchill.....	¹ \$719,361	\$723,091	Sand and gravel, diatomite, iron ore, salt, lead, mercury, tungsten, silver, fluorspar, stone, gold.
Clark.....	15,761,421	13,048,042	Manganese ore, lime, sand and gravel, gypsum, stone, lead, zinc, copper, clays, silver, tungsten, gold.
Douglas.....	¹ 1,455,727	1,708,699	Iron ore, sand and gravel, tungsten.
Elko.....	1,125,591	669,224	Sand and gravel, barite, lead, copper, silver, zinc, tungsten, gold, mercury.
Esmeralda.....	818,989	677,937	Diatomite, talc and soapstone, silver, mercury, gem stones, gold, sand and gravel, zinc, lead.
Eureka.....	¹ 1,303,651	1,764,471	Lead, gold, silver, sand and gravel, copper, zinc, stone, gem stones.
Humboldt.....	¹ 9,601,683	2,775,163	Mercury, iron ore, tungsten, stone, gem stones, sulfur ore, sand and gravel, barite, copper, gold, silver.
Lander.....	² 2,371,849	1,718,465	Gold, barite, copper, sand and gravel, silver, uranium, gem stones, lead, tungsten, zinc, stone.
Lincoln.....	³ 7,196,573	³ 3,831,311	Zinc, tungsten, copper, lead, silver, perlite, sand and gravel, stone, manganese ore, gold, fluorspar, gem stones.
Lyon.....	² 26,576,001	16,439,227	Copper, sand and gravel, clays, uranium, tungsten, gold, gem stones, silver.
Mineral.....	3,520,881	919,641	Fluorspar, sand and gravel, tungsten, lead, gold, barite, silver, copper, mercury, zinc, gem stones, uranium, pumice.
Nye.....	¹ 3,565,658	2,766,489	Magnesite, sand and gravel, iron ore, brucite, petroleum, fluorspar, tungsten, volcanic cinder, barite, antimony, gold, mercury, silver, stone, lead, gem stones, zinc.
Ormsby.....	50,927	120,780	Sand and gravel, gold, silver.
Pershing.....	¹ 6,546,002	3,809,204	Iron ore, gypsum, tungsten, mercury, perlite, gold, sand and gravel, lead, silver, copper, zinc.
Storey.....	1,236,530	1,399,936	Diatomite, gold, silver, tungsten, sand and gravel.
Washoe.....	² 838,562	1,202,150	Sand and gravel, marl, stone, clays, uranium, gold, gem stones, silver.
White Pine.....	² 43,952,116	³ 32,397,804	Copper, gold, lime, sand and gravel, stone, molybdenum, silver, lead, zinc, tungsten.
Undistributed ⁴	39,765	51,806	
Total.....	⁴ 126,681,000	86,023,000	

¹ Iron-ore value revised, based on average value f. o. b. railroad.

² Revised to include value of uranium shipments for the entire year 1956.

³ Excludes value of manganese and low-grade manganese ores sold and blended at Government low-grade stockpiles for future beneficiation.

⁴ Revised figure.

⁵ Includes gem stone, mercury, lead, copper, silver, and gold not listed by counties as data are not available.

Magnetite ore was mined by two operators in the Buena Vista Hills in the north central area of the county adjacent to the iron deposits of Pershing County. Minerals Materials Co. mined from its Buena Vista group of claims and sold direct-shipping ore for export. The lower grade material was concentrated at its plant by magnetic separation and shipped for use as aggregate in atomic shielding. Pruitt & Stowers mined direct-shipping ore from the same group under lease operations and sold its product to a California broker for ultimate use in pig iron and steel. The Leslie Salt Co. produced salt by solar evaporation and surface-mining a dry-lake bed near Salt Wells. Compared with 1956, production was up about 600 percent. Most of the output was shipped to the company California plant in the San Francisco Bay area to help offset a production loss due to a labor strike. The Big Ben mine in the Chalk Mountain area, 45 miles southeast of Fallon, had the only production of lead in the county. Some silver and a small quantity of gold were also recovered from the direct-smelting ore. A small quantity of mercury was produced from the Red Bird group of claims in Shoshone Canyon, 22 miles northeast of Dixie Valley.

Three tungsten mines in the county were active for part of the year but on a very limited basis. The Hilltop (Tungsten Mountain) mine, 25 miles north of Eastgate, was operated, but no concentrate was produced or shipments made. An exploration contract for tungsten ore at this mine under a DMEA loan was executed in December. Ore and concentrate were produced at the Red Top No. 2 mine in the *Sand Springs* district, 30 miles east of Fallon and at the Gila Peak mine in the *Alpine* district, 25 miles north of Eastgate. The production from both mines was sold to a California buyer.

A small tonnage of fluorspar, produced at the Revenue mines, 23 miles northeast of Stillwater, was shipped to the Kaiser Aluminum & Chemical Corp. flotation plant at Fallon. The Fallon plant produced Acid-grade fluorspar from company ore mined in Mineral County and from purchased ore. The finished material was shipped to a California chemical plant. The mill was placed on standby status near the close of 1957 because Specification-grade ore at the company leased mine was depleted.

The Nevada Highway Department utilized county-produced crushed and broken miscellaneous stone for riprap in the county's road projects.

Clark.—Clark County continued to be the major source of manganese ore in the Nation, due primarily to the output from the Manganese, Inc., Three Kids open-pit mine 6 miles northeast of Henderson. The ore was treated in the company concentrating and nodulizing plant at Henderson and shipped for stockpiling under the Government purchase program. The American Potash & Chemical Corp., also at Henderson, prepared Battery-grade electrolytic manganese dioxide from manganese nodules produced in Montana and from Mexican ore.

United States Lime Products Corp. prepared quick and hydrated lime from limestone and dolomite produced at its Apex and Sloan quarries, respectively, in its Henderson and Sloan plants for use as finishing lime for building and for metallurgy, paper, water purification, and other chemical and industrial applications. Most of the output from each plant was shipped to California and other adjoining States or exported.

An important tonnage of crushed stone from the company quarries was sold for metallurgical flux and for use in refractories, sugar refining, and other industrial applications.

Simplot Silica Products and United States Silica Corp. prepared silica sand near Overton for glass and molding and for chemical use in manufacturing sodium silicate. Other producers of molding sand in the Overton and Logandale areas were Fred L. Morledge and Snoreen & Son. Gornowich Sand & Gravel Co. operated a portable plant 3 miles south of the intersection of Highways 93 and 95 near Las Vegas and produced sand and gravel for building, paving, fill, gunite, and roofing. Las Vegas Building Materials, at Pittman, and Stocks Mill & Supply Co., at Las Vegas, produced building and fill sand and gravel. Wells Cargo, Inc., Wells-Stewart, Whiting Bros., Inc., and Pahlen Construction Co. were among the major producers of building and paving sand and gravel during the year. Lake Mead National Recreation area, National Park Service, utilized contracted building and paving sand and building gravel produced by its own crews.

City, county, and State agencies used over 400,000 tons of paving sand and gravel produced in the county.

The Blue Diamond Corp., with a quarry and calcining plant at Blue Diamond, produced crude gypsum and manufactured calcined-gypsum products, including wallboard, lath, and plaster. The Fiberboard Paper Products Corp., with a quarry near Henderson, produced crude gypsum for shipment to its California wallboard plants at South Gate, Los Angeles County, and Newark, Alameda County.

Dimension sandstone was shipped from the Nevada Red quarry northwest of Las Vegas for building, flagging, and rubble and from a quarry near Goodsprings for building. Simon's Rainbow quarry, southwest of Jean, yielded sandstone for flagging and roofing granules. A contractor for the city of Las Vegas produced over 9,000 tons of crushed miscellaneous stone for use as filter material.

The lead residue, obtained in treating manganese ores from the Three Kids mine near Henderson, was the chief source of lead in the county. The residue, which also contained some gold, silver, and copper, was sent to a Utah smelter for treatment. One thousand tons of oxidized zinc ore from the stockpile at Jean (from mines in the *Goodsprings* district, stockpiled previous to June 1944 by the Government) was shipped to a Utah smelter-fuming plant. Considerable silver, lead, and zinc and some copper were recovered and credited to Clark County. In the same district smaller tonnages of direct-shipment ores were mined: Copper ores from the Copper King and Boss mines; lead-zinc ores from the Kirby and Root Zinc mines; and lead ore from the Maiden Rock mine. A small tonnage of direct-shipment copper-lead ore was mined from the Duplex mine in the *Searchlight* district. A few ounces of gold and silver was recovered from most of the copper, lead, and zinc ores treated.

Miscellaneous clay was mined at the El Dorado pit near Nelson or Las Vegas Brick & Tile Co., which utilized the material at the company plant in Whitney for manufacturing common brick.

A very small quantity of tungsten concentrate was produced at the Silver Leaf mine near Mesquite and sold to a California buyer.

The Joe W. Brown well, on Flamingo Road outside Las Vegas, was abandoned as a test well for petroleum in February. The test was completed as a hot-water well later in the year. At the end of 1957 Bonanza Oil Co. was drilling a wildcat well in the Arden Dome area, but operations were sporadic.

Douglas.—The Standard Slag Co. operated the Minnesota open-pit mine in the *Buckskin* district 14 miles northwest of Yerington and mined nearly 362,000 long tons of magnetite ore, from which more than 325,000 long tons of concentrate, averaging 58 percent iron, was produced, by magnetic separation, for shipment to Japan.

The Schwake Construction Co., Inc., crews and contractors of the Bureau of Public Roads, and State and county road departments utilized over 105,000 tons of sand and gravel produced in the county for road construction and maintenance.

Only 1 of the 13 producers of tungsten ore and concentrate in 1956 reported an output in 1957. A small tonnage was sold to a Mineral County tungsten mill.

Elko.—The cities of Elko and Wells and the Nevada Highway Department utilized over 260,000 tons of sand and gravel (produced in the county) for road construction and maintenance in 1957, compared with 212,000 tons in 1956. Crews of the town of Carlin produced 15,000 cubic yards of paving material in 1957, more than doubling the quantity of sand and gravel produced in 1956.

The Baroid Div., National Lead Co., shipped crude barite from stocks mined in 1956 at its Rossi mine near Dunphy to the company grinding plant at Merced, Calif. An operator near Carlin mined and shipped crude barite to a custom mill in Utah and to grinders in California. Another operator near Wells shipped crude barite to a California grinder in the San Francisco Bay area. Total shipments of barite in 1957 were about 35 percent below 1956 figures.

Most of the county copper output and considerable silver and gold, were obtained from ore mined from the Marshall (Nevada-Bellevue) mine in the *Contact* district. The Brooklyn mine in the same district was the second largest county producer of copper ore, which contained some silver and a minor quantity of gold. The Delno mine in the *Delano (Delno)* district yielded much of the lead, zinc, and silver and some of the copper and gold produced in the county. The Diamond Jim mine in the *Island Mountain* district was the source of important quantities of the same metals. Ore from the Rosebud mine in the same district also yielded considerable lead and zinc and a small quantity of gold. A carload of direct-shipping lead ore was mined at the Bullshead group of claims in the Spruce Mountain area; and a few tons of lead-zinc ore, which contained a few ounces of recoverable silver, was produced in the *Loray* district. An exploration contract for copper-lead ore under DMEA was executed in May at the Aladdin mine in the *Railroad* district, 30 miles southwest of Elko.

Three tungsten properties were active for a short time. One operator near Contact mined ore but produced no concentrate. The Lakeview and Star mines in the *Ruby Mountains* district southeast of Jiggs had a very limited production. Ore from the Star property was milled in White Pine County.

A total of 6 flasks of mercury was produced at 2 small operations, 1 each in the *Ivanhoe* and *Tuscarora* districts.

Uranium activity was confined to exploratory drilling by the Continental Oil Co. on the property of Thomas White & Associates near Mountain City.

Esmeralda.—The Mining and Mineral Products Division of Great Lakes Carbon Corp. quarried and processed diatomite at its mine and mill near Basalt for use in paper, paint, and insecticides. The major production of talc was from the Sylvania and Palmetto areas southwest of Lida at the White King mine and the Oversight and Crystal Butte mines. Soapstone was also produced in the Lida area at the Hideout and Lone Springs mines. Eight other producers contributed to the total talc output, all of which was shipped to southern California grinding plants.

Silver production in Esmeralda County dropped over 70 percent from that in 1956 because operations were suspended from January to September at the Mohawk mine and mill in the Silver Peak area. Direct-smelting ore from this mine also yielded a small quantity of zinc. Considerable silver with a small amount of gold as a byproduct

was produced from ore of the Silver Zone mine in the *Klondyke* district.

A small shipment of ore from the Montezuma mine in the *Montezuma* district west of Goldfield supplied the total lead production in the county and a moderate quantity of silver. A few ounces of gold and silver was recovered by small-scale hand methods at the Indian Springs placer deposit in the Tule Canyon area south of Lida.

Mercury was produced at the Red Rock mine 12 miles northwest of Dyer from an area uncovered by bulldozer stripping. The ore was treated at the mine site in a 20-ton-a-day furnace. The Monarch Mining & Milling Co. produced a few flasks of mercury from the Argentite mine, 26 miles southwest from Silver Peak. The ore was treated at the company plant in Goldfield.

A considerable quantity of turquoise was produced at the Lone Mountain Turquoise mine southwest of Tonopah.

Crews of the Nevada Highway Department produced over 1,200 tons of paving gravel.

Eureka.—Eureka County was first in the State in the value of lead production, second in silver and zinc, third in gold, and sixth in copper. Most of the base metals came from ores of the *Eureka* district. The Richmond-Eureka mine was the major producer and shipped oxide and sulfide ores from March to December to out-of-State smelters for treatment. Metals recovered were lead, gold, silver, copper, and zinc, in order of value. In the same district the Consolidated Eureka (Diamond-Excelsior) mine was the other major county producer from its direct-smelting lead ore containing high silver and gold values and some copper. Considerable silver and some gold were recovered in treating ore from the Aurora mine in the *Cortez* district. Direct-smelting lead-zinc ore, containing considerable silver was shipped from the Union mine in the *Safford* district to a Utah smelter. The principal copper output, along with some silver and gold, came from the Copper King and Good Hope mines, *Maggie Creek* district. Some gold and a minor quantity of silver were recovered from a small-scale stream-gravel operation on the Sheep Creek No. 1 claim, 20 miles north of Carlin.

Construction and maintenance crews of the Eureka County Road Department removed over 36,000 tons of gravel from various county pits for paving and road use, compared with 24,000 tons in 1956. The Nevada Highway Department and contractors used 147,000 tons of paving sand and gravel, which was 12 percent less than their 1956 output. Over 35,000 tons of miscellaneous stone was produced and loaded on cars at Palisade for use as railroad ballast by the Southern Pacific Co. The Nevada Highway Department utilized miscellaneous stone for riprap.

Four hundred pounds of azurite gathered at the Copper King mine, 13 miles north of Carlin, was marketed.

Humboldt.—The Cordero mine, 12 miles southwest of McDermitt, produced a high percentage of the Nevada mercury output in 1957. The mine has been the major quicksilver producer in the State for many years. The ore, derived mostly from the 600 and 700 levels of the underground workings, was treated in the company reduction plant at the mine site. A 100-ton-per-day Nichols-Herreshoff furnace was used to recover the metal. A small quantity of mercury was

produced at the Buckskin Peak mine, 12 miles southeast of McDermitt. In the *Bottle Creek* district, about 55 miles northwest of Winnemucca, mercury ore produced from the Red Ore mine was concentrated in a 125-ton-per-day flotation plant and then treated in a 3-pipe retort.

Humboldt County ranked third in iron-ore production in Nevada, furnishing 12 percent of the total output in 1957—20 percent more than in 1956. All the ore (magnetite) was produced by three operators in the *Jackson Creek* district north of Jungo. The largest production was from the Iron King open-pit mine; except for a small tonnage sold for export, the ore was shipped to eastern furnaces. The remaining output came from open pits on the Red Bird and Black Jack groups of claims. The entire output from these two groups was shipped to a steel plant in the Midwest.

The Getchell and Riley mines in the *Potosi* district northeast of Golconda were the only active tungsten operations in 1957, and both had closed by September. Combined production of concentrate from ore mined at these 2 properties was only 20 percent of that produced in 1956.

Sandstone was quarried in Virgin Valley, southwest of Denio, for use as dimension building stone. A contractor for the Bureau of Indian Affairs produced over 27,000 tons of miscellaneous stone for concrete and road metal.

A sizable quantity of fire opal was collected in Virgin Valley. Agate was gathered near Battle Mountain and sulfur specimens near Jungo. The Western Sulphur Corp. operated the Sulphur open-pit mine and processing plant near Sulphur. The material was ground, screened, and sold in sacks or bulk to consumers in Nevada and neighboring States as a soil conditioner.

Crews of the Nevada Highway Department produced sand and gravel locally for road construction and maintenance. The Baroid Div., National Lead Co., shipped a moderate tonnage of barite, a washed product from crude ore previously mined at its Red House property near Winnemucca, to the company grinding plant in California.

Copper, silver, and gold were recovered from direct-smelting ores mined in the Battle Mountain area at the Morning Glory, Morning Star, and Copper Acres mines. Some copper and silver were recovered from ores at various mine dumps in the Golconda area. Some gold-silver ore from the May Day group of claims in the *Awakening* district northwest of Winnemucca was milled. The recovered gold bullion was shipped to the San Francisco Mint. A small quantity of placer gold was obtained by hand-panning bench gravel and old tailings in the Gold Run area, 8 miles south of Golconda.

Lander.—Gold production decreased 16 percent below that in 1956, but Lander County still ranked second in output. Most of the gold was produced from the Goldacres open-pit mine and cyanide plant in the *Bullion* district south of Beowawe. The operator also recovered some silver as a coproduct. Silver and lead production decreased 35 and 55 percent, while copper and zinc increased 4 and 60 percent, respectively. The output of these metals was low compared with State totals and came mostly from deposits in the *Battle Mountain* district by numerous lessees who mined and shipped direct-smelting

ores. The Battle Mountain Copper Co. formerly mined these properties and operated a mill for treating lower grade ores; however, the company was inactive in 1957 due to litigation. The principal zinc production was from a carload of direct-shipping ore, which also contained appreciable quantities of gold and silver mined at the Iron Canyon mine in the *Battle Mountain* district.

Stream gravel on the Dahl placer claim, 17 miles southwest of Battle Mountain, was worked by small-scale hand methods. Considerable gold and some silver were recovered.

Barium Products, Ltd., mined crude barite at its Argenta and Mountain Springs properties near Battle Mountain and shipped to the company barium-chemicals plant at Modesto, Calif., where the mineral was processed. Magnet Cove Barium Corp. produced crude barite at its Greystone open-pit mine near Beowawe and ground the ore at its mill near Battle Mountain. The product was shipped to a company plant in Texas, where it was processed for use in well-drilling fluids. Crude barite from the Shelton Barite mines near Battle Mountain was shipped to custom grinders in Utah and California. Barite mined at the White Rock properties near Beowawe was consigned to southern California for resale.

The Nevada Highway Department utilized over 265,000 tons of paving sand and gravel produced in Lander County, and county crews produced 11,000 tons of building sand and gravel in 1957. Uranium ore was shipped from the *Early Day* property near Austin to a Utah concentrator. This mine continued as major producer of uranium ore in Nevada. Development of an ore body adjacent to the *Apex* property was begun. Trenching by bulldozer was to be followed by a rather extensive drilling program.

Several hundred pounds of turquoise was collected in the Battle Mountain and Cortez areas in addition to some agate and cinnabar crystals.

The *Blue Horizon* mine near Austin was the county's only active tungsten property in 1957. The limited quantity of concentrate produced was sold to an out-of-State buyer.

Crushed and broken miscellaneous stone produced in the county was utilized by the Nevada Highway Department for use as riprap.

A test well for oil drilled near Battle Mountain was abandoned as dry.

Lincoln.—Lincoln County was the leading producer of recoverable zinc and silver in Nevada and ranked second in lead, third in copper, and fourth in gold. Although the Combined Metals Reduction Co. ceased mining operations in the Pioche area on August 1, 1957, the district was the principal source of the zinc, lead, and gold produced in the county. The company milled lead-zinc ore mined from the Pioche Nos. 1 and 2 ore bodies through its Caselton mine; lead-zinc ore from the Raymond-Combined Mines, Inc., mined under an agreement with the latter; and custom-milled a limited tonnage of locally produced lead-zinc ore. Exploration was begun for lead and zinc ore under a DMEA contract at the *Black Prince* mine. Another DMEA contract—a joint venture with Raymond-Combined Mines, Inc., conducted from the lower levels of the Caselton mine—was terminated in August. In the same district the *Yuba Dike* mine produced lead-zinc ore containing silver and gold, which was shipped to a Utah smelter.

A carload of ore, which contained lead, silver, gold, and some copper, was also shipped from the L & Z mine, 1 mile northwest of Pioche. The Bristol mine in the *Jack Rabbit* district, 25 miles northwest of Pioche, was the county's leading producer of copper and silver obtained from direct-smelting ore, which also contained some recoverable lead, zinc, and gold. The ore was treated at a Utah smelter-fuming plant. Exploratory work under a DMEA contract for copper-lead-zinc ore was in progress at this mine during the year, and a DMEA exploratory project for lead-zinc ore at the Comet mine—in the *Comet* district, 9 miles southwest of Pioche—was terminated in December. A small tonnage of sorted silver ore, containing recoverable gold, from the Tempiute Silver mine in the *Tem Piute* district, was shipped to the McGill smelter, White Pine County.

The Lincoln mine, *Tem piute* district, the only active tungsten property in the county and the second largest producer in the State, was closed August 31. Shipments in short-ton units of WO_3 were down 40 percent from 1956 figures. Exploration for tungsten ore at the Lincoln mine under a DMEA loan was terminated in October.

A sizable tonnage of crude perlite was quarried from the Hollinger property near Pioche. The material was crushed at the Caselton mill, 19 miles southeast of the quarry, for shipment to out-of-State expanding plants. Crude perlite was mined at the Delamar (Mackie) underground and open-pit operations, 35 miles west of Caliente. The ore was crushed at the Caliente plant and sold to an expanding plant in southern California.

Contractors for the city of Caliente and the Nevada Highway Department produced 167,000 tons of paving sand and gravel in 1957, compared with 147,000 tons in 1956. Miscellaneous stone was prepared at Caliente for use as railroad ballast and riprap by the Union Pacific Railroad Co., and a contractor for the Nevada Highway Department produced miscellaneous stone for riprap in road projects. Manganese ore and low-grade manganese ore from underground operations at the Southpaw mine, 20 miles west of Hiko, was shipped to a Government stockpile.

Acid-grade fluorspar was produced from tungsten tailings from the Lincoln mine and was blended with fluorspar from Nye County.

Four hundred pounds of petrified wood was collected in the Fish Lake Valley area as gem material and shipped to dealers.

Late in the year Sundown Petroleum Co. began stripping at its uranium property near Panaca. Although drilling had not been completed enough to block out the deposit, amenability tests of the ore at a Utah concentrator indicated the ore could be treated successfully.

Lyon.—Lyon County was the second-ranking copper producer in Nevada, due primarily to The Anaconda Co. open-pit mining and acid-leaching operations in the *Yerington* district. The cement-copper precipitate produced was shipped to the company smelter at Anaconda, Mont. A small tonnage of copper ore, containing some recoverable silver, was shipped from the Last Chance mine in the *Pine Grove* district, 26 miles south of Yerington, to a smelter. A few hundred tons of molybdenum ore from this mine was stockpiled. Small quantities of gold and silver were recovered from old placer

tailings of Carson River stream gravels in the Silver City area using a nonfloating washing plant.

Portable sand and gravel plants were operated in the Dayton area, and over 47,000 tons of these materials was prepared for building and paving.

The Industrial Minerals and Chemical Co. increased the production of bentonite from its Jupiter pit near Weeks. The clay was shipped to the company plant in California for preparation and sale to the chemical, ceramic, and building trades.

The Glacier King property, 7 miles east of Carson City, has been the most consistent producer of uranium ore in the county. Although the tonnage shipped in 1957 was slightly less than in 1956, the average grade was better, resulting in a higher return value. Uranium ore was shipped from the River Road property, 37 miles southwest of Hawthorne. The operator had made a test shipment in 1956.

The only active tungsten property in 1957, and one that did not produce in 1956, was on land leased from the Southern Pacific Co., near Fallon. The few tons of ore yielded was sold to a Mineral County concentrator.

Three hundred pounds of jasper-agate was collected near Fernley.

Mineral.—Crude fluorspar was mined at the Kaiser (Baxter) mine northwest of Gabbs, but the operation was discontinued toward the end of the year, when Specification-grade spar had been depleted. Fluorspar was also mined at the Spardome claim in the Gillis Range. The ores from both deposits were shipped to the Kaiser flotation plant at Fallon, Churchill County.

Over 224,000 tons of paving sand and gravel was produced by crews and contractors of the Nevada Highway Department.

Although 5 tungsten properties were active in 1957, compared with 19 in 1956, only the Leonard mine and mill, 5 miles east of Rawhide, had more than a token output. Production and shipments of concentrate from this property were less than 5 percent of those in 1956, and mining was stopped during the year. Construction of a plant capable of producing about 20,000 pounds of tungsten carbide per month was begun at the millsite in June and completed during the year; operation was on a pilot basis only. Exploration for tungsten ore under a DMEA contract, which was started at the Leonard mine in 1956, was completed in September 1957.

Most of the county gold, silver, lead, and zinc was produced by 2 operators in the *Candelaria* district and 1 in the *Cedar Mountain* district. The New Potosi mine yielded the largest quantities of gold, silver, and lead, and some antimony. The ore was shipped to smelters in California and Utah for treatment. A high percentage of the county silver and gold was produced from ore of the Northern Belle mine. The ore was milled in a 300-ton-per-day flotation plant at Columbus Marsh. The silver concentrate was treated at California and Nevada smelters. The Simon Lead mine in the *Cedar Mountain* district, 25 miles northeast of Mina, was the only source of zinc in the county and also provided considerable lead and silver with some gold. The mine-run ore was shipped to California and Utah smelters.

The chief output of copper ore in the county came from the Dunlap mine in the Pilot Peak area, 12 miles southeast of Mina. Other copper producers were the Hercules mine, *Santa Fe* district; the

Excelsior mine, *Silver Star* district; and the Digmore mine, *Whiskey Flat* district.

Macco Corp. mined crude barite at its Noquez Barium open-pit deposit near Basalt and shipped the mineral to its washing and jigging plant in Inyo County, Calif., for upgrading.

A small quantity of mercury was produced in the *Pilot Mountain* district southeast of Mina at the Hasbrouck prospect, the Red Wing property, and the Reward mine. All work was exploratory, and total mercury recovered was 6 flasks.

Turquoise was produced at the Turquoise Bonanza mine at Pilot Mountain, 27 miles east of Mina, and several hundred pounds of obsidian was collected at Montgomery Pass.

At the broken Bow group a few miles northwest of Luning a few tons of uranium ore was mined and shipped to a Utah concentrator. This was the first recorded production in the county of acceptable-grade uranium ore.

Pumice for concrete was removed from the Pumco Aggregate pit, 5 miles east of Mina.

Nye.—Two operators produced magnesite and brucite from deposits a few miles east of Gabbs. Basic, Inc., quarried brucite and magnesite from the Betty O'Neal pit and the Nevada-Massachusetts lease. The brucite was upgraded and shipped to the company Ohio plant and consumed in manufacturing a magnesia-grain refractory used in basic-steel furnace bottoms. The magnesite was fired at a nearby rotary kiln to produce caustic-calcined and refractory magnesia. Standard Slag Co. quarried magnesite from its Greenstone Extension pit and operated a calcined plant. Some magnetite, mined by the company at its leased Iron Mountain property, 7 miles northeast of Gabbs, was used in preparing dead-burned magnesia. Most of the iron ore produced was upgraded and shipped for export. Crews and contractors of the Nevada Highway Department and Nye County Road Department produced over 654,000 tons of sand and gravel in the county for their road projects.

The Eagle Springs Unit of Shell Oil Co. was the only producer of crude petroleum in Nevada. E. S. U. No. 1 well was pumped throughout the year, and E. S. U. No. 35-35 only during the last 6 months. The crude was shipped to a refinery at Bakersfield, Calif. Standard Oil Co. of California drilled on its White River Valley Unit in the Lund area near the White Pine County line with negative results. West of White River Valley, West End Opoteca Mines of Long Beach, Calif., completed the drilling of its No. 1 Federal well, begun several years ago, and abandoned the hole as dry.

Fluorspar was mined at the Daisy group near Beatty for shipment to California steel plants and a Lincoln County producer of Acid-grade spar. The latter also mined a moderate tonnage of fluorspar in the same area.

Five tungsten properties in the county were active during 1957; only two produced more than a token quantity of concentrate. The Terrill Lease near Currant and the Victory mine near Gabbs supplied 99 percent of the county production in short-ton units of WO₃. Both shipped to a California buyer. Concentrate from the Victory operation also went to a New York consumer. Gabbs Exploration Co., operator of the Victory mine, was 1 of Nevada's major producers

and 1 of the 2 Nevada producers still operating at year end. Exploration for tungsten ore under a DMEA contract at the Climax mine in the Oak Spring Butte area, which started in November 1956, was in progress during 1957.

Cind R Lite Co. produced volcanic cinder near Lathrop Wells for shipment to its block plant at Las Vegas in Clark County. The Nevada Highway Department utilized some cinder produced in the county for its road projects.

A few thousand tons of crude barite was shipped from stocks previously mined at the Jumbo property near Tonopah to a chemical plant in Alameda County, Calif., where the mineral was processed for use in well-drilling fluid, paint filler, and asphalt emulsion.

Although ores from 9 lode mines in the county were the source of recoverable gold, silver, lead, and zinc, the total crude-ore production was only 710 tons. Most of the mineral value was contained in 203 tons of silver ore shipped from the Tonopah King mine in the *Tonopah* district. Shipments were made to the McGill smelter, White Pine County. Dump ore and old tailing were treated at the Blue Bell mine in the *Manhattan* district by amalgamation; gold and silver were recovered. The largest lead output, and some recoverable silver, was from lead concentrate produced at the New Reveille mine, *Reveille* district, and shipped to a Utah smelter. The only zinc production, and some lead and silver, also shipped to a Utah smelter, was from a few tons of sorted ore mined at the Grand View claim, *Washington* district. Minor quantities of placer gold and silver were recovered in the *Manhattan* and *Fairplay* districts by hand methods.

Thirty flasks of mercury were produced from 5 operations in the county in 1957. The principal sources were the Red Bird mine (3 miles east of Round Mountain) and the Lahontan mine (2 miles southeast of Ione). All other operations yielded from 1 to 3 flasks each for the entire year.

A small quantity of stockpiled antimony ore from the Last Chance mine in Wall Canyon, 10 miles west of Round Mountain, was shipped to a mill at Austin, Lander County. The concentrate produced was sold to an out-of-State buyer.

Approximately 2,200 tons of miscellaneous stone was produced in the county by Nevada Highway Department contractors.

Several hundred pounds of agate collected near Tonopah was shipped to a gem dealer in Chicago.

Ormsby.—Over 169,000 tons of paving sand and gravel was produced by crews and contractors of the Nevada Highway Department.

One ton of old tailing was treated from the Eureka millsite in the *Delaware* district, from which a few ounces of gold and silver were recovered.

Pershing.—This county, the leading iron-ore producer in Nevada in 1957, furnished over 40 percent of the State output, all of which came from the *Mineral Basin* district southeast of Lovelock. The major production was from the Thomas pit (Southern Pacific Co. lease) and from the Iron Horse group (Ford prospect). Other production was from the Segerstrom & Heizer (S. P. lease) and Iron Castle mine. Over 50 percent of the total output went to California steel plants; the remainder was exported to Japan.

The United States Gypsum Co. produced crude gypsum from its

quarry at Empire and manufactured calcined products at the nearby company plant in Washoe County, 6 miles south of Gerlach. The company contracted for quarrying crude perlite from its Pearl Hill deposit northwest of Lovelock and trucked the material to the crushing and grading plant at Kodak. The product was subsequently transferred to its Empire expansion plant in Washoe County.

In 1956 there were 28 producing tungsten properties in the county; only 3 were active in 1957. Of the three, only the Tungsten group, *Mill City* district, yielded more than a few hundred tons of ore. Nevada-Massachusetts Co., operator of this mine, was the leading producer in the State, and 1 of 2 operators in Nevada still producing, on a very limited scale, at the end of the year. Most of the concentrate produced was shipped to an east coast buyer. Production and shipments were, respectively, 32 and 64 percent below 1956 figures. Exploration for tungsten ore under a DMEA loan at the Stormy Fraction (Thrasher) claim in the *Hooker* district 14 miles south of Gerlach was in progress during the year.

Mercury production in Pershing County decreased 36 percent from that of 1956; there were 15 operations—1 less than in the previous year. The principal producers were: The Pershing group of mines in the *Relief* district, 22 miles east of Lovelock, and the Miller Basin (Eureka) mine in the *Kennedy* district, about 50 miles east of Lovelock. These 2 mines yielded nearly 70 percent of the county output. Other operations were minor and yields varied from 1 to 18 flasks each for the entire year. Exploration for mercury ore under a DMEA contract was in progress during the year at the Red Bird Quicksilver mine in the *Relief* district and at the Mount Tobin mine in the *Kennedy* district, where a DMEA contract was executed in October.

Small quantities of gold and silver were produced from ores of the Reign-O-Gold mine, 17 miles southeast of Imlay, and the Little Jupiter mine, 12 miles east of Mill City. The entire lead output of the county was contained in a few tons of ore mined at the Republican mine in the *Mill City (Central)* district and shipped to a California smelter fuming plant for treatment. The ore contained some recoverable silver and gold and a small quantity of zinc. Gold and silver recoveries by placer methods were minor, limited to a nonfloat operation on stream gravel at the Willow Creek (Wadley) deposit (Willow Creek area southeast of Imlay) and to small-scale hand methods by miscellaneous prospectors and snipers (*Trinity* district north of Lovelock).

Maintenance crews of the Nevada Highway Department locally produced and utilized 756 tons of gravel for roads.

The Eagle-Picher Co. began constructing a diatomite-processing plant at Colado (near Lovelock) during the latter part of the year. The new deposit will be worked in the Trinity Mountain area about 20 miles west of Lovelock. The new plant will be the same in size and construction as the company plant at Clark Station, Storey County, and it is expected to be in operation by the latter part of 1958. The plant output will include all diatomaceous earth products, with emphasis on filter aids.

Storey.—The Celatom open-pit mine a few miles southwest of Wadsworth was the source of a high percentage of the State diatomite

production, the most important mineral commodity in the county in 1957. The crude material was trucked to the plant at Clark Station on Highway No. 40, where it was crushed, ground, screened, dried, classified, and calcined. The product was shipped to various consumers in the United States and Canada for use in insulation, refractories, fillers, filters, and various other applications. The Electro-Silicon Sales Co. sold its diatomaceous-earth property near Virginia City to Curtis-Wright Corp. for a proposed test site. There had been no reported production from this deposit.

The *Comstock Lode* district was the source of the county's entire yield of gold and silver, more than 30 percent less than in 1956. The Double King Mines, Inc., mined ore at the Silver Hill and Tarto open-pit deposits; the ore was treated at the Donovan stamp mill and cyanide plant at Silver City, Lyon County. A small quantity of gold and silver was recovered from material obtained in cleanup operations at an old millsite in the same district.

A minor amount of tungsten concentrate was recovered from ore mined at the Shamrock No. 1 property near Gold Hill and sold to an out-of-State buyer. Storey County had no previously reported tungsten production.

Several hundred tons of paving sand was prepared by maintenance crews of the Nevada Highway Department for use in the county.

Washoe.—Ninety-four percent of the total value of mineral production in Washoe County during 1957 was ascribed to the sand and gravel output—the highest of any county in the State. Building and paving sand and gravel were produced in the Reno area by portable equipment. Sand and gravel was also produced and prepared for road construction by crews of the Nevada Highway Department and its contractors. A fixed plant at Vista near the Truckee River prepared sand and gravel for paving.

The Double Check open pit near Flanigan was the source of all calcareous marl produced in Nevada. The entire output was shipped to a California processor of poultry and livestock feeds.

More than 18,000 tons of basalt and miscellaneous stone was quarried in the county and used as riprap in various State and county road projects. Granite from the Spanish Springs pit and Grayhorse claim was quarried and crushed for paving and fill material.

Reno Press Brick Co. mined semi-fire and miscellaneous clays from its pits near the Geiger grade south of Reno. The company used these clays in manufacturing heavy clay products. Near Empire, United States Gypsum Co. operated its gypsum-processing plant and perlite-expanding plant, using crude materials obtained from company quarries in Pershing County.

Although several properties in Washoe County had previously yielded shipping-grade uranium ore, only two, in the *Pyramid* district, reported shipments to a Utah concentrator in 1957. One of these, the Lowary group, has been a consistent producer. The other, the Armstrong No. 1, produced and shipped for the first time during 1957. Total shipments were 30 percent less than in 1956, but the average grade contained 0.10 percent more U_3O_8 .

A small quantity of gold and silver was recovered in the treatment of dump material obtained at the Cabin No. 2 open-pit mine and from

a few tons of hand-sorted ore mined at the Texas No. 2 underground mine, both in the *Olinghouse* district. Prospectors and snipers supplied a few ounces of gold and silver, recovered by small-scale hand methods at several stream gravel deposits in the *Peavine* district.

Collectors gathered nearly 500 pounds of opalized wood in the county.

White Pine.—White Pine County led all others in total mineral production in 1957, ranking first in output of copper, gold, and molybdenum; second in lime; and third in silver. A very high percentage of the State copper, gold, and molybdenum production and important quantities of silver came from combined pit and underground operations of Nevada Mines Div., Kennecott Copper Corp. and Consolidated Coppermines Corp. The porphyry-copper ores were transported to Kennecott's McGill concentrator and smelter for processing. The resulting blister-copper product was shipped to an eastern refinery. Molybdenum concentrate was recovered as a byproduct at the concentrator and sold to a domestic consumer outside the State. The McGill smelter also received copper, gold, and silver fluxing ores from various mines in Nevada, Utah, and California. The White Pine County properties in this group included the Ada, Sunnyside, and Tipple mines, *Robinson* district, Siegel mine, *Aurum* district, Exchequer mine, *Cherry Creek* district, and Antelope mine, *Tungstonia* district. The Rabbit mine, *Robinson* district, shipped lead ore containing recoverable gold, silver, and zinc to a California smelter-fuming plant. Properties from which lead and lead-zinc ore shipments were made to Utah smelters were: The Great Valley, Rocco Homestake, and Grand Prize mines, *White Pine* district; and the Bay State mine, *Newark* district. The exploration contract for lead-zinc ore under DMEA loan at the Wheeler mine (*Mt. Washington* district) was terminated in June.

Only 3 tungsten properties were active in 1957 compared with 14 in 1956. The Everit mine and Minerva mill, *Shoshone* district were active but made no shipments during the year. Small quantities of tungsten concentrate were recovered in treating ores mined from the Hill Top mine in the same district and the Only Chance mine, *Cherry Creek* district, all of which was sold to a California buyer. A DMEA contract for tungsten exploration at the Valley View mine was terminated in November.

Low-grade manganese ores were mined on the Isaacs and Keystone claims, *Robinson* district, and at the Manganese mine, *Nevada* district. A modest tonnage of manganese ore was also produced at the latter. The output from all properties was shipped to a Government stockpile.

Although only 33,000 tons of sand and gravel produced by the county was used in the maintenance of county roads in 1957 (8 percent less than in 1956) State highway projects required about 273,000 tons, an increase of more than 200 percent above 1956.

As part of its integrated copper operations at McGill, Kennecott Copper Corp. quarried limestone, which was kilned to provide the lime requirements of its concentrator and smelter. The stone screenings were used in surfacing company roads. Near Baker, Star Dust Mines, Inc., quarried dimension sandstone for use as building material.

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



ALTHOUGH VALUE of mineral production in New Hampshire in 1957 exceeded \$3 million for the second consecutive year, a 3-percent decline was recorded for 1957 as compared with 1956. The decline was due primarily to the completion of the Portsmouth Air Base, resulting in a sharp drop in the demand for stone. In terms of value, sand and gravel continued for the fourth straight year as the leading mineral product, while mica replaced stone as the second most important mineral. Mineral production was reported from every county; Merrimack, Cheshire, and Grafton Counties, in order of value, were the centers of greatest mineral activity.

Legislation and Government Programs.—The United States Government, through the General Services Administration (GSA), continued its purchasing program of stockpiling strategic minerals. GSA purchased mica produced in New Hampshire at its purchase depots in Franklin, N. H., Spruce Pine, N. C., and Custer, S. Dak. Beryl recovered in New Hampshire was sold to the Government through the GSA Purchase Depot in Franklin, N. H., only.

TABLE 1.—Mineral production in New Hampshire, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate.....gross weight..	(?)	(?)	4	\$2,287
Clays.....	36,320	\$47,040	37,300	50,500
Gem stones.....	(?)	500	(?)	81
Mica.....	330	187,619	549	477,277
Peat.....	320	(?)	85	(?)
Sand and gravel.....thousand short tons..	3,862	1,822,230	4,505	1,969,913
Value of items that cannot be disclosed: Abrasive stones, feldspar, stone, and values indicated by footnote 2.....		1,378,492		831,410
Total New Hampshire.....		3,436,000		3,331,000

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.

¹ Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives (Scythestones).—Although total sales of scythestones in New Hampshire continued to decline, a slight increase in the average value per pound was reported in 1957 as compared with 1956. Sales were made from stockpiled material recovered from an idle quarry at Piermont, Grafton County.

Clays.—Tonnage and value of clay in the State increased in 1957. Four producers were active during the year, 1 each in Grafton and Strafford Counties and 2 in Rockingham County. Only miscellaneous clay was produced, the total output being utilized to manufacture building brick.

Feldspar.—Production and value of crude feldspar more than doubled in 1957 as compared with 1956. The sharp increase was due to higher demand for ground feldspar in manufacturing pottery, soap, abrasives, and enamel. In addition, the average value per long ton of crude feldspar increased more than \$0.70 in 1957. Three companies produced feldspar, one each in Cheshire, Grafton, and Sullivan Counties. The Colony and Lot No. 10 mines of Golding-Keene Co. did not yield crude feldspar as in the preceding year. Two grinding mills, both in Cheshire County, were operated during the year. Foote Mineral Co. (Philadelphia, Pa.) purchased the feldspar mine and grinding mill of J. F. Morton, Inc., on December 31, 1956.

Gem Stones.—Varieties of gem stones recovered in New Hampshire in 1957 included agate, lepidolite, tourmaline, and various other stones.

Gypsum.—Crude gypsum shipped from outside the State was processed and used to manufacture building materials at Portsmouth, Rockingham County.

Mica.—In 1957 output of sheet and scrap mica in New Hampshire increased substantially over 1956, as valuation more than doubled. The large increase in tonnage was due primarily to increased sales of scrap mica to industry and in valuation due to increased sales of sheet mica to the Government. The Government purchased sheet mica produced in New Hampshire through purchase depots at Franklin, N. H., Spruce Pine, N. C., and Custer, S. Dak. Industry purchased limited quantities of punch, hand-cobbed, full-trimmed, and other sheet mica but increased quantities of scrap mica. The Government purchased only hand-cobbed and full-trimmed mica. Although sales of sheet mica to industry declined sharply, Government purchases increased sharply and brought the State's total mica valuation to its highest level since 1944. Mica was ground at a plant in Merrimack County for use in manufacturing paint, rubber, wallpaper, and for other uses. Quantities of scrap mica recovered from New Hampshire mines were shipped out of the State for grinding.

Sand and Gravel.—Sand and gravel continued in 1957 as the leading mineral commodity produced in New Hampshire and accounted for over half of the State's total value. In comparison with 1956, output and value of sand and gravel produced by commercial operations declined slightly, while production by Government-and-contractor operations increased substantially in 1957, increasing the State's total output and value 17 percent and 8 percent, respectively. Active road repair and paving by the New Hampshire Department of Public

Works and Highways was the major factor in the increased production. Production of paving gravel, railroad-ballast sand, and other sand increased considerably, while output of structural and railroad-ballast gravel increased slightly. Production of sand for paving, engines, structural purposes, and filter uses, as well as gravel for other uses, declined during the year. Twenty-eight percent of the State's total production was washed, crushed, sized, or otherwise prepared. Sand and gravel was produced in every county by Government-and-contractor operations, while commercial producers were active in all but Sullivan County.

TABLE 2.—Production of sand and gravel and stone by Government-and-contractor operations, 1956-57, by counties in short tons

County	Sand and gravel		Stone	
	1956	1957	1956	1957
Belknap.....	200,446	153,711	-----	1,590
Carroll.....	166,411	275,379	180	103
Cheshire.....	8,425	342,106	-----	90
Coos.....	15,367	270,550	-----	497
Grafton.....	590,135	243,643	13,574	-----
Hillsboro.....	1,098,668	466,062	7,397	846
Merrimack.....	185,571	219,850	-----	45
Rockingham.....	144,931	688,668	9,188	339
Strafford.....	6,461	300,526	-----	20
Sullivan.....	11,249	123,091	-----	-----
Total.....	2,427,664	3,083,586	31,186	3,530

Stone.—Production and value of stone in 1957 decreased 69 percent as compared with 1956. This sharp decline was due primarily to the completion of the Portsmouth Air Base in Rockingham County, where considerable tonnages of crushed miscellaneous stone were used. During 1957 only granite, dimensional and crushed, was produced. Three commercial granite producers were active in Merrimack County, the center of the stone industry. Tonnages of granite, used mainly for riprap, were produced under contract for the New Hampshire Department of Public Works and Highways. Stone produced for the department was reported from all counties except Grafton and Strafford.

METALS

Beryllium.—Production and sales of beryl in New Hampshire in 1957 declined substantially in 1957 as compared with 1956. Grafton County was the center of Beryl production in New Hampshire in 1957, furnishing 61 percent of the State's total sales. The Government purchased beryl through the GSA Franklin, N. H., Purchase Depot; the average BeO content of the ore purchased was 11.99 percent.

MINERAL FUELS

Peat.—Production of peat used to improve soil was reported in Belknap County.

REVIEW BY COUNTIES

During 1957 road repair and maintenance work by the New Hampshire Department of Public Works and Highways required

tonnages of paving sand and gravel from every county and granite, used mainly for riprap, from all counties except Grafton and Strafford. Table 2 summarizes, by counties, the production of sand and gravel and stone produced for the department and includes a limited quantity of paving sand and gravel produced by the Manchester Department of Highways in Hillsboro County. The sand and gravel was produced by the department's own crews and by operators under contract to the department from unspecified locations in each county. In addition, the department purchased quantities of sand and gravel from commercial producers in Carroll, Coos, and Grafton Counties at unspecified locations. These producers are not listed in the county review. Granite was produced by operators under contract to the department only and also from unspecified locations in the producing counties. With the exception of Carroll, Coos, and Hillsboro Counties, references to sand and gravel and stone production by Government-and-contractor operations is not made in the appropriate county.

TABLE 3.—Value of mineral production in New Hampshire, 1956-57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Belknap.....	(1)	(1)	Sand and gravel, peat, stone.
Carroll.....	\$22, 311	\$36, 821	Sand and gravel, stone.
Cheshire.....	442, 861	818, 559	Feldspar, sand and gravel, mica, beryllium, stone.
Coos.....	10, 450	65, 673	Sand and gravel, stone.
Grafton.....	330, 603	600, 854	Mica, sand and gravel, feldspar, clays, abrasives, beryllium.
Hillsboro.....	(1)	(1)	Sand and gravel, stone.
Merrimack.....	(1)	(1)	Sand and gravel, stone, mica, beryllium.
Rockingham.....	(1)	130, 449	Sand and gravel, clays, stone, gem stones.
Strafford.....	(1)	(1)	Sand and gravel, clays.
Sullivan.....	(1)	17, 903	Sand and gravel, mica, feldspar, beryllium, stone.
Undistributed ²	2, 629, 656	1, 661, 209	
Total.....	3, 436, 000	3, 331, 000	

¹ Value included with "Undistributed."

² Includes value of production in counties, as indicated by footnote 1, and a quantity unspecified by certain counties.

Belknap.—Tilton Sand & Gravel, Inc., Tilton, produced structural and paving sand and gravel as well as a limited quantity of sand used as fill. The company enlarged its facilities by adding a secondary crusher at the processing plant. Reed-sedge peat was recovered from a bog near Center Barnstead.

Carroll.—Mineral activity in Carroll County in 1957 was limited to Government-and-contractor operations where paving sand and gravel and granite used for riprap was produced for the New Hampshire Department of Public Works and Highways.

Cheshire.—Golding-Keene Co. recovered crude feldspar from the Kiddor mine near Alstead and ground the material at the local company-owned grinding mill. The Colony mine, from which beryl and crude potash-type feldspar was produced by the company in 1956, was not operated in 1957. The Cold River plant of Foote Mineral Co., formerly owned by J. F. Morton, Inc., ground a limited quantity of crude feldspar for use in enamel. The crude material was shipped from the company mine in Sullivan County.

Sand and gravel was recovered and processed from operations at Swanzey and Walpole. Warren H. Plimpton did not produce sand and gravel in 1957. In terms of value, Cheshire County was replaced as the leading mica-producing county in 1957. Hand-cobbed and full-trimmed mica was recovered from mines in the Alstead area. Otto K. Lassmann recovered beryl and mica from the French mine near Alstead. The mica was sold to both industry and the Government GSA depot while the beryl was sold only to GSA.

Coos.—Commercial production of sand and gravel in Coos County came from the vicinity of Randolph and other unspecified locations. Output was utilized mainly as paving material and sold to the New Hampshire Department of Public Works and Highways. No gem stones were reported recovered in Coos County in 1957.

Grafton.—In terms of value, Grafton County ranked second among the mineral-producing counties of the State. In addition, it was first in the value of its production of mica and beryl. The county also was the only source of scythestones in the State. The mica and beryl production was centered in the southern part of the county near Alexandria, Grafton, Groton, Orange, and Wentworth. In some mines both mica and beryl were recovered. The Government, through the GSA Purchase Depots at Franklin, N. H., and Spruce Pine, N. C., purchased the bulk of the sheet mica produced in the county. Limited quantities of punch, hand-cobbed, full-trimmed, scrap, and other sheet mica were sold to industry. The number of producers reporting production of mica in the county increased from 17 in 1956 to 37 in 1957. Production and sales of beryl to the GSA declined in 1957, even though the number of producers selling to the GSA increased from 4 in 1956 to 6 in 1957.

Whitehall Co., Inc., operating the Ruggles mine (Grafton), produced crude potash-type feldspar and beryl. The crude feldspar was produced for the parent company—The Oxford Soap Co., Manchester, Conn.—for use in soap manufacture. The Lot No. 10 mine (Canaan) of Golding-Keene Co., from which feldspar was mined in 1956, was not operated in 1957.

Littleton Sand & Gravel Co., Inc., producers of paving sand and gravel, purchased new excavating and crushing equipment to handle the larger sized gravel at its Littleton operation. Paving and fill sand and gravel also were produced at West Campton and other unspecified locations in the county.

Miscellaneous clay was mined and processed at Lebanon for manufacturing brick.

Owing to declining sales, Norton Pike Co. planned to discontinue selling scythestones as soon as the remaining stockpile at the Pike quarry is exhausted. The quarry was closed indefinitely on January 1, 1953.

Hillsboro.—Structural and paving sand and gravel were produced at Manchester. Structural, paving, and fill sand and gravel were produced at Peterborough. In addition, maintenance crews of the Manchester Department of Highways produced paving sand and gravel for repairing city streets.

Merrimack.—Merrimack County continued as the leading sand- and gravel-producing area in the State. Manchester Sand, Gravel & Cement Co., Inc., the only reporting commercial producer of sand

and gravel in the county, produced mainly structural and paving sand and gravel as well as limited quantities of sand for engines, filter purposes, and railroad ballast. The company reported installing a water-sand scalping tank and screw washers for processing their material. The company prepared their total output by crushing, washing, and sizing. Concord was the center of the granite industry in the county and State with three active quarries during the year. Dimensional granite for rough construction, dressed architectural stone, rough monumental stone, and curbing was quarried. In addition some granite was crushed and broken for use as concrete aggregate and roadstone. Producers were John Swenson Granite Co., Inc., Lapiere Bros., and Frank Palazzi & Sons, Inc. Hand-cobbed mica recovered from an unspecified location in the county was sold to GSA. Concord Mica Corp. ground both domestic and imported mica at its plant in Penacook. A limited quantity of beryl was recovered from the Weatherbee mine near Wilmot. Under the Government's program of stockpiling strategic material, the GSA Franklin (N. H.) Purchase Depot bought hand-cobbed and full-trimmed mica and beryl recovered from mines in New Hampshire and other states during the year.

Rockingham.—Structural sand and gravel and other gravel was produced at Exeter. Miscellaneous clay for the manufacture of building brick was recovered from open-pit mines at Exeter and Epping. In 1957 Merrimack County replaced Rockingham County as the leading stone-producing county as a result of completion of work at the Iafolla quarry, near Portsmouth, operated by Morrison-Knudsen Co., Inc., and Landers & Griffin, Inc. In 1956 the quarry had produced stone used in the construction of the Portsmouth Air Base. A limited quantity of gem stones was recovered from unspecified locations in the county. National Gypsum Co. calcined crude gypsum shipped from its Clarence Center (N. Y.) mine to its plant at Portsmouth. The company calcined the gypsum by the kettle process and utilized oil for fuel. Capacity of the calcining equipment at this plant is 335 tons a day. The calcined gypsum is used in the manufacture of finished building material such as lath, wallboards, and various building plasters.

Strafford.—Sand and gravel used mainly as structural and paving material was produced in the vicinity of Dover and Lee. Kenneth Allen, Rochester, did not produce any sand and gravel during the year. Strafford County continued as the leading clay-producing county in 1957. Miscellaneous clay was recovered from an open-pit mine near Rochester for manufacturing building brick.

Sullivan.—No commercial sand and gravel output was reported in Sullivan County in 1957. All sand and gravel production came from Government-and-contractor operations. Sheet mica, mostly hand-cobbed, was recovered in the vicinity of Claremont and Springfield. Foote Mineral Co. (Philadelphia, Pa.) produced a limited quantity of crude feldspar from the Yuhas No. 2 mine near South Acworth. The output was shipped to the company-owned grinding plant at Cold River, Cheshire County, for processing. Beryl was recovered from the Beryl Mountain area near Acworth.

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 Krickich¹ and Geraldine C. Slaypoh²



MINERAL production in New Jersey in 1957 was valued about the same as in 1956. Although valuation of most of the State's mineral commodities decreased, the value of zinc, stone, and magnesium compounds increased enough to raise the total mineral value 1 percent above the preceding year. Stone, sand and gravel, and iron ore remained the leading minerals produced in the State and furnished 85 percent of the total value in 1957.

The discovery of commercial-grade deposits of ilmenite were reported during the year, and exploration was conducted by the New Jersey Department of Conservation and Economic Development and private companies. Formation of a new company to produce manganese from domestic ores and the award of a Government contract to pilot a process for such production were announced.

Consumption, Trade, and Markets.—The bulk of the minerals produced was consumed in the State. The notable exception was iron ore, which was consumed in steel mills outside the State. Sand and gravel, stone, and clays were chiefly used locally; some were shipped to metropolitan areas of neighboring States. Magnesium compounds were produced in the State and shipped to chemical and industrial markets nearby. Crude manganiferous zinc ore mined in New Jersey was shipped to a company-owned smelter in Pennsylvania for smelting and refining. Crude gypsum, perlite, and vermiculite, mined outside the State, were shipped to processing plants in New Jersey because ready markets for finished building materials existed in the area.

New Jersey produced no fuels, but oil refineries in the State refined and processed both domestic and foreign crude oil.

Trends and Development.—Completion in 1957 of a new lightweight-aggregate plant in Middlesex County emphasized the trend toward more and greater use of manufactured lightweight aggregate as a building material. Manufactured lightweight aggregate was used mainly for concrete masonry units; but, as the material becomes more established with builders and architects, wider and greater use of the material was anticipated.

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TABLE 1.—Mineral production in New Jersey, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)
Clays ²	651,080	\$2,214	593,402	\$1,872
Gem stones.....	(³)	(⁴)	(³)	(⁴)
Iron ore (usable).....long tons, gross weight..	911,535	16,842	876,605	16,668
Manganiferous residuum.....gross weight..	130,129	(⁵)	(⁵)	(⁵)
Sand and gravel.....	11,194,412	18,239	10,322,742	17,619
Stone.....	9,012,323	20,825	8,791,866	21,222
Sulfur, recovered elemental.....long tons..	8,972	291	(⁵)	(⁵)
Zinc (recoverable content of ores, etc.) ⁶	4,667	1,259	12,530	2,857
Value of items that cannot be disclosed: Ball clay, lime, magnesium compounds, marl (greensand), peat, and values indicated by footnote 5. Ex- cludes limestone used in manufacturing lime.....		4,609		4,699
Total New Jersey.....		64,279		64,937

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 values of ore at mine.

MILLION DOLLARS

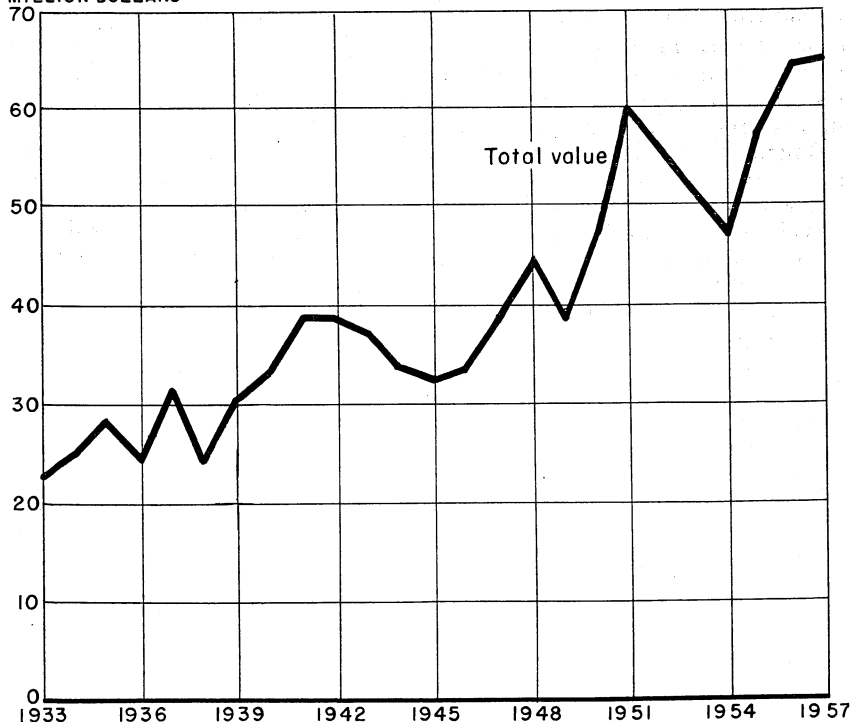


FIGURE 1.—Total value of mineral production in New Jersey, 1933-57.

Newly discovered deposits of Commercial-grade ilmenite in southern New Jersey could have substantial effect upon the mineral industry of the State. The new source of ilmenite is convenient to plants manufacturing titanium pigments in New Jersey and neighboring States. During the year tracts of land were optioned or acquired by interested firms, and plans were being made to actively mine parts of the deposits.

Legislation and Government Programs.—The Federal Government, through General Services Administration, awarded a contract to Vitro Laboratories (a division of Vitro Corporation of America, West Orange, N. J.) to install, equip, and operate a pilot plant to test and develop a new process for obtaining Metallurgical-grade manganese from low-grade deposits of manganiferous ores of domestic origin. The New Jersey Department of Conservation and Economic Development conducted test borings along a 4- by 10-mile belt in South Jersey and collected test samples to determine the extent of mineral occurrence of recently discovered ilmenite deposits.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production and value of clays in New Jersey declined in 1957 as compared with 1956. The decline was due mainly to decreased demand for clays used in heavy clay products, such as building bricks. Ball, fire, and miscellaneous clays were mined from open pits in the State. Ball clay was used exclusively for refractories. The bulk of the fire-clay output was used for refractory purposes and heavy clay products. Miscellaneous clay was used mainly for heavy clay products and for manufacturing lightweight aggregate. Middlesex County continued as the leading clay-producing county in 1957. Sayre and Fisher Brick Co. produced lightweight aggregate from its newly completed plant in Middlesex County.

Gem Stones.—Through the efforts of several amateur gem collectors, crude gem stones were recovered in Passaic and Sussex Counties in 1957. Varieties of gem material recovered were calcite, franklinite, prehnite, rhodomite, and willemite.

Gypsum.—Crude gypsum mined outside the State was calcined and finished into gypsum building products by two companies in 1957. There were processing plants in Burlington, Essex, and Hudson Counties.

Lime.—Limestone Products Corp. of America, Sussex County, continued as the only producer of lime in New Jersey during 1957. Hydrated lime was produced for building, agricultural, and industrial uses. Peapack Limestone Quarry, Inc., Somerset County, was inactive for the second consecutive year. The company reported that remodeling work and installation of new equipment was completed in 1957. Production of "burnt" lime at its Peapack plant was expected to resume early in 1958.

Magnesium Compounds.—Production of refractory magnesia in New Jersey declined, but valuation rose in 1957 compared with 1956, because the average valuation of material increased. Refractory magnesia was produced in Cape May County from dolomite and raw sea water. Various refined magnesium compounds were produced

from purchased dolomite and magnesium compounds. To avoid duplicating mineral-production data, only the magnesia produced from sea water is included in the mineral output of the State.

Marl, Greensand.—Inversand Co. continued in 1957 as the only producer of greensand marl in the State. Production was limited to Gloucester County and was used for water-softening purposes.

Perlite.—Crude perlite shipped from Southwestern United States was expanded at four plants in Middlesex, Passaic, Somerset, and Union Counties. The expanded perlite was used principally as plaster aggregate, concrete aggregate, and insulation.

Pigments.—Black, brown, red, and yellow iron oxide pigments were manufactured in the State at plants in Essex, Mercer, and Middlesex Counties.

Sand and Gravel.—Production of sand and gravel declined 8 percent in 1957 compared with 1956; value declined only 3 percent owing to increased average valuation of raw material. Output decreased mainly because demand for structural and paving sand and gravel declined reflecting less activity in the construction industry throughout the State. The number of counties reporting no production of sand and gravel increased from 2 in 1956 to 5 in 1957. Production of paving sand and gravel by Government-and-contractor operations declined in 1957 and was limited to Camden County. Cumberland, Morris, Bergen, and Ocean Counties, in order of decreasing value, were the centers of the sand and gravel industry in the State. As in previous years, the bulk of the sand output was used for building, molding, and paving, and gravel was used principally for building and paving purposes. Eighty-seven percent of the sand and gravel produced in the State was washed, screened, or otherwise prepared. Production of ground sand declined in 1957, but an average increase of more than \$2 per short ton of material was recorded for the year. Ground sand was produced chiefly for foundry and filler uses; other uses included abrasives, enamel glass, pottery, porcelain, and tile manufacture.

Stone.—In value, stone continued as New Jersey's leading mineral commodity, supplying 33 percent of the State's total value of mineral production in 1957. Basalt, limestone, granite, miscellaneous stone, sandstone, and marble, in order of decreasing value, were quarried and crushed during the year. Limited quantities of sandstone, granite, and miscellaneous stone were also quarried for use in rough construction and as rubble. Shells, employed exclusively for poultry grit, were recovered and crushed in Gloucester and Cumberland Counties. In 1957, 85 percent of the State total stone production was used as concrete aggregate and roadstone. Crushed and broken stone used as riprap, flux, agricultural stone, railroad ballast, terrazzo, and for other purposes also was produced. Government-and-contractor production was limited to crushed and broken basalt in Mercer County. Somerset and Passaic Counties furnished 75 percent of the State's total stone production and continued as the leading stone-producing areas in New Jersey. During the year Houdaille Construction Materials, Inc., acquired the Somerset and Union County quarries of North Jersey Quarry Co. and the Passaic County operations of Consolidated Stone-Sand Co. Four companies produced natural and artificially colored roofing granules in Bergen, Passaic, and Somerset Counties.

TABLE 2.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

Uses	1956		1957	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Glass.....	(1)	(1)	921	\$2,493
Molding.....	1,766	\$4,464	1,626	4,645
Structural.....	3,785	3,727	3,277	3,120
Paving.....	1,235	1,069	1,144	1,083
Grinding and polishing.....	15	58		
Blast.....	81	335	114	521
Fire or furnace.....	13	25	20	40
Railroad Ballast.....	(1)	(1)		
Fill.....			215	79
Other ²	568	1,754	444	1,817
Gravel:				
Structural.....	1,569	2,887	1,510	2,674
Paving.....	1,100	1,337	866	887
Fill.....			76	46
Other.....	35	83	24	76
Undistributed ³	955	2,422	59	134
Total.....	11,122	18,161	10,296	17,615
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving.....	13	24	5	(4)
Gravel:				
Structural.....	6	2		
Paving.....	53	52	22	4
Total.....	72	78	27	4
Grand total.....	11,194	18,239	10,323	17,619

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

² Includes ground sand.

³ Includes engine and filter sand and those uses indicated by footnote 1.

⁴ Less than \$1,000.

Sulfur.—The production and value of recovered elemental sulfur increased in 1957 compared with 1956. Sulfur was recovered as a byproduct in the liquid purification of gas in the form of brimstone and flotation sulfur paste. Two companies produced byproduct sulfur in Camden, Gloucester, and Hudson Counties.

Vermiculite.—Crude vermiculite was processed at exfoliating plants in Essex, Hudson, and Mercer Counties. The bulk of the exfoliated material was used in insulation and as concrete and plaster aggregate.

METALS

Ilmenite.—The New Jersey Department of Conservation and Economic Development announced discovery of commercial-grade ilmenite deposits in the State. Extensive deposits were found in Ocean and Burlington Counties. The original discovery was made in a pit in western Ocean County by a State geologist. Test borings in the area were made by the State to determine the ilmenite content and extent of mineral occurrence. Samples processed showed 2- to 3-percent ilmenite. Several chemical and industrial firms explored the area for possible development.

Iron Ore.—Production of crude iron ore in New Jersey totaled 1,710,000 gross tons in 1957, a 7-percent decline compared with 1956. Shipments of usable ore, mainly concentrate for pig-iron and steel

manufacture, declined 4 percent. Compared with 1956, the average price of the State's usable iron ore increased more than \$0.50 in 1957. Treatment of crude iron ore consisted principally of separation and concentration by gravity and flotation. The iron content of the State's usable ore shipments averaged 64 percent. Crude ore was shipped direct for pig-iron and steel manufacture; limited quantities of concentrated ore were shipped for treating sewage and manufacturing paint. Four underground mines were active—3 in Morris County and 1 in Warren County.

Lead and Antimony.—The Perth Amboy (Middlesex County) plant of American Smelting and Refining Co. produced various grades of refined lead and antimony oxide from both domestic and foreign sources.

Manganese.—Vitro Laboratories, a division of Vitro Corporation of America, West Orange (Essex County), was awarded a Government (GSA) contract to install, equip, and operate a pilot plant to test and develop the Sheer-Korman high-intensity-arc process of recovering Metallurgical-grade manganese from domestic ores. The GSA contract, extending 19 months and totaling \$271,000, was awarded to obtain economic-evaluation data of the Sheer-Korman process that could be used in designing a commercial plant.

In addition, a new company (U. S. Manganese Corp.) was formed to obtain, explore, and develop the raw material (rhodonite), for use in the pilot plant. U. S. Manganese Corp. was owned jointly by Vitro Corp. of America, Sheer-Korman Associates, Inc., and Great Divide Mining and Milling Corp. This mining company has vast resources of rhodonite in Colorado.

Manganiferous Residuum.—Manganiferous residuum was recovered as a byproduct of zinc smelting of a manganiferous zinc ore mined in Sussex County.

Zinc.—In 1957 zinc was recovered from manganiferous zinc ore that was crushed locally and shipped to Palmerton, Pa., for smelting. The output of recoverable zinc from New Jersey ore more than doubled in 1957 compared with 1956. The Sterling Hill mine produced recoverable zinc in 1957 for nearly 8 months; it was active in 1956 only 4 months because a labor dispute suspended work at the mine from January to August. Production was suspended again in August 1957 because of an unfavorable domestic zinc market.

TABLE 3.—Mine production of recoverable zinc, 1948–52 (average) and 1953–57

Year	Short tons	Year	Short tons
1948-52 (average).....	60,890	1955.....	11,643
1953.....	45,700	1956.....	4,667
1954.....	37,416	1957.....	12,530

MINERAL FUELS

Peat.—Production and valuation of reed-sedge peat recovered in Sussex County increased in 1957 as compared with 1956. Output was used for soil improvement.

REVIEW BY COUNTIES

Mineral production was recorded in all 21 counties in the State. Morris, Somerset, Cumberland, Sussex, and Passaic, in decreasing order of value, were the centers of greatest mineral activity in 1957. Mineral output from these counties supplied 73 percent of the State's total value. Compared with 1956, Sussex County showed the greatest rise in mineral valuation, because production of recoverable zinc in the county increased. Middlesex County showed the largest decline from the previous year, owing to decreased output of clays and sand and gravel.

Atlantic.—Sand and gravel was recovered in the county in 1957 along the Atlantic Seaboard and in the western part of the county near Cedar Lake, Buena, and Folsom. Output was used chiefly for building purposes and as molding sand.

Bergen.—Bergen County continued to rank third in value of sand and gravel production in 1957. Output from four operations in the northern part of the county was used mainly as building material. Alluvial clays for manufacturing building brick was produced by Tri-County Brick Corp. at Moonachie near Carlstadt. The Flintkote Co. produced artificially colored roofing granules at its East Rutherford plant.

TABLE 4.—Value of mineral production in New Jersey, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Atlantic.....	\$114,374	\$93,135	Sand and gravel.
Bergen.....	1,340,096	1,104,936	Sand and gravel, clays.
Burlington.....	770,570	620,242	Do.
Camden.....	1,138,600	970,751	Sand and gravel, clays, recoverable sulfur.
Cape May.....	(1)	(1)	Magnesium compounds, sand and gravel.
Cumberland.....	7,752,781	8,310,386	Sand and gravel, clays, stone.
Essex.....	(1)	(1)	Stone, sand and gravel.
Gloucester.....	770,674	772,877	Sand and gravel, recoverable sulfur, greensand marl, stone.
Hudson.....	87,703	(1)	Recovered elemental sulfur.
Hunterdon.....	(1)	(1)	Stone.
Mercer.....	(1)	(1)	Do.
Middlesex.....	3,117,700	2,487,495	Clays, sand and gravel.
Monmouth.....	943,705	848,906	Sand and gravel.
Morris.....	17,677,009	17,168,356	Iron ore, sand and gravel, stone, clays.
Ocean.....	568,413	1,051,689	Sand and gravel.
Passaic.....	5,731,183	6,598,347	Stone, sand and gravel, clays, gem stones.
Salem.....	2,543	1,762	Sand and gravel.
Somerset.....	9,280,290	8,957,297	Stone, clays.
Sussex.....	5,024,660	6,603,091	Zinc, stone, manganiferous residuum, lime, peat, sand and gravel, gem stones.
Union.....	989,025	(1)	Stone.
Warren.....	(1)	(1)	Iron ore, sand and gravel, stone, clays.
Undistributed ²	8,970,054	9,347,929	
Total.....	64,279,000	64,937,000	

¹ Value included with "Undistributed."² Includes counties indicated by footnote 1 and a quantity unspecified by county.

Burlington.—Sand and gravel was produced at five places in the county during 1957. Production was centered near Riverside, Mount Holly, and East Riverton. Output was used mainly as building material. Quantities of molding sand and paving sand and gravel were also produced. Church Brick Co. manufactured building brick from miscellaneous clay mined near Fieldsboro. National Gypsum

Co. manufactured calcined gypsum and finished-gypsum building products at its Burlington plant.

Camden County.—Commercial sand and gravel production was reported from seven operations throughout the county in 1957. Output consisted mainly of molding sand and structural and paving sand and gravel. Construction and maintenance crews of the Camden County Highway Department produced unprepared paving sand and gravel. Miscellaneous clay used for manufacturing building brick was mined near Winslow Junction. Public Service Electric & Gas Co. used the Thylox process to recover flotation sulfur paste from gases produced at its Camden coke plant. No miscellaneous stone was reported quarried in the county in 1957.

Cape May.—The Cape May plant of Northwest Magnesite Co. recovered refractory magnesia from raw sea water and dolomite. Structural and paving sand and gravel and fill sand were recovered near Tuckahoe, Marmora, and Cape May Court House.

Cumberland.—Cumberland County continued to be the leading sand and gravel-producing county and supplied 47 percent of the State's total valuation of sand and gravel. Production was reported from 17 operations throughout the county and consisted mainly of molding and glass sand. In addition blast, fire, filter, and engine sand, as well, as building, paving and other sand and gravel, were produced. Brunetti Bros., producers of building sand and gravel, installed a water-scalping tank for processing material at its dredging operations near Vineland. The production of ground sand used as foundry, abrasive, and filler sand and for enamel, glass, pottery, porcelain, and tile manufacture and other miscellaneous uses was also reported. Producers were National Glass Sand Corp. (formerly National Pulverizing Co.) and Pennsylvania Glass Sand Corp., both of Millville. Fire clay used for foundry purposes and as refractory mortar was mined near Millville. William Edge produced ground oystershell for use as poultry grit near Dorchester.

Essex.—Orange Quarry Co., West Orange, quarried traprock for use as riprap and crushed for concrete aggregate and roadstone. The company constructed a new crushing plant to replace one destroyed by fire in 1957. The company also produced a limited quantity of paving and road sand.

Barnett Division, Allied Chemical & Dye Corp. (Newark), produced calcined gypsum and transferred the output to its Hudson County plant, where it was processed into finished building material. Vermiculite Industrial Corp. (Newark), imported crude material from South Africa and exfoliated vermiculite during the year. E. I. du Pont de Nemours Co., Inc., manufactured a limited quantity of hydrated ferric oxide pigments at its Newark plant.

Gloucester.—Production of sand and gravel was reported from three operations in the county at Bridgeport, Downer, and Mount Royal. The output consisted mainly of structural sand and gravel and a quantity of furnace sand. Freeport Sulfur Co. recovered sulfur (brimstone) in liquid purification of gas by the modified Baehr process at its Eagle Point plant near Westville. Greensand marl used for water softening was recovered from a surface mine near Sewell. Joseph Bauder & Sons (Franklinville), recovered oystershell that was ground and used for poultry grit.

Hudson.—Flotation sulfur paste was recovered from gases as a byproduct by the Thylox process at Harrison Gas Works of Public Service Electric & Gas Co. Koppers Co., Inc., produced hydrogen sulfide by the Koppers hot-vacuum activation process at its Seaboard plant near Kearny. No sand and gravel production was reported in 1957. Barrett Division, Allied Chemical & Dye Corp. (South Kearny) produced building materials from gypsum calcined at its plant in Essex County. F. E. Schundler & Co., Inc., exfoliated vermiculite near South Kearny, using crude material from South Africa and Montana.

Hunterdon.—Crushed and broken basalt used for concrete aggregate, railroad ballast, and as riprap was quarried near Lambertville. Sandstone and miscellaneous stone used for rough construction and granite used for concrete aggregate and roadstone were also quarried in the county.

Mercer.—Diabase (basalt) was quarried and crushed near Pennington. The output was used as concrete aggregate, roadstone, and railroad ballast. Mercer County Work House also quarried basalt used for concrete aggregate and roadstone. No sand and gravel production was reported in the county for the year. Columbian Carbon Co. (Trenton), manufactured black, brown, red, and yellow iron oxide pigments in 1957. Zonolite Co. exfoliated vermiculite from crude material, largely from Montana and South Carolina and partly from South Africa.

Middlesex.—Middlesex County continued to be the leading clay-producing county in New Jersey and supplied over 75 percent of the State total clay valuation. Ball, fire, and miscellaneous clays were recovered in the county. Eleven companies were active in the county during the year. Most of the output came from open pits near the eastern seaboard. Sayre and Fisher Brick Co. constructed a \$1-million plant for producing the lightweight aggregate, "Aglite." The plant is comprised of 2 sintering units with a total capacity of 1,500 cubic yards per day. Loading facilities permit shipment by rail, water, and truck.³ Valentine Fire Brick Co., producers of fire clay, rebuilt its old plant at Woodbridge. The company operates 2 clay banks—1 at Woodbridge and 1 at Perth Amboy.

Production of sand and gravel was reported from eight operations throughout the county in 1957. Output consisted mainly of building and paving sand and gravel. Quantities of molding, blast, furnace, engine, and filter sand also were produced.

Stabilized Pigments, Inc., manufactured red iron oxide pigments (calcined copperas) in the county at its plant near New Brunswick. Columbian Carbon Co. also manufactured red iron oxide pigments (calcined copperas) near Monmouth Junction. The Coralux Perlite Corp. of New Jersey processed crude perlite from material produced in Southwestern United States at its Metuchen plant.

Monmouth.—Structural sand and gravel and paving gravel were the principal mineral commodities recovered in the county in 1957. Quantities of filter and fill sand and other gravel were also recovered. Production was reported from eight operations, mainly along the Atlantic seaboard.

³ Rock Products, Aglite Plant Erected: Vol. 60, No. 5, May 1957, p. 53.

Morris County.—Morris County continued to be the leading mineral-producing area in New Jersey and furnished 26 percent of the State's total mineral valuation. Iron ore, the principal mineral of the county, was recovered from the Mount Hope mine, Shahmoon Industries, Inc.; the Scrub Oak mine, Alan Wood Steel Co.; and the Richard Ore mine, Colorado Fuel & Iron Corp. Ore recovery from the underground Richards mine was by shrinkage stoping. Development of the mine included a 1,200-foot vertical shaft and an incline 1,000 feet in length, with 25° inclination.

The county also continued to rank second in valuation of sand and gravel output among the State's 16 producing counties. Most of the sand and gravel produced was used for building and paving purposes. Quantities of engine sand and other sand and gravel also were produced. In March 1957 Consolidated Stone & Sand Co. (Riverdale) and Sequine-Bogert Co., Inc. (Kenvil), consolidated with Houdaille Construction Materials, Inc. The Netcong operation of Houdaille Construction Materials, Inc. (formerly North Jersey Quarry Co.) was abandoned in 1957.

Pompton Crushed Stone Co. enlarged the facilities of its crushing plant at the granite quarry near Riverdale. The company added another crusher and constructed a new screenhouse and storage bins. Granite was also produced by Wharton Sand & Stone Co. (Wharton), and Alan Wood Steel Co. (Dover). Miscellaneous clay used for manufacturing flowerpots was mined near Bernardsville.

Ocean.—Ocean County ranked fourth in valuation of sand and gravel production in 1957. The output was used mainly for building and paving purposes. The Lakewood operation of Houdaille Construction Materials, Inc. (formerly North Jersey Quarry Co.), produced paving material. New Jersey Pulverizing Co. (Pinewald) produced blast and engine sand as well as a quantity of ground sand used for abrasives, filler, and foundry purposes. Clayton's Sand & Gravel, Inc. (Barnegat), added a conveyor belt to facilitate processing its washed and sized material. The Brown & Burdge fixed plant at Herbertsville produced building sand and gravel.

Passaic.—Passaic County continued to rank second in valuation of stone production in the State. Quarries yielded basalt and miscellaneous stone; basalt was the more important. The entire basalt output came from quarries in the southeastern part of the county. Most of the crushed basalt was used for concrete aggregate and roadstone. Quantities were used also for roofing granules. Passaic Crushed Stone Co., producers of miscellaneous stone, installed a 42- by 48-inch primary crusher near Pompton Lakes. Sand and gravel used mainly for structural purposes was produced at Piquanock, Paterson, and Wayne. Paving and fill sand was also produced.

Paterson Brick Co. (formerly Paterson Brick Co., Inc.) produced miscellaneous clay for brick manufacture at an open pit in Wayne Township. The company property was transferred from Paterson Brick Co., Inc., to Paterson Brick Co. (a partnership) on May 1, 1957. Gem material (prehnite) was recovered near Paterson. H. B. Reed & Co., Inc. (Passaic), and Great Notch Granule Co. (Great Notch) produced natural roofing granules. PerAlex of New Jersey, Inc., expanded perlite from material shipped from Western United States at its Paterson plant.

Salem.—A. W. Davis Lumber Co. produced a limited quantity of structural sand by dredging near Salem.

Somerset.—The leading stone-producing county in the State was again Somerset. It furnished over half of the State total stone output. Output consisted entirely of crushed and broken basalt, used principally for concrete aggregate and roadstone. Substantial quantities of riprap and railroad ballast were also produced. Houdaille Construction Materials, Inc., acquired the Bound Brook and Millington quarries of North Jersey Quarry Co. during the year. Somerset Crushed Stone, Inc., Bernardsville, increased its capacity by adding a new plant on the quarry floor, which connects with the older plant by a tunnel-belt conveyor. The \$400,000 addition included a 36-inch primary gyratory crusher, a double-deck scalping screen, secondary gyratory crusher, tunnel-belt conveyor, triple-deck screen, and four stacker-belt conveyors.⁴ Basalt also was produced near Kingston, Westfield, and Martinsville. Miscellaneous clay used for brick and tile manufacture was mined from an open pit near Somerville.

Peapack Limestone Quarry, Inc., did not produce burnt lime for the second consecutive year. During 1957 remodeling and installation of new equipment was completed at its Peapack plant. New equipment included a stone crusher, an aglime hammer mill, a three-high pulverizer, and a triple-deck screen. Production was expected to be resumed early in 1958. Natural and artificially colored roofing granules were produced by Central Commercial Co. at Bound Brook. Johns-Manville Corp. expanded perlite at its Manville plant from material purchased in Western United States.

Sussex.—In terms of value, zinc in 1957 replaced stone as the leading mineral recovered from the county. Zinc and manganiferous residuum were recovered from manganiferous zinc ore produced at the Sterling Hill underground mine near Ogdensburg. Ore recovery at this mine was chiefly by shrinkage stoping with some square-set stoping and horizontal cutting and filling. Mine openings consisted of 3 inclines and a 370-foot tunnel. The inclines average 2,167 feet in depth and 53 degrees inclination.

Limestone Products Corp. of America (Newton) and Farber White Limestone Co. (Franklin) quarried and crushed limestone. The output was used mainly for agricultural purposes and concrete aggregate. Hydrated lime was produced at the Lime Crest plant of Limestone Products Corp. of America. The output was sold for masonry and agricultural use, as well as for water purification and softening. The bulk 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. Sand and gravel also was recovered near Sparta and Andover.

Andover and Stanhope in the southern part of the county were the centers of the peat industry in the county and the State. Output consisted of reed-sedge peat used for soil improvement. Crude gem material (calcite, franklinite, rhodomite, and willemite), originating near Franklin, was recovered in 1957 by 3 amateur gem collectors.

Union.—Near Summit, Houdaille Construction Materials, Inc. (formerly North Jersey Quarry Co.), quarried and crushed basalt used

⁴Rock Products, Quarry Expansion: Vol. 60, No. 2, February 1957, p. 70.

for concrete aggregate and roadstone. No sand and gravel production was reported in the county in 1957. Esso Standard Oil Co. produced hydrogen sulfide by diethanolamine treating for their own use at its Bayway refinery. Certified Industrial Products, Inc. (Hillside), expanded perlite from material produced in Western United States.

Warren.—Magnetite was recovered from the Washington underground mine of Alan Wood Steel Co. Underground mining was by sublevel stoping, with long-hole drilling. The mine had 2 inclined openings—one 1,600 feet in length with 69° inclination and the other 1,500 feet in length with 45° inclination. A 2,000-foot winze inclined at 34° was also used in the development of the mine. Houdaille Construction Materials, Inc. (formerly Portland Sand & Gravel Co.), produced structural and paving sand and gravel at a fixed plant near Carpentersville. Steckel Concrete Co. (Phillipsburg) produced structural sand and gravel. The Royal Green Marble Co., Inc., the only producer of marble in the State, quarried and crushed marble near Phillipsburg. The output was used exclusively for terrazzo. Natco Corp. produced miscellaneous clay, used for brick manufacture, from an open pit near Port Murray. A variety of magnesium compounds was produced from carbonates, oxides, and sulfates of magnesium by J. T. Baker Chemical Co. at its Phillipsburg plant. The plant was idle from May 10 to July 25 because of a labor dispute.

The Mineral Industry of New Mexico

By Frank J. Kelly,¹ William H. Kerns,¹ and D. H. Mullen¹



PROSPERITY in terms of increased output for some commodities and recession in the form of serious production cutbacks for others characterized the mineral industry of New Mexico in 1957. Output as well as value of the liquid fuels—petroleum, natural gas, and natural-gas liquids—potash, and sand and gravel increased significantly. In contrast producers of copper, lead, and zinc reported decreases in output. These producers suffered from substantially reduced prices for these metals. Uranium-ore shipments were larger, but producers actually realized less dollar return because the grade of ore was lower. The aggregate increase in value of output of some of the principal minerals—primarily liquid fuels—was greater than the combined losses for others and therefore the total value of the mineral production in New Mexico (\$553 million) showed a net gain of 7 percent above 1956 (\$515 million).

The mineral fuels group valued at \$387.9 million supplied 70 percent of the total for all minerals. Nonmetals (valued at \$91.1 million) contributed 17 percent, and metals (valued at \$74.0 million) 13 percent of the total for the State.

Copper, lead, and zinc production declined, mainly because of the drop in the price paid for these metals. Production of copper decreased 9 percent in 1957, and the value fell 36 percent. Similarly, lead output dropped 17 percent in quantity and 20 percent in value; zinc output was 7 percent lower, and value dropped 21 percent.

The construction of new mills and processing plants in the State during 1957 was limited to those for uranium. Four mills with a planned combined daily capacity of 7,275 tons were being built. When these mills are completed, New Mexico will have 53 percent of the uranium-milling capacity for the Western States. Of major importance to the mineral industry of New Mexico was continued development of uranium ore bodies in the Ambrosia Lake area, McKinley County. According to the Atomic Energy Commission (AEC) New Mexico, by the end of 1957, had 53.3 million tons of uranium reserves—68 percent of the national total.

Many New Mexico ores contain small quantities of such valuable metals as cadmium, bismuth, selenium, tellurium, and gallium. These quantities sometimes are unknown and sometimes although known by analyses are not accounted for metallurgically in early processing stages. As it is impossible to distribute these mineral products by States of origin, their values are not included in the total value of the mineral output of New Mexico; however, the amount involved is small.

Five Defense Minerals Exploration Administration (DMEA) contracts were signed during the year; 3 were for uranium and 1 each for manganese and molybdenum.

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TABLE 1.—Mineral production in New Mexico, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite.....	4,059	\$81	4,441	\$98
Beryllium concentrate..... gross weight..	31	(²)	29	15
Clays..... thousand short tons..	40	95	33	83
Coal..... do.....	158	923	137	829
Columbium-tantalum concentrate..... pounds..	95	(³)	866	1
Copper (recoverable content of ores, etc.)..	74,345	63,193	67,472	40,618
Gem stones.....	(⁴)	30	(⁴)	30
Gold (recoverable content of ores, etc.)... troy ounces..	3,275	115	3,212	112
Helium (shipments)..... thousand cubic feet..	76,072	1,350	⁵ 69,336	⁵ 1,189
Iron ore (usable)..... long tons, gross weight..	(²)	(²)	150	1
Lead (recoverable content of ores, etc.)..	6,042	1,897	5,294	1,514
Lime..... thousand short tons..	31	873	24	290
Manganese ore and concentrate (35 percent or more Mn)..... gross weight..	22,012	1,835	25,459	2,114
Manganiferous ore and concentrate (5 to 35 percent Mn)..... gross weight..	38,782	139	42,535	152
Mica:				
Sheet..... pounds..	6,247	53	2,134	16
Scrap.....	767	22	1,347	47
Natural gas..... million cubic feet..	626,340	55,118	⁵ 735,100	⁵ 69,800
Natural-gas liquids:				
LP-gases..... thousand gallons..	308,218	11,065	375,930	13,046
Natural gasoline..... do.....	306,595	16,560	309,010	19,941
Perlite (crude).....	167,705	1,271	187,259	1,568
Petroleum (crude)..... thousand 42-gallon barrels..	87,893	241,706	⁵ 94,759	⁵ 283,128
Potassium salts (K ₂ O equivalent) thousand short tons..	1,997	⁶ 75,122	2,080	77,197
Pumice..... do.....	292	667	321	756
Salt..... do.....	57	501	53	429
Sand and gravel..... do.....	6,055	5,776	7,991	7,803
Silver (recoverable content of ores, etc.)				
thousand troy ounces..	393	356	309	280
Stone..... thousand short tons..	1,268	1,272	1,348	1,618
Tungsten concentrate..... 60-percent WO ₃ basis..	(⁷)	2		
Zinc (recoverable content of ores, etc.)..	35,010	9,593	32,680	7,582
Uranium ore..... thousand short tons..	⁶ 1,105	⁶ 24,086	1,176	20,538
Value of items that cannot be disclosed: Carbon dioxide (natural), magnesium compounds, molybdenum, rare-earth metals concentrate (1956), sulfur, vanadium, and values indicated by footnote 2.....		1,900		2,317
Total New Mexico ⁸		⁶ 515,009		553,034

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 Less than \$1,000.

⁴ Weight not recorded.

⁵ Preliminary figure.

⁶ Revised figure.

⁷ Less than 1 ton.

⁸ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing lime.

TABLE 2.—Average unit value of selected mineral commodities produced in New Mexico, 1953-57¹

Commodity	1953	1954	1955	1956	1957
Beryl.....short ton.....	\$584.43	\$374.11	\$532.26	(?)	\$506.79
Clays.....do.....	2.12	1.74	2.39	\$2.41	2.50
Coal.....do.....	6.00	5.91	6.13	5.82	6.05
Columbium-tantalum.....pound.....	1.70	1.70	1.70	4.26	1.33
Copper ³.....do.....	.287	.295	.373	.425	.301
Helium.....thousand cubic feet.....	13.46	17.61	17.62	17.75	⁴ 17.35
Iron ore.....long ton.....	(?)	(?)	(?)	4.78	7.03
Lead ³.....pound.....	.131	.137	.149	.157	.143
Lime.....short ton.....				12.11	12.10
Manganese ore and concentrate (35 percent or more Mn).....short ton.....			(?)	83.34	83.03
Manganiferous ore and concentrate (5 to 35 percent Mn).....short ton.....	3.87	4.00	(?)	3.57	3.57
Mica:					
Sheet.....pound.....		6.74	6.88	8.42	7.33
Scrap.....short ton.....			29.46	28.96	34.79
Molybdenum.....pound.....	.95	.94	1.00	1.07	1.13
Natural gas.....thousand cubic feet.....	.06	.08	.09	.09	4.10
Natural-gas liquids:					
L.P.-gases.....gallon.....	.04	.02	.02	.04	.04
Natural gasoline.....do.....	.06	.05	.06	.05	.06
Perlite (crude).....short ton.....	7.80	7.98	7.38	7.58	8.38
Petroleum ⁵.....42-gallon barrel.....	2.63	2.75	2.74	2.75	⁴ 2.99
Potassium salts.....short ton.....	37.40	37.16	37.82	⁶ 37.62	37.11
Pumice.....do.....	1.44	2.91	1.98	2.28	2.36
Salt.....do.....	3.48	6.58	12.00	8.77	8.09
Sand and gravel.....do.....	.88	1.28	1.32	.95	.98
Stone.....do.....	.82	.92	.98	1.00	1.20
Uranium (U ₃ O ₈ contained).....pound.....				4.17	3.97
Zinc ³.....do.....	.115	.108	.123	.137	.116

¹ Average value f. o. b. mines or mills reported by the producers, except as otherwise noted.

² Figure withheld to avoid disclosing individual company confidential data.

³ Yearly average weighted price of all grades of primary metal sold by producers.

⁴ Preliminary figure.

⁵ Value at wells.

⁶ Revised figure.

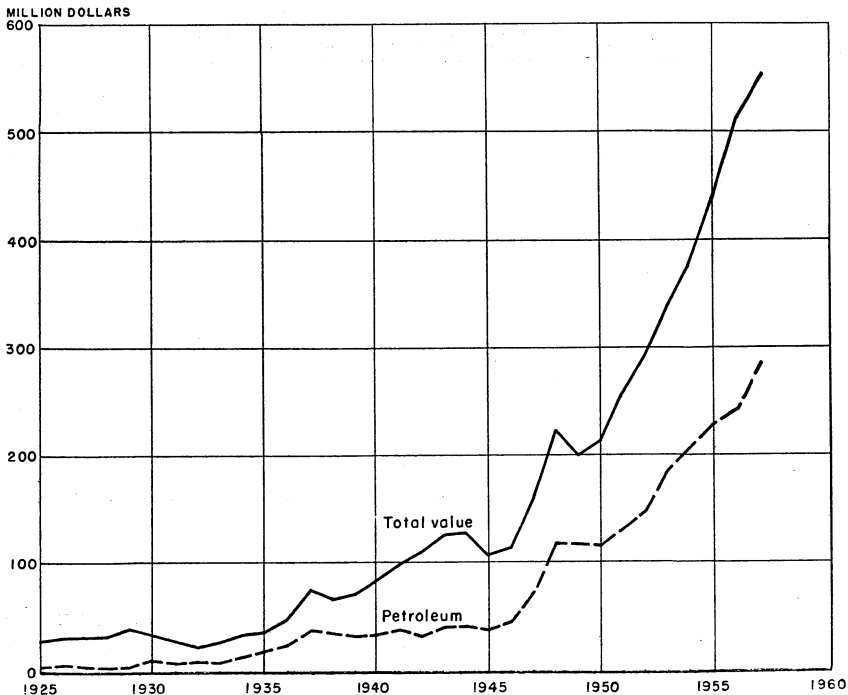


FIGURE 1.—Value of petroleum production and total value of all minerals produced in New Mexico, 1925-57.

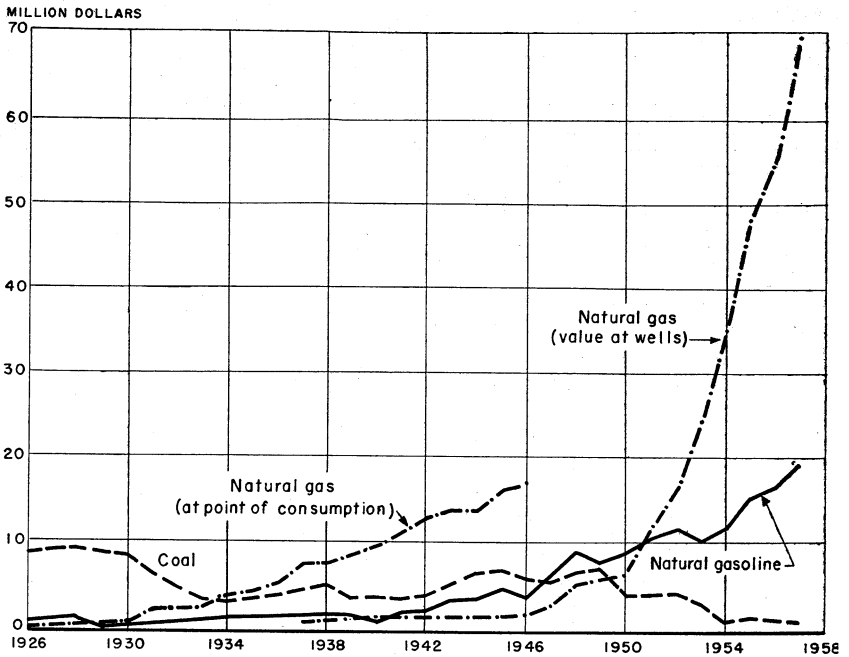


FIGURE 2.—Value of natural gas, natural gasoline, and coal produced in New Mexico, 1926–57.

TABLE 3.—DMEA contracts executed in 1957

County and contractor	Property	Commodity	Contract	
			Date	Total amount ¹
LUNA				
Florida Manganese, Inc.-----	Killion mine.-----	Manganese-----	Nov. 19, 1956	\$19,920
MC KINLEY				
Mid-Continent Uranium Corp.-----	West Limestone Claim group.	Uranium-----	Aug. 30, 1957	113,244
The New Jersey Zinc Co.-----	Sec. 34, T. 14 N., R. 10 W.	do-----	May 20, 1957	90,890
Treasure Uranium & Resources, Inc.	NW ¼ Sec. 6, T. 13 N., R. 9 W., N. M. P. M.	do-----	Jan. 17, 1957	25,832
TAOS				
Molybdenum Corp. of America.-----	Molybdenum or Questa mine.	Molybdenum.	May 31, 1957	510,500
Total-----	-----	-----	-----	760,386

¹ Government participation: Manganese and uranium, 75 percent; molybdenum, 50 percent.

EMPLOYMENT AND INJURIES

All data on employment in New Mexico were obtained from the United States Department of Labor, Bureau of Labor Statistics, and

the Employment Security Commission of New Mexico. Annual average employment in the mining industry of New Mexico gained 5 per cent in 1957, but the ratio to the total nonagricultural employment remained virtually unchanged from 1956. The continued exploration, development, and mining of uranium plus the increased activity in oil and gas drilling in northern New Mexico largely furnished the gain in number of men employed in mining despite the shutdown or severe cutback of most lead, zinc, and copper mines in the State. The average hourly earnings and the average weekly earnings for most nonagricultural workers continued to climb in 1957, but the average hours worked per week remained unchanged.

No major disasters occurred in any New Mexico mineral industry in 1957.

TABLE 4.—Annual average employment in mining and other nonagricultural industries in New Mexico, 1956-57

[Bureau of Labor Statistics, U. S. Department of Labor, and Employment Security Commission of New Mexico]

Industry	Annual average employment		Percent of total nonagricultural	
	1956	1957	1956	1957
Mining ¹	16, 700	17, 600	9	8
Contract construction ²	15, 500	17, 200	8	8
Manufacturing.....	20, 000	20, 800	10	10
Transportation and public utilities.....	19, 600	20, 100	10	10
Wholesale and retail trade.....	43, 600	46, 400	22	22
Finance, insurance, and real estate.....	6, 600	7, 300	3	4
Service and miscellaneous.....	23, 900	26, 000	12	12
Government.....	50, 100	53, 300	26	26
Total nonagricultural.....	196, 000	208, 700	100	100

¹ Includes extraction of minerals occurring naturally, quarrying, well operation, milling, exploration and development of mineral properties, and removal of overburden.

² Includes some employees engaged in mining, quarrying, and removing overburden where work was done by contractors conducting types of construction work other than mining, where separate records were not kept for work in connection with the mineral industry.

TABLE 5.—Mining employment by types of mining in New Mexico, 1956-57

[Bureau of Labor Statistics, U. S. Department of Labor, and Employment Security Commission of New Mexico]

	1956 ¹		1957	
	Percent of total	Average number of men	Percent of total	Average number of men
Mining total.....	100	16, 700	100	17, 600
Metal mining.....	28	4, 700	27	4, 700
Petroleum and natural gas.....	58	9, 700	60	10, 500
Nonmetal and coal mining.....	14	2, 300	13	2, 400

¹ Revised.

TABLE 6.—Average hours and earnings of workers in selected industries in New Mexico, 1956-57¹

[Bureau of Labor Statistics, U. S. Department of Labor, and Employment Security Commission of New Mexico]

	Average weekly earnings		Average weekly hours		Average hourly earnings	
	1956	1957	1956	1957	1956	1957
Mining.....	\$99.07	\$102.85	43.5	43.5	\$2.27	\$2.36
Contract construction.....	90.87	95.14	37.6	37.3	2.38	2.55
Manufacturing.....	85.80	90.12	41.1	40.9	2.11	2.20
Communication and utilities.....	83.06	80.23	42.7	41.0	2.01	1.96
Wholesale and retail trade.....	62.79	65.87	41.3	41.5	1.52	1.58

¹ Excludes administrative and nonworking supervisory personnel. Average weekly earnings are gross amounts, including overtime, paid vacations, etc.

COMMODITY REVIEW

MINERAL FUELS

The mineral-fuels (coal, natural gas, natural-gas liquids, and petroleum) as a group constituted 70 percent of the total value of the mineral production in the State in 1957, mineral fuels was \$386.4 million—an 18-percent increase over 1956, when the value was \$326.8 million or 63 percent of the State total.

Carbon Dioxide.—The production of carbon dioxide from wells in Harding and Union Counties in 1957 increased 43 percent compared with 1956. Reported occurrences in other counties have not been developed.

Coal.—Production of coal in 1957 from 23 underground and 3 strip mines in 6 counties was 137,151 tons—a decline of 13 percent in volume and 10 percent in value compared with 1956. McKinley and Colfax Counties were the leading producers, with 81 percent of the total. Rehabilitation of the Koehler mine in Colfax County was of major importance.

TABLE 7.—Production of coal, 1956-57, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1956		1957	
	Short tons	Average value per ton ¹	Short tons	Average value per ton ¹
Colfax.....	72,786	\$6.15	48,396	\$6.01
McKinley.....	50,868	5.50	62,400	6.16
Rio Arriba.....	16,025	5.16	16,786	5.37
Sandoval.....	2,537	5.11	2,198	2.82
San Juan.....	9,946	4.89	-----	-----
Santa Fe.....	4,582	9.25	5,371	7.84
Socorro.....	1,700	5.21	2,000	7.81
Total.....	158,444	5.82	137,151	6.05

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.)

Helium.—Shipments of helium in 1957 from the Bureau of Mines plant at Shiprock, San Juan County, were 69 million cubic feet, a 9-percent decline compared with 1956. The encroachment of water in the gas wells of the Rattlesnake field, the major source of gas for the plant, has reduced the quantity of recoverable helium.

Natural Gas.—Marketed natural gas from oil and gas fields in Lea, San Juan, and Rio Arriba Counties in 1957 was an estimated 735.1 billion cubic feet—an increase of 17 percent compared with 1956. Ten new gas fields were discovered—6 in San Juan County, 2 in Chaves County, and 1 each in Eddy and Lea Counties. Field development was concentrated in Rio Arriba and San Juan Counties in the northwest area, where 567 successful wells were completed, compared with 29 successful completions in Lea and Eddy Counties in the southeast area. A substantial quantity of natural gas was used at three plants in the southeastern fields for producing carbon black.

Natural-Gas Liquids.—Natural gasoline, butane, and related natural-gas liquids recovered from natural gas at 21 plants in 1957 was 684.9 million gallons, an 11-percent increase over 1956. Sinclair Oil & Gas Co. announced plans to construct a 36,000-gallon-a-day natural-gasoline plant in Lea County.

Petroleum.—Petroleum, produced in 8 counties, was estimated at 94.8 million barrels in 1957, an 8-percent gain over the 87.9 million barrels produced in 1956. Lea County continued to lead the State in quantity and value of production, followed by Eddy, Chaves, and San Juan Counties. Rapid development of the Bisti field in San Juan County, discovered in mid-1956, definitely established the field as a major producing area. Liquefied-petroleum gases will be used to increase ultimate recovery in this comparatively new field to 60 or 70 percent where oil in place was estimated to be 100 million barrels.

TABLE 8.—Production of crude petroleum, 1956–57, by counties ¹

(Thousand barrels)

County	1956	1957 (preliminary)	Principal fields in 1957 in order of production
Chaves.....	4,787	4,405	Caprock.
Eddy.....	4,522	5,900	Grayburg-Jackson, Artesia, Loco Hills.
Lea.....	77,436	82,122	Eunice-Monument, Denton, Caprock East, Gladiola.
McKinley.....	133	132	Hospah.
Rio Arriba.....	310	327	South Blanco.
Roosevelt.....	11	179	Milnsand.
Sandoval.....	16	18	Otero.
San Juan.....	678	1,676	Bisti, Verde.
Total.....	87,893	94,759	

¹ Distribution by county effected by use of New Mexico Oil Conservation Commission data adjusted to Bureau of Mines total.

Exploration activities decreased slightly from 1956; however, the success ratio remained high—1:3.5 in the northwestern area and 1:4 in the southeastern area. The number of discoveries was 66, the same as in 1956. However, discoveries in the northwest increased from 22 in 1956 to 29 in 1957, whereas discoveries in the southeast decreased from 44 in 1956 to 37 in 1957. Discovery ratio throughout the State was 1:4.

Development drilling increased from 1,626 wells in 1956 to 1,862 in 1957; most of the increase was in the northwestern counties. The percentage of successful completions ranged from 93 percent in the northwest to 85 percent in the southeast. The percentage of successes for the State was 89.

Two pipelines were under construction during the year. The Four Corners pipeline will transport oil from the Aneth area in Utah and the San Juan basin, N. Mex., to Los Angeles, Calif. The 750 miles of 16-inch line was nearing completion at the end of the year, and filling had begun. The Texas-New Mexico Pipe Line Co. began constructing a 16-inch pipe from the Aneth area in Utah through the Bisti field in San Juan County to join existing facilities at Jal in Lea County. The pipeline will provide an outlet from the San Juan basin to the Gulf coast. Completion was expected about April 1958.

A 7,200-barrel-a-day refinery 10 miles east of Gallup in McKinley County was completed by El Paso Natural Gas Products Co.

TABLE 9.—Wildcat- and development-well completions in 1957, by districts and counties

District and county	Oil	Gas	Dry	Total	Footage
NORTHWEST NEW MEXICO					
Wildcat:					
McKinley.....			19	19	49,900
Rio Arriba.....	3		13	16	84,700
Sandoval.....	4		7	11	58,500
San Juan.....	16	6	31	53	251,100
Torrance.....			1	1	400
Union.....			1	1	5,300
Valencia.....			1	1	3,700
Total.....	23	6	73	102	453,600
Development:					
McKinley.....			3	3	5,300
Rio Arriba.....	14	340	23	377	1,656,600
Sandoval.....			3	3	6,400
San Juan.....	180	227	28	435	1,779,000
Total.....	194	567	57	818	3,447,300
SOUTHEAST NEW MEXICO					
Wildcat:					
Chaves.....		2	16	18	62,400
De Baca.....			2	2	3,800
Eddy.....	6	1	45	52	161,400
Lea.....	26	1	56	83	643,300
Roosevelt.....	1		6	7	49,800
San Miguel.....			1	1	4,300
Union.....			2	2	7,900
Total.....	33	4	128	165	932,900
Development:					
Chaves.....	38		15	53	140,200
Eddy.....	250	3	54	307	838,600
Lea.....	570	26	82	678	4,111,300
Roosevelt.....	5		1	6	55,800
Total.....	863	29	152	1,044	5,145,900
Total all drilling.....	1,113	606	410	2,129	9,979,700

NONMETALS

Barite.—Sales of ground barite improved slightly in 1957 and shipments were 9 percent above 1956. Mex-Tex Mining Co., Inc., continued as the only grinder and operated the Mex-Tex mines throughout the year. Crude lead-barite ore was milled at the company plant at San Antonio; the finished barite was used as a constituent in oil-well-drilling mud.

The Barite Corp. of America announced the scheduled construction

of a \$200,000 barite-grinding plant near Bernalillo; however, by year end only limited construction had been completed.

Cement.—The race between a number of major producers for first place in construction of a cement plant in New Mexico culminated in site-preparation activities and preliminary construction work at Tijeras, 16 miles east of Albuquerque, by the Ideal Cement Co. The plant, a 1-million-barrel dry-process facility, will be a 1-kiln operation. The estimated cost of the project was \$12 million.

Clays.—Output of clays in 1957 continued to decline and dropped to 33,000 tons, 18 percent below 1956. Smaller demand for clay for building brick and other structural-clay products was the reason for the decrease. Of the 32,960 tons of clays mined in 1957, 4,890 tons was fire clay, and 28,070 tons miscellaneous clay. The principal producer in 1957 was Kinney Brick Co., Inc., followed by El Paso Brick Co., Olson Mud Service Co., Gallup Brick & Tile Co., Phelps Dodge Corp., and Native Blanca Clay Co.

TABLE 10.—Production of clays, 1953–57

Year	Short tons	Value	Year	Short tons	Value
1953.....	49, 089	\$103, 931	1956.....	39, 623	\$95, 386
1954.....	47, 832	83, 085	1957.....	32, 963	82, 581
1955.....	45, 351	108, 582			

Gem Stones.—Gem and ornamental stones collected in 1957 and valued at \$30,000 consisted mainly of agate, although a small quantity of recolite and obsidian was reported. The Deming area of Luna County continued to be the principal productive area. Other counties where stones were collected were Hidalgo, Sandoval, Sierra, and Socorro.

Lime.—The Chino Mines Division of Kennecott Copper Corp. was the only producer of lime in 1957. The operation of its rotary kiln and continuous hydrator yielded 23,986 tons of hydrated lime, which was used in processing copper ores mined by the company.

Magnesium Compounds.—International Minerals & Chemical Corp. in conjunction with potash refining, recovered magnesium compounds from magnesium chloride liquors, which were wastes from its potash refinery. The finished product was sold to consumers for use as a refractory, chemical neutralizer, and in manufacturing synthetic mica.

Mica.—Production and shipments of hand-cobbed mica continued to decline during 1957—dropping to 52,150 pounds compared with 174,370 pounds in 1956. Sheet mica recovered amounted to 2,134 pounds in 1957 and 6,247 pounds in 1956. This downward trend in sales occurred despite the continued operation of the Government purchase depot at Custer, S. Dak. An attempt to have a Government-buying station established in or near Santa Fe was unsuccessful.

On the other hand, scrap-mica production rose to 1,347 tons in 1957 compared with 767 tons in 1956. The major producer was Petaca Mines Division, Minerals Engineering Co., which mined scrap mica for its grinding mill at Petaca. A number of individual producers mined small quantities of scrap and sold it to Petaca Mines.

TABLE 11.—Mica sold or used by producers, 1954-57

	1954	1955	1956	1957
Hand-cobbed mica, ¹ total pounds.....	45,457	219,894	174,367	52,150
Sheet mica: ¹				
Full trimmed:				
Pounds.....	8	399	11	
Value.....	\$208	\$5,559	\$256	
Average per pound.....	\$26.00	\$13.93	\$23.27	
From hand-cobbed mica:				
Pounds.....	2,046	9,032	6,236	2,134
Value.....	\$13,637	\$59,371	\$52,310	\$15,645
Average per pound.....	\$6.67	\$6.57	\$8.39	\$7.33
Total:				
Pounds.....	2,054	9,431	6,247	2,134
Value.....	\$13,845	\$64,930	\$52,566	\$15,645
Average per pound.....	\$6.74	\$6.88	\$8.41	\$7.33
Scrap mica, total:				
Short tons.....		84	767	1,347
Value.....		\$2,475	\$22,213	\$46,865
Average per ton.....		\$29.46	\$28.96	\$34.79
Total sheet and scrap mica:				
Short tons.....	1	89	770	1,348
Value.....	\$13,845	\$67,405	\$74,779	\$62,510

¹ Sold to the Government through GSA.

Ground-mica production from the Petaca mill was 1,312 tons valued at \$109,300. Uses for the ground material included paint, roofing, and oil-well-drilling mud.

Perlite. The exploitation of New Mexico perlite reserves continued in 1957, and production rose to 187,260 tons in 1957—an 11-percent increase over 1956. New Mexico led the Nation as a source of perlite, and output in 1957 was valued at \$1.6 million. The F. E. Schundler & Co., Inc., No Agua mine in Taos County was the outstanding producer, followed by the Great Lakes Carbon Corp. mines in Socorro and Taos Counties and by the United States Gypsum Co. mine in Valencia County. Great Lakes Carbon Corp. shipped crude perlite to its plants in other States. This company also operated an expanding plant in conjunction with its Socorro mine. F. E. Schundler & Co., Inc., sold all its material as crude; United States Gypsum Co. shipped crude material to company-owned expanding plants outside New Mexico.

TABLE 12.—Production of crude perlite, 1953-57

Year	Short tons	Value	Year	Short tons	Value
1953.....	84,891	\$661,698	1956.....	167,705	\$1,270,993
1954.....	111,040	885,824	1957.....	187,259	1,568,391
1955.....	147,805	1,091,250			

The Great Lakes Carbon Corp. announced in December opening of its El Grande perlite deposit in the No Agua region of northern New Mexico. The deposit, which had been held in reserve for nearly 10 years, is reported to be the world's largest known deposit of uniform Commercial-grade perlite. To exploit this deposit, a new crushing and sizing plant was under construction. Preliminary tests indicated that, in most perlite-expanding furnaces, this material will show a higher expansion rate and require lower furnace temperatures than the

original "Alexite" mined at Rosita, Colo. Mining of the latter deposit was discontinued in 1957.

The underground mining operations of Great Lakes at Socorro reported in the press consisted only of short development tunnels west of the main mining area. Nothing of interest was uncovered, and work was discontinued.

Potash.—Production of potash (K_2O equivalent) in New Mexico in 1957 was 2.1 million tons compared with 2 million in 1956—a 4-percent gain. However, shipments in 1957 were almost 2 million tons, only 2 percent greater than 1956. The increase in producers' stocks from 403,000 tons in 1956 to 497,000 tons in 1957 resulted from a dip in demand at home and abroad. During the last half of 1957 there was a marked reduction in exports of potash from the United States and a lessening of domestic demand intensified by the severe winter and the delayed planting of crops. Operators had difficulty storing potash in the available space and faced the realization that the potash supply was considerably greater than demand.

Production by New Mexico's newest potash-producing firm began on January 30, 1957, at the National Potash Co. new \$19 million operation, 30 miles east of Carlsbad. Product output at capacity was to be 1,200 tons per day, based on 4,800 tons per day of ore. The facility is co-owned by Freeport-Sulphur Co. and Pittsburgh Consolidation Coal Co. The shipping product is a high-grade muriate of potash guaranteed 60 percent K_2O sold as a coarse product (minus-10; plus-28-mesh) and a dust-free standard product (minus-28-mesh) to the agricultural industry. The ore horizon, at about 1,700 feet, is a gently undulating bed about 5 feet thick, averaging 15 to 20 percent K_2O .

TABLE 13.—Production and sales of potassium salts, 1953–57, in short tons

Year	Crude salts; ¹ mine production		Marketable potash salts					
			Production			Sales		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value	Gross weight	K_2O equivalent	Value
1953.....	9, 100, 671	1, 908, 280	2, 937, 960	1, 721, 435	\$64, 106, 287	2, 661, 587	1, 552, 831	\$58, 076, 435
1954.....	9, 975, 460	1, 985, 626	3, 007, 724	1, 763, 378	65, 538, 306	2, 954, 043	1, 732, 240	64, 366, 641
1955.....	10, 956, 466	2, 159, 010	3, 221, 460	1, 898, 770	71, 838, 558	3, 122, 432	1, 841, 122	69, 640, 740
1956.....	11, 941, 474	2, 304, 572	3, 383, 882	1, 996, 693	75, 122, 180	3, 278, 977	1, 930, 754	72, 802, 302
1957.....	12, 895, 260	2, 313, 106	3, 527, 677	2, 080, 475	77, 197, 178	3, 353, 456	1, 977, 126	73, 243, 049

¹ Sylvite and langbeinite.

Sinking of the first shaft of the Farm Chemical Resources Development Corp. mine was completed in December. The Farm Chemical mine, seventh in the Carlsbad district, was expected to be producing in 1958.

Two companies began expansion programs to increase production of granular products during 1957. Potash Company of America nearly completed a new \$1 million granular plant, using a new refinery method. A second plant under construction will use the compaction method of making a granular product. Giant compressing machines will press refined potash into large sheets, which will be ground and

sized. International Minerals & Chemical Corp. also increased its capacity to produce granular products. International also began using a cable-supported conveyor in its potash mine at Carlsbad. By reducing the length of hauls, the 42-inch-wide conveyor belt released 2 shuttle cars per shift for use in other parts of the mine and still maintained langbeinite-production rates. The company also redesigned its ore-loading stations on the sylvite level.

Pumice.—Output of pumice and scoria in 1957 increased to 320,860 tons, a 10-percent gain over 1956; however, the advance was not evenly distributed throughout the industry but rather was due almost entirely to a 25,960-ton increase in producing scoria for railroad ballast in Union County by Twin Mountain Rock Co. During 1957 Folsom Cinder Co. of Englewood, Colo., discontinued mining. The company found it uneconomical to mine and transport scoria from its New Mexico mine near Antonito, Colo., to markets in Denver, Colorado Springs, and Pueblo, Colo.

Two new firms reported mine production for the first time—Associated Materials Co. from the Black Mountain and Black Bear claims near Las Cruces, Dona Ana County; and Copar Pumice Co., Inc., from a deposit near Espanola, Rio Arriba County.

The leading consumers of volcanic ash were the Colorado & Southern Railway Co. and concrete-aggregate producers. Cleansing and scouring compounds, concrete admixture, acoustic plaster, and other miscellaneous uses supplied only 2 percent of the total output.

Salt.—Salt production fell 7 percent in 1957—to 53,000 tons—largely because of less demand for salt for oil-well drilling. The center of productive activity continued to be the Carlsbad area of southern New Mexico. Five companies reported shipments in Eddy County and three in Lea County; salt shipped was processed potash tailings. One producer—Curtis Salt Co.—recovered salt from an old, dry salt lake. As in years past, the bulk of the output was shipped to cattle dealers.

TABLE 14.—Salt sold or used by producers, 1953–57

Year	Short tons	Value	Year	Short tons	Value
1953.....	62,087	\$216,364	1956.....	57,156	\$501,040
1954.....	50,669	333,255	1957.....	53,065	429,320
1955.....	49,738	596,780			

Sand and Gravel.—For the second consecutive year output of sand and gravel increased 32 percent over the preceding year. In 1957 production reached 8 million tons valued at \$7.8 million. Highway-construction activities were again the sustaining force behind the gain in output. The Federal Bureau of Public Roads, in its December 31, 1957, report, showed that New Mexico ranked fourth in the Nation in mileage (110.2 miles) of all construction underway on the interstate system. In mileage completed on the 41,000-mile superhighway network, New Mexico was 13th with 40.6 miles. For total work programed—in all stages of planning and construction—since July 1, 1956, New Mexico was 15th, with 151.3 miles.

The principal producing counties were Bernalillo, Otero, San Juan, Valencia, Socorro, and Torrance.

TABLE 15.—Production of sand and gravel in 1957, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Bernalillo.....	922	\$817	Mora.....	21	\$1
Catron.....	38	71	Otero.....	723	661
Chaves.....	415	361	Quay.....	156	182
Colfax.....	194	324	Rio Arriba.....	299	373
Curry.....	1	1	Roosevelt.....	342	308
De Baca.....	124	83	Sandoval.....	53	17
Dona Ana.....	281	174	San Juan.....	694	653
Eddy.....	370	294	San Miguel.....	120	134
Grant.....	133	85	Santa Fe.....	146	269
Guadalupe.....	319	313	Sierra.....	26	25
Harding.....	43	4	Socorro.....	539	278
Hidalgo.....	278	287	Taos.....	146	146
Lea.....	90	175	Torrance.....	538	672
Lincoln.....	9	26	Union.....	226	144
Los Alamos.....	17	16	Valencia.....	576	647
Luna.....	24	22			
McKinley.....	148	153	Total.....	7,991	7,803

TABLE 16.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	516	\$599	\$1.16	714	\$846	\$1.18
Paving.....	(1)	(1)		342	255	.74
Engine.....				(1)	(1)	
Other.....				(1)	(1)	
Gravel:						
Building.....	629	767	1.22	949	1,168	1.23
Paving.....	334	363	1.09	2,279	2,085	.92
Railroad ballast.....	(1)	(1)		12	9	.69
Other.....				249	200	.80
Undistributed.....	42	31	.74	3	3	1.07
Total sand and gravel.....	1,521	1,760	1.15	4,548	4,566	1.00
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	84	98	1.05	4	5	1.19
Paving.....	8	11	1.43	21	20	.97
Gravel:						
Building.....	263	152	.60	28	53	1.93
Paving.....	4,179	3,759	.90	3,390	3,159	.93
Total sand and gravel.....	4,534	4,016	.89	3,443	3,237	.94
Grand total.....	6,055	5,776	.95	7,991	7,803	.98

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

Stone.—The construction activities of the State and county highway departments provided the stimulus for the stone industry of the State to expand. The total output of all types of stone rose to 1.35 million tons in 1957—a 6-percent gain over 1956. A small quantity of crushed basalt and miscellaneous stone was quarried and used in roadbuilding. In addition 350 tons of dimension sandstone was used as dressed building stone and flagging. Grant, Valencia, Torrance, Eddy, McKinley,

Socorro, and San Miguel Counties furnished 75 percent of the output.

TABLE 17.—Production of stone, 1957, by counties

County	Short tons	Value	County	Short tons	Value
Eddy.....	52,700	\$40,800	Torrance.....	190,000	\$400,000
Grant.....	372,400	596,000	Valencia.....	346,500	305,800
McKinley.....	48,000	34,500	Undistributed.....	331,000	231,100
San Miguel.....	460	4,545			
Socorro.....	7,300	4,800	Total.....	1,343,360	1,617,545

TABLE 18.—Stone sold or used by producers, 1953-57, by kinds

Year	Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	30,380	\$55,800				
1954.....	83,704	126,750	100	\$700	(0)	(0)
1955.....	20,722	17,400	90	1,260	276,306	\$354,896
1956.....	10,915	9,100	350	4,900	(0)	(0)
1957.....	9,300	6,100			715,900	1,147,400

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	844	\$4,075	593,304	\$450,838	624,528	\$510,713
1954.....	890	4,190	631,936	532,397	771,620	714,037
1955.....	812,491	496,991	463,822	676,118	1,573,441	1,546,655
1956.....	685,129	532,017	571,841	725,820	1,268,235	1,271,837
1957.....	615,060	456,845	8,100	7,200	1,343,360	1,617,545

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

Sulfur.—The recovery of elemental sulfur in New Mexico has never progressed much beyond the pilot-plant stage and overall annual output never has exceeded a few thousand tons. Several companies operated small plants in 1957. The San Juan plant of El Paso Natural Gas Co. has been abandoned owing to the low sulfur content of the gas processed, and its Eunice plant was still not operated at capacity. A similar problem, but to a smaller degree, was found by Warren Petroleum Corp. at Monument. The entire State output was marketed by General Chemical Division, Allied Chemical & Dye Corp.

Vermiculite.—Crude ore purchased from Montana producers was used by Southwest Vermiculite Co. of Albuquerque to produce exfoliated vermiculite marketed for insulation purposes under the trade name Zonolite.

METALS

Beryllium.—Output of beryllium concentrate (beryl) in New Mexico in 1957 was down slightly from 1956. As in former years, the principal beryl-producing mine in the State in 1957 was the Harding, near Dixon, Taos County, operated by Arthur Montgomery. All of the beryl shipped was marketed under the Government purchase program administered by the General Services Administration (GSA).

Columbium-Tantalum.—The entire output of columbium-tantalum (columbite-tantalite) came from the Old Priest mine in San Miguel County operated by the Onego Corp. and shipped to the Fansteel Metallurgical Corp. The ore shipped contained 39.98 percent Ta_2O_5 and was paid for on the basis of \$3.329 per pound of contained Ta_2O_5 . The Cb_2O_5 content (32.70 percent) had no value to the purchasing company and was not recovered or used.

Copper.—In 1957 copper output in New Mexico declined 9 percent below 1956, mainly because of reduced output by the principal copper producer, Chino open-pit mine of the Chino Mines Division of the Kennecott Copper Corp. According to the company annual report,

TABLE 20.—Mine production of gold, silver, copper, lead, and zinc, 1948–52 (average), 1953–57, and total, 1848–1957, 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		Fine ounces	Value	Fine ounces	Value
1948–52 (average)---	79	2	7,992,630	3,397	\$118,895	435,939	\$394,547
1953-----	55	2	8,070,056	2,614	91,490	205,309	185,815
1954-----	37	4	6,763,529	3,539	123,865	109,132	98,770
1955-----	50	6	7,446,772	1,917	67,095	251,072	227,233
1956-----	75	1	8,751,559	3,275	114,625	392,967	355,655
1957-----	60	-----	8,059,888	3,212	112,420	309,385	280,009
1848–1957-----	-----	-----	(³)	2,217,523	50,947,498	71,718,124	56,532,243

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948–52 (average)---	69,209	\$30,851,622	5,864	\$1,922,757	39,301	\$12,016,849	\$45,304,670
1953-----	72,477	41,601,798	2,943	771,066	13,373	3,075,790	45,725,959
1954-----	60,558	35,729,220	887	243,038	6	1,296	36,196,189
1955-----	66,417	49,547,082	3,296	982,208	15,277	3,758,142	54,581,760
1956-----	74,345	63,193,250	6,042	1,897,188	35,010	9,592,740	75,153,458
1957-----	67,472	40,618,144	5,294	1,514,084	32,680	7,581,760	50,106,417
1848–1957-----	2,097,718	808,662,421	329,008	45,415,571	1,181,894	220,795,094	1,182,352,827

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.

TABLE 21.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January-----	347	36,423	6,217	616	3,417
February-----	317	27,309	5,348	572	3,451
March-----	293	34,332	5,802	620	3,564
April-----	236	32,540	5,482	725	3,394
May-----	234	32,088	6,106	504	3,219
June-----	280	31,427	6,206	570	3,392
July-----	325	34,934	5,846	607	3,204
August-----	244	16,354	5,770	225	2,072
September-----	252	22,038	5,456	246	1,838
October-----	225	13,525	3,745	203	1,743
November-----	227	14,180	5,657	200	1,702
December-----	232	14,235	5,837	206	1,684
Total-----	3,212	309,385	67,472	5,294	32,680

total copper production from this mine was 63,454 tons in 1957 compared with 69,629 tons in 1956. The 1957 output from the Chino mine represented 94 percent of the State copper production. Four other copper producers, Miser's Chest, Bayard, Ground Hog Unit, and Stauber mines, supplied 5 of the remaining 6 percent of the total copper output.

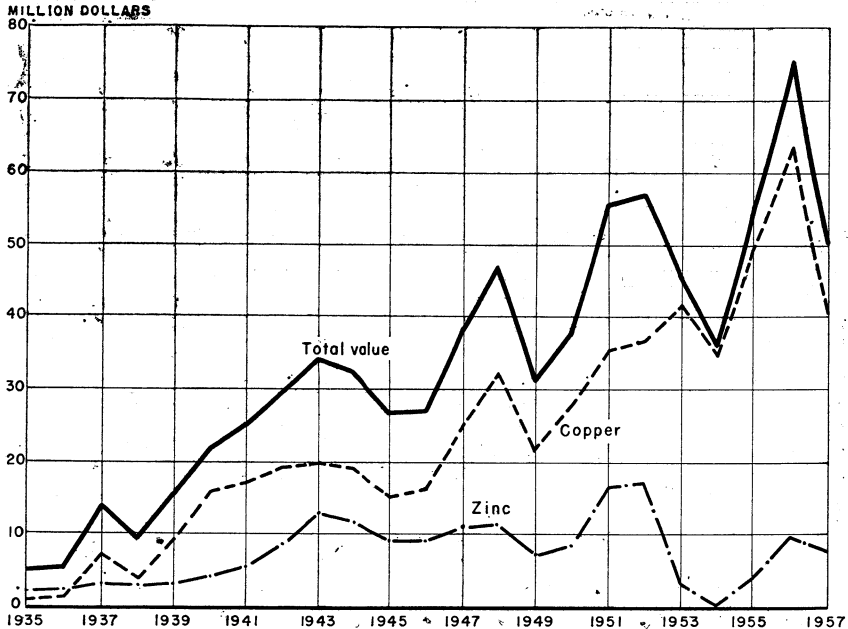


FIGURE 3.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1935-57. The value of gold, silver, and lead produced annually has been relatively small.

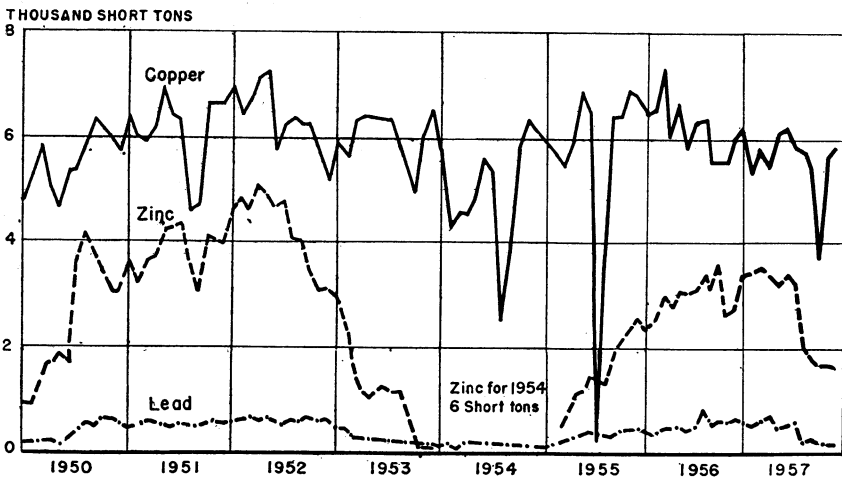


FIGURE 4.—Mine production of copper, lead, and zinc in New Mexico, by months, 1950-57, in terms of recoverable metals.

TABLE 22.—Mine production of gold, silver, copper, lead, and zinc in 1957 by counties and districts, in terms of recoverable metals

County and district	Mines producing ¹ (lode)	Lode material sold or treated ² (short tons)	Gold		Silver	
			Fine ounces	Value	Fine ounces	Value
Catron County: Mogollon (Cooney)-----		51	27	\$945	370	\$335
Grant County:						
Central-----	10	7,893,595	2,492	87,220	201,057	181,967
Eureka ³ -----	1	1,500	18	630	4,257	3,853
Pinos Altos and Steeple Rock ⁴ -----	3	578	13	455	1,525	1,380
Swartz-----	1	200			473	428
White Signal-----	1	39			43	39
Total-----	16	7,895,912	2,523	88,305	207,355	187,667
Guadalupe County: Pintado-----	1	5,126				
Hidalgo County:						
Eureka ³ -----	1	115			12	11
Lordsburg-----	5	83,887	495	17,325	30,685	27,771
Total-----	6	84,002	495	17,325	30,697	27,782
Luna County:						
Tres Hermanas-----	2	5			33	30
Victorio-----	2	53			239	216
Total-----	4	58			272	246
Otero County:						
Sacramento-----	2	41	1	35	9	8
Tularosa-----	1	9				
Total-----	3	50	1	35	9	8
Sandoval County: Cuba (Nacimiento Mountains)-----	3	10,094			1,392	1,260
Santa Fe County:						
Cerrillos-----	1	82	3	105	217	196
Cooper (Pecos)-----	1	44			33	30
San Pedro or New Placers-----	2	135	11	385	284	257
Total-----	4	261	14	490	534	483
Sierra County:						
Chloride-----	4	18	12	420	966	874
Kingston-----	2	73			705	638
Las Animas and Tierra Blanca ⁴ -----	3	304	4	140	4	4
Pittsburg and Caballos Mountains-----	1	8	1	35	74	67
Total-----	10	403	17	595	1,749	1,583
Socorro County:						
Hansonberg-----	2	34,897	1	35	3,690	3,340
Magdalena-----	7	26,130	132	4,620	60,922	55,137
Socorro Peak-----	1	11			2,290	2,073
Total-----	10	61,038	133	4,655	66,902	60,550
Taos County: Tres Piedras-----	1	17	2	70	24	22
Torrance County: Carocito-----	2	2,876			81	73
Total New Mexico-----	60	8,059,888	3,212	112,420	309,385	280,009

See footnotes at end of table.

TABLE 22.—Mine production of gold, silver, copper, lead, and zinc, 1957, by counties and districts, in terms of recoverable metals—Continued

County and district	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron County: Mogollon (Cooney).....			100	\$14			\$1, 294
Grant County:							
Central.....	130, 754, 500	\$39, 357, 105	7, 037, 500	1, 006, 362	61, 246, 600	\$7, 104, 606	47, 737, 260
Eureka ³	300	90	130, 800	18, 705	35, 600	4, 130	27, 408
Pinos Altos and Steeple Rock ⁴	100	30	31, 500	4, 504	50, 700	5, 881	12, 250
Swartz.....	200	60	16, 900	2, 417	32, 700	3, 793	6, 698
White Signal.....	100	30	100	14			83
Total.....	130, 755, 200	39, 357, 315	7, 216, 800	1, 032, 002	61, 365, 600	7, 118, 410	47, 783, 699
Guadalupe County: Pintado.....	201, 500	60, 652					60, 652
Hidalgo County:							
Eureka ³	3, 200	963	100	14			988
Lordsburg.....	3, 432, 100	1, 033, 062	7, 500	1, 073	1, 500	174	1, 079, 405
Total.....	3, 435, 300	1, 034, 025	7, 600	1, 087	1, 500	174	1, 080, 393
Luna County:							
Tres Hermanas.....			1, 200	172			202
Victorio.....			4, 800	686	2, 000	232	1, 134
Total.....			6, 000	858	2, 000	232	1, 336
Otero County:							
Sacramento.....	700	211					254
Tularosa.....	300	90					90
Total.....	1, 000	301					344
Sandoval County: Cuba (Nacimiento Mountains).....	421, 700	126, 932					128, 192
Santa Fe County:							
Cerrillos.....	300	90	12, 700	1, 816			2, 207
Cooper (Pecos).....	2, 900	873					903
San Pedro or New Placers.....	19, 100	5, 749					6, 391
Total.....	22, 300	6, 712	12, 700	1, 816			9, 501
Sierra County:							
Chloride.....	1, 100	331	100	14			1, 639
Kingston.....	2, 300	692	6, 500	930	8, 900	1, 032	3, 292
Las Animas and Tierra Blanca ⁴	3, 300	994					1, 138
Pittsburg and Caballos Mountains.....	100	30	600	86			218
Total.....	6, 800	2, 047	7, 200	1, 030	8, 900	1, 032	6, 287
Socorro County:							
Hansonberg.....	400	120	909, 900	130, 116			133, 611
Magdalena.....	21, 800	6, 562	2, 427, 700	347, 161	3, 982, 000	461, 912	875, 392
Socorro Peak.....							2, 073
Total.....	22, 200	6, 682	3, 337, 600	477, 277	3, 982, 000	461, 912	1, 011, 076
Taos County: Tres Piedras.....	8, 500	2, 559					2, 651
Torrance County: Carocito.....	69, 500	20, 919					20, 992
Total New Mexico.....	134, 944, 000	40, 618, 144	10, 588, 000	1, 514, 084	65, 360, 000	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 Eureka district lies in both Grant and Hidalgo Counties.

⁴ Combined to avoid disclosing individual company confidential data.

TABLE 23.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	4	23	31	19			
Dry gold-silver.....	3	160	12	822	1,500	600	
Dry silver.....	13	13,434	4	4,934	496,500	6,200	
Total.....	20	13,617	47	5,775	498,000	6,800	
Copper							
	20	7,600,248	1,796	51,537	102,420,000	4,800	1,500
Lead.....	12	902	71	1,934	2,400	204,700	23,200
Lead-zinc.....	9	82,582	244	150,299	455,000	6,151,700	19,924,700
Zinc.....	3	327,591	1,026	95,780	3,211,100	3,310,000	45,410,600
Total.....	40	8,011,323	3,137	299,550	106,088,500	9,671,200	65,360,000
Other "lode" material:							
Gold-silver mill cleanings.....		51	27	370		100	
Copper precipitates.....	1	17,767			28,357,100		
Lead-barite ore.....	2	34,897	1	3,690	400	909,900	
Total.....	3	52,715	28	4,060	28,357,500	910,000	
Total "lode" material.....	60	8,077,655	3,212	309,385	134,944,000	10,588,000	65,360,000

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

TABLE 24.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore.....	4	2,294			
Concentration, and smelting of concentrates: ¹ Ore.....	2,996	297,702	104,442,600	10,371,600	65,335,300
Direct-smelting:					
Ore.....	185	9,019	2,013,100	216,300	24,700
Mill cleanings.....	27	370		100	
Copper precipitates.....			28,357,100		
Total.....	212	9,389	30,370,200	216,400	24,700
Other: Leaching of copper ore.....			131,200		
Grand total.....	3,212	309,385	134,944,000	10,588,000	65,360,000

¹ Includes lead-barite ore concentrate.

TABLE 25.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and classes of material processed, in terms of recoverable metals*A. For ore treated at mills*

	Ore treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Grant.....	7,695,956			273,954	2,484	206,518	101,036,800	7,215,700	61,365,600
Hidalgo.....	82,984			5,981	444	28,376	3,401,900		
Sierra.....	60	4	4	13		453	400	5,400	8,900
Socorro.....	60,055		2,290	6,340	68	62,355	3,500	3,150,500	3,960,800
Total: 1957..	7,839,055	4	2,294	286,288	2,996	297,702	104,442,600	10,371,600	65,335,300
1956.....	8,651,707	24	8	310,917	2,769	360,033	114,180,200	11,879,600	69,990,800
BY CLASSES OF ORE TREATED									
Dry gold.....	12	4	4						
Dry silver.....	11		2,290						
Copper.....	7,393,962			207,763	1,725	47,933	100,776,100		
Lead-barite.....	34,897			661	1	3,690	400	909,900	
Lead-zinc.....	82,582			24,107	244	150,299	455,000	6,151,700	19,924,700
Zinc.....	327,591			53,757	1,026	95,780	3,211,100	3,310,000	45,410,600
Total: 1957..	7,839,055	4	2,294	286,288	2,996	297,702	104,442,600	10,371,600	65,335,300
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS									
Copper.....				213,731	2,202	59,722	103,619,900	1,800	900
Copper-lead-zinc.....				3,567	123	65,513	215,800	3,520,200	636,400
Lead.....				1,248	24	18,253	17,300	1,522,000	35,100
Lead-zinc.....				3,982	314	100,058	68,600	4,690,600	466,300
Zinc.....				63,760	333	54,156	521,000	637,000	64,196,600
Total: 1957.....				286,288	2,996	297,702	104,442,600	10,371,600	65,335,300

¹ Includes concentrate and contained recoverable metal from lead-barite ore.

B. For copper ore treated by leaching

	Ore treated (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Grant.....	135,000			122,700		
Sierra.....	292			3,300		
Torrance.....	300			5,200		
Total: 1957.....	135,592			131,200		
1956.....	137,500			147,100		

TABLE 25.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and classes of material processed, in terms of recoverable metals—Continued

C. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Catron.....	51	27	370		100	
Grant.....	82,723	39	837	29,595,700	1,100	
Guadalupe.....	5,126			201,500		
Hidalgo.....	1,018	51	2,321	33,400	7,600	1,500
Luna.....	58		272		6,000	2,000
Otero.....	50	1	9	1,000		
Sandoval.....	10,094		1,392	421,700		
Santa Fe.....	261	14	534	22,300	12,700	
Sierra.....	51	13	1,292	3,100	1,800	
Socorro.....	983	65	2,257	18,700	187,100	21,200
Taos.....	17	2	24	8,500		
Torrance.....	2,576		81	64,300		
Total: 1957.....	103,008	212	9,389	30,370,200	216,400	24,700
1956.....	119,676	480	32,926	34,509,800	204,400	29,200
BY CLASSES OF MATERIAL						
Dry gold: Crude ore.....	11	27	15			
Dry gold-silver: Crude ore.....	160	12	822	1,500	600	
Mill cleanings.....	51	27	370		100	
Dry silver: Crude ore.....	13,423	4	2,644	496,500	6,200	
Copper: Crude ore.....	70,694	71	3,604	1,512,700	4,800	1,500
Precipitates.....	17,677			28,357,100		
Lead: Crude ore.....	902	71	1,934	2,400	204,700	23,200
Total: 1957.....	103,008	212	9,389	30,370,200	216,400	24,700

In 1957, despite a drop of only 9 percent in quantity, the value of copper output declined 36 percent owing to a major drop in price. The weighted annual average price in 1957 was 30.1 cents a pound compared with 42.5 cents in 1956.

Three-fourths of the State's copper output in 1957 was recovered from copper ore mined and milled or smelted, and one-fifth came from copper precipitate recovered by leaching mine-dump material. The remainder came equally from ores mined primarily for the contained lead and zinc or for the contained gold and silver.

Gold.—Output from three mines—Chino, Bayard, and Miser's Chest—supplied 85 percent of the total gold production, which remained virtually the same as in 1956. Copper ore was the source of 56 percent of the total gold output, 42 percent came from ores of lead and zinc, and the remaining 2 percent was from ores of gold and silver and cleanup material.

Iron Ore.—In 1957 O. R. Smith Manufacturing Co., Inc., made a test shipment of 150 long tons of magnetic iron ore from the Magnetite Nos. 1 and 2 claims in Grant County to Sheffield Steel Division of Armco Steel Corp., Houston, Tex. Dotson Minerals Corp. of Socorro mined some magnetite from the Jones Iron mine near Carrizozo in Socorro County for use as an aggregate in concrete for anchoring underwater oil pipelines in the Texas offshore and tidewater

TABLE 26.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and classes of material processed, in terms of gross metal content

Class of material	Material shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Copper.....	213, 731	5, 706	122, 292	105, 396, 319	3, 021	6, 644
Copper-lead-zinc.....	3, 567	123	65, 513	269, 784	3, 592, 010	815, 819
Lead ¹	1, 248	24	18, 253	21, 922	1, 553, 020	45, 031
Lead-zinc.....	3, 982	314	100, 058	85, 817	4, 785, 686	597, 901
Zinc.....	63, 760	333	55, 804	637, 126	709, 975	69, 988, 381
Total: 1957.....	286, 288	6, 500	361, 920	106, 410, 968	10, 643, 712	71, 453, 776
1956.....	310, 917	7, 414	467, 053	116, 878, 527	12, 558, 218	78, 542, 543
ORE TO LEACHING PLANT						
Copper.....	135, 592	-----	-----	135, 171	39	-----
Total: 1957.....	135, 592	-----	-----	135, 171	39	-----
1956.....	137, 500	-----	-----	151, 700	-----	-----
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold: Crude ore.....	11	27	15	9	2	-----
Dry gold-silver:						
Crude ore.....	160	12	822	1, 632	1, 079	-----
Mill cleanings.....	51	27	370	-----	206	-----
Dry silver: Crude ore.....	13, 423	4	2, 644	512, 038	8, 248	-----
Copper:						
Crude ore.....	70, 694	138	4, 180	1, 973, 961	8, 144	10, 990
Precipitates.....	17, 767	-----	-----	28, 936, 586	14	-----
Lead: Crude ore.....	902	71	1, 934	3, 177	209, 000	29, 648
Total: 1957.....	103, 008	279	9, 965	31, 427, 403	226, 693	40, 638
1956.....	119, 676	539	33, 566	35, 152, 741	217, 353	37, 292

¹ Includes concentrate and contained metal from lead-barite ore.

oilfields, but none of the iron ore was shipped during 1957. There was no activity in 1957 at either the Hanover-Bessemer mine (under lease to the United States Smelting Refining and Mining Co.) or at the Ferro mines by Ferro, Inc.

Lead.—Lead production in New Mexico declined 17 percent in quantity and 20 percent in value in 1957, compared with 1956. The leading 5 lead producers supplied 88 percent of the State's 1957 output, and the top 3 furnished 74 percent. As in 1956, the Ground Hog Unit of the American Smelting and Refining Co. was the major producer followed by the Linchburg mine owned by The New Jersey Zinc Co. and operated by Elayer & Co. (lessee), and the Bayard group mine owned by the United States Smelting Refining and Mining Co. and operated by four groups of lessees.

Manganese.—In 1957 shipments of manganese ore and concentrate from deposits in New Mexico to the Government (under the "carlot" program that required a minimum manganese content of 40 percent) increased 14 percent above 1956. This production came from 25 mines in 7 counties. Eighty-one percent of the material shipped came from 11 mines in Socorro County.

Manganiferous ore (ferruginous manganese ore containing an average of 10 percent manganese and 36 percent iron) was mined in 1957 from the Boston Hill deposit in Grant County by the Luck Mining & Construction Co. and shipped to the Colorado Fuel & Iron Corp. for use in making pig iron and steel at its Pueblo (Colo.) plant. The output increased in 1957.

Molybdenum.—All molybdenum in New Mexico in 1957 originated from molybdenum concentrate produced as a byproduct of copper ore from the Chino open-pit mine in Grant County by the Kennecott Copper Corp. and milled at Hurley. The Molybdenum Corp. of America continued an exploration and development program at the Questa mine in Taos County. Molybdenum concentrate recovered from testwork on tailing and dump material at this mine during 1957 was retained as stocks at the close of the year.

Rare-Earth Metals.—Although there was significant activity in prospecting and developing deposits, no sales of rare earths were reported during 1957.

Silver.—Ninety-eight percent of the silver output in the State in 1957 was recovered as a byproduct of the milling and smelting of ores of copper, lead, and zinc. Corresponding with a drop in producing each of these metals, silver output declined 21 percent in New Mexico in 1957. The State's 5 leading silver producers supplied 83 percent of the total for New Mexico.

Tungsten.—Exhaustion of funds of the Government domestic purchase program in December 1956 and the economic inability to produce tungsten at the market price caused cessation of all tungsten-mining activity in New Mexico. No tungsten concentrate was produced or marketed in the State in 1957.

Uranium.—Development of uranium ore bodies in the Ambrosia Lake area in McKinley County was of outstanding importance in 1957. The AEC estimated that on December 31, 1957, reserves in New Mexico totaled 53.3 million tons of ore containing 0.26 percent (5.2 pounds a ton) of uranium oxide.² The estimated reserve on November 1, 1956, was 41 million tons containing 0.24 (4.8 pounds a ton) of uranium oxide. Most of the increase in reserves was in the Ambrosia Lake area. Exploration and development were confined largely to McKinley and Valencia Counties; minor amounts being done in other counties, mostly in the northern part of the State. Reporting companies show 771,930 feet of drilling, 3,058 feet of shaft sinking and raising, 14,285 feet of drifts and crosscuts, and 8.5 million cubic yards of stripping.

Four mills were being built in the Ambrosia Lake area with a total daily capacity of 7,275 tons; when completed these 4, with the 2 mills currently operating in 1957, will raise the daily capacity to 10,775 tons, or 53 percent of the authorized milling capacity in the Western States.

Production of uranium ore in 1957 increased 6 percent compared with 1956; however, the average grade was lower, declining from 0.26 percent U_3O_8 in 1956 to 0.22 percent U_3O_8 in 1957. Production was reported from 11 counties; the major part came from McKinley and Valencia Counties.

² AEC, Additional Domestic Uranium Production Statistics for 1957: Press Release 208 (Grand Junction, Colo., Office) Mar. 7, 1958, 4 pp.

TABLE 27.—Mine production of uranium ore, July 1955–December 1957¹

County	July 1–December 31, 1955					1956					1957					
	Number of prop- erties	Ore (short tons)	U ₃ O ₈ con- tained (pounds)	F. o. b. mine value ²	Number of prop- erties	Ore (short tons)	U ₃ O ₈ con- tained (pounds)	F. o. b. mine value ²	Number of prop- erties	Ore (short tons)	U ₃ O ₈ con- tained (pounds)	F. o. b. mine value ²	Number of prop- erties	Ore (short tons)	U ₃ O ₈ con- tained (pounds)	F. o. b. mine value ²
Catron.....	1	(*)	(*)	(*)	2	(*)	(*)	(*)	1	(*)	(*)	(*)	1	(*)	(*)	(*)
Grant.....	23	64,340	308,153	\$1,491,319	1	(*)	(*)	(*)	40	134,847	657,942	\$2,696,872	1	(*)	(*)	(*)
McKinley.....	1	(*)	(*)	(*)	27	170,343	771,841	\$3,063,823	1	(*)	(*)	(*)	1	(*)	(*)	(*)
Quay.....	2	(*)	(*)	(*)	1	(*)	(*)	(*)	2	(*)	(*)	(*)	2	(*)	(*)	(*)
Rio Arriba.....	2	(*)	(*)	(*)	2	(*)	(*)	(*)	2	(*)	(*)	(*)	2	(*)	(*)	(*)
Sandoval.....	11	2,357	10,847	44,322	13	2,806	12,244	48,793	4	60	244	192	4	(*)	(*)	(*)
San Juan.....	1	(*)	(*)	(*)	3	(*)	(*)	(*)	2	(*)	(*)	(*)	2	(*)	(*)	(*)
San Miguel.....	1	(*)	(*)	(*)	3	(*)	(*)	(*)	2	(*)	(*)	(*)	2	(*)	(*)	(*)
Santa Fe.....	5	48	136	427	2	(*)	(*)	(*)	1	(*)	(*)	(*)	1	(*)	(*)	(*)
Socorro.....	3	(*)	(*)	(*)	5	(*)	(*)	(*)	1	(*)	(*)	(*)	1	(*)	(*)	(*)
Taos.....	15	(*)	(*)	(*)	13	(*)	(*)	(*)	0	(*)	(*)	(*)	0	(*)	(*)	(*)
Valencia.....	62	157,748	735,601	3,171,633	70	1,105,183	5,780,242	24,086,234	66	1,175,742	5,169,321	20,538,086	66	1,175,742	5,169,321	20,538,086
Total.....																

¹ Based on data supplied to the Bureau of Mines by the Atomic Energy Commission.

² Figure withheld to avoid disclosing individual company confidential data, included with "Total."

In October the AEC announced that no new concentrate purchase contracts would be considered, because the capacity of mills operating and building was deemed adequate to meet anticipated demands until 1962. Because of the limited outlet for ores in some areas, AEC began a study to determine the extent of exploration, developed reserves, and availability of milling capacity in various producing areas. The purpose of the study was to determine the advisability of increasing milling capacity in certain areas. Completion of the study was expected early in 1958.

Vanadium.—Although vanadium is found in many New Mexico uranium ores, except for a few deposits in western San Juan County the vanadium content is too low to warrant recovery, and none of the mills in New Mexico was equipped to do so. Vanadium was recovered from a small quantity of ore from San Juan County processed at the plant at Durango, Colo. The vanadium recovered from these ores was credited to New Mexico.

Zinc.—Zinc output in New Mexico in 1957 declined 6 percent below 1956. Ground Hog Unit mines, at Vanadium in Grant County, the State's leading zinc producer in 1956, was operated by the American Smelting and Refining Co. and dropped to third place in zinc output in 1957; both the mines and the company mill at Deming closed on July 15. Zinc production increased in 1957, compared with 1956, from both the leading and the second-ranking zinc producers, Hanover and Bayard group mines, respectively. The Kearney and Linchburg mines ranked fourth and fifth as zinc producers. The 5 leading mines supplied 32,534 short tons of the 32,680 tons of zinc produced in New Mexico in 1957.

REVIEW BY COUNTIES

Bernalillo.—Nonmetals continued to be the only mineral commodities produced in the county during 1957. Clay production consisted of 16,000 tons of miscellaneous clay used by the Kinney Brick Co. in manufacturing building brick. Sand and gravel output amounted to 922,300 tons—879,100 tons produced by 4 commercial operators and 43,200 tons by 2 Government-and-contractor producers. Albuquerque Gravel Products Co. was the principal commercial operator, followed by Allison & Haney, Inc., Ribble Concrete Co., and Springer Transfer Co., Inc. Government-and-contractor production came from C. R. Davis as contractor for the United States Army Corps of Engineers and Miller, Smith & O'Hara as contractor for the New Mexico State Highway Commission.

Catron.—Although a wide variety of minerals was produced within Catron County in 1957, the total value of all minerals dropped 44 percent below 1956. The principal reason for the decline was a 110,000-ton decrease in sand and gravel output. Solar-evaporated salt produced at Quemado by Curtis Salt Co. remained the same as in 1956. No gem or ornamental stones were reported collected in 1957.

Carl T. McLendon recovered small quantities of gold, silver, and lead from a cleanup of the Deadwood mill in the Mogollon district.

TABLE 28.—Value of mineral production in New Mexico, 1956-57, by counties

County	1956 ¹	1957 ²	Minerals produced in 1957, in order of value
Bernalillo.....	\$1,252,002	\$833,300	Sand and gravel, clays.
Catron.....	³ 173,030	96,546	Sand and gravel, salt, uranium ore, gold, silver, lead.
Chaves ⁴	13,502,635	13,527,677	Petroleum, sand and gravel, clays.
Colfax.....	494,300	615,117	Sand and gravel, coal.
Curry.....	52,264	500	Sand and gravel.
De Baca.....	77,000	83,200	Do.
Dona Ana.....	994,991	293,004	Sand and gravel, pumice, clays, manganese ore and concentrate.
Eddy ⁵	⁶ 88,751,521	93,703,768	Potassium salts, petroleum, magnesium compounds, salt, sand and gravel, stone.
Grant.....	³ 73,414,329	49,929,518	Copper, zinc, lead, molybdenum, stone, lime, silver, manganese ore and concentrate, gold, sand and gravel, manganese ore and concentrate, iron ore.
Guadalupe.....	555,577	373,652	Sand and gravel, copper.
Harding ⁷	35,259	4,200	Sand and gravel.
Hidalgo.....	1,903,535	1,391,730	Copper, sand and gravel, silver, manganese ore and concentrate, gold, clays, lead, zinc, gem stones.
Lea ⁵	213,388,612	248,635,574	Petroleum, potassium salts, sand and gravel, salt, sulfur.
Lincoln.....	(⁸)	25,700	Sand and gravel.
Los Alamos.....		15,800	Do.
Luna.....	253,887	319,195	Manganese ore and concentrate, sand and gravel, gem stones, lead, silver, zinc.
McKinley.....	712,365	3,681,106	Uranium ore, petroleum, coal, sand and gravel, stone, clays.
Mora.....	22,681	800	Sand and gravel.
Otero.....	590,438	661,844	Sand and gravel, copper, gold, silver.
Quay.....	³ 99,500	(⁸)	Sand and gravel, uranium ore.
Rio Arriba ⁴	³ 1,670,797	1,682,447	Petroleum, sand and gravel, pumice, coal, mica, beryllium concentrate, uranium ore.
Roosevelt ⁴	125,004	843,710	Petroleum, sand and gravel.
Sandoval ⁴	164,631	313,269	Copper, pumice, petroleum, manganese ore and concentrate, sand and gravel, coal, silver, uranium ore, gem stones.
San Juan ⁹	³ 3,560,918	6,862,204	Petroleum, helium, sand and gravel, uranium ore.
San Miguel.....	³ 134,530	139,497	Sand and gravel, stone, columbium-tantalum concentrate.
Santa Fe.....	³ 947,112	555,161	Sand and gravel, pumice, coal, copper, lead, gold, silver, uranium ore.
Sierra.....	³ 40,497	80,637	Manganese ore and concentrate, sand and gravel, copper, silver, uranium ore, zinc, lead, gold gem stones.
Socorro.....	³ 2,945,459	3,672,901	Manganese ore and concentrate, lead, zinc, perlite, sand and gravel, uranium ore, barite, silver, coal, copper, stone, gold, gem stones.
Taos.....	631,954	914,756	Perlite, sand and gravel, beryllium concentrate, copper, gold, silver, uranium ore.
Torrance.....	572,870	1,093,392	Sand and gravel, stone, copper, silver.
Union ⁷	386,061	345,835	Pumice, sand and gravel.
Valencia.....	³ 625,837	(⁸)	Uranium ore, sand and gravel, perlite, stone.
Undistributed ¹⁰	107,021,017	122,415,641	
Total ¹¹	⁵ 515,009,000	553,034,000	

¹ Revised to include value of petroleum.² Helium, natural gas, and petroleum values are preliminary.³ Excludes uranium.⁴ Excludes natural gas.⁵ Excludes natural gas and natural-gas liquids.⁶ Revised figure.⁷ Excludes carbon dioxide (natural).⁸ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."⁹ Excludes natural gas, natural-gas liquids, and vanadium.¹⁰ Includes all carbon dioxide (natural), natural gas, natural-gas liquids, uranium (1956), vanadium, some gem stones, sand and gravel (1956), stone (1957), and values indicated by footnote 8.¹¹ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing lime.

Chaves.—Petroleum was produced from 12 fields and furnished 97 percent of the total value of mineral output. The county ranked third in the State in the value of petroleum output. Exploration and development drilling decreased from 123 completions in 1956 to 71 completions in 1957. Two new gasfields were discovered, and 38 development oil wells were successful. Natural gas was also produced in the county.

Nonmetal output consisted of miscellaneous clay used for oil-well drilling, produced by Native Blanca Clay Co. of Lovington, and 415,100 tons of commercial and Government-and-contractor sand and gravel.

Colfax.—For the first time in the history of Colfax County, the value of sand and gravel outranked that of coal. The sand and gravel was quarried and used by Skousen-Hise Construction Co. in conjunction with a contract with the State highway department.

Coal production in 1957 decreased 34 percent compared with 1956. The Kaiser Steel Corp., at the Koehler mine, continued its program of rehabilitation and modernization. Coal from the mine will be used to make coke at the new company blast furnace at Fontana, Calif.

Dona Ana.—The total mineral output declined in 1957. No stone was quarried because of a shift in the location of highway construction, sand and gravel production dropped considerably below the 1956 figure, and the total value for the county was 71 percent below 1956. Scoria was produced by Associated Materials Co. and Volcanic Cinder Co., and El Paso Brick Co. quarried fire and miscellaneous clay for use at its brick plant near El Paso (Tex.).

Eddy.—Potash mining and refining continued to be the principal activity in the mineral industry of the Carlsbad region during 1957. Mines and refineries were operated by International Minerals & Chemical Corp., Potash Company of America, United States Potash Division of the United States Borax & Chemical Corp., Duval Sulfur & Potash Co., and Southwest Potash Co. Potash was also the source of magnesium compounds and hydrochloric-acid byproducts, which were recovered by International Minerals & Chemical Corp. The tailings from the potash refineries were purchased and reprocessed by five companies; the salt recovered was sold to cattle dealers, oil-well drilling companies, and a number of small local consumers.

The county ranked second in the State in the value of petroleum and fourth in producing natural gas. Production came from 60 oilfields and 10 gasfields. Exploration and development drilling increased from 247 completions in 1956 to 359 completions in 1957. Six new oilfields and 1 new gasfield were discovered. Development drilling resulted in 250 successful oil wells and 3 successful gas wells. Three plants processed natural gas for the recovery of natural gasoline and liquid-petroleum gases.

Sand and gravel production amounted to 370,400 tons produced by 6 commercial producers and construction and maintenance crews of the State highway department. Jack Adams was the most important commercial producer, followed by Jess Rose, Longenbaugh & Coe, and Carlsbad Transit Mix Cement Co., Inc. The 52,700 tons of stone quarried in 1957 consisted of 44,600 tons of crushed limestone

and 8,100 tons of crushed miscellaneous stone—the entire output was used for road construction.

Grant.—The value of output of the metals, mainly copper, zinc, lead, and molybdenum, supplied 98 percent (\$49 million) of the total value of mineral production (\$49.9 million) in Grant County in 1957. A drop of \$23.5 million in the total value of all minerals produced resulted chiefly from a \$21.1-million decline in value of copper output and a \$2.2-million fall in the value of zinc production in 1957. Copper alone supplied \$39.4 million (79 percent) of Grant County's total value of mineral production, zinc \$7.1 million (14 percent), and lead \$1 million (2 percent).

In 1957 the Central district, encompassing the mines in the vicinity of Bayard, Central, Fierro, Hanover, Santa Rita, and Vanadium, continued, as in past years, to be the most important gold-, silver-, copper-, lead-, and zinc-producing district in New Mexico. The accompanying historical table shows mine production of these metals from the Central district.

TABLE 29.—Mine production of gold, silver, copper, lead, and zinc in Central District, Grant County, N. Mex., 1948–52 (average), 1953–57, and total, 1904–57, in terms of recoverable metals

Year	Number of mines	Material ¹ (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value	Percentage of State total value of gold, silver, copper, lead, and zinc
1948–52 (average).....	9	7,811,423	1,412	205,196	66,874	3,230	35,668	\$42,060,034	93
1953.....	5	7,887,446	987	78,842	69,869	1,460	12,743	43,524,291	95
1954.....	7	6,606,815	3,003	30,426	58,178	5	.....	34,459,191	95
1955.....	6	7,289,242	690	128,719	64,084	2,604	15,104	52,438,565	96
1956.....	8	8,570,011	2,306	259,575	71,216	4,682	33,631	71,534,733	95
1957.....	10	7,893,595	2,492	201,057	65,377	3,519	30,623	47,737,260	95
1904–57.....	.....	202,654,658	138,338	8,766,127	1,892,104	103,693	778,897	929,307,850	83

¹ Does not include tonnage of precipitates shipped.

The Chino open-pit mine, in the Central district at Santa Rita, operated by the Chino Mines Division of Kennecott Copper Corp., produced the bulk of the State's output of copper; gold, silver, and molybdenum were recovered as byproducts. In its annual report the company stated that the total copper production from all sources from Chino was 63,454 short tons in 1957, compared with 69,629 tons in 1956. The 7,310,978 tons of ore mined and milled during 1957 (compared with 7,945,386 tons in 1956) averaged 16.3 pounds of copper per ton (17.4 pounds in 1956). The Chino Mines Division was operated throughout 1957 on a 7-day-week basis, except for 12 days beginning September 29 when the powerplant, mill, and smelter were shut down for major maintenance. A \$6-million improvement program was begun during 1957; half of the expenditure was to be used for increasing the capacity of the powerplant 15,625 kilowatts. The remainder was to be used for improving the existing facilities and purchasing new loading and hauling equipment for the Santa Rita pit, and buying new equipment for the concentrator at Hurley.

Churn and wagon drills were being replaced by rotary and tractor-mounted air drills, with greatly increased drilling efficiency.

The Bayard group of mines, also in the Central district and operated by leasers, ranked next to Chino in copper production in Grant County and third in the State in 1957. The group was also a major producer of gold, silver, lead, and zinc. The owner of the group of mines (United States Smelting Refining and Mining Co.) continued to operate its 600-ton-per-day flotation mill at Bayard to treat ore from these mines.

The Ground Hog Unit mines, in the Central district and operated by the American Smelting and Refining Co., was the principal lead and silver producer in New Mexico in 1957. In 1957 the unit fell from first place to third in zinc output in the State. The company stated, in its printed annual report, that operations at the Ground Hog Unit and the Deming mill were suspended July 15 because of declining lead and zinc prices.

The Hanover and Kearney mines both were major producers of lead, zinc, and silver in the Central district, Grant County, and in the State. The Hanover mine was operated by The New Jersey Zinc Co. throughout the year, but the Kearney mine was closed down May 7 by the Peru Mining Co., along with its mill at Deming, because of the low price for zinc.

In addition to the Chino, Bayard, Ground Hog, Hanover, and Kearney mines—the 5 major metal producers in the county—11 other mines in the county produced gold, silver, copper, lead, and zinc.

Manganese ore and concentrate were shipped under the GSA "carlot" program from two mines in Grant County. The Luck Mining & Construction Co. continued to ship manganiferous ore from the Boston Hill mine near Silver City to the Colorado Fuel & Iron Corp. at Pueblo, Colo.

Nonmetal production consisted of construction materials, which furnished only a small percentage of the total value for all minerals. The output of lime by Kennecott Copper Corp. declined somewhat, owing to a reduction in the quantity of copper ores treated by that corporation. Sand and gravel quarried by Brown Construction Co. and Wade A. White was used in highway construction. Stone, the remaining nonmetal, comprised 372,400 tons of crushed limestone quarried by Kennecott Copper Corp. (used in manufacturing lime and as a smelter flux) and by Brown Construction Co. (used in road construction by the State highway department).

Guadalupe.—Highway-construction activities in the county during 1957 were responsible for producing 319,200 tons of paving gravel by Wylie Bros. Construction Co. and construction and maintenance crews of the State highway department.

As in 1956, the Drusan Mining Co. mined siliceous copper fluxing ore from the Stauber mine, 17 miles southwest of Santa Rosa, in 1957 and shipped it to the American Smelting and Refining Co. El Paso (Tex.) copper smelter. The company closed the mine and surrendered the lease on the property on March 1, reportedly because of the drop in copper prices.

Hidalgo.—In 1957, as in each year since 1936, the Banner Mining Co. Miser's Chest group of mines, 6 miles south of Lordsburg, was

the leading metal producer in the county. Its production of copper ranked second to the Chino mine in the State in 1957. Gold and silver were recovered as byproducts of the copper ore. Output was down slightly from last year. In October the mill was closed, and the mines were closed except for a small amount of development including deepening the main shaft at the Bonney mine. The mines were kept unwatered and on a standby basis, awaiting an increased price for copper.

In addition to the Miser's Chest group, 5 other mines were active in the county from which varying quantities of gold, silver, copper, lead, and zinc were produced—these 6 mines supplied 78 percent of the total value of mineral output. Of the latter five mines, the leading producer was Werner Lake Nickel Mines, Ltd., at the Henry Clay mine for the first 11 months of the year, then the Brannan & Fuller partnership during December. Manganese ore and concentrate was shipped from the Lucky Three mine by Jeff Dunagan and from the Ridge No. 1—4 claims by John D. Flack to the Government under the "carlot" program administered by the GSA. Phelps Dodge Corp. quarried 1,360 tons of fire clay for resale and for use as taphole plugs at company smelters. Sand and gravel production consisted of 277,900 tons of paving gravel mined by Jack Adams and Brown Construction Co. Ornamental stone consisting of 100 pounds of ricolite was collected by Mrs. Clyde Brown.

Lea.—The county led the State in producing petroleum, natural gas, and natural-gas liquids; output came from 188 oilfields and 18 gasfields. Exploration drilling was at the same rate as in 1956; 83 completions were reported for both 1956 and 1957 with 27 discoveries in each year. Development drilling increased from 595 completions in 1956 to 678 in 1957, with 570 successful oil wells and 26 successful gas wells. Natural gas was processed at 14 plants for recovering natural gasoline, butane, and propane. Carbon black was recovered from natural gas at three plants; the product was used for curing rubber and for manufacturing ink. Potash was produced for the first time in 1957 as National Potash Co. began operation of its mine and refinery. The company was the sixth and newest producer in the State.

Salt recovered from byproduct potash tailings, sulfur recovered from sour natural gas, and sand and gravel for highway construction furnished less than 1 percent of the total value of all minerals produced in the county.

Luna.—Most of the value of mineral production in Luna County in 1957 came from manganese ore and concentrate produced from two mines by Muller Manganese and Florida Manganese, Inc., respectively, and shipped under the Government "carlot" program administered by the GSA. A \$9,920 DMEA contract for manganese exploration at the Killion mine by Florida Manganese, Inc., was executed in 1957. The Government will participate in 75 percent of the total cost of the contract. In 1957 small quantities of silver, lead, and zinc were recovered from shipments of ore (each under 50 tons) from 4 mines in the county. O'Kelley's Motor Transport & Transfer Co., Mark Terry, and construction crews of the State highway department produced 24,000 tons of structural sand and struc-

tural and paving gravel. Agate valued at \$10,400 was collected in the Deming area.

McKinley.—The total value of mineral production in McKinley County declined in 1957, principally because of reduced shipment of uranium ore. The number of producing properties increased from 27 to 40, and intensive development made it one of the most active counties in the State. Eight companies operated 13 mines; 11 mines produced more than 5,000 tons, supplying 85 percent of all uranium ore produced in this county.

Kermac-Nuclear Fuels Corp. began constructing a 3,300-ton-a-day mill, the largest in the Nation. Completion was expected near the end of 1958. Phillips Petroleum Co. was building a 1,725-ton-a-day mill that was to be completed by mid-1958. Production in 1957 was shipped to the mills at Bluewater and Shiprock and to the Government stockpile at Grants.

Coal was produced by 6 operators at 5 underground mines and 3 strip pits. Production increased 23 percent compared with 1956. Petroleum was produced from 3 fields. Nineteen exploration and 3 development wells were completed; all were failures. El Paso Natural Gas Products Co. completed its 7,200-barrel-a-day Cinizia refinery, 10 miles east of Gallup, and began producing. The refining site adjoins that of its Wingate fractionation plant. The company also increased the capacity of its Brickland plant at Prewitt to 4,000 barrels a day.

Skousen Construction Co. and Leslie Wheeler, contractors for the State highway department, produced 88,100 tons of paving gravel, and Bubany Lumber Co., Floyd Haake, and Henry Thygesen quarried 60,000 tons of structural sand and paving gravel. Wheeler Construction Co. produced 48,000 tons of crushed sandstone for a highway-construction contract with the State highway department. Clay production was reported by Gallup Brick & Tile Co. and Olson Mud Service Co. Output consisted of fire clay used in making brick and miscellaneous clay used as a constituent in oil-well-drilling mud.

Otero.—During 1957, 8 producers quarried 722,600 tons of sand and gravel valued at \$661,500, an 11-percent increase in tonnage over 1956. On the other hand, metal production amounted to only 1 ounce of gold, 9 ounces of silver, and $\frac{1}{2}$ ton of copper recovered from ore from 3 mines.

Quay.—Mineral production in the county consisted of a small quantity of uranium ore mined by Dennis & Fife from the Good Luck No. 3 claim and 156,500 tons of sand and gravel used for road construction.

Rio Arriba.—Petroleum production of 327,000 barrels furnished 58 percent of the total value of all minerals. Crude oil and natural gas were recovered from 4 oilfields and 17 gasfields, and the county ranked fifth in the State in the value of petroleum and third in the value of natural-gas production. Sixteen wildcat wells were completed of which 3 were discoveries; and, of 377 development wells completed, 14 oil wells and 340 gas wells were successful. Coal, amounting to 17,000 tons, was mined by Amargo Knot Coal Co., Caranta Bros., Inc., and Inez E. Erler.

Mica production declined significantly from 1956 although the Government mica-purchasing depot was active throughout 1957.

Twelve individuals or companies supplied the entire output of hand-cobbed and scrap mica in 1957. The principal companies producing hand-cobbed mica were Continental Mine Products Co. at the Globe mine, Jean H. Stivers at the Apache mine, and Louis B. Lothmann on the Kiowa Lode. Minerals Engineering Co., Petaca Division, was the most important scrap-mica producer. Scrap output also was reported by Trujillo & Girard working the Hidden Treasure mine, Continental Mine Products Co., on the Globe mine, Columbian Milling & Mining Co. on the Francis mine, and five other smaller operators. Sand and gravel used for highway-construction work by private contractors and the State highway department remained at 299,000 tons, the same as 1956, whereas production of scoria used in concrete aggregate increased 16 percent. Folsom Cinder Co., a producer in 1956, discontinued mining in 1957, and a new company, Copar Pumice, Inc., began mining in 1957. General Pumice Corp. continued to operate its Cullum open-pit mine near Espanola.

Uranium ore was mined from the Box Canyon and Box Canyon No. 7 claims by the Box Canyon Mining Co., Inc., and the Lucky Strike No. 19 claim by the Arroya DeAgua Mining Co. All output went to mills at Bluewater and Shiprock and to the Government stockpile at Grants.

Three DMEA contracts totaling \$230,000 were executed during the year for uranium exploration. The companies involved were Mid-Continent Uranium Corp., The New Jersey Zinc Co., and Treasure Uranium and Resources, Inc.

Roosevelt.—Both petroleum and sand and gravel output increased considerably in 1957. Sand and gravel production rose to 341,500 tons from 133,000 in 1956, chiefly output by Sam Sanders of structural sand and gravel used for well packing. Jack Adams quarried gravel for paving purposes.

Petroleum production increased from 11,000 barrels in 1956 to 179,000 barrels in 1957. Output came from 2 fields. Exploration activity consisted of 7 wildcat wells; 1 was a discovery.

Sandoval.—Silver and copper were recovered from ore from three mines in the county in 1957, but the Eureka operated by George M. Baker was by far the largest mine. This mine was operated until July 1, when it was closed because of the low price for copper, according to the producer. Manganese ore and concentrate was shipped from the Jicarilla and Lander mines under the Government "carlot" program administered by the GSA.

Scoria continued as the principal nonmetal in value and was produced by Big Chief Mining Co., Dooley Bros. Pumice, Inc., and Lava Pumice, Inc. Increased sand and gravel production resulted from activities of the Federal Bureau of Reclamation and the New Mexico State Highway Commission. Output in 1957 reached 32,600 tons compared with 11,000 tons in 1956.

Butler Bros. and E. H. Collins, operating separate prospects, shipped a small quantity of uranium ore to the Kermac mill at Shiprock.

Coal production at the Padilla mine decreased slightly from 1956. Petroleum was produced from 4 fields, and of 11 wildcat wells completed, 4 were successful.

San Juan.—The principal mineral products of San Juan County were petroleum, natural gas, and helium. Production was from 9 oilfields and 30 gasfields; the county ranked second in the State in the value of natural gas and fourth in the value of petroleum production. Exploration and development drilling declined from that in 1956; 53 wildcat wells and 435 development wells were completed. Sixteen oilfields and 6 gasfields were discovered. Development drilling was largely in the Bisti oilfield and the Blanca gasfield, with 180 successful oil wells and 227 successful gas wells completed. Three plants processed natural gas to recover natural gasoline, butane, and propane. The Federal Bureau of Mines recovered helium at the Navajo helium plant at Shiprock; production declined 9 percent compared with 1956. Four operators in the East Carrizo district produced uranium-vanadium ores, mostly shipped to the mills at Shiprock and Durango, Colo. The mill at Durango was the only one from which New Mexico vanadium was recovered. The Navajo Uranium Division, Kerr-McGee Oil Industries, Inc., at Shiprock, operated the 500-ton mill the entire year.

San Juan ranked third among the 32 counties reporting sand and gravel production. Output in 1957 was more than triple that of 1956 and was valued at \$653,100. Construction crews of the State highway department and Allison & Haney, contractors, produced 361,200 tons and Daniels Construction Co., Farmington Sand & Gravel Co., Jensen Ready-Mix Co., Inc., and San Juan Gravel Products Co. furnished the bulk of the 332,500 tons classed as commercial output.

San Miguel.—The State's entire output of columbium-tantalum ore in 1957 came from one mine, Old Priest, in San Miguel County. It was produced by the Onego Corp. and shipped to the Fansteel Metallurgical Corp. for its tantalum pentoxide content only.

Road-construction activities in the county resulted in production of 7,700 tons of paving gravel by the State highway department and 111,800 tons of paving gravel by Henry Young Gravel Co. and Longenbaugh & Coe. Taylor Quarries produced 100 tons of crushed sandstone for concrete aggregate and 10 tons for roofing chips, and prepared 350 tons of dimension sandstone used as dressed building stone and flagging.

Santa Fe.—The mineral industry of the county in 1957 reversed its 1956 record of increased output for all minerals by mining less of all commodities except coal, pumice, and scoria.

Sand and gravel in 1957 consisted of only 146,300 tons of commercial structural and paving sand and gravel quarried by Jimmy Johnson, Kaufmann Trucking Co., and Longenbaugh & Coe. Less highway work in the county was the reason for the decline from 521,500 tons in 1956. Crude scoria sold and used by the Crego Block Plant furnished the gain in output of volcanic ash in 1957 although a small increase in sales of ground pumice was reported by James H. Rhodes Pumice, Inc. Inasmuch as the State penitentiary discontinued manufacturing brick, no clay was mined in 1957. The State does not plan to resume brickmaking activities within the foreseeable future.

Albuquerque and Cerrillos Coal Co. operated 4 mines, the Whiteash (1), and the Cook & White (3) seams; production reached 5,400 tons, 17-percent greater than in 1956. A small quantity of uranium ore was shipped to the Government-buying station at Grants from the

La Bajada No. 1 claim by the Lone Star Mining Co. and from the San Jose No. 13 by J. C. Roybal.

The Tom Payne mine and dump, the principal lead and zinc producer in the county in 1956, was not operated in 1957. The San Pedro mine, operated by Tom B. Scartaccini and the important copper producer in 1956, was operated throughout 1957 but on a reduced scale. Three other mines (La Mina de la Tierra, Kindom Moya No. 1, and Santa Ysabel), each producing less than 100 tons of copper or lead ore for the year, were active in 1957.

Sierra.—The value of manganese ore and concentrate shipped under the Government "carlot" program administered by the GSA supplied 59 percent of the total value of mineral production in the county in 1957. Output came from 5 mines; the 3 leading producers, in order of output, were the Empire Zinc Lease, Miner's Dream, and Copper Rope Nos. 1 and 2.

In 1957 small quantities of gold, silver, copper, lead, and zinc with a combined value of \$6,300 (compared with \$32,400 in 1956) were recovered from a total of 403 tons of ore from 10 mines in the county. Operations were small; less than 100 tons of ore was produced from each of 9 of the 10 mines. At the tenth mine, Copper Flat, 292 tons of ore was mined by G. O. Lotspeich, Jr., during exploration drifting of 200 feet and leached in a 5-ton-per-day test-leaching plant.

Paving gravel was produced by construction crews for the State highway department and one commercial producer. Ornamental stone collected from the Elephant Butte area consisted of agate valued at \$116.

Socorro.—A total of 20,722 short wet tons of manganese ore and concentrate produced from 11 mines in Socorro County was shipped in 1957 under the Government "carlot" program administered by the GSA. This material, valued at \$1.7 million, supplied 46 percent of the total value of all minerals produced in the county in 1957. More than 1,000 tons of ore and concentrate was shipped from each of 5 mines, which, in order of output, were RFC, Black Canyon, Niggerhead Claims Nos. 1-3, Red Hill Nos. 3-5, and Lucky Strike No. 1. The ore and concentrate shipped from the county averaged 43.1 percent manganese.

The combined value of output of gold, silver, copper, lead, and zinc in Socorro County increased from \$693,000 in 1956 to \$1 million in 1957. Most of the advance resulted from an increased output of silver, lead, and zinc from the county's leading metal producer, Linchburg mine, operated by Elayer & Co. under lease from The New Jersey Zinc Co. It was the second leading lead producer, third leading silver producer, and fifth leading zinc producer in the State in 1957. The second ranking lead producer in the county was the Mex-Tex Mining Co., Inc., at the Mex-Tex mine, Royal Flush and Malchite claims. In addition to lead, barite was recovered from the ore. A total of 27,749 short tons of lead-barite ore was mined and milled, from which 441 tons of lead concentrate (containing 2,786 ounces of silver and 322 tons of lead) was produced. A. L. Greer & Associates produced 7,148 tons of lead-barite ore and recovered 220 tons of lead concentrates containing 142 tons of lead. From these 2 mining and milling operations, 4,441 tons of ground barite was produced (the entire quantity was ground by the Mex-Tex Mining

Co., Inc.). Varying quantities of gold, silver, copper, lead, and zinc were recovered from 7 other mines in the county.

Perlite was the principal nonmetal produced in Socorro County during 1957 and Great Lakes Carbon Corp. supplied the entire output. Both crude and expanded perlite was shipped from the company's expanding plant, which was operated throughout 1957 at Socorro. Five contractors for the Bureau of Reclamation and 3 contractors and construction crews for the New Mexico State Highway Commission produced 439,400 tons of sand and gravel; Henry Thygesen quarried 99,800 tons of commercial paving gravel. The output totaled 539,200 tons of sand and gravel, the county ranked fifth in sand and gravel output. Stone production consisted of 7,300 tons of riprap quarried by 5 contractors for the Bureau of Reclamation.

Coal produced at the Carthage No. 3 mine was 18 percent greater than in 1956. Uteco Uranium Corp. shipped uranium ore to the Government stockpile at Grants from the Charley No. 2 mine.

Taos.—Nonmetal output—perlite and sand and gravel valued at \$897,800—supplied 98 percent of the total value of mineral production in Taos County in 1957. F. E. Schundler & Co., Inc., was the principal perlite producer. Great Lakes Carbon Corp. began mining perlite on a limited scale at its new El Grande unit at No Agua. Sand and gravel production, all used for highway construction, rose to 146,100 tons in 1957; contractors for the highway department supplied the entire output.

Arthur Montgomery at the Harding mine was again the leading beryl-producer in the county and State in 1957. A total of 56,200 pounds of beryl averaging 10.61 percent BeO was hand-sorted from pegmatite and marketed to the Government under a purchase program administered by the GSA.

Small quantities of gold, silver, and copper were recovered from ore mined by Taos Minerals from the Mercy mine and shipped directly to the American Smelting and Refining Co. El Paso (Tex.) copper smelter.

Molybdenum Corp. of America continued its exploration and development work at the Questa mine throughout the year. No ore was mined but some tailing and dump ore was treated and a few tons of molybdenum concentrate was produced. This concentrate remained on hand at the mine at the close of the year. During the year a \$510,500 DMEA contract was executed for exploration at the Questa mine; the company and the Government will have equal participation. This work was begun on June 15 and continued throughout the year.

Torrance.—Reports from mineral producers indicated that nonmetals, chiefly sand and gravel and stone, supplied 98 percent of the total value of all minerals produced in the county. Construction contracts between the State highway department and C. R. Davis Construction Co., G. I. Martin & O. D. Cowart, and Wylie Bros. Construction Co., as well as limited mining by construction crews of the State highway department, resulted in producing 535,500 tons of sand and gravel valued at \$663,500. A commercial producer—Floyd Haake—quarried 3,000 tons of paving gravel, which was sold to the highway department; this quantity was the remaining output. Stone production consisting of 190,000 tons of crushed limestone used as an

aggregate for concrete on State roads was quarried by Wylie Bros. Construction Co.

Most of the copper and all of the silver production in the county in 1957 was recovered from ore mined by the Schoole Corp. from the Big D mine and shipped to the American Smelting and Refining Co. El Paso (Tex.) copper smelter.

Union.—The only commercial minerals reported produced in Union County in 1957 were scoria and sand and gravel. The scoria was mined by the Twin Mountain Rock Co. for the Colorado & Southern Railway Co. for use as railroad ballast and totaled 172,200 tons. Imperial Paving Co. as contractor for the State highway department supplied the entire 225,800 tons of paving gravel reported.

Valencia.—The county led the State in producing uranium ore. The Anaconda Co. was the major producer at 3 properties. The greatest production was from the Jackpile mine, operated by The Anaconda Co. Six other operators produced ore; all was shipped to the mill at Bluewater and to the Government stockpile at Grants. The Anaconda Co. operated its processing mill at Bluewater the entire year. Drilling operations in areas controlled by the company added about 2 million tons of uranium-ore reserve to the 15 million tons reported at the close of 1956.

Two other mills in the county were under construction during the year. The 750-ton-a-day mill of Homestake-New Mexico Partners in the Ambrosia Lake area was nearing completion at year end. Operation was expected early in 1958. On a site adjacent to that of that of the Homestake-New Mexico Partners mill, construction of the Homestake-Sapin Partners 1,500-ton-a-day mill was progressing rapidly. Completion was expected about mid-1958. Ore for these mills from properties controlled by, or committed to, the companies in the partnerships totaled nearly 4 million tons, containing 5 pounds or more per ton of uranium oxide.

Seventeen mining companies or individuals produced perlite, sand and gravel, and stone valued at \$1.5 million in 1957 compared with 15 companies or individuals producing mineral products valued at \$623,000 in 1956. The principal reason for the increase in value was the gain in highway construction in the county which engaged 5 contractors in the production of sand and gravel for the State highway department and 3 contractors for the Federal Bureau of Reclamation. The Belen Sand & Gravel Co. was the only operator selling structural sand and gravel to the local building trades. United States Gypsum Co. continued to be the sole producer of perlite, and output from the company mine 9 miles north of Grants increased 2 percent over 1956. The company also operated a mill at Grants from which the processed ore was shipped to expanding plants throughout the country. Stone output totaled 346,500 tons valued at \$305,800. Sandstone, the most important stone, was quarried by Sharp & Fellows Contracting Co.; 235,600 tons was used in concrete aggregate. Crushed limestone amounting to 108,900 tons was mined by Allison & Haney and O. D. Cowart for the State highway department and used in concrete aggregate. The remaining 2,000 tons was crushed basalt quarried by 3 contractors for the Federal Bureau of Reclamation.

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 Robert W. Metcalf,¹ and Mary E. Otte²



NEW YORK mineral output in 1957 rose 3 percent in value compared with 1956. Twenty-two mineral commodities were produced as in 1956. The mineral products leading in value were cement, iron ore, stone, salt, and sand and gravel. Large increases in value of iron ore, stone (especially crushed limestone), salt, titanium concentrate, and wollastonite, were almost offset by sizable declines in value of clays, gypsum, sand and gravel, lead, and zinc. Reduced building construction affected clays, gypsum, and sand and gravel adversely; increased road construction and maintenance created a greater demand for crushed stone. Rising demand for white pigment reacted favorably for New York titanium concentrate.

TABLE 1.—Mineral production in New York, 1956–57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays.....thousand short tons..	1,235	\$1,508	1,002	\$1,270
Emery.....	12,153	174	11,893	184
Gem stones.....	(²)	2	(²)	5
Gypsum.....thousand short tons..	1,140	4,817	864	3,749
Iron ore (usable) thousand long tons, gross weight..	3,188	41,094	3,329	44,567
Lead (recoverable content of ores, etc.)..	1,608	505	1,667	477
Lime.....thousand short tons..	87	1,030	(³)	(³)
Natural gas.....million cubic feet..	4,098	1,160	4,300	4,1050
Peat.....	2,900	23	(²)	(²)
Petroleum (crude).....thousand 42-gallon barrels..	2,748	12,091	2,677	12,662
Salt (common).....thousand short tons..	3,873	27,545	3,691	28,002
Sand and gravel.....do.....	27,815	28,722	25,640	26,480
Silver (recoverable content of ores, etc.) thousand troy ounces..	84	76	64	58
Slate.....thousand short tons..	64	944	59	961
Stone.....do.....	22,805	36,135	24,265	43,276
Zinc (recoverable content of ores, etc.)..	59,111	16,196	64,659	15,001
Value of items that cannot be disclosed: A brasive garnet, cement, crude-iron oxide pigments, talc, titanium concentrate, wollas tonite, and items indicated by footnote 3.....		68,969		70,699
Total New York ⁴		237,016		244,349

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 Preliminary figure.

⁵ The total has been adjusted to avoid duplicating the value of clays and stone.

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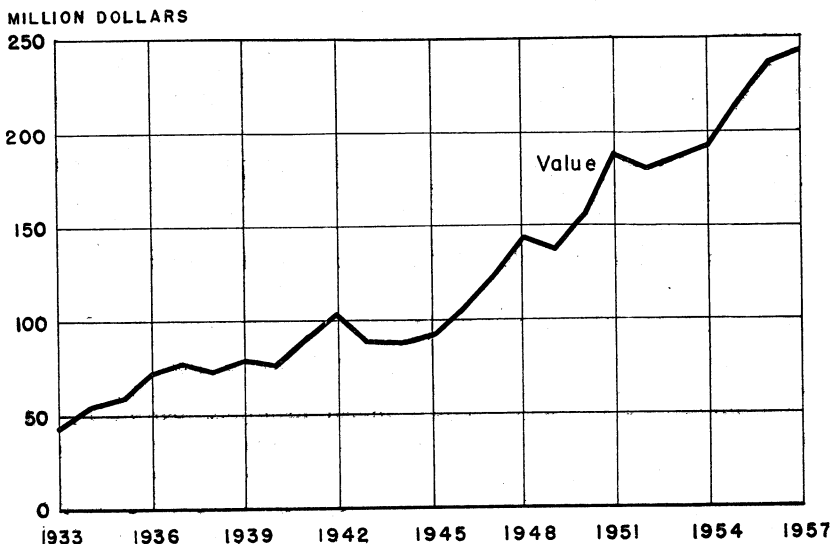


FIGURE 1.—Total value of mineral production in New York, 1933-57.

CONSUMPTION, TRADE, AND MARKETS

The St. Lawrence Seaway required large tonnages of aggregate from adjacent rock quarries and gravel pits and continuing Federal road-building programs provided additional demand for cement and aggregates. For the most part, clays were consumed locally in manufacturing of building brick and in making cement; the bulk of the output came from the Albany and New York City areas. The chief out-of-State marketing areas for New York cement were Massachusetts and Connecticut. Other New England States consumed most of the remainder; a small quantity was shipped to other States and Canada.

Magnetite iron ore produced in upper New York by Jones & Laughlin Steel Corp. and by Republic Steel Corp. was shipped mostly to the Buffalo, N. Y., Pittsburgh, Pa., and other eastern steelmaking districts for consumption in blast furnaces and steel plants. Some iron ore was consumed in making cement. Zinc concentrate from the Balmat-mine flotation plant, and the zinc-lead concentrate from the Edwards mine were shipped to Josephstown, Pa., for smelting, where zinc and a lead residue were recovered. The lead residue from Josephstown and lead concentrate from the Edwards mine were treated at the Herculaneum, Mo., smelter to recover lead and silver.

Talc produced in St. Lawrence County was widely distributed to ceramic, floor and wall-tile, and paint manufacturers; small shipments went as far as Texas and Mexico. Iron oxide pigment (hematite) was mined and consumed in making paint in Oneida County. Salt ranked fourth or fifth in value in New York State; it was marketed as rock salt, evaporated salt, and brine. Rock and evaporated salt were distributed mostly in New York and New England States; smaller quantities went to New Jersey, Pennsylvania, Maryland,

and other States. Foreign destinations included Canada, West Indies, Virgin Islands, Bermuda, Lebanon, and Arabia. Brine was consumed entirely in New York in manufacturing chemicals.

TRENDS AND DEVELOPMENTS

Significant 1957 developments included factories making and processing new products for atomic energy purposes and expansion in the aluminum and titanium industries. Among the more important of these was the \$80-million aluminum-reduction plant at Massena on the St. Lawrence Seaway; ground was broken in mid-June. The Reynolds Metals Co. will operate this 100,000-ton annual-capacity plant, scheduled for completion in mid-1959. The plant will have three potlines, using alumina from the Reynolds plant at Corpus Christi, Tex., or from Arkansas. General Motors Corp. will build a diecasting foundry adjacent to the Reynolds plant and will use large quantities of Reynolds aluminum.

Another important expansion was that of the Niagara Falls facilities of the Stauffer Chemical Co., where capacity for making zirconium tetrachloride was increased 40 percent and for silicon tetrachloride, 20 percent. Stauffer Chemical Co. announced increased research expenditure for titanium and boron compounds over \$0.5 million, and built a new boron tetrachloride plant at Niagara Falls, using a new process developed by the company.

The first large-scale test of the Sill process of alkaline leach and hydrometallurgical separation of high-content arsenic and sulfur ores was scheduled at the new "smelterless" plant at Newburgh by Metallurgical Resources, Inc. At first ore from Cobalt, Ontario, will be utilized, but the process was said to be applicable also to nickel-, copper-, silver-, iron-, lithium-, and tungsten-bearing ores. Recovery of arsenic and sulfur in commercial form without fumes and higher recovery at lower cost were claimed.³

Possibilities for additional development of the titaniferous magnetites and other minerals in the Ogdensburg and other areas, particularly in northern New York State, were described. Data on possible lead and zinc properties also were included.⁴

To meet the rapidly growing demand for crushed stone, the New York Trap Rock Corp., a leading supplier in the Hudson River area, contracted to build 50 new steel-deck cargo barges at a cost of nearly \$4 million, raising the number of deck barges in its stone-carrying fleet to 260. Delivery was scheduled over a 3-year period; 14 were scheduled for 1957.

An outstanding example of land rehabilitation was a program undertaken by a sand and gravel producer on Long Island. This firm, Steers Sand & Gravel Co., reclaimed 300 acres formerly occupied by production operations and turned it into a successful real-estate development.

³ Canadian Mining Journal, To Process Cobalt Ores: Vol. 78, No. 8, August 1957, pp. 141-142.

Engineering and Mining Journal, Plant Uses Sill Process: Vol. 158, No. 7, July 1957, p. 130.

⁴ American Metal Market, Harris Reports on Titanium Also Discusses Iron Ore, Lead, and Zinc: Vol. 64, No. 15, Jan. 22, 1957, pp. 7, 12.

Mining Engineering, vol. 9, No. 2, February 1957, pp. 218-214.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement continued as New York's leading mineral commodity in value, but quantity and value decreased 11 and 5 percent, respectively compared with 1956. The decreased output was due principally to suspended production at most plants in mid-1957 caused by a cement workers' strike. The dispute was settled by the end of July, and production was resumed. Portland, masonry, and natural cements were produced during the year. The average value per barrel of portland and masonry cements increased from \$3.06 and \$3.42 in 1956 to \$3.27 and \$3.60, respectively, in 1957. The average value of natural cement dropped slightly in 1957. Ten plants with a total annual finished-cement capacity of 20,351,000 barrels were active during the year. Cement-producing counties for all types of cement, in decreasing order of value, were Greene, Columbia, Erie, Schoharie, Warren, Onondaga, and Ulster. Natural cement was produced in Ulster County.

Clays.—Owing largely to less active business conditions, lower building, and reduced output of cement, the production of clay in New York declined 19 percent. The chief uses for clays (all miscellaneous clay) were for heavy clay products, particularly building brick, and cement. Some clay also was sold for making lightweight aggregate, artificial abrasives (Albany slip clay), and pottery. Twenty producers in 10 counties mined miscellaneous clay; leading producing counties were Ulster, Albany, Dutchess, and Orange.

Emery.—Production of emery remained about the same as in the previous year—a 2-percent decline in 1957. Output was obtained in Westchester County from the De Luca No. 1 and No. 2 mines near Peekskill and Croton and from the Kingston mine near Croton. Production from the De Luca mines was shipped to Peekskill for use as aggregate in heavy-duty, nonslip floors. Crude-emery ore from the Kingston mine was shipped outside the State for abrasive uses.

Garnet.—Abrasive garnet was produced at 2 operations in the State—1 each in Essex and Warren County. The garnet (andradite) produced in Essex County was recovered as a byproduct of wollastonite production and was sold for tumbling-barrel, rouge, and metal-blasting use. The abrasive garnet produced in Warren County was used for manufacturing sandpaper and grinding and polishing glass.

Gem Stones.—The valuation of crude and finished gem stones recovered in New York in 1957 increased substantially for the second consecutive year. Output of gem material originating in the State consisted of garnet, quartz, zircon, and other varieties. Recovery of the gem material resulted from the efforts of amateur gem collectors.

Gypsum.—In comparison with 1956, production of crude gypsum, entirely from underground operations, declined in 1957. Output came from 5 operations—3 in Erie County and 1 each in Genesee and Monroe Counties. Most crude production was calcined at company-owned plants for use in manufacturing building materials such as plaster and gypsum lath. Some crude material was used for portland-cement retarder and agricultural purposes. Crude gypsum was calcined at plants in Bronx, Erie, Monroe, Richmond, and Rockland Counties.

TABLE 2.—Production of crude gypsum, 1948-52 (average) and 1953-57

Year	Active mines	Short tons	Value	
			Total	Average per ton
1948-52 (average).....	6	1,165,596	\$3,560,643	\$3.05
1953.....	6	987,156	3,507,207	3.55
1954.....	5	1,133,579	4,005,353	3.53
1955.....	5	1,249,119	4,403,895	3.53
1956.....	5	1,140,187	4,817,353	4.23
1957.....	5	863,963	3,749,243	4.34

Iron Oxide Pigments.—Clinton Metallic Paint Co. produced crude and finished iron oxide pigments in Oneida County in 1957. Rossie Iron Ore Co. (St. Lawrence County) was dissolved in 1957. Previously the company produced finished iron oxide from crude material from out-of-State.

Lime.—Quick and hydrated lime were produced in Clinton and Erie Counties. Output was used for chemical, industrial, agricultural, and building purposes. Most of the lime from Clinton County was shipped to Canada and the New England States; the remainder was consumed in the State. The bulk of the Erie County lime consisted of quicklime and was consumed in New York for metallurgical purposes.

Nitrogen Compounds.—At two plants in Niagara Falls, Niagara County, atmospheric nitrogen was used in manufacturing fertilizers and explosives and in numerous other chemical and industrial applications.

Perlite.—Six plants expanded perlite in New York in 1957—3 in Erie County and 1 each in Bronx, Genesee, and Onondaga County. Crude perlite shipped from Western United States was processed mainly for use as plaster aggregate. Production of expanded perlite dropped from 22,000 short tons valued at \$955,000 in 1956 to 20,000 short tons valued at \$841,000 in 1957.

Salt.—Salt production continued as one of the major mineral industries in New York. Evaporated and rock salt and brine were produced. The average value, per short ton, of all types of salt sold or used by producers in the State increased from \$7.11 in 1956 to \$7.59 in 1957. The bulk of the rock salt was used for chlorine and other chemical manufacture and for melting snow and ice on roads. Brine was used exclusively for manufacturing chemicals. Evaporated salt was used mostly for chemical manufacturing and for miscellaneous other uses. Salt was produced in Livingston, Onondaga, Tompkins, Schuyler, and Wyoming Counties, in decreasing order of output.

TABLE 3.—Salt sold or used by producers, 1948-52 (average) and 1953-57

Year	Evaporated		Rock and brine		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	469,033	\$6,125,091	2,683,100	\$8,569,124	3,152,133	\$14,694,215
1953.....	532,924	7,832,362	2,789,735	9,518,749	3,322,659	17,351,111
1954.....	529,602	8,734,524	2,883,034	14,019,594	3,412,636	22,754,118
1955.....	568,497	9,655,884	3,211,050	15,558,307	3,779,547	25,214,191
1956.....	560,693	10,116,141	3,312,084	17,428,767	3,872,777	27,544,908
1957.....	548,345	11,193,251	3,142,636	16,808,581	3,690,981	28,001,832

Sand and Gravel.—The production and value of sand and gravel decreased 8 percent in 1957 as compared with 1956. Decreased demand for structural material was the major contributing factor to the decline in total output, reflecting a decrease of activity in the construction industry throughout the State. In addition, production of sand and gravel by Government-and-contractor operations declined. Nassau, Suffolk, and Erie Counties, in order of decreasing value, were the principal centers of the sand and gravel industry in the State. As in previous years, most of the sand and gravel production was used as structural and paving material. In 1957, 56 percent of the total output was washed, screened, or otherwise prepared compared with 82 percent in 1956. As in 1956, production was reported from 54 of 62 counties in New York.

TABLE 4.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses
(In thousands)

	1956		1957	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding.....	(1)	(1)	199	\$569
Building.....	8,371	\$8,417	6,735	7,730
Paving.....	4,898	4,637	6,241	5,498
Blast.....	3	1	1	(2)
Engine.....	29	32	(1)	(1)
Filter.....	41	59	(1)	(1)
Other.....	295	182	856	454
Undistributed ³	372	1,020	164	449
Total.....	14,009	14,348	14,196	14,700
Gravel:				
Building.....	5,886	8,514	3,690	5,324
Paving.....	3,917	4,118	4,034	4,370
Railroad ballast.....	34	36	68	68
Other.....	1,600	1,099	1,669	1,219
Total.....	11,437	13,767	9,461	10,981
Total sand and gravel.....	25,446	28,115	23,657	25,681
GOVERNMENT-AND-CONTRACTOR OPERATIONS⁴				
Sand:				
Building.....	21	29		
Paving.....	166	90	246	157
Total.....	187	119	246	157
Gravel:				
Building.....	91	39		
Paving.....	2,091	449	1,737	642
Total.....	2,182	488	1,737	642
Total sand and gravel.....	2,369	607	1,983	799
Grand total.....	27,815	28,722	25,640	26,480

¹ Figure withheld to avoid disclosing individual company confidential data.

² Less than \$1,000.

³ Includes glass, and data indicated by footnote 1.

⁴ Includes figures for State, counties, municipalities, and other Government agencies.

Slate.—Compared with 1956, output of slate decreased; but the valuation rose slightly in 1957. This increased valuation was due principally to an increase in average value per short ton of slate sold

for granules, flagging, and flour—the principal uses of New York slate. In 1957, 14 producers were active in Washington County—the center of the slate industry in New York—as compared with 10 in 1956. Limited quantities of roofing slate and slate for other uses also were produced during the year.

TABLE 5.—Slate sold by producers, 1948–52 (average) and 1953–57, by uses

Year	Oper- ators	Roofing		Flagging, granules, flour, and other uses		Total value
		Squares (100 square feet)	Value	Short tons	Value	
1948-52 (average).....	20	1, 172	\$36, 903	129, 726	\$1, 766, 232	\$1, 803, 135
1953.....	20	566	20, 037	113, 345	1, 713, 295	1, 733, 332
1954.....	13	242	10, 879	114, 832	1, 731, 169	1, 742, 048
1955.....	13	82	5, 587	90, 635	1, 339, 128	1, 344, 715
1956.....	10	171	7, 995	64, 216	935, 549	943, 544
1957.....	14	32	2, 554	58, 693	958, 023	960, 577

Stone.—Stone production in 1957 increased over \$7 million in value, the largest gain of any New York mineral commodity. Total production rose 6 percent; value increased 20 percent owing to increased average valuation of stone, which boosted total value to over \$43 million. The average value per short ton of stone used for concrete aggregate, roadstone, and railroad ballast (the principal uses of New York stone) increased \$0.27 in 1957 compared with 1956. Basalt, limestone, marble, sandstone, and miscellaneous stone were crushed for highway and railroad construction and maintenance, as riprap, and for other uses. In addition, limestone was quarried and crushed for use in manufacturing cement and lime and for metallurgical and agricultural purposes. In 1957 only dimension sandstone was quarried for use as rough and dressed building stone, rubble, and curbing and flagging. Limestone continued to be the principal stone quarried in the State and constituted 89 percent of the total stone production.

TABLE 6.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone.....	20, 192	\$677, 470	14, 247	\$641, 027
Curbing and flagging.....	19, 865	521, 197	49, 386	640, 393
Total.....	40, 057	1, 198, 667	63, 633	1, 281, 420
Crushed and broken:				
Riprap.....	256, 737	433, 642	129, 840	192, 288
Concrete aggregate, roadstone, and railroad ballast.....	16, 399, 087	26, 057, 076	17, 305, 463	32, 235, 451
Furnace flux.....	124, 339	239, 990	115, 451	239, 420
Agricultural.....	419, 986	1, 342, 430	418, 836	1, 200, 134
Other.....	2, 188, 540	3, 249, 208	2, 623, 810	4, 318, 404
Limestone for cement and lime.....	3, 376, 748	3, 613, 752	3, 608, 014	3, 808, 911
Total.....	22, 765, 437	34, 936, 098	24, 201, 414	41, 994, 608
Grand total.....	22, 805, 494	36, 134, 765	24, 265, 047	43, 276, 028

Rockland, Dutchess, Onondaga, Erie, and Niagara Counties, in decreasing order of value, were the leading stone-producing counties. A limited quantity of crushed and broken limestone and miscellaneous stone was quarried by Government-and-contractor operations. The output was used principally for concrete aggregate and roadstone.

Talc.—Production of talc declined in 1957 compared with 1956 owing to decreased demands for talc in the ceramic and paint industries. 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 for use principally in ceramics and paint manufacture. Other uses included paper, rubber, textile, soap, and floor- and wall-tile manufacture.

Vermiculite.—The Oneida County plant of Zonolite Co. was the only producer of exfoliated vermiculite in 1957; its Albany County plant had been closed in June 1956. The company processed crude vermiculite, mainly from company-owned mines in Montana and South Carolina and partly from South Africa.

Wollastonite.—Production of wollastonite increased again in 1957. Output came from the Fox Knoll mine in Essex County and was refined and sold as a filler in paint, ceramics, and plastics.

METALS

Iron and Steel.—Blast furnaces were operated in 1957 by 5 firms at 6 locations, all except 1 in the Buffalo-Tonawanda area in western New York. The capacity of these furnaces increased 7 percent in 1957 and totaled 5,766,000 short tons. Seventeen stacks were active in 1957. According to the American Iron and Steel Institute, 7 companies at 9 steel plants produced ingots and steel for castings and recorded a 4-percent increase in capacity. Of the 9, 3 were open-hearth mills in the Buffalo area, and the other 6 were electric- and crucible-type plants at Watervliet, Syracuse, and Cortland in eastern and middle New York and at Lockport, Tonawanda, and Dunkirk in the extreme western part of the State.

Iron Ore.—Both production of crude magnetite and shipments of usable ore increased in 1957 compared with 1956. Loadings of direct shipping ore and sinter each were higher than in 1956. Sizable shipments of concentrate also were made. The greater part of usable ore shipments was sinter. The average value of usable iron ore rose 4 percent in 1957 to \$13.39 compared with \$12.89 in 1956. Three companies operated 5 mines in 1957—3 in Essex County and 1 each in Clinton and St. Lawrence Counties. All ore mined in Essex County was magnetite, mostly from open-pit mines. Treatment of the ore included concentration, agglomeration, spiraling, jigging, and magnetic separation.

Lead.—The output of recoverable lead in 1957 totaled 1,667,000 short tons—the highest since 1943 and 4 percent larger than in 1956. Its total value declined owing to a 9-percent decrease in price per ton compared with 1956. The Balmat mine in St. Lawrence County was the only lead producer in New York.

Silver.—Recoverable silver was obtained as a byproduct of zinc-lead mining at the Balmat mine in St. Lawrence County. Reduced

market for silver-free lead resulted in a 24-percent drop in silver production in 1957 compared with 1956.

Titanium Concentrate (Ilmenite).—In spite of a declining market toward the end of 1957, production of ilmenite rose to new records in 1957 in both quantity and value, surpassing 1956 by nearly one-quarter in tonnage and almost one-half in value. Ilmenite was recovered from the titaniferous iron ore (magnetite) mined by the National Lead Co. at its MacIntyre mine near Tahawus and beneficiated at the nearby mill. A comprehensive study of the titanium industry was published.⁵ Included were estimated reserves of northern New York State deposits and a description of mining and beneficiation at the MacIntyre mine and mill at Tahawus, Essex County. The 3 chief deposits, with estimated reserves listed in parentheses, were: MacIntyre, the only one being mined (100 million tons of ore containing 20 percent TiO_2), Calamity Mill (9.5 million tons of titaniferous material), and Iron Mountain (12 million tons containing 19.4 percent TiO_2).

During 1957 Mallory-Sharon Metals Corp. was formed and was reported to be the largest fully integrated company to produce titanium and zirconium from the ore to the finished mill product. Three firms have combined their resources in this project—P. R. Mallory & Co., Sharon Steel Corp., and National Distiller & Chemical Corp. Reactive Metals, Inc., a research and development company, also was incorporated into the new company.

Uranium.—Ramapo Uranium Corp. produced a small quantity of selected uranium ore from a plant near Warwick, Orange County, about 60 miles northeast of New York City. Although some concentrate was shipped, commercial quantities of uranium were not proved to be present, except in irregular patches, and the deposit was considered by most geologists as a marginal project. The company has since ceased operations.

Zinc.—Production of recoverable zinc in New York in 1957 again broke all records and totaled nearly 65,000 short tons—9 percent above the previous peak year 1956. The value of output was less than in 1957 because of a lower unit value, which was 15 percent under that for 1956. Output was entirely from the Balmat and Edwards mines in southern St. Lawrence County.

TABLE 7.—Mine production of silver, lead, and zinc, 1948-52 (average) and 1953-57 in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Silver		Lead		Zinc		Total value
			Fine ounces	Value	Short tons	Value	Short tons	Value	
1948-52 (average)-----	3	480, 123	31, 251	\$28, 284	1, 330	\$427, 438	36, 709	\$10, 981, 748	\$11, 437, 470
1953-----	2	646, 041	35, 398	32, 037	1, 435	375, 970	51, 529	11, 851, 670	12, 259, 677
1954-----	2	662, 665	34, 576	31, 293	1, 187	325, 238	53, 199	11, 490, 984	11, 847, 515
1955-----	2	650, 877	66, 162	59, 880	1, 037	309, 026	53, 016	13, 041, 936	13, 410, 842
1956-----	2	657, 445	84, 158	76, 167	1, 608	504, 912	59, 111	16, 196, 414	16, 777, 493
1957-----	2	660, 638	63, 880	57, 815	1, 667	476, 762	64, 659	15, 000, 888	15, 533, 465

⁵ Miller, Jesse A., 'Titanium, a Materials Survey: U. S. Bureau of Mines Inf. Circ. 7791, 1957, 202 pp.

MINERAL FUELS

Coke.—Coke capacity at steel-plant ovens remained unchanged in 1957. Utilizing out-of-State coal, 2 firms operated 711 slot-type ovens in 1957. The combined production of these 2 plants and 1 merchant-coke installation rose 8 percent compared with 1956 and totaled over 4 million short tons—the highest tonnage since 1953.

Peat.—The production of peat declined in 1957 and was limited to Seneca County. No production was reported for Dutchess County, as in previous years.

Petroleum and Natural Gas.—Petroleum output in 1957 continued to decline slightly, although the total value rose 5 percent because of the increased price of crude compared with 1956. Production in 1957 was entirely from Allegany, Steuben, and Cattaraugus Counties in the southwestern part of the State. Breakdown by counties was not available. No new discoveries were made during 1957. The estimated proved recoverable crude-oil reserves on January 1, 1958, totaled 61.5 million barrels (primary recovery).

Natural-gas output in 1957 also was less than in 1956, although the average value at the wellhead increased. Natural gas in 1957 was produced mostly from the Oriskany horizon; sizable quantities came from the Medina formations, but no distribution by counties was available. Gas reserves, as of January 1, 1958, totaled 87 billion cubic feet. Oil and gas wells drilled during 1957 totaled 443, separated as follows: Crude oil, 208; gas, 5; dry, 10; and service, 220. The total footage drilled was 490,202 feet, an average footage of 1,107 feet compared with an average of 1,465 feet and 512 wells in 1956.⁶

REVIEW BY COUNTIES

Mineral production was recorded in all but 6 of New York's 62 counties. As in 1956, St. Lawrence, Essex, Erie, Greene, and Columbia Counties, in decreasing order of value, were the centers of greatest mineral activity. Compared with 1956, Essex County made the greatest increase of mineral valuation owing to the increased valuation of ilmenite and iron ore recovered in the county. Erie County showed the largest decline from the preceding year, owing principally to decreased production of cement and gypsum.

Albany.—Plant No. 1 of Callanan Road Improvement Co. (South Bethlehem) produced crushed and broken limestone for riprap, blast-furnace flux, concrete aggregate, roadstone, railroad ballast, and agricultural uses. Sand and gravel was recovered mainly in the eastern part of the county. Output consisted chiefly of molding and building sand, and gravel for paving and other uses. Albany Gravel Co., Inc., used its South Bethlehem portable plant for preliminary crushing and transferred the material to its other plants. The company also added a gyratory crusher at its Cedar Hill plant and reported that the Dennis pit near Loudonville was idle in 1957. Albany County continued to rank second in output of clay in 1957. Miscellaneous clay, used chiefly for manufacturing building brick, was mined near Coeymans and Albany.

⁶ Oil and Gas Journal, Annual Review and Forecast Number: Vol. 56, No. 4, Jan. 27, 1958.

TABLE 8.—Production of sand and gravel by Government-and-contractor operations, 1956-57, by counties

(In short tons)

County	1956	1957	County	1956	1957
Albany.....	7,500	28,054	Oneida.....	47,250	47,250
Broome.....	7,136	47,584	Onondaga.....	2,217	(1)
Cattaraugus.....	21,218	69,109	Ontario.....	41,560	35,063
Cayuga.....	14,175	8,235	Orange.....	55,207	102,222
Chautauqua.....	610,909	10,424	Orleans.....	17,493	12,655
Chemung.....	2,843	9,604	Oswego.....	48,750	38,750
Chenango.....		7,887	Otsego.....	42,345	29,632
Clinton.....	91,809	90,563	Rensselaer.....	4,455	97,565
Columbia.....	22,658	4,631	St. Lawrence.....	345,259	70,200
Cortland.....		25,900	Saratoga.....	60,450	84,905
Delaware.....	14,945	37,768	Schenectady.....	24,287	
Dutchess.....	9,329	14,704	Schoharie.....	2,430	4,462
Erie.....	100,003	316,391	Schuyler.....		21,304
Essex.....	5,600	124,891	Steuben.....	255,707	156,600
Franklin.....	55,842	31,050	Suffolk.....	35,633	36,619
Fulton.....	22,590	29,109	Sullivan.....	6,031	78
Genesee.....	36,114	34,010	Ulster.....		5,486
Greene.....		23,166	Washington.....	11,458	28,663
Herkimer.....	12,381	16,863	Wayne.....	92,378	42,514
Jefferson.....	100,252	50,415	Wyoming.....	9,450	
Lewis.....	9,600	1,431	Yates.....	41,728	76,123
Livingston.....	22,350	(1)	Undistributed.....		71,607
Monroe.....	20,700	15,900			
Niagara.....	37,325	24,473	Total.....	2,369,413	1,982,960

¹ Figure withheld to avoid disclosing individual company confidential data.

Allegany.—Sand and gravel was recovered from open pits at Alfred, Belmont, Friendship, and other unspecified places in the county. Output was used principally for paving and building purposes.

Broome.—Sand and gravel was produced near Binghamton and Vestal and consisted principally of building and paving material. Barney & Dickenson, Inc. (Vestal), acquired 50 acres for future production of sand and gravel. Other producers were Binghamton Crushed Stone & Gravel Co., Inc. (Binghamton), and Royal Winne (Vestal). Dimension and crushed and broken sandstones were produced in the county. Binghamton Brick Co., Inc. (Binghamton), produced miscellaneous clay used in manufacturing building brick.

Bronx.—Crude gypsum was calcined at the Bronx plant of National Gypsum Co. The company calcined gypsum by the kettle process and used oil as fuel. The company also expanded crude perlite from Colorado at the plant.

Cattaraugus.—Production of sand and gravel was reported from nine operations in the county during 1957. Principal operations were at Franklinville, Allegany, Red House, and Onoville. Production was used mainly for building and paving material. Filter sand and gravel for fill were also produced.

Cayuga.—Crushed and broken limestone used for concrete aggregate, roadstone, railroad ballast, and miscellaneous other uses was produced by the General Crushed Stone Co. (Auburn). The Jay W. Robinson & Son and J. J. Harrington sand and gravel pits near Auburn produced structural and paving sand and gravel.

Chautauqua.—Six operators reported production of sand and gravel at various places throughout the county. Structural and paving sand and gravel and fill gravel were produced.

TABLE 9.—Value of mineral production in New York, 1956-57, by counties ^{1 2 3}

County	1956	1957	Minerals produced in 1957 in order of value
Albany.....	\$1,416,215	(⁴)	Stone, sand and gravel, clays.
Allegany.....	265,350	\$369,239	Sand and gravel.
Broome.....	690,494	(⁴)	Sand and gravel, stone, clays.
Cattaraugus.....	777,223	705,450	Sand and gravel.
Cayuga.....	(⁴)	(⁴)	Stone, sand and gravel.
Chautauqua.....	339,319	193,817	Sand and gravel.
Chemung.....	(⁴)	(⁴)	Sand and gravel, clays.
Chenango.....	122,064	87,312	Sand and gravel.
Clinton.....	5,311,890	(⁴)	Iron ore, stone, lime, sand and gravel.
Columbia.....	(⁴)	(⁴)	Cement, sand and gravel, stone.
Cortland.....	(⁴)	(⁴)	Sand and gravel.
Delaware.....	681,737	799,634	Stone, sand and gravel.
Dutchess.....	(⁴)	(⁴)	Stone, sand and gravel, clays.
Erie.....	24,108,393	21,728,108	Cement, sand and gravel, stone, gypsum, lime, clays.
Essex.....	25,741,568	(⁴)	Iron ore, titanium concentrate, wollastonite, sand and gravel, garnet.
Franklin.....	111,066	75,222	Stone, sand and gravel.
Fulton.....	116,011	36,449	Sand and gravel.
Genesee.....	3,316,766	(⁴)	Gypsum, stone, sand and gravel.
Greene.....	(⁴)	(⁴)	Cement, stone, sand and gravel.
Herkimer.....	(⁴)	(⁴)	Stone, sand and gravel.
Jefferson.....	(⁴)	(⁴)	Do.
Kings.....	18,320	(⁴)	Do.
Lewis.....	(⁴)	(⁴)	Salt, sand and gravel.
Livingston.....	(⁴)	(⁴)	Stone, sand and gravel.
Madison.....	(⁴)	(⁴)	Sand and gravel, gypsum, stone.
Monroe.....	2,924,089	1,067,443	Stone, sand and gravel.
Montgomery.....	(⁴)	(⁴)	Sand and gravel, clays.
Nassau.....	6,250,714	5,260,847	Stone, sand and gravel.
Niagara.....	(⁴)	(⁴)	Sand and gravel, stone, crude iron oxide pigments.
Oneida.....	1,798,040	2,841,999	Salt, stone, cement, sand and gravel, clays.
Onondaga.....	11,370,384	11,661,712	Sand and gravel, stone.
Ontario.....	(⁴)	(⁴)	Sand and gravel, stone, clays, gem stones.
Orange.....	(⁴)	(⁴)	Stone, sand and gravel.
Orleans.....	(⁴)	(⁴)	Sand and gravel.
Oswego.....	226,066	(⁴)	Do.
Otsego.....	(⁴)	74,072	Stone.
Putnam.....	(⁴)	(⁴)	Stone, sand and gravel, clays.
Rensselaer.....	444,155	(⁴)	Stone, sand and gravel.
Rockland.....	(⁴)	(⁴)	Iron ore, zinc, stone, talc, lead, silver, sand and gravel, gem stones.
St. Lawrence.....	38,234,301	40,981,733	Sand and gravel, stone.
Saratoga.....	606,729	(⁴)	Cement, stone, sand and gravel.
Schenectady.....	340,745	370,531	Salt, sand and gravel.
Schoharie.....	(⁴)	(⁴)	Peat.
Schuyler.....	(⁴)	(⁴)	Sand and gravel.
Seneca.....	(⁴)	(⁴)	Sand and gravel.
Steuben.....	(⁴)	338,934	Do.
Suffolk.....	6,613,096	4,846,887	Sand and gravel, stone.
Sullivan.....	291,626	343,068	Sand and gravel.
Tioga.....	(⁴)	(⁴)	Salt, stone, sand and gravel.
Tompkins.....	(⁴)	(⁴)	Cement, stone, clays, sand and gravel.
Ulster.....	(⁴)	(⁴)	Cement, garnet, stone, gem stones, sand and gravel.
Warren.....	(⁴)	(⁴)	Slate, stone, sand and gravel.
Washington.....	1,074,990	(⁴)	Stone, sand and gravel.
Wayne.....	(⁴)	(⁴)	Emery, stone, sand and gravel, gem stones.
Westchester.....	370,374	(⁴)	Salt, stone, sand and gravel.
Wyoming.....	(⁴)	(⁴)	Sand and gravel.
Yates.....	4,173	7,574	
Undistributed.....	103,249,909	152,559,383	
Total.....	237,016,000	244,349,000	

¹ Bronx, Hamilton, 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.

Chemung.—Two operators of sand and gravel pits near Horseheads and Elmira reported output for structural and paving purposes. Consolidated Brick Co. recovered miscellaneous clay from an open-pit mine near Horseheads.

Chenango.—The Bundy Concrete Co., Sherburne, the only commercial producer of sand and gravel in the county, reported output of building sand and gravel, paving gravel, and gravel for use as fill.

Clinton.—The Republic Steel Corp. produced magnetite iron ore at its Chateaugay underground and open-pit mine at Lyon Mountain in the northeastern part of the county. This mine was the fourth largest iron-ore mine in New York, and treatment facilities included a concentration mill and a Dwight-Lloyd sintering plant.

International Lime & Stone Corp. (Chazy) quarried limestone for use as open-hearth and blast-furnace flux, road material, agricultural stone, and other purposes. The company also produced quick lime and hydrated lime for chemical uses at its Chazy plant. Lancaster Development, Inc. produced limestone for road material, riprap, and agricultural uses. Miscellaneous crushed stone was recovered as a byproduct of the Chateaugay mine of Republic Steel Corp. near Lyon Mountain. Bero Construction Co. produced sand and gravel at an open pit near Morrisonville. Total output was washed at the local plant for use as paving material.

Columbia.—In 1957 Columbia County replaced Erie County as the second-ranking cement-producing county in the State. Cement producers were Lone Star Cement Corp. (Greenport) and Universal Atlas Cement Co. (Hudson). These companies also quarried and crushed limestone for their own use in manufacturing portland and masonry cements. Crushed and broken limestone was also produced at Claverack by Catskill Mountain Stone Corp. Six companies recovered sand and gravel from pits at Claverack, Hudson, Livingston, and other unspecified areas. Production was used principally for building and paving material. Gravel for fill and railroad ballast was also produced.

Cortland.—Sand and gravel, the only mineral commodity reported in the county, was recovered from a pit at Cortland. Some of the material was washed for building purposes. Paving gravel and unwashed gravel for use as fill were also produced.

Delaware.—In terms of value, Delaware was the leading sandstone-producing county in the State in 1957. Output consisted entirely of dimension stone used for building purposes and curbing and flagging and came from quarries near Unadilla, East Branch, Hancock, and Deposit.

Dutchess.—Dutchess County ranked second in value of limestone in 1957. Output came from 2 quarries—1 each in Poughkeepsie and Pleasant Valley Township. Seventeen commercial sand and gravel producers, at various places throughout the county, produced chiefly building and paving sand and gravel. Sand and gravel for various uses and fill gravel were also produced. Miscellaneous clay was mined near Beacon.

Erie.—Erie County ranked third in both total mineral valuation and in cement production in New York in 1957. Portland and masonry cements were produced at plants near Buffalo by Lehigh Portland Cement Co. and Penn-Dixie Cement Corp. Masonry

cement was produced by Louisville Cement Co. of New York at a plant near Akron. Production of sand and gravel was reported from 12 operations throughout the county and consisted mainly of structural paving sand and gravel. In addition, filter sand, and gravel for fill and other uses were produced. Pine Hill Concrete Mix Corp. near Lancaster, purchased the Pfohl Bros., Inc., sand and gravel operations on July 1, 1957. Quarries near Bowmansville and Cheektowaga produced crushed and broken limestone for riprap, concrete aggregate, roadstone, railroad ballast, and other uses.

Bestwall Gypsum Co. recovered crude gypsum at a mine near Clarence. 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 expended at the Akron plant. The expanded perlite was used exclusively for plaster aggregate. National Gypsum Co. mined and calcined gypsum and processed crude perlite at Clarence Center. Universal Atlas Cement Co. mined crude gypsum near Clarence for use in manufacturing cement at company-owned plants. Expended perlite was produced by Buffalo Perlite Corp. (Cheektowaga) from crude material from Western States. Quick lime and hydrated lime were produced by Kelly Island New York Corp. at its Buffalo plant. The output was used mainly for metallurgical purposes. John H. Black Co. (Jewettville) discontinued mining and processing shale for lightweight aggregate in October 1957. Miscellaneous clay, used principally for manufacturing building brick, was also mined and processed near Lake View and Orchard Park.

Essex.—The value of production in Essex County in 1957 continued to rank second in New York State. The chief mineral produced was iron ore. Republic Steel Corp. two open-pit mines—the Fisher Hill and the New Bed-Harmony-Old Bed near Mineville near Lake Champlain—and the National Lead Co. underground MacIntyre mine at Tahawus, western Essex County in the heart of the Adirondacks, produced iron ore. The National Lead Co. also recovered ilmenite at the Tahawus plant. Essex County had the second largest iron mine in New York. Shipments of ore, concentrate, and sinter went to pig-iron and steel mills, and cement mills, and for unspecified uses.

Wollastonite and byproduct garnet (andradite) was produced at the Willsboro mine of Cabot Carbon Co. The company reported that by 1959 production of the byproduct garnet will be 40,000 tons per year. The company also listed potential uses of this inexpensive material, which were sandblasting, marble and granite gangsawing, dilution or extension of other abrasives, polishing, roofing and tarpaper coating, and manufacture of garnet paper. Sand and gravel was recovered along Saranac Lake in the northeastern part of the county. Output was used principally for paving and building material.

Franklin.—Adirondack Stone Quarries, Inc., prepared dimension sandstone for rough construction at its quarry near Burke. Output of six sand and gravel producers in various sections of the county consisted of paving sand and gravel and blast sand. Dave Williams reported no production in 1957 and stated that the pit will be closed

indefinitely. Louis Paro did not produce sand and gravel in 1957 owing to a fire in February that destroyed his trucks.

Fulton.—The major part of sand and gravel produced in the county was recovered from pits in the southern part of the county near Johnstown, Gloversville, and Ephratah. Output was used chiefly for building and paving purposes. In February, R. H. Machold purchased the sand and gravel pit formerly owned by H. R. Becker, Johnstown.

Genesee.—United States Gypsum Co. produced crude and calcined gypsum near Oakfield. Limestone was quarried and crushed at 3 places in the county—2 near Leroy and 1 near Batavia. Output consisted chiefly of stone used for concrete aggregate and roadstone. Batavia Washed Sand & Gravel Co., Inc., and Western New York Gravel & Concrete, both of Batavia, produced structural sand and gravel and a quantity of gravel for use as fill. Batavia Washed Sand & Gravel Co., Inc., sold a section of its property to the State to be used by the New York Central Railroad for relocating its tracks. The company also acquired the property and holdings of Western New York Gravel & Concrete in December 1957.

Greene.—The county again led in output of cement in 1957. Producers were Alpha Portland Cement Co. (Cementon) and Lehigh Portland Cement Co. and North American Cement Corp., both near Alsen. These companies also quarried limestone for their own use. Limestone, cement rock, gypsum, and iron ore were used to manufacture portland and masonry cements. Sandstone was quarried and crushed by Catskill Mountain Stone Corp. (Cairo) for use as concrete aggregate and road material. Lawrence Bros., Ashland, produced bank-run sand for use on highways. Whitehead Bros. produced molding sand from a pit and fixed plant near Catskill.

Herkimer.—Limestone, used principally for concrete aggregate, roadstone, and agricultural purposes, was quarried and crushed near Jordanville by The General Crushed Stone Co. The Newport quarry of Newport Quarries, Inc., was inactive during 1957. Production of sand for use as building material and gravel for paving purposes was reported from two operations in the southeastern section of the county.

Jefferson.—The General Crushed Stone Co., Watertown, produced limestone for highway and railroad maintenance and agricultural purposes. The Highway Departments of the Town of Cape Vincent and Lyne produced limestone for concrete aggregate and road material. Output by seven producers of structural and paving sand and gravel, other sand, and gravel for fill came from various places in the county in 1957.

Lewis.—Crushed limestone for use in whitening and insecticides was quarried and crushed by Carbola Chemical Co. 2 miles east of Natural Bridge. During 1957 the company installed a new crusher and enlarged the crusher building. Limestone as concrete aggregate and road material was produced by the town of Lowville. R. D. Allen & Son, Lowville, the only producer of sand and gravel in Lewis County, reported output of sand for building and other uses and paving gravel.

Livingston.—The county led again in producing salt in 1957. Rock salt was recovered from the Retsof underground mine of International Salt Co. The mine has two vertical shafts—a 1,073-foot main shaft and a 1,060-foot emergency shaft. Mining was done entirely by the

room-and-pillar method. Sand and gravel was recovered from a bank in the southeastern section of the county and from a pit at an unspecified place. The output was used mostly as building and paving material.

Madison.—Limestone was quarried and crushed near Munnsville and Sullivan. Worlock Stone Co., Inc. (Sullivan), enlarged its processing facilities by adding a new crusher during the year. Most of the output of Jossitt Concrete Products Co., Inc., sand and gravel pit and plant near Hamilton, was washed for use as building material.

Monroe.—Fifteen sand and gravel operations scattered throughout the county were active during the year. Production was used exclusively as building and paving material. Crude gypsum was mined and calcined at The Ruberoid Co., Wheatland mine, which had a 38° incline and 200 foot length. Crude material was recovered by the room-and-pillar method. Gypsum was calcined at the plant by the kettle process and made into finished building material, principally gypsum lath and wallboard. Limestone, used mostly for concrete aggregate and road material, was quarried near Sweden.

Montgomery.—Limestone, used chiefly for concrete aggregate and roadstone, was quarried near South Amsterdam. The output of St. Johnsville Supply Co., Inc., the only sand and gravel producer in the county in 1957 at a pit and fixed plant near St. Johnsville was sold as building and paving material.

Nassau.—In 1957 Nassau County replaced Suffolk as a leading sand- and gravel-producing county in the State. Output totaled 6,060,000 short tons in 1957, a 5-percent increase over 1956. Major production came from the southeastern and northern areas of the county and was used exclusively for structural and paving material. Miscellaneous clay was recovered at a pit near Farmingdale by Nassau Brick Co., Inc.

Niagara.—Quarries near Niagara Falls, Gasport, and Lockport yielded limestone used primarily for concrete aggregate and roadstone. The Gasport Sand & Gravel Co., Inc., pit and fixed plant near Lockport in the southeastern section of the county produced structural sand and gravel, paving and filter sand, and gravel for fill. Atmospheric nitrogen (anhydrous ammonia) was recovered at plants near Niagara Falls by E. I. du Pont de Nemours & Co., Inc., and Olin-Mathieson Chemical Corp.

Oneida.—Pits and plants operating mainly along the eastern border of the county produced the major portion of the sand and gravel output in Oneida County during the year. Nine companies reported producing sand and gravel for building and paving uses, sand for molding, glass sand, engine sand, and sand for other uses. Railroad ballast and other gravel were also produced. Geo. W. Bryant Core Sands, Inc., producers of sand for the foundry industry, enlarged its plant facilities near Camden. The company added two silos, a drier, and a stacking conveyor and extended its railroad siding. Limestone used for concrete aggregate, roadstone, agricultural purposes, and riprap was quarried near Orinskany Falls and Prospect. Crude iron oxide pigment was recovered from the Brimfield underground mine of Clinton Metallic Paint Co. (Clinton). Long-face mining was used at the mine, which has a 72-foot vertical shaft.

Onondaga.—Allied Chemical & Dye Corp., Solvay Process Division, operated wells at Tully and a plant at Syracuse for producing evaporated salt and brine. The brine was used in manufacturing chemicals. Onondaga County ranked third in value of limestone produced in 1957. Limestone was produced at quarries near Jamesville and DeWitt Township. Alpha Portland Cement Co. produced portland and masonry cements at its plant near Jamesville. Sand and gravel was recovered in the county in 1957 at 11 commercial operations throughout the county. Output was used mainly for structural purposes. Engine sand, railroad ballast, and fill gravel were also produced.

Miscellaneous shale used exclusively for manufacturing lightweight aggregate was produced by Onondaga Brick Corp. at its pit near Warners. Syracuse Pottery Co., Inc. (Warners), mined clay for use in flowerpots. Syracuse Brick Corp. mined and processed miscellaneous clay near Cicero for brick manufacture. Crude perlite from Western States was expanded at the Syracuse plant of Minerals Processing Corp.

Ontario.—Leading areas for producing sand and gravel in Ontario County were Oaks Corners, Geneva, and Clifton Springs in the northeastern section and Victor in the northwestern section. Structural and paving sand and gravel and molding sand were the chief products. The General Crushed Stone Co. quarried and crushed limestone 1 mile south of Phelps.

Orange.—Fourteen companies recovered sand and gravel throughout the county for use principally as building and paving material. Dutchess Quarry & Supply Co., Goshen, produced limestone used entirely for concrete aggregate and roadstone. The Jova Brick Works (Newburgh) produced miscellaneous clay for manufacturing building brick. Crude garnet and zircon of gem quality were recovered near Tuxedo and Amity, respectively, in 1957.

Orleans.—Limestone used for concrete aggregate, roadstone, and miscellaneous other uses was quarried and crushed by Clarendon Stone Co., Inc., Clarendon. Sand and gravel was recovered from pits in the southeastern and southwestern sections of the county and used as structural and paving material. Gravel for fill and other uses was also produced.

Oswego.—Sand and gravel used as building and paving material and glass sand were produced near Pulaski and Lacuna in the northwestern corner of the county and in Oswego and Fulton in the southwestern area.

Otsego.—Seaward Gravel Co. produced building and paving sand and gravel from a pit and fixed plant near Milford. Unadilla Concrete Products Co. reported output of building sand and gravel near Unadilla.

Putnam.—Eastern Mineral Co., Inc., crushed limestone at its quarry near Patterson for agricultural and filler purposes.

Rensselaer.—Basalt used entirely for concrete aggregate and roadstone was quarried near Brunswick by Fitzgerald Bros. Construction Co. Output of sand and gravel in the county was recovered by 6 companies at 9 pits in the southwestern area near Wynantskill, Rensselaer, Averill Park, and West Sand Lake. The bulk of the output was used as building and paving material. Clay for use in manufacturing

building brick and artificial abrasives was mined near Troy and Mechanicville.

Richmond.—United States Gypsum Co. calcined and processed gypsum at its New Brighton plant.

Rockland.—Rockland County continued to lead in value of stone production in the State in 1957 and in value of basalt and limestone production. Limestone used entirely for concrete aggregate and roadstone was produced by New York Trap Rock Corp. at Tompkins Cove. The company was also the major producer of basalt in the county; output from its Haverstraw and West Nyack quarries was crushed and broken for riprap, concrete aggregate, roadstone, railroad ballast, and other uses. Suffern Stone Co. (Suffern) quarried basalt for use in highway and railroad construction and maintenance. Production of sand and gravel was confined principally to the northeastern section of the county near Mount Ivy, Thiells, and Stony Point and to the southeastern section near Sparkill and Ramapo. Building sand and gravel and sand for use as fill were produced. At the Stony Point plant of United States Gypsum Co. crude gypsum was calcined and processed.

St. Lawrence.—St. Lawrence County was the chief mineral-producing county in New York. The value of its output totaled nearly \$41 million. The two principal products were iron ore and zinc. Jones & Laughlin Steel Corp. mined magnetite at its Benson open-pit mine 2 miles east of Starlake in the southern part of the county and shipped sinter for use in pig iron and steel. St. Joseph Lead Co. mined a zinc-lead ore at Edwards and a zinc ore at Balmat, both in southeastern St. Lawrence County. Mining at both mines was entirely by open stoping. Development of the Edwards mine includes a 1,560-foot vertical shaft and a 2,497-foot incline with 42-degree inclination. The Balmat mine development included a 898-foot vertical shaft and a 40-degree incline, 3,264 feet in length. Zinc-lead ore was concentrated at the 1,800-ton flotation mill at Balmat and zinc ore only at a 600-ton flotation mill at Edwards.

Limestone used principally for concrete aggregate and roadstone was produced in the county near Gouverneur, Norwood, Ogdensburg, and Helena. Crews of the St. Lawrence County Highway Department produced miscellaneous stone for use as concrete aggregate and roadstone. International Talc Co., Inc., and Gouverneur Talc Co., Inc., mined and ground talc in the Gouverneur area. The room-and-pillar method was used entirely at the underground mine of Gouverneur Talc Co., Inc. Development of the mine included a 800-foot vertical shaft and a 43-degree incline, 300 feet long. Thirteen companies recovered sand and gravel from open pits scattered throughout the county. Production was used mainly as sand for icy highways. Gravel for use as fill and paving material was also produced. Production decreased in 1957, owing principally to completion of projects for constructing the St. Lawrence Seaway. Danburite and various other gem-material specimens were recovered near Russell, Fowler, and other unspecified places in the county.

Saratoga.—Nine companies reported output of sand and gravel in the county; 7 companies operated pits in the southeastern area and 2 in the northeastern area. The production was used principally as molding and glass sand and as building sand and gravel. Production

in the county declined because demand for sand in the foundry industry decreased. Batten Kill Stone Corp., Fort Edward, purchased the Hudson Valley Sand & Stone Co. in April. Limestone, used chiefly for cement manufacture and concrete aggregate and roadstone, was produced at quarries near Saratoga Springs and south of Glens Falls.

Schenectady.—Sand and gravel was recovered in the county, mainly in the eastern section of the county near Schenectady, Glenville, and Rotterdam. The major part of the output was used as building and paving material.

Schoharie.—Limestone and portland cement were produced by North American Cement Corp. near Howes Cave. Limestone also was produced near Schoharie, and Cobleskill. A quantity of sand for paving purposes was recovered from a pit at an unspecified locality in the county.

Schuyler.—Evaporated salt was produced at the Watkins Glen plants of International Salt Co., Inc., and Watkins Salt Co. International Salt Co., Inc., operated 9 hydraulic wells and recovered salt at the 1,780–2,300 foot level. D. & T. Franzese Bros., Watkins Glen, produced sand for use as building material and gravel for paving, fill, and other uses.

Seneca.—The only output of peat in New York in 1957 was recovered from bogs near Waterloo.

Steuben.—Bath Sand & Gravel Co. (Bath), Buffalo Slag Co., Inc. (Cohocton), and Rinehart Sand & Gravel, Inc. (Corning) produced sand and gravel, chiefly for building and paving material.

Suffolk.—Suffolk County was replaced by Nassau County as the leading sand and gravel-producing county in 1957. Commercial output of sand and gravel dropped from 6,535,000 short tons in 1956 to 4,861,000 short tons in 1957, a 26-percent decline. This decline was due chiefly to decreased demand for structural sand and gravel in 1957. In addition, the number of active commercial producers dropped from 25 in 1956 to 20 in 1957. Sand and gravel was produced throughout the county and used principally as building and paving material.

Sullivan.—Sand and gravel was produced from 4 pits—2 near Liberty, and 1 each near Summitville, and Mongaup Valley. Output was used mainly as building and paving material. I. Pshonick & Son added a portable crusher to its processing facilities near Liberty. Dimension sandstone was quarried in the county and fabricated in Delaware County for building, curbing, and flagging.

Tioga.—Central Materials Corp. (Oswego) and Herman E. Bunce (Barton) produced sand and gravel for building and paving material.

Tompkins.—Rock salt was recovered from the underground mine of Cayuga Rock Salt Co., Inc., near Myers. The mine had two 1,920-foot vertical shafts and used a combination of mining methods to recover salt. International Salt Co., Inc., produced evaporated salt in vacuum pans at its Ludlowville refinery. Finger Lakes Stone Co., Inc., produced sawed and dressed sandstone for building purposes at a quarry southwest of Varna. Washed sand and gravel was produced by B. C. Perkins, owner of University Sand & Gravel, and Rumsey-Ithaca Corp., both near Ithaca. The latter company improved its plant by replacing obsolete screening and sizing equipment.

Sand and gravel used as building and paving material and for fill purposes was produced.

Ulster.—Natural and masonry cements were produced near Rosendale by Century Cement Mfg. Co., Inc. The Callanan Road Improvement Co., Kingston, produced crushed and broken limestone for road construction and riprap. Sandstone for curbing was produced at the Jockey Hill quarry of Richard F. Dunn Estate (Elizabeth M. Dunn, executrix). The quarry was active only during the first 6 months of 1957. Government-and-contractor stone was produced for flood-repair work at an unspecified place in the county.

The county continued to lead in output of clay in 1957. During the year three companies produced miscellaneous clay used exclusively for manufacturing building brick. During the latter part of 1957 the East Kingston plant of Star Brick Corp. was damaged by fire and lost two kilns and thousands of green brick. The Hutton Co. (Kingston) added new mixing equipment to their facilities. Alva S. Staples produced miscellaneous clay at Saugerties. Brigham Brick Corp. (East Kingston) was inactive in 1957. Sand for use as fill and paving gravel were recovered from a pit near Port Ewen. Paving sand and gravel was recovered from a pit near Wewarsing.

Warren.—Glens Falls Portland Cement Co. operated its masonry- and portland-cement plant and limestone quarry near Glens Falls. Abrasive garnet was recovered and processed at the open-pit mine and mill of Barton Mines Corp., 5 miles south of North Creek. Jointa Lime Co., Inc., quarried and crushed limestone used entirely for concrete aggregate and roadstone at its quarry near Glens Falls. Crude garnet originating near North Creek was recovered by an amateur gem collector in 1957. Some of the gem material was cut and finished. Paving gravel was recovered from a pit in the southeastern section of the county.

Washington.—The center of the slate industry in the State was the northeastern part of Washington County, near Granville, Whitehall, and Hampton. Production of flagging, granule, roofing, and flour slate was reported from 14 operations in the area. Limestone was produced at a quarry near Middle Falls. Production of sand and gravel near Fort Ann, Clemons, Salem, and Eagle Bridge was used mainly for paving gravel.

Wayne.—The General Crushed Stone Co., Sodus, quarried and crushed limestone for use in highway and railroad construction, agricultural, and other purposes. Six producers reported output of sand and gravel from Clyde, Palmyra, Red Creek, and other unspecified places. Structural sand and gravel, and paving and railroad ballast gravel were the principal products.

Westchester.—The DeLuca No. 1 (Peekskill) and DeLuca No. 2 (Croton) mines of DeLuca Emery Mine and the Kingston mine of DiRubbo & Ellis were the only sources of emery in the State. Colbate Emery Co. (Peekskill) operated the Kingston mine for DiRubbo & Ellis. The Thornwood quarry of Universal Marble Products Corp. produced white marble, which was crushed for various uses, including terrazzo, stucco, roofing, and asphalt filler. Three sand and gravel pits yielded building sand and gravel and sand for fill and other uses. Peekskill Mason Supply Co., Peekskill, reported constructing a new conveyor system, which was not completed by the end of the year.

Varieties of quartz (rose, smoky, and milky) were recovered in Bedford Township by an amateur gem collector in 1957.

Wyoming.—Evaporated salt was produced by the open-pan and vacuum-pan processes at the Silver Springs plant of Morton Salt Co. The Ambluco quarry of American Bluestone Co. (Portageville) produced dimension building sandstone. A quantity of sand for use on icy roads was recovered from a pit at an unspecified place.

Yates.—Paving sand and gravel was produced in the county by road-maintenance crews of New York State Department of Public Works and 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. Valley,¹ Jasper L. Stuckey,² and Mildred E. Rivers³



NORTH CAROLINA mineral production in 1957 declined to \$37.6 million, 8 percent lower than the \$40.9 million listed in 1956 and 10 percent below 1954, the record year. Of the State's principal minerals, only production of stone, scrap mica, and copper increased; the output of clays, feldspar, sheet mica, sand and gravel, talc and pyrophyllite, and tungsten declined.

TABLE 1.—Mineral production in North Carolina, 1956–57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Abrasive stones..... tons..	2 454	3 \$16	(4)	5 \$5
Beryllium concentrate..... pounds..	6, 302	2	3, 013	1
Clays.....	2, 663	2, 027	2, 392	1, 407
Feldspar..... thousand long tons..	256	3, 192	233	2, 728
Gem stones.....	(4)	1	(4)	(7)
Gold (recoverable content of ores, etc.)..... troy ounces..	882	31	1, 373	48
Lead (recoverable content of ores, etc.)..... tons..	10	3	9	3
Mica:				
Scrap.....	47	1, 065	53	1, 173
Sheet..... pounds..	770, 903	2, 135	577, 607	1, 575
Sand and gravel.....	7, 581	6, 264	6, 820	5, 724
Silver (recoverable content of ores, etc.)..... troy ounces..	753	1	12, 347	11
Stone ²	8, 352	11, 472	9, 455	12, 839
Talc and pyrophyllite.....	125	529	121	558
Tungsten concentrate (60 percent WO ₃ basis).....	3	(9)	2	(9)
Zinc (recoverable content of ores, etc.)..... tons..			2	(7)
Value of items that cannot be disclosed: Asbestos (1957), copper, grinding pebbles and tube-mill liners (1957), kaolin (1957), olivine, slate (1957), stone (crushed limestone, marble, sandstone, basalt and dimension granite and marble, and values indicated by footnote 9.....		10 14, 135		11, 498
Total North Carolina.....		10 40, 873		37, 570

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Grinding pebbles and tube-mill liners.

³ Grinding pebbles, tube-mill liners, and millstones.

⁴ Weight not recorded.

⁵ Millstones only.

⁶ Incomplete total; excludes kaolin.

⁷ Less than \$1,000.

⁸ Excludes certain stone; value included with "Items that cannot be disclosed."

⁹ Figure withheld to avoid disclosing individual company confidential data.

¹⁰ Revised figure.

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The value of sand and gravel and stone comprised 66 percent of the mineral-production total. North Carolina led all States in producing feldspar, sheet and scrap mica, and olivine; it ranked second in output of tungsten; third, in talc and pyrophyllite combined; and fifth, in kaolin. It was the only State producing millstones.

The leading mineral industries were stone quarrying, sand and gravel mining, feldspar and mica mining and processing, and metal mining. Leading companies were Superior Stone Co. (crushed granite, limestone and traprock), Tungsten Mining Corp. (tungsten), and Appalachian Sulfides, Inc. (copper, gold and silver).

TABLE 2.—Average unit value of mineral commodities produced in North Carolina, 1948-52 (average) and 1953-57

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Abrasives:						
Grinding pebbles.....short ton	\$17.28	\$17.60	\$20.25	\$21.91	\$24.60	\$25.00
Tube-mill liners.....do	17.39	17.95	22.00	22.71	25.18	25.20
Asbestos.....do	(¹)	21.10	17.10	8.95	-----	8.95
Beryl.....do	283.01	399.17	504.76	591.69	572.83	596.75
Clay:						
Kaolin.....do	20.19	18.87	18.80	16.69	22.07	22.80
Miscellaneous.....do	.98	1.16	1.15	.61	.58	.59
Feldspar.....long ton	7.02	12.28	9.62	9.00	12.48	11.69
Mica:						
Scrap.....short ton	25.73	25.14	23.87	22.62	22.59	21.95
Sheet.....pound	.41	2.11	3.73	4.96	2.77	2.73
Olivine.....short ton	19.98	18.78	20.48	16.00	15.08	14.59
Sand and gravel:						
Gravel.....do	1.10	1.16	1.10	1.15	1.17	1.26
Sand.....do	.39	.47	.47	.49	.58	.60
Slate, dimension.....do	-----	-----	-----	-----	-----	54.70
Stone:						
Granite:						
Crushed.....do	1.43	1.42	1.41	1.40	1.37	1.36
Dimension.....do	50.01	33.90	41.13	33.81	40.04	49.50
Limestone: Crushed.....do	1.35	1.39	1.39	1.37	1.32	1.40
Marble:						
Crushed.....do	4.02	5.60	6.75	7.88	12.24	7.99
Dimension.....do	116.60	117.70	117.62	117.62	117.62	97.04
Sandstone:						
Crushed.....do	.59	-----	-----	4.59	4.30	3.61
Dimension.....do	2.40	-----	-----	6.86	10.98	18.52
Traprock: Crushed.....do	1.59	-----	1.46	1.43	1.24	1.43
Talc and pyrophyllite.....do	(¹)	4.85	3.44	4.57	4.22	4.61

¹ Data not available.

EMPLOYMENT AND INJURIES

Reports submitted to the Bureau of Mines by producers indicate that employment in the mineral industries was 8 percent higher than in 1956. Although the number of men working daily increased, the average number of days worked decreased from 258 to 242. Sand and gravel showed the greatest apparent gain, the result of more complete data on this industry in 1957. A new copper mine began producing during the year, but employment in metal mining decreased 6 percent. On the other hand, quarries and mills increased 11 percent and nonmetal mines, 14 percent.

Injury experience for sand and gravel mines is shown for the first time for 1957. Four fatal accidents occurred, compared with two in

1956. The frequency rate for the State declined 9 percent below 1956, decreasing 5 percent for metal mines and 36 percent for non-metal mines and increasing 42 percent for quarries and mills.

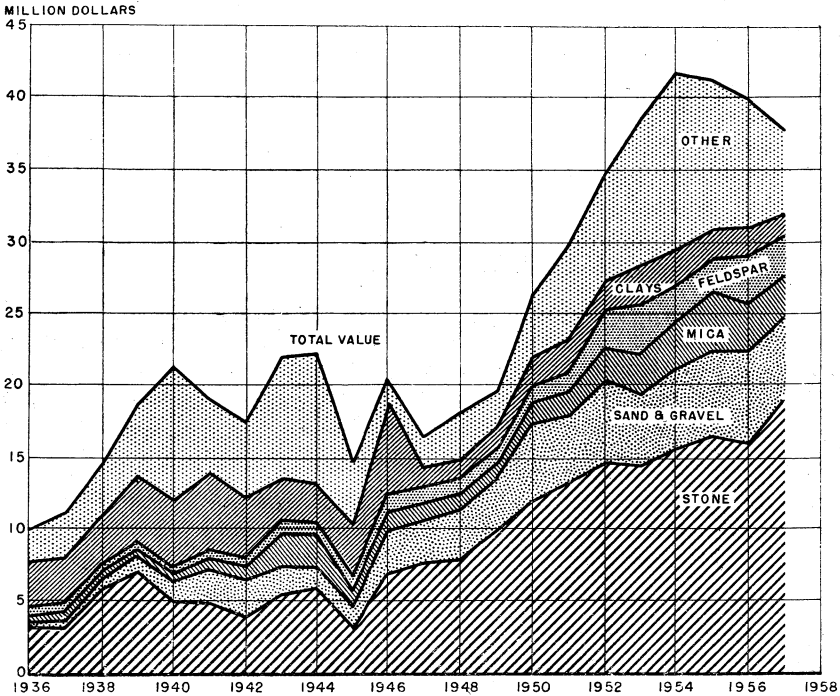


FIGURE 1.—Value of stone, sand and gravel, mica, feldspar, clays, and total value of mineral production in North Carolina, 1936-57.

TABLE 3.—Employment in the mineral industries, 1956-57

Industry	1956 ¹			1957 ²		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Nonmetal mines.....	1,814	244	443,401	2,200	229	504,317
Metal mines ³	1,410	338	477,107	1,437	311	447,054
Quarries and mills.....	1,929	220	424,765	2,177	216	469,600
Sand and gravel mines.....	⁴ 386	⁴ 219	⁴ 84,497	552	221	122,051
Total.....	5,539	258	1,429,770	6,366	242	1,543,022

¹ Final figures.

² Preliminary figures.

³ Includes aluminum smelters.

⁴ Excludes Government-and-contractor operations.

TABLE 4.—Injuries in the mineral industries, 1956-57

Industry	1956 ¹				1957 ²			
	Fatal	Non-fatal	Total	Injuries per million man-days	Fatal	Non-fatal	Total	Injuries per million man-days
Sand and gravel mines.....	(³)	(³)	(³)	(³)	1	16	17	139
Metal mines ⁴	2	81	83	174	3	74	74	166
Nonmetal mines.....		127	127	286		89	92	182
Quarries and mills.....		69	69	162		108	108	230
Total.....	2	277	279	207	4	287	291	189

¹ Final figures.² Preliminary figures.³ Data not available.⁴ Includes aluminum smelters

CONSUMPTION, TRADE, AND MARKETS

Except for the construction materials—clay, slate, and stone—most North Carolina mineral production was shipped to out-of-State processing plants and markets. Copper and tungsten concentrates were shipped to eastern plants for smelting and refining. Lithium ore imported from Canada, as well as North Carolina ore, was processed in the State. Hand-cobbed mica was converted to sheet at the Government Spruce Pine Mica Purchase Depot, and some sheet was fabricated in Mitchell County. Scrap mica was ground and shipped to out-of-State markets. Feldspar, quartz, olivine, talc, and pyrophyllite were also shipped out-of-State for use in ceramics, glass, and refractories. Clays (except kaolin) were used in local brick- and clay-products plants; North Carolina ranked as one of the leading brick-producing States; aluminum metal, artificial graphite, expanded perlite, and exfoliated vermiculite were produced from out-of-State minerals.

North Carolina was deficient in fuels; no petroleum or natural gas has been produced in the State; and only small tonnages of coal were mined before 1952. It was also the only State in the southeast without a cement plant.

TRENDS AND DEVELOPMENTS

Output of copper began from the new Ore Knob mine of Appalachian Sulfides, Inc., partly offsetting the large loss in tungsten production caused by low prices and the curtailed operations of Tungsten Mining Corp. Near the end of the year, Lawson-United Feldspar & Minerals Co. completed and began producing at a new feldspar-flotation plant. Other developments included construction of a new scrap-mica plant near Kings Mountain, development of a kyanite mine in the same area, and a shell-rock (limestone) quarry near New Bern.

Allied-Kennecott Titanium Corp. announced plans for a \$40 million plant to produce titanium-sponge metal, forgings and billets at Wilmington. E. I. duPont de Nemours & Co. was constructing a new plant at Brevard to produce high-purity silicon. Bear Creek Mining Co., a subsidiary of Kennecott Copper Co., was negotiating for a prospecting and mining lease for phosphate on 60,000 acres of

State land and seeking options on private tracts. Considerable interest was noted in the possibility of developing economic deposits of ilmenite along the coast. Aluminum Co. of America and Kaiser Aluminum acquired options on large tracts of land in the Spartanburg, S. C.-Rutherfordton, N. C., area to prospect for and test alumina-bearing ores.

LEGISLATION AND GOVERNMENT PROGRAMS

Under the Defense Minerals Exploration Administration (DMEA) program of Government participation in exploration for critical and strategic minerals, 41 contracts totaling \$498,606 were in force during 1957. In all, \$208,120 was spent on these projects during the year; the Government share was 75 percent. In 1956, \$164,575 was spent on 73 contracts, which totaled \$660,152 in value. All but one (tungsten) were mica contracts.

The Government Spruce Pine Mica Purchase Depot continued to buy beryl and hand-cobbed and sheet mica mined in North Carolina and other States.

United States Government purchases of tungsten under Public Law 733 had been suspended in December 1956 and were not resumed during 1957.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grinding pebbles, millstones, and tube-mill liners were produced in Rowan County. The total value of production was considerably less than in 1956.

Asbestos.—A small tonnage of amphibole asbestos was produced in Transylvania County.

Clays.—Total production of clays was less than in 1956; kaolin and miscellaneous clay both declined in tonnage and value. However, average unit value of kaolin increased 3 percent and miscellaneous clay, 2 percent. Miscellaneous clay declined 9 percent in both tonnage and value. One producer mined kaolin at 2 mines in Avery County. Twenty-six companies mined miscellaneous clay from 32 mines in 21 counties for brick and other clay products.

Feldspar.—Crude feldspar production, including flotation concentrate, was 233,000 tons valued at \$2.7 million, 9 percent lower in tonnage and 15 percent lower in value than in 1956, the peak year. Feldspar output ranked fourth in value in the State. Production of ground feldspar decreased 9 percent and 20 percent in tonnage and value, respectively. The Consolidated Feldspar Department of International Minerals & Chemical Corp. and Feldspar Corp. flotation mills and grinding plants were the principal producers. The Lawson-United Feldspar & Minerals Co. new feldspar-flotation plant at Spruce Pine began producing late in the year. Rated monthly capacity of the new plant is 8,000 tons of glass-grade feldspar, 2,500 tons of low-iron, glass-melting quartz and 400 tons of scrap mica.

Gem Stones.—Gem stones and gem materials were collected in Avery, Macon, Madison, Mitchell, and Randolph Counties. Minerals reported included: Corundum, epidote, garnet, pyrophyllite, quartz,

TABLE 5.—Defense Minerals Exploration Administration mica contracts in force during 1957

Contractor	Property	County	Contract	
			Date	Total amount ¹
Aldridge, Lewie, et al	Johnson	Avery	December 1956	\$6,644
Phillips, John	Ed Bureson	do	October 1956	4,580
Do	John	do	September 1956	6,940
Smith, Sam G.	Doe Hill	do	July 1956	5,164
Vance, Joe C.	Leaning Locust	do	April 1956	8,902
Phillips, Sam L.	Black Mountain	Buncombe	May 1957	5,376
Beam, J. R.	Back	Cleveland	November 1956	4,840
Blanton, Chas., Mining Co.	Charlie Blanton	do	April 1957	6,216
Huskins, Edward	Falls	do	June 1957	6,316
Phillips & Beam	Mauney	do	July 1957	6,064
Carolina Mining Co.	Upper Clark	Jackson	November 1956	5,240
Do	Wilson	do	do	5,068
Do	Moody	Macon	November 1957	4,492
Crawford, Eugene E.	Setser	do	October 1956	5,484
Boone, McMahan et al.	Paul McMahan	Mitchell	October 1957	6,288
Buchanan, Clifton D.	Boone	do	November 1956	5,552
Buchanan, Glenn	Chestnut Branch	do	January 1957	6,296
Gouge, W. G.	Dinky Line	do	February 1957	4,992
Grindstaff & Greene	Johnson	do	September 1957	6,624
Hawk Mining Co.	Hawk	do	September 1956	6,760
Huskins, Ed.	Bill's	do	November 1956	4,936
Huskins, Huskins, et al.	Big Ridge	do	October 1957	4,208
Jarrett, John	Hensley	do	January 1957	6,348
Jarrett & Grindstaff	McBee	do	April 1956	10,662
McKinney, Howard	McKinney	do	May 1957	5,652
Mitch-Lincoln Mining Co.	Mitch-Lincoln	do	March 1957	6,856
Phillips, John	Roby	do	August 1956	6,612
Phillips, Sam L.	Old Buchanan	do	May 1956	6,641
Phillips, et al.	Avery	do	October 1957	6,080
Pitman, Earl, et al.	Pitman	do	December 1956	5,496
Stevenson, Ted, et al.	Stevenson	do	December 1955	6,716
Young, Arnold, Mining Co.	Arnold Young	do	May 1957	7,600
Tony and Grady	Claude Blanton	Rutherford	July 1956	5,412
Beam and Phillips	Little Ray	Yancey	September 1955	12,735
Bennett, Yates, et al.	Palen Ridge	do	December 1956	5,692
Boone, Homer	Pete	do	February 1957	5,048
McCurry, Guy, et al.	Mitchell Branch	do	November 1956	5,876
Moody Rock Mining Co.	Moody Rock	do	April 1957	11,590
Murphy Mining Co.	Murphy	do	November 1956	4,236
Rathborn, C. W., et al.	Crip Ogle	do	December 1956	5,712

¹ Government participation, 75 percent.

and ruby. Plans were announced to reopen an old emerald mine on Crabtree Mountain in Mitchell County.

Lithium.—Foote Mineral Co. continued mining and processing spodumene at Kings Mountain, and Lithium Corp. of America processed foreign ore at its Bessemer City plant. Production data are classified and are not included in the State total.

Mica.—The total value of sheet-and-scrap mica production declined for the second year, from \$3.2 million in 1956 to \$2.7 million in 1957, a loss of 16 percent. Sheet mica totaled 578,000 pounds valued at \$1.6 million, compared with 771,000 pounds and \$2.1 million in 1956, decreases of 25 percent and 26 percent in quantity and value, respectively. Production of scrap mica was 53,000 tons valued at \$1.2 million, increases of 13 percent in tonnage and 10 percent in value above output in 1956, when 47,000 tons valued at \$1.1 million was produced. Most sheet-mica production was sold through the General Services Administration (GSA) to the Government.

Forty DMEA mica contracts were active during the year; 6 remained in force at the end of the year.

In 1957 production was reported from 21 counties, the same as in 1956. Four hundred mines were active compared with 259 in the preceding year. Considerable tonnage could not be identified as to county and/or mine origin. The 5 leading mica-producing counties supplied 96 percent of the tonnage and 86 percent of the value. The number of mines (in parentheses) and value of production of each follows: Mitchell (104), \$931,000; Yancey (85), \$622,000; Avery (49), \$334,000; Macon (32), \$254,000; and Cleveland (35), \$218,000. One new scrap-mica mine and plant began producing at Kings Mountain early in the year.

TABLE 6.—Mica sold or used by producers, 1956-57

Kind	1956		1957	
	Quantity	Value	Quantity	Value
Sheet mica:				
Uncut punch and circle.....pounds..	565,618	\$48,205	418,306	\$32,998
Larger uncut mica.....do.....	41,979	29,335	12,045	9,055
Full trimmed purchased by GSA ¹.....do.....	163,306	2,057,517	147,256	1,533,046
Total sheet mica.....do.....	770,903	2,135,057	577,607	1,575,099
Scrap mica: Total.....short tons.....	47,125	1,064,631	53,452	1,173,215
Grand total (sheet and scrap).....do.....	47,510	3,199,688	53,741	2,748,314

¹ Includes full-trimmed-mica equivalent of hand-cobbed mica.

Olivine.—The production of olivine decreased in 1957. Tonnage and value were lower by 9 and 12 percent, respectively, than in 1956. Three mines were active in 1957—2 in Jackson and 1 in Yancey County.

Perlite.—Expanded perlite was produced at Salisbury from crude material shipped into North Carolina. Tonnage and value were virtually the same as in 1956.

Quartz.—Two companies recovered quartz as a byproduct in feldspar-flotation plants in Mitchell County. Since 1955 quartz-production data have been included under stone—sandstone, quartz, and quartzite. The output rose 24 percent and value 4 percent over 1956.

Sand and Gravel.—Production of sand and gravel ranked second in the State in both tonnage and value; 6.8 million tons valued at \$5.7 million was produced, representing a 10-percent decrease in tonnage and a 9-percent decline in value. Commercial sand and gravel made up 63 percent of the tonnage and 77 percent of the value, compared with 64 and 77 percent, respectively, in 1956. Commercial sand—structural and paving—decreased 3 percent in tonnage but was 2 percent higher in value than in 1956. Commercial gravel—structural and paving—declined 21 percent in tonnage and 13 in value. Government-and-contractor sand output decreased 3 percent; its value was virtually the same as in 1956. Government-and-contractor gravel, however, was 24 and 30 percent lower in tonnage and value, respectively. Commercial sand and gravel was produced in 10 counties, sand only in 5 others, and gravel only in 6 counties. Twenty-two companies operated 29 pits in these counties compared with 23 companies at 31 pits in 1956. Government-and-contractors produced sand in 57 counties, gravel in 2 counties, and both sand and gravel in 12 others—a total of 74 compared with 75 in 1956.

TABLE 7.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Structural.....	1,767,319	\$1,250,820	1,663,958	\$1,212,091
Paving.....	310,153	188,580	361,640	255,370
Filter.....	6,000	4,000	(1)	(1)
Other.....	(1)	(1)	(1)	(1)
Total.....	² 2,083,472	² 1,443,400	² 2,025,598	² 1,467,461
Gravel:				
Paving.....	1,545,957	1,661,208	1,086,944	1,304,631
Structural.....	881,246	1,309,121	838,727	1,267,372
Other.....	(1)	(1)	(1)	(1)
Total.....	² 2,427,203	² 2,970,329	² 1,925,671	² 2,572,003
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving.....	2,190,367	1,030,310	2,158,369	1,067,439
Structural.....	58,073	50,026	19,221	9,801
Total.....	2,248,440	1,080,336	2,177,590	1,077,240
Gravel:				
Paving.....	387,629	214,628	351,479	258,131
Structural.....	76,161	152,322	(1)	(1)
Total.....	463,790	366,950	351,479	258,131
ALL OPERATIONS				
Sand.....	4,331,912	2,523,736	4,203,188	2,544,701
Gravel.....	2,890,993	3,337,279	2,277,150	2,830,134
Undistributed.....	357,688	403,120	349,013	349,368
Grand total.....	7,580,593	6,264,135	6,829,351	5,724,203

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

² Incomplete, portion not included is combined as "Undistributed."

Stone.—The total production of stone reached a record high in 1957 and was 13 percent higher in tonnage and value than in 1956. Crushed granite exceeded 1956 tonnage by 13 percent and value by 12 percent. Crushed-limestone production increased 20 percent in tonnage and 25 percent in value. Crushed marble and sandstone also were higher than in 1956. Crushed basalt (traprock) declined 21 percent in tonnage and 9 percent in value. Dimension marble increased in tonnage and value, and dimension granite declined. Dimension sandstone produced totaled 200 tons valued at \$3,700.

Stone led in both total tonnage and value in the State. Granite was quarried in 28 counties, limestone in 6, basalt in Union, marble in Cherokee, and sandstone in Mitchell (byproduct quartz) and Swain Counties. Excluding quartz, 19 operators produced commercial stone from 45 quarries, including 36 granite, 6 limestone, and 1 quarry each of marble, sandstone, and traprock. North Carolina State Highway and Public Works Commission crushed stone from 16 granite quarries and 1 limestone quarry. Government-and-contractor stone comprised 8 percent of the tonnage and 6 percent of value of the total crushed-stone production. During the year 6 new granite quarries reported production; one reopened; and another was inactive.

TABLE 8.—Sand and gravel produced by the North Carolina State Highway and Public Works Commission in 1956-57, by counties

County	1956		1957		Use
	Sand (short tons)	Gravel (short tons)	Sand (short tons)	Gravel (short tons)	
Alamance	1,000		8,000		Paving sand.
Alexander	36,000		44,017		Do.
Alleghany		1,600			
Anson	(1)	(1)	20,500	25,000	Paving sand and gravel.
Ashe		(1)	800		Structural sand.
Avery	600				
Beaufort	67,200		77,000		Paving sand.
Bertie	5,100		4,000		Do.
Bladen	56,000	6,100	119,291		Do.
Brunswick		40,900	27,800		Do.
Burke	142,000	30,000	143,500	37,534	Paving sand and gravel.
Cabarrus	(1)	(1)	8,000		Paving sand.
Caldwell	5,300		6,800	950	Structural sand and paving gravel.
Camden	32,000		15,000		Paving sand.
Carteret	2,000				
Caswell			28,000		Paving sand.
Catawba	54,000		46,000		Do.
Chowan	100,000		34,000		Do.
Cleveland	69,800		40,806		Do.
Columbus	81,000		71,167		Do.
Craven	10,000		3,000		Do.
Cumberland	(1)	(1)	65,790	31,700	Paving sand and gravel.
Currituck	22,000		20,000		Paving sand.
Dare	56,000		56,000		Do.
Davidson	22,000	136,000	24,000	150,000	Paving sand and gravel.
Davie	61,000		67,000		Paving sand.
Duplin		23,200	24,300		Do.
Forsyth	(1)		89,000		Do.
Franklin	11,300		6,000		Do.
Gaston	48,400		27,000		Do.
Gates	28,000		25,000		Do.
Granville	3,000		4,000		Do.
Greene	60,000		45,000		Do.
Guilford	5,500	10,000	5,900		Structural sand.
Halifax	5,400		6,968		Paving sand.
Harnett	(1)	(1)	153,610	60,900	Paving sand and gravel.
Hertford	20,600				
Hyde	56,200		4,400		Paving sand.
Iredell	101,300		75,667		Do.
Johnston	26,000		25,000	6,500	Paving sand and gravel.
Jones	(1)	(1)	30,000		Paving sand.
Lee	1,800		2,650		Do.
Lenoir	(1)	(1)	60,000		Do.
Lincoln	41,900		28,500		Do.
Martin	52,200		8,000		Do.
Montgomery	14,000	22,100	6,027		Do.
Moore	(1)		6,305		Do.
Nash	(1)		33,000		Do.
New Hanover			4,000		Do.
Northampton	(1)	(1)	11,000		Do.
Onslow		(1)	6,100		Do.
Pamlico	1,000				
Pasquotank	60,000		25,000		Paving sand.
Pender	13,400		8,800		Do.
Perquimans	16,000		14,000		Do.
Person	9,300		11,150		Do.
Pitt	72,400		94,000		Do.
Polk	25,000		25,000		Do.
Randolph			4,000		Do.
Richmond	5,500	3,800	2,203	10,000	Paving sand and gravel.
Robeson	114,000		87,000		Paving sand.
Rockingham		(1)	3,821		Structural sand.
Rowan	38,000		40,000		Paving sand.
Rutherford			6,000	35,600	Paving sand and gravel.
Sampson		22,200	18,090		Paving sand.
Scotland		15,900	3,770		Do.
Stokes	82,000		82,000		Do.
Surry		(1)		15,045	Paving gravel.
Tyrrell	1,200		2,200		Do.
Union	8,000				
Wake	3,600		1,900		Structural sand.
Washington	7,100		32,000		Do.
Watauga	(1)	(1)		2,900	Paving gravel.
Wayne	(1)		16,800	4,000	Paving sand and gravel.
Wilkes	20,000	41,200	19,623	8,160	Do.
Wilson	30,600		30,000		Paving sand.
Yadkin	4,400	44,000	31,635		Do.

¹ See county review.

One new limestone quarry was also begun. The State highway commission closed 4 quarries and reported 3 other new quarries in production.

TABLE 9.—Crushed granite sold or used by producers, 1956-57, by uses

Use	1956		1957		Percent of change in—	
	Short tons	Value	Short tons	Value	Short tons	Value
Concrete and roads.....	7,811,282	\$10,790,843	8,910,827	\$12,208,013	+14	+13
Other.....	540,671	677,243	543,483	626,785	+1	-7
Total.....	8,351,953	11,468,086	9,454,310	12,835,698	+13	+12

Talc and Pyrophyllite.—Crude talc and pyrophyllite output was 4 percent lower than in 1956 but increased 5 percent in value. Production was 121,000 tons valued at \$558,000, compared with 125,000 tons at \$529,000 in 1956. Ground talc and pyrophyllite also was 3 percent lower in tonnage but 9 percent higher in value. Sawed material increased in both tonnage and value. Pyrophyllite was produced from 6 mines in Alamance, Moore, Orange, and Randolph Counties and talc from 2 mines in Cherokee County.

TABLE 10.—Talc and pyrophyllite production, 1948-52 (average) and 1953-57

Year	Crude mined		Sales (crude, sawed, and ground)	
	Short tons	Value	Short tons	Value
1948-52 (average).....	108,236	(¹)	107,317	\$1,682,013
1953.....	119,341	\$578,239	118,614	1,909,027
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	557,350	98,185	2,003,189

¹Data not available.

Vermiculite.—No crude vermiculite has been mined in the State since 1955. Exfoliated vermiculite was produced from crude shipped into North Carolina by Alabama Vermiculite Co., Sylva; Roy M. Biddle, Franklin; and Zonolite Co., High Point. Quantity sold or used was 1 percent lower than in 1956, and value declined 20 percent.

METALS

Aluminum.—Carolina Aluminum Co. operated its aluminum smelter at Badin throughout the year.

Beryllium.—Beryl production, only half of that in 1956, totaled 3,000 pounds valued at \$900 and came from Burke, Davie, and Yancey Counties. The entire output was sold to the Government (GSA) depot at Spruce Pine.

Gold, Silver, Copper, Lead, and Zinc.—Appalachian Sulfides, Inc., completed constructing an 800-ton-daily-capacity flotation mill and began full-scale production of copper with gold and silver at the newly developed Ore Knob mine in Ashe County in March 1958. H & H Mines, Inc., of Enfield (Halifax County) increased ore production 50 percent; however, the total value of the gold, silver, copper, lead, and

zinc recovered decreased 14 percent because of depressed base-metal prices.

Tungsten.—Production of tungsten from the Hamme mine (Vance County) of Tungsten Mining Co. dropped to 2,287 short tons (60-percent WO_3 basis) of concentrate, a 20-percent decrease below 1956. Sales were 1,828 tons (60-percent WO_3 basis) compared with 2,732 tons in 1956, a decline of 33 percent in tonnage and almost 70 percent in value. Tungsten Mining Co. DMEA contract of \$246,600 for exploration at the Hamme mine continued in force throughout the year.

TABLE 11.—Tungsten concentrates produced and shipped, 1948–52 (average) and 1953–57

Year	Produced		Shipped from mines	
	Short tons, 60-percent WO_3 equivalent	Units	Short tons, 60-percent WO_3 equivalent	Units
1948–52 (average).....	1,051	63,052	1,054	63,244
1953.....	2,146	128,645	2,074	124,465
1954.....	2,519	151,166	2,538	152,296
1955.....	2,638	158,304	2,609	156,537
1956.....	2,858	171,451	2,732	163,913
1957.....	2,287	137,215	1,828	109,675

REVIEW BY COUNTIES

Ninety-six of the 100 counties in North Carolina reported mineral production; Vance, Mitchell, Guilford, Ashe, and Cleveland were the leaders. In addition to the detailed county production listed in table 12, a considerable quantity of crude feldspar, 305,000 pounds of sheet mica, 1,800 tons of scrap mica, and a small quantity of gem stones were produced; all these were of undetermined county origin.

Alamance.—Boren & Harvey (Snow Camp mine) mined 10,300 tons of pyrophyllite for refractory purposes. North Carolina State Highway and Public Works Commission crushed 39,000 tons of granite for concrete aggregate and roadstone. Hanford Brick Co., Inc., mined miscellaneous clay for heavy clay products. The State highway commission mined 8,000 tons of paving sand.

Anson.—Three operators mined structural, paving, and railroad-ballast sands and structural, paving, railroad-ballast, and other gravels; leading producers were Lessees of B. V. Hedrick and W. R. Bonsal. The State highway commission (Sugartown quarry) crushed 36,000 tons of granite for concrete aggregate and roadstone.

Ashe.—Ashe County ranked fourth in value of mineral production. Appalachian Sulphides, Inc., began producing copper at its new Ore Knob mine and recovered 628 troy ounces of gold and 11,761 troy ounces of silver. Thirteen mines produced 24,000 pounds of sheet and 38 tons of scrap mica; leading companies were Duncan Mining Co. (Duncan mine) and P. & W. Mining Co. (Hardin mine). Macon Construction Co. and the State highway commission mined 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 49 mines; leading pro-

ducers of sheet mica were Harold Benfield (Mill Race mine) and Penland Mining Co. (Charlie Ridge mine); the leading producer of scrap mica was Harris Clay Co. Five DMEA mica contracts were active.

The Feldspar Corp. mined crude feldspar at the Buchanan, Pine Patch, Dugger, and Burleson mines. Harris Clay Co. mined a small quantity of structural sand. Floyd Wilson produced a small quantity of gem stones.

Buncombe.—Three operators mined structural and paving sands and structural, paving, and railroad-ballast gravels; the leading producers were Grove Stone & Sand Branch of B. V. Hedrick Gravel

TABLE 12.—Value of mineral production in North Carolina, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Alamance.....	\$138,410	\$138,563	Talc, granite, miscellaneous clay, sand and gravel.
Alexander.....	11,858	14,682	Sand and gravel.
Alleghany.....	3,523		
Anson.....	(²)	(²)	Sand and gravel, granite.
Ashe.....	(²)	(²)	Copper, mica, sand and gravel, gold, silver.
Avery.....	989,311	(²)	Kaolin, mica, feldspar, sand and gravel, gem stones.
Beaufort.....	50,426	48,600	Sand and gravel.
Bertie.....	1,530	1,000	Do.
Bladen.....	62,050	70,600	Do.
Brunswick.....	40,900	13,300	Do.
Buncombe.....	(²)	(²)	Sand and gravel, granite, mica.
Burke.....	64,254	76,139	Sand and gravel, mica, beryl.
Cabarrus.....	(²)	4,000	Sand and gravel.
Caldwell.....	(²)	189,823	Granite, sand and gravel, miscellaneous clay, mica.
Camden.....	8,000	3,750	Sand and gravel.
Carteret.....	1,500		
Caswell.....	748,696	(²)	Granite, sand and gravel.
Catawaba.....	(²)	(²)	Granite, miscellaneous clay, sand and gravel, mica.
Chatham.....	219,383	210,446	Miscellaneous clay, granite.
Cherokee.....	294,122	(²)	Marble, talc, sand and gravel.
Chowan.....	25,000	8,500	Sand and gravel.
Cleveland.....	(²)	(²)	Limestone, mica, sand and gravel, miscellaneous clay.
Columbus.....	81,000	34,160	Sand and gravel.
Craven.....	7,500	(²)	Limestone, sand and gravel.
Cumberland.....	363,255	222,156	Sand and gravel, miscellaneous clay.
Currituck.....	5,500	5,000	Sand and gravel.
Dare.....	15,000	16,000	Do.
Davidson.....	109,200	(²)	Slate, sand and gravel, miscellaneous clay.
Davie.....	36,540	40,592	Sand and gravel, feldspar, beryl, mica.
Duplin.....	2,320	12,000	Sand and gravel.
Durham.....	(²)	(²)	Granite, miscellaneous clay.
Forsyth.....	583,635	1,094,742	Granite, sand and gravel, feldspar.
Franklin.....	5,638	3,000	Sand and gravel.
Gaston.....	61,538	51,631	Mica, sand and gravel, miscellaneous clay.
Gates.....	7,000	6,250	Sand and gravel.
Granville.....	23,784	16,000	Granite, sand and gravel.
Greene.....	45,000	30,000	Sand and gravel.
Gulford.....	(²)	2,810,154	Granite, miscellaneous clay, sand and gravel.
Halifax.....	36,543	44,735	Gold, miscellaneous clay, lead, sand and gravel, copper, silver, zinc.
Harnett.....	(²)	(²)	Sand and gravel.
Haywood.....	(²)	(²)	Sand and gravel, mica.
Henderson.....	250,100	272,402	Limestone, miscellaneous clay.
Hertford.....	6,188		
Hoke.....	(²)	(²)	Sand and gravel.
Hyde.....	31,538	1,100	Do.
Iredell.....	30,401	25,317	Do.
Jackson.....	(²)	(²)	Olivine, sand and gravel, mica.
Johnston.....	26,000	20,000	Granite, sand and gravel.
Jones.....	24,675	(²)	Sand and gravel.
Lee.....	257,228	(²)	Miscellaneous clay, sand and gravel.
Lenoir.....	142,805	131,697	Sand and gravel.
Lincoln.....	(²)	31,552	Mica, sand and gravel.
Macon.....	(²)	260,797	Mica, sand and gravel, gem stones.
Madison.....	(²)	(²)	Feldspar, gem stones.
Martin.....	15,058	2,000	Sand and gravel.
McDowell.....	(²)	310,854	Sand and gravel, limestone.
Mecklenberg.....	(²)	(²)	Granite.
Mitchell.....	3,969,729	(²)	Feldspar, mica, sandstone, gem stones.
Montgomery.....	114,134	(²)	Miscellaneous clay, sand and gravel.
Moore.....	(²)	(²)	Pyrophyllite, sand and gravel.
Nash.....	(²)	(²)	Granite, sand and gravel, miscellaneous clay.

See footnotes at end of table.

TABLE 12.—Value of mineral production in North Carolina, 1956-57, by counties 1—Continued

County	1956	1957	Minerals produced in 1957 in order of value
New Hanover	\$15,000	(2)	Sand and gravel.
Northampton	241,766	(2)	Do.
Onslow	(2)	(2)	Limestone, sand and gravel.
Orange	(2)	(2)	Pyrophyllite, granite.
Pamlico	750		
Pasquotank	16,200	\$6,250	Sand and gravel.
Pender	1,340	4,200	Do.
Perquimans	4,000	3,500	Do.
Person	6,068	8,363	Do.
Pitt	84,296	63,000	Do.
Polk	25,000	26,000	Sand and gravel, granite.
Randolph	(2)	(2)	Granite, pyrophyllite, sand and gravel, gem stones.
Richmond	5,120	6,300	Sand and gravel.
Robeson	28,500	42,100	Do.
Rockingham	208,831	(2)	Granite, miscellaneous clay, sand and gravel.
Rowan	1,220,936	1,553,598	Granite, miscellaneous clay, sand and gravel, abrasive stones.
Rutherford	171,369	(2)	Sand and gravel, mica.
Sampson	123,854	127,074	Miscellaneous clay, sand and gravel.
Scotland	15,898	3,770	Sand and gravel.
Stanly	234,490	181,600	Miscellaneous clay.
Stokes	253,892	(2)	Mica, miscellaneous clay, sand and gravel.
Surry	(2)	(2)	Granite, sand and gravel.
Swain	(2)	265,447	Limestone, granite, feldspar, sandstone.
Transylvania	170	(2)	Granite, sand and gravel, asbestos, mica.
Tyrrell	300	550	Sand and gravel.
Union	(2)	(2)	Traprock, granite, miscellaneous clay.
Vance	(2)	(2)	Tungsten, granite.
Wake	(2)	(2)	Granite, sand and gravel, mica.
Washington	1,766	8,000	Sand and gravel.
Watauga	(2)	67,800	Granite, sand and gravel, mica.
Wayne	140,573	54,453	Sand and gravel.
Wilkes	(2)	(2)	Sand and gravel, mica.
Wilson	1,774,309	(2)	Granite, sand and gravel.
Yadkin	(2)	(2)	Do.
Yancey	765,027	660,448	Mica, feldspar, olivine beryl.
Undistributed	* 26,654,060	28,317,000	
Total	\$ 40,873,000	37,570,000	

1 The following counties are not listed because no production was reported: Clay, Edgecombe, Graham, and Warren.

2 Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

* Revised figure.

& Sand Co. and Bell Sand Co. The State highway commission (Weaverville quarry) crushed 28,300 tons of granite for concrete aggregate and roadstone. Seven companies mined 2,310 pounds of sheet mica; leading producers were Steele Mining Co. (Watkins mine) and Black Mining Co. (Black Mountain mine).

One DMEA mica contract was in force.

Burke.—The State highway commission mined 181,000 tons of paving sand and gravel. Mica was produced at 8 mines; leading producers were Tallent & Cook (Britton mine) and Standard Mineral Co. (Hudson mine). S. & B. Mining Co. produced a small quantity of beryl at the Watkins mine. Great Lakes Carbon Corp. produced artificial graphite at its plant in Morganton.

Caldwell.—Clement Bros., Inc. (Caldwell quarry), crushed 100,000 tons of granite for concrete aggregate and roadstone. The State highway commission mined 7,800 tons of paving sand and gravel. Miscellaneous clay was produced by Moore Brick Co. for use in heavy clay products. Three operators produced 170 pounds of sheet mica; leading producers were J. Mack Thompson (Auton mine) and Bowman Bros. (Bowman mine).

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 28,000 tons of paving sand.

Catawba.—Superior Stone Co. (Hickory quarry) crushed granite for concrete aggregate and roadstone. Statesville Brick Co. mined miscellaneous clay for heavy clay products. The State highway commission mined 46,000 tons of paving sand. Oakley Buchanan mined a small quantity of sheet mica at the Drum mine.

Chatham.—Four companies mined 274,000 tons of miscellaneous clay for heavy clay products; the leading producers were Pomona Terra Cotta Co. and Boren Clay Products Co. The State highway commission (Goldston quarry) crushed 58,000 tons of granite for concrete aggregate and roadstone.

Cherokee.—Columbia Marble Co. (Pleasant Valley quarry) quarried dimension marble for exterior stone, dressed building stone, and cut and dressed monumental stone and crushed marble for terrazzo and agstone. The Hitchcock Corp. (Nancy Jordan mine) and Minerals & Metals Corp. (Mulberry Gap mine) mined talc for crayons, insecticides, rubber, textiles, toilet preparations, and other uses. Charles Coleman mined a small quantity of paving gravel.

Cleveland.—Cleveland County ranked fifth in value of mineral production. Superior Stone Co. (Kings Mountain quarry) crushed limestone for concrete aggregate and roadstone. Twenty-eight operators mined mica; leading producers of sheet mica were A. W. Warlick (Warlick mine) and W. H. Humphries & Pink Lovelace (Fred Blanton mine); the leading producer of scrap mica was Kings Mountain Mica Co. (Patterson and Moss mines). The State highway commission mined 41,000 tons of paving sand. Bennett Brick & Tile Co. mined 16,800 tons of miscellaneous clay for heavy clay products. Foote Mineral Co. mined and processed spodumene at Kings Mountain.

Four DMEA mica contracts were in force.

Craven.—Nello L. Teer Co. (Shell quarry) crushed limestone for concrete aggregate and roadstone. The State highway commission mined 3,000 tons of paving sand.

Cumberland.—Three producers mined structural, paving, and railroad-ballast sands and structural and paving gravels; leading producers were Becker County Sand & Gravel Co. (Fayetteville mine) and the State highway commission. Ideal Brick Co. (Linden mine) mined miscellaneous clay for heavy clay products.

Davidson.—Jacob's Creek Flagstone Co., Inc., quarried dimension slate for windowsills. The State highway commission mined 174,000 tons of paving sand and gravel. Cunningham Brick Co. mined 35,300 tons of miscellaneous clay for heavy clay products.

Davie.—The State highway commission mined 67,000 tons of paving sand. The Feldspar Corp. (Smith mine) and Clinchfield Sand & Feldspar Co. (Porter-Strand mine) mined crude feldspar. Dock Brown (Brown mine) and Boston F. Bledsoe (Bledsoe mine) mined small quantities of beryl. T. L. Letterman (Dock Brown mine) mined 25 pounds of sheet mica.

Durham.—Nello L. Teer Co. crushed granite for concrete aggregate and roadstone. Borden Brick & Tile Co. mined miscellaneous clay for heavy clay products.

Forsyth.—W. E. Graham & Sons (Graham quarry) and Piedmont Quarry Co. (Salem quarry) crushed 751,000 tons of granite for concrete aggregate and roadstone. Ira Pope & Sons, Inc. (Yadkin

River mine), and the State highway commission mined 116,000 tons of structural and paving sand. The Feldspar Corp. (Meyers mine) produced a small quantity of feldspar.

Gaston.—Seven operators mined sheet and scrap mica; the leading producers were Self Mine Enterprise (Self mine) and Frank W. Phillips (Huskins mine). The State highway commission mined 27,000 tons of paving sand. Kendrick Brick & Tile Co. mined 14,000 tons of miscellaneous clay for heavy clay products. Lithium Corp. of America processed foreign lithium ore at its Bessemer City plant.

Granville.—The State highway commission crushed 6,500 tons of granite for concrete and roadstone and mined 4,000 tons of paving sand.

Guilford.—Guilford County ranked third in value of mineral production. Six quarries produced crushed granite for concrete aggregate, roadstone, and stone sand; leading producers were Superior Stone Co. (McLeansville, Jamestown, and Pomona quarries) and Buchanan Stone Co. (Buchanan quarry). Boren Clay Products Co. (Pleasant Garden mine) mined miscellaneous clay for heavy clay products. The State highway commission mined 5,900 tons of structural sand. The Zonolite Co. exfoliated vermiculite in its plant at High Point.

Halifax.—H & H Mines, Inc., operated the H & H mine and recovered 745 troy ounces of gold, 586 troy ounces of silver, and small quantities of copper, lead, and zinc. Nash Brick Co. (Ita mine) mined 21,000 tons of miscellaneous clay for heavy clay products. The State highway commission mined 7,000 tons of paving sand.

Harnett.—Becker County Sand & Gravel Co. (Senter mine), Southern Sand & Gravel Co., and the State highway commission mined sands for structural, paving, filler, and railroad-ballast purposes and gravel for structural, paving, and railroad-ballast uses.

Haywood.—Sale & Alexander mined structural and paving sands and structural, paving, and other gravels. Fouts Mining Co. (Putnam mine) and Conway Construction Co. (Robinson mine) mined a small quantity of sheet mica.

Henderson.—Fletcher Limestone Co. (Fletcher quarry) and Cogdill Limestone Co., Inc. (Cogdill quarry), crushed 189,000 tons of limestone for concrete aggregate and roadstone. Etowah Brick Co. (Etowah and Fletcher mines) mined miscellaneous clay for heavy clay products.

Hoke.—Cumberland Gravel & Sand Co. (Vass mine) mined structural sand and gravel.

Jackson.—Harbison-Walker Refractories Co. (Addie mine) and Balsam Gap Co. (Balsam Gap mine) mined olivine. J. L. Colville Construction Co. mined paving gravel. Twelve mines produced sheet and scrap mica. Leading producers of sheet mica were Carolina Mining Co. (Eagle Cope mine) and Rice Mining Co. (Rice mine). Alabama Vermiculite Co. exfoliated vermiculite at its plant at Sylva.

Two DMEA mica contracts were in force.

Johnston.—Nello L. Teer Co. (Princeton quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined paving sand and gravel.

Lee.—Sanford Brick & Tile Co. (Colon mine) and Borden Brick & Tile Co. (Sanford mine) mined miscellaneous clay for heavy clay products.

Lenoir.—Barrus Construction Co. (Kinston mine) and the State highway commission mined 160,000 tons of structural and paving sands and 7,000 tons of structural gravel.

Lincoln.—Sixteen mines produced sheet and scrap mica. Leading producers of sheet mica were Lance Crowder (Huskins mine) and Paul Carpenter (Wood mine).

Macon.—Thirty-two mines produced 19,000 pounds of sheet mica; leading producers were Harris Mining Co. (Harris mine) and Mica Development Corp. (Chalk Hill mine). Leading producers of scrap mica were Macon Mica Co. (Shepherd Knob mine) and H. H. Plemons (Bowers mine). Hays Block Co. and John D. Miller mined structural sand and gravel. Mrs. George Gardner, Otis R. Lugar, and W. M. Johnson mined a small quantity of gem stones. Roy M. Biddle exfoliated vermiculite at the Franklin plant.

Two DMEA mica contracts were in force.

Madison.—The Feldspar Corp. produced a small quantity of feldspar at the Robinson mine. Otis L. Lugar and W. M. Johnson mined a small quantity of gem stones.

McDowell.—Becker County Sand & Gravel Co. (Marion mine) mined structural and paving sands and structural, paving, and railroad-ballast gravels. The State highway commission (Woodlawn quarry) crushed 87,000 tons of limestone for concrete aggregate and roadstone.

Mecklenberg.—Superior Stone Co. (Charlotte quarry) and the State highway commission (Mechlenberg quarry) crushed granite for concrete aggregate and roadstone.

Mitchell.—Mitchell County ranked second in value of mineral production. Seven companies mined crude feldspar; the leading producers were International Minerals & Chemical Corp. (Hawkins and Kona mines) and the Feldspar Corp. (Wiseman, Poteat, Dogwood Flats, Bennett, Glenn, Neilus, Sullins, Vance, and Gopher mines). Mica was produced at 104 mines. Leading producers of sheet mica were Abernathy Mining Co. (Abernathy mine), Sink Hole Miners (Sink Hole mine), and R & B Mining Co. (R. B. Phillips mine). Leading producers of scrap mica were International Minerals & Chemical Corp. (Hawkins and Kona mines) and the Feldspar Corp. (Wiseman and Poteat mines).

International Minerals & Chemical Corp. and the Feldspar Corp. recovered crushed sandstone (quartz) from feldspar milling. Greene's Mineral & Gift Shop mined a small quantity of gem stones.

Eighteen DMEA mica contracts were in force.

Montgomery.—Mt. Gilead Brick Co. mined miscellaneous clay for heavy clay products.

Moore.—Standard Mineral Co., Inc., and Glendon Pyrophyllite Co. mined pyrophyllite for asphalt filler, ceramic, insecticide, paint, refractory, rubber, and other uses. Five mines produced structural and paving sands; leading producers were Pleasants Sand & Supply Co. (Pleasant mine) and Bryan Rock & Sand Co. (Montrose and West End mines).

Nash.—Nello L. Teer Co. (Castalia quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined sand for paving. Nash Brick Co. mined miscellaneous clay for heavy clay products.

New Hanover.—Mrs. E. L. Robbins mined sand for fertilizer filler.

Northampton.—Bryan Rock & Sand Co. (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.

Orange.—Boren & Harvey (Hillsboro mine) mined pyrophyllite for refractory uses. The State highway commission (Bacon quarry) crushed granite for concrete aggregate and roadstone. Duke University (Hillsboro quarry) produced dimension granite for rough construction.

Polk.—J. C. Williams quarried 150 tons of granite for rough construction.

Randolph.—The State highway commission (Parks Cross Road and Glenola quarries) crushed granite for concrete aggregate and roadstone. Carolina Pyrophyllite Co., Inc. (Gerhardt mine), mined pyrophyllite for ceramic uses. Greene's Mineral & Gift Shop mined a small quantity of gem stones.

Rockingham.—The State highway commission (Newman quarry) crushed granite for concrete aggregate and roadstone and mined a small quantity of paving sand. Pine Hall Brick & Pipe Co. (Madison mine) and Roanoke-Webster Brick Co., Inc. (Draper mine), mined miscellaneous clay for heavy clay products.

Rowan.—Superior Stone Co. (Woodleaf and Kannapolis quarries) crushed granite for concrete aggregate and roadstone. Young Stone Co. began crushing granite for concrete aggregate. Five quarries produced dimension granite; leading producers were Harris Granite Quarries Co. (Collins, Balfour, and Shuping quarries) and H. P. Stirewalt. Carolina Tufflite Co. and Isenhour Brick & Tile Co. mined miscellaneous clay for lightweight aggregate and heavy clay products. Gardner Granite Works produced millstones. Harris Granite Quarries Co. produced tube-mill liners and grinding pebbles. Carolina Perlite Co. expanded perlite at its mill.

Rutherford.—The State highway commission and A. R. Thompson, contractor, mined paving sand and paving gravel. Mica was produced at eight mines; leading producers of sheet mica were Frank W. Phillips (Dycus mine) and Mace & Son (Mace mine). Leading producer of scrap mica was Frank W. Phillips (Dycus mine).

One DMEA mica contract was in force.

Stanley.—Southern Lightweight Aggregate Corp. (Aquadale mine), Stanly Shale Products Co. (Norwood mine), and Yadkin Brick Yards, Inc., mined 310,000 tons of miscellaneous clay for lightweight aggregates and heavy clay products. Carolina Aluminum Co. produced aluminum metal at Badin.

Stokes.—Six mines produced mica. The leading producers of mica were Stokes County Mining Co. (Sandy Ridge mine) and Lemmie & Curtis Mabe (Mabe mine). Pine Hall Brick & Pipe Co. (Nos. 1 and 2 mines) mined miscellaneous clay for heavy products.

Surry.—North Carolina Granite Corp. quarried dimension granite for rough construction, rubble, rough-architectural building stone, dressed construction and dressed-architectural building stone, rough and dressed monumental stone, paving block, and curbing and flagging. North Carolina Granite Corp. (Mt. Airy quarry) and W. E. Graham & Sons produced granite for riprap, concrete aggregate, roadstone, and other uses.

Swain.—Nantahala Talc & Limestone Co. (Hewitt quarry) crushed 133,000 tons of limestone for concrete aggregate, roadstone, and agstone. The State highway commission crushed 59,000 tons of granite for concrete aggregate and roadstone. The Feldspar Corp. (Alexander mine) mined feldspar. J. O. DeBord (Needmore quarry) quarried 200 tons of sandstone for flagging.

Transylvania.—McCrary Contracting Service (Penrose quarry) crushed granite for concrete aggregate and roadstone. Seniard Bros. mined a small quantity of paving gravel. Powhattan Mining Co. (Kilpatrick mine) mined asbestos. Marson Baynard (Chestnut Ridge mine) mined a small quantity of sheet mica.

Union.—Superior Stone Co. (Bakers quarry) crushed traprock for concrete aggregate and roadstone. The State highway commission crushed 103,000 tons of granite for concrete aggregate and roadstone. Kendrick Brick & Tile Co. (Monroe mine) mined 85,000 tons of miscellaneous clay for heavy clay products.

Vance.—Tungsten Mining Corp. (Hamme mine) shipped tungsten concentrates. Greystone Granite quarries crushed granite for concrete aggregate and roadstone.

DMEA activity consisted of a contract with Tungsten Mining Corp.

Wake.—Bryan Rock & Sand Co. (Crabtree and Rolesville quarries) and Nello L. Teer Co. (Raleigh quarry) crushed granite for concrete aggregate and roadstone. East Piedmont Mining Co. mined a small quantity of sheet mica.

Watauga.—W. E. Graham & Sons and the State highway commission crushed 83,000 tons of granite for concrete aggregate and roadstone and mined 2,900 tons of paving gravel. Ronald C. Cook (Cliff mine), Jesse Callahan (Dollie Shell mine), and Nathan Ollis (Joe Beam mine) mined 230 pounds of sheet mica.

Wayne.—Bryan Rock & Sand Co. (Goldsboro mine) and the State highway commission mined 67,000 tons of structural and paving sands and paving gravel.

Wilkes.—Macon Construction Co. and the State highway commission mined paving sand and paving gravel. R. L. Auton (Williams mine), Wilburt C. Cook (Hill mine), and Dufay Blackwell (Brown mine) mined small quantities of sheet mica.

Wilson.—Bryan Rock & Sand Co. (Neverson and Elm City quarries) crushed granite for concrete aggregate, roadstone, and other uses.

Yadkin.—J. E. Dooley (Cycle quarry) crushed granite for concrete aggregate and roadstone.

Yancey.—A total of 80 mines produced 33,000 pounds of sheet mica; the leading producers were Gouge & Allen (Barger mine), Hector Mining Co. (Barger No. 2 mine), and Pitman & Burlison (Ed Sparks mine). The leading producers of scrap mica were Guy McCurry (Young Mica mine) and Southern Mica Co. of N. C., Inc. (Thompson mine). Seven DMEA mica contracts were in force.

The Feldspar Corp. (Mud Hole, Webb, Laws, McCurry, and Geouge mines) and Ward Woody (Ward Woody mine) mined crude feldspar; C. R. Wiseman (Wray mine) olivine; M. P. Lipe a small quantity of beryl.

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, United States Department of the Interior, and the State Geological Survey of North Dakota.

By D. H. Mullen ¹



IN 1957 North Dakota mineral production reached a new record value of \$57.8 million and maintained the steady upward climb begun in 1938. The gain of \$4.2 million (8 percent) compared with 1956 can be attributed chiefly to the increased value of petroleum, natural gas, and natural-gas liquids. The value of sand and gravel and sulfur advanced, whereas the value of clays, coal, pumice, and stone declined.

The combined value of the mineral fuels in 1957 increased \$3.4 million (7 percent) compared with 1956. As a group this represented 91 percent of the total value of the State mineral production. The decline in coal (lignite) production resulted from increased power available from hydroelectric plants on the Missouri River and the greater use of natural gas in the eastern part of the State.

Exploratory drilling rose 88 percent over 1956, and 25 discoveries (including 1 gasfield) were listed during the year. Several of these discoveries were later determined to be on previously developed pools and were not considered official discoveries. New production horizons were discovered in three fields. The most outstanding discovery was the Lignite field in Burke County, where a program of drilling covered an area of 144 square miles and resulted in 7 discoveries. The bulk of petroleum was produced from the Madison limestone; small quantities came from the Sanish and Heath sandstones. Production from Silurian and Devonian formations in the Beaver Lodge field created considerable interest in these horizons in this and other fields, and several tests were in progress at year end.

EMPLOYMENT

Employment in the mineral industries during 1957 averaged 1,674, including nearly 1,300 workers in the oilfields and petroleum-processing plants. General contractors, except for building and special trade contractors, employed an average of 3,113; this category includes contractors engaged in heavy construction, such as roadbuilding, which involves production of substantial quantities of sand and gravel. The total nonagricultural employment averaged 118,367 workers.

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

TABLE 1.—Mineral production in North Dakota, 1956-57 ¹

Mineral	1956		1957	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays ¹ thousand short tons..	52	\$71	54	\$87
Coal (lignite)..... do.....	2,815	6,578	2,561	5,947
Natural gas..... million cubic feet..	11,725	950	12,400	1,100
Petroleum (crude)..... thousand 42-gallon barrels..	13,495	39,136	13,642	42,699
Pumice..... thousand short tons..	5	5	2	2
Sand and gravel..... do.....	5,946	4,259	7,048	4,967
Stone..... do.....	83	87	29	52
Sulfur (shipments)..... long tons..	1,735	46	10,314	264
Value of items that cannot be disclosed: Bentonite, gem stones (1957), and natural-gas liquids.....		2,423		2,698
Total North Dakota.....		53,555		57,796

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

* Excludes bentonite; value included with "Items that cannot be disclosed."

† Preliminary figure.

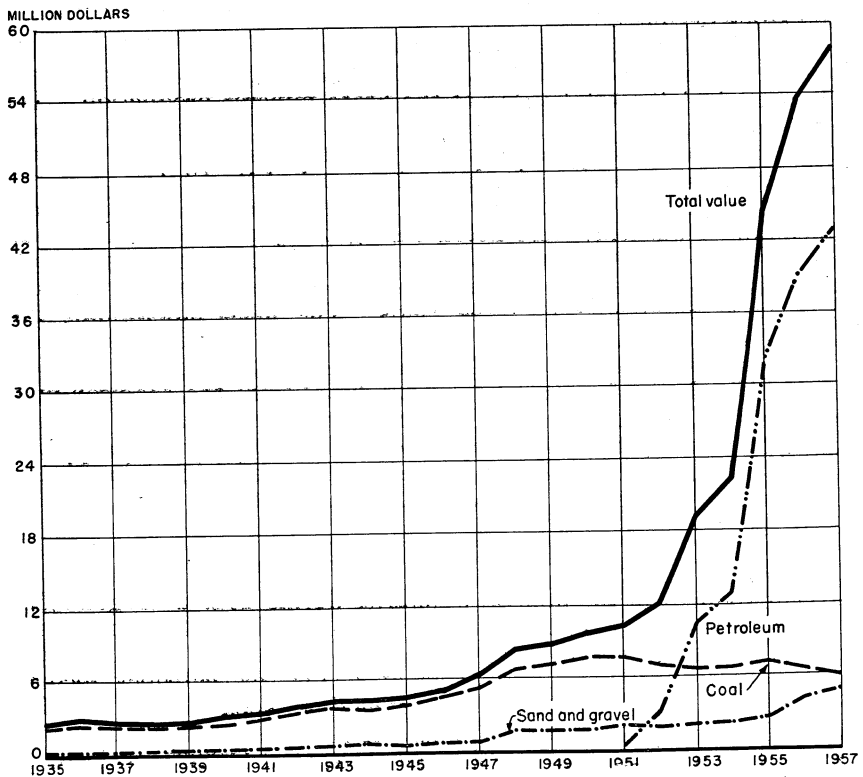


FIGURE 1.—Value of sand and gravel, petroleum, and coal, and total value of mineral production in North Dakota, 1935-57.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—Coal (lignite) was produced at 38 mines (yielding 1,000 tons or more annually) in 15 counties compared with 44 mines in 16 counties reported in 1956. A decline in production in 1957 of 9 percent in quantity and 10 percent in value from 1956 reflected the increase in power available from hydroelectric plants on the Missouri River and the increased supply of natural gas in the eastern counties. Production in 1957 came from 36 strip mines and 2 underground mines. Coal was prepared for market by crushing and sizing at 19 mines; 14 mines used oil to allay dust; and 2 used wax. Mercer County led the State in producing coal from 5 mines, followed by Ward County (4 mines), Burke County (2 mines), Divide, and Bowman Counties (1 mine each).

Studies in the field of gasification of lignites continued at the Bureau of Mines Charles R. Robertson Lignite Laboratory at Grand Forks. Results of experimental work were published.³

TABLE 2.—Production of coal (lignite), 1956-57, by counties

(Exclusive of mines producing less than 1,000 tons)

County	1956		1957	
	Short tons	Average value per ton ¹	Short tons	Average value per ton ¹
Adams.....	33,589	\$2.74	26,325	\$2.65
Bowman.....	211,943	1.85	195,217	1.77
Burke.....	430,507	2.31	441,634	2.27
Burleigh.....	13,867	3.26	13,637	3.28
Divide.....	236,374	2.45	243,012	2.45
Dunn.....	12,600	2.33	11,029	2.92
Grant.....	25,049	3.04	21,333	3.32
Hettinger.....	11,908	2.74	8,655	2.93
McKenzie.....	1,925	3.94		
McLean.....	123,772	2.90	114,939	2.90
Mercer.....	993,690	2.25	912,663	2.36
Morton.....	30,934	2.47	23,396	2.43
Oliver.....	9,739	2.39	9,521	2.56
Stark.....	79,933	2.31	67,734	2.29
Ward.....	506,444	2.38	463,671	2.41
Williams.....	4,086	4.05	2,836	4.47
Total.....	2,815,174	2.34	2,590,652	2.32

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).

Natural Gas.—Natural gas, from 30 wells in the Cedar Creek and Little Missouri gasfields in Bowman County and from the Tioga oilfield in Williams County, was processed in the natural-gasoline plant at the field and marketed through lines of the Montana-Dakota Utilities Co. to consumers in North Dakota, Montana, Wyoming, and South Dakota. The quantity sold in 1957 was an estimated 12.4 billion cubic feet, a 6-percent increase over 1956. The total production of gas from both oilfields and gasfields was 18.5 billion cubic feet.

³ Oppelt, W. H., Kamps, T. W., Gronhord, C. H., Kube, W. B., and McMurtrie, R., Production of Crude Ammonia-Synthesis Gas from North Dakota Lignite in an Annular-Retort Gasifier: Bureau of Mines Rept. of Investigations 5297, 1957, 29 pp.

Gas produced in fields without pipeline connections was flared, repressured, or wasted. Natural gas used in the eastern part of the State was imported from fields in other States.

One new gasfield, Max Bass, was discovered in Bottineau County in April.

Natural-Gas Liquids.—The natural-gasoline plant at the Tioga field in Williams County was active the entire year. Natural gas from the Tioga and Beaver Lodge fields was processed; natural gasoline, propane, butane, and elemental sulfur were recovered. Throughput at the plant in 1957 was 14 billion cubic feet of wet gas. Processed gas amounting to 7.3 billion cubic feet was marketed through pipelines serving western North Dakota and adjoining States. The quantity of natural gasoline, propane, and butane recovered was 7 percent greater than in 1956.

Petroleum.—Crude petroleum produced in 1957 in 10 counties from 920 wells in 44 fields increased 1 percent in quantity and 9 percent in value compared with 1956. The State ranked 15th among the 30 States producing petroleum. Total production was an estimated 13.6 million barrels. Exploratory drilling increased sharply in 1957; 149 wells were completed and the total footage was 810,700, compared with 78 completions and a total footage of 431,400 in 1956. Twenty-five discoveries, 1 a gasfield, were made in 1957 compared with 8 in 1956. Success ratios were 1:6.0 and 1:9.8, respectively. Development drilling decreased 10 percent from 185 completions in 1956 to 167 in 1957. Successes, however, increased from 84 percent in 1956 to 90 in 1957. Total drilling increased 20 percent over 1956.

The most successful exploratory drilling was in Burke County, where 10 discoveries were listed. Some of these discoveries were later determined to be on pools previously discovered; therefore only seven new fields were credited to the county during the year. Other drilling in Bottineau, Divide, and Ward Counties added four more fields to the area north and east of the Nesson anticline. One of the discoveries was the first in Ward County. Exploration on the Nesson anticline in Billings, McKenzie, Stark, and Williams Counties added seven more fields to the area. New producing horizons were discovered in three fields.

TABLE 3.—Production of crude petroleum, 1956–57, by counties ¹

(Thousand barrels)

County	1956	1957 (preliminary)	Principal producing fields in 1957
Billings.....	172	234	Fryburg, Rocky Ridge.
Bottineau.....	392	423	Westhope-N, Landa-NE, Kuroki, Souris-N.
Burke.....	126	310	Tioga, Lignite, Flaxton, Rival.
Divide.....	11	22	Noonan.
McKenzie.....	2,054	3,391	Blue Buttes, Charlson, Antelope, Sanish.
Mountrail.....	2,514	2,156	Tioga, White Earth, Tioga-E.
Renville.....	9	3	Bluell.
Stark.....	1	3	Dickinson.
Ward.....	.....	3	Aurelia-SW.
Williams.....	8,216	7,097	Tioga, Beaver Lodge, Capa, Hofflund.
Total.....	13,495	13,642	

¹ Based on North Dakota Geological Survey county data adjusted to Bureau of Mines total.

TABLE 4.—Wildcat and development well completions in 1957, by counties
[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage
WILDCAT					
Billings.....	1			1	8,100
Bottineau.....	4	1	42	47	172,500
Bowman.....			1	1	9,600
Burke.....	10		13	23	152,700
Burleigh.....			3	3	15,000
Dickey.....			1	1	3,200
Divide.....	1		2	3	25,000
Dunn.....			1	1	9,800
Grand Forks.....			2	2	2,200
Logan.....			9	9	29,300
McHenry.....			12	12	48,400
McIntosh.....			1	1	2,600
McKenzie.....	4		6	10	97,000
McLean.....			1	1	6,600
Mountrail.....			2	2	17,300
Nelson.....			1	1	1,700
Pierce.....			1	1	3,200
Renville.....			10	10	53,100
Rolette.....			3	3	11,600
Sheridan.....			3	3	12,600
Slope.....			1	1	9,000
Stark.....	1		3	4	36,900
Ward.....	1		3	4	27,300
Wells.....			1	1	3,800
Williams.....	2		2	4	52,200
Total wildcat.....	24	1	124	149	810,700
DEVELOPMENT					
Billings.....	2		2	4	34,200
Bottineau.....	15		5	20	70,400
Burke.....	23		3	26	183,800
Divide.....	1			1	7,300
McKenzie.....	74		2	76	712,100
Mountrail.....	6			6	50,000
Ward.....			2	2	13,600
Williams.....	30		2	32	275,300
Total development.....	151		16	167	1,346,700
Total drilling.....	175	1	140	316	2,157,400

Development drilling in 1957 was not as extensive as in 1956, but the percentage of successful completions was greater. More than 100 of the successful development wells completed were on the Nesson anticline at the Antelope, Blue Buttes, and Tioga fields in Burke, McKenzie, and Williams Counties. Development drilling east of the Nesson anticline was mostly at the Lignite and Newburg fields in Bottineau and Burke Counties.

Refineries at Mandan (Standard Oil of Indiana) and Williston (Westland Oil Co.) operated the entire year. The refinery at Dickinson remained idle.

NONMETALS

Clays.—Miscellaneous clay was produced in Adams and Morton Counties for building brick, draintile, and other heavy clay products. A small quantity of bentonite produced in Morton County was used in foundries and in manufacturing refractories. Shale produced in Divide and Morton Counties was used for lightweight aggregate. Production of miscellaneous clay in 1957 increased 4 percent in volume but decreased 5 percent in value compared with 1956.

Gem Stones.—Specimens of petrified wood collected along the Canadian border were sold to collectors and dealers.

Pumice.—Shale, partly fused by fires in underlying coal beds and locally termed "scoria," was mined in Bowman and Mercer Counties for use in road construction. The quantity produced in 1957 declined 52 percent compared with 1956.

TABLE 5.—Sand and gravel sold or used by producers in 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thou- sand short tons	Value		Thou- sand short tons	Value	
		Thou- sands	Average per ton		Thou- sands	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	301	\$291	\$0. 97	551	\$403	\$0. 73
Paving.....	110	88	. 80	127	91	. 72
Filter.....				(¹)	(¹)	1. 00
Other.....				5	3	. 63
Total sand.....	411	379	. 92	683	497	. 73
Gravel:						
Building.....	314	390	1. 24	229	388	1. 69
Paving.....	623	429	. 69	1, 881	1, 303	. 69
Railroad ballast.....	303	270	. 89	232	177	. 76
Other.....	70	49	. 71	172	86	. 50
Total gravel.....	1, 310	1, 138	. 87	2, 514	1, 954	. 78
Total sand and gravel.....	1, 721	1, 517	. 88	3, 197	2, 451	. 77
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	3	2	. 67			
Paving.....	1, 500	750	. 50	83	34	. 41
Total sand.....	1, 503	752	. 50	83	34	. 41
Gravel:						
Building.....	227	272	1. 20	41	35	. 85
Paving.....	2, 495	1, 718	. 69	3, 727	2, 447	. 66
Total gravel.....	2, 722	1, 990	. 73	3, 768	2, 482	. 66
Total sand and gravel.....	4, 225	2, 742	. 65	3, 851	2, 516	. 65
ALL OPERATIONS						
Sand.....	1, 914	1, 131	. 59	766	531	. 69
Gravel.....	4, 032	3, 128	. 78	6, 282	4, 436	. 71
Grand total.....	5, 946	4, 259	. 72	7, 048	4, 967	. 70

¹ Less than 1 thousand.

Sand and Gravel.—Production of sand and gravel in 1957 by commercial producers and by Government-and-contractor operators increased 19 percent in quantity and 17 percent in value compared with 1956. Production by commercial producers increased 86 percent, but output by Government-and-contractor operators declined 9 percent. The decrease reported by Government-and-contractor operators represents completion of fewer roadbuilding contracts in 1957 rather than an actual drop in production. The State highway department and many counties report output in terms of completed contracts instead of total production during the year. Of the 1957 output,

83 percent was used for paving and road building. Government-and-contractor operators produced 65 percent of the sand and gravel used for road building and 72 percent of this quantity was by and for the State highway department.

Progress of construction of the National System of Interstate and Defense Highways in North Dakota, according to a report by the United States Department of Commerce, Bureau of Public Roads, showed that 209.3 miles of highway had been programmed, of which 92.4 miles of construction had been authorized between July 1, 1956, and December 31, 1957. Of the 92.4 miles authorized, 54.3 miles had been completed, and 28.2 miles was under construction. The total cost of the program by the end of 1957 was \$45.5 million. A balance of \$13.7 million remains for future programming and construction.

Sand and gravel production was reported in 29 of 53 counties in the State; 21 counties reported commercial production and 17 counties reported Government-and-contractor production. A substantial quantity produced for the State highway department was not identified by county of origin.

Leading commercial producers included Bradshaw Gravel Co., Lindteigen Construction Co., Minot Sand & Gravel Co., Norgaard & Hilling, Roy Schleffler, Inc., and Schultz & Lindsay Gravel Co. The principal contractors were Casey Construction Co., Haggart Construction Co., Joe Mayo & Son, W. H. Noel Co., and Clarence Wiseman.

Stone.—Stone production in 1957 was limited to broken granite for riprap produced by contractors for the State highway department in various parts of the State. Production in 1957 declined 65 percent compared with 1956.

Sulfur.—Sulfur was recovered by the Signal Oil & Gas Co. at its natural-gasoline plant at Tioga, Williams County. The sulfur was extracted from natural gas by the Modified Claus process. Production in 1957 was 11,614 long tons, of which 10,314 tons was sold. Shipments in 1957 increased sixfold compared with 1956.

Vermiculite.—Crude vermiculite from deposits in Montana was exfoliated at a plant in Ward County. The exfoliated material was used principally for insulation; small quantities were used as a light-weight aggregate and as a soil conditioner.

METALS

Uranium.—Landis-Gress-McCann-Getting Uranium Association explored uraniumiferous lignites in Billings County drilling 40,000 feet with rotary tools. No shipments were made. Experimental work continued at Grand Junction, Colo., on extracting uranium from the uraniumiferous lignites. Raw Materials Division, Atomic Energy Commission (AEC), announced that extraction of uranium from the lignites was technically possible, but the cost of extraction would be higher than at mills now processing carnotite-type ores.

Two firms, Ohio Oil Co.-Arthur Pew Associates and International Resources Co., submitted proposals to AEC for concentrate-purchase contracts that would justify constructing processing plants in North

Dakota and/or South Dakota. Ohio Oil Co.-Arthur Pew Associates later withdrew its proposal, as studies indicated that the proposed processing would not be economically feasible at the ceiling price of \$10.50 a pound of U_3O_8 contained in acceptable concentrate derived from lignites. The proposal by International Resources Co. was being considered by AEC.

A bill was passed by the Congress and signed by the President permitting holders of mining claims on uraniferous lignite to defer assessment work until July 1, 1958. This was to protect holders of the claims while experimental work was being done toward developing a suitable extraction process.

In October AEC announced that no concentrate purchase contracts other than those previously approved would be considered as the capacity of mills operating and under construction was believed to be enough to meet anticipated demands until 1962. Because of possible inadequacy of milling facilities in some areas to process known reserves by 1962, AEC began to study the exploration, development, and reserves of uranium-bearing materials in the Western States to determine whether milling capacity in individual areas was adequate for processing reserves as of November 1, 1957, by 1962. Because no existing facility processed uraniferous lignites, some capacity would apparently be authorized. Completion of the study was expected early in 1958.

REVIEW BY COUNTIES

Barnes.—Barnes County continued to lead the State in the quantity of sand and gravel produced by Government-and-contractor operations. Output in 1957—229,500 tons, all produced by crews of the county highway department—increased 17 percent over 1956. The county ranked sixth in the State in the quantity of sand and gravel produced.

Billings.—Petroleum was produced from the Heath and Madison formations in the Fryburg field discovered in 1953. The discovery well, Lucy Fritz No. 1, was drilled in 1956 and completed in January 1957 in the Heath sandstone of the Rocky Ridge field. The Scoria field was discovered December 23, when the Scoria Unit No. 1 well was completed and began producing from the Heath sandstone and Madison limestone. The county ranked sixth in the State in petroleum production and was eighth in the State in value of mineral production.

Bottineau.—Petroleum production in 1957 increased 8 percent compared with 1956. The county ranked fourth in the State in petroleum production and seventh in the value of minerals produced. Production came from 10 fields; 1 was a 1957 discovery. A new producing horizon was discovered in the Newburg field. The original discovery in 1955 was from the Spearfish, and in 1957 the Henry No. 1 well was completed in the Spearfish, which is Triassic in age, and the Charles, which is Mississippian. The Wayne field was discovered in April when the Oscar Fossum No. 1 well was completed in the Madison limestone at a depth of 4,310 feet. The Russell R. Smith well, 8 miles south of the Westhope field, completed late in December, was the discovery well of the South Westhope field. Production came from the Spearfish formation at a depth of 3,680 feet. The Max

Bass gasfield was discovered in April, when the Leslie Romine No. 1 well was completed at a depth of 184 feet in the glacial drift. Initial flow was 10,000 cubic feet a day. The well was shut in.

TABLE 6.—Value of mineral production in North Dakota, 1956-57, by counties ¹

County	1956	1957 ²	Minerals produced in 1957 in order of value
Adams.....	\$106,567	\$70,607	Coal, clays.
Barnes.....	147,000	159,800	Sand and gravel.
Benson.....	39,500	80,600	Do.
Billings.....	498,800	732,126	Petroleum.
Bottineau.....	1,136,800	1,325,264	Do.
Bowman ³	393,196	348,276	Coal, pumice.
Burke.....	1,477,842	2,006,621	Coal, petroleum, sand and gravel.
Burleigh.....	188,567	119,660	Sand and gravel, coal.
Cass.....		246,400	Sand and gravel.
Dickey.....	15,000		
Divide.....	750,893	702,901	Coal, petroleum, sand and gravel, clays.
Dunn.....	35,630	32,235	Coal.
Eddy.....	47,250	(⁴)	Sand and gravel.
Foster.....	22,000		
Grand Forks.....	127,000	304,700	Sand and gravel.
Grant.....	76,218	60,116	Coal.
Griggs.....	13,000		
Hettinger.....	47,043	25,359	Coal.
McHenry.....		(⁴)	Sand and gravel.
McIntosh.....	102,750	94,100	Do.
McKenzie.....	6,003,000	10,670,720	Petroleum, sand and gravel.
McLean.....	536,523	640,890	Coal, sand and gravel.
Mercer.....	2,243,076	2,061,782	Coal, pumice.
Morton.....	239,583	199,604	Sand and gravel, coal, clays.
Mountrail.....	7,490,600	6,864,862	Petroleum, sand and gravel.
Nelson.....	121,375	18,000	Sand and gravel.
Oliver.....	22,644	23,802	Coal.
Pierce.....	19,250		
Ramsey.....		16,900	Sand and gravel.
Ransom.....	10,000	21,500	Do.
Renville.....	254,030	7,600	Petroleum.
Richland.....		23,200	Sand and gravel.
Rolette.....	30,500	30,600	Do.
Sargent.....	22,500	(⁴)	Do.
Sheridan.....	42,250	76,700	Do.
Stark.....	258,144	254,135	Coal, sand and gravel, petroleum.
Steele.....		1,800	Sand and gravel.
Stutsman.....	6,000	(⁴)	Do.
Trail.....	37,500	101,400	Do.
Walsh.....	96,250	64,700	Do.
Ward.....	1,567,360	1,421,917	Coal, sand and gravel, petroleum.
Wells.....	35,000	21,900	Sand and gravel.
Williams ⁵	24,001,861	22,738,202	Petroleum, sulfur, sand and gravel, coal.
Undistributed ⁶	5,292,975	6,227,200	
Total.....	53,555,000	57,796,000	

¹ The following counties are not listed because no production was reported: Cavalier, Emmons, Golden Valley, Kidder, La Moure, Logan, Pembina, Sioux, Slope, Towner.

² Values of petroleum and natural gas are preliminary.

³ Excludes natural gas.

⁴ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Excludes natural-gas liquids.

⁶ Includes all natural-gas liquids, natural gas, stone, gem stones (1957), some sand and gravel, and values indicated by footnote 4.

Bowman.—The Montana-Dakota Utilities Co. produced natural gas from 19 wells in the Cedar Creek field and 11 wells in the Little Missouri field and marketed in western North Dakota, Montana, South Dakota, and Wyoming. Both fields produced from the Eagle sandstone. The Knife River Coal Mining Co. output at the Peerless strip mine declined 8 percent compared with 1956. The company also produced shale, partly fused by the burning of underlying coal beds and locally termed "scoria," for road construction.

Burke.—Burke County ranked third in the State in the production of lignite, fifth in the output of petroleum, and fifth in the value of mineral production. Major output of lignite was obtained from the Kincaid strip mine by Truax-Traer Coal Co.

The county was the most active in the State in petroleum exploration; seven new fields were discovered during the year. The most important of the new fields was the Lignite, discovered in July, when the Ed Bunting No. 1 well was completed in the Madison limestone at a depth of 6,640 feet. Initial production was 215 barrels of oil a day. Successful wildcats both north and south of the discovery were listed as new fields but were later included as a part of the Lignite field. The Flaxton field, actually discovered late in December 1956, was not officially listed as a new field until 1957. A discovery well, the Sorum No. 1, was completed on December 29, 1956, in the Madison limestone at a depth of 6,295 feet.

Other 1957 discoveries were the Entry field, near the Canadian border, in April when the Alfred Walkenhauer No. 1 well was completed in the Madison limestone at a depth of 5,933 feet; the Rival field in October when the Joe Probst No. 1 well was completed in the Madison limestone at a depth of 6,425 feet; the Woburn field in November when the Theodore Olson No. 1 well was completed in the Madison limestone at a depth of 6,315 feet; an unnamed field in November when the Bonnie "B" No. 1 well was completed in the Madison limestone at a depth of 6,390 feet; and the Portal field, also near the Canadian border, in December when the M. Ballantine No. 1 was completed in the Madison limestone at a depth of 6,195 feet.

Production in 1957 more than doubled that in 1956 and came from that part of the Tioga field in Burke County and from the Columbus and Coteau fields, as well as from the fields discovered in 1957. Sandberg Construction Co. and S. Susag produced building sand and gravel and fill gravel.

Cass.—Cass County led the State in producing sand and gravel. R & K Construction and Roy Scheffler, Inc., produced building sand and paving gravel, and the City of Fargo produced paving sand and gravel. Production was 601,600 tons.

Divide.—Mineral products of the county were coal (lignite), clay, sand and gravel, and petroleum. The county ranked fourth in coal production and ninth in the total value of all mineral production. Lignite was produced by Baukol-Noonan, Inc., at the Baukol-Noonan strip mine. Production in 1957 declined 15 percent compared with 1956. The company also produced shale for manufacturing light-weight aggregate. Paving gravel was produced by Dale Shubert, Bober Construction Co., and the county highway department.

Petroleum exploration resulted in discovery of the Baukol-Noonan field in September, when the Klara V. Ecklund No. 1 well was completed at a depth of 6,854 feet in the Madison limestone. Production in 1957 from the Noonan field (discovered in 1956) and the Baukol-Noonan field (discovered in 1957) was double that of 1956.

McKenzie.—The county ranked second in the State in the output of petroleum and in the value of mineral production. Paving gravel was produced by the county highway department. Petroleum production in 1957, from 219 wells in 8 fields, increased 65 percent compared with 1956. Three new fields were discovered, and new

producing horizons were found in two fields. The Fancy Buttes field was discovered in June, when the C. Kerr No. 1 well was completed in the Madison limestone at a depth of 9,606 feet. The Bear Den field was discovered in September, when the Bear Den Unit No. 1 well was completed at a depth of 9,844 feet in the Madison limestone. Dimmick Lake field was discovered in December, when the Angus Kennedy No. 1 well was completed in the Madison limestone at a depth of 9,488 feet. New producing horizons were found in the Sanish sandstone at the Antelope field and in the Madison limestone at the Sanish field. Late in the year development of the Antelope and Sanish fields brought production in the two fields to less than a mile apart, and the fields were combined into the Antelope field.

Substantial production continued from the Antelope, Blue Buttes, and Charlson fields. Development drilling in the Williston basin in 1957 was heaviest in the Blue Buttes field. As the result of 37 successful completions during the year the field was extended north and south to a length of about 14 miles; the greatest width is 2 miles. At the end of the year 84 wells in the field were producing an average daily quantity in excess of 4,000 barrels a day. Total production from the field exceeds 1.7 million barrels since its discovery in 1955.

McLean.—McLean County ranked 3d in the State in the production of sand and gravel, 6th in the output of coal (lignite), and 10th in the value of mineral production. Coal came from four strip mines. Truax-Traer Coal Co., operating the Custer strip, was the major producer, followed by the Underwood Coal Co. and Burns & Wretling Coal Co. Production in 1957 declined 7 percent compared with 1956. Lindteigen Construction Co. produced 307,300 tons of gravel for building and paving compared with 236,000 tons produced by 2 operators in 1956.

Mercer.—The county was the leading producer of coal (lignite) in the State and ranked fourth in the value of mineral production. Coal was produced from five strip mines. The major producers were Knife River Coal Mining Co. at the Knife River strip mine, Truax-Traer Coal Co. at the Dakota Star strip mine, and the North American Coal Corp., Dakota Collieries Division, at the Indian Head strip mine, acquired from Dakota Collieries Co. in June. Production in 1957 was 8 percent lower than in 1956.

Morton.—Hebron Brick Co. produced miscellaneous clay for building brick, draintile, and other heavy clay products. The company also produced a small quantity of bentonite for use in foundries and in the manufacture of refractories. Molite, Inc., produced shale for bloating at its plant in Mandan for use as a lightweight aggregate. Four operators produced building sand, building and paving gravel, and fill gravel. The major producers were Helm Bros., Inc., and Riverside Coal Co.

The Standard Oil Co. of Indiana refinery at Mandan operated the entire year. The Service Pipeline Co. transported crude oil from fields on the Nesson anticline in the western counties to the refinery. The original capacity of the plant, completed in September 1954, was 33,000 barrels of crude oil a day. This was increased through a program of expansion over several years to 34,700 barrels. An alkylation unit under construction at the end of the year was expected

to be completed by September 1958. Approximately 314 people were employed at the plant.

Mountrail.—The county ranked third in the State in output of petroleum and in the value of mineral production. Petroleum came from that part of the Tioga field lying within the county, White Earth field, and East Tioga field. Production in 1957 declined 14 percent compared with 1956. Morrison-Knudsen Co., Inc., produced gravel principally for use as railroad ballast.

Renville.—Petroleum production in 1957 from the Bluell field declined 67 percent compared with 1956.

Stark.—Stark County produced coal (lignite), sand and gravel, and petroleum. The county ranked seventh in the State in coal output. The major producer was Dakota Briquets & Tar Products, Inc., at the Lehigh strip mine. The entire output of coal was used for briquets and tar products. Other producers were the Dickinson Coal Mining Co. and Valentine Walter. Sand and gravel for building, paving, and fill was produced by Badinger Sand & Gravel Co. and Fisher Sand & Gravel Co. Petroleum production in 1957 from the Belfield and Dickinson (a 1957 discovery) fields increased threefold compared with 1956. The Dickinson field was discovered in September when the William Kalanek No. 1 well was completed in the Madison limestone at a depth of 9,100 feet.

Ward.—Ward County ranked second in the State in coal (lignite) production, fourth in sand and gravel output, and sixth in the value of mineral production, and entered the ranks of petroleum producers in 1957. Coal was produced from four mines; the principal output came from the Truax-Traer Coal Co. Velva strip mine. Other producers were Quality Lignite Co., Sawyer Fuels, Inc., and Valley Coal Co. Production in 1957 declined 8 percent compared with 1956. Minneapolis, St. Paul & Sault Ste. Marie Railroad Co. produced gravel for building, railroad ballast, and fill. Minot Sand & Gravel Co. produced building, paving, and fill sand and gravel, and filter sand. Discovery of the S. W. Aurelia field, the first in Ward County, was in February when the A. C. Knudtson No. 1 well was completed in the Madison limestone at a depth of 6,797 feet. Initial production was 232 barrels of oil a day on pump.

Williams.—Williams County led the State in output of petroleum and in the value of mineral production, ranked second in sand and gravel output, and was the only county that produced sulfur. Coal (lignite) was produced at the Black Diamond mine, 1 of the 2 underground mines reporting in 1957. Sand and gravel for building, paving, and fill was produced by nine operators.

Petroleum produced from 7 fields in 1957 (one a 1957 discovery) declined 14 percent compared with 1956. The Delta field, south of the Hofflund field, was discovered in April, when the USA No. 1 well was completed at a depth of 8,389 feet in the Madison limestone. The well was shut in after small production. The West Tioga field was discovered in August upon completing the Christ Hemsing No. 1 well in the Madison limestone at a depth of 8,361 feet. Two new producing horizons were discovered in the Beaver Lodge field, the second largest in the Williston basin, and the first commercial success in the United States part of the basin. Commercial production was established in Devonian and Silurian formations from four wells

completed during the year. The field contains 200 producing wells, and average production exceeded 8,000 barrels a day. Total production from the field exceeded 17 million barrels. Development at the Capa field, lying south of the Beaver Lodge field, in 1957 resulted in joining its northern producing units with the southern edge of the Beaver Lodge field. Total production from the Capa field at the close of the year was nearly 3 million barrels. Development at the Tioga field was mostly in the northern part. The field occupies about 90 square miles in Burke, Mountrail, and Williams Counties; major part was in Williams County. Daily production from the entire field in December 1957 exceeded 11,000 barrels. Total production of the field exceeded 18 million barrels.

The Signal Oil & Gas Co. natural-gasoline plant at Tioga produced the entire year. Natural gas was obtained from the Tioga, Beaver Lodge, Capa, Hofflund, Charlson, Antelope, and Blue Buttes fields delivered to the plant through a gas-gathering pipeline system. Products recovered at the plant were natural gasoline, butane, propane, elemental sulfur, and residue gas. Natural gasoline was delivered through pipelines to the Standard Oil Co. of Indiana refinery at Mandan for use as blending stock. Residue gas was marketed by the Montana-Dakota Utilities Co. through its pipeline system. Throughput of wet gas in 1957 was approximately 14 billion cubic feet. Elemental sulfur recovered by the Modified Claus process was sold for manufacturing sulfuric acid. The plant employed about 40 people.

Westland Oil Co. operated its 2,000-barrel-a-day refinery at Williston. A thermal cracking unit was completed in September and a platformer under construction was expected to be completed early in 1958. Crude oil from fields in Burke County and in northeastern Montana was delivered to the plant by tank transports. Products were sold through the company marketing organization in northeastern Montana and northern North Dakota. About 40 people were employed at the plant.

The Mineral Industry of Ohio

By Joseph Krickich¹ and Geraldine C. Slaypoh²



MINERAL production in Ohio in 1957 continued high, as its value increased 3 percent or \$10 million over the preceding year. Although the value of coal, lime, and clays declined, these were more than offset by increases for stone, cement, petroleum, natural gas, and sand and gravel. Among the 13 minerals produced in the State in 1957, coal, stone, cement, lime, and sand and gravel led in order of decreasing value of output. Ohio continued to rank high nationally in the output of minerals, leading in lime and clay, ranking third in sand and gravel, and standing fifth in coal and salt.

Consumption, Trade, and Markets.—The major portion of the minerals produced in Ohio was consumed in the State. Bituminous coal, the State's foremost mineral, was used primarily in local powerplants and for other industrial and residential fuel uses. The other mineral fuels produced in Ohio (petroleum, natural gas, and natural gasoline) found ready markets within the State. Although Ohio ranked high

TABLE 1.—Mineral production in Ohio, 1956–57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thou- sands)	Short tons (unless otherwise stated)	Value (thou- sands)
Abrasive stones.....	(²)	(²)	1,505	\$132
Cement:				
Portland..... 376-pound barrels	15,150,874	\$46,342	15,454,422	49,115
Masonry..... do	914,371	3,452	784,443	3,069
Clays.....	6,702,531	17,676	6,136,024	16,073
Coal.....	38,933,557	143,650	36,861,607	146,134
Lime.....	2,995,320	40,805	2,763,128	38,383
Natural gas..... million cubic feet	25,368	6,088	³ 29,300	³ 7,200
Peat.....	15,509	174	5,478	102
Petroleum (crude)..... 42-gallon barrels	4,785	15,025	³ 5,478	³ 17,694
Salt (common).....	2,971,702	15,923	2,824,878	16,936
Sand and gravel.....	30,199,822	36,146	30,595,877	37,503
Stone ⁴	33,417,662	50,947	37,451,161	61,847
Value of items that cannot be disclosed: Gypsum, di- mension limestone (1957), marl (calcareous) (1957), natural gasoline, natural salines (1956), crushed sand- stone (1956), recovered elemental sulfur (1956) and values indicated by footnote 2.....		5,394		2,584
Total Ohio ⁵		375,488		385,858

¹ Productions as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Figure withheld to avoid disclosing individual company confidential data.

³ Preliminary figure; subject to revision.

⁴ Excludes certain stone, value for which is included with "Value of items that cannot be disclosed."

⁵ Totals have been adjusted to avoid duplicating value of limestone, clays, and calcareous marl (1957) used for manufacturing cement and lime.

¹ Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

² Statistical clerk, Region V, Bureau of Mines, Pittsburgh, Pa.

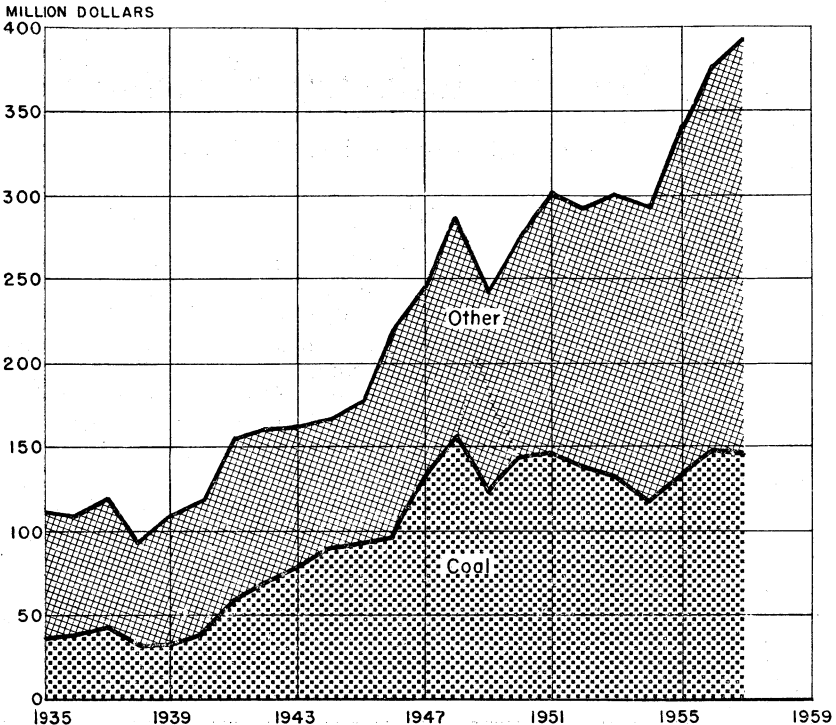


FIGURE 1.—Value of coal and total value of mineral production in Ohio, 1935-57.

as a coke producer, all the coking coal was shipped in from the nearby coal-producing States. Most of the coke produced was consumed by the producing iron and steel companies for metallurgical utilization. In addition to consuming large quantities of coke, iron and steel plants in Ohio consumed significant tonnages of iron ore, shipped mainly from the Lake Superior region and unloaded at Ashtabula. Ohio's iron and steel industry also utilized large quantities of refractory materials made from sandstone and quartzite, fire clay, and lime, produced in the State.

Trends and Developments.—Important among the new plants constructed or in process of construction during 1957 were the new 180,000-ton aluminum-reduction plant of Ormet Corp. near Clarington, the new titanium rolling and forging mill of Titanium Metals Corp. of America at Toronto, the new titanium and zirconium plant of Mallory-Sharon Metals Corp. at Ashtabula, and the new beryllium plant of Brush Beryllium Co. at Elmore. During late 1957 the new ferroalloy plant of Vanadium Corporation of America near Steubenville began operations, and Republic Steel Corp. announced that expansion plans at its Cleveland Works were nearly completed.

To keep pace with demands by expanding Ohio Valley industries the North American Coal Co. acquired 17,000 acres of virgin coal land and announced plans for developing a \$10 million coal mine in Monroe County. Hanna Coal Co. Division of Pittsburgh Consolidation Coal Co. expanded operations by enlarging its limestone facilities and

acquiring a deposit of high-grade limestone near Carrolton. In addition to using limestone for building access roads to its coal operations, the company was able to supply limestone for the commercial market as agstone and concrete aggregate.

Expansion plans of several nonmetal producers also were announced in 1957. Columbia-Southern Chemical Corp. began to construct a 1.5-million-barrel-annual-capacity cement plant at Barberton. Equipment at the facility will include a rotary kiln 450 feet in length and 13 feet in diameter. Limestone will be supplied from the nearby company underground limestone mine. Logan Clay Products Co., a leading producer of vitrified sewer pipe, announced plans to build a modern \$1 million plant near its present operation in Perry County. Automatic equipment included in the proposed plant will be two horizontal extrusion machines; automatic takeoff and finishing equipment; Bonnot machines; a tunnel drier and preheater; a gas-fired, 363-foot tunnel kiln; and other modern machinery. The annual capacity of the plant will be about 30,000 tons of finished ware. Vitrified pipe ranging from 4 to 8 inches in diameter and 4 to 5 feet in length will be produced.

Interest in Lake Erie in 1957 was taken when petroleum and natural-gas producers acquired offshore leases for future possible drilling. Discoveries reported in Ohio during the year awakened interest in further development of the State's oil and gas reserves and in possible future developments in the Lake Erie area.

Legislation and Government Programs.—The Federal Government, through the General Services Administration (GSA), sold Armco Steel Corp. a sintering unit that had been on loan to the company since 1943. The State of Ohio granted a 50-year contract to International Salt Co. to mine salt under Lake Erie near Cleveland.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—The production and value of grindstones produced in Ohio decreased in 1957 compared with 1956. Output was from 3 quarry operations—2 in Washington County and 1 in Lorain County.

Cement.—In terms of value, cement continued to be Ohio's third-ranking mineral commodity in 1957. Portland-cement shipments increased 2 percent and the average value per barrel increased 4 percent. Shipments of masonry cement dropped 14 percent. The production of cement was reported in 8 counties; Greene County ranked first in both production and value. Ten plants operated at 90 percent of capacity in the State during the year. The estimated annual capacity in 1957 was rated as 18 million barrels, a 1-percent increase from the preceding year. Stocks of portland cement at mills as of December 31, 1957, totaled nearly 2 million barrels, a 53-percent increase from 1956. Most of the companies operated limestone quarries and clay pits and utilized this output in nearby cement plants. Quantities of gypsum, sand, calcareous marl, slag, and iron ore also were utilized as raw materials. The demand for cement remained about the same, but price increases were reported at three

plants to offset increased wages and rising maintenance and operating costs. No labor disputes were reported.

TABLE 2.—Finished portland cement produced, shipped, and in stock, 1948-52 (average) and 1953-57

Year	Active plants	Production (barrels)	Shipment from mills			Stocks at mills on Dec. 31 (barrels)
			Barrels	Value		
				Total	Average per barrel	
1948-52 (average).....	9	10, 819, 946	10, 787, 858	\$24, 977, 219	\$2. 32	763, 284
1953.....	9	12, 539, 132	12, 532, 437	32, 957, 308	2. 63	755, 237
1954.....	9	13, 306, 570	13, 076, 921	35, 929, 163	2. 75	984, 704
1955.....	9	13, 965, 839	13, 981, 909	39, 642, 957	2. 84	838, 914
1956.....	10	15, 722, 402	15, 150, 874	46, 341, 562	3. 06	1, 293, 165
1957.....	10	16, 291, 464	15, 454, 422	49, 115, 317	3. 18	1, 974, 121

Clays.—Ohio continued to rank as the Nation's leading clay producer in 1957, even though clay production and value decreased 9 percent. The decrease was due chiefly to decreased demand for heavy clay products, including building brick and draintile. Fire clay was the more important type produced, comprising 76 percent of the total State clay valuation but only 45 percent of the output. The average value per ton of fire clay increased from \$4.42 in 1956

TABLE 3.—Clays sold or used by producers, 1956-57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Carroll.....	209, 335	\$512, 081	150, 005	(¹)
Columbiana.....	495, 388	2, 767, 968	391, 427	(¹)
Cuyahoga.....	488, 424	446, 453	479, 067	\$378, 263
Highland.....	16, 778	(¹)	8, 919	(¹)
Hocking.....	247, 867	1, 099, 037	141, 869	618, 915
Holmes.....	113, 207	(¹)	(¹)	(¹)
Jackson.....	216, 646	819, 621	189, 245	724, 453
Jefferson.....	183, 898	1, 287, 806	142, 872	979, 371
Lawrence.....	177, 027	860, 345	166, 948	963, 434
Madison.....	(¹)	(¹)	990	(¹)
Mahoning.....	269, 983	(¹)	(¹)	(¹)
Medina.....	57, 119	(¹)	(¹)	(¹)
Noble.....	38, 873	(¹)	(¹)	(¹)
Paulding.....	22, 407	41, 272	23, 200	(¹)
Perry.....	528, 135	684, 678	301, 060	744, 775
Putnam.....	29, 196	34, 247	29, 192	35, 955
Scioto.....	86, 248	602, 330	74, 157	580, 161
Seneca.....	5, 500	(¹)	7, 500	(¹)
Stark.....	780, 988	1, 813, 002	630, 697	1, 523, 049
Summit.....	36, 680	41, 822	64, 954	119, 465
Tuscarawas.....	1, 284, 790	3, 751, 586	1, 259, 220	3, 787, 210
Washington.....	41, 363	(¹)	40, 674	40, 674
Wayne.....	51, 224	48, 427	(¹)	(¹)
Wood.....	2, 151	(¹)	3, 190	(¹)
Wyandot.....	25, 344	(¹)	(¹)	(¹)
Undistributed ²	1, 293, 960	2, 864, 829	2, 030, 838	5, 577, 158
Total.....	6, 702, 531	17, 675, 504	6, 136, 024	16, 072, 883

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes data for the following counties: Ashland, Belmont, Darke, Delaware, Franklin, Hancock, Harrison, Henry, Licking (1956), Marion, Muskingum, Portage (1956), Richland, Van Wert, Vinton and Williams; clays used in cement manufacturing not apportioned by counties; and values indicated by footnote 1.

to \$4.48 in 1957, while miscellaneous clay increased from \$1.04 to \$1.12. In terms of value, the leading clay-producing counties were Tuscarawas, Columbiana, and Stark.

TABLE 4.—Clays sold or used by producers in 1956–57, by kinds and uses, in short tons

Uses	Fire clay		Miscellaneous clay	
	1956	1957	1956	1957
Tile, high-grade.....	87,399	95,407	61,986	63,201
Architectural terra cotta.....	2,282	527		
Portland and other hydraulic cements ¹			1,234,294	1,219,318
Refractories:				
Firebrick and block.....	669,283	664,563		
Fire-clay mortar.....	56,809	42,066		
Zinc retorts and condensers.....	526	457		
Saggers, pins, stilts, and wads.....	433	347		
Foundries and steelworks.....	386,392	324,110		
Other refractories.....	(²)	46,132		
Heavy clay products.....	1,925,499	1,531,057	2,241,531	2,111,521
Filler: Flux.....		479		
Chemicals.....	5,638			
Rotary drilling mud.....	2,910			
Other uses.....		7,500		
Undistributed ³	27,549	29,339		
Total.....	3,164,720	2,741,984	3,537,811	3,394,040

¹ Includes miscellaneous clay used for fire-clay, mortar and lightweight aggregate.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

³ Includes stoneware and art pottery, exports of fire clay, and those uses indicated by footnote 2.

Gypsum.—The production and value of crude gypsum increased slightly in 1957 compared with 1956. Output was centered in Ottawa County, where two companies mined and calcined crude gypsum for manufacturing finished building products.

Iron Oxide Pigments.—Manufactured red iron oxide pigments were produced in Summit County from purchased pyrite cinders.

Lime.—The output and value of lime produced in Ohio in 1957 decreased 8 and 6 percent, respectively, compared with 1956. This followed the national trend in 1957, in which total lime production fell 3 percent from the alltime high of 1956. Decreased demand for Ohio lime in all major use categories (agricultural, building, chemical and industrial, and refractory) was recorded for the year. Seventy-eight percent of the lime production was sold or used as quicklime; the remainder was hydrated. Eighteen plants in 10 counties were active during the year. Sandusky County continued to be the leading lime-producing area, accounting for 40 percent of the State's total lime value. Producing companies reported 288 shaft-type and 39 rotary kilns active, using mostly bituminous coal as fuel. A combination of bituminous coal and producer gas was used as fuel at 2 plants, and 1 plant reported using bituminous coal and coke. Types of hydrators used (lime) were batch and continuous, the batch type being the more predominant. No atmospheric or pressure hydrators were used, as in the previous year.

Natural Salines.—The Meigs County operation of Pomeroy Salt Corp., the only producer of calcium-magnesium chlorides (natural salines), was inactive in 1957.

TABLE 5.—Lime (quick and hydrated) sold or used by producers, 1948-52 (average) and 1953-57

Year	Agricultural (burnt)		Building		Chemical and other industrial		Refractory		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	50,322	\$570,499	580,759	\$7,647,806	395,897	\$3,901,388	1,030,164	\$12,981,775	2,057,142	\$25,101,468
1953.....	52,376	618,108	556,537	8,328,900	922,655	7,350,473	1,414,232	19,012,872	2,945,800	35,310,353
1954.....	68,460	889,070	516,679	8,133,692	1,040,082	9,135,604	923,825	13,285,717	2,549,046	31,444,083
1955.....	43,852	544,361	639,338	10,352,762	1,086,415	9,827,930	1,269,344	18,668,581	3,038,949	39,393,634
1956.....	36,651	541,952	577,592	9,574,331	967,767	8,612,008	1,413,310	22,076,289	2,995,320	40,804,580
1957.....	34,931	481,809	510,052	9,049,380	917,827	8,410,762	1,300,318	20,441,155	2,763,128	38,383,106

Perlite, Expanded.—Crude perlite from Western States was expanded at plants in Cuyahoga, Montgomery, and Summit Counties. The output was used as a lightweight plaster and concrete aggregate.

Salt.—Compared with 1956, salt production in Ohio in 1957 declined 5 percent, but value increased 6 percent. This followed the general nationwide trend in 1957, in which value increased, while production decreased slightly from the record high established in 1956. Although Ohio salt production decreased, the State continued to rank fifth in output among the salt-producing States. The output was from well brines. Most of the salt produced was consumed as brine for manufacturing chlorine and soda ash. The remainder was sold as evaporated salt for a wide variety of uses. The evaporated salt was recovered mainly by the vacuum-pan process. Five producers were active in four counties. Pomeroy Salt Corp. (Meigs County) was inactive in 1957. The combined capacity (evaporated and brine) of the active producers exceeded 3.3 million tons of salt. During the year the industry operated at 85 percent of capacity. In terms of value, Summit County was the leading salt-producing county. Other producing counties were Lake, Wayne, and Meigs. In September 1957 International Salt Co. was granted a 50-year contract by the State of Ohio to mine rock salt under Lake Erie near Cleveland. The company will pay the State a royalty of 5 cents per ton for any salt recovered from a 5,193-acre tract in the Whiskey Island area. The company planned to sink a 2,000-foot shaft to obtain access to the deposit.

Sand and Gravel.—Production and value of sand and gravel increased slightly (1 and 4 percent, respectively) in 1957 compared with the previous year. Compared with other States in 1957, Ohio ranked third in output and second in value. In Ohio decreased demand for building sand and gravel during the year was offset by an increased demand for paving material, reflecting increased highway and road construction and maintenance. Markets and sales areas for most producers decreased; however, the majority reported operating under generally favorable economic conditions in 1957. Overall, more producers reported general construction and home-building activities down. Competition was keen due to the availability of competitive materials (crushed limestone and sandstone) and an increased demand for better prepared material. In addition to an increased output of

paving material, the production of glass sand also increased substantially. The output of grinding and polishing, blast, fire or furnace, engine, filter, and railroad-ballast sands decreased. Ninety-one percent of the State's total output was washed, screened, or otherwise prepared. The bulk of the total output was by commercial operations, with the output from Government-and-contractor operations furnishing less than 1 percent of the total. Production was recorded in 71 counties in 1957. Hamilton, Franklin, Montgomery, and Portage Counties, in order of decreasing value, were the leading sand-and-gravel-producing areas in the State.

TABLE 6.—Sand and gravel sold or used by producers, 1956-57, by uses (in thousands)

Use	1956		1957	
	Short tons	Value	Short tons	Value
Sand:				
Molding.....	(1)	(1)	546	\$1,845
Structural.....	6,182	\$6,737	5,792	6,377
Paving.....	4,630	4,634	5,472	5,556
Filter.....	91	133	79	115
Railroad ballast.....	18	16	(1)	(1)
Other ²	1,575	4,625	989	2,590
Gravel:				
Structural.....	5,414	6,296	5,435	6,430
Paving.....	9,847	10,837	9,832	11,526
Railroad ballast.....	463	461	345	340
Other.....	1,980	2,407	2,106	2,724
Total sand and gravel.....	30,200	36,146	30,596	37,503

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

² Includes glass sand, grinding and polishing sand, blast sand, fire or furnace sand, engine sand, ground sand, other sands, and data indicated by footnote 1.

Stone.—The total production and value of stone produced in Ohio increased substantially in 1957, as output increased over 4 million tons more than was recorded in 1956. Both limestone and sandstone production increased, owing mainly to an increased demand for stone used as concrete aggregate and roadstone. Of the two types of stone quarried in the State, limestone was the more important. Production was reported from 59 counties in 1957 compared with 56 in 1956. In terms of value, the leading stone-producing counties were Sandusky, Franklin, Seneca, Lorain, and Summit. Stone production in the State was geared primarily to local construction and road-building activity. On a county-by-county basis, most stone producers reported favorable economic conditions during the year. In some areas producers reported that demand was low, due to lack of construction activity and road building, while in other areas companies reported increased sales during the year.

Sulfur, Recovered Elemental.—No brimstone (recovered elemental sulfur) was recovered as a byproduct of gas purification in Cuyahoga County in 1957, as was reported in previous years.

Vermiculite (Exfoliated).—Crude vermiculite from Montana was processed at a plant in Cuyahoga County. The exfoliated vermiculite was used as concrete and plaster aggregate and for insulation purposes.

TABLE 7.—Commercial sand and gravel sold or used by producers, 1956–57, by counties

County	1956 ¹			1957		
	Number of pits	Short tons	Value	Number of pits	Short tons	Value
Allen	1	67,457	\$77,577	1	114,569	\$131,757
Ashland	3	41,922	31,057	(?)	(?)	(?)
Ashtabula	5	237,668	235,846	5	186,540	217,340
Athens	2	57,150	73,965	2	53,200	74,965
Auglaize	3	374,034	440,277	7	324,957	416,064
Brown	1	(?)	(?)	1	2,025	3,000
Butler	2	1,655,938	1,765,289	13	1,639,722	1,906,101
Champaign	8	354,451	327,788	3	390,238	445,251
Clark	7	477,697	490,919	12	553,787	553,687
Clermont	1	702,441	772,685	2	454,464	635,933
Clinton	1	108,912	64,000	2	145,650	97,090
Columbiana	(?)	(?)	(?)	4	449,836	667,236
Coshocton	10	350,310	322,322	7	468,272	531,226
Crawford	1	45,313	41,715	1	52,722	65,874
Cuyahoga	8	823,781	814,088	8	1,050,450	965,101
Darke	6	253,912	274,983	7	305,851	342,703
Fairfield	7	170,087	189,533	8	204,237	291,209
Franklin	5	2,675,812	3,209,715	7	2,734,482	3,457,421
Fulton	(?)	(?)	(?)	(?)	(?)	(?)
Gallia	3	222,487	457,696	(?)	(?)	(?)
Geauga	7	664,246	921,630	5	599,165	862,713
Greene	8	364,258	303,696	7	373,249	312,097
Hamilton	9	3,739,375	4,429,884	10	3,263,664	4,267,801
Hancock	1	76,313	76,148	(?)	(?)	(?)
Henry	2	74,630	99,505	2	47,720	63,621
Highland	1	6,482	4,036	1	669	385
Hocking	3	72,897	105,186	2	51,021	75,439
Holmes	3	126,044	119,093	3	124,321	110,816
Jackson	1	2,038	713	1	4,179	3,969
Jefferson	3	690,007	875,645	(?)	(?)	(?)
Knox	4	596,657	656,803	6	787,257	1,409,492
Lake	7	100,294	105,160	4	132,554	121,053
Lawrence	1	50,954	52,887	1	73,557	90,499
Licking	8	409,154	426,614	10	437,508	480,560
Logan	4	41,400	46,895	8	52,109	57,539
Lucas	(?)	(?)	(?)	4	252,730	251,230
Mahoning	2	22,553	33,884	2	19,375	28,525
Marion	1	53,382	57,720	1	61,247	66,398
Medina	6	898,630	989,650	4	818,609	675,317
Mercer	(?)	(?)	(?)	2	3,629	9,985
Miami	4	502,240	521,937	5	587,003	562,687
Monroe	(?)	(?)	(?)	(?)	(?)	(?)
Montgomery	15	2,733,445	2,700,548	18	2,527,245	2,566,650
Morgan	2	111,480	153,110	2	97,518	132,491
Morrow	1	38,830	41,606	1	45,000	43,000
Perry	1	16,019	53,775	(?)	(?)	(?)
Pike	4	427,301	614,037	6	410,914	595,247
Portage	17	1,446,829	2,374,862	20	1,697,834	2,566,428
Preble	4	176,851	199,683	3	154,528	183,994
Richland	4	287,856	237,748	4	405,844	369,394
Ross	6	918,056	861,960	7	764,401	699,540
Sandusky	1	25,685	37,204	(?)	(?)	(?)
Shelby	3	166,850	183,453	6	221,400	260,735
Stark	13	1,328,794	1,349,952	16	1,590,094	1,716,623
Summit	9	544,158	571,724	8	682,374	777,706
Trumbull	1	183,000	207,650	1	154,060	177,901
Tuscarawas	9	652,951	840,102	8	854,532	993,204
Union	(?)	(?)	(?)	1	21,910	22,636
Warren	7	531,092	550,151	7	418,498	449,273
Washington	6	170,254	298,448	5	277,377	347,965
Wayne	4	126,104	121,007	(?)	(?)	(?)
Williams	6	199,347	125,445	5	144,214	94,720
Undistributed ²	23	2,328,377	2,878,861	30	3,201,897	5,213,819
Total	284	29,524,205	33,797,957	316	30,550,808	37,479,919

¹ Excludes ground sand.² Included with "Undistributed" to avoid disclosing individual company confidential data.³ Includes data for Carroll, Erie, Huron, Madison, Muskingum, Pickaway, Wyandot Counties, and data indicated by footnote 2.

TABLE 8.—Stone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Dimension stone:				
Rough construction.....	7,929	\$16,807	(1)	(1)
Rubble.....	5,472	16,416	(1)	(1)
Rough architectural ²	34,242	953,663	41,720	\$1,284,865
Sawed and dressed ²	136,685	5,678,132	105,876	4,630,510
Curbing and flagging.....	9,852	359,785	5,517	227,296
Total dimension stone.....	194,180	7,024,803	³ 153,113	⁴ 6,142,671
Crushed and broken stone:				
Refractory.....	(1)	(1)	349,523	4,437,313
Riprap.....	50,767	77,541	519,259	554,508
Concrete aggregate and roadstone.....	15,087,381	18,776,155	16,955,497	21,548,070
Railroad ballast.....	1,261,837	1,470,490	1,451,842	1,684,424
Flux.....	5,469,616	7,546,968	5,629,422	8,090,051
Agricultural.....	2,014,336	3,163,077	2,125,569	3,414,108
Other uses.....	9,339,545	12,887,681	10,266,936	15,975,979
Total crushed and broken stone.....	⁴ 33,223,482	⁴ 43,921,912	⁵ 37,298,048	⁶ 55,704,453
Grand total.....	⁴ 33,417,662	⁴ 50,946,715	⁵ 37,451,161	⁶ 61,847,124

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes quantities of sandstone used for refractory lining.

³ Incomplete total; excludes dimension limestone.

⁴ Incomplete total; excludes crushed sandstone.

⁵ Incomplete total; excludes calcareous marl used for manufacture of cement.

⁶ Incomplete total; excludes dimension limestone and calcareous marl.

MINERAL FUELS

Coal.—Bituminous-coal production in Ohio in 1957 decreased 5 percent below 1956, but its value decreased only 2 percent, as the average per ton increased slightly. This decline followed the national trend, as coal production fell sharply during the latter part of 1957. Sixty-five percent of Ohio's coal output in 1957 was obtained by strip mining and 32 and 3 percent, respectively, by underground and auger mining. Less coal was recovered by underground mining compared with the preceding year. The number of underground mines active in 1957 decreased 14 percent, while the number of strip mines increased slightly. At the 251 active strip mines in the State, 614 power shovels and draglines, 58 carryall scrapers, 494 bulldozers, and 172 power drills were used to recover the coal. Although the bulk of the power shovels had dipper capacities averaging less than 3 cubic yards, 14 shovels had dipper capacities over 12 cubic yards. Most of the power shovels and draglines were diesel. At the 177 active underground mines, virtually the entire production (over 99 percent) was cut by machine, and 91 percent of the output was mechanically loaded. Of the total mechanically loaded, 68 percent was handled by mobile loaders (primarily into shuttle cars) and 31 percent was loaded by continuous miners. The remaining 1 percent was loaded either by self-loading conveyors or hand-loaded onto conveyors. The number of machines and tons of coal prepared by continuous mining machines increased from 23 and 2 million tons, respectively, in 1956 to 34 and 3.3 million tons in 1957. Over 16.6 million tons of coal was cleaned, primarily by wet washing methods, at the 26 cleaning plants in the State. Nine percent was treated for dust preventa-

tive or antifreezing purposes, using either oil or calcium chloride or a combination of both. Ten percent of the State's total production was captive coal. As in previous years, Harrison, Belmont, and Jefferson Counties were the leading coal-producing areas in Ohio.

TABLE 9.—Bituminous coal production, 1948-52 (average) and 1953-57

Year	Short tons	Value	Value per ton	Year	Short tons	Value	Value per ton
1948-52 (average)	36,317,410	\$141,360,704	\$3.89	1955.....	37,869,791	\$133,814,166	\$3.53
1953.....	34,736,773	131,475,408	3.78	1956.....	38,933,557	148,650,186	3.82
1954.....	32,468,728	117,519,936	3.62	1957.....	36,861,607	146,133,623	3.96

Coke and Coal Chemicals.—Ohio ranked second to Pennsylvania both in number of coke ovens and total coke produced in 1957. Over 11.2 million tons of coke valued at \$198.6 million were produced during the year—a 4-percent decline in production compared with 1956. As of December 31, 1957, 15 plants operating 2,439 ovens (all slot-type) were in existence, 1 less plant and 54 fewer ovens than in the preceding year. Most (89 percent) of the coke was consumed by producing companies for blast-furnace operations and other purposes. The remaining coke was sold by producers to blast-furnace plants, foundries, and other industrial users and for residential heating. Coke byproducts recovered at coke plants included 747,000 tons of coke breeze, 162,298 million cubic feet of coke-oven gas, 249,555,000 pounds of ammonium sulfate, 11,305,000 pounds NH₃ content of ammonia liquor, 123,711,000 gallons of coke-oven tar, and 45,426,000 gallons of crude light oil (from which 26,232,000 gallons of benzene, 4,984,000 gallons of toluene, 1,797,000 gallons of xylene, and 789,000 gallons of solvent naphtha were derived).

Peat.—The output of peat in Ohio in 1957 decreased for the third successive year, dropping 65 percent below 1956. The decline was opposed to the national trend, which rose in 1957 and established a new record. Peat output was reported from 8 producers in 5 counties in 1957 as compared with 11 producers in 7 counties in 1956. The peat was used primarily for soil improvement. In terms of value, Summit County replaced Wyandot as the leading peat-producing area. Other producing counties were Portage, Richland, and Stark.

Petroleum and Natural Gas.—The value of both petroleum and natural gas produced increased 18 percent in 1957 compared with 1956. Well completions increased from 1,086 in 1956 to 1,115 (including 593 oil, 201 gas, 237 dry, and 84 service) in 1957. The average footage drilled was 2,412 feet compared with 2,378 feet in 1956. Total completions included 15 wildcat operations (4 oil, 3 gas, and 8 dry holes), and the remainder were extensions of known fields. Coshocton County led in total completions, with 129 (102 oil, 9 gas, and 18 dry); it was followed by Licking County with 85 oil, 4 gas, and 17 dry holes. Although the national trend in well drilling was to use rotary tools, most (98.9 percent) of the State's total completed wells were drilled with cable tools.³ Production

³ Oil and Gas Journal, Annual Review and Forecast Number: Vol. 56, No. 4, Jan. 27, 1958.

and value of natural-gas liquids (natural gasoline) dropped 24 percent in 1957 compared with the previous year. Proved reserves as of January 1958 (according to the American Petroleum Institute and the American Gas Association) were: Crude petroleum, 68,150,000 barrels; natural-gas liquids, 1,810,000 barrels; and natural gas, 901,814 million cubic feet.

METALS

No metal ores were mined in Ohio, but the State continued to be an important center for processing ores and other raw materials into finished metal products.

Aluminum.—Construction continued on the new 180,000-ton aluminum-reduction plant of Ormet Corp. (originally called Olin Revere Metals Corp.) near Clarrington, Monroe County. Completion of the plant was scheduled for early 1958. Ormet Corp. was owned jointly by Olin Mathieson Chemical Corp. and Revere Copper & Brass, Inc. Bauxite from Surinam will be processed into alumina at a company plant being built at Burnside, La. The alumina will be shipped up the Mississippi and Ohio Rivers in specially designed barges to the Clarrington reduction plant. This plant will utilize power supplied by three 225,000-kilowatt, coal-fired generating units at a new power plant built across the river at Cresap, W. Va. Two-thirds (120,000 tons) of the annual output of the reduction plant will be used by Olin Mathieson Chemical Corp.; the remainder (60,000 tons) by Revere Copper & Brass, Inc. Most of Olin Mathieson's share will be used by the company at a new rolling mill adjacent to the reduction plant. The rest of the aluminum will be shipped to the company Metal Division plants in Tennessee, Illinois, Mississippi, and California. Revere Copper & Brass, Inc., will fabricate its share of the annual output at plants in Maryland and Illinois.

Beryllium.—Construction of the new \$4.5 million plant of Brush Beryllium Co. at Elmore (Ottawa County) was completed during the year. The new plant, erected for the production of beryllium metal, is situated near the company beryllium-alloy plant. The plant was designed to produce 20,000 pounds of beryllium as hydroxide and 10,000 pounds of vacuum-cast beryllium per month. The company had previously been awarded a contract to supply 500,000 pounds of Reactor-grade beryllium to the Atomic Energy Commission (AEC) over a 5-year period starting in 1958.

Iron and Steel.—Ohio ranked second to Pennsylvania in iron and steel production in 1957. Blast-furnace capacity at the State's 22 plants (53 stacks) totaled 18,263,000 net tons as of January 1, 1958—a 313,000-net-ton increase from January 1, 1957. Capacity of the State's 20 steel plants (179 open hearths, 11 Bessemer converters, and 35 electric and crucible furnaces) totaled 28,117,000 net tons as of January 1, 1958—an increase of over 1 million tons above the preceding year. Pig-iron production in Ohio totaled 14,980,000 tons in 1957. Seventy-three percent of the total pig iron was used in basic open hearths, 21 percent went to Bessemer converters, and the remainder was used for malleable, low-phosphorus, foundry, and direct casting. Over 21 million long tons of iron ore was consumed in the State for metallurgical uses. In December 1957 Republic Steel Corp. announced that the largest single steel expansion in the State's

history, nearing completion at its Cleveland plant, will increase annual ingot capacity 788,000 tons to 3,360,000. The expansion included 2 new 375-ton open-hearth furnaces and expansion of 4 other open hearths from a rated capacity of 275 tons per heat to 375 tons per heat; a new 45-inch slabbing mill, 16 new soaking pits, increased rolling facilities of the 98-inch hot strip mill to permit rolling steel slabs up to 75 inches wide compared with the previous maximum width of 54 inches; and a new battery of 51 coke ovens. Another battery of 51 coke ovens was to be in operation by mid-1958 and a third battery was being constructed. In October 1957 the new ferroalloy plant of Vanadium Corporation of America was formally opened at Vancoram near Steubenville. Facilities at the new plant included two electric arc furnaces; one to produce low carbon ferrochromium and the other to produce all types of high carbon ferrochromium alloys. A third unit was contemplated for the production of manganese products.

Armco Steel Corp. purchased a sintering unit formerly leased from the Federal Government at its Hamilton plant. The unit which was bought for \$580,000, was built by the Reconstruction Finance Corp. (RFC) during early World War II and had been operated by Armco after 1943. It was designed to recover flue dust and iron ore fines to conserve raw materials and increase blast furnace pig iron output. The unit served three blast furnaces; two at the Hamilton plant and one at Armco's Middletown plant.

Titanium.—Plants in Ohio continued to play an integral part in the production and processing of titanium metal. It was announced that the Electro Metallurgical Co. titanium-sponge plant at Ashtabula was producing at capacity less than 9 months after the first batch of sponge had been produced on April 26, 1956. This was the Nation's largest titanium sponge plant; it has a rated annual capacity of 7,500 tons. The plant also was the first in the United States to produce titanium sponge commercially by the sodium-reduction process rather than by the magnesium-reduction method. On November 4 Titanium Metals Corp. of America announced initial production at its new Toronto titanium rolling plant. Titanium Metal Corp. of America is owned jointly by National Lead Co. and Allegheny Ludlum Steel Corp. According to Titanium Metals Corp. of America, the Toronto plant was the world's first fully integrated plant devoted exclusively to rolling and forging titanium metal, from sponge through forgings, billets, and alloy sheets. Billets and rounds have been shipped for military and civilian jet-engine applications. The rolling facilities for sheet were expected to be ready early in 1958. Three titanium-sponge melting plants were active in Ohio in 1957; Mallory-Sharon Titanium Corp. (Niles) and Republic Steel Corp. (Massillon and Canton). Mallory-Sharon Titanium Corp., in a joint venture with United States Industrial Chemical Co. division of National Distillers and Chemical Corp., was in the process of constructing a new 5,000 ton-per-year titanium-sponge plant in the jointly owned new zirconium plant at Ashtabula. The new titanium plant will utilize metallic sodium from the nearby United States Industrial Chemical Co. sodium and chlorine plant for reducing titanium tetrachloride to titanium sponge.

Zirconium.—The Mallory-Sharon Metals Corp. zirconium plant near Ashtabula was completed in 1957. This company was owned jointly by Mallory-Sharon Titanium Corp. and United States Industrial Chemical Co., a division of National Distillers and Chemical Corp. Production at the 2-million-pound-per-year plant was expected to begin early in 1958. Output will consist of zirconium sponge and "chunklets" and byproduct hafnium. Half of the output (1 million pounds per year) of zirconium will be supplied at Reactor grade to the AEC under a 5-year contract. The other half of the output will be available to industry in both commercial and Reactor grades for nuclear work, as well as for structural use where high corrosion resistance is desired. The plant will utilize a sodium-reduction process that yields hafnium-free zirconium sponge. The process can also be applied to other metals, such as hafnium, titanium, tantalum, and columbium. The sodium employed in the process will be supplied by United States Industrial Chemical Corp. from its nearby sodium and chlorine plant. Hafnium will be recovered as hafnium tetrachloride, oxide, sponge, and platelets, some of which also will be available to industry.

REVIEW BY COUNTIES

Mineral production was recorded in all but two of the State's 88 counties. In 1957 Harrison, Belmont, Sandusky, Greene, and Jefferson Counties, in decreasing order of value, were the centers of greatest mineral activity. Compared with 1956, Tuscarawas County reported the greatest increase in mineral value owing to the increased valuation of the coal, clay, and sand and gravel recovered in the county. Belmont County had the largest decline from the preceding year owing primarily to decreased output of coal, the predominant mineral produced in the county. The State of Ohio Highway Department reported production of sand and gravel by either its own crews or by contractors in Athens, Meigs, Morgan, Vinton, and Washington Counties. Sand and gravel was also produced by Government-and-contractor operations for the highway departments of Ashland, Knox, Lake, and Summit Counties.

Adams.—Davon, Inc. (formerly New York Coal Co.), quarried and crushed limestone at Peebles. Most of the output was used for concrete aggregate and roadstone; the remainder was utilized for coal-mine rock dust, agricultural purposes, and railroad ballast. Crews of the Adams County Highway Department produced limestone used exclusively for concrete aggregate and roadstone.

Allen.—The output and value of limestone produced in Allen County declined in 1957 compared with 1956. Four quarries were active during the year—1 each near Bluffton and Delphos and 2 near Lima. The county output was used for concrete aggregate and roadstone primarily as well as for railroad ballast and agstone. C. E. Duff & Son produced building and paving sand and gravel and filter sand from its Westminster operation.

Ashland.—Paving and other gravel was recovered from commercial operations near Loudonville and Mifflin. Miscellaneous clay for manufacturing heavy clay products was mined from an open pit near New London.

TABLE 10.—Value of mineral production in Ohio, 1956-57, by counties ^{1 2}

County	1956	1957	Minerals produced in 1957 in order of value
Adams	\$546, 271	\$617, 032	Stone.
Allen	1, 247, 535	1, 208, 653	Stone, sand and gravel.
Ashland	(³)	(³)	Sand and gravel, clays.
Ashtabula	235, 846	217, 340	Sand and gravel.
Athens	2, 984, 795	(³)	Coal, stone, sand and gravel.
Auglaize	(³)	(³)	Sand and gravel, stone.
Belmont	(³)	28, 607, 849	Coal, stone, clays.
Brown	35, 916	45, 467	Stone, sand and gravel.
Butler	1, 784, 417	1, 912, 291	Sand and gravel, stone.
Carroll	2, 581, 803	2, 827, 424	Coal, stone, clays, sand and gravel.
Champaign	327, 788	443, 251	Sand and gravel.
Clark	(³)	(³)	Sand and gravel, lime, stone.
Clermont	772, 685	635, 933	Sand and gravel.
Clinton	490, 998	882, 482	Stone, sand and gravel.
Columbiana	8, 257, 777	(³)	Coal, clays, sand and gravel.
Coshocton	(³)	5, 163, 762	Coal, sand and gravel, stone.
Crawford	(³)	(³)	Stone, sand and gravel.
Cuyahoga	1, 260, 607	1, 341, 364	Sand and gravel, clays.
Darke	(³)	(³)	Do.
Delaware	(³)	(³)	Stone, lime, clays.
Erie	(³)	5, 543, 313	Cement, stone, sand and gravel.
Fairfield	(³)	(³)	Sand and gravel, stone.
Fayette	900, 825	1, 169, 244	Stone.
Franklin	8, 020, 020	8, 293, 635	Stone, sand and gravel, lime, clays.
Fulton	(³)	(³)	
Gallia	3, 272, 988	(³)	Coal, sand and gravel.
Geauga	(³)	(³)	Stone, sand and gravel.
Greene	(³)	(³)	Cement, sand and gravel.
Guernsey	2, 237, 937	2, 797, 056	Coal, stone.
Hamilton	4, 471, 047	4, 315, 168	Sand and gravel, stone.
Hancock	(³)	(³)	Stone, clays, sand and gravel.
Hardin	467, 776	(³)	Stone.
Harrison	43, 556, 460	42, 433, 097	Coal, stone, clays.
Henry	(³)	(³)	Sand and gravel, clays.
Highland	(³)	(³)	Stone, clays, sand and gravel.
Hocking	1, 429, 306	1, 024, 543	Clays, coal, sand and gravel.
Holmes	1, 628, 545	558, 740	Stone, clays, sand and gravel, coal.
Huron	(³)	(³)	Sand and gravel.
Jackson	3, 366, 146	2, 679, 086	Coal, clays, stone, sand and gravel.
Jefferson	17, 796, 196	(³)	Coal, clays, sand and gravel.
Knox	(³)	(³)	Sand and gravel, stone.
Lake	(³)	(³)	Cement, salt, sand and gravel.
Lawrence	9, 090, 508	8, 535, 121	Cement, clays, coal, sand and gravel, stone.
Licking	(³)	480, 569	Sand and gravel.
Logan	248, 618	297, 515	Stone, sand and gravel.
Lorain	(³)	(³)	Stone, sand and gravel, grindstone.
Lucas	(³)	(³)	Cement, stone, sand and gravel.
Madison	(³)	(³)	Sand and gravel, clays.
Mahoning	6, 238, 277	6, 527, 179	Coal, stone, 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	482, 828	(³)	Stone, sand and gravel.
Miami	1, 717, 007	1, 911, 373	Do.
Monroe	48, 630	(³)	Sand and gravel, stone.
Montgomery	(³)	(³)	Do.
Morgan	5, 718, 571	7, 059, 134	Coal, stone, sand and gravel.
Morrow	51, 703	43, 000	Sand and gravel.
Muskingum	10, 611, 218	(³)	Cement, coal, sand and gravel, stone, clays.
Noble	(³)	(³)	Coal, stone, clays.
Ottawa	9, 831, 127	9, 322, 288	Lime, stone, gypsum.
Paulding	(³)	(³)	Cement, stone, clays.
Perry	(³)	(³)	Coal, sand and gravel, clays.
Pickaway	(³)	(³)	Sand and gravel.
Pike	(³)	(³)	Stone, sand and gravel.
Portage	4, 658, 442	4, 850, 588	Sand and gravel, stone, coal, peat.
Preble	(³)	(³)	Lime, sand and gravel, stone.
Putnam	428, 043	382, 851	Stone, clays.
Richland	(³)	(³)	Sand and gravel, clays, peat.
Ross	(³)	(³)	Sand and gravel, stone.
Sandusky	17, 847, 616	18, 640, 914	Lime, stone, sand and gravel.
Scioto	2, 729, 187	2, 415, 014	Stone, clays.
Seneca	(³)	(³)	Lime, stone, clays.
Shelby	297, 737	387, 566	Sand and gravel, stone.
Stark	10, 917, 622	10, 872, 078	Cement, coal, sand and gravel, clays, stone, peat.
Summit	12, 688, 748	13, 009, 790	Salt, lime, sand and gravel, stone, clays, peat.
Trumbull	207, 650	177, 901	Sand and gravel.
Tuscarawas	12, 644, 970	(³)	Coal, clays, sand and gravel.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Ohio, 1956-57, by counties^{1 2}—Continued

County	1956	1957	Minerals produced in 1957 in order of value
Union.....	(3)	(3)	Stone, sand and gravel.
Van Wert.....	(3)	(3)	Stone, clays.
Vinton.....	(3)	(3)	Coal, clays, stone, sand and gravel.
Warren.....	\$550, 151	\$449, 273	Sand and gravel.
Washington.....	1, 139, 093	(3)	Coal, sand and gravel, grindstone, clays.
Wayne.....	(3)	(3)	Salt, coal, sand and gravel, clays.
Williams.....	(3)	(3)	Sand and gravel, clays.
Wood.....	1, 449, 603	(3)	Stone, lime, clays.
Wyandot.....	(3)	(3)	Stone, lime, sand and gravel, clays, peat.
Undistributed.....	158, 216, 973	187, 778, 861	
Total.....	375, 498, 000	385, 858, 000	

¹ Defiance County was 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."

Ashtabula.—Mostly structural and paving sand and gravel were produced by five operators in the northern part of the county. A limited quantity of molding sand was produced near Conneaut.

Athens.—Most of the coal recovered in the county was mined underground and was shipped primarily by truck. The No. 255 cleaning plant of Gem Coal Co. was active during the year. Limestone for concrete aggregate and road material was obtained from the quarries of Shamrock Quarries, Inc. (formerly Dickson Bros.), and Diamond Stone Quarries, Inc., both near Albany; and Amesville Stone Co., Amesville. Commercial sand and gravel production was limited to two operations in the midwestern part of the county and consisted of paving and structural material.

Auglaize.—Sand and gravel produced in Auglaize County originated at seven pits, most of which were near Wapakoneta, Lima, Jackson Center, Celina, and Findlay. The output was utilized chiefly for building and paving purposes. A small quantity of filter and other sands also was produced. National Lime & Stone Co. quarried limestone for concrete aggregate and agricultural purposes at its Buckland No. 1 quarry near Wapakoneta. It also reported a new quarry—Buckland No. 2 near Buckland—where crushed limestone for use as concrete aggregate and road material was produced.

Belmont.—Although production of coal in Belmont County dropped from 7.4 million tons in 1956 to 6.6 million in 1957, the county continued to rank second in the State in coal output, which was mainly from underground mines. Over 4 million tons of coal was cleaned at 7 cleaning plants in the county. Thirty continuous mining machines were utilized in county mines. Limestone was crushed for use as concrete aggregate and road material and for agricultural purposes at quarries near Malaga and Somerton. Miscellaneous clay for manufacturing building brick was recovered near Bellaire.

Brown.—The only commercial mineral producer in the county was Howard S. Watson, who produced paving gravel at a pit near Georgetown and quarried limestone for building roads and agricultural purposes. Limestone for concrete aggregate and roadstone was produced by Government-and-contractor operations for the Brown County Highway Department.

Butler.—Butler County continued as a leading sand and gravel producing area and ranked fifth in value of output in 1957. Thirteen operations were active during the year, producing mainly building and paving material. Most of the operations were near Hamilton and Middletown. Mecco, Inc., producers of paving and building gravel, installed a conveyor and sizing and screening equipment at its Middletown fixed plant. The North Cincinnati Co. (Hamilton) produced limestone for use as concrete aggregate and roadstone, as well as sand and gravel.

Carroll.—Coal was recovered in Carroll County largely by strip mining. No auger mines were active during the year. Limestone was quarried for concrete aggregate, road material, and agricultural purposes at the Ames Limestone Plant of Hanna Coal Co., Division of Pittsburgh Consolidation Coal Company. The Rainbow Stone Co. produced dimension sandstone for architectural purposes at its Sherrodsville quarry. Clay was produced at six open-pit operations in the county. Fire clay was recovered from pits near Magnolia and Minerva, and miscellaneous clay was produced near Malvern and Magnolia. Output was used for firebrick and block, building brick, vitrified sewer pipe, and other heavy clay products. Minerals City Sand Co. (Minerals City) produced molding sand.

Champaign.—Sand and gravel was produced by American Aggregates at a fixed plant near Urbana. The output was used for paving purposes and railroad ballast. Walter R. Dorsey produced a limited quantity of building gravel at his portable plant near Spring Hill. A small quantity of paving gravel also was produced near Mechanicsburg.

Clark.—The production of sand and gravel increased 16 percent, as 12 sand and gravel operations in Clark County were active during the year, compared with 7 in 1956. County output was used mainly as building and paving material. Springfield Cement Products, Inc. (Springfield), a leading producer, reported that its name was changed to Eagle City Sand and Gravel. M. L. Eidemiller reported that its Springfield operation has not been in operation since October 1956. Limestone was quarried and crushed by The Moores Lime Co. for use as concrete aggregate, blast-furnace flux, and agstone and in lime manufacture at its Durbin plant. The lime output was used primarily for agricultural and refractory purposes. No peat production was reported in Clark County in 1957.

Clermont.—The county had two sand and gravel producers in 1957. Ohio Gravel Co. (Miamiville) produced large quantities of building and paving sand and gravel. A small quantity of paving gravel was produced by W. A. Hodson (Highland).

Clinton.—The Melvin Stone Co. recovered limestone from an underground mine near Melvin for concrete aggregate, agricultural purposes, blast-furnace flux, riprap and asphalt filler. The company also mined sand and gravel near Sligo, mostly for building and paving material. Some paving gravel was produced by Clinton Asphalt & Paving Co. (Wilmington).

Columbiana.—Coal production in the county increased in 1957 compared with 1956, despite a drop in the number of active mines. Output was primarily from strip mines. Five of the county's 42 mines crushed coal, and one used oil as a dust preventive. The county ranked second in value of clay production among Ohio's 39 clay-

producing counties. Fire and miscellaneous clay was produced along the eastern section of the county. McLain Fire Brick Co., Division of H. K. Porter Co., Inc., the leading fire-clay producer, operated 3 underground mines—1 near Irondale and 2 near Wellsville. The bulk of the county fire-clay production was utilized for refractories, and miscellaneous clay was used chiefly for manufacturing building brick. Four sand and gravel operations were active during the year near Leetonia and East Liverpool. Output consisted mainly of building and paving sand and gravel. Cherry Valley Sand Co. acquired the Leetonia open-pit operation of the Morgan Sand Bank Co. The company also operated its Franklin Square pit near Leetonia.

Coshocton.—Production of coal in the county (mainly strip-mined) increased slightly in 1957 over the previous year. Seven mines crushed coal only, while one mine both crushed and used oil for treating coal. Seven sand and gravel operations were active in the county in 1957 compared with 10 in 1956. Although the number of active producers decreased, the output of sand and gravel increased owing to increased demand for paving material. Structural and other sand and gravel were also produced. Boyd Gravel (formerly B. W. Boyd & Son) installed a new washer at its Coshocton plant. W. P. McCarren Co. operated two portable plants at Wolhonding and Lewisville and produced large quantities of paving material. Miller Gravel Co. (formerly George E. Miller) was active near Newcomertown. There were other sand and gravel operations near Coshocton and Warsaw. Ayers Mineral Co. produced molding sand at its Blissfield operations. Six quarries of Briar Hill Stone Co. were active during the year, producing sandstone for architectural purposes. The Variegated Quarries Division, Nicholl Stone Co. produced dimension sandstone at its quarry in the county. The output was shipped to Killbuck, Holmes County, for fabrication into sawed architectural stone. The Fresno sandstone quarry of the Pearl Sandstone Co. was not active during the year.

Crawford.—National Lime & Stone Co. (Bucyrus) quarried a large quantity of limestone for concrete aggregate and agricultural and metallurgical purposes and for railroad ballast. Galion Gravel Co. produced sand and gravel for building and paving purposes, filter sand, and sand and gravel for fill, at its operation near Galion.

Cuyahoga.—Sand and gravel was recovered from eight operations in the county in 1957. Production increased substantially over the preceding year, as the demand for building and paving material increased. Sand for fill and filter uses also was produced. Most of the output came from the Cleveland area. Six miscellaneous clay operations, mostly near the Cleveland metropolitan area, were active during the year. Hydraulic Press Brick Co., South Park, mined and processed miscellaneous shale for use as lightweight aggregate. Building brick was the end product of the other clay operations in the county. Wyodak Chemical Division, Federal Foundry Supply Co., exfoliated crude vermiculite shipped from outside Ohio at its Cleveland plant. Cleveland Builders Supply Co. expanded perlite at its plant near Cleveland. Republic Steel Corp. did not recover any brimstone (recovered elemental sulfur) as a byproduct of gas purification at its Cleveland plant.

Darke.—Seven sand and gravel producers were active in Darke County in 1957. The output was utilized for paving, building, and fill purposes. Production was reported from operations near Fort Jefferson, Greenville, New Madison, and Versailles. Miscellaneous clay for draintile was produced near Greenville.

Delaware.—Limestone was quarried by the Scioto Lime & Stone Co. near Delaware. A large part of the output was used as concrete aggregate, railroad ballast, agricultural purposes, and riprap. The remainder was utilized in manufacturing lime at its nearby plant. The lime output was employed mainly for metallurgical and water-purification purposes. During the year Marble Cliff Quarries Co. acquired the Powell operations of Shawnee Stone Co. and enlarged the facilities by adding a 100-ton-per-hour crushing plant. The output from this plant was used for roadstone, agstone, and riprap. Other limestone operations near Radnor and Ostrander produced roadstone and agstone. Building brick was made from miscellaneous clay mined near Westville and Galena.

Erie.—Portland and masonry cements were manufactured at the Bay Bridge plant of Medusa Portland Cement Co. Raw materials used to manufacture cement included limestone, marl, clay, gypsum, and fly ash. Substantial quantities of limestone were quarried in Erie County in 1957. Sandusky Crushed Stone Co., Inc., the leading producer, installed a 43- by 50-inch impact crusher at its Parkertown operation. Limestone was also produced from quarries near Castalia and Sandusky. The county limestone output was used mainly for concrete aggregate, roadstone, and agstone. Ohio Foundry Sand Co. and Keener Sand & Clay Co. produced molding sand near Huron and Shinrock, respectively.

Fairfield.—Structural and paving sand and gravel, molding and other sand, and gravel for fill were produced in the county by seven operators. Production was centered near Lancaster, Reynoldsburg, and Carroll. R & M Sand & Gravel Co., producers of paving and other gravel, built a gravel-washing plant at its Reynoldsburg operation. Limestone for concrete aggregate and agricultural purposes was quarried near Lancaster.

Fayette.—Crushed limestone was produced by Blue Rock, Inc., Fayette Limestone Co., Inc., and Sugar Creek Stone Co., all near Washington Court House. Their production was utilized as concrete aggregate, riprap, agstone, and railroad ballast.

Franklin.—Franklin County ranked second in Ohio in the value of stone and sand and gravel production. Marble Cliff Quarries Co. (Columbus) quarried and crushed limestone for metallurgical purposes, concrete aggregate, railroad ballast, and agstone. Part of the output was also used by the company in manufacturing quicklime and hydrated lime. The company also erected a new sand-and-gravel processing plant. The American Aggregates Corp. (Columbus) led Franklin County again in 1957 in producing sand and gravel. This company reported installing a correction process at its plant. Five other producers, also near Columbus, produced sand and gravel, used mainly for building and paving purposes. Molding and fill sand and railroad ballast and other gravel were also produced. Miscellaneous clay and shale were mined at two operations near Blacklick. The output was used to manufacture building brick and draintile.

Gallia.—Seven underground, 6 strip, and 2 auger coal mines were active in the county during the year. Production increased slightly in 1957, as more coal was strip-mined. The entire output of three mines in the county was crushed for marketing. The Cheshire Cleaning plant of Peacock Coal Co. cleaned run-of-mine coal. M. T. Epling Co., Gallipolis, produced building and paving sand and gravel and a limited quantity of blast sand. Keener Sand & Clay Co. produced molding sand at its Kerrs operation.

Geauga.—Harbison-Walker Refractories quarried and crushed quartzite for silica brick at its Thompson operation. Five operators at various localities in the county produced sand and gravel, primarily for building and paving.

Greene.—Southwestern Portland Cement Co. and Universal Atlas Cement Co. quarried limestone at Fairborn and crushed the entire output for use in manufacturing cement at its Fairborn plants. In addition to limestone, substantial quantities of clay and gypsum were used as cement raw materials. The combined cement output of these plants made Greene County the leading cement-producing area in Ohio in 1957. Seven sand and gravel operators were active at various sites in Greene County in 1957. Their output consisted mainly of gravel used for building and paving purposes.

Guernsey.—The production of coal in Guernsey County increased 33 percent in 1957 as the number of active mines rose from 12 in 1956 to 20 in 1957. The output was mostly from strip mines. John Gress quarried and crushed limestone for roadstone at New Concord.

Hamilton.—Although production and value dropped from those in the preceding year, Hamilton County continued to be the leading sand-and-gravel-producing area in Ohio. The leading producer in the county was Ohio Gravel Co., with operations at Camp Dennison, Cleves, Miamitown, and Newtown. The remaining county output was produced by six companies in other sections of the county. The output was used mainly for building and paving. Filter and other sands and railroad ballast and other gravel were also produced. The Ohio Gravel Co. also quarried and crushed limestone for agricultural purposes at two plants near Newtown and Camp Dennison.

Hancock.—National Lime & Stone Co., Tarbox-McCall Stone Co. (both of Findlay) and Pifer Stone Co., Inc. (Williamstown), quarried limestone for concrete aggregate, railroad ballast, and agricultural purposes. Various heavy clay products were made from clay mined near Findlay. Sand and gravel used for building and paving was produced at McComb.

Hardin.—Limestone was quarried by the Herzog Lime & Stone Co. (Forest), the leading producer; Hardin Quarry Co., Blanchard; and the France Co., Kenton. Hardin County output was used for concrete aggregate, metallurgical work, agricultural purposes, railroad ballast, and riprap.

Harrison.—Harrison County continued to be the leading coal-producing area in the State, despite a 9-percent drop from the 1956 production of over 10 million tons. The county also continued to rank first in mineral valuation of the State's 86 mineral-producing counties. Sixty-seven percent of the coal was mined from strip pits, 31 percent from underground mines, and 2 percent by auger methods. Seven of the State's 14 power shovels with dipper capacities of over 12

cubic yards were active in the county. The Georgetown plant of Hanna Coal Co., Division, Pittsburgh Consolidation Coal Co., and the Nelms plant of Youghiogheny and Ohio Coal Co. cleaned considerable tonnages of coal during the year. Over 3.7 million tons of coal was crushed and over 2.2 million tons was treated for dust preventative or antifreezing at mines in the county. The Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co., also quarried and crushed large quantities of limestone near Cadiz for concrete aggregate and agricultural purposes. Draintile for use on farms was produced from miscellaneous shale mined near Bowerston.

Henry.—Sand was dredged from the Maumee River for building purposes by Turkey Foot Sand & Gravel Co. (formerly Arthur A. Williams) and Napoleon Sand & Gravel Co. Miscellaneous clay and shale was recovered from open pit operations near Malinta and Napoleon for use in manufacturing draintile and other heavy clay products.

Highland.—Limestone was quarried and crushed for concrete aggregate and agstone by Highland Stone Division of Davon, Inc. (formerly New York Coal Co.), Hillsboro; and Ohio Asphaltic Limestone Co., New Vienna. Building brick was made from clay mined near Mowrystown. The only sand and gravel producer in the county was Uhrig & Collins at Hillsboro; output consisted of structural and paving gravel.

Hocking.—Clays were recovered at four operations in the county near Logan, Haydenville, and Nelsonville. The output was chiefly fire clay; it was used for building brick and other heavy clay products. Seven underground, 7 strip, and 3 auger coal mines were active in the county during 1957. The bulk of Hocking County's coal production came from strip pits. F. H. Brewer Co. and Donahey Bros. (formerly Hocking Valley Sand & Gravel) produced building and paving sand and gravel at Enterprise and Logan, respectively.

Holmes.—Dimension sandstone was quarried for architectural use and flagging by the Briar Hill Stone Co., Glenmont. The Nicholl Stone Co. (Killbuck) fabricated sandstone quarried in Coshocton County. Plastic fire clay and miscellaneous clay were mined at operations near Berlin and Baltic, respectively. The miscellaneous clay was used for manufacturing building brick; the fire clay was used primarily for building brick and refractory uses. Holmes County sand and gravel operations were concentrated in the central part of the county. The output from three producers consisted of building and paving sand and gravel and railroad ballast and other gravel. Coal production in Holmes County was limited to 1 underground and 1 strip mine.

Huron.—Huron Sand & Gravel Co. (Willard) produced building and paving sand and gravel and filter gravel. Greenwich Sand Co. (Greenwich) produced sand for building purposes and gravel for other uses. No peat production was reported in Huron County in 1957.

Jackson.—The output of coal in Jackson County in 1957 decreased 34 percent compared with 1956 and was mostly from strip mines. The Broken Aro and Waterloo cleaning plants of Broken Aro Coal Co. and Waterloo Coal Co., respectively, were active during the year. The county continued to be a leading fire-clay-producing area in 1957. Seven operations were active during the year and were cen-

tered near Oak Hill. Most of the output was used for firebrick and block and other refractory use. Cambria Clay Products Co. (Black Fork) quarried quartzite for silica brick in 1957. A small amount of building sand was recovered from the silica-quarry operation of Charles E. Wilson (Jackson).

Jefferson.—Jefferson County continued to rank third in coal output. Production totaled 3,796,000 short tons in 1957—a 4-percent decline from 1956. Over 50 percent of Jefferson County's total output was from strip operations. Over 1 million tons of coal was cleaned at the Piney Fork No. 1 plant of Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co., and the Jennie plant of Warner Collieries Co. Coal was crushed for marketing at 12 mines in the county. In terms of value, Jefferson County ranked fourth in clay production during 1957. The output consisted mainly of fire clay and was mined from six operations, mainly in the eastern section of the county. The bulk of the fire clay was used for vitrified sewer pipe and refractory use. The Iron City Sand & Gravel Corp. (Stratton) dredged sand and gravel from the Ohio River for building and paving purposes. The Brilliant property of Brilliant Sand Co. was appropriated by the State of Ohio Highway Department for highway purposes. The company was forced to cease operations as of December 31, 1956, and during 1957 the company sought new deposits to resume operations but was unsuccessful.

Knox.—Sand and gravel was produced at six commercial operations in the county. The output increased substantially from the preceding year, owing to increased demand for paving material. In addition, structural sand and gravel, glass sand, foundry sand, and filter sand also were produced. Millwood Sand Co. (Howard) produced ground sand for foundry uses and for manufacturing pottery, procelain, and tile. Sawed architectural sandstone was recovered from the No. 6 quarry of Briar Hill Stone Co.

Lake.—Standard Portland Cement Division of Diamond Alkali Co. produced portland and masonry cement at its Painesville plant. Limestone, clay, and gypsum were used as cement raw materials. Diamond Alkali Co. also recovered brine from wells near Painesville for use in manufacturing chlorine and soda ash. Sand and gravel for building, paving, and fill purposes was produced by four commercial operators in the county. Production was reported from Kirtland, Eastlake, Mentor, and Painesville.

Lawrence.—Limestone and sandstone were quarried in Lawrence County by Alpha Portland Cement Co. for use in manufacturing cement at its Ironton plant. In addition to limestone and sandstone, sand, gypsum, and iron ore also were used in manufacturing portland and masonry cement. Marquette Cement Manufacturing Co. opened a new limestone quarry in the county. Output was utilized entirely in manufacturing cement at the company Superior plant. The company also used shale and purchased gypsum as cement raw materials. Crushed limestone used for roadstone was also produced for the Lawrence County Highway Department. From eight operations scattered throughout the county, fire and miscellaneous clay was mined chiefly for refractory purposes and floor and wall-tile manufacture. Four strip and 2 underground coal mines were active in the county during 1957. One mine crushed coal for marketing.

Wilson Sand & Gravel Co. (Chesapeake) produced sand and gravel used for building and paving.

Licking.—Building and paving sand and gravel, railroad-ballast gravel, and other sand and gravel were produced by 10 operators at various locations in the county in 1957. Dry Creek Crushed Gravel Co., a leading sand and gravel producer, enlarged its gravel plant at Newark during the year. The Hanover clay operation of Bowerston Shale Co. was inactive in 1957.

Logan.—National Lime & Stone Co. (East Liberty), Northwood Stone & Asphalt Co. (Belle Center), and Western Ohio Stone Co. (Huntsville) quarried limestone, which was crushed for use as concrete aggregate, agstone, and riprap. Sand and gravel was recovered from eight operations throughout Logan County in 1957. The bulk of the output was used as building and paving material.

Lorain.—Cleveland Quarries Co. (Amherst) produced rough and sawed architectural stone, including dimension stone for refractory lining. The company also produced stone for curbing, flagging, riprap, concrete aggregate, roadstone, and other uses. The Nicholl Stone Co. produced architectural sandstone, as well as a limited quantity of grindstones (abrasive stones), at its quarry near Kipton. The combined output of these companies made Lorain County the fourth ranking in stone valuation in the State. Lorain Elyria Sand Co. produced structural and paving sand and gravel and other gravel at their dredging operation near Lorain. The company improved its dock facilities during the year. National Sand & Gravel Co. produced paving sand from dredging operations near Lorain.

Lucas.—Substantial quantities of portland cement was manufactured at the Toledo plant of Medusa Portland Cement Co. Calcareous marl, clay, and gypsum were used as cement raw materials. Crushed and broken limestone was produced for use as concrete aggregate, agricultural and metallurgical purposes, railroad ballast, and riprap by the France Stone Co., Waterville; Maumee Stone Co., Maumee; and Toledo Stone & Glass Sand Co., Sylvania. Dimension limestone used for rubble and building purposes was produced by Toledo House of Correction. Building and paving sand and gravel and engine sand were recovered by dredging near Toledo by four producers.

Madison.—West Jefferson Sand & Gravel Co. (West Jefferson) produced sand and gravel for building and paving purposes. Drain-tile was made from surface clay recovered near London.

Mahoning.—Coal production was limited to 12 strip operations in Mahoning County and increased 10 percent in 1957 compared with 1956. Output from six of the mines was crushed for marketing. Limestone was quarried and crushed near Poland Township. The output was used for flux in blast furnaces and as concrete aggregate, agstone, rock dust for coal mines, mineral food, asphalt, and poultry grit. Miscellaneous clay used for building brick was mined at operations near Alliance and Sebring. Two open-pit mines near Canfield and Youngstown produced fire clay used exclusively for refractories. Sand and gravel for building and paving purposes was produced by two operators near Salem. R. A. Fortune erected a new sand and gravel plant near Salem.

Marion.—The National Lime & Stone Co., the leading producer, and J. M. Hamilton & Sons Co., (Marion) and Tri-County Limestone Co., (La Rue) produced limestone for use as concrete aggregate, railroad ballast, agstone, and riprap. Marion Brick Corp. (formerly Marion Brick & Tile Corp.) mined and processed miscellaneous clay into building brick. During the year the company doubled its brick-burning capacity at its Caledonia plant. Miscellaneous clay also was mined at La Rue Tile Co. and was utilized for manufacturing heavy clay products. Penry Sand & Gravel Co. produced sand and gravel used chiefly for building and paving material.

Medina.—Substantial quantities of sand and gravel for building, paving, and fill purposes were produced by four operators in Medina County in 1957. Building brick was produced from miscellaneous clay mined near Wadsworth.

Meigs.—Coal production in Meigs County dropped 27 percent in 1957 compared with 1956; it was mainly strip-mined. Building sand and building and paving gravel were produced by Tri-State Materials Corp., Pomeroy. Richards & Son, Inc., also of Pomeroy, produced a sizable amount of structural gravel. Excelsior Salt Works, Inc. (Pomeroy), operated a 1,220-foot well and was the only producer of salt in Meigs County in 1957. Pomeroy Salt Corp. (Minersville), producers of salt and natural salines (calcium chloride) in 1956, did not operate during the year.

Mercer.—Rockford Stone Co. and the John W. Karch Stone Co., Celina, quarried limestone for concrete aggregate, agstone, and riprap. Rockford Stone Co. also produced a limited quantity of paving sand and gravel. A limited quantity of paving sand was recovered near New Weston.

Miami.—Armco Steel Corp., Piqua Quarries (Piqua) quarried a large quantity of limestone for metallurgical purposes, concrete aggregate, agricultural uses, and riprap and for filler material. Sand and gravel used as building and paving material and for fill purposes was produced by five operators in various parts of the county in 1957. Fenton Construction Co. (Troy) reported that two shifts were utilized to meet increased demands for paving material.

Monroe.—Witten Gravel Pit produced paving gravel at its pit in Jackson Township. Christman Quarry Co. quarried limestone used for concrete aggregate and agstone.

Montgomery.—Although output declined from 1956, Montgomery County continued to rank third in value of sand and gravel production in 1957. Eighteen producers were active during the year. The output consisted mainly of structural and paving material. Central Sand & Gravel Co. added a new crusher at its Dayton operations in 1957. Laura Gravel & Stone Co. (Phillipsburg) and Limestone Dayton Co. (Dayton) reported an output of limestone for concrete aggregate, agricultural purposes, blast-furnace flux, and riprap. Schumacher Industries, Inc., produced expanded perlite near Dayton. The plant was in operation only 9 months in 1957.

Morgan.—Production of coal, mostly from strip operations, totaled 1,923,000 short tons in 1957, an 8-percent increase over 1956. The bulk of Morgan County's coal output was cleaned at the Roberts and Schaefer plant of Central Ohio Coal Co. and the Misco plant of Simpson Coal & Chemical Corp. Chesterhill Stone Co. (Reiners-

ville) quarried limestone for concrete aggregate and roadstone. Stockport Sand & Gravel Co. reported production of sand and gravel for paving in 1957. Douglas Ervin produced a small quantity of gravel. Both operations were near Stockport.

Morrow.—Chesterville Sand & Gravel Co. (Chesterville) produced building and paving sand and fill gravel in 1957.

Muskingum.—Limestone and miscellaneous clay were recovered and processed for portland- and masonry-cement manufacture at the East Fultonham operation of Columbia Cement Division, Columbia-Southern Chemical Corp. The company also purchased and used shale, sand, and gypsum as cement raw materials. Sidwell Bros. (Zanesville) also quarried limestone for use as concrete aggregate and roadstone and for agricultural purposes. Eleven underground, 6 strip, and 1 auger coal mines were active in the county during the year; the bulk of the coal production came from strip operations. Production decreased over 50 percent in 1957, as the number of active mines dropped from 26 in 1956 to 18 in 1957. Limited tonnages of coal were cleaned at the Ten X plant of Ten X Coal Co. Sand and gravel, used mainly for structural purposes, was produced at Duncan Falls, Nashport, and Zanesville. Miscellaneous clay was mined for stoneware and building brick at Roseville and Frazeytsburg. Tionesta Clay Co. (Zanesville) was inactive during 1957 due to decreased demand for miscellaneous clay used for manufacturing pottery.

Noble.—Although the number of active mines decreased from 9 in 1956 to 4 in 1957, the production of coal increased slightly in 1957. All output was from strip operations as no auger mines were active in 1957. Over half of Noble County's total production was cleaned at the Cumberland plant of Central Ohio Coal Co. In addition, over 500,000 tons of coal was prepared for marketing at 2 plants in the county. James Merry Stone Co. (Caldwell) and Yerian Bros. (Ava) quarried limestone for use as concrete aggregate, roadstone, and agstone. Miscellaneous clay used for manufacturing building brick was recovered from an open pit near Ava.

Ottawa.—Ottawa County continued to be an important area in limestone production; it was also the only source of gypsum in Ohio. The county also ranked third in the value of lime produced in 1957. Quicklime and hydrated lime were processed at the Genoa plant of United States Gypsum Co.; and at the White Rock (Clay Center) plant of Basic, Inc. Chemstone Corp., Minerals & Chemicals of America, quarried and crushed limestone at Marblehead, principally for metallurgical work and for concrete aggregate, agstone, and riprap. Basic, Inc., quarried limestone at Clay Center for metallurgical work, refractory material, concrete aggregate, and agricultural purposes and for its own use in manufacturing lime. Crude gypsum was mined and calcined for manufacturing finished building materials at the Port Clinton operation of Celotex Corp. and by United States Gypsum Co. at Gypsum.

Perry.—Coal production in Perry County exceeded 2.2 million in 1957—a 28-percent increase over 1956. The county also ranked fifth in coal output in 1957, moving up from sixth-ranking in 1956. Ten underground, 15 strip, and 2 auger coal mines were active during the year, with strip mines producing the bulk of Perry County's total output. Glass and molding sands were recovered near Glenford

and New Lexington. In addition, sand was ground for use in pottery, porcelain, and tile manufacture. Fire and miscellaneous clays were produced at operations throughout the county. The output was used mainly for heavy clay products, lightweight aggregate, and floor and wall tile. Lightweight aggregate was produced from miscellaneous shale by Lite-Stone Aggregates Corp. at New Lexington. The corporation was active until August 1, 1957, when the assets of the firm were sold to Buildex, Inc., of Pittsburg, Kans. Buildex, Inc., did not operate during the remainder of the year but was engaged in repairing the plant's facilities.

Pickaway.—The Sturm & Dillard Co. produced sand and gravel for paving and railroad-ballast gravel at its Circleville operation. The company reported that it increased the washing facilities at its plant.

Pike.—Harbison-Walker Refractories Co. quarried and crushed quartzite for use in manufacturing silica brick at Beaver. Durex Refractories Co. (formerly Ohio Mineral Co., Inc.) operated its plant near Beaver. The output was used for glass, molding, building, blast, fire or furnace, and refractory sand. In addition, metallurgical and refractory gravels were produced. Five other producers were active in the Scioto River area in 1957. Their output consisted mainly of structural and paving material. Scioto Valley Sand & Gravel Co., Jasper, went out of business and sold its equipment on April 1, 1957.

Portage.—This county ranked fourth in the value of its sand and gravel output, as 20 operations were active in 1957. Most of the production was used for structural and paving purposes and came from pits near Kent, Ravenna, and Mantua. In addition, large quantities of molding sand were produced by Industrial Silica Corp. at two operations near Garrettsville and Geauga Lake. The company also produced grinding and polishing, blast, engine, and other industrial sands. Harbison-Walker Refractories quarried and crushed quartzite at Nelson for use in silica brick. Sandstone was quarried and crushed for manufacturing silica brick at Garrettsville by Niles Fire Brick Division, Mexico Refractories Co. Coal production in the county was limited to the strip operation of Peterson Coal Co., which also cleaned most of the output at its Atwater cleaning plant. Moss and humus peat was recovered from a bog near Ravenna.

Preble.—Marble Cliff Quarries Co. manufactured quicklime and hydrated lime at the site of its limestone quarry near Lewisburg. In addition to its use in lime, the limestone was utilized as concrete aggregate, roadstone, agstone, and blast-furnace flux. Building and paving sand and gravel were produced by White Gravel Co. (Camden), Steiner Washed Sand and Gravel Co., and Blue Bank Gravel Co., both of West Alexandria.

Putnam.—The bulk (93 percent) of the limestone quarried in Putnam County was used for concrete aggregate and roadstone. The remainder was used for agricultural and other purposes. Output came from four operations near Ottawa, Columbus Grove, and Pandora. Four open pits near Continental, Glandorf, Dupont, and Ottoville produced miscellaneous clay used exclusively for manufacturing drain tile.

Richland.—Structural and paving sand and gravel and a small quantity of filter sand were produced by four companies in the south-

ern part of the county in 1957. Building brick was produced from miscellaneous clay mined at two operations near Manfield. Peat was produced from bogs near Shelby and Shiloh.

Ross.—Central States Construction Co. (Chillicothe) led Ross County again in sand and gravel production in 1957. Six other operations, mostly in the Chillicothe area, were active during the year. County output consisted of building and paving sand and gravel, molding sand, and railroad-ballast gravel. Ohio Silica Co., Inc., at Richmondale, quarried and crushed quartz for use in silica brick and glass and for metallurgical purposes. Limestone used mainly for concrete aggregate and roadstone was quarried by Paint Valley Sand & Gravel Co.

Sandusky.—Sandusky County continued to be the leading stone (limestone) and lime-producing area in Ohio. Eight companies produced lime (quick and hydrated) totaling 958,000 short tons valued at \$15,387,000. Sixty-three percent of the county output was used as refractory material; the remainder was utilized as building material (23 percent) and for chemical, industrial, and agricultural purposes (14 percent). In addition to lime production, these companies quarried limestone near their plants. There were 4 operations near Gibsonburg, 3 near Woodville, and 1 near Millersville. Most of the limestone from the quarries was consumed in manufacturing lime. Two other limestone quarries were also active in the county during the year—1 near Fremont and 1 at Bellevue. In addition to being used for manufacturing lime, substantial tonnages of the limestone produced in the county were used as concrete aggregate and roadstone and for metallurgical purposes. Home Sand & Coal Co. dredged sand from the Sandusky River near Fremont for building purposes.

Scioto.—Dimension sandstone for architectural purposes and flagging was quarried by Taylor Stone Co. (McDermott). The company also produced crushed and broken stone for riprap and refractory uses. Waller Bros. Stone Co. (McDermott) produced architectural sandstone and crushed and broken stone for refractory purposes. Fire clay for firebrick and block and other refractories was produced at five operations in the county during the year. International Minerals & Chemical Corp., a fire-clay producer, purchased the property at its plant site near Lyra.

Seneca.—Seneca County ranked second and third, respectively, in Ohio in the value of its lime and stone (limestone) production. The entire output of dead-burned dolomite (lime) at the Maple Grove plant of Basic, Inc., was used for refractory purposes. Limestone was also quarried by Basic, Inc., at Maple Grove for metallurgical work and agricultural purposes and as concrete aggregate and roadstone. Other county limestone producers were the France Co., Bloomville; and Northern Ohio Stone Co., Flat Rock. Output from these companies was used for blast-furnace flux, concrete aggregate, railroad ballast, agstone, and riprap. Arnold Gerhardstine, producer of draitile, added a kiln to his plant facilities at St. Stephen.

Shelby.—Six sand and gravel producers were active in Shelby County in 1957. The bulk of the output was used for building and paving purposes. Miami River Quarries, Inc., quarried limestone

near Sidney. The production was used almost entirely as concrete aggregate and roadstone.

Stark.—The Diamond Portland Cement Co. quarried limestone near Middle Branch and used the entire output for manufacturing portland and masonry cement at a nearby plant. The company also used shale, gypsum, and slag as cement raw materials. Improvement and expansion of company facilities in 1957 included addition of a new raw-material preparation department and a new kiln, which was started on October 12. The output of coal dropped in the county, as two fewer strip operations were active during the year. One underground and 15 strip mines accounted for Stark County's coal production in 1957. Coal was cleaned and treated with oil at the Tri-Seam Mining, Inc., plant. Five mines crushed coal for marketing. The county continued to be an important sand-and-gravel-producing area, as output was reported from 16 operations compared with 13 in 1956. Production and value increased during the year owing to an increased demand for paving material. The Standard Slag Co. (the leading producer) added a crusher for processing material at its Massillon plant.

Although production declined 19 percent from the preceding year, Stark County ranked third in the value of clay in 1957. Eleven operations were active during the year compared with 13 in 1956. Fire and miscellaneous clays were recovered and used chiefly for manufacturing building brick and other heavy clay products. Clays for floor and wall tile and refractory purposes also were produced. Bogs near Canton yielded humus peat.

Summit.—Columbia-Southern Chemical Corp. (Barberton) operated 16 wells, averaging 3,000 feet, and produced evaporated salt and brine. The evaporated salt was used for chemicals, soap, and other various uses, and the brine was used exclusively for manufacturing soda ash and chlorine. The Diamond Crystal Salt Co. (Akron) also produced evaporated salt and brine from wells. Columbia-Southern Chemical Corp. also recovered limestone from an underground mine near Barberton and sandstone, used for concrete aggregate, roadstone, and glass manufacture, from a quarry in Norton Township. The limestone mine was developed by 2 vertical shafts averaging 2,280 feet in depth. Mining methods utilized at the mine were room-and-pillar (70 percent) and open stope (30 percent). Most of the output from the mine was transferred to the company plant nearby and made into quicklime, used in manufacturing alkalies. The remaining limestone was crushed and broken for agstone, concrete aggregate, and roadstone.

Compared with 1956, production and value of sand and gravel increased in Summit County in 1957 owing primarily to the increased demand for structural and paving material. The output came from eight commercial operations throughout the county. In addition to structural and paving material, quantities of grinding and polishing sand, filter sand, and railroad-ballast and other sand and gravel were also produced.

The production of clay increased in 1957, as 3 operations were active in 1957, compared with only 1 in 1956. Two companies operated near Magadore and one near Greentown. Output consisted of fire and miscellaneous clay used for manufacturing heavy clay products.

Perlite was expanded at the Akron plant of J. P. Loomis Concrete & Supply Co. Minnesota Mining & Manufacturing Co. produced red iron oxides (Fe_2O_3) from pyrite cinders shipped from Delaware. Peat was recovered from a bog near Copley.

Trumbull.—The Kinsman Sand & Gravel Co. (Kinsman) produced sand and gravel for building and paving at its fixed plant at Kinsman.

Tuscarawas.—Although the number of active mines dropped from 56 in 1956 to 51 in 1957, the production of coal increased 10 percent in 1957. The county also continued to rank fourth in coal output, producing over 2.4 million tons. Twenty-nine strip, 19 underground, and 3 auger coal operations were active in 1957. Over 1 million tons of coal was crushed at 18 mines for marketing. Coal from the Midvale mine of Columbia-Southern Chemical Corp. was cleaned by jigs and air tables.

Of Ohio's 39 clay-producing counties, Tuscarawas ranked first in production and value in 1957. Fire and miscellaneous clays were produced at the operations of 30 active mines. Fire clay furnished 74 and 91 percent, respectively, of the county's total clay output and value. Most of the fire clay (78 percent) was used for manufacturing heavy clay products, and the remainder for refractory purposes and for floor and wall tile. Miscellaneous clay was used exclusively for manufacturing heavy clay products, primarily building brick. Of the county's 30 active mines in 1957, 21 were open pit, 6 were underground, and 3 were combinations of open pit and underground. All underground mines were developed by inclined entrances, ranging from 123 feet to 1 mile in length. Most of the underground mines utilized the room-and-pillar method of clay recovery, and one recovered clay by open stoping. Dennison Sewer Pipe Corp. (Uhrichsville) reported that its underground mine was abandoned on October 1, 1957.

Sand and gravel (used mainly for structural and paving purposes) was recovered from eight operations in the county in 1957. Molding sand, fire or furnace sand, and filter and other sands were also produced during the year.

Union.—L. G. Rockhold & Sons (York Center) and Clymer Materials Co. (Millcreek Township) quarried and crushed limestone for concrete aggregate and roadstone and for agricultural purposes. A small quantity was also produced for riprap. The limestone property of Clymer Materials Co. was transferred to Union Limestone Co. on September 1, 1957. Sand and gravel for building and paving purposes was produced by Clymer Materials Co. (Union Township).

Van Wert.—Limestone was produced and crushed for concrete aggregate, road material, railroad ballast, and agricultural purposes in the central part of Van Wert County by Delphos Quarries Co., the France Co., and the Union Quarries Co. Miscellaneous clay was recovered from pits near Delphos and Van Wert. The output was used for manufacturing drain tile and other heavy clay products.

Vinton.—Although the number of active mines in Vinton County increased from the preceding year, coal production dropped slightly in 1957. Most of the output was from seven strip operations. Coal was crushed at five mines and cleaned at the Econocoal plant of Benedict, Inc. Fire clay used for firebrick and block was mined

from an underground operation near Zaleski. Miscellaneous clay was recovered near McArthur for manufacturing building brick. The McArthur Stone & Coal Co. quarried limestone for concrete aggregate and agricultural purposes near McArthur. The Vinton County Highway Department reported an output of limestone used for highway maintenance.

Warren.—Production of sand and gravel was reported from seven operations throughout the county and consisted mainly of building and paving sand and gravel. A limited quantity of fill gravel also was produced. The leading producer was Van Camp Sand & Gravel Co. (Morrow). Armitage Sand & Gravel (formerly Armitage & Son) operated two plants at South Lebanon and Waynesville. There were other operations at Franklin, Loveland, and Morrow.

Washington.—Coal production in Washington County increased slightly in 1957, as 4 strip mines (2 in 1956) were active during the year. Sand and gravel production in Washington County in 1957 was used principally for building and paving material. Five commercial operations were active during the year and were centered near Marietta and Waterford. Marietta Concrete Corp. (Marietta) reported that its Washington County supply of sand and gravel was depleted early in 1957. Abrasive stones (grindstones) were produced by Hall Grindstone Co. (Marietta) and Constitution Stone Co. (Constitution). Miscellaneous clay was mined and processed into lightweight-aggregate material by Marietta Concrete Corp. (Marietta). Briggs Gravel Co. (producers of fire clay) added a new crusher to its facilities near Marietta.

Wayne.—Evaporated salt was recovered by the open and vacuum-pan methods at Rittman by Morton Salt Co. Coal output in the county was limited to the strip operation of Millet Coal Co. which also crushed tonnages for marketing. Three sand and gravel companies reported production from pits near Marshallville, Rittman, and Wooster. County output consisted of structural and paving material, filter and other sands, and railroad ballast and fill gravel. Heavy clay products were produced from miscellaneous clay recovered near Wooster and Orrville.

Williams.—Tri-State Gravel Co. was the leading sand and gravel producer in Williams County in 1957. Company output consisted of building and paving sand and building gravel and came from dredging operations near Pioneer. Four other producers, with operations near Blakeslee, Edgerton, and Edon, produced filter and other sands, in addition to building and paving sand and gravel. Clay production in the county was limited to an open-pit operation near Stryker. The output of miscellaneous clay was used in manufacturing heavy clay products.

Wood.—Limestone was quarried mostly for use as concrete aggregate and roadstone and for metallurgical purposes, agricultural use, and riprap. Five companies in the southern part of the county were active during the year. National Gypsum Co. quarried limestone at Luckey and used most of its output in manufacturing quicklime and hydrated lime at a nearby plant. The lime was used mainly for building material. A limited quantity of surface clay was mined near Perrysburg for use in manufacturing drain and building tile.

Wyandot.—The National Lime & Stone Co. quarried a large quantity of limestone for concrete aggregate and roadstone, metallurgical work, railroad ballast, agricultural purposes, and other uses. The company also utilized limestone for manufacturing lime at its Carey plant. The lime was employed mainly for manufacturing glass. Limestone was also quarried near Upper Sandusky by J. L. Foucht for use as concrete aggregate, roadstone, and agstone. Wilson Sand Co. (Upper Sandusky) and Corfman Gravel Co. (Sycamore) produced sand and gravel for building and paving and for use as fill material. Surface shale used in manufacturing building brick was mined at an open pit near Upper Sandusky. Humus peat was recovered near Carey.

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, United States Department of the Interior, and the Oklahoma Geological Survey.

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OKLAHOMA'S mineral production attained a record total of \$804 million in 1957 compared with \$757 million in 1956 and \$711 million in 1955. The 1957 increase was due almost entirely to a higher unit value for petroleum. Output of 15 minerals and 5 mineral fuels was reported from 75 of the State's 77 counties. Compared with other States in 1957, Oklahoma ranked fourth as producer of natural gas, natural-gas liquids, and crude petroleum. Appreciable quantities of zinc, lead, cement, coal, gypsum, sand and gravel, and stone also were produced. Manganese was reported or the first time since World War II.

TABLE 1.—Mineral production in Oklahoma, 1956–57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays..... thousand short tons.....	2 705	2 701	2 641	2 862
Coal..... do.....	2, 007	12, 341	2, 195	14, 165
Lead (recoverable content of ores, etc.).....	12, 350	3, 878	7, 183	2, 054
Natural gas..... million cubic feet.....	678, 603	54, 288	3 635, 000	3 53, 300
Natural-gas liquids:				
Natural gasoline and cycle products				
thousand gallons.....	489, 963	26, 543	460, 644	25, 329
LP-gases..... do.....	579, 101	23, 427	587, 140	21, 824
Petroleum (crude)..... thousand 42-gallon barrels.....	215, 882	600, 096	2 215, 111	3 651, 786
Pumice.....	305	3	(4)	(4)
Salt (common)..... thousand short tons.....	10	90	7	63
Sand and gravel..... do.....	5, 947	4, 843	4, 960	4, 507
Stone..... do.....	10, 547	12, 417	12, 016	14, 064
Tripoli.....	(4)	(4)	22, 236	66
Zinc (recoverable content of ores, etc.).....	27, 515	7, 539	14, 951	3, 469
Value of items that cannot be disclosed: Asphalt (native), bentonite, cement, gypsum, lime, manganese, sulfur (recovered elemental), uranium (1956), and values indicated by footnote 4.....		12, 969		14, 587
Total Oklahoma ⁴		757, 120		803, 937

¹ Production as measured by mine shipments or mine sales (including consumption by producers).

² Excludes bentonite, value for which is included with "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.

The mineral fuels—petroleum, natural gas and natural-gas liquids, and coal—were the most important in value, furnishing 94 percent of Oklahoma's total value of mineral production. Metals and non-

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metals supplied the remaining 6 percent. Petroleum was produced in 61 of Oklahoma's 77 counties and natural gas in 60 counties; nonmetals in 70 counties; and metals (lead and zinc) in Ottawa County only. Oil and natural gas were produced in a wide belt extending from the northeastern part of the State to the southeastern and northwestern parts; nonmetal mining was distributed widely over the northeast, north central, and central regions and in the Arbuckle and Wichita Mountain areas of the southern part.

EMPLOYMENT AND INJURIES IN THE MINERAL INDUSTRIES

Employment.—Total employment in the Oklahoma mineral industries was 49,600 compared with 52,200 in 1956. Distribution of this total employment was: Oil and gas production, 94 percent; metals, 1 percent; coal, 2 percent; and nonmetals, 3 percent. The wages in 1957 for these mineral industries totaled \$198.6 million—a 22-percent loss from 1956.

Injuries.—Accidents reported in coal, metal, and nonmetal mining comprised 2 fatal and 474 nonfatal injuries; of these, 1 fatal and 142 nonfatal injuries were incurred in coal mining. In the oil and gas industry (exploration drilling, production, natural gasoline, pipelines and refining) there were 7 fatal and 498 nonfatal injuries.

TABLE 2.—Employment in mineral industries, 1948–52 (average) and 1953–57

(In thousands)

	1948-52 (average)	1953	1954	1955	² 1956	1957
Oil and gas drilling and production.....	39.5	44.7	46.5	48.4	48.7	46.5
Coal mining.....	1.9	1.5	1.3	1.3	1.1	1.1
Other mining.....	2.7	2.0	2.2	2.3	2.4	2.0
Total.....	44.1	48.2	50.0	52.0	52.2	49.6

¹ Oklahoma Employment Security Commission, Handbook of Employment Statistics of Oklahoma: 1939-57.

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; 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 Oklahoma clays, shales, silica sands, and limestone; 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.

Demand for Oklahoma crude petroleum declined after the first quarter of the year and then regained part of the loss during the last 2 months. This reduction after the first quarter was attributed partly to decreased shipments of oil to western Europe when movement of Mid-east oil through the Suez Canal was resumed. These

market fluctuations, however, did not change the annual demand appreciably from 1956.

The metals industry was hampered by increasing inventories, declines in lead and zinc prices, and a work stoppage at the Henryetta smelter of Eagle-Picher Co. These adversities caused two periodic suspensions of mining and milling operations. The first suspension was for a 5-day period from April 29; the second was from July 31 to November 27. The Henryetta smelter remained closed from July 1 throughout the remainder of the year.

TABLE 3.—Average unit value of mineral commodities produced in Oklahoma, 1953-57

Commodity	1953	1954	1955	1956	1957
Asphalt, native..... short ton	\$4.75	\$4.75	\$4.75	\$4.75	\$4.75
Cement:					
Portland..... 376-pound barrel	2.54	2.64	2.72	2.89	3.00
Masonry..... do				3.81	3.93
Clays:					
Miscellaneous..... short ton	1.02	² 1.09	1.01	.99	.99
Bentonite..... do	9.64	10.00	4.50	4.50	4.50
For cement..... do	1.00	1.00	1.00	1.00	1.00
Coal..... do	6.10	5.88	5.86	6.15	6.45
Gypsum..... do	2.76	2.81	2.94	2.93	3.14
Lead..... pound	.131	.137	1.49	.157	.143
Lime..... short ton	8.67	9.85	9.55	11.02	10.41
Natural gas..... 1,000-cubic feet	.069	.070	.074	.080	.084
Natural-gas liquids:					
Natural gasoline and cycle products, per gallon	.065	.051	.057	.054	.055
LP-gases..... do	.036	.030	.028	.040	.037
Petroleum..... 42-gallon barrel	2.70	2.79	2.78	2.78	3.03
Pumice..... short ton	9.54	8.36		10.00	10.44
Salt (common)..... do	7.47	7.62	7.83	8.99	9.03
Sand and gravel..... do	.85	.79	.76	.81	.91
Stone:					
Granite (dimension)..... do	102.34	60.40	67.91	² 102.99	101.33
Sandstone..... do	.60	1.45	1.16	1.49	1.22
Limestone..... do	1.07	1.08	1.15	1.23	1.18
Miscellaneous (crushed)..... do	.41	.34	.47	.58	.53
Sulfur (recovered elemental)..... do	126.74	26.50	26.50	³ 26.64	³ 25.82
Tripoli..... pound	5.00	3.00	3.00	3.00	3.00
Zinc..... pound	.115	.108	.123	.137	.116
Vermiculite (exfoliated)..... short ton					169.99

¹ First year reported.

² Revised figure.

³ Calculated on a sulfur-content basis.

In construction materials, the production of sand and gravel was set back by heavy spring rains that retarded both output and road construction. However, the trend in other types of construction permitted gains in both stone and cement produced. Despite a 5-week cement strike that affected 1 Oklahoma plant and a 30-day repair shutdown at the other plant, cement output still showed an appreciable gain over 1956. The demand for lime from the State's one plant also was up, as more of this material was consumed chemically by the Pryor industries and by municipal water-treating plants.

TRENDS AND DEVELOPMENTS

Recoverable petroleum reserves underwent another slight reduction, despite widespread drilling and many impressive discoveries, especially in the northwestern corner, south central counties, and in the Permian area of the Panhandle.

The trend toward increased refinery capacity for Premium-grade motor fuel and toward the higher octane rating of motor fuels was continued. The competitive race for upgrading motor fuels was evidenced by new installations of catalytic cracking units and catalytic reformers at refineries at West Tulsa, Duncan, and Ponca City.

Closely related to the refining industry was the rise of petrochemicals in Oklahoma. An ammonia plant with a capacity of 65,800 tons yearly was operating at Pryor. Adjuncts to two refineries at Ponca City and Duncan were producing benzene, toluene, and propylene hydrocarbons. At Ponca City Continental Oil Co. completed constructing its atomic radiation laboratory designed to improve petrochemical products and processes. A new addition to the metals industry was opening of the \$6.5 million plant of Fansteel Metallurgical Corp. of Muskogee. This tantalum-columbium plant was expected to boost the Nation's supply of tantalum 50 percent. Also in Muskogee a high-energy fuel plant was under construction. This plant will utilize boron as an ingredient in the manufactured fuel.

Facilities for petroleum research in Oklahoma took a forward step in 1957 as two major oil companies opened extensively equipped new laboratories at Tulsa and Bartlesville.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma continued to be a leading domestic producer of the Nation's crude petroleum and natural gas in 1957 and remained a major supplier of refined products. Native asphalt and a substantial quantity of low-ash bituminous coal also were produced.

Asphalt (Native).—Output of native rock asphalt (bituminous limestone and bituminous sandstone) for road surfacing was reported from Murray County in 1957. Production in 1957 was down 33 percent from the previous year, partly because continuous rains during the spring season hindered both quarrying and construction work.

Coal.—Coal production in Oklahoma gained about 9 percent in 1957. Part of the gain was due to renewal of Lone Star Steel Co. mining near McCurtain, following shutdowns after two explosions in 1956. The State had 30 operators in 9 counties, of which Rogers, Sequoyah, Haskell, Le Flore, and Pittsburg Counties led as producers; each reported over \$2 million in value. The total output in 1957 was 2.2 million short tons valued at \$14.2 million.

TABLE 4.—Coal production, 1948–52 (average) and 1953–57

Year	Thousand short tons	Value		Year	Thousand short tons	Value	
		Total (thousands)	Average per ton			Total (thousands)	Average per ton
1948-52 (average)...	2,716	\$14,598	\$5.38	1955.....	2,164	\$12,668	\$5.86
1953.....	2,168	13,227	6.10	1956.....	2,007	12,341	6.15
1954.....	1,915	11,265	5.88	1957.....	2,195	14,165	6.45

A report estimated the coal reserve of Oklahoma at 3,245 million short tons, as of January 1, 1953.⁴

TABLE 5.—Marketed production of natural gas, 1948-52 (average) and 1953-57¹

Year	Million cubic feet	Value		Year	Million cubic feet	Value	
		Total (thousands)	Per thousand cubic feet, cents			Total (thousands)	Per thousand cubic feet, cents
1948-52 (average)	498,197	\$25,158	5.0	1955.....	614,976	\$45,508	7.4
1953.....	599,955	41,397	6.9	1956.....	678,603	54,288	8.0
1954.....	616,355	43,145	7.0	1957 ²	635,000	53,300	8.3

¹ Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

² Preliminary figures.

Natural Gas.—Oklahoma continued to rank fourth in the Nation in marketed production of natural gas; it was 635 billion cubic feet valued at \$53.3 million, a 6-percent loss in volume and a 2-percent loss in value compared with 1956. Production was reported from 60 counties, of which Texas, Garvin, Beaver, Oklahoma, and Beckham led in the order named. The industry pressed its search for gas reserves by completing 234 gas wells out of a total 6,235 wells of all types, as reported by the Oil and Gas Journal. Exploratory drilling alone resulted in 31 gas discoveries out of 747 exploratory tests. The most promising exploratory drilling was in northwestern Oklahoma and in the Panhandle, where 5 gas discoveries were made in Beaver, 2 in Harper, and 1 in Ellis Counties. Elsewhere, Lincoln and Grant Counties scored three gas discoveries each; renewed interest in the southeastern section led to a gas completion in Coal County and a completion in the old gas area of Sequoyah and Le Flore Counties.

TABLE 6.—Estimated proved reserves of crude oil, natural-gas liquids, and natural gas¹

	Proved reserves, Dec. 31, 1956	Changes in proved reserves, due to extensions and new discoveries in 1957	Proved reserves, Dec. 31, 1957 (production was deducted)	Change from 1956 (percent)
Crude oil..... thousand barrels..	2,009,798	143,170	1,941,521	-3
Natural-gas liquids ² do.....	355,588	21,152	342,643	-4
Natural gas ³ million cubic feet..	13,775,049	1,416,920	14,259,480	+4

¹ American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Pp. 9-10, 19.

² Includes condensate, natural gasoline, and L-P-gases.

³ Proved recoverable reserves.

Natural-Gas Liquids.—Production of natural-gas liquids from Oklahoma's 66 natural gasoline plants totaled 1,048 million gallons in 1957 and was valued at \$47.2 million. This was a year of widening markets for LP-gases (propane and butane), not only for domestic heating fuel, but for production of petrochemicals, particularly

⁴ Trumbull, James V. A., Coal Resources of Oklahoma: Geol. Survey Bull. 1042-J; prepared in cooperation with Oklahoma Geol. Survey. 1957, 382 pp.

TABLE 7.—Natural-gas liquids produced, 1948–52 (average) and 1953–57

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1948–52 (average).....	339, 788	\$25, 008	286, 446	\$10, 858	626, 234	\$35, 866
1953.....	433, 650	28, 066	414, 036	14, 886	847, 686	42, 952
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

polyethylene, and for air conditioning. Use of LP-gases as a motor fuel for farm and industrial tractors and for drilling rigs also was expanded. At the Short Junction oilfield in Cleveland County, the new Continental Oil Co. natural-gasoline plant was recovering propane and butane for intermittent injection with natural gas, as a "miscible-phase sweep," into the Hunton limestone formation to increase oil recovery.

Sunray Mid-Continent Oil Co. completed a gas-products plant near Carney, Okla., and was processing approximately 14 million cubic feet of wet gas daily. The plant was designed to extract a total of 575 barrels of propane, butane, and natural gasoline daily.

About 6 percent less natural gasoline and cycle products was produced than in 1956, partly because of surplus stocks at the beginning of the year; however, improved technology for processing natural-gas liquids at refineries tended to strengthen the market. Refinery capacity was being increased to reform the heavier fractions of natural gasoline catalytically—an operation that improves the octane rating and widens the use of natural gasoline in motor fuels. Natural gasoline and cycle products furnished 44 percent of the quantity and 54 percent of the value; LP-gases supplied the remainder.

TABLE 8.—Production of petroleum (crude), 1948–52 (average) and 1953–57

Year	Thousand 42-gallon barrels	Value		Year	Thousand 42-gallon barrels	Value	
		At wells (thousands)	Average per barrel			At wells (thousands)	Average per barrel
1948–52 (average).....	169, 604	\$435, 504	\$2. 57	1955.....	202, 817	\$563, 830	\$2. 78
1953.....	202, 570	546, 940	2. 70	1956.....	215, 862	600, 096	2. 78
1954.....	185, 851	518, 520	2. 79	1957 ¹	215, 111	651, 786	3. 03

¹ Preliminary figures.

Petroleum.—Oklahoma remained the Nation's fourth largest producer of petroleum in 1957, with an output of 215 million barrels valued at \$651.8 million. The State regulatory body under the Interstate Oil Compact reduced the allowable production of oil slightly below the 1956 allowable to conform with the indicated demand for Oklahoma petroleum and permit gradual reduction of monthly stocks. Total production, however, remained about the same as in 1956, as over half of it came from nonallocated fields that

TABLE 9.—Production of crude petroleum, 1953–57, by fields in thousand barrels
(Oil and Gas Journal)

Field	1953	1954	1955	1956	1957
Allen	1,456	1,709	1,733	1,638	1,608
Bebee	1,087	926	836	745	707
Burbank	3,476	3,466	10,139	13,519	14,280
Cache Creek	956	787	707	661	721
Camp	1,606	1,329	(1)	(1)	(1)
Cement	4,070	3,517	4,186	4,372	4,061
Cumberland	2,562	1,690	1,841	1,944	1,812
Cushing	3,385	3,176	2,823	2,549	2,650
Dilworth	(1)	1,279	1,135	921	677
Doyle	3,934	2,976	2,683	3,056	2,798
Elk City	6,380	5,348	6,277	5,326	4,078
Eola	1,651	1,424	2,193	3,566	3,886
Fox-Graham	5,920	4,559	(1)	(1)	(1)
Glennpool	2,145	2,045	1,983	1,901	2,259
Golden Trend	(1)	(1)	(1)	20,204	17,245
Haldton	2,288	2,171	2,307	2,347	2,200
Hewitt	2,703	3,339	3,411	3,495	3,240
Holdenville-East	(1)	1,149	1,476	1,117	628
Hoover-Northwest	601	1,189	1,662	2,063	1,863
Knox	1,595	1,165	1,143	1,291	1,232
Milroy	2,325	1,755	(1)	(1)	(1)
Oklahoma City	5,187	4,143	3,803	3,743	3,482
Olympic	4,064	4,083	2,662	1,752	1,573
Payson-East	1,725	1,076	918	786	467
Ringwood	855	727	551	484	(1)
Seminole:					
Bowlegs	1,121	872	718	685	655
Little River	826	756	699	571	478
St. Louis	1,507	1,464	1,672	1,486	1,443
Seminole	1,211	998	921	827	912
Sholem-Alechem	12,736	10,261	(1)	(1)	(1)
Sho-Vel-Tum			30,316	29,717	29,008
South Burbank	894	1,429	(1)	(1)	(1)
Tatums	3,892	3,321	(1)	(1)	(1)
Velma-West	16,064	8,435	(1)	(1)	(1)
West Edmond	1,887	1,821	1,733	1,945	1,292
Witcher	660	541	439	378	
Yale-Quay	2,171	1,915	1,479	1,322	1,765
Other fields ²	99,630	99,005	110,371	101,451	108,031
Total	202,570	185,851	202,817	215,862	215,111

¹ Included with "Other fields."

² Bureau of Mines figures.

include secondary-recovery projects. According to a report made for the first time by the Oklahoma Oil and Gas Conservation Department, the State had 449 waterflooding (secondary-recovery) projects in 1957; these furnished about 20 percent of the annual production. Petroleum was reported from 61 counties, and the leading 5 producers were Garvin, Osage, Stephens, Carter, and Creek.

The average price per barrel of petroleum at the wells was \$3.03 in 1957 compared with the 1956 average (\$2.78). The search for more oil led to the drilling of 747 exploratory wells in 1957, third highest in the Nation. The test wells totaled 3,350,237 feet drilled—an average of 4,485 feet each compared with an average of 4,540 feet each in 1956. Field-development wells totaled 18,244,372 feet drilled—an average of 3,324 feet each compared with an average of 3,322 feet each in 1956.

Prospecting crews worked 1,285 crew-weeks compared with 1,746 crew-weeks in 1956. Seismograph work was particularly extensive in the vast Anadarko basin, where Caddo and Grady Counties received most attention.

Many impressive discoveries were made during the year. Success was widespread in the deep area of south central Oklahoma and in the pre-Permian areas of the northwestern counties and the Panhandle.

TABLE 10.—Oil and gas wells drilled in 1957 by counties ¹

County	Proved field wells			Exploratory wells			Total		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alfalfa	69	4	8	5		11	74	4	19
Atoka			1			5			6
Beaver	22	49	16	8	5	6	30	54	22
Beckham	17	7	13		2	10	17	9	23
Blaine	2			1			3		
Bryan			3			6			9
Caddo	130	4	22			1	6	130	28
Canadian						6			6
Carter	250		63	1		8	251		71
Choctaw			7			4			4
Cimarron	4	8	7	1	1	10	5	9	17
Cleveland	102	5	31	7		19	109	5	50
Coal	4		4		1	5	4	1	9
Comanche	42	1	41	2		20	44	1	61
Cotton	6		23			11	6		34
Creek	296	6	183	1		3	297	6	186
Dewey				1		1	1		1
Ellis	2				1	1	2	1	1
Garfield	47		30	4		9	51		39
Garvin	178	1	81	2		12	180	1	93
Grady	30	5	16	1		1	31	5	17
Grant	32	13	18	6	3	16	38	16	34
Greer	5		5		1	12	5	1	17
Harmon						1			1
Harper	31	14	9	5	2	9	36	16	18
Haskell			2			1			3
Hughes	71	6	54		1	5	71	7	59
Jackson			1			4			5
Jefferson	15		23			11	15		34
Johnston						8			8
Key	97		58	3		24	100		82
Kingfisher	13		1	1	1	2	14	1	3
Kiowa	63	1	76	3	1	45	66	2	121
Le Flore		1	2					1	2
Lincoln	86	12	60	4	3	31	90	15	91
Logan	85	2	25	5		12	90	2	37
Love	59		23	3		6	62		29
McClain	51	2	18	5		5	56	2	23
McCurtain			1			4			5
McIntosh			3		1	1		1	4
Major			1	1		1			2
Marshall	29	1	12	2		5	31	1	17
Murray	6		4			9	6		13
Muskogee	3		3		1	4	3	1	7
Noble	73		46	2		17	75		63
Oklfuskee	106	5	61	5		8	111	5	69
Oklahoma	28		9		1	8	28	1	17
Okmulgee	144	3	115			1	144	4	116
Osage	575	2	331	7	1	88	582	2	419
Pawnee	69		43	2		13	71		56
Payne	60		44	3		14	63		53
Pittsburg			2						2
Pontotoc	47	4	28			9	47	4	37
Pottawatomie	50		33	2		23	52		56
Pushmataha						1			1
Roger Mills						1			1
Rogers				1		2			2
Seminole	136	6	68			4	136	6	72
Sequoyah		1			1	1		2	1
Stephens	256	9	99	5	2	12	261	11	111
Texas	10	30	17	1		3	11	30	20
Tillman	24		14	2		19	26		33
Wagoner			2			1			3
Washita	1	1	1			1	1	1	2
Woods	1		1	2		7	3		8
Woodward	2		1	3	1	6	5	1	7
Total: 1957	² 3,429	203	³ 1,856	² 107	31	609	3,536	234	³ 2,465
1956	4,671	278	⁴ 2,238	⁵ 154	39	672	4,825	317	⁴ 2,910

¹ Oil and Gas Journal, vol. 56, No. 4, Jan. 27, 1958.² Includes distillate wells.³ Includes service wells.⁴ Includes 434 service wells.⁵ Includes 24 distillate wells.

TABLE 11.—Summary of seismograph, magnetometer, and core-drill prospecting in 1957, by counties¹

(In crew-weeks)

County	Seismo-graph	Magne-tometer	Core drill	County	Seismo-graph	Magne-tometer	Core drill
Alfalfa.....	4	-----	-----	Kiowa.....	16	-----	-----
Atoka.....	7	-----	-----	Lincoln.....	10	-----	-----
Beaver.....	4	-----	-----	Love.....	18	-----	-----
Beckham.....	7	-----	-----	McClain.....	74	-----	-----
Blaine.....	43	-----	-----	McIntosh.....	19	-----	-----
Bryan.....	18	-----	10	Major.....	6	-----	-----
Caddo.....	127	-----	-----	Marshall.....	5	-----	-----
Canadian.....	10	-----	-----	Mayer.....	-----	7	-----
Carter.....	33	-----	-----	Murray.....	7	-----	-----
Cimarron.....	29	-----	17	Muskogee.....	20	-----	-----
Cleveland.....	68	-----	-----	Noble.....	1	-----	-----
Coal.....	24	-----	-----	Nowata.....	-----	4	-----
Comanche.....	44	-----	-----	Okfuskee.....	5	-----	-----
Craig.....	-----	23	-----	Oklahoma.....	9	-----	-----
Custer.....	27	-----	-----	Ottawa.....	-----	5	-----
Delaware.....	-----	5	-----	Payne.....	1	-----	-----
Ellis.....	66	-----	-----	Pittsburg.....	2	-----	-----
Garfield.....	38	-----	-----	Pontotoc.....	2	-----	-----
Garvin.....	40	-----	-----	Pottawatomie.....	13	-----	-----
Grady.....	127	-----	-----	Roger Mills.....	2	-----	-----
Greer.....	11	-----	-----	Seminole.....	8	-----	-----
Harmon.....	39	-----	-----	Sequoyah.....	2	-----	13
Harper.....	-----	-----	14	Stephens.....	86	-----	-----
Haskell.....	3	-----	-----	Texas.....	9	-----	-----
Jackson.....	8	-----	-----	Washita.....	25	-----	-----
Jefferson.....	2	-----	-----	Woods.....	19	-----	-----
Johnston.....	9	-----	-----	Woodward.....	7	-----	-----
Kay.....	3	-----	-----				
Kingfisher.....	30	-----	-----				
				Total: 1957..	1,187	44	54
				1956..	1,636	73	37

¹ National Oil Scouts and Landmen's Association, Oil and Gas Field Development in the United States: Austin, Tex., vol. 23, 1958.

Counties adjacent to the Nemaha granite ridge (such as Grant and Garfield) were also the scenes of continued exploratory drilling. Osage County, again first in both total exploratory and field-development wells, reported 7 discoveries out of 95 tests. Beaver County, credited with 13 successful tests owing to the intense drive for natural gas, was followed by Grant with 9 and Stephens, Cleveland, Harper, and Lincoln with 7 successful tests each.

Oklahoma's depth record (20,426 feet) was made by Magnolia Petroleum Co. in the Cement field, Caddo County, but production was unsuccessful; however, other tests in the deep trough of the Anadarko basin proved productive. In the Carter-Knox field of Grady and Stephens Counties, British-American Oil Producing Co. tapped the State's deepest production in the Oil Creek-Ordovician sands at a depth of 16,546 feet. Several other wells in this field were producing from depths below 15,000 feet, and more were planned. Also, first production was reported in Blaine, Dewey, and Woodward Counties. At the year end an exploratory well being drilled on the Fort Cobb anticline in Caddo County was aiming for the world's new depth mark of 24,000 feet. Revival of oil and gas activity in eastern Oklahoma received another boost in 1957, when a large natural-gas reserve was opened in northern Le Flore County.

At the beginning of 1957 Oklahoma had 15 operating refineries (with a daily crude-oil capacity that totaled 352,000 barrels) and 2 nonoperating refineries.

In Oklahoma's refining industry upgrading of motor fuels was continued by installing more cracking and reforming capacity.

The D-X Sunray Oil Co. \$10 million expansion program at its Tulsa and Duncan refineries reached the first state of completion during May 1957. The expansion at Tulsa called for (1) a 12,000-barrel-a-day catalytic reforming unit, (2) a 12,000-barrel-a-day hydrogenation unit augmented by a 2,500-barrel-a-day alkylation plant, and (3) a 1,500-barrel-a-day butane-isomerization unit. At the Duncan refinery a 6,000-barrel-a-day unifier was under construction.

TABLE 12.—Indicated demand, production, and stocks of crude petroleum in 1957, by months

Month	Thousand 42-gallon barrels			Month	Thousand 42-gallon barrels		
	Indicated demand	Production	Stocks originating in Oklahoma		Indicated demand	Production	Stocks originating in Oklahoma
January.....	20,498	19,027	21,545	September.....	16,927	16,727	20,050
February.....	17,852	18,011	21,704	October.....	17,871	17,736	19,915
March.....	20,102	20,224	21,826	November.....	18,020	17,091	18,986
April.....	18,955	18,589	21,460	December.....	18,447	18,077	18,616
May.....	18,449	18,624	21,635	Total: 1957..	220,011	215,111	
June.....	17,214	16,423	21,344	1956..	213,632	215,862	
July.....	16,712	17,287	21,919				
August.....	18,964	17,295	20,250				

At Ponca City, Cities Service Oil Co. installed a Rexformer unit to catalytically reform petroleum components to higher octane fuels. The program included an increase in refinery capacity from 23,000 barrels daily to 30,000.

At Cyril, Okla., the refinery capacity of Anderson-Prichard Oil Corp. was being increased 2,000 barrels daily. Also, an 11,000-barrel-per-day fluid catalytic cracking unit, and a 600-barrel-per-day hydrofluoric acid alkylation unit were being added.

A report on oil-recovery techniques, prepared in cooperation with the State of Oklahoma, was published.⁵

NONMETALS

Oklahoma, endowed with abundant resources of nonmetals, yielded a record \$32 million worth of these commodities in 1957 compared with \$28.6 million in 1956 and with the previous record \$31.3 million established in 1955. Despite the adverse affects of heavy spring rains on both sand and gravel production and road building, overall construction gained so that the 1957 value of nonmetals remained 12.3 percent higher than in 1956.

Stone and lime established individual alltime high values in 1957.

Cement.—The production of cement, the second ranking product in terms of value of nonmetals produced in Oklahoma, gained 13 percent in 1957. Two plants (at Dewey in Washington County and at Ada in Pontotoc County) produced cement in 1957.

⁵ Johanson, R. T., Powell, J. P., and Dunning, H. N., The Use of Nonionic Detergent and Citric Acid for Improving Cleanout Procedures of Water-Input Wells in Secondary Oil-Recovery Projects: Bureau of Mines Inf. Circ. 7797, 1957, 18 pp.

TABLE 13.—Capacity of petroleum refineries and cracking plants, January 1, 1957

(Barrels per day)

Company	Location	County	Type of plant	Crude-oil capacity		Cracked gasoline capacity	
				Operat- ing	Shut- down	Operat- ing	Shut- down
Allied Materials Corp.	Stroud.....	Lincoln....	Skimming and as- phalt.	3,000	-----	-----	-----
Anderson-Prichard Oil Corp.	Cyril.....	Caddo.....	Skimming, cracking, and asphalt.	11,000	-----	4,000	-----
Bell Oil and Gas Co.	Grandfield..	Tillman....	Skimming and cracking.	8,000	-----	5,800	-----
Ben Franklin Refin- ing Co.	Ardmore....	Carter.....	Skimming, cracking, and asphalt.	13,000	-----	8,000	-----
Champlin Refining Co.	Enid.....	Garfield....	Complete.....	20,000	-----	12,400	-----
Cities Service Oil Co.	Ponca City	Kay.....	do.....	23,000	-----	7,400	-----
Continental Oil Co.	do.....	do.....	do.....	58,000	-----	16,690	1,650
D-X Sunray Oil Co.	Duncan.....	Stephens...	do.....	37,000	6,000	28,000	-----
Do.....	West Tulsa	Tulsa.....	Skimming, cracking, and lube.	73,000	-----	34,500	1,000
Kerr-McGee Oil In- dustries, Inc.	Cleveland..	Pawnee....	Skimming and crack- ing.	-----	6,500	1,800	3,500
Do.....	Cushing....	Payne....	Complete.....	22,000	-----	5,250	-----
Do.....	Wynne- wood.....	Garvin....	Skimming, crack- ing, and asphalt.	17,000	-----	4,900	-----
Midland Coopera- tives, Inc.	Cushing....	Payne....	Skimming and cracking.	12,000	-----	5,140	-----
Monarch Refineries, Inc.	Oklahoma City.....	Oklahoma	Skimming and asphalt.	1,000	-----	-----	-----
Phillips Petroleum Co.	Okmulgee..	Okmulgee..	Skimming and cracking.	19,000	-----	4,300	-----
The Texas Co.....	West Tulsa	Tulsa.....	do.....	35,000	-----	22,500	-----
Tide Water Associ- ated Oil Co.	Drumright.	Creek.....	do.....	-----	15,000	-----	4,300
Total.....	-----	-----	-----	352,000	27,500	160,680	10,450

Ideal Cement Co. experienced a work stoppage in the general 5-week cement strike. This plant also was undergoing a \$14-million expansion that included a new 12- by 450-foot kiln to increase cement capacity from about 2,200,000 to 3,700,000 barrels yearly.⁶ Dewey Portland Cement Co. was closed 30 days for repairs, but shipments of cement were continued from stock.

TABLE 14.—Clays sold or used by producers 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	523,524	\$479,361	1955.....	724,156	\$726,856
1953.....	577,556	637,082	1956.....	705,061	701,038
1954.....	452,050	1,282,848	1957.....	1,640,969	1,641,858

¹ Excludes bentonite.

Clays.—Oklahoma has extensive clay resources. Production in 1957 was used primarily in manufacturing brick and tile and to a smaller extent for manufacturing of portland cement and lightweight expanded-clay products. Brick and tile were produced in Creek, Custer, Garfield, Greer, Lincoln, Oklahoma, Pittsburg, Seminole, and Tulsa Counties, and bentonite in Dewey County. Expanded

⁶ Mining Congress Journal, vol. 43, No. 2, February 1957, p. 169.

lightweight aggregate was made from clay in Tulsa and Oklahoma Counties.

Clays sold or used in 1957, including clay used for cement, totaled 641 thousand tons, valued at \$642,000. This tonnage was 9 percent less than in 1956.

Winart Pottery, Miami, Okla., installed a new kiln to double the production. Six new pieces and a new color were added to the pottery line.

Gypsum.—The tonnage and value of gypsum recorded in Oklahoma in 1957 remained relatively high, slightly less than in 1956, in response to continued demands for wallboard, plasters, and portland cement. Most of the production was from Blaine County, where the United States Gypsum Co. operated quarries and plants to manufacture wallboard and plasters at Southard. Universal Atlas Cement Co. operated a quarry near Watonga and S. A. Walton a quarry near Southard. Production also was reported from Caddo County. A report on the geology and gypsum resources of the Carter area, southeastern Beckham County, Okla., was published by the Oklahoma Geological Survey.⁷ The report shows a gypsum reserve accessible by open-cut mining estimated at 375 million tons. Moreover, a reserve of anhydrite to a depth of 130 feet is estimated at 1,140 million tons.

Lime.—Lime production in the State, all by the St. Clair Lime Co. in Sequoyah County was 9 percent more than in 1956. The record production was attributed to increased consumption by chemical plants at Pryor and for treating water at municipal plants.

Pumice.—There was a marked increase in the production of pumice during 1957, reported by one operator in Beaver County, although the total tonnage was relatively small. No pumice was produced in 1955.

Salt.—Output of salt, reported by 3 producers in 3 counties, declined 30 percent from 1956. At Sayre, 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 encrustations 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 deposits suitable for concrete aggregate and road surfacing occur along and adjacent to most of the larger streams in Oklahoma. Production was reported from 55 counties in the State in 1957. Tulsa, Johnston, Cherokee, Le Flore, Pontotoc, Logan, Kiowa, and Oklahoma were the leading counties, supplying over half of the total value.

Most of the sand and gravel produced in Oklahoma was used for paving concrete and mortar. Second in tonnage and value was high-purity glass sand, produced by two plants in the 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.

⁷Scott, Geo. L., Jr., and Ham, William E., *Geology and Gypsum Resources of the Carter Area, Okla.*: Oklahoma Geol. Survey Circ. 42, 1957, 64 pp.

TABLE 15.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Commercial		Government-and-contractor		Total sand and gravel		Average value per ton
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	
1948-52 (average).....	1,876	\$1,610	1,157	\$431	3,033	\$2,041	\$0.67
1953.....	2,998	2,928	2,014	1,331	5,011	4,259	.85
1954.....	3,211	3,380	2,213	885	5,424	4,266	.79
1955.....	3,654	3,719	2,640	1,067	6,294	4,786	.76
1956.....	3,417	3,886	2,530	957	5,947	4,843	.81
1957.....	3,297	3,608	1,663	899	4,960	4,507	.91

Sand and gravel (including glass sand) produced in Oklahoma during 1957 totaled 5 million tons valued at \$4.5 million.

Stone.—Oklahoma stone producers in 1957 reported 12 million tons of crushed limestone, crushed granite, dimension granite, dimension sandstone, dimension limestone, crushed sandstone, and miscellaneous stone. The reported value (\$14 million) was a 13-percent gain over 1956. Production was reported from 49 counties; Tulsa, Comanche, Murray, and Ottawa supplied most of the stone tonnage in the State. Crushed limestone was reported by 15 producers at 25 quarries in 1957 and by 15 construction contractors, including the State highway department. The material was used principally for cement, concrete aggregate, and road construction and to a smaller extent as agricultural limestone.

TABLE 16.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	6,862	\$702,250	5,654,022	\$6,029,258	228,897	\$137,407
1954.....	11,022	665,753	16,974,697	17,527,413	160,883	233,469
1955.....	576,187	1,276,088	18,826,553	110,123,738	236,778	275,704
1956.....	3 5,074	3 522,570	18,626,450	110,603,022	152,518	227,464
1957.....	3 5,497	3 557,020	110,237,730	112,041,047	305,749	373,213

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1953.....	2,600,213	\$1,061,822	1 2 8,489,994	2 \$7,930,737
1954.....	2,092,209	720,360	1 2 9,238,811	1 2 9,146,995
1955.....	1,293,837	619,746	2 10,933,355	2 12,295,274
1956.....	1,762,570	1,063,830	2 10,546,612	2 12,416,886
1957.....	1,466,931	1,092,382	2 12,015,907	2 14,063,662

¹ Excludes dimension limestone.

² Includes limestone used in cement and lime.

³ Excludes crushed granite.

Chat.—Chat, included with miscellaneous stone, consists of coarse tailing from milling 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. In 1957 Ottawa County operators reported 41 percent less tonnage than in 1956.

Granite.—The Oklahoma dimension-granite industry was centered in the Wichita Mountains in the southwestern part of the State, where 5 producers operated 5 quarries in Greer and Kiowa Counties in 1957. One quarry was operated in Johnston County in the Arbuckle Mountains. Crushed granite was produced at a quarry in Jackson County and by the State highway department in Beckham County.

Production was from Precambrian granites, predominantly pink and red. Dimension granite was used mostly for monumental stone and partly for exterior trim. Much of the stone was finished in plants in the Wichita Mountains, and some was shipped to other States as rough rock. In 1957 dimension-granite production was reported to be 5,497 tons with a value of \$557,020.

Limestone and Dolomite.—In 1957, limestone and dolomite were quarried in 36 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.

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 Oklahoma was used for building and veneer stone in building construction. The stone was cut in slabs 1½ to 6 inches thick from shallow, open-face quarries in Okmulgee and Mayes Counties. Approximately 300 tons valued at \$4,000 was produced in 1957.

Stone, Crushed (Government-and-Contractor).—Stone crushed by municipal, county, and State agencies included limestone and sandstone obtained from local quarries through the State.

Sulfur (Recovered Elemental).—Decreases of about 67 percent on both tonnage and value of sulfur, produced from waste natural gases by Central Chemical Co. at Madill, Marshall County, were reported in 1957.

Tripoli.—The output of tripoli, mined in eastern Ottawa County in 1957, was 12 percent more than in 1956; 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.

Vermiculite.—Exfoliated vermiculite, produced from ores mined in Western States, was reported from Oklahoma County for the first time. The material was used mainly in concrete and plaster.

METALS

Output of metals in 1957 declined for the third consecutive year.

Cadmium, Germanium, Indium, and Gallium.—These minor metals occur as trace elements in the lead and zinc concentrates of Oklahoma and were recovered from the flue and zinc dusts of zinc-retort smelters

and from the precipitates of electrolytic zinc smelters. Production of these metals cannot be assigned to a State of origin, because they were recovered at the smelters from the accumulated flue dusts and residues of ores from various domestic and foreign sources.

Lead.—Mine production of lead in 1957 (all from Ottawa County) was 43 percent less than in 1956 in terms of concentrates and 42 percent less in terms of recoverable metal. The value of recoverable lead produced was \$2.1 million, a loss of 47 percent from the 1956 value. The leading producer of lead in Oklahoma was Eagle-Picher Co., followed by Potter-Sims Mining Co., Wesah Mining Co., Contack Mining Co., and Searcy-Henderson Mining Co.

TABLE 17.—Mine production of lead and zinc, 1948–52 (average), 1953–57, and total 1891–1957, in terms of concentrates and recoverable metals ¹

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content ²			
	Short tons	Value	Short tons	Value	Lead		Zinc	
					Short tons	Value	Short tons	Value
1948–52 (average).....	23, 979	\$4, 654, 523	90, 742	\$9, 169, 118	17, 842	\$5, 707, 263	48, 592	\$14, 707, 672
1953.....	12, 213	1, 915, 195	61, 896	4, 541, 616	9, 304	2, 437, 648	33, 413	7, 684, 990
1954.....	19, 004	3, 194, 245	84, 444	5, 466, 727	14, 204	3, 891, 896	43, 171	9, 324, 936
1955.....	19, 555	3, 368, 713	78, 726	5, 997, 071	14, 126	4, 209, 548	41, 543	10, 219, 578
1956.....	17, 971	3, 225, 015	52, 993	4, 485, 122	12, 350	3, 877, 900	27, 515	7, 539, 110
1957.....	10, 198	1, 896, 207	27, 702	2, 288, 457	7, 183	2, 054, 338	14, 951	3, 468, 632
1891–1957.....	1, 667, 593	161, 871, 652	9, 721, 769	481, 537, 733	1, 279, 459	193, 189, 435	5, 125, 848	770, 664, 306

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 18.—Tenor of lead-zinc ore milled and concentrates produced, 1956–57

	1956	1957
Total material milled..... short tons.....	1, 755, 607	899, 973
Recovery of concentrate and metal from quantity milled:		
Galena..... do.....	17, 971	10, 198
Sphalerite..... do.....	52, 993	27, 702
Galena..... percent.....	1.02	1.13
Sphalerite..... do.....	3.02	3.08
Lead ¹ do.....	0.70	0.80
Zinc ¹ do.....	1.57	1.66
Average lead content of galena concentrate..... do.....	70.11	71.88
Average zinc content of sphalerite concentrate..... do.....	57.69	59.95
Average value per ton:		
Galena concentrate.....	\$179.46	\$185.94
Sphalerite concentrate.....	\$4.64	\$2.61

¹ Figures represent metal content of the crude ore only insofar as it is recovered in the concentrate. Data on tailing losses not available.

The price of lead opened the year at 16.0 cents per pound, New York, dropped gradually to 13.0 cents on December 2, and then remained unchanged to the end of the year.

Manganese.—A small quantity of manganese ore was mined in McCurtain County in the course of exploration and prospecting.

Silicon.—According to the 1957 Annual Report of Eagle-Picher Co., the Mining and Smelter Division during 1957 expanded its Rare

TABLE 19.—Mine production of lead and zinc in 1957, by months, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January.....	1,416	2,588	August.....	230	615
February.....	1,167	2,611	September.....		
March.....	1,102	2,634	October.....		
April.....	960	2,606	November.....	177	271
May.....	129	569	December.....	503	851
June.....	762	1,211	Total.....	7,183	14,951
July.....	737	995			

Metals Plant at Miami, Okla., to add silicon—a metal that was being produced and sold in small quantities. The plant also has been producing germanium.

Titanium.—The Federal Bureau of Mines examined the alluvial sands of the Otter Creek Valley in Klowa County, Okla., as a possible source of titanium mineral. Study and analysis of data had not been completed, but preliminary examination indicated that the ilmenite-bearing sand has an average thickness between 10 and 30 feet, underlies silty clay overburden averaging about 20 feet in thickness, and has an average width of about $\frac{1}{4}$ of a mile.

Uranium.—Prospecting for radioactive minerals was carried on in Roger Mills County by the Western Oklahoma Uranium Partnership, Oklahoma City, Okla. Radioactivity was reported in 2 of 5 test holes drilled. In Custer County limited prospecting was done near Foss by Red Rock Co., Hammon, Okla.

Zinc.—Mine production of recoverable zinc in 1957, all from Ottawa County, declined 46 percent from the previous year to 14,951 tons, owing to increased inventories and to a 6-month work stoppage at the Henryetta smelter. Zinc output (valued at \$3.5 million) declined 53 percent from the 1956 value. Eagle-Picher Co. was the principal producer in the State, followed by Mark Twain, Buffalo Mining Co., C. & M. Mining Co., and Potter-Sims Mining Co.

At the beginning of 1957 zinc-metal price was quoted at 13.5 cents per pound, East St. Louis, dropped gradually in May and June to 10.0 cents per pound on July 1 and remained stable to the end of the year.

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 zinc retort plants in Oklahoma in 1957. 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. The output efficiency at these plants was improved by installing mechanical chargers and cleaners.

TABLE 20.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1957¹

Zinc concentrate		Lead concentrate	
Effective date	Price per short ton	Effective date	Price per short ton
Jan. 1–May 3.....	\$84. 00	Jan. 1–May 8.....	\$201. 32
May 6–May 12.....	72. 00	May 9–May 15.....	192. 12
May 13–June 3.....	68. 00	May 16–June 10.....	184. 92
June 4–June 23.....	64. 00	June 11–Oct. 13.....	170. 52
June 24–July 7.....	60. 00	Oct. 14–Dec. 11.....	163. 32
July 8–Dec. 31.....	56. 00	Dec. 12–Dec. 31.....	156. 12

¹ E&MJ Metal and Mineral Markets.**TABLE 21.**—Mine production of lead and zinc concentrates in the Tri-State district, 1948–52 (average) and 1953–57, in terms of concentrate and recoverable metals

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average)...	38, 136	\$7, 496, 463	158, 909	\$15, 974, 173	28, 641	\$9, 184, 017	85, 218	\$25, 664, 133
1953.....	17, 403	2, 715, 987	102, 821	7, 455, 540	13, 273	3, 477, 526	55, 729	12, 817, 670
1954.....	24, 497	4, 127, 232	127, 053	8, 483, 611	18, 314	5, 018, 036	64, 322	13, 893, 552
1955.....	326, 992	4, 734, 339	131, 026	10, 052, 448	19, 679	5, 864, 342	69, 696	17, 145, 216
1956.....	28, 597	5, 282, 389	107, 997	9, 334, 754	20, 373	6, 397, 122	57, 215	15, 676, 910
1957:								
Kansas.....	5, 703	1, 026, 116	29, 189	2, 311, 401	4, 257	1, 217, 502	15, 859	3, 679, 288
Southwest Missouri.....	29	5, 576	161	4, 270	22	6, 292	85	19, 720
Oklahoma.....	10, 198	1, 896, 207	27, 702	2, 288, 457	7, 183	2, 054, 338	14, 951	3, 468, 632
Total: 1957.....	15, 930	2, 927, 899	57, 052	4, 604, 128	11, 462	3, 278, 132	30, 895	7, 167, 640

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.**TRI-STATE DISTRICT**

The Tri-State district of Oklahoma, Kansas, and Southwest Missouri produced 1.8 million tons of crude ore in 1957 compared with 3.6 million tons in 1956. Lead concentrate recovered was down 44 percent and zinc concentrate recovered was down 47 percent from 1956. Oklahoma produced 64 percent of the district's lead concentrate and 49 percent of the zinc concentrate; Kansas 36 percent of the district's lead concentrate and 51 percent of the zinc concentrate; and Southwest Missouri furnished less than 1 percent of the district's lead and zinc concentrates.

Mineral Brokers.—Several smelting companies maintained mineral brokers or ore buyers in the Tri-State district. No metal concen-

trates were stockpiled at the mines, as all production continued to be purchased f. o. b. the mill by the brokers.

TABLE 22.—Tenor of lead and zinc ore milled and concentrate produced in Tri-State district, 1953-57

	1953	1954	1955	1956	1957
Total material milled:					
Crude ore..... short tons.....	3,454,980	4,092,278	4,140,281	3,584,902	1,836,942
Tailings and slimes..... do.....		18,000	486,280		
Recovery of concentrate and metal from material milled:					
Galena..... percent.....	0.50	0.60	0.58	0.80	0.87
Sphalerite..... do.....	2.98	3.09	2.85	3.01	3.11
Lead ¹ do.....	.38	.45	.43	.57	.62
Zinc ¹ do.....	1.61	1.56	1.51	1.60	1.68
Average lead content of galena concentrate..... percent.....	77.81	76.28	74.41	72.69	73.46
Average zinc content of sphalerite concentrate..... percent.....	60.22	56.24	59.09	58.87	60.16
Average value per ton:					
Galena concentrate.....	\$156.06	\$168.48	\$175.40	\$184.72	\$183.80
Sphalerite concentrate.....	72.51	66.77	76.72	86.44	80.70

¹ Figures represent metal content of the crude ore only insofar as it is recovered in the concentrate.

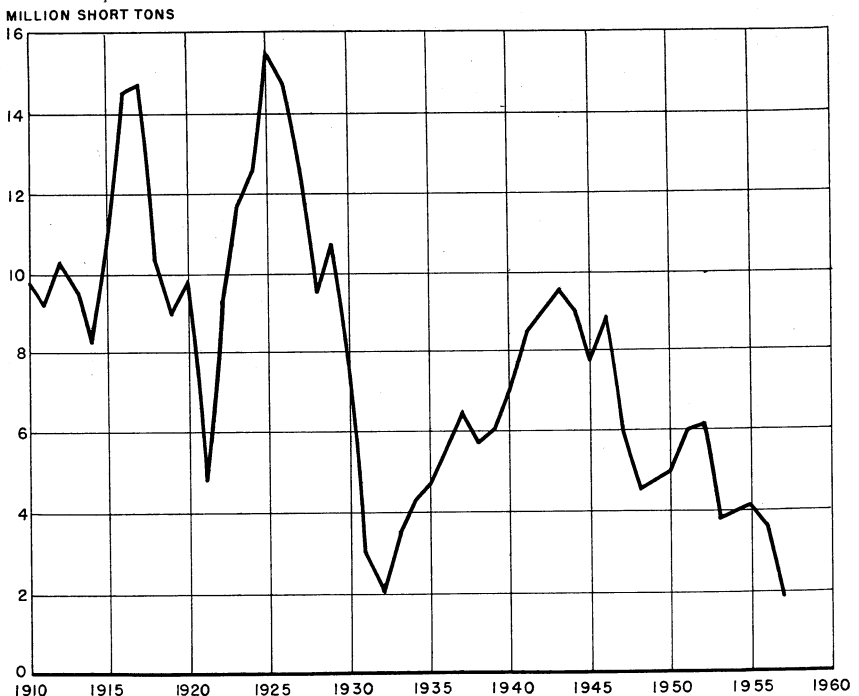


FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State district, 1910-57.

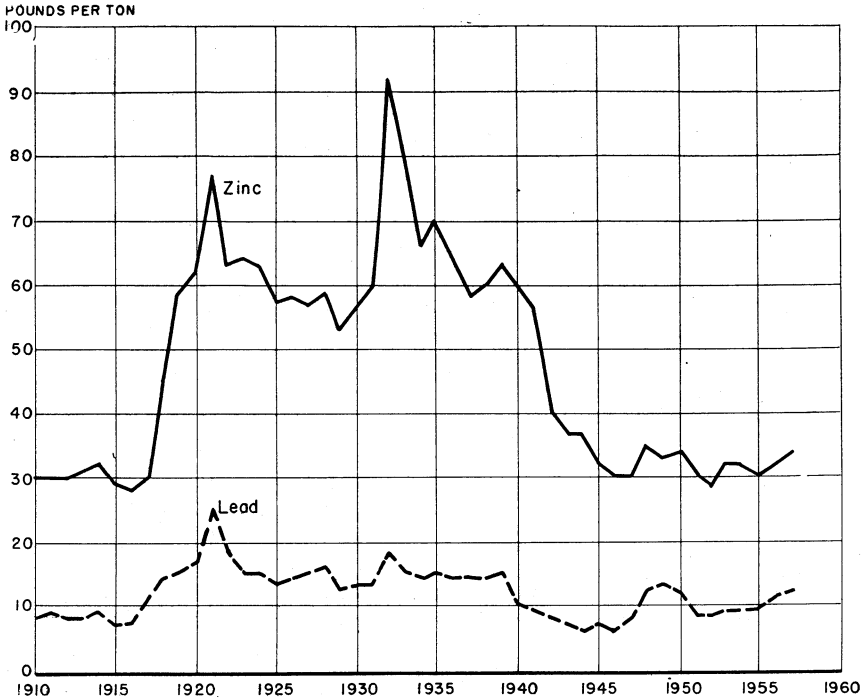


FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1910-57.

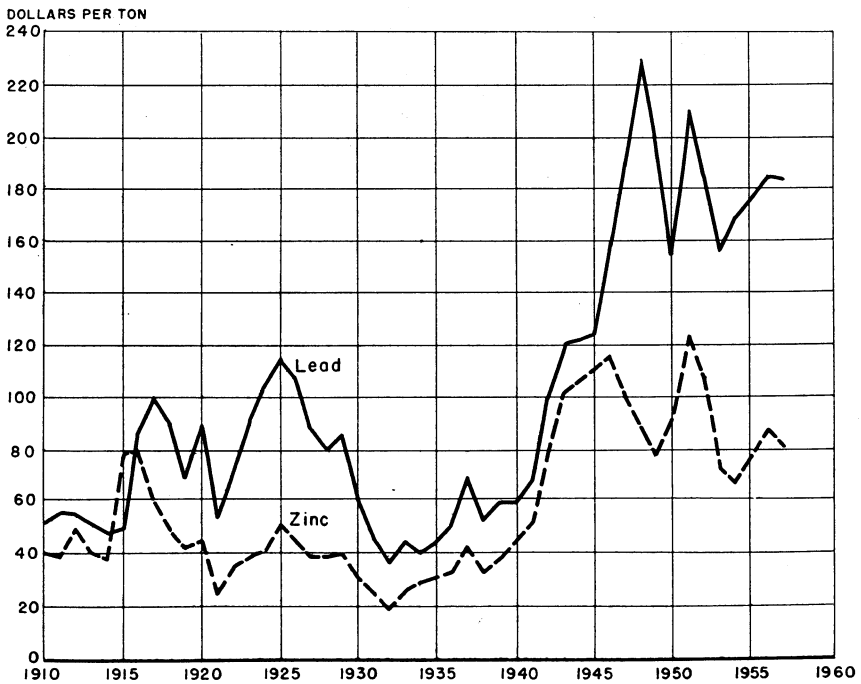


FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State district, 1910-57.

REVIEW BY COUNTIES

Production of metals, nonmetals, and mineral fuels in 1957 was reported from 75 of the 77 Oklahoma counties. Adair and Roger Mills were the only nonproducing counties.

Alfalfa.—Petroleum was produced, and 5 of the 16 exploratory wells drilled in the county in 1957 proved oil productive. Construction sand and gravel was produced by Earl Kirkpatrick; other sand and gravel, crushed limestone, and crushed sandstone were produced by the county and State highway departments.

Atoka.—Limestone was crushed at the Southwest Stone Co.'s quarry near Stringtown for use as railroad ballast, road base, and aggregate in concrete. A small quantity of petroleum was produced. Five exploratory wells were drilled, all proved dry.

Beaver.—Petroleum and natural gas were produced. The Mocane gas area was the largest. Drilling of 19 test wells resulted in 8 that were oil productive and 5 that were gas productive. LaRue Axtell Pumice Co. (formerly Stay-Ready Laboratories) mined almost pure volcanic ash near Gate. The deposit (an estimated 5 million tons) has been known for 30 years and has been mined intermittently.

TABLE 23.—Value of mineral production in Oklahoma, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Alfalfa.....	\$365, 295	\$1, 718, 488	Petroleum, natural gas, sand and gravel, stone.
Atoka.....	257, 951	353, 800	Stone, petroleum.
Beaver.....	2, 936, 262	3, 962, 483	Natural gas, petroleum, pumice.
Beckham.....	22, 683, 546	14, 978, 798	Petroleum, natural gas, salt, stone.
Blaine.....	(?)	1, 328, 525	Gypsum, sand and gravel, natural gas, petroleum.
Bryan.....	1, 840, 464	2, 126, 922	Petroleum, sand and gravel, stone; natural gas.
Caddo.....	13, 831, 911	14, 933, 724	Petroleum, natural gas, stone, gypsum, sand and gravel.
Canadian.....	328, 248	279, 425	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Carter.....	61, 641, 664	67, 007, 569	Petroleum, natural-gas liquids, natural gas.
Cherokee.....	534, 420	384, 200	Sand and gravel, stone.
Choctaw.....	23, 449	14, 666	Sand and gravel.
Cimarron.....	1, 647, 715	2, 024, 758	Natural gas, petroleum.
Cleveland.....	13, 684, 376	22, 694, 614	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Coal.....	1, 978, 215	2, 220, 726	Petroleum, stone, natural gas, sand and gravel.
Comanche.....	2, 517, 057	2, 582, 034	Stone, petroleum.
Cotton.....	4, 418, 543	4, 913, 586	Petroleum, natural gas.
Craig.....	221, 153	439, 820	Coal, stone, sand and gravel, petroleum, natural gas.
Creek.....	31, 031, 687	33, 373, 127	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel, stone.
Custer.....	367, 402	309, 566	Natural-gas liquids, clays, sand and gravel, stone.
Delaware.....	18, 090	36, 250	Sand and gravel.
Dewey.....	(?)	105, 290	Bentonite, sand and gravel, petroleum.
Ellis.....		2, 818	Natural gas.
Garfield.....	7, 783, 835	8, 604, 804	Petroleum, natural-gas liquids, natural gas, clays.
Garvin.....	99, 725, 969	103, 524, 113	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Grady.....	21, 789, 241	21, 465, 109	Petroleum, natural gas, sand and gravel, stone.
Grant.....	1, 991, 254	3, 081, 385	Petroleum, natural gas, stone.
Greer.....	509, 539	584, 753	Petroleum, clays, stone, sand and gravel.
Harmon.....	18, 200	17, 600	Salt, sand and gravel.
Harper.....	43, 549	427, 090	Petroleum, natural gas, stone.
Haskell.....	2, 617, 127	2, 593, 846	Coal, natural gas, stone.
Hughes.....	10, 603, 304	10, 142, 807	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jackson.....	1, 006, 593	1, 168, 369	Petroleum, stone, natural gas.
Jefferson.....	3, 205, 422	3, 605, 448	Petroleum, natural gas, stone.
Johnston.....	1, 812, 645	1, 788, 635	Sand and gravel, stone.
Kay.....	12, 119, 080	13, 929, 526	Petroleum, natural-gas liquids, stone, natural gas, sand and gravel.
Kingfisher.....	875, 729	1, 238, 486	Petroleum, sand and gravel, natural gas, stone.
Kiowa.....	1, 143, 126	2, 308, 747	Stone, petroleum, natural gas, sand and gravel.

See footnotes at end of table.

TABLE 23.—Value of mineral production in Oklahoma, 1956-57, by counties ¹—Continued

County	1956	1957	Minerals produced in 1957 in order of value
Latimer.....	\$389, 150	\$814, 201	Coal, sand and gravel, natural gas, stone.
Le Flore.....	2, 380, 770	2, 980, 745	Coal, natural gas, sand and gravel.
Lincoln.....	25, 064, 864	24, 166, 804	Petroleum, natural-gas liquids, natural gas, stone, clays.
Logan.....	10, 932, 125	12, 421, 767	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Love.....	1, 132, 533	2, 584, 021	Petroleum, natural gas, sand and gravel.
Major.....	2, 310, 055	1, 957, 484	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Marshall.....	8, 007, 989	8, 721, 740	Petroleum, natural-gas liquids, natural gas, sand and gravel, recovered sulfur, stone.
Mayes.....	7, 009	23, 967	Stone, sand and gravel, petroleum.
McClain.....	7, 274, 912	10, 038, 360	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
McCurtain.....	136, 025	79, 559	Sand and gravel, manganese, stone.
McIntosh.....	680, 503	580, 938	Coal, natural gas, sand and gravel, petroleum.
Murray.....	2, 140, 311	2, 592, 518	Stone, petroleum, asphalt, sand and gravel.
Muskogee.....	937, 479	864, 356	Petroleum, sand and gravel, stone, natural gas.
Noble.....	9, 676, 220	9, 781, 474	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Nowata.....	15, 681, 295	15, 230, 491	Petroleum, stone, natural gas.
Oklfuskee.....	10, 132, 686	11, 117, 032	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Oklahoma.....	35, 065, 312	30, 033, 325	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone, clays.
Okmulgee.....	7, 821, 495	7, 957, 790	Petroleum, coal, stone, natural gas, sand and gravel.
Osage.....	68, 558, 343	81, 009, 593	Petroleum, natural-gas liquids, stone, natural gas, sand and gravel.
Ottawa.....	12, 511, 898	6, 054, 064	Zinc, lead, stone, tripoli, sand and gravel.
Pawnee.....	7, 946, 312	8, 242, 510	Petroleum, sand and gravel, natural gas, stone.
Payne.....	13, 448, 121	15, 166, 521	Petroleum, natural gas, stone, natural-gas liquids.
Pittsburg.....	2, 373, 938	2, 642, 451	Coal, stone, natural gas, sand and gravel, clays, petroleum.
Pontotoc.....	17, 436, 733	17, 547, 261	Petroleum, cement, stone, natural-gas liquids, sand and gravel, natural gas, clays.
Pottawatomie.....	16, 227, 843	11, 962, 650	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Pushmataha.....	53, 763	2, 062	Sand and gravel.
Rogers.....	5, 649, 402	6, 887, 366	Petroleum, coal, stone, clays, natural gas, sand and gravel.
Seminole.....	28, 532, 761	31, 465, 563	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays.
Sequoyah.....	2, 786, 748	3, 462, 054	Coal, lime, stone, natural gas.
Stephens.....	59, 003, 172	71, 528, 115	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Texas.....	26, 852, 160	23, 967, 803	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Tillman.....	1, 638, 025	2, 379, 124	Petroleum, sand and gravel, natural gas.
Tulsa.....	7, 082, 548	7, 198, 975	Petroleum, stone, sand and gravel, clays, natural gas.
Wagoner.....	1, 165, 168	1, 596, 165	Petroleum, natural gas, sand and gravel.
Washington.....	16, 749, 979	18, 553, 788	Petroleum, cement, stone, clays, natural gas.
Washita.....	1, 694, 564	1, 396, 625	Petroleum, natural gas.
Woods.....	665, 988	432, 443	Natural gas, petroleum, sand and gravel, stone, salt.
Woodward.....	2, 855	8, 815	Sand and gravel, natural gas, petroleum.
Undistributed.....	1, 397, 122	214, 566	
Total.....	757, 120, 000	803, 937, 000	

¹ Adair and Roger Mills Counties not listed because no production was reported.

² Included with "Undistributed," to avoid disclosing individual company confidential data.

Beckham.—Petroleum and natural gas were produced, mostly from the Elk City field. Exploratory crews completed 2 gas wells out of 12 test holes. Salt was obtained from wells southwest of Sayre by the Oklahoma Salt Industries, Inc. Crushed granite for road construction 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. United States Gypsum Co. also quarried and crushed gypsum and operated a large calcining, sheet-rock, and plaster plant at South-

ard. One test well was drilled and proved oil productive. The county also became an oil producer in 1957.

Bryan.—Sand and gravel for construction was produced from the pits near Colbert and for paving by the State highway department. Petroleum and natural gas were produced from the Aylesworth, S. E. field. Six exploratory wells were drilled; all proved dry.

Caddo.—Petroleum and natural gas were produced. Cement, the largest of these fields, yielded 4 million barrels of oil in 1957. Drilling of 7 exploratory wells proved only 1 gas well; however, field-development wells drilled included 130 oil wells, 4 gas wells, and 22 dry holes. The plant of Apache Gasoline Co. remained shut down. The State's deepest test well was drilled to 20,426 feet in the Cement field, but it was abandoned as a dry hole. Another test well that was being drilled on the Fort Cobb anticline was aimed at the world's new depth mark of 24,000 feet. At Cyril refinery capacity of Anderson-Prichard Oil Corp. was being increased by 2,000 barrels of crude oil per day. Construction sand and gravel was produced by two operators. Dimension limestone was quarried by one operator. Gypsum was produced by the Harrison Gypsum Co.

Canadian.—Petroleum and natural gas were produced mostly from the Edmond W. field. Exploratory drilling resulted in six dry holes. Paving sand was produced by the State highway department.

Carter.—Carter County ranked third in the value of mineral 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 produced by the Magnolia Petroleum Co., Shell Oil Co., Signal Oil & Gas Co., Harry Ells, Inc., Apache Gasoline Co., and Sokla Gasoline Co. One exploratory well was completed as an oil well; eight were dry. Also, 250 field-development wells were completed as oil wells, and 63 were dry. At Ardmore the refinery of Ben Franklin Refining Co. operated during the year.

Cimarron.—Petroleum and natural gas were produced from several small fields in the Keyes area. Of 12 exploratory wells drilled, 1 proved oil productive and 1 gas productive.

Cleveland.—Petroleum and natural gas were produced. Natural-gas liquids were produced by Continental Oil Co. and Sunray Mid-Continent Petroleum Corp. Drilling of 26 exploratory wells resulted in 7 oil producers; drilling of 138 field-development wells resulted in 102 oil producers and 5 gas producers.

Coal.—About \$1.9 million of petroleum and natural gas were produced. Crushed limestone and paving gravel were produced by the State highway department; limestone for concrete aggregate was quarried and crushed by one operator. Of 6 exploratory wells drilled, 1 was gas productive.

Comanche.—Crushed limestone was produced by Dolese Bros. Co. from its Richards Spur quarry north of Lawton. Petroleum was produced from a group of small fields, comprising three districts, and Fort Sill Reservation field. Only 2 of 22 exploratory wells drilled proved oil productive.

Cotton.—Petroleum and natural gas were produced from a group of fields in the Walters and Cache Creek districts, and from several other fields. All 11 exploratory wells drilled proved to be dry holes.

Craig.—Coal was strip mined at 4 pits by 3 producers. Minor amounts of petroleum and natural gas were produced. No exploratory wells were drilled in 1957. Limestone for road construction was crushed by two construction companies and by the State highway department.

Creek.—Petroleum and natural gas were produced from numerous fields, and of these the prolific Cushing and Glenn fields supplied 4.9 million barrels of petroleum during the year. Natural-gas liquids were recovered by plants of Sinclair Oil & Gas Co., Kerr-McGee Oil Industries, Inc., Pure Oil Co., Boswell-Frates Co., and Sunray Mid-Continent Oil Corp. Clay for the manufacture of brick and tile was produced at the Sapulpa plant of the Sapulpa Brick & Tile Co.; for pottery, it was produced at Sapulpa by Frankhoma Pottery Co. A small quantity of crushed limestone and sand and gravel was produced for highway purposes. Exploratory drilling resulted in 1 oil well and 3 dry holes; field-development wells resulted in 296 oil wells, 6 gas wells, and 183 dry holes. Tide Water Associated Oil Co., refinery at Drumright, shut down in 1955, was being dismantled.

Garfield.—Petroleum and natural gas were produced. Natural-gas liquids were produced by the plants of Sterling Oil Co. of Oklahoma near the East Spring Valley field and by Sinclair Oil & Gas Co. at Covington. The 20,000-barrel-per-day Enid refinery of Champlin Refining Co. operated throughout the year. Exploratory drilling accounted for 4 oil wells and 9 dry holes. The Davies Brick & Tile Co. was sold April 1, 1957, to Enid Brick & Tile Mfg. Co. who continued to produce clay for manufacturing of brick.

Garvin.—Garvin County retained first position in the value of minerals and mineral fuels produced in the State. Petroleum and natural gas were produced from numerous fields, which supplied 27 million barrels of oil in 1957. Six plants recovered natural-gas liquids. Exploratory drilling resulted in 2 oil wells and 12 dry holes; field-development wells resulted in 178 oil wells, 1 gas well, and 81 dry holes. The 17,000-barrel-per-day refinery of Kerr-McGee Oil Industries, Inc., at Wynnewood operated throughout the year. Construction sand was obtained from deposits east of Pauls Valley by two operators; paving sand and gravel and crushed limestone were produced for highways by the highway department.

Grady.—Petroleum and natural gas were produced. British-American Oil Producing Co. completed the State's deepest producing well at a depth of 16,546 feet in the Carter-Knox field. Only one exploratory well was drilled, and it was dry. Sand and gravel for construction and paving was obtained from pits near Tuttle by Dolese Bros. Co. Crushed sandstone and crushed limestone for road construction were produced by the State highway department.

Grant.—Petroleum and natural gas were produced from numerous small fields. Exploratory drilling resulted in 6 oil wells, 3 gas wells, and 16 dry holes. Southwest Rock and Chat Co. produced a small amount of crushed limestone for the State highway department for road construction.

Greer.—J. P. Gilman Granite Co. quarried granite near the town of Granite. Clay was produced south of Mangum from the pit of Mangum Brick & Tile Co. Two operators produced sand and gravel.

Petroleum was produced from the Lake Creek district. Drilling of 13 exploratory wells resulted in 1 gas producer.

Harmon.—W. H. Flowers & Sons Salt Co. produced salt by solar evaporation of brine from salt springs. Oliver May produced sand and gravel. Only one dry exploratory well was drilled.

Harper.—Small amounts of petroleum, natural gas, and stone were produced. Five oil wells and 2 gas wells out of 16 exploratory tests were productive. Crushed limestone and miscellaneous stone were produced for highways.

Haskell.—Haskell County ranked third in value of coal produced. Coal was mined underground by Dock Coal Co. and strip-mined by Garland Coal Mining Co., Cedar Creek Coal Co., Cary Contracting Co., Choctaw Coal Co., Inc., and McAlpine and Dock. Natural gas was produced from the Quinton and Kinta districts. Two field wells and one exploratory well were drilled and proved dry. Crushed sandstone for road construction was produced by the State highway department.

Hughes.—Petroleum and natural gas were produced from numerous fields. The Holdenville East field, discovered in 1946, yielded 628,000 barrels of oil in 1957. Natural-gas liquids were recovered by the Grimes Gasoline Co. Exploratory drilling resulted in 1 gas well and 5 dry holes; field-development wells drilled included 71 oil, 6 gas, and 54 dry. Paving gravel was produced for highways.

Jackson.—Petroleum and natural gas were produced from fields southeast of Altus. Crushed granite was produced by H. D. Youngman for air-base construction. Four exploratory wells and one field well proved dry.

Jefferson.—Petroleum and natural gas were produced. Eleven exploratory wells drilled proved dry. Crushed sandstone 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 by the Ada Stone Co. near Pontotoc. Crushed dolomite for glass manufacture and fillers was produced by Rock Products Co. Dimension granite was obtained from a quarry south of Mill Creek. Exploratory drilling resulted in eight dry holes.

Kay.—Petroleum and natural gas were produced from numerous fields, and natural-gas liquids were recovered by plants of Cities Service Oil Co. and Wunderlich Development Co. Crushed limestone was produced by Cookson Stone Co. from its quarry northeast of Ponca City and by Mervine Stone Co. Sand was produced by three operators for construction and paving. Exploratory drilling resulted in 3 oil wells and 24 dry holes; field wells resulted in 97 oil wells and 58 dry holes. Cities Service Oil Co. was expanding the capacity of its Ponca City refinery from 23,000 to 30,000 barrels daily, and construction was completed of a new Rexformer unit to reform petroleum components. The petrochemical unit of the Continental Oil Co. refinery at Ponca City was producing benzene, toluene, and propylene hydrocarbons. This company also completed its atomic radiation laboratory, designed to improve petrochemical products or processes.

American Metal Climax, Inc., zinc smelter at Blackwell operated continuously throughout the year.

Kingfisher.—Crushed limestone for road construction was produced by Southwest Rock Co. and the State highway department. Construction and paving sand was produced from pits near Dover by Dolese Bros. Co. and paving sand by the State highway department. Petroleum and natural gas were produced. Four exploratory wells drilled resulted in 1 oil producer and 1 gas producer.

Kiowa.—Dimension granite was quarried near Snyder by three operators and near Hobart by Century Granite Co., which has a finishing plant at Snyder. Two operators produced construction sand and gravel. Crushed limestone for road construction was produced by two operators. The Bureau of Mines drilled test holes for titanium ore in the sands of Otter Creek Valley from Cold Springs to the Tillman County line. Results of the examination of samples will be published. Petroleum and natural gas were produced. Exploratory wells drilled resulted in 3 oil producers, 1 gas producer, and 45 dry holes; field wells resulted in 63 oil wells, 1 gas well, and 76 dry holes.

Latimer.—Coal was strip-mined by Kinta Stripping Co. Natural gas was produced from the Red Oak and Morris fields. Crushed sandstone and paving sand and gravel were produced for highways.

Le Flore.—Coal was mined by 9 operators—2 using strip mining and the rest mining underground. In terms of value, the county was the fourth leading coal producer in the State. Sand and gravel was produced for highway surfacing. Natural gas was produced mainly from three fields. Drilling of 3 field wells resulted in 1 gas producer.

Lincoln.—Petroleum and natural gas were produced from numerous fields, of which the East Payson yielded about 467,000 barrels in 1957. Five plants recovered natural-gas liquids. Allied Materials Corp. refinery at Stroud operated throughout the year. Extensive exploratory drilling in the county resulted in 4 oil wells, 3 gas wells, and 31 dry holes; field wells proved 86 oil producers, 12 gas producers, and 60 dry holes. Crushed limestone and crushed sandstone were produced for concrete aggregate by the State highway department. Amis Construction Co. also produced crushed sandstone. Stroud Clay Products Co. produced clay for building bricks.

Logan.—Petroleum and natural gas were obtained from numerous fields, and natural-gas liquids were recovered by the Eason Oil Co. Of 17 test wells drilled, 5 were oil producers; of 112 field wells drilled, 85 were oil and 2 gas producers. Construction sand was produced by two operators.

Major.—Petroleum and natural gas were produced mostly from the Ringwood field and other smaller fields. Natural-gas liquids were recovered by Warren Petroleum Co., at Ringwood. Two test wells resulted in an oil producer and a dry hole. Construction sand was produced near Cleo Springs by three operators.

Marshall.—Petroleum was produced from several fields, of which the Cumberland field yielded 1.8 million barrels in 1957. The Warren Petroleum Corp. and the Universal Gasoline Co. recovered natural-gas liquids. Near Madill, the Central Chemical Co. recovered sulfur from waste sour gas. Two of 7 exploratory wells drilled were oil producers. Sand and gravel and crushed limestone were produced for highways.

McClain.—Petroleum and natural gas were produced from numerous small fields, and exploratory drilling accounted for 5 oil wells and 5 dry holes. Sand and gravel and crushed sandstone for paving were 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. The drilling of 2 test wells resulted in 1 gas producer.

Murray.—The United States Asphalt Corp. produced asphaltic limestone and sandstone near Dougherty. Limestone was crushed at the Rayford and Big Canyon quarries of Dolese Bros. Co. Crushed limestone and paving sand and gravel were produced for highways. Petroleum was produced from two fields. Nine exploratory wells proved dry.

Muskogee.—Petroleum and natural gas were produced, and, of 5 exploratory tests drilled, 1 was a gas producer. Yahola Sand & Gravel Co. pumped sand and gravel from the Arkansas River north of Muskogee. Crushed limestone was produced for highways. At Muskogee Fansteel Metallurgical Corp. completed constructing a \$6.5 million columbium-tantalum plant designed to boost the Nation's supply of tantalum 50 percent. Also at Muskogee, Callery Chemical Co. was constructing a high-energy fuel plant for Navy missiles and jet planes.

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. Two of 19 exploratory wells were found oil productive. Sand and gravel was produced by the Noble County Highway Department.

Nowata.—Petroleum and natural gas were produced from six fields. Crushed limestone was produced by Peerless Rock Co. and by the State highway department.

Okfuskee.—Petroleum and natural gas were produced from numerous fields, of which the Olympic field supplied 1.57 million barrels of oil in 1957. Natural-gas liquids were recovered by two plants of Grimes & Grimes. Drilling of 9 exploratory wells resulted in 1 gas producer; however, extensive field-drilling programs resulted in 106 oil wells, 5 gas wells, and 61 dry holes. Sand and gravel was produced for highways.

Oklahoma.—Petroleum and natural gas were produced from numerous fields; of these, Oklahoma City and West Edmond each yielded over 1 million barrels of oil. Natural-gas liquids were recovered by Patton & Swab, Inc., Phillips Petroleum Co. (three plants), and Cities Service Oil Co. The plant of Monarch Refineries, Inc., operated during the year. Exploratory drilling resulted in 1 gas producer and 8 dry holes. Clay for manufacturing brick and tile was obtained from pits in the west part of Oklahoma City by the Acme Brick Co. and the United Brick & Tile Co. Near Choctaw, clay for lightweight aggregate was produced by the Oklahoma Lightweight Aggregate Corp. Exfoliated vermiculite was produced at Oklahoma City. Crushed sandstone and limestone were produced for highways.

Construction and paving sand was produced by three operators; other sand and gravel was produced by the State highway department and by the Corps of Engineers.

Okmulgee.—Coal was mined near Henryetta by Sunray Coal Co., Carbon Hill Coal Co., and Ben Hur Coal Co. Petroleum and natural gas were produced from numerous fields. Phillips Petroleum Co. refinery at Okmulgee was in operation. Two exploratory tests resulted in one gas producer. Crushed limestone and paving sand were produced for highways. A sandstone quarry was operated near Henryetta by the Ada Stone Co.

Osage.—Osage, with many fields producing oil and gas, was the second leading oil-producing county in 1957. Under an extensive waterflooding program, the Burbank field produced 14.3 million barrels of oil and remained the most prolific. Natural-gas liquids were recovered by Phillips Petroleum Co. (two plants), Skelly Oil Co., Neal Gasoline Co., and Sunray Mid-Continent Oil Corp. The county also led in exploratory drilling. Out of 95 tests, 7 were oil productive; also, oil producers drilled 908 field wells of which 575 were oil producers, 2 gas wells, and the remainder were water-input wells or dry holes.

Limestone was quarried and crushed east of Burbank; paving sand was produced by the State highway department. Crushed limestone and paving sand were produced for highways. Crushed limestone was produced by Burbank Rock Co. and Mervine Stone Co.

Ottawa.—All of Oklahoma's lead and zinc output and a major part of the Tri-State district's output were supplied from 64 operating mines in Ottawa County. Because of declining metal prices, these mining operations experienced 2 work stoppages—a 5-day period in April and a 4-month period starting August 1. The Rare Metals plant of Eagle-Picher Co. at Miami was expanded to produce silicon. The plant also has been producing germanium. Also at Miami, Winart Pottery installed a new kiln to double the production. 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 and chat were produced by the State highway department.

Pawnee.—Numerous fields supplied petroleum and natural gas. Construction and paving sand and gravel were produced by three operators. Crushed limestone was produced by the highway department; at the Ralston quarry it was produced by Cookson Stone Co. Exploratory drilling of 15 test wells resulted in 2 oil producers.

Payne.—Numerous fields produced petroleum and natural gas; Yale-Quay, with a production of 1.8 million barrels of oil in 1957, was the largest in Payne County. Exploratory drilling resulted in 3 oil wells and 14 dry holes. At Cushing refineries of Kerr-McGee Oil Industries, Inc., and of Midland Cooperatives, Inc., operated throughout the year. Crushed limestone and crushed sandstone for road construction were produced by the highway department, and crushed limestone was produced by Cookson Stone Co. at the Cushing quarry.

Pittsburg.—Pittsburg County ranked fifth in value of coal produced. Coal was mined underground by Lone Star Steel Co. and strip-mined by Jet Coal Co. 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. Nine exploratory wells were drilled; all proved dry. 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 plant at Ada. Mid-Continent Glass Sand Co. produced glass sand and molding sand. Paving sand and gravel was produced by the State highway department. At Ada, Oklahoma Ideal Cement Co. was erecting a new \$14-million plant, which included an additional 12-by-450-foot kiln. The combined cement capacity of the new and old plants will be 3,700,000 barrels yearly.⁸

Pottawatomie.—Petroleum and natural gas were produced from numerous fields, of which the St. Louis was the largest. Natural-gas liquids were recovered by the plants of Warren Petroleum Corp. and the Sinclair Oil & Gas Corp. Exploratory drilling resulted in 2 oil producers and 23 dry holes. Paving gravel was produced for highways.

Rogers.—The county ranked first in coal production. Coal was strip-mined by the McNabb Coal Co. 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 accounted for most of the oil produced. Three test wells were drilled, and one proved a gas producer. Sand and gravel and crushed limestone were 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 Carter Oil Co., Sinclair Oil & Gas Co., and Phillips Petroleum Co. Exploratory drilling crews drilled 4 dry holes; field-development crews drilled 136 oil producers, 6 gas producers, and 68 dry holes. 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 second in value of coal. The Sallisaw Stripping Co. and the Fall River Coal Co. strip-mined coal. 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. Crushed limestone was produced for highways. Natural gas was produced from a small field, and exploratory drilling resulted in 1 gas well and 1 dry hole.

Stephens.—The county ranked third in petroleum production. Petroleum and natural gas were produced. Magnolia Petroleum Co., Warren Petroleum Corp., Skelly Oil Co., and Patoma Hydrocarbon Corp. recovered natural-gas liquids. Exploratory drilling yielded 5 oil producers, 2 gas producers, and 12 dry holes; field-development

⁸Work cited in footnote 6, p. 11.

wells drilled resulted in 256 oil producers, 9 gas producers, and 99 dry holes. At Duncan D-X Sunray refinery had a 6,000 barrel-a-day unifier under construction. Crushed sandstone 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.; elsewhere by Dorchester Corp. and Excelsior Corp. One oil well and three dry holes resulted from exploratory drilling. Construction sand and gravel was produced north and south of Guymon by Stewart Bros.

Tillman.—Petroleum, natural gas, and sand and gravel were produced. Exploratory drilling resulted in 2 oil wells and 19 dry holes. The refinery of Bell Oil & Gas Co. at Grandfield operated throughout the year. Construction sand was produced near Grandfield by Floyd King.

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.; elsewhere by Standard Industries, Inc. Construction and paving sand were produced by nine operators; paving sand alone 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 completed the first expansion step at West Tulsa by adding three special refining units. The company also opened an extensively equipped laboratory for petroleum research.

Washington.—Petroleum and natural gas were produced from five districts. Limestone and clay were quarried near Dewey by the Dewey Portland Cement Co. for manufacturing portland cement. Part of the limestone quarried at Dewey was marketed as crushed limestone. Crushed limestone also was produced near Bartlesville by the Matoaka Stone Co. The Research Center of Phillips Petroleum Co. was completed at Bartlesville during the year. The company announced plans to install two atomic reactors at the Research Center.

Washita.—Petroleum and natural gas were produced from several small fields and from part of the prolific Elk City field. One exploratory well was drilled and it was dry.

Woods.—Construction sand was produced near Waynoka by Waynoka Sand & Gravel Co. Salt was produced by Ezra Blackmon west of Freedom. Petroleum and natural gas were produced from 1 field, and exploratory drilling resulted in 2 oil wells and 7 dry holes.

Woodward.—This county was added to the list of oil producers. Exploratory drilling resulted in 3 oil producers, 1 gas producer, and 6 dry holes. Paving sand was produced for highways.



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, United States Department of the Interior, and the Oregon State Department of Geology and Mineral Industries.

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RESPONDING to increased demand for heavy engineering construction, mainly on dams, roads, and bridges, Oregon mineral production advanced to more than \$42 million—a new record and 25 percent greater than in 1956. The sand and gravel, stone, and cement industries benefited chiefly.

Production of nickel and mercury also reported increases. The value of chromite receded sharply, because the upgrading of Government-stockpiled material was completed.

Mineral-industry expansion included near-completion of an aluminum-reduction works at The Dalles, AEC approval of construction plans for a uranium-ore-processing plant near Lakeview, doubling of capacity at a cement mill at Lime, and a new lime plant at Baker.

Consumption, Trade, and Markets.—Construction by public agencies and electric-utility companies was the major factor in increased mineral-production value in Oregon. The extent of the gain in these projects, in terms of value of construction put in place or value of contracts awarded, is not available for individual States, and these projects are not covered by building permits. The State highway department record budget of some \$68 million (\$39.9 million went for contract work) was an indication of the increase. Both figures represent record highs. The \$39.9 million figure represents contracts awarded; \$37.7 million was the value of work done during the year. Under the Federal Highway Act of 1956 the State receives 90 percent of construction costs on the Columbia River Highway and the Pacific Highway, both a part of the Federal interstate highway system. Power dams under construction by electric-utility companies were Pelton, on the Deschutes River; North Fork, on the Clackamas River; and Brownlee, in Hells Canyon on the Snake River between Oregon and Idaho. The Dalles Dam (a Federal project) on the Columbia River was substantially completed, and the first 78,000-kw. unit of 14 scheduled generating units was placed on the line September 25.

Residential building decreased nearly one-third from 1956, and nonresidential building (commercial, industrial, community, and public-utility buildings, etc.) declined 5 percent, as measured by value of permits issued by municipalities. Because construction costs increased about 4 percent in 1957, the physical volume of construction dropped by an even greater percentage than was shown by the

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value of permits issued. Some improvement in both residential and nonresidential building occurred in the fourth quarter.

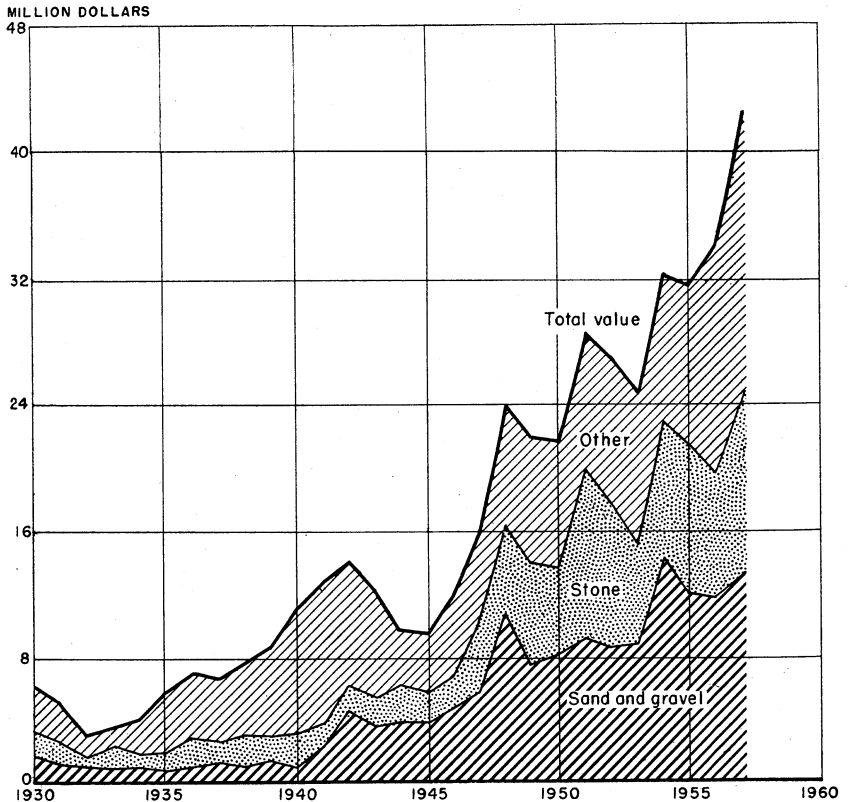


FIGURE 1.—Value of sand and gravel, stone, and total value of mineral production in Oregon, 1930-57.

Another measure of construction in Oregon is employment. In 1957 employment by construction contractors was down 9 percent. Increased activity in engineering projects was not enough to offset decreased building construction, which affords more employment than engineering works of equivalent value.

Reduction of FHA down payments by the Federal Housing Act of 1957 and availability of more money for residential loans stimulated some home building by the end of the year.

Primary-metals processing was a stabilizing influence most of the year; and activity was stronger than in 1956, contrary to the general downward trend of manufacturing.

The export-import volume of bulk mineral commodities handled at terminals of the Portland Dock Commission increased to new high tonnages. Coal, mainly from Utah mines and destined for Korea and Japan, totaled 697,000 tons, or $2\frac{1}{2}$ times the 1956 total, and lead and zinc concentrates from foreign mines consigned to smelters in Montana and Idaho totaled 112,842 tons, almost triple the 1956

TABLE 1.—Mineral production in Oregon, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromium ore and concentrate.....gross weight...	54,577	\$2,001	7,900	\$675
Clays.....thousand short tons...	257	278	240	266
Copper (recoverable content of ores, etc.).....	7	6	23	14
Gold (recoverable content of ores, etc.).....troy ounces...	2,738	96	3,381	118
Iron ore (limonite).....long tons...	893	(²)	(²)	(²)
Lead (recoverable content of ores, etc.).....	5	2	5	1
Mercury.....76-pound flasks...	1,893	492	3,993	986
Nickel ore.....nickel content...	6,866	(²)	12,276	(²)
Pumice and volcanic cinders.....	(²)	(²)	123,644	294
Sand and gravel.....thousand short tons...	11,637	11,646	12,843	13,431
Silver (recoverable content of ores, etc.).....troy ounces...	13,542	12	15,924	14
Stone.....thousand short tons...	6,098	7,890	10,311	11,405
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, gem stones, lime (1957), mineral pigments, natural sodium carbonates (1956), tungsten, uranium, and values indicated by footnote 3.....		12,940		16,154
Total		34,021		42,480

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low-grade ore and concentrate stockpiled near Coquille, Ore., during World War II.

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Total adjusted to eliminate duplicating value of clays and stone; 1956 figure revised.

tonnage. New facilities for handling bulk ore were installed in 1954, and imports and exports have increased steadily since.

Trends and Developments.—Chromite mining neared an end in 1957, with the approaching completion of the Government purchase program for stockpiling of this commodity. Gold mining was virtually nonexistent.

Mineral-aggregate and cement production will continue to benefit from increased construction. In 1958 the State highway commission will have a record budget of \$87 million, or \$19 million above the previous high, and by 1970 the State will have spent \$1 billion—an average of \$80 million per year—on highway construction. The State highway commission announced that concrete surfacing had been selected for construction on two projects on sections of Federal Route 99—the first time in more than 10 years that concrete was used in major highway surfacing in Oregon.

Employment.—As reported by the Oregon State Unemployment Compensation Commission, employment in mineral manufacturing rose 6 percent, and payrolls increased 12 percent, reflecting increased activity in primary metals, glass, and pottery and a continued upward trend of wages. Mining employment and payrolls decreased slightly. These industry groups are not identical with those in the Bureau of Mines mineral-production canvass.

The average weekly earnings of production workers in primary metals (mainly steelworks and rolling mills and smelting of nonferrous metals) rose from \$97.64 in 1956 to a new high of \$101.55, according to data compiled by the Oregon State Unemployment Compensation Commission, in cooperation with the United States Bureau of Labor Statistics. Workers in this industry group received higher average

weekly earnings than in any other manufacturing industry. The increase was due to a gain from \$2.44 to \$2.58 in average hourly earnings. Average weekly hours declined from 40.1 to 39.3, reflecting to some extent the general slowdown of industrial activity in the last half of 1957.

Legislation and Government Programs.—The State enacted a new dredge-mining law requiring a permit and bond and establishing standards for dredging, such as replacement of top soil and ground cover and construction of settling ponds to remove silt caused by dredging before water is discharged into a stream.

TABLE 2.—Employment and payrolls in mineral-industry establishments subject to Oregon Unemployment-Compensation law, 1956–57, by industry ¹

Industry	1956		1957	
	Employment	Payrolls	Employment	Payrolls
Mining:				
Metal.....	279	\$1,378,443	296	\$1,517,569
Nonmetallic, including mineral fuels.....	980	4,849,906	920	4,632,811
Total mining.....	1,259	6,228,349	1,216	6,150,380
Mineral manufacturing: Stone, clay, and glass products:				
Glass and pottery.....	156	770,311	312	1,726,525
Hydraulic cement.....	453	2,337,194	442	2,420,044
Structural clay products.....	240	1,144,621	287	1,110,626
Concrete, gypsum, and plaster products.....	486	2,264,483	518	2,531,975
Cut-stone and stone products.....	51	233,342	48	235,734
Miscellaneous nonmetallic mineral products.....	77	338,154	106	457,388
Total.....	1,469	7,088,105	1,663	8,482,287
Primary metals:				
Blast furnaces, steelworks, and rolling mills; and primary and secondary smelting and refining of non-ferrous metals.....	2,226	12,893,260	2,525	15,499,457
Iron and steel foundries.....	1,976	10,435,438	1,902	10,434,466
Nonferrous foundries.....	333	1,522,009	364	1,788,262
Miscellaneous primary metal industries.....	128	636,508	194	1,006,081
Total.....	4,660	25,487,215	4,985	28,728,266
Industrial organic and inorganic chemicals.....	334	1,605,525	331	1,779,051
Fertilizers.....	61	248,010	70	324,175
Products of petroleum and coal.....	418	2,086,474	300	1,538,343
Total mineral manufacturing.....	6,942	36,515,329	7,349	40,852,122
Grand total.....	8,201	42,743,678	8,565	47,002,502

¹ Oregon State Unemployment Compensation Commission. Figures were limited to data reported by employers subject to Oregon Unemployment-Compensation law, under the provisions requiring coverage of employers hiring 2 or more workers in any 6 weeks in a quarter in which the payroll amounted to \$500 or more. Some industries were combined in the table because there were less than 3 employers.

Six contracts were active under the Defense Minerals Exploration Administration (DMEA) program to encourage the investigation of strategic and critical mineral occurrences, compared with only two in 1956. All new contracts were for amounts less than \$25,000.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Production and shipments of portland cement during 1957 increased 10 percent over 1956, continuing the upward trend that

TABLE 3.—Defense Minerals Exploration Administration contracts active during 1957

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
HARNEY Timber Beast Mining Co.	Timber Beast Group.	Uranium....	Oct. 22, 1957	24, 772	75
JACKSON Ford M. Converse.....	Grand Cove	Copper.....	July 23, 1957	7, 200	50
JEFFERSON International Engineering & Mining Co.	Axehandle.....	Mercury....	Aug. 21, 1957	10, 420	75
LANE Mercury & Chemicals Corp..	Black Butte.....	.....do.....	Aug. 22, 1956	62, 340	75
MALHEUR H. K. Riddle.....	Jordan.....	.....do.....	May 28, 1956	1 30, 500	75

¹ Amended.

began in 1954. Year-end stocks of finished portland cement were 21 percent greater than those reported for 1956. The average price for cement shipped by producers in Oregon and Washington increased 3 cents above the 1956 average of \$3.48 per barrel f. o. b. mill. Cement from Oregon plants was shipped chiefly within the State; out-of-State shipments went to Washington, Idaho, and California (small quantity). Output came from 3 plants, 1 each in Baker, Clackamas, and Jackson Counties.

Oregon Portland Cement Co. completed a general expansion and modernization program at its plants in Oswego, Clackamas County, and Lime, Baker County. A new kiln that was brought into operation at the Lime plant in 1957 doubled production capacity. A new kiln added to the Oswego facility had begun producing in 1956. Improvements begun by the company in 1955 also involved dust-control systems at both plants, rock handling and processing facilities at Oswego, new equipment and improvements at the company-operated limestone quarry at Dallas, Polk County, and expansion of its distribution facilities at Portland.

Clays and Shale.—The output of clays declined 7 percent in tonnage and 3 percent in value compared with 1956. Generally declining construction activity during 1957 was the principal reason for the 11-percent reduction of clay mined for making heavy clay products and a 21-percent decline in output of expanded shale for lightweight aggregate. Thirteen plants in 11 counties processed clay to heavy clay products, principally brick and draintile. In addition, clays used in cement and shales in lightweight aggregate were mined in three other counties. Three plants—one each in Clackamas, Linn, and Washing-

ton Counties—that produced in 1956 were reported closed in 1957. Multnomah County continued to lead in the quantity of clay mined for heavy clay products. Other counties reporting clay production were Baker, Benton, Clackamas, Jackson, Klamath, Malheur, Marion, Multnomah, Polk, Tillamook, Union, Washington, and Yamhill.

Two companies in Washington County mined shale that was expanded for making lightweight-concrete products, principally building block. In Washington County, Northwest Aggregate, Inc., obtained shale from the Banks pit, and Smithwick Concrete Products Co. mined shale at the Haydite quarry south of Vernonia. In August the latter company completed transfer of its expanding facilities from Portland, Multnomah County, to the quarry. Modernization of the expanding plant was incorporated into the relocation program. The company block-manufacturing plant and headquarters were to remain at Portland.

Diatomite.—Production of diatomite increased 12 percent, reversing the downward trend reported for this commodity since 1954. The Great Lakes Carbon Corp., Mining & Mineral Products Division (formerly Dicalite Division), continued to be the only producer of diatomite in the State at an open-pit mine and processing plant west of Terrebonne, Deschutes County. Output was shipped to consumers, principally for filtration, filler, and insulation uses. The company developed and tested diatomite deposits near Fort Rock, Lake County, but there was no production from these deposits in 1957.

Diatomite is used extensively as a filtration medium in processing sugar, beverages, water, oils, and many other materials. The commodity also is used as a mineral filler in rubber, paper, asphalt products, explosives, insecticides, and paints, as well as many other products. Owing to its porous nature and ability to withstand high temperatures, diatomite is also a good insulating medium.

Gem Stones.—Collection of gem stones during 1957 again largely resulted from many individuals gathering the material as a hobby. The members of numerous mineral clubs collected gem minerals in the field. A leading authority on gem stones in the Pacific Northwest stated that in 1957 there were 105 clubs in these States, principally Oregon and Washington, with a membership of about 7,000.³ An accurate estimate of the value of gem material collected by these individuals during the year is almost impossible. Estimates range from \$250,000 to over \$500,000 for the year. A conservative estimate for value of crude gem material collected in 1957 would be between \$200,000 and \$300,000. The value of polished and cut gem material, however, would be much greater. As in previous years, the State was a source of agate, obsidian, thunder eggs, and petrified wood. The central Oregon counties—Deschutes, Jefferson, Crook, and Morrow—were the most productive areas in the State during 1957.

Lime.—In October production of lime was begun by Chemical Lime Co. at a new two-kiln plant north of Baker, Baker County. The output of quick and hydrated lime was marketed to consumers in Oregon and Washington, principally paper mills; a small quantity was reported sold for use at metallurgical plants. Natural gas was

³ Dake, H. C., Letter to Bureau of Mines: Feb. 3, 1958.

used to fire the kilns. The Chemical Lime Co. operation was described in detail in several articles.⁴

Mineral Pigments.—Crude iron oxide pigment was produced near Scappoose, Columbia County. Output, which was shipped to California for manufacturing paints, increased 20 percent over 1956. A small quantity of manufactured iron oxide pigment was produced at another plant, also near Scappoose. The raw material—limonite—was obtained from a nearby pit.

Natural Salines.—A. M. Matlock developed the Alkali Lake saline deposits north of Lakeview, Lake County. No production or sales were reported for 1957.

Perlite.—The output of expanded perlite by Supreme Perlite Co., Portland, Multnomah County, the only producer in the State, was 8 percent less in 1957 than in 1956. Crude perlite was shipped to the Portland plant from mines in Lincoln County, Nev. The expanded product was used principally as building-plaster aggregate; small quantities were consumed as concrete aggregate and as a soil conditioner. The general decline in residential construction in the Pacific Northwest was the chief reason for the drop in production.

Pumice and Volcanic Cinders.—The output of pumice and volcanic cinder in 1957 was 123,644 tons valued at \$294,374. Production came from 3 commercial operations in Deschutes County and 1 each in Crook and Harney Counties.

Pumice production (excluding cinder and volcanic scoria) decreased 10 percent in tonnage and 12 percent in value compared with 1956. Pumice was marketed principally for aggregate in manufacturing lightweight-concrete building block. Smaller quantities were sold for insulation and abrasive purposes.

An increase in the use of volcanic cinder and scoria for concrete aggregate was reported. A quantity of volcanic scoria was sold for roofing rock. The output of volcanic cinder for ballast and road purposes was less than in 1956.

Sand and Gravel.—Production of sand and gravel in 1957 gained 10 percent in quantity and 16 percent in value. Increased use by the Oregon State Highway Department and United States Army Corps of Engineers furnished 75 percent of the total advance. Output of 8.1 million tons of sand and gravel by commercial producers valued at \$9.2 million was a 1-percent reduction in tonnage and a 10-percent rise in value compared with 1956. The higher value was chiefly because a larger proportion of material was sold as prepared or processed sand and gravel at a higher value per ton. Government-and-contractor production of 4.7 million tons was valued at \$4.2 million, an increase of 36 percent in tonnage and 32 percent in value.

Sixty-eight percent of all sand and gravel produced in the State during 1957 was used for road building and maintenance purposes; 25 percent, for construction and building uses; and the remaining 7 percent for other purposes that included railroad ballast and sands for special applications. In 1956, 64 percent of the sand and gravel produced was used for roads and 29 percent for building purposes.

⁴ Oregon State Department of Geology and Mineral Industries, *The Ore.-Bin*: Vol. 19, No. 11, November 1957, pp. 93-96. *Mining Engineering*, Chemical Lime Co. Plant in Baker, Ore.: Vol. 10, No. 2, February 1958, pp. 216-218. Utley, H. F., *Chemical Lime Company. First Large-Scale Commercial Lime Producer in Oregon: Pit and Quarry*, vol. 50, No. 6, December 1957, pp. 144-145, 150. *Chemical Engineering*, December 1957, p. 170. *Rock Products*, *Industry News*: Vol. 60, No. 12, December 1957, p. 33.

Output of sand and gravel was reported from 30 of 36 counties in the State. Counties that exceeded 1 million tons of production were Clackamas, Douglas, Lane, and Multnomah.

TABLE 4.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

	1956			1957			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average per ton		Total	Average per ton		
COMMERCIAL OPERATIONS								
Sand and gravel:								
Building.....	3,256,879	\$3,418,622	\$1.05	3,041,928	\$4,099,222	\$1.35	-7	+29
Concrete and roadstone..	4,109,715	4,351,838	1.06	4,182,933	4,388,176	1.05	+2	-1
Railroad ballast (gravel)..	177,284	194,504	1.10	234,965	358,755	1.53	+32	+39
Other ¹	635,121	461,626	.73	662,114	390,336	.59	+4	-19
Total sand and gravel..	8,178,999	8,426,590	1.03	8,121,940	9,236,489	1.14	-1	+11
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand and gravel:								
Building.....	138,713	119,447	.86	174,794	57,039	.33	+26	-62
Concrete and roadstone..	3,319,471	3,100,330	.93	4,546,207	4,187,735	.92	+37	-1
Total sand and gravel..	3,458,184	3,219,777	.93	4,721,001	4,244,774	.90	+36	-3
TOTAL ALL OPERATIONS								
Sand and gravel:								
Building.....	3,395,592	3,538,069	1.04	3,216,722	4,156,261	1.29	-5	+24
Concrete and roadstone..	7,429,186	7,452,168	1.00	8,729,140	8,575,911	.98	+17	-2
Railroad ballast (gravel)..	177,284	194,504	1.10	234,965	358,755	1.53	+32	+39
Other ¹	635,121	461,626	.73	662,114	390,336	.59	+4	-19
Grand total.....	11,637,183	11,646,367	1.00	12,842,941	13,481,263	1.05	+10	+5

¹ Includes molding, engine, and ballast sands and sand and gravel used for miscellaneous unspecified purposes.

Stone.—Output of stone increased 69 percent in tonnage and 44 percent in value compared with 1956. The principal reason for the increase was the large quantity of lower value stone used by the United States Army Corps of Engineers at The Dalles Dam. Larger quantities of crushed stone also were used by the Bureau of Reclamation, Bureau of Public Roads, and the Oregon State Highway Department. Production of 2.9 million tons of stone by commercial producers valued at \$3.9 million was a decline of 11 percent in output and 16 percent in value from 1956. Government-and-contractor production, however, more than doubled the quantity and value for the preceding year. Sixty percent of the stone produced in 1957 was used for road-building and maintenance purposes.

The output of crushed limestone increased to 985,000 tons in 1957—a rise of 3 percent. Limestone was quarried in Baker, Josephine, Polk, and Wallowa Counties. Output of limestone was begun by Chemical Lime Co. from the Marble Creek quarry northwest of Baker, Baker County. Output was processed to quick and hydrated lime at the company lime plant at Wing Siding, north of Baker. The cement industry continued to be the leading user of limestone in

TABLE 5.—Stone sold or used by producers, 1956-57, by uses

	1956		1957	
	Short tons	Value	Short tons	Value
Building (dimension stone).....	(1)	(1)	(1)	(1)
Concrete, roadstone, and screening.....	4,205,073	\$5,193,947	6,251,557	\$7,517,626
Riprap.....	685,571	574,007	2,788,189	2,015,733
Railroad ballast.....	(1)	(1)	(1)	(1)
Other ²	1,207,321	2,122,243	1,271,483	1,871,603
Total.....	6,097,965	7,890,197	10,311,229	11,404,962

¹ Included with "Other" to avoid disclosing individual company confidential data.

² Used at sugar refineries, in manufacturing paper and cement, in metallurgical and chemical plants, and for other unspecified uses.

the State; however, output for this purpose decreased 4 percent in 1957. Other consumers of limestone, in order of quantity used, were the sugar, paper, lime, calcium carbide, and metallurgical industries and agricultural applications.

A report listed the principal limestone deposits and presented data on various deposits in Alaska, British Columbia, Idaho, Oregon, and Washington.⁵

The Bristol quarry near Rogue River, Jackson County, continued to be the only source of industrial silica in the State. Output was sold for manufacturing ferrosilicon, abrasives, and refractories and for other purposes. Granite for poultry grit was produced in Jackson County.

Quarry production of dimension stone for building and decorative purposes in the State increased over 30 percent. Volcanic tuff, granite, and sandstone were quarried for dimension stone, and a quantity of sandstone for flagging was obtained at a new quarry in Douglas County.

Vermiculite (Exfoliated).—Crude vermiculite from Lincoln County, Mont., was exfoliated (expanded) at the Portland, Multnomah County, plant of Vermiculite Northwest, Inc.—the only such plant in the State in 1957. The exfoliated product was marketed chiefly for insulation and for concrete aggregate; a small quantity was sold for soil conditioning. Supreme Perlite Co. began to implement plans during the year for exfoliating vermiculite at the company Portland plant and reported that production was expected to begin in 1958.

METALS

Aluminum.—The first output of metal from the second aluminum-reduction plant in Oregon was reported near as the year ended. A 115,000-volt, 7-mile, transmission line from the Bonneville Power Administration Big Eddy substation to the new Harvey Aluminum Co. 108-million-pound annual-capacity plant, 2 miles east of The Dalles in Wasco County, was energized in November. Partial operations at the plant were scheduled to begin in the first part of 1958. Arrangements with 3 Canadian shipping firms for transportation of Japanese-produced alumina to Portland were completed, and construction of a 600-foot dock in Portland for unloading the carriers

⁵ Libbey, F. W., Limestone Resources of the Pacific Northwest: Raw Materials Survey, Inc., Resource Rept. 9, 1957, 92 pp.

was begun. Facilities at the dock included pneumatic bulk-unloading equipment for transferring the annual plant requirement of 100,000 tons of alumina from the freighters to storage bins or to rail cars.

Output at the first aluminum plant in Oregon (that of Reynolds Metals Co. at Troutdale, Multnomah County) was affected adversely by a Pacific Northwest hydropower shortage during the first part of the year. Cutback in the quantity of interruptible power available resulted in shutting down 1 potline and idling 140 employees from late January to early April. Restricted interruptible power usage again was necessary from late in August to mid-November. Aluminum Company of America built the Troutdale plant for the Government early in World War II and operated it during the war. After the plant was declared surplus in 1946, Reynolds Metals Co. leased and later purchased it.

National Metallurgical Corp. continued to produce silicon metal and aluminum-silicon alloy at Springfield in Lane County. The company announced it would seek to develop a market for aluminum-alloy ingot in the die-casting industry of the Pacific Northwest.

Chromium.—Considerably less chromite ores and concentrates were produced in 1957 than in 1956, when concentrate derived from ore mined and stockpiled for the Government during World War II was included in the State total. Output of the newly mined material was also less (7,900 short tons, compared with 8,867 tons in 1956, a decrease of nearly 11 percent). This entire production was delivered to the Government stockpile depot at Grants Pass.

Exploration for, development of, and production from chromite deposits declined because of the rapidly approaching termination date for Government purchases under the amended stockpiling program, which would cease when 200,000 long tons had been purchased or on June 30, 1959, whichever occurred first. At the end of September 1957 purchases at the depot from producers, mainly in California and Oregon, totaled 158,667 long tons, and by the end of the year it was expected that the authorized quota would be reached by mid-1958.

Josephine County continued to supply the bulk of the chromite produced in the State; Grant County again ranked second. The

TABLE 6.—Shipments of chromium ore and concentrate in 1957

County	Number of operations reported	Value		Short tons, gross weight		
		1956	1957	45 percent or more Cr ₂ O ₃	Less than 45 percent Cr ₂ O ₃	Total
Coos.....	2	(¹)	\$3,060	38	-----	38
Curry.....	8	\$95,111	52,498	626	26	652
Douglas.....	4	(¹)	5,698	38	51	89
Grant.....	13	164,671	140,678	1,482	133	1,615
Jackson.....	2	2,776	4,648	64	-----	64
Josephine.....	22	506,926	468,049	3,328	2,114	5,442
Malheur.....	-----	(¹)	-----	-----	-----	-----
Unassigned.....	-----	1,231,599	-----	-----	-----	-----
Total.....	51	2,001,083	674,631	5,576	2,324	7,900

¹ Included with "Unassigned" to avoid disclosing individual company confidential data.

Oregon Chrome mine (Wm. S. Robertson) was by far the largest mine in the State; shipments to the stockpile amounted to more than 3,600 short wet tons or over 45 percent of the State total.

Two papers published during the year described southwestern Oregon chromite deposits.⁶

Copper.—Copper output although comparatively small, increased again in 1957. Most of the 23 tons of recoverable metal (7 tons in 1956) was derived from the Standard mine (Ray E. Summers) in Grant County. There were no shipments from the mine in 1956. Several mines in Josephine County, principally the Queen of Bronze, also contributed to the State total.

Ferroalloys.—Generally low availability of hydropower in the Pacific Northwest partly caused less-than-capacity production at the Electro Metallurgical Co. 15-year-old ferroalloy plant in Portland. Employment averaged about 150 persons (240 in 1956); the payroll exceeded \$800,000; and raw-material receipts and ferroalloy and calcium carbide shipments totaled more than 130,000 tons. During the year the company, a division of Union Carbide Corp., built an alloy-storage warehouse and as part of its smoke-abatement program, covered an additional furnace.

Hanna Nickel Smelting Co. produced 20,564 short tons of ferro-nickel averaging 44 percent nickel at its smelter near Riddle, Douglas County, compared with 12,378 tons in 1956, 7,609 tons in 1955, and about 340 tons in 1954, the first year of operation. Nickel ore smelted in electric furnaces at the plant in 1957 totaled 781,456 short dry tons. The ore was mined by the affiliated Hanna Coal & Ore Corp. from an open pit atop nearby Nickel Mountain. Increased capacity (33 percent) at the smelter resulted from modifying ore-drying equipment to meet the increased demand of the smelting furnaces.

Gold.—The total output of gold was 3,381 ounces, a 23-percent increase. The bulk of production continued to be from the Buffalo lode-gold mine (Boaz Mining Co.) in Grant County, and the remainder came principally from Jackson and Baker Counties.

Iron Ore.—Orr Engineering & Chemical Co. continued producing iron ore (activated limonite) from a deposit near Scappoose in Columbia County; most of it was used by Pacific Northwest gas companies for desulfurizing manufactured gas. Consumption for this purpose declined when natural gas was introduced into the region in 1956.

Lead.—Gold ore from the Buffalo mine (Boaz Mining Co.) in Grant County contained the only lead recovered at mines in the State. The quantity produced remained unchanged from 1956.

Manganese.—The Pinky No. 2 property, operated by J. H. Spiney in Baker County, yielded 41 short dry tons of oxide manganese ore containing 36 percent manganese—the only manganese operation in the State. The ore was shipped to the Government low-grade-manganese purchase depot at Butte, Mont., but will not be included in State mineral-production totals until the material is upgraded and sold.

⁶ Ramp, Len, Nature and Origin of Southwestern Oregon Chromite Deposits: Mining Eng., vol. 9, No. 8, August 1957, pp. 894-897. Geology of the Lower Illinois River Chromite District: Oregon Dept. of Geol. and Min., Ind., The Ore.-Bin, vol. 19, No. 4, April 1957, pp. 29-34.

Mercury.—The output of mercury in 1957 was 3,993 flasks, more than twice the 1956 total and the highest since 1943. The value of production, calculated at an average price for the year of \$246.98 per flask, was slightly less than \$1 million. The Bonanza Oil & Mine Corp. Bonanza mine in Douglas County yielded 1,434 flasks from 15,278 tons of ore and again was the leading producer but only by a slight margin. The Arentz-Comstock Mining Venture at the Bretz mine in Malheur County ran a close second with output of 1,413 flasks from 36,950 tons of ore. The process at this plant, unusual in that flotation concentrate rather than crude ore was furnaced, was described in an article published during the year.⁷

TABLE 7.—Mine production of gold and silver in 1957, by months, in fine ounces of recoverable metals

Month	Gold	Silver	Month	Gold	Silver
January			August		
February	160	20	September	470	2,230
March	20	5	October	660	1,990
April	30	5	November	410	1,404
May	10	20	December	87	35
June	1,480	10,200		9½	10
July	28	5	Total	3,381	15,924

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total 1852-1957, in terms of recoverable metals¹

Year	Mines producing		Material sold or treated ² (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1948-52 (average)	29	32	3,203	11,066	\$387,317	9,922	\$8,980
1953	8	21	1,215	8,488	297,080	12,269	11,095
1954	20	26	2,916	6,520	228,200	14,335	12,974
1955	19	21	3,835	1,708	59,780	8,815	7,978
1956	15	15	1,991	2,738	95,830	13,542	12,256
1957	23	17	2,594	3,381	118,335	15,924	14,412
1852-1957			(*)	5,788,697	130,567,488	5,370,177	4,925,544

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average)	11	\$4,492	8	\$2,380	6	\$1,775	\$404,944
1953	6	5,166	5	1,310			314,651
1954	5	2,950	5	1,370			245,494
1955	4	2,984	3	894			71,636
1956	7	5,950	5	1,570			115,606
1957	23	13,546	5	1,430			148,023
1852-1957	12,453	4,699,709	822	98,713	173	23,194	140,314,688

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.

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.

⁷ Brooks, Howard C., Oregon's Opalite Mining District Active Again: Oregon Dept. of Geol. and Min. Ind., The Ore-Bin, vol. 19, No. 10, October 1957, pp. 83-88.

TABLE 9.—Gold produced at placer mines, 1948-52 (average) and 1953-57, by classes of mines and methods of recovery

Class and method	Mines producing ¹	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	
				Total	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1948-52 (average)	2	3,057,467	7,869	\$276,374	\$0.090
1953	1	2,176,000	6,985	242,725	.112
1954	1	1,382,000	4,685	163,975	.119
1955					
1956					
1957					
Dragline dredges: ²					
1948-52 (average)	3	220,230	1,158	40,544	.184
1953					
1954	1	3,000	11	385	.128
1955					
1956					
1957					
Nonfloating washing plants: ⁴					
1948-52 (average)	3	9,500	75	2,632	.277
1953					
1954	2	2,610	44	1,540	.590
1955					
1956	2	1,500	26	910	.607
1957					
Gravel hydraulically handled:					
1948-52 (average)	15	54,174	280	9,807	.181
1953	9	27,500	209	7,315	.266
1954	16	101,300	170	5,950	.059
1955	8	24,400	103	3,605	.148
1956	8	60,990	283	10,080	.198
1957	10	27,000	98	3,430	.127
Small-scale hand methods: ⁷					
1948-52 (average)	8	10,303	195	6,811	.661
1953	10	9,800	138	4,830	.493
1954	5	12,400	60	2,100	.169
1955	12	8,400	64	2,240	.267
1956	5	3,020	40	1,400	.464
1957	8	6,960	53	1,855	.267
Underground placers (drift):					
1948-52 (average)	1	360	9	315	.875
1953	1	450	7	245	.544
1954	1	80	22	770	9.623
1955	1	150	14	490	3.267
1956					
1957					
Grand total placers:					
1948-52 (average)	32	3,852,034	9,613	336,483	.100
1953	21	2,213,750	7,289	255,115	.115
1954	26	1,501,390	4,922	174,720	.116
1955	21	32,950	203	7,105	.216
1956	15	55,510	354	12,390	.223
1957	18	40,960	179	6,265	.153

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

² Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.

³ Includes gold recovered before 1957 but reported during the year.

⁴ Includes all placer operations using power excavator and washing plant both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

⁵ Includes commercial gravel plant that produced gold from gravels. Byproduct gold is included with gold recovered, but material treated and average value per cubic yard refer only to straight gold dredging.

⁶ Includes bucketline dredges; Bureau of Mines is not at liberty to disclose output.

⁷ Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc. "Wet" method used exclusively in Oregon.

⁸ Includes suction dredge; Bureau of Mines is not at liberty to disclose output.

TABLE 10.—Mine production of gold, silver, copper, and lead in 1957, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer ¹	Fine ounces	Value	Fine ounces	Value
Baker.....	7	1	178	\$6,230	324	\$293
Grant.....	3	1	2,567	89,845	15,450	13,983
Jackson.....	6	4	533	18,655	116	105
Josephine.....	6	9	78	2,730	29	26
Malheur.....	1	-----	10	350	2	2
Other ²	2	2	15	525	3	3
Total.....	25	17	3,381	118,335	15,924	14,412

County	Copper		Lead		Total value
	Pounds	Value	Pounds	Value	
Baker.....	-----	-----	-----	-----	\$6,523
Grant.....	40,000	\$12,040	10,000	\$1,430	117,298
Jackson.....	-----	-----	-----	-----	18,760
Josephine.....	6,000	1,806	-----	-----	4,562
Malheur.....	-----	-----	-----	-----	352
Other ²	-----	-----	-----	-----	528
Total.....	46,000	13,846	10,000	1,430	148,023

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

² Includes values and quantities that cannot be shown separately for Coos, Douglas, and Wheeler Counties.

TABLE 11.—Mine production of gold, silver, copper, and lead in 1957, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Lode ore:						
Dry gold.....	17	2,400	3,090	15,471	2,900	10,000
Copper.....	5	167	38	157	43,100	-----
Total.....	22	2,567	3,128	15,628	46,000	10,000
Other "lode" material:						
Dry gold: Mill cleanup.....	2	7	20	56	-----	-----
Old tailings.....	1	20	54	213	-----	-----
Total.....	3	27	74	269	-----	-----
Total "lode" material.....	25	2,594	3,202	15,897	46,000	10,000
Gravel (placer operations).....	17	(¹)	179	27	-----	-----
Total, all sources.....	42	2,594	3,381	15,924	46,000	10,000

¹ 40,960 cubic yards of placer gravel washed.

Cordero Mining Co., which was reported to be nearing the end of its reserves at the old Horse Heaven mine in Jefferson County, ranked third, with recovery of 749 flasks from 9,483 tons of ore. The Black Butte mine in Lane County was operated by Mercury & Chemicals Corp. until the mine was closed on July 15, and a substantial quantity of mercury was produced. The old Black Butte property had been reopened in 1956 after extensive rehabilitation of underground workings and construction of a new plant. Five other operators in the

TABLE 12.—Mine production of gold, silver, copper, and lead in 1957, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Lode:				
Amalgamation.....	147	34		
Concentration, and smelting of concentrates.....	2,584	15,526	2,900	10,000
Direct smelting.....	471	337	43,100	
Total lode.....	3,202	15,897	46,000	10,000
Placer.....	179	27		
Grand total.....	3,381	15,924	46,000	10,000

TABLE 13.—Mine production of gold, silver, copper, and lead in 1957, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Lode material (short tons)	Gold (lode and placer) ² (fine ounces)	Silver (lode and placer) ³ (fine ounces)	Copper (pounds)	Lead (pounds)	Total value
	Lode	Placer ¹						
Baker County:								
Cracker Creek, Sumpster, and Virtue ⁴	3		47	54	93			\$1,974
East Eagle.....		(⁵) 1		1				35
Greenhorn.....	2	⁶ 1	6	42	10			1,479
Rock Creek.....	1		20	54	213			2,083
Upper Burnt River.....	1		45	27	8			952
Grant County:								
Granite.....	1	1	2,000	2,530	15,313	2,900	10,000	104,712
Quartzburg.....	1		75	35	137	37,100		12,516
Jackson County:								
Gold Hill.....	4	1	194	437	98			15,384
Upper Applegate.....	2	⁶ 3	6	96	18			3,376
Josephine County:								
Galice, Illinois River, and Waldo ⁴	5	5	94	20	20	6,000		2,524
Greenback.....		4		56	9			1,968
Lower Applegate.....	1		1	2				70
Malheur County:								
Malheur.....	1		40	10	2			352
Undistributed ⁷	3	⁵ 2	66	17	3			598
Total.....	25	17	2,594	3,381	15,924	46,000	10,000	148,023

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

² Source of gold: 3,202 ounces from lode mines and 179 ounces from placers.

³ Source of silver: 15,897 ounces from lode mines and 27 ounces from placers.

⁴ Combined to avoid disclosing individual company confidential data.

⁵ Includes production from property not classed as a mine.

⁶ Includes gold recovered before 1957 but reported during year.

⁷ Includes values and quantities that cannot be shown separately for Eden district, Coos County; Crackerjack, Green Mountain, and Riddle districts, Douglas County; Canyon district, Grant County; and Spanish Gulch district, Wheeler County.

State reported production of mercury, and exploration was carried on in a number of localities.

A historical résumé of mercury mining in Oregon was published.⁸

Nickel.—Hanna Coal & Ore Corp. produced 813,000 short dry tons of nickel ore containing 1.51-percent nickel from an open pit on Nickel Mountain near Riddle, Douglas County. This output again was nearly double that of the preceding year (437,316 tons). The

⁸ Brooks, Howard C., Thirty Years of Mercury in Oregon: Oregon Dept. of Geol. and Min. Ind., The Ore.-Bin, vol. 19, No. 3, March 1957, pp. 19-24.

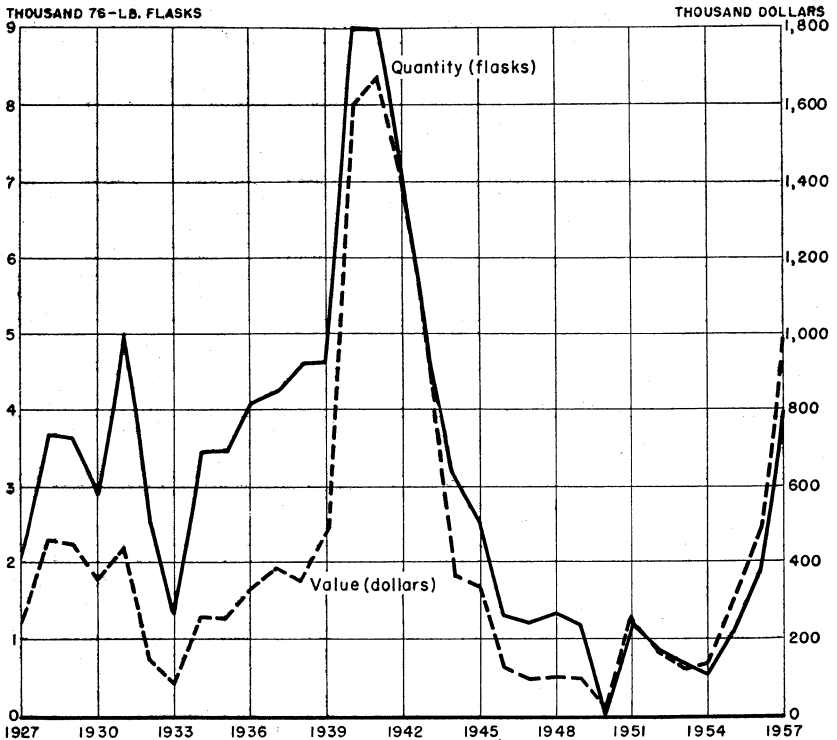


FIGURE 2.—Mercury production and value in Oregon, 1927–57

company, the only domestic producer of nickel ore, reported that development of mining benches, mine haul roads, waste, and reject haul roads, as well as the clearing of timber from adjacent areas preparatory to mining, was continued. (See also Douglas County.)

An article dealing with the Hanna operations at Riddle was published during the year.⁹

The nickeliferous laterite deposits in southwestern Oregon received considerable attention. Exploration activities were centered on deposits on Woodcock and Eight Dollar Mountains in Josephine County by Nickel Corporation of America and in the Red Flat area of Curry County by Pacific Nickel Co. The grade of the nickel ores in these areas is less than 1 percent compared with approximately 1.5 percent at the Riddle deposit. Reports indicated that preliminary tests using the Krupp-Renn direct-smelting process on the ores were successful.

Silver.—Byproduct silver from the Buffalo lode-gold mine (Boaz Mining Co.) in Grant County furnished the bulk of the State total, 15,924 ounces, an increase of 18 percent over 1956. Small quantities of silver also were recovered at most other gold mines in the State.

Tungsten.—A small quantity of tungsten concentrate was shipped to a California buyer from the Billings property in Jackson County.

⁹ Foster, W. A., Open Pit on Nickel Mountain: Mining Eng., vol. 9, No. 8, August 1957, pp. 903-904.

Uranium.—A major mineral-industry development was announced in October of Atomic Energy Commission approval for constructing a uranium-ore processing mill near Lakeview, Lake County. The \$2.6 million, 210-ton-per-day-capacity processing plant was to be built and operated by Lakeview Mining Co. This company was also developing and producing ore from the White King property, the only major uranium mine in the State. The mill, construction of which was to begin early in 1958, would employ about 60 persons, and 20 percent of its capacity would be available for custom ores. Following the discovery of the White King deposit north of Lakeview in July 1955, core drilling and underground exploration reportedly disclosed more than 500,000 tons of ore.

Uranium activity in other areas of the State was limited. Claims on Steens Mountain in southeastern Harney County were explored, and the property was acquired by Solar-X Corp. late in the year. Extensive investigation of the deposit was planned for 1958. Timber Beast Mining Co. concluded a contract with the DMEA for a \$24,772 underground exploration project at its uranium prospect, also in Harney County.

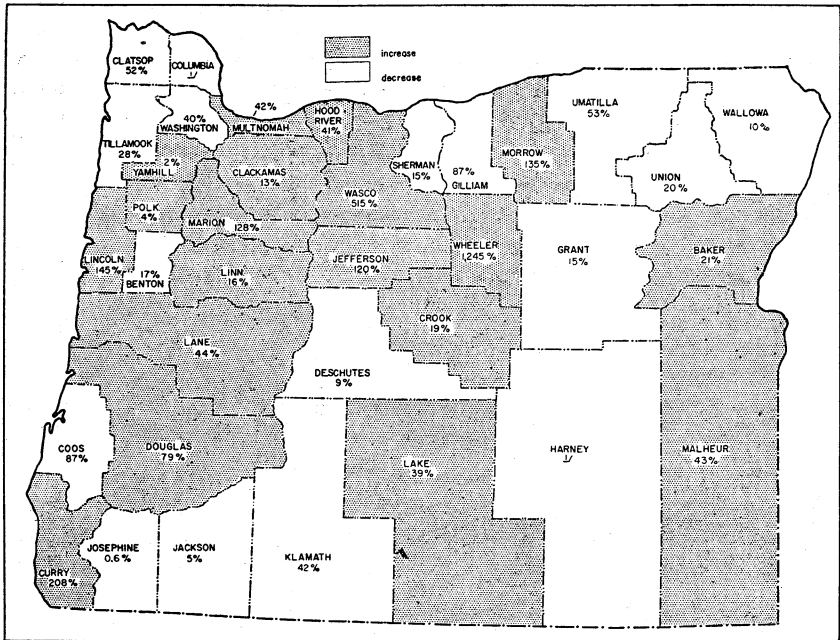
Zirconium and Titanium.—An infant metallurgical industry in Linn County, which evolved from the research laboratories of the Federal Bureau of Mines at Albany, expanded rapidly during the year. Under contract, Wah Chang Corp. continued processing zirconium tetrachloride, shipped in from eastern plants, at AEC-owned facilities on Bureau of Mines property in Albany. The company also completed construction of its zirconium-sponge plant north of Albany and at dedication ceremonies in April announced plans to build a \$500,000 addition for purifying zirconium tetrachloride (removal of hafnium). Later, plans for increasing capacity of the reduction facility from 400,000 to 550,000 pounds per year at a cost of \$1 million were revealed. The original plant was built in 1956 at a cost of \$2 million.

Wah Chang also experimented with recovery of titanium from ore. Ilmenite (a titanium-iron mineral) concentrate, recovered from dredging in Idaho, was smelted in an electric furnace to produce pig iron and high-titanium slag.

Oregon Metallurgical Corp., a local company organized to produce zirconium and titanium ingot by melting the sponge form of the respective metals, also was expanding during the year. New presses for compacting sponge were added at the plant, which began operations in mid-1956 south of Albany. In November 1957 the company signed a \$4 million contract to deliver zirconium ingot to the Westinghouse Electric Corp. Wah Chang Corp. would participate in the contract by supplying Oregon Metallurgical with its requirements of zirconium sponge. A brief description of operations at the Oregon Metallurgical Corp. plant was published.¹⁰

The Federal Bureau of Mines continued research on zirconium, titanium, and hafnium (as well as on many other metals) at its Northwest Electrodevelopment Experiment Station in Albany. Hafnium removed as a contaminant from zirconium tetrachloride by Wah

¹⁰ Jackson, Blake, New Methods and Controls to Produce Wonder Metals: Western Industry, vol. 22, No. 11, November 1957, p. 44.



¹ Figure withheld to avoid disclosing individual company confidential data.

FIGURE 3.—Change in value of county mineral production, 1956–57

Chang Corp. was converted by the Bureau of Mines to ingot metal under contract with the AEC.

MINERAL FUELS

Carbon Dioxide.—Recovery of natural carbon dioxide from mineral waters at the Gas-Ice Corp. plant near Ashland, Jackson County, was about 6 percent less than in 1956. The plant processed the carbon dioxide to dry ice—the only operation of its kind in Oregon. The company was operating a similar facility at Klickitat, Wash.

Coal.—One mine in Clackamas County produced a small tonnage of coal in 1957 and was the only producing coal mine in the State.

Pacific Power & Light Co., Portland, continued to explore coal beds at Eden Ridge in Coos and Curry Counties to determine whether these deposits would be suitable as a source of energy for a steam-electric generation plant. During the year extensive core-drilling was done to determine the quality and quantity of minable coal in the area; samples for boiler-firing tests also were taken. Preliminary exploration was completed in August.

Petroleum and Natural Gas.—Oil-well-drilling activity was substantially the same as in 1956. Seven new drilling permits were issued by the State—3 in Polk County and 1 each in Douglas, Grant, Multnomah, and Wheeler Counties. There were no significant discoveries during the year, and six oil-well tests were abandoned as dry holes.¹¹

¹¹ Oregon State Department of Geology and Mineral Industries, *The Ore.-Bin*: Vol. 20, No. 1, January 1958, pp. 9-10.

In September a petroleum engineer for the Oregon Department of Geology and Mineral Industries began assisting companies or individuals seeking information on petroleum in the State, as well as helping with enforcement of the Oil and Gas Conservation Law of Oregon.

Natural gas became available to the Pacific Northwest for the first time when in 1956 the Pacific Northwest Pipeline Corp. made the first deliveries from fields in Colorado and New Mexico. Natural gas continued to find new industrial markets in the State during 1957. In August West Coast Transmission Co., Ltd., completed a pipeline from the Peace River fields of western Alberta and eastern British Columbia to the International Boundary at Sumas, Wash. The Canadian pipeline system was connected with the Pacific Northwest Pipeline Corp. system in October.

REVIEW BY COUNTIES

Mineral production was reported from all 36 counties in Oregon in 1957. With certain important exceptions, output was principally from deposits of nonmetal minerals. Only 13 of the 36 counties produced metal ores, and only 8 of these contributed a significant quantity.

Construction and road building and maintenance required large tonnages of stone, sand and gravel, and clays. Almost every county was a source of one or more of these commodities. Stone and sand and gravel was produced by individual companies for their own use and for the market; contributors also included various county highway departments, the State highway department, the Federal Bureau of Reclamation, the United States Army Corps of Engineers, and the United States Forest Service and their contractors. Clay was used chiefly in cement manufacturing and brick and tile; stone was employed in riprap, railroad ballast, road construction and maintenance, dam construction, agricultural applications (lime), and cement manufacturing and for decorative purposes (flagstone, etc.); and sand and gravel was used in general construction and maintenance.

Interest long since had shifted from the historically important and often romantic era of gold and silver (and, to a lesser extent, copper, lead, and zinc) to the more modern "atomic-age" uranium mining in Lake County and the less glamorous but strategically vital nickel in Douglas County. Chromite and mercury, carryovers from earlier days that maintained their importance and were mined in central and southwestern Oregon counties, were again subject to market uncertainties. Stockpiling of chromite under the existing Government purchasing program was nearing an end; the availability of foreign mercury drove prices for this metal down to a floor price (established by another Government-purchase program) that offered short-term stability to a market plagued by violent fluctuations.

Additional information is presented on activities in the more important metal- and nonmetal-producing counties.

Baker.—Cement production at the Lime plant of the Oregon Portland Cement Co. continued to be the principal mineral-industry activity in the county. During the year a second kiln was put into operation as part of a general modernization and expansion program

TABLE 14.—Value of mineral production in Oregon, 1956-57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Baker.....	(1)	(1)	Cement, stone, sand and gravel, lime, clays, gold, silver.
Benton.....	\$377, 249	\$311, 447	Sand and gravel, stone, clays.
Clackamas.....	6, 485, 302	7, 471, 265	Cement, sand and gravel, stone, clays.
Clatsop.....	290, 465	140, 387	Stone, sand and gravel.
Columbia.....	429, 997	(1)	Sand and gravel, iron ore, mineral pigments.
Coos.....	1, 684, 398	213, 170	Stone, sand and gravel, chromite, gold, silver.
Crook.....	373, 856	324, 373	Stone, sand and gravel, pumice, mercury.
Curry.....	91, 511	282, 161	Stone, chromite, sand and gravel.
Deschutes.....	1, 195, 744	1, 088, 935	Diatomite, pumice, sand and gravel, stone.
Douglas.....	4, 140, 753	7, 395, 255	Nickel, sand and gravel, stone, mercury, chromite, gold, silver.
Gilliam.....	128, 412	16, 866	Stone.
Grant.....	373, 746	318, 750	Chromite, gold, sand and gravel, stone, silver, copper, lead.
Harney.....	34, 053	(1)	Pumice.
Hood River.....	82, 150	116, 030	Stone, sand and gravel.
Jackson.....	3, 330, 672	3, 164, 605	Cement, stone, sand and gravel, clays, gold, carbon dioxide, chromite, tungsten, silver.
Jefferson.....	206, 762	454, 328	Mercury, sand and gravel, stone.
Josephine.....	936, 027	930, 740	Chromite, sand and gravel, stone, gold, copper, silver.
Klamath.....	389, 636	224, 981	Stone, sand and gravel, clays.
Lake.....	244, 675	341, 043	Stone, sand and gravel, mercury, uranium.
Lane.....	2, 029, 907	2, 928, 058	Stone, sand and gravel, mercury.
Lincoln.....	355, 917	372, 958	Stone, sand and gravel.
Linn.....	615, 949	715, 850	Sand and gravel, stone.
Malheur.....	637, 268	909, 111	Sand and gravel, mercury, clays, gold, stone, silver.
Marion.....	454, 375	1, 035, 088	Sand and gravel, stone, clays.
Morrow.....	77, 574	182, 115	Stone.
Multnomah.....	2, 596, 652	3, 674, 887	Sand and gravel, stone, clays.
Polk.....	778, 568	810, 895	Do.
Sherman.....	274, 922	233, 690	Stone.
Tillamook.....	418, 033	302, 318	Sand and gravel, stone, clays.
Umatilla.....	836, 376	397, 722	Sand and gravel, stone.
Union.....	320, 991	256, 602	Sand and gravel, stone, clays.
Wallowa.....	133, 928	120, 502	Stone.
Wasco.....	188, 732	1, 161, 505	Stone, sand and gravel.
Washington.....	810, 489	483, 207	Sand and gravel, stone, clays.
Wheeler.....	736	92, 376	Stone, gold, silver.
Yamhill.....	324, 677	332, 261	Sand and gravel, stone, clays.
Undistributed ²	3, 812, 592	6, 105, 260	Stone, gem stones, sand and gravel.
Total ³	34, 021, 000	42, 486, 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 adjusted to eliminate duplicating value of clays and stone.

begun in 1955. With addition of the new kiln production capacity was doubled. Output from the facility increased substantially in 1957 compared with the preceding year. Limestone, the principal raw material, was obtained from the company-operated Limerock quarry near Huntington.

A new industry based on the large high-grade limestone deposits in the county began operating on October 29, when Chemical Lime Co. completed constructing a two-kiln lime plant northwest of Baker. Raw material was obtained from the company-operated Marble Creek limestone quarry nearby.

Limestone for use by sugar refineries and by pulp and paper, cement, and metallurgical plants was quarried and crushed by National Industrial Products Corp. east of Durkee. A small quantity of dimension granite for monuments was quarried near Haines by Northwestern Granite Co. In addition, sand and gravel and stone for road and construction purposes were produced in the county.

J. H. Spiney shipped a small quantity of manganese ore from the Pinky No. 2 mine to the Government low-grade stockpile at Butte, Mont. Manganese ore has been mined sporadically in Baker County since the opening of the Butte Stockpile depot in 1951. Other properties that have produced manganese ore include the Raney (1955-56), Jewell (1953), and Sheep Mountain (1952).

Benton.—Clay was produced at two operations in the county. The output, used to make building brick and draintile, was 13 percent greater than in 1956. Sand and gravel and stone for road and building purposes also were produced. The output of sand and gravel increased 12 percent and crushed-stone output decreased over 50 percent compared with 1956.

Clackamas.—The county continued to lead the State in value of mineral commodities produced, owing largely to its output of cement and sand and gravel. Cement production at the Oregon Portland Cement Co. Oswego plant continued to be the principal mineral-industry activity. Production and shipments from this facility increased. Limestone, the principal raw material, was supplied from company-operated quarries at Dallas, Polk County, and Lime, Baker County. Clay, used in manufacturing building brick and draintile, was produced at two operations. Clay output declined 14 percent. Sand and gravel and stone were produced for road and construction purposes.

Columbia.—The output of sand and gravel, the principal mineral commodities, decreased 8 percent compared with 1956. The principal use was for road construction and maintenance, which consumed 60 percent of the total sand and gravel produced. C. K. Williams & Co., Western Division, produced crude iron oxide pigment near Scappoose for use at its Emeryville, Calif., paint-manufacturing plant. Orr Engineering & Chemical Co. also produced a small quantity of iron oxide pigment at a plant near Scappoose and in addition shipped an activated limonite product to Northwest gas companies for use as a desulfurizing agent for manufactured gas.

Coos.—The output of chromite receded to a low level from 1956, when the Government-stockpiled low-grade concentrate remaining from World War II was beneficiated and credited to the county; the upgraded concentrate was shipped to Spokane, Wash., for conversion to ferrochromium under Government contract.

Deschutes.—Diatomite, the principal mineral in value, was mined and processed by Great Lakes Carbon Corp., Mining & Mineral Products Division, west of Terrebonne. The county also was the principal source of pumice in the State. Central Oregon Pumice Co. dug pumice and volcanic scoria from a pit north of Bend; Lloyd A. Williamson prepared pumice and a quantity of volcanic cinder at a pit and plant near Bend. The Cinder Hill Co. produced cinder from the Cinder Hill quarry north of Redmond and sold crude and prepared cinder for ballast, road, and miscellaneous uses. Sand and gravel and stone for road and construction also were produced in the county. Sand and gravel output declined 4 percent, and production of stone rose 45 percent compared with 1956. The increased use of crushed stone for road construction and maintenance by the United States Forest Service and the Oregon State Highway Department resulted in the larger output.

Douglas.—Operations of Hanna Coal & Ore Corp. and Hanna Nickel Smelting Co. near Riddle continued without interruption as the principal mineral industries in the county. Ore containing about 1.5 percent nickel from an open pit at the top of Nickel Mountain was mined, crushed and screened, and carried by aerial tram to the smelter at the base of the mountain, where it was converted into ferronickel in 4 large electric furnaces. Over 430 million kilowatt-hours of electric energy provided by Bonneville Power Administration was consumed.¹² The operation was the only one recovering nickel from domestic ore mined primarily for nickel. The two M. A. Hanna Co. subsidiaries began producing in 1954. A paper dealing with mining at the Riddle deposit by the Hanna Coal & Ore Corp. was delivered during the year.¹³ It is quoted in part as follows:

The major axis of the ore body strikes northeast and exploration so far has shown it to be roughly 6,000 feet long and 3,000 feet wide. The concentration ranges in thickness from a few feet to a maximum of 250 feet. * * * The ore is dug from the face of a 20-foot bench by a 2½-yard shovel and loaded into 22-ton trucks. The ore is hauled from the benches to a stockpile area in front of the screening plant. The truck loads average about 17 tons and using 1 shovel it is possible to handle 2,500 tons per shift. Because of the fractured state of the ore in place, practically no blasting is necessary. * * * Transporting the ore from the surge pile on the mountain to the stockpile at the foot of the mountain is accomplished by means of a continuous aerial tramway. * * * Once in the (tram) car the ore travels a distance of 8,306 feet and drops 2,000 feet in elevation before being deposited at the smelter stockpile. The 50-cubic-foot capacity cars each carry approximately 2½ tons of ore down the mountain at a speed of 500 feet per minute. The cars, spaced 260 feet apart by a 2-inch connecting cable, travel loaded on 2-inch track cables and return inverted and empty on 1½-inch track cables. The tramway is held to constant speed by two 300-horsepower induction generators, which when the tram cars are fully loaded, generates 375 kilowatts of electricity.

Mercury was produced at two mines in the county. The Bonanza mine (Bonanza Oil & Mine Corp.), east of Sutherlin, was again the leading producer in the State. The company reported that 15,278 tons of ore, containing 0.356 percent mercury, was mined and furnaceed, yielding over 1,400 flasks of metal. All the ore was processed in an oil-fired 4- by 60-foot Gould rotary furnace; a 14-foot Herreshoff furnace at the plant was not in use. Production of a small quantity of mercury was reported at the old Elkhead mine; a 10-ton rotary furnace and two small D-retorts were in use. Four operators reported production of chromite ore; output was sold to the Government stockpile at Grants Pass.

The county ranked third and fourth in the State in tonnage of stone and sand and gravel, respectively, in 1957. More road-construction activity resulted in a 24-percent rise in the tonnage of sand and gravel and a fivefold increase in output of stone. A small quantity of dimension sandstone for flagging was quarried near Riddle by M. W. Parker; the quarry began production in 1957.

Grant.—Substantial tonnages of chromite ores and concentrates were shipped to the Government stockpile depot at Grants Pass by 13 producers; the county again ranked second to Josephine County in quantity and value of output. As in 1956 William Gardner produced

¹² Bonneville Power Administration, U. S. Columbia River Power System: U. S. Department of the Interior, 1957 Report, p. 29.

¹³ Foster, W. A., Riddle Nickel Deposit: Paper pres. at Northwest Regional Conference, AIME, Portland, Oreg., Apr. 11-13, 1957, 4 pp.

the largest quantity of chromite in the county by a wide margin at the Haggard-New mine; about 230 tons of ore and 640 tons of concentrate were shipped from the property. The Buffalo gold mine of Boaz Mining Co. in Granite district supplied most of the gold and silver and all of the lead produced in the State. Nearly 200 tons of gold concentrate was shipped to the Tacoma, Wash., smelter.

Harney.—Crude and prepared pumice was marketed by Harney Concrete Tile Co., Burns. The crude pumice was sold for road ballast and the prepared material for concrete aggregate. The output of prepared pumice increased slightly over 1956.

Jackson.—Jackson County in 1957 ranked fourth in value of non-metal commodities in the State, owing largely to the output of cement at the Gold Hill plant of Ideal Cement Co., but declined compared with 1956. Limestone for the plant was obtained at the Marble Mountain quarry, Josephine County, and shale (clay) was supplied from the nearby company-operated Gold Hill pit. Quartzite as a source of industrial silica was quarried by Bristol Silica Co. near Rogue River and was sold for manufacturing ferrosilicon, refractory brick, and abrasives and for filters and miscellaneous uses. Granite also was quarried and crushed for poultry grit by the Bristol Silica Co. Gas-Ice Corp. recovered carbon dioxide from ground water near Ashland for manufacturing dry ice. Sand and gravel and stone for road and construction purposes were produced. Output of sand and gravel increased 26 percent, and stone advanced 21 percent in 1957 owing to increased road-construction activity.

Jefferson.—Cordero Mining Co. produced the only metal ore in the county at the old Horse Heaven mine near Ashwood. The property, idle from 1944 until reactivated in 1955, yielded 9,483 tons of ore containing 0.3 percent mercury, and 749 flasks of the liquid metal was recovered with a 25-ton rotary furnace.

Josephine.—The county continued to be the leading source of chromite in Oregon; output was more than three times that in Grant County, which ranked second. As in previous years, a large part of the ore produced came from the Oregon Chrome mine, west of Selma in the Illinois River district. Over 3,600 tons of ore and ore fines was shipped direct to the Grants Pass stockpile depot and a considerable tonnage of lower grade material from the mine was processed by J. G. Gallagher at a mill near Wilderville before shipment to the stockpile. Second largest operation in the county was that of George Tulare at the Shady Cove mine in Galice district. Chromite output reported by 22 producers in 1957 compared with 16 in 1956; the total output was nearly 6 percent less. Gold, silver, and copper were other metals produced in the county, most of the copper was shipped from the reactivated Queen of Bronze mine to the Tacoma, Wash., smelter. Some copper ore also was produced from the Copper Bell mine. Most of the gold output was derived from a number of small placer workings.

Ideal Cement Co., Pacific Division, supplied its Gold Hill cement plant, Jackson County, from the Marble Mountain limestone quarry. Production of sand and gravel increased over 48 percent in 1957, owing to increased use by the Oregon State Highway Department for road construction. Output of stone declined 15 percent principally because of smaller production at the Marble Mountain quarry.

Lake.—Output of sand and gravel and crushed stone for roadwork, the principal commodities produced in the county, was more than double that of 1956.

Great Lakes Carbon Corp., Mining & Mineral Products Division, explored a diatomite (diatomaceous earth) deposit near Fort Rock. Stripping of overburden in preparation for mining and other development was reported. No ore was shipped.

A. M. Matlock, Eugene, reported that his natural saline operation was inactive; however, development was continued. A small quantity of material had been mined in 1956.

Generating considerable excitement because of its importance to the county and State was an announcement that a mill to produce uranium oxide concentrate was planned for construction near Lakeview. Since discovery of uranium at the White King and Lucky Lass properties north of Lakeview in mid-1955, extensive core drilling and underground exploration begun in 1956 disclosed an ore body of enough size to warrant application to the AEC for building a mill. Commission approval for a \$2.6 million plant, which would employ about 60 men, was given in November. The mill would be the second of its kind in the Pacific Coast States; a similar plant was built late in 1956 near Spokane, Wash.

Production of mercury again was reported at Glass Buttes in the northeastern part of the county. Output was by Oregon Uranium Corp., using a 20-ton rotary furnace installed in May.

Lane.—The output of sand and gravel and stone increased 34 and 87 percent, respectively, and the county ranked second in the State in production of both commodities. The increase resulted mainly from the greater use of these materials by the United States Forest Service, United States Army Corps of Engineers, and the Oregon State Highway Department for construction and maintenance.

Linn.—Growth of the metallurgical industry at Albany continued. Plant expansions were made, and more were planned by both the Wah Chang Corp. and Oregon Metallurgical Corp. Operations by these companies, a direct outgrowth of research conducted at Federal Bureau of Mines laboratories in Albany, employed about 500 persons. In addition, approximately 250 persons were employed at the Bureau of Mines installation. (See "Zirconium and Titanium.")

Malheur.—The old Bretz mercury mine, a leading producer in the State about 1930–36 and 1940–42, again was in full operation. Exploration, stimulated by the high prices of 1956, led to discovery of additional ore at the property, and ore production from the open pit by Arentz-Comstock Mining Venture totaled 52,000 tons in 1957. The processing plant at the mine employed a preliminary flotation-separation step before the ore was furnaceed; pilot-plant tests to determine the feasibility of the flotation process were conducted by the Federal Bureau of Mines at Albany. In 1957 the 130-ton-per-day flotation plant treated 36,950 tons of ore; concentrate was processed in a 60-inch, 6-hearth, Pacific Foundry furnace. Mercury contained in ore treated was reported by the company to be 0.185 percent. In the same area a small quantity of mercury was recovered during cleanup around the furnace site at the old Opalite mine, also a former leading producer in the State.

Clay for making building brick was mined by Oregon Clay Products, Inc., from an open pit east of Vale. Output increased slightly over that in the preceding year. In addition, sand and gravel for road and construction uses and a small quantity of roadstone were produced in the county.

Marion.—Sand and gravel, stone, and clays were the nonmetal minerals produced during the year. The output of sand and gravel almost doubled the 1956 rate, owing to increased highway construction. Oregon Tuff Stone Co. quarried volcanic-tuff dimension stone near Sublimity for building and decorative stone. Clay for use in making heavy clay products was mined by Donald Brick & Tile Co. Output of clay was at a reduced rate compared with 1956.

Multnomah.—Much of the mineral-processing activity in the State was centered in the county; plants in Portland, the largest city in Oregon, produced calcium carbide, ferrosilicon, ferromanganese, caustic soda, chlorine, and steel products. Imported aluminum oxide was reduced to aluminum metal at a plant at Troutdale. The Port of Portland increased activity as a waypoint in the movement of base-metal ores and concentrates from foreign mines to domestic smelters.

Multnomah County ranked second in the State in the total value of sand and gravel, stone, and clays, the only mineral commodities produced. The output of 2.7 million tons of sand and gravel, leading the State, was 7 percent higher than in the preceding year. Greater requirements for sand and gravel by the Oregon State Highway Department were the principal reason for the larger output. Production of clay by two of the leading brick manufacturers in Oregon declined in 1957, owing to declining construction activity. The shale-expanding plant of Smithwick Concrete Products Co. was moved from Portland to the quarry in Washington County. The expanded shale was used in making lightweight-concrete products. The company block-manufacturing facilities and headquarters were to remain at Portland. Perlite, soapstone, and vermiculite from out-of-State sources also were processed at plants in the county. Crude vermiculite from Montana was expanded at the Portland plant of Vermiculite Northwest, Inc. The expanded product was used for insulation, aggregate, and agricultural purposes. Supreme Perlite Co. continued to expand perlite at a plant in Portland, processing crude perlite shipped from Nevada. The expanded product was used chiefly as an additive in building plaster; smaller quantities were sold for use as a soil conditioner and as filler material. The output of expanded perlite decreased 8 percent compared with 1956, owing to a decline in building construction. Preparations were underway by the company to expand crude vermiculite at Portland; production was expected to begin in 1958. Soapstone mined in Washington was prepared at grinding plants of Stauffer Chemical Co. and Miller Products Co., both of Portland. The ground product was used as a filler material for insecticides.

Polk.—Sand and gravel, stone, and clays were produced at a decreased rate compared with 1956. Oregon Portland Cement Co. quarried limestone at the Dallas quarry to supply the company cement facility at Oswego, Clackamas County. Limestone for agricultural uses was quarried and crushed near Dallas by the Polk County Lime Co. Monmouth Brick & Tile Co. processed clay to heavy clay products at a plant north of Monmouth.

Wasco.—Stone was the principal commodity produced in the county. The value of mineral production increased six-fold over 1956, owing to the large quantity of quarried rock required by the United States Army Corps of Engineers at The Dalles Dam. Rainbow Rock, Inc., quarried volcanic tuff at the Rainbow Rock quarry south of Pine Grove; the output was used for building, decorative purposes, and flagstone.

Washington.—The county continued to lead the State in the quantity and value of clays; however, output declined 20 percent from 1956. Northwest Aggregate, Inc., continued to operate a shale pit near Banks and an expanding plant west of Manning; the output was used in making concrete products. In August Smithwick Concrete Products Co. began operating a shale-expanding facility at the Haydite quarry south of Vernonia; the plant was relocated at the quarry site from its former site at Portland, Multnomah County. Clay for making draintile was mined by the Scholls Tile Co. from a pit north of Scholls. The output at this operation remained substantially the same as in 1956.

Yamhill.—The production of clay for building-brick manufacture continued from the Willamina pit of the Willamina Clay Products Co. McMinnville Brick & Tile Co. continued its output of clay for making building brick and draintile at a pit near McMinnville; the company reported construction of a new tunnel kiln and installation of new grinding and screening equipment. Sand and gravel and stone for road and building purposes were produced.

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, United States Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey.

By Robert D. Thomson¹ and Mary E. Otte²



SIXTEEN of the twenty-five mineral commodities produced in Pennsylvania in 1957 increased in value of output. Bituminous coal, natural gas, petroleum, and iron ore showed the greatest growth. However, overall mineral output in Pennsylvania was lower in 1957 than in 1956. Substantially lower total values for cement, clays, sand and gravel, and stone resulted in a decline of over \$7 million in the total value of Pennsylvania's mineral output.

Mineral fuels, valued at \$795 million, supplied 73 percent of the total value of all minerals; nonmetals, valued at \$286 million, contributed 26 percent and metals 1 percent.

Sixty-six of the sixty-seven counties reported production of one or more mineral commodities. The major producing counties (in order of decreasing value) were: Washington, Luzerne, Greene, Northampton, Schuylkill, Cambria, and Allegheny.

Consumption, Trade, and Markets.—The major part of the mineral commodities produced in Pennsylvania in 1957 was consumed in the State. Bituminous coal, the most important commodity, was employed locally, for coke production and other industrial uses, for residential fuel, and by powerplants. Bituminous coal was also exported.

Eighty-three percent of the anthracite output was shipped out of the producing regions. Domestic shipments were made principally to Pennsylvania (the leading consumer), New York, New Jersey, and the New England States; exports went mainly to Canada, France, and the Netherlands.

The other mineral fuels produced in Pennsylvania—petroleum, natural gas, and natural-gas liquids—were consumed within the State.

Although Pennsylvania ranks high as a coke producer, some coking coal must be shipped into the State. In 1957 the coal consumed in Pennsylvania for producing coke came from Pennsylvania (67 percent), West Virginia (30 percent), Virginia (2 percent), and Kentucky (1 percent).

Nonmetallic minerals also were important to the mineral economy of Pennsylvania in 1957. It was a surplus producer of cement, consuming only one-third of its production. Cement was shipped to 40 States and the District of Columbia; 30 percent went to New York, 28 percent to New Jersey, 12 percent to Connecticut, 8 percent to

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Ohio, 8 percent to Maryland, and 4 percent to Massachusetts. Most of the lime was consumed within the State (63 percent), but large quantities were shipped to New York (8 percent), New Jersey (6 percent), Maryland (5 percent), Delaware (3 percent), and Maine (2 percent).

Clay production in Pennsylvania was principally captive tonnage, which was used in the many refractory and heavy-clay-product plants scattered throughout the State. Large quantities of industrial sand were produced and consumed, principally within Pennsylvania. Slate producers had a ready market within the State and Eastern United States, the nearest competing States being New York, Vermont, and Virginia. Besides domestic shipments, slate was exported to Canada, South America, and Costa Rica.

Pennsylvania did not produce much metallic ore, and production came entirely from the Cornwall mine. The steel industry relied on shipments of iron ore from other States and from foreign deposits. In 1957 less than 5 percent of the iron ore consumed in blast furnaces came from Pennsylvania. The industry also depends on imports for all its ferroalloys. 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.

Legislation and Government Programs.—Under the Federal-State program of mine-water control in the anthracite region, begun in

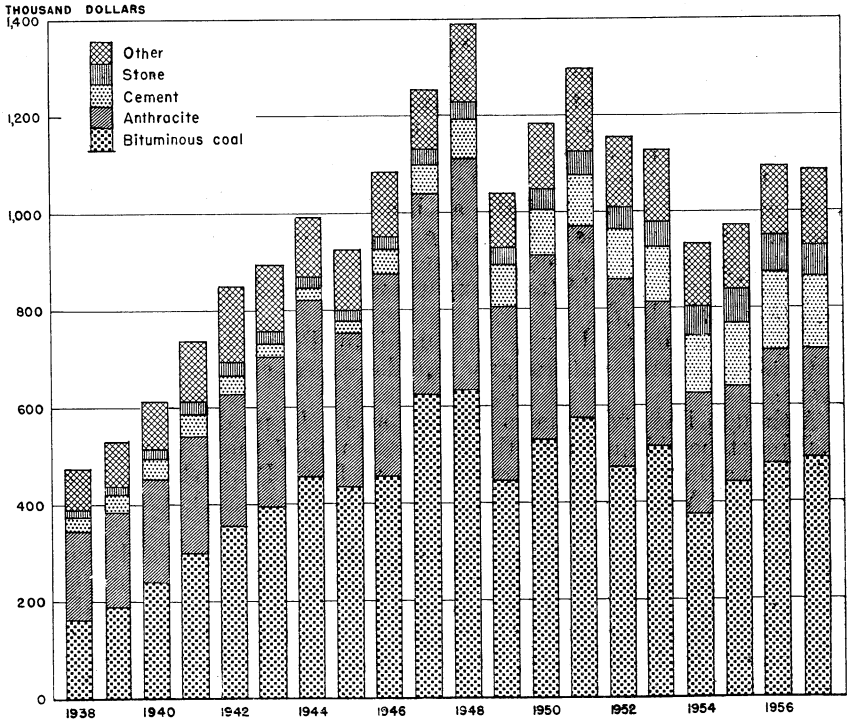


FIGURE 1.—Value of bituminous coal, anthracite, cement, stone, and total value of mineral production in Pennsylvania, 1938–57.

1955, 16 projects were approved by the end of 1957. The total cost, contracted or estimated, was slightly less than \$5 million and was shared equally by the Federal and State Governments.

Nine projects required large-capacity, deep-well pumps for controlling the level of water pools in underground workings. Seven projects proposed surface-drainage improvements, such as concrete flumes and pipes, steel and wood flumes, and backfilling abandoned strip pits.

The first project, installation of concrete flumes and culverts in Boston Creek, Luzerne County, was completed in 1957. The completed project is expected to reduce infiltration of surface water into underlying active mines by an estimated 200 million gallons per year.

TABLE 1.—Mineral production in Pennsylvania, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland.....376-pound barrels.....	49,526,640	\$153,506	42,519,334	\$140,100
Masonry.....do.....	2,437,168	8,832	2,161,109	8,030
Clays.....do.....	2,412,550	23,782	4,073,666	22,012
Coal:				
Anthracite.....	28,900,220	236,785	25,338,321	227,754
Bituminous.....	90,286,692	479,437	85,365,254	492,539
Cobalt (content of ore).....pounds.....	533,329	(⁴)	599,122	(⁴)
Gem stones.....	(⁵)	(⁵)	(⁵)	(⁵)
Iron oxide pigment (crude).....	600	7	998	9
Lime.....	1,443,430	18,232	1,298,401	18,406
Natural gas.....million cubic feet.....	104,508	33,652	2107,300	35,400
Natural-gas liquids:				
Natural-gasoline.....thousand gallons.....	4,081	251	3,106	192
LP-gases.....do.....	1,127	99	1,211	106
Peat.....	20,498	214	26,086	236
Petroleum (crude).....thousand 42-gallon barrels.....	8,230	35,718	8,179	38,687
Sand and gravel.....	14,047,068	21,321	12,405,654	19,570
Slate.....	153,824	4,194	139,283	4,005
Stone.....	744,912,987	773,831	43,257,558	73,090
Sulfur (recoverable elemental sulfur) long tons.....	11,350	386	(⁴)	(⁴)
Tripoli.....	1,030	7	(⁴)	(⁴)
Value of items that cannot be disclosed: Copper, gold, iron ore, mica, oystershell (1956), pyrites, sericite schist, silver, stone (dimension basalt 1956), and values indicated by footnote 4.....		16,200		16,911
Total Pennsylvania ²		1,088,867		1,082,093

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Excludes kaolin; value included with items that cannot be disclosed.

³ Preliminary figure.

⁴ Figure withheld to avoid disclosing individual company confidential data.

⁵ Weight not recorded.

⁶ Less than \$1,000.

⁷ Excludes certain stones, value for which is included with items that cannot be disclosed.

⁸ Includes oystershell.

⁹ Total adjusted to eliminate duplicating value of clays and stone in manufacturing lime and cement.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Anthracite.—Anthracite production in Pennsylvania in 1957 resumed a downward trend. Except for 1956, when output was greater than the preceding year, this downward trend has prevailed since

1946. The decline resulted principally from lower space-heating demand and increased use of competitive fuels. Production in 1957 declined 12 percent in tonnage and 4 percent in value, compared with 1956. The average value per ton increased from \$8.19 in 1956 to \$8.99 in 1957.

As in 1956, the percentage of anthracite produced from underground mines decreased. Output from underground mines represented 50 percent of the total anthracite production (2 percent less than in 1956), whereas output from strip mines represented 30 percent—approximately the same as in 1956. Production from culm banks and dredges totaled 20 percent, compared with 19 percent in 1956.

Apparent consumption decreased 12 percent in quantity, totaling 20.8 million net tons. About 21 million net tons of anthracite was shipped out of the producing area, 4 million tons was sold to local trade, and 279,000 tons was sold as colliery fuel. According to the Pennsylvania Department of Mines, about 71 percent of the anthracite shipped by rail went to the New England States, New York, New Jersey, and Pennsylvania, whereas truck shipments went primarily to the eastern coast, principally to Pennsylvania.

Since 1953 the trend has been for a larger portion of the coal mined underground to be mechanically loaded. In 1957, 53 percent of underground production was mechanically loaded, compared with 49 percent in 1956. In all, 295 scraper loaders, 66 mobile loaders, and 1,437 conveyors and pit-car loaders were used in 1957. Seventy percent of the underground production was loaded by hand-loaded face conveyors and 30 percent by scraper loaders including mobile loaders.

Schuylkill County replaced Luzerne County as the leading county in production of anthracite in Pennsylvania but ranked second to Luzerne County in total value of output. Producers in Schuylkill and Luzerne Counties supplied 66 percent of the total tonnage and 68 percent of the total value. Other counties producing anthracite (in order of decreasing value) were: Northumberland, Lackawanna, Carbon, Columbia, Dauphin, Lancaster, Northampton, Snyder, Sullivan, and Lebanon.

An estimated 2,877 nonfatal injuries and 51 fatal injuries occurred in the anthracite industry in 1957—an improvement compared with 3,330 nonfatal injuries and 56 fatal injuries in 1956. Injury rates in 1957 were 1.15 per million man-hours for fatal injuries and 64.93 per million man-hours for nonfatal injuries, compared with 1.12 and 66.31, respectively, for 1956. Injury rates per million tons in 1957 were 2.00 for fatal and 112.69 for nonfatal injuries. These injury rates were based on a total of 30,825 men working 44,311,269 man-hours to produce 25,530,391 short tons.

Bituminous Coal.—Output from bituminous-coal mining—the leading mineral industry in Pennsylvania—dropped 5 percent in tonnage, about 4.9 million tons less than production in 1956 and 348,000 tons less than in 1955. Despite the drop in tonnage, the value of output rose 3 percent, averaging \$5.77 per ton, 46 cents higher than in 1956. Bituminous coal was produced at underground, strip, and auger mines. Seventy-five percent of the tonnage was from underground mines; 25 percent came from strip mines. In 1957, 1,599 mines producing 1,000 tons or more were active. These mines employed

47,000 men—22 percent of the total employment in the United States bituminous industry.

In 1957, 893 underground mines producing 1,000 tons or more were in operation, 104 mines less than in 1956. Of total underground output, 97 percent was cut by machine, including 33 percent mined by continuous miners; the remainder was cut by hand or shot from the solid. Locomotives, shuttle cars, rope hoists, animals, and mother conveyors were used for underground haulage. As in 1956, 91 percent of the underground output was loaded mechanically. Mobile loaders were the primary moving device—loading into shuttle cars supplied 75 percent (3 percent more than in 1956), into mine cars 20 percent (10 percent less than in 1956), and onto conveyors 5 percent (2 percent more than in 1956). Somerset County had the largest number of underground mines (132), but Washington County was the leading producer from underground mines, with an output of 13 million tons. Greene, Cambria, and Allegheny Counties were also important for underground-mine production.

In 1957, 663 strip mines were active, 17 less than in 1956. About 10 percent less coal was produced by stripping methods in 1957 than in 1956. Output totaled 21.2 million short tons, valued at \$86.2 million. The average value per ton of strip-mine coal was \$4.10, 20 cents more than in 1956.

Electric, diesel-electric, and diesel power shovels and electric, diesel-electric, diesel, and gasoline draglines were used in 1957. Of the 1,427 shovels and draglines in operation, 1,044 were power shovels, of which 976 had a capacity of less than 3 cubic yards, 62 of 3 to 5 cubic yards, 4 of 6 to 12 cubic yards, and 2 of over 12 cubic yards. This was 28 shovels less than were used in 1956—26 fewer of less than 3-cubic-yard, 1 fewer of 3- to 5-cubic-yard, and 1 fewer of over 12-cubic-yard capacity. Draglines totaled 383, 12 more than in 1956, of which 203 had less than a 3-cubic-yard, 109 a 3- to 5- 66 a 6- to 12- and 5 over a 12-cubic-yard capacity. Compared with 1956, 27 more draglines with less than a 3-cubic-yard capacity and 7 more draglines with a 6- to 12-cubic-yard capacity were used. Twenty-three fewer draglines with a 6- to 12-cubic-yard capacity and 1 less dragline with over a 12-cubic-yard capacity were used.

Forty-three auger mines were active in 1957, 10 more than in 1956. Production totaled 367,000 short tons with an average value of \$3.55 per ton, an increase of 91 percent in production and 22 percent in value. Auger mines were active in 16 counties; the largest production came from 9 mines in Armstrong County.

Ninety-eight preparation plants were operated in 1957, 2 less than in 1956. These plants produced 49.3 million short tons of clean coal, of which 93 percent came from underground mines and 7 percent from strip mines. Of the total production mechanically cleaned, 87 percent was wet-washed (33 percent by jigs and 67 percent by other wet methods), and 13 percent was cleaned by pneumatic methods.

In 1957, 2 more fatalities were reported for the bituminous-coal industry than in 1956; however, nonfatal injuries (2,060) decreased by 360. Injury rates in 1957 per million man-hours were 0.66 for fatal and 25.16 for nonfatal injuries and, per million tons, 0.63 for fatal and 23.87 for nonfatal injuries. Pennsylvania ranked third among the States in nonfatal injuries per million man-hours and fourth in fatal

injuries per million man-hours. In 1957, 47,000 men worked in bituminous-coalfields for 10,285,000 man-days or 81,860,000 man-hours to produce 86,300,000 short tons of coal.

TABLE 2.—Bituminous-coal production, by types of mining and counties, 1957

County	Underground		Strip		Auger	
	Number of mines	Short tons	Number of mines	Short tons	Number of mines	Short tons
Allegheny.....	38	6,552,017	27	481,025	1	1,401
Armstrong.....	62	1,183,329	38	1,098,058	9	98,921
Beaver.....	3	37,449	11	220,028	1	3,133
Bedford.....	32	153,710	2	12,913	-----	-----
Blair.....	(¹)	(¹)	(¹)	(¹)	-----	-----
Bradford.....	-----	-----	(¹)	(¹)	-----	-----
Butler.....	30	287,964	45	1,679,211	2	32,089
Cambria.....	120	10,199,792	26	572,044	(¹)	(¹)
Cameron.....	-----	-----	(¹)	(¹)	-----	-----
Centre.....	17	70,651	22	985,496	1	10,800
Clarion.....	17	150,785	36	2,711,404	-----	-----
Clearfield.....	93	1,615,616	120	5,079,205	10	75,027
Clinton.....	6	34,000	7	552,916	1	8,894
Elk.....	15	153,608	11	157,220	1	17,588
Fayette.....	54	5,205,705	51	592,347	1	4,960
Greene.....	27	12,265,953	2	5,977	-----	-----
Huntingdon.....	9	24,066	5	28,060	-----	-----
Indiana.....	86	5,700,213	40	1,036,511	4	33,224
Jefferson.....	43	637,395	32	969,151	2	16,281
Lawrence.....	(¹)	(¹)	24	1,012,682	(¹)	(¹)
Lycoming.....	4	15,800	2	69,808	-----	-----
McKean.....	-----	-----	(¹)	(¹)	-----	-----
Mercer.....	3	50,395	9	457,805	-----	-----
Somerset.....	132	2,539,868	72	1,346,118	4	23,622
Tioga.....	7	43,091	(¹)	(¹)	-----	-----
Venango.....	(¹)	(¹)	10	810,598	-----	-----
Washington.....	27	13,015,406	24	816,610	1	17,095
Westmoreland.....	64	3,814,788	35	164,810	2	4,427
Undistributed.....	4	26,326	12	360,733	3	21,137
Total.....	893	63,777,927	663	21,220,728	43	366,599

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

Coke and Coal Chemicals.—Pennsylvania ranked first in tonnage and value for both beehive and oven coke produced in the United States, supplying 27 percent of the output from slot-type ovens and 77 percent from beehive ovens. A slackening in pig-iron production in the latter part of 1957 affected the production of coke. Output of beehive coke in Pennsylvania decreased 19 percent, and output of oven coke increased only 5 percent. Fourteen plants, operating 4,069 slot-type ovens, carbonized 29.2 billion net tons of coal to produce 20.1 million net tons of oven coke. A total of 2.6 million net tons of coal was carbonized in 8,036 beehive ovens to produce 1.6 million net tons of beehive coke. The average value for oven coke at the ovens was \$17.11, compared with \$14.42 for beehive coke, an increase of 53 cents per ton for oven coke and 60 cents per ton for beehive coke. Coke produced in Pennsylvania was shipped to blast-furnaces, plants, foundries, and other industrial plants and also was used for residential heating. Ninety-six percent of the coke was consumed at blast furnaces and 1 percent at foundries.

TABLE 3.—Annual capacity of coke ovens owned by iron and steel companies on December 31, 1957, in net tons

Company	Location of plant	Beehive		Other		Total annual capacity
		Number of ovens	Annual capacity	Number of ovens	Annual capacity	
United States Steel Corp. (central operations). Pittsburgh Coke & Chemical Co.	Allegheny County: Clairton.....			1,503	7,589,900	7,589,900
	Neville Island.....			105	750,000	750,000
Jones & Laughlin Steel Corp.....	Pittsburgh.....			379	1,301,000	1,301,000
Jones & Laughlin Steel Corp.... Crucible Steel Co. of America...	Beaver County: Aliquippa.....			352	2,190,000	2,190,000
	Midland.....			213	831,600	831,600
United States Steel Corp. (central operations). Bethlehem Steel Co.....	Bucks County: Fairless Hills.....			174	952,100	952,100
	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
Alan Wood Steel Co.....	Montgomery County: Swedeland.....			151	600,000	600,000
	Northampton County: Bethlehem.....			496	2,136,000	2,136,000
Carpentertown Coal & Coke Co.	Westmoreland County: Mount Pleasant.....	277	182,000			182,000
Pittsburgh Steel Co..... United States Steel Corp. (central operations).	Various locations.....			93	644,000	644,000
	do.....	1,240	700,100			700,100

Peat.—Pennsylvania was fifth among the 20 peat-producing States in 1957. Production and value of production in the State increased 27 and 10 percent, respectively, compared with 1956. Varieties of peat produced were humus and reed sedge. Peat was recovered from bogs in Luzerne, Mercer, and Erie Counties, in order of importance.

Petroleum and Natural Gas.—The output of crude petroleum dropped in 1957, whereas production of natural gas increased. Among the States, Pennsylvania ranked 18th as a crude-petroleum producer and 10th as a natural-gas producer. The output of petroleum decreased less than 1 percent in barrels and increased 8 percent in value. The value of crude petroleum at the wells totaled \$4.73. Natural gas increased substantially in output (2,792 million cubic feet) and value (nearly \$2 million), a 3- and 5-percent increase, respectively.

A total of 833 wells was completed in Pennsylvania in 1957. Of this total, 302 were oil wells; 292, gas wells; 94, dry holes; and 145, service wells. Completed wildcat wells totaled 18 in 1957, of which 3 were in new gas pools and 15 in dry holes. Completed field wells totaled 815 (302 oil wells, 289 gas wells, 79 dry holes, and 215 service wells). Footage for completed wildcat wells totaled 196,799 and for field wells 2,467,979. Eighty-three percent of all wells drilled were put down with cable tools and the remainder by rotary.

Proved recoverable crude-oil reserves in Pennsylvania were estimated at 126 million barrels as of January 1, 1958—6 million barrels less than was reported in 1956 and 14 less than in 1955. The natural-gas reserve was estimated at 854 billion cubic feet as of January 1,

1958. A total of 156 billion cubic feet of new natural-gas reserve was established in 1957.

Natural-Gas Liquids.—Natural-gas liquids, natural gasoline and liquefied-petroleum gas were produced in Pennsylvania in 1957. Natural-gasoline output decreased 24 percent in quantity and value compared with 1956, whereas LP-gas output increased 7 percent in quantity and value. Reserves of natural-gas liquids, as of January 1, 1958, were estimated at 3.5 million barrels—about 3 million barrels more than was reported at the end of 1956.

NONMETALS

Cement.—Activity in the Pennsylvania cement industry declined during 1957, with shipments dropping 14 percent in barrels and 9 percent in value. Shipments in 1957 were less than in the preceding 3 years and totaled only 400,000 barrels more than in 1953.

Pennsylvania ranked first in the United States in output of both portland and prepared cement, producing 15 percent of total United States shipments in 1957.

Portland cement was produced in 8 counties at 24 plants operating during 1957. Lehigh and Northampton Counties continued to be the principal centers of production, supplying 66 percent of the portland-cement shipments—1 percent less than in 1956. Capacity at the 24 plants was reported to be 56 million barrels—67 percent by the dry process and 33 percent by the wet process. The industry reported consuming 1,000 million kilowatt-hours of electrical energy, of which 693 million was purchased from public-utility companies.

Shipments of masonry cement also were less in 1957 than in 1956. Of the plants producing portland cement, 22 also produced masonry cement. Production was principally in Lehigh and Northampton Counties.

TABLE 4.—Shipments of portland cement, 1956–57, by counties

County	1956		1957	
	Barrels	Value	Barrels	Value
Lehigh.....	8,700,326	\$26,513,074	7,239,300	\$23,585,408
Northampton.....	24,278,213	76,401,740	20,616,513	67,448,502
Allegheny.....	10,629,275	32,590,052	9,492,915	31,061,528
Lawrence.....				
Butler.....	5,468,826	18,001,060	5,170,606	18,004,400
Berks.....				
Montgomery.....				
York.....				
Total.....	49,526,640	153,505,926	42,519,334	140,099,838

Clays.—The clay industry declined in 1957; this followed a national trend, which resulted principally from lower demand for refractory materials by the steel, glass, and foundry industries and for light-weight aggregate. However, Pennsylvania ranked second in output of clay, with 9 percent of the United States tonnage of clay and 14 percent of the total value. The State also ranked second in the United States in fire-clay production, fourth in kaolin production, and fifth in tonnage of miscellaneous clay produced.

Fire clay was again the most important clay produced in Pennsylvania, representing 51 percent of the State clay tonnage and 75 percent of the total value of clays. The output of fire clay in 1957 decreased 14 percent in tonnage and 9 percent in value from 1956. This decline was due to a lower demand for refractory materials by the steel, glass, and foundry industries and lower production of heavy clay products.

Declining 1 percent in tonnage and 6 percent in value, miscellaneous clay also decreased in production, although not as drastically as fire clay. Lower demand for miscellaneous clay for producing lightweight aggregate and cement and as filler materials offset a slight increase in the production of heavy clay products.

TABLE 5.—Clays sold or used by producers in 1956-57, by kinds and uses, in short tons

Uses	Fire clay		Miscellaneous clay		Kaolin	
	1956	1957	1956	1957	1956	1957
Refractories:						
Bauxite, high-alumina brick.....	8,463	(1)				
Firebrick and block.....	1,089,738	931,680			(2)	9,078
Fire-clay mortar.....	27,631	(1)				
Foundries and steelworks.....	136,753	94,815	(1)	(1)		
Miscellaneous refractories.....	153,672	(1)				
Heavy clay products.....	995,360	896,076	1,571,625	1,590,363		
Lightweight aggregate.....		(1)		126,360		
Paint fillers or extenders.....			360	219		
Cement.....			204,683	201,250	(2)	
Undistributed.....	* 26,369	† 168,731	‡ 192,911	§ 28,539		26,555
Total.....	2,442,986	2,091,302	1,969,564	1,946,731	(2)	35,633

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

² Figure withheld to avoid disclosing individual company confidential data.

³ Includes fire clay for art pottery and stoneware, fire-clay mortar, glass and miscellaneous refractories, lightweight aggregate, and high-alumina brick.

⁴ Includes miscellaneous clay for art pottery and stoneware, lightweight aggregate, foundries and steelworks, high-grade tile, linoleum and oilcloth, miscellaneous filler, and other uses.

TABLE 6.—Clays sold or used by producers in 1957, by counties

County	Short tons	Value	Types of clay
Adams.....	59,950	\$30,575	Miscellaneous clay.
Allegheny.....	273,413	863,841	Do.
Armstrong.....	234,019	3,180,877	Fire clay.
Butler.....	23,495	38,493	Fire clay, miscellaneous clay.
Cambria.....	57,544	(1)	Do.
Carbon.....	43,030	6,777	Miscellaneous clay.
Clarion.....	96,451	643,303	Fire clay, miscellaneous clay.
Clearfield.....	577,255	5,106,750	Do.
Columbia.....	14,617	13,886	Miscellaneous clay.
Cumberland.....	26,555	159,086	Kaolin.
Fayette.....	159,135	(1)	Fire clay, miscellaneous clay.
Lancaster.....	63,061	(1)	Do.
Luzerne.....	52,200	78,300	Miscellaneous clay.
Lycoming.....	219	4,218	Do.
Montgomery.....	76,747	126,821	Fire clay, miscellaneous clay.
Schuylkill.....	114,507	44,287	Miscellaneous clay.
Washington.....	43,932	61,432	Do.
Undistributed *.....	2,157,536	11,653,936	
Total.....	4,073,666	22,012,582	

¹ Included with "Undistributed" to avoid disclosing individual company confidential data.

* Includes tonnage and value for counties that must be concealed as indicated by footnote 1 and for the following counties: Beaver, Berks, Blair, Bucks, Centre, Chester, Clinton, Dauphin, Elk, Huntingdon, Indiana, Jefferson, Lawrence, McKean, Northumberland, Snyder, Somerset, Westmoreland, and York.

Kaolin again was produced in Pennsylvania, declining in both tonnage and value. It was used to produce firebrick and block and portland cement (the most important use).

Clay was produced in 36 counties. Clearfield County led in production, with a value of over \$5 million; Armstrong County ranked second, with a production valued at more than \$3 million, followed in decreasing order by Beaver, Fayette, and Jefferson Counties.

Gem Stones.—Gem stones were obtained from mineral deposits in Pennsylvania by amateur collectors. They were used largely for mineral collections or handmade jewelry.

Iron Oxide Pigments.—The output of crude iron oxide pigments again increased, rising 66 percent in tonnage and 38 percent in value over 1956. Crude iron oxide pigments consisted solely of the sulfur-mud variety and were produced in Cambria and Elk Counties.

Pennsylvania was the leading State in production of finished natural and manufactured iron oxide pigments. 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.—Production of lime in 1957 dropped 10 percent in quantity but increased almost 1 percent in value. Decline in Pennsylvania production was due largely to a lower demand for lime by chemical and other industries. Sales of lime decreased 16 percent for agricultural, refractory, and building purposes and 7 percent for chemical and industrial uses.

Eighteen companies operated 23 plants in 15 counties in 1957, ranking Pennsylvania third among the States in quantity of lime marketed and second in value of sales. Centre County continued to be the leading producing county with nearly one-half of the State's lime output. Centre, Chester, Lancaster, Lebanon, and Mont-

TABLE 7.—Lime sold by producers, 1948-52 (average) and 1953-57, by uses

Year	Agricultural		Building	
	Short tons	Value	Short tons	Value
1948-52 (average).....	134,176	\$1,497,535	121,329	\$1,681,295
1953.....	116,863	1,367,594	114,839	1,575,387
1954.....	129,146	1,537,949	120,661	1,697,895
1955.....	118,274	1,430,454	118,727	1,529,627
1956.....	³ 360,718	³ 5,140,428	110,344	1,456,088
1957.....	286,720	4,469,173	110,815	1,874,125

Year	Chemical and Industrial		Refractory		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	¹ 801,855	¹ \$8,781,560	² 180,606	² \$2,473,755	1,237,966	\$14,434,145
1953.....	865,747	9,766,852	237,851	3,300,281	1,335,300	16,010,114
1954.....	816,044	9,753,519	15,732	217,047	1,081,583	13,205,310
1955.....	1,083,043	13,178,612	104,007	1,493,101	1,424,051	17,631,794
1956.....	³ 972,368	³ 11,685,619	(4)	(4)	1,443,430	18,282,135
1957.....	900,866	12,062,525	(4)	(4)	1,298,401	18,405,823

¹ Includes "Refractory" lime for 1950-51.

² 1952 only.

³ Revised figure.

⁴ Refractory lime included with "Agricultural" to avoid disclosing individual company confidential data.

TABLE 8.—Lime sold or used by producers, 1956-57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Armstrong.....	884	\$10, 185	1, 220	\$14, 658
Blair.....	192	1, 638		
Centre.....	(1)	(1)	614, 653	8, 325, 614
Dauphin.....	70, 893	686, 491	31, 313	404, 060
Franklin.....	2, 305	20, 745	2, 307	20, 763
Fulton.....	(1)	(1)	833	7, 497
Lebanon.....	165, 418	1, 737, 841	192, 000	2, 482, 307
Lycoming.....	1, 400	11, 200		
Mifflin.....	(1)	(1)	2, 500	28, 750
Montgomery.....	71, 782	1, 077, 063	71, 817	1, 225, 240
Montour.....	60	378		
Northumberland.....	485	4, 000	700	6, 000
Snyder.....	1, 959	13, 844	890	8, 010
York.....	142, 424	2, 136, 327	(1)	(1)
Undistributed 1.....	985, 628	12, 582, 423	380, 168	5, 882, 924
Total.....	1, 443, 430	18, 282, 135	1, 298, 401	18, 405, 823

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, Butler, Chester, Juniata (1956), Lancaster, and York.

gomery Counties each had an output of over \$1 million. Of the total lime sold or used, 79 percent was quicklime and dead-burned dolomite and 21 percent hydrated lime.

Magnesium Compounds.—Production in 1957 dropped mainly because of less demand for precipitated magnesium carbonate and magnesium insulation. Magnesium carbonate, magnesium oxide, and magnesium for insulation were produced from raw dolomite at plants at Ambler and Plymouth Meeting.

Mica.—Output of mica increased slightly in tonnage and value compared with 1956. Mica was mined and processed near Glenville and marketed for use in manufacturing paints and welding rods and as a mold lubricant.

Perlite (Expanded).—Crude perlite mined in Colorado, Nevada, and New Mexico was expanded at plants in Allegheny, Delaware, Lehigh, and Montgomery Counties. A total of 16,858 short tons of expanded perlite valued at \$975,398 was marketed from plants in Pennsylvania. Expanded perlite was used principally as an aggregate in building plaster, with smaller quantities used as a filler, soil conditioner, concrete aggregate and in insulation.

Pyrite.—The output of pyrite increased in production and value compared with 1956. The pyrite was obtained as a byproduct of iron mining at Cornwall, Lebanon County, and processed at the Bethlehem Steel Co. plant at Steelton.

Pyrophyllite (Sericite Schist).—Output of sericite schist in 1957 increased in both tonnage and value, principally because of greater demand for processed material as a filler in asphaltic compounds. Sericite schist, after processing, 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 increased in both tonnage and value in 1957. Natural granules represented 28 percent of the total production. Three plants were active—1 at Delta (York County) producing roofing granule from slate, 1 at Charmian (Adams County) using quartzite and basalt, and

1 at Darlington (Beaver County) using clay. In addition to granules, stone flour was produced.

Sand and Gravel.—Sand and gravel output decreased 12 percent in tonnage and 8 percent in value, compared with 1956. Decreased construction and industrial activity hampered the growth of the sand and gravel industry in 1957. Among the States, Pennsylvania ranked 14th in tonnage of sand and gravel produced, with 2 percent of the Nation's total, and 7th in value of sand and gravel, with 3 percent of the Nation's total.

Sand was sold for nine major uses; only engine sand increased in sales. Sand for building purposes decreased 4 percent in tonnage and 3 percent in value; paving sand decreased 16 percent in tonnage and 5 percent in value. Sales of glass, molding, fire, and ground sand also declined.

The quantity of gravel used for each of the four major applications decreased in 1957. Commercial output of building gravel decreased 14 percent in tonnage and 13 percent in value; the output of paving gravel decreased 21 percent in tonnage and 9 percent in value.

Production of sand and gravel by Government agencies increased considerably in tonnage; however, the usage pattern changed. In

TABLE 9.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Building.....	3,817,152	\$4,660,060	3,630,924	\$4,812,433
Paving.....	2,245,280	2,990,176	1,884,880	2,828,916
Other.....	(¹)	(²)	233,272	453,888
Undistributed.....	1,827,094	1,562,849	2,318,629	2,428,659
Total.....	7,889,526	13,279,085	7,067,705	12,375,896
Gravel:				
Building.....	4,039,259	5,471,500	3,456,047	4,760,230
Paving.....	1,934,265	2,413,949	1,527,864	2,204,341
Railroad ballast.....	103,163	76,579	(³)	(³)
Other.....	57,605	35,228	(³)	(³)
Undistributed.....	-----	-----	197,432	174,235
Total.....	6,134,292	7,997,256	5,181,343	7,138,806
Total sand and gravel.....	14,023,818	21,276,341	12,249,048	19,514,702
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building.....	-----	-----	44,239	15,484
Paving.....	9,300	16,740	-----	-----
Total.....	9,300	16,740	44,239	15,484
Gravel:				
Building.....	-----	-----	112,367	39,328
Paving.....	13,950	27,900	-----	-----
Total.....	13,950	27,900	112,367	39,328
Total sand and gravel.....	23,250	44,640	156,606	54,812
Grand total.....	14,047,068	21,320,981	12,405,654	19,569,514

¹ Includes glass, molding, grinding and polishing, fire or furnace, engine, other uses, and ground sand.

² Includes glass, molding, grinding and polishing, fire or furnace, engine, and ground sand.

³ Included with "Undistributed" to avoid disclosing individual company confidential data.

1956, sand and gravel was used by Government agencies for paving purposes, whereas in 1957 it was employed for building purposes.

In 1957, as in 1956, commercial production of sand and gravel was reported in 41 counties. Bucks County was the leading producer of sand and gravel with 31 percent of the State's total tonnage and 25 percent of the State's total value, followed by Armstrong County, with 11 and 14 percent, respectively. Centre County was the only county that reported Government-and-contractor production. Ninety-eight percent of the sand and gravel production was washed or otherwise processed before use. Of the total commercial sand production, 25 percent was transported by railroads and 47 percent by truck. Of the total gravel production, about 11 percent was transported by railroads and 45 percent by trucks.

TABLE 10.—Sand and gravel sold or used by producers, 1956-57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Armstrong.....	1,339,083	\$2,436,281	1,373,555	\$2,692,256
Beaver.....	437,872	453,279	(¹)	(¹)
Bedford.....	10,770	25,525	10,503	30,143
Berks.....	(¹)	(¹)	38,844	60,610
Bucks.....	4,585,135	5,705,930	3,811,626	4,797,972
Cambria.....	3,500	10,500	3,061	9,183
Carbon.....	269,593	389,859	227,999	344,456
Centre.....			156,606	54,812
Crawford.....	134,535	160,505	98,209	137,984
Cumberland.....	92,195	136,188	112,835	178,804
Dauphin.....	44,577	42,374	(¹)	(¹)
Erie.....	130,312	168,459	149,371	197,490
Fayette.....	190,457	446,804	196,337	466,419
Forest.....	103,050	150,977	(¹)	(¹)
Franklin.....	143,198	209,542	135,700	186,013
Luzerne.....	468,763	554,573	454,271	528,787
Lycoming.....	847,649	630,090	(¹)	(¹)
Mercer.....	267,217	381,092	(¹)	(¹)
Monroe.....	205,942	330,338	92,497	128,711
Montgomery.....	11,000	26,050	(¹)	(¹)
Northampton.....	(¹)		280,456	397,014
Northumberland.....	8,014	9,900	7,890	10,151
Philadelphia.....	625,325	429,412	553,395	415,045
Schuylkill.....	215,768	545,487	167,734	564,197
Somerset.....	(¹)	(¹)	350	1,050
Wayne.....	40,142	60,059	71,823	105,638
Undistributed ²	3,872,971	8,017,757	4,462,092	8,262,789
Total.....	14,047,068	21,320,981	12,405,654	19,569,514

¹ Figure withheld 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: Allegheny, Blair, Bradford, Butler, Chester (1956), Clearfield, Columbia, Elk (1957), Huntingdon, Lancaster, Lawrence, McKean, Mifflin, Venango, Warren, Wyoming, and York.

Slate.—Despite a drop of 9 percent in quantity and 4 percent in value, the Pennsylvania slate industry continued to rank first in the United States in total value of production and second in total tonnage, representing 36 percent of the Nation's total value and 22 percent of the tonnage. Lower demand for slate as roofing, sanitary, and flagging material and slate granules contributed to the decline of the industry in 1957. The market for slate for billiard tables, school slates, and slate flour also dropped during 1957, whereas demand for electrical slate and grave vaults and covers increased. Slate prices were approximately the same as in 1956, but industry wages increased from 4 to 10 percent during the year.

Quarries were operated in Lehigh, Lycoming, Northampton, and York Counties; Northampton County furnished 79 percent of the value of production. Fifteen operators (1 less than in 1956), were active in producing slate—12 in Northampton County and 1 each in Lehigh, Lycoming, and York Counties.

Slate was exported from Pennsylvania to Canada, South America, and Costa Rica. Exported, in decreasing order, were billboard slate, slate flour, slate granules, roofing slate, billiard slate, structural slate, and school slate. Except for blackboard slate, exports in 1957 were less than in 1956.

Stone.—Stone production in 1957 decreased in both tonnage and value. Tonnage was less than in 1955 or 1956 but greater than in 1954. The decline was due principally to lower demand for dimension stone for rough architectural, curbing, and flagging purposes and crushed stone as concrete aggregate, flux, and riprap. Stone (sandstone, granite, basalt, limestone, shell, and miscellaneous stone) was produced in 45 of the 67 counties, ranking Pennsylvania as the leading stone-producing State in 1957. Of the total State value of stone sold or used, sandstone represented 9 and limestone 81 percent.

Sandstone was marketed as both dimension and crushed stone, decreasing 27 percent in tonnage and 14 percent in value from 1956. Reduced output resulted principally from decreased demand for dimension stone for rough architectural use and crushed stone for concrete aggregate, railroad ballast, and refractory material. About 2 percent less dimension sandstone was marketed in 1957; the sandstone was prepared as rough construction, rubble, rough architectural, dressed, curbing, and flagging stone. About 28 percent less crushed sandstone was marketed in 1957. This stone was marketed as riprap, concrete aggregate, railroad ballast, and refractory material and for miscellaneous uses.

Dimension granite was prepared and marketed from quarries in Pennsylvania. The granite was used as building stone; use as rough architectural stone increased.

The output of basalt increased over 1956 in both tonnage and value. This rise was due principally to a greater demand for dimension stone in rough construction use and for basalt as concrete aggregate and railroad ballast.

The output of miscellaneous stone in Pennsylvania decreased considerably in tonnage and value in 1957. Although demand for dimension miscellaneous stone as rough construction stone and rubble increased slightly, the use of crushed miscellaneous stone as concrete aggregate decreased sharply.

The output of limestone also fell in 1957; crushed limestone decreased 4 percent in tonnage and 2 percent in value. Less demand for dimension limestone as rubble and rough construction material caused a decline in this phase of the stone industry. Increases of 2 percent in the demand for crushed limestone as concrete aggregate, 39 percent as railroad ballast, and 13 percent as agricultural stone were not great enough to offset a 4-percent decrease in the demand for flux and a sharp decline in sales of limestone as riprap.

Basalt was produced in Adams, Berks, Bucks, Centre, Dauphin, Delaware, and Montgomery Counties; granite was produced in

Delaware and Montour Counties. Delaware County led in production of both basalt and granite.

Crushed miscellaneous stone was produced in Bucks and Montgomery Counties. The output of dimension stone was reported from Delaware, Lycoming, Montgomery, and Westmoreland Counties.

Dimension sandstone was produced in 11 counties: Allegheny, Chester, Delaware, Lycoming, Mercer, Montgomery, Potter, Susquehanna, Wayne, Westmoreland, and Wyoming Counties. Crushed sandstone was produced in Bedford, Blair, Bucks, Carbon, Fayette, Huntingdon, Juniata, Lebanon, Lehigh, Luzerne, Mifflin, Montgomery, Northumberland, Schuylkill, Susquehanna, Wayne, and Westmoreland Counties. Luzerne County led in the production of crushed sandstone, whereas Montgomery County led in the production of dimension sandstone.

Dimension limestone was produced in three counties—Bucks, Lancaster, and Chester—with Bucks County leading. Output of crushed limestone came from 35 counties; Northampton County led in output with 5.7 million short tons, followed in decreasing order by counties producing more than 2 million short tons—Montgomery, Lawrence, York, Lebanon, Cambria, Centre, and Lancaster.

TABLE 11.—Stone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone ¹	172,413	\$1,114,847	211,379	\$1,580,456
Monumental stone.....	168	24,115		
Total dimension stone.....	172,581	1,138,962	211,379	1,580,456
Crushed and broken stone:				
Riprap.....	262,089	382,834	(?)	(?)
Concrete and road stone.....	16,746,444	25,419,908	16,686,666	25,185,979
Railroad ballast.....	756,014	1,248,772	1,166,649	1,915,052
Furnace flux (limestone).....	9,365,869	16,314,675	8,958,591	16,151,026
Refractory.....	367,700	4,122,215	306,194	3,838,049
Agricultural.....	759,365	2,610,549	856,641	2,756,244
Other uses.....	16,482,925	22,592,805	15,071,438	21,662,688
Total crushed and broken stone.....	44,740,406	72,691,758	43,046,179	71,509,038
Grand total.....	44,912,987	73,830,720	43,257,558	73,089,494

¹ Includes "Curbing and flagging" to avoid disclosure of company confidential data.

² Included with "Concrete and road stone."

³ Includes oystershell.

⁴ Incomplete total; excludes certain stones to avoid disclosure of company confidential data.

Tripoli.—Tripoli (rottenstone) is produced in Pennsylvania. The State ranked last among the States producing tripoli in 1957, with production slightly more than in 1956. The ground material was used principally as an abrasive and filler.

Vermiculite (Exfoliated).—Crude vermiculite from Montana and the Union of South Africa was exfoliated at plants in Bucks, Clearfield, and Lawrence Counties. The exfoliated vermiculite was used to make cement and refractory and other insulation.

TABLE 12.—Stone sold or used, 1956–57, by counties

County	1956		1957	
	Short tons	Value	Short tons	Value
Allegheny	9,280	\$31,442	9,030	\$30,949
Berks	2,192,384	2,832,145	(¹)	(¹)
Bucks	745,468	1,370,960	667,519	1,282,113
Butler	(¹)	(¹)	2,197,164	4,224,471
Carbon	(¹)	(¹)	88,255	1,226,700
Centre	2,148,594	3,641,169	2,107,910	3,901,388
Chester	2,059,717	3,139,266	1,795,129	3,258,916
Clinton	158,134	236,808	(¹)	(¹)
Cumberland	594,146	1,013,487	137,033	282,836
Dauphin	1,351,944	2,298,394	(¹)	(¹)
Franklin	439,426	702,703	428,527	718,736
Fulton	100,312	152,847	(¹)	(¹)
Huntingdon	(¹)	(¹)	503,048	1,840,389
Indiana	1,810	8,145	300	1,200
Lancaster	1,827,280	3,005,250	2,022,971	3,106,309
Lawrence	3,287,899	5,561,574	(¹)	(¹)
Lebanon	(¹)	(¹)	2,861,601	5,226,348
Lehigh	2,362,481	2,384,814	1,836,260	2,104,085
Luzerne	(¹)	(¹)	228,068	364,081
Lycoming	357,682	583,692	(¹)	(¹)
Mercer	500	2,500	4	1,091
Montgomery	4,689,348	7,770,243	3,797,478	6,625,753
Northampton	6,066,925	5,540,291	5,658,861	5,302,443
Northumberland	(¹)	(¹)	19,600	29,400
Perry	46,943	94,353	(¹)	(¹)
Potter	(¹)	(¹)	5,104	142,072
Schuylkill	(¹)	(¹)	89,671	594,301
Susquehanna	(¹)	(¹)	184,322	426,810
Union	(¹)	(¹)	249,981	413,413
Wayne	131,592	239,698	190,074	354,142
Westmoreland	(¹)	(¹)	294,699	658,021
Wyoming	(¹)	(¹)	1,078	24,420
York	2,363,575	4,016,227	2,911,603	4,833,049
Undistributed ²	13,977,547	29,204,712	14,972,268	26,116,058
Total	³ 44,912,987	³ 73,830,720	⁴ 43,237,558	⁴ 73,089,494

¹ Included with "Undistributed" 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, Blair, Delaware, Fayette, Juniata, Mifflin, Monroe, Montour, Snyder, and Somerset.

³ Incomplete total; excludes certain stones to avoid disclosing individual company confidential data.

⁴ Includes oystershell.

METALS

Iron Ore.—Shipments of usable iron ore from the Cornwall mine decreased in 1957, chiefly because of a lower demand for ore by the steel industry. All ore produced at the underground Cornwall mine was shipped to the Lebanon concentrator for processing. Iron shipments from the concentrator consisted of sinter and pellets for use in producing pig iron and steel. The copper concentrate produced at the concentrator was transferred primarily to a smelter at Laurel Hill, N. Y., to recover copper, gold, and silver. The pyrite concentrate was processed at Sparrow Point for recovery of sulfur and at Wilmington, Del., for cobalt.

Pig Iron and Ferrous Scrap.—Consumption of pig iron and ferrous scrap in 1957 totaled 37,700,000 short tons, 4 percent less than in 1956. This decrease was due largely to scattered work stoppages in the steel industries and less demand, resulting from a general business

recession in the third and fourth quarters of 1957. Despite an 8-percent decrease in scrap consumption, the use of pig iron remained approximately the same. However, the production of pig iron in Pennsylvania increased 3 percent. During 1957, 18.7 million short tons of domestic iron ore, 4.6 million tons of foreign iron ore, and 10.7 million tons of agglomerate were consumed in the blast furnaces. Classes of pig iron produced in 1957 were: Foundry, basic, bessemer, low-phosphorus, malleable, and direct-casting. More basic and bessemer pig iron was produced than any other class, totaling 17.2 million tons for basic and 2.7 million tons for bessemer.

The annual capacity of blast furnaces in Pennsylvania, as of January 1, 1958, totaled 25.7 million net tons, an increase of 1.5 million net tons in 1957. There were 79 stacks active in 1957, 1 more than in 1956; the addition was at the United States Steel Corp. Fairless Hill plant. Distribution of blast-furnace capacity is shown in table 15.

Iron and steel scrap came principally from Allentown, Harrisburg, Norristown, Scranton, Tarentum, Philadelphia, Pittsburgh, and Wilkes Barre. Of scrap 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 borings.

TABLE 13.—Consumption of pig iron and ferrous scrap in 1956–57, by type of furnace, in short tons

Type of furnace and raw material	1956	1957	Type of furnace and raw material	1956	1957
Open-hearth furnaces:			Blast furnaces:		
Pig iron.....	17,883,714	18,160,715	Pig iron.....		
Scrap.....	14,166,691	13,224,718	Scrap.....	1,532,895	1,519,257
Total.....	32,050,405	31,385,433	Total.....	1,532,895	1,519,257
Bessemer converters: ¹			Ferroalloy furnaces:		
Pig iron.....	716,047	638,014	Pig iron.....		
Scrap.....	79,586	87,254	Scrap.....	334	341
Total.....	795,633	725,268	Total.....	334	341
Electric steel furnaces:			Miscellaneous uses:		
Pig iron.....	26,715	23,962	Pig iron.....	² 1,422,020	² 1,281,961
Scrap.....	1,897,991	1,536,209	Scrap.....	³ 99,552	³ 93,895
Total.....	1,924,706	1,560,171	Total.....	1,521,572	1,375,856
Cupola furnaces:			Total Pennsylvania:		
Pig iron.....	346,810	301,121	Pig iron.....	20,450,118	20,450,516
Scrap.....	767,346	659,080	Scrap.....	18,707,871	17,255,039
Total.....	1,114,156	960,201	Total.....	39,157,989	37,705,555
Air furnaces:					
Pig iron.....	54,812	44,743			
Scrap.....	163,476	134,285			
Total.....	218,288	179,028			

¹ Includes scrap and pig iron consumed in oxygen steel process during 1957.

² Direct castings.

³ Includes small quantity used in crucible furnaces.

TABLE 14.—Annual capacity of blast furnaces, January 1, 1958, in net tons

[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (tons)
Allegheny County:			
U. S. Steel Corp. (central operations) -----	Braddock	7	2,730,200
Do	Clairton	3	772,800
Do	Duquesne	16	1,402,900
National Tube Division	McKeesport	4	1,280,000
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	2,305,500
Beaver County:			
Jones & Laughlin Steel Corp.	Aliquippa	5	2,090,000
Crucible Steel Co. of America	Midland	3	895,000
Colorado Fuel & Iron Corp. ....	.....	1	151,200
U. S. Steel Corp. (central operations) ..	Berks County: Birdsboro	3	1,878,000
Bethlehem Steel Co.	Bucks County: Fairless Hills	7	2,048,000
New Jersey Zinc Co.	Cambria County: Johnstown	3	112,000
Bethlehem Steel Co.	Carbon County: Palmerton	32	1,020,000
Barium Steel Corp. (Phoenix Iron & Steel Co.) ..	Dauphin County: Steelton	1	200,000
Interlake Iron Corp.	Delaware County: Chester	3	271,000
Lavino & Co., E. J.	Erie County: Erie	41	46,660
Mercer County:			
Sharon Steel Corp.	Farrell	2	676,000
Shenango Furnace Co.	Sharpsville	2	445,450
Alan Wood Steel Co. ....	.....	2	544,200
Bethlehem Steel Co.	Montgomery County: Swedeland	7	2,718,000
American Steel & Wire Division	Northampton County: Bethlehem	2	450,000
Pittsburgh Steel Co.	Washington County: Donora	3	950,000
	Westmoreland County: Monessen		

¹ Includes 302,500 tons ferroalloys capacity.

² Includes 240,000 tons ferroalloys capacity.

³ Spiegeleisen only.

⁴ Ferromanganese only.

REVIEW BY COUNTIES

Production of metals and nonmetals in 1957 in 62 of the 67 counties of Pennsylvania was reported. Bituminous coal was produced in 28 counties and anthracite in 12. Production of petroleum, natural gas, and natural-gas liquids is not covered in the county descriptions. A more complete listing of coal producers than is given in this report can be found in Bituminous Coal Division and Anthracite Division 1957 Annual Reports published by the Department of Mines and Mineral Industries, Commonwealth of Pennsylvania.

Adams.—Bethlehem Limestone Co. quarried and crushed limestone at the Hanover operation west of Hanover in Adams County, principally for blast-furnace flux, concrete aggregate, roadstone, stone sand, and railroad ballast. Quantities of the stone were sold under contract to nearby Government agencies for road construction. The Funkhouser Co. continued to operate an open quarry and underground mine east of Charmian in Adams County to produce basalt and quartzite. The basalt and quartzite were crushed and ground at a local mill and sold for use as roofing granules and stone flour.

Production of miscellaneous clay decreased from 68,000 short tons in 1956 to 60,000 in 1957. Output recovered from open pits by Alwine Brick Co. (New Oxford) and Gettysburg Drain Tile Works (Gettysburg), was used to manufacture heavy clay products.

The Summit Mining Corp. operated an open pit 3 miles west of Bendersville and a processing plant at Aspers to produce sericite

TABLE 15.—Value of mineral production in Pennsylvania, 1956-57, by counties^{1 2 3}

County	1956	1957	Minerals produced in 1957 in order of value
Adams.....	(4)	(4)	Stone, sericite schist, clays.
Allegheny.....	\$64,836,756	\$59,809,854	Coal, cement, clays, sand and gravel, stone.
Armstrong.....	15,915,421	17,486,325	Coal, clays, sand and gravel, stone, lime.
Beaver.....	4,687,410	(4)	Clays, coal, sand and gravel.
Bedford.....	2,083,765	1,661,061	Stone, coal, lime, sand and gravel.
Berks.....	9,671,278	9,604,834	Cement, stone, clays, sand and gravel, oyster shell.
Blair.....	2,453,437	2,110,450	Stone, coal, clays, sand and gravel.
Bradford.....	(4)	(4)	Sand and gravel, coal.
Bucks.....	7,120,640	(4)	Sand and gravel, stone, clays.
Butler.....	16,751,886	17,027,113	Coal, cement, stone, lime, sand and gravel, clays.
Cambria.....	68,839,370	71,430,438	Coal, clays, sand and gravel, crude iron oxide pigments.
Cameron.....	(4)	(4)	Coal.
Carbon.....	15,866,478	10,023,818	Coal, stone, sand and gravel, clays.
Centre.....	16,623,942	15,044,014	Lime, coal, stone, clays, sand and gravel.
Chester.....	4,635,706	4,644,037	Stone, lime, clays, gem stone.
Clarion.....	14,236,105	12,181,928	Coal, clays.
Clearfield.....	(4)	(4)	Coal, clays, sand and gravel.
Clinton.....	2,745,587	2,650,497	Coal, stone, clays.
Columbia.....	6,186,419	(4)	Coal, sand and gravel, clays.
Crawford.....	160,505	137,984	Sand and gravel.
Cumberland.....	1,149,675	461,640	Stone, sand and gravel, clays.
Dauphin.....	4,641,527	4,214,567	Stone, coal, clays, lime, sand and gravel.
Delaware.....	(4)	3,178,565	Stone, sulfur.
Elk.....	(4)	1,596,227	Coal, clays, sand and gravel, crude iron oxide pigments.
Erie.....	(4)	(4)	Sand and gravel, peat.
Fayette.....	35,322,678	40,836,337	Coal, clays, stone, sand and gravel.
Forest.....	150,977	(4)	Sand and gravel.
Franklin.....	932,990	925,512	Stone, sand and gravel, lime.
Fulton.....	399,014	(4)	Stone, lime.
Greene.....	68,823,643	80,300,164	Coal.
Huntingdon.....	5,848,287	4,333,799	Sand and gravel, stone, coal, clays.
Indiana.....	36,557,072	(4)	Coal, clays, stone.
Jefferson.....	(4)	(4)	Coal, clays.
Juniata.....	554,045	(4)	Stone.
Lackawanna.....	28,612,975	26,503,139	Coal.
Lancaster.....	6,131,612	5,621,771	Stone, lime, coal, sand and gravel, clays, gem stone.
Lawrence.....	18,978,581	22,084,103	Cement, stone, coal, clays, sand and gravel.
Lebanon.....	20,130,548	22,039,326	Iron ore, stone, copper, lime, cobalt, pyrite, gold, silver, coal.
Lehigh.....	(4)	(4)	Cement, stone, oystershell.
Luzerne.....	91,793,125	(4)	Coal, sand and gravel, stone, peat, clays.
Lycoming.....	1,493,880	1,708,075	Stone, sand and gravel, coal, tripoli, clays, slate.
McKean.....	820,155	614,601	Clays, coal, sand and gravel.
Mercer.....	3,015,701	2,607,174	Coal, sand and gravel, peat, stone.
Mifflin.....	(4)	(4)	Sand and gravel, stone, lime.
Monroe.....	(4)	(4)	Stone, sand and gravel.
Montgomery.....	(4)	13,660,095	Stone, cement, lime, clays, sand and gravel.
Montour.....	(4)	(4)	Stone.
Northampton.....	83,082,046	(4)	Cement, slate, stone, sand and gravel, coal.
Northumberland.....	26,593,629	(4)	Coal, clays, stone, sand and gravel, lime.
Perry.....	94,353	(4)	Stone.
Philadelphia.....	429,412	415,045	Sand and gravel.
Potter.....	(4)	142,072	Stone.
Schuylkill.....	69,799,731	74,040,576	Coal, stone, sand and gravel, clays.
Snyder.....	388,141	382,348	Clays, stone, coal, lime.
Somerset.....	22,474,172	21,797,665	Coal, clays, stone, sand and gravel.
Sullivan.....	57,042	(4)	Coal.
Susquehanna.....	(4)	426,810	Stone.
Tioga.....	486,275	(4)	Coal.
Union.....	(4)	413,413	Stone.
Venango.....	(4)	(4)	Coal, sand and gravel.
Warren.....	(4)	(4)	Sand and gravel.
Washington.....	95,669,087	91,826,557	Coal, clays.
Wayne.....	299,757	459,780	Stone, sand and gravel.
Westmoreland.....	20,937,309	(4)	Coal, stone, clays.
Wyoming.....	(4)	(4)	Sand and gravel, stone.
York.....	12,527,337	15,016,224	Cement, stone, lime, slate, clays, sand and gravel, mica, gem stone.
Undistributed.....	178,157,713	422,675,243	
Total.....	1,088,867,000	1,082,093,000	

¹ Pike County is not listed, because no production was reported.² Excludes value of production for LP-gases, natural gas, 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 the manufacture of lime and cement.⁴ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

schist. The crude sericite schist was crushed, ground, air-floated, and dried before marketing as a filler in asphaltic compounds and joint cements and for use in insecticides.

Allegheny.—Ninety-three percent of the bituminous coal mined in Allegheny County in 1957 originated in underground mines; smaller quantities came from strip and auger mines. The 38 active underground mines having 166 cutting machines in operation, produced over 1,000 tons of bituminous coal in 1957, cutting 6.5 million tons. Thirty-seven power shovels and twelve draglines were active at the 27 strip mines in Allegheny County. A total of 6.4 million tons of coal was mechanically loaded in the underground mines; 5.1 million tons was mechanically cleaned. S. & P. Coal Co. operated the only auger mine, mining the Redstone coal seam at the Natali mine.

Universal Atlas Cement Co., a subsidiary of the United States Steel Corp., operated its cement plant at Universal, producing both portland and mortar cements. Pittsburgh Coke & Chemical Co. produced portland-pozzolan, waterproof-portland, and mortar cement at its Neville Island plant.

The production of miscellaneous clay in 1957 increased from 128,000 to 273,000 short tons. The six active companies were at Bridgeville, Creighton, North Bessemer, Pitcairn, and Wilksburg. The leading producer was Bridgeville Brick Co.

James H. McCrady, Jr. (Harmarville) and Sidwell Loam Sand Co. (Cheswick) produced sand and gravel for molding sand and other uses.

Francis Matesia produced dimension sandstone from a quarry near Cuddy for use as rubble. Malli Mines produced irregular dimension sandstone from a quarry in Jefferson Borough for rough construction.

Panacalite Perlite Co. (Pittsburgh) and Perlite Manufacturing Corp. (Carnegie) expanded perlite from crude material mined in the Western States. The expanded perlite was marketed principally as aggregate in building plaster; smaller quantities were consumed as concrete aggregate or soil conditioner.

Armstrong.—Bituminous coal was produced in 1957 from 109 mines—62 underground, 38 strip, and 9 auger. Underground mines yielded 50 percent of the total tonnage and strip mines 46 percent. Thirty-two percent of the tonnage produced was mechanically cleaned; 17,000 short tons was wet-washed, using jigs, 603,000 short tons using other wet methods, and 150,000 short tons using pneumatic methods.

In terms of tonnage, Armstrong County ranked fifth among the counties in clay production and second in total clays value. Nine clay producers were active in 1957, with 1 each at Adrian, Craigsville, Freeport, Madison Township, Templeton, and Worthington and 3 at Kittanning. Clay output was used to produce firebrick and block and heavy clay products.

Armstrong County was the second ranking sand-and-gravel-producing county in the State. J. K. Davidson & Bros. operated a dredge along the Allegheny River near Ford City, shipping the material by barge to the company plants at New Kensington and Pittsburgh and to buyers in the Allegheny Valley. Glacial Sand & Gravel Co. (near Kittanning) and Manorville Sand Co. (Manorville) operated

sand and gravel pits; production was used principally as structural and paving material and railroad ballast.

C. D. McCanna (Kittanning) produced crushed limestone for use in making lime. Michigan Limestone Division, United States Steel Corp., produced and crushed limestone at the Kaylor underground mine south of East Brady for use as blast-furnace flux, concrete aggregate, roadstone, and railroad ballast and in manufacturing cement. Some roadstone was sold to local Government agencies.

Agricultural lime was produced by Walter Hershberger, C. D. McCanna, and Robert E. Toy near Kittanning.

Beaver.—Beaver County ranked second in the State in clay production in 1957. Five companies reported production; the leading producers were: R. A. Veon, Inc., Darlington; Negley Fire Clay Co., New Galilee; McQuiston Coal Co., Darlington; Natco Corp., 4 miles east of Negley, Ohio; and McLain Fire Brick Co., Vanport. Fire clay was sold and used to manufacture refractories, pottery, lightweight aggregates, and heavy clay products. Miscellaneous clay was used to produce heavy clay products.

Eighty-four percent of the bituminous-coal production in 1957 came from 11 strip mines, 14 percent from 3 underground mines, and the remainder from 1 auger mine. Nine draglines and seventeen power shovels were used to produce 220,000 short tons of bituminous coal.

Building and paving sand and gravel were produced by Shippingport Sand & Gravel Co. (Shippingport).

The Central Commercial Co. made roofing granules at Darlington, using as raw material miscellaneous clay produced by the company or other local producers.

Bedford.—New Enterprise Stone & Lime Co. (Everett) crushed limestone at the Aschom quarry and plant, principally for concrete aggregate, roadstone, asphalt fill, dust for coal mines, and agricultural uses. Some stone was sold to Government agencies as road material. Leap Ganister Rock Co. (Madley) produced ganister rock, which it crushed and sized at its local plant for use in foundries and steel mills, and in making ferrosilicon.

Ninety-two percent of the bituminous-coal production came from 32 mines; the rest came from 2 strip mines. Thirty-eight percent of the coal mined underground was mechanically loaded, but none of the coal was mechanically cleaned.

Agricultural lime was produced by New Enterprise Stone & Lime Co., Inc., and Mason Kerr. New Enterprise Stone & Lime Co., Inc., produced hydrated lime, using 2 continuous hydrators, and Mason Kerr produced quicklime, using 1 pot kiln.

Feight Bros. recovered and processed building sand from a pit and fixed plant near Everett.

Berks.—Allentown Portland Cement Co., the leading stone producer in the county, quarried limestone and cement rock at the Oley and Evansville quarries. The material was crushed and used at the Evansville No. 1 plant for use in manufacturing cement (types I-II and masonry).

Eastern Lime Corp. produced and crushed limestone from the Hinterleiter quarry at Kutztown and a new quarry at Oley, both in the southeastern part of the county. Berks Products Corp. (Reading) and E. J. Breneman, Inc. (Sinking Spring), also produced crushed

limestone. The stone was used for road material, railroad ballast, agricultural purposes, and cement manufacture. Some road material was sold under contract to local Government agencies.

Basalt, produced by the John T. Dyer Quarry Co., at the Clingan and Birdsboro quarries (both near Birdsboro), was crushed and sized at the local plant for railroad ballast and roadstone. Stowe Trap Rock Co. (Douglassville) quarried and crushed basalt for road material and railroad ballast. Reading Poultry Co. (Reading) crushed oystershell for use as poultry grit.

Glen-Gery Shale Brick Corp. (Wyomissing and Shoemakersville) produced miscellaneous clay from open pits for use in manufacturing building brick.

Four companies produced sand and gravel near Sinking Spring and Temple and at several unspecified locations in the county. Output was used principally as building sand and gravel and paving gravel.

The Beryllium Corp. processed beryl at Reading, producing beryllium metal, beryllium-copper master alloy, beryllium-aluminum, beryllium-nickel, beryllium-iron, and beryllia. This corporation also had rolling, foundry, and fabricating facilities at Reading.

Blair.—Crushed limestone was produced by 4 companies operating 5 quarries; output was used chiefly as concrete aggregate and roadstone but also for agricultural purposes. Leading producer was New Enterprise Stone & Lime Co. (Hollidaysburg and Roaring Spring).

Other companies operated quarries and plants near Altoona, Hollidaysburg, and Claysburg. Quartzite was quarried by Basalt Trap Rock Co. near Williamsburg and crushed and sized for use as railroad ballast, road material, and riprap. General Refractories Co. (Claysburg) and J. L. Hartman, operator of the Sarah Furnace quarry (Sproul), quarried and crushed quartzite for use in making silica brick.

Bituminous coal was mined from 2 underground and 2 strip mines.

Kaolin, fire clay, and miscellaneous clay were produced in Blair County in 1957. Kaolin was produced by Grannas Bros. from the No. 1 open pit near Williamsburg for use in manufacturing firebrick and block. Plastic fire clay was produced by Woodbury Clay Co. (Williamsburg) for use in manufacturing foundry refractories and by Harbison-Walker Refractories Co. (3 miles south of Williamsburg) for use at a local plant in making refractories. Blair Clay Products, Inc. (Altoona), produced miscellaneous clay for making building brick.

Frankstown Sand Supply and George G. Trude recovered building sand from pits in the southern part of the county near Hollidaysburg.

Bradford.—Towanda Sand & Gravel Co., Inc., produced and processed sand and gravel from a pit and fixed plant near Towanda for use as black-top fill. Gravel was sold under contract to the Pennsylvania Department of Highways.

Paul Percival operated the Sand Run mine, mining the Kittanning coal seam.

Bucks.—Bucks County continued to lead in 1957 in sand and gravel production in the State, although there was a decrease in production and value compared with 1956. Warner Co. (Tullytown) operated its Van Sciver and Dredge Franklin plants. Nine other companies produced sand and gravel from pits at Morrisville, Tullytown, New Hope, and Falls Township in the southeastern section

of the county and at Kintersville, Riegelsville, and Upper Black Eddy in the northern part of the county. Production was used principally for building and paving material.

Dimension limestone for use as rubble was quarried by Edward Karpinsky in the southern part of the county near Langhorne. New Hope Crushed Stone Lime Co. (New Hope) and Bituminous Service Co. (Buckingham) produced crushed limestone for road material.

Crushed and dimension basalt was quarried at various sites near Telford, east of Coopersburg in Bucks County, Edison, Quakertown, and Rushland. The crushed material was marketed as road material and railroad ballast. Dimension stone was sold or used as surface plates, architectural stone, paving blocks, and rough and dressed building stone. Samuel M. Yoder Estate operated the Blooming Glen Crushing Works and quarry at Blooming Glen (redstone and bluestone), and George Wiley operated Wiley's quarry (bluestone) near Point Pleasant. Both companies crushed sandstone for road material. George Wiley also produced crushed miscellaneous stone for road material.

Miscellaneous clay was produced from an open pit near Quakertown by Quakertown Brick & Tile Co., Inc., for making building brick.

Hyzer & Lewellen operated a plant at Southampton for exfoliating vermiculite. The vermiculite was sold for various purposes, basically for use in insulation products.

Butler.—Butler County was the third-ranking county in production of strip-mine coal. Strip mining represented 84 percent of the output. At the 45 strip mines 65 power shovels and 43 draglines were used to produce 1.7 million short tons of coal. Thirty underground mines producing 14 percent of the county coal output, and 2 auger mines also were active in 1957. A total of 319,000 short tons of coal, 16 percent of the county production, was mechanically cleaned using jigs.

Penn-Dixie Cement Corp. produced limestone from its underground mine at West Winfield and used the crushed stone at its No. 9 plant for the manufacture of cement. Both portland and mortar cements were produced and marketed by this company.

Michigan Limestone Division of United States Steel Corp. operated the Annondale mine and plant near Boyers, producing crushed limestone for blast-furnace flux, road material, railroad ballast, and cement manufacture. Road material was sold under contract to local Government agencies. Grove City Limestone Co. recovered and crushed limestone for concrete aggregate, roadstone, and agricultural use from a quarry and plant at Branchton.

Mercer Lime & 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 principal product. The hydrated lime was marketed for chemical and industrial uses also, and as agricultural lime.

H. W. Cooper and Highway Sand & Gravel Co., Inc. (both near Slippery Rock), produced sand and gravel for use as building and paving material.

Miscellaneous clay was produced by Scott Borland at Mars for manufacturing building brick. Plastic fire clay was recovered by

D. B. Boesel from an open pit near Slippery Rock for producing fire-brick and block.

Cambria.—Cambria County ranked third in production of coal from underground mines; output from the 120 active mines totaled 10.2 million short tons. Ninety-eight percent of the underground production was cut by 344 machines, and 71 percent of the total production was mechanically cleaned. Besides the underground mines, 26 strip mines and 2 auger mines were active in 1957.

Plastic fire clay was produced by Patton Clay Manufacturing Co. (Patton) and Harbison-Walker Refractories Co. (Blandburg), whereas Hiram Swank's Sons, Inc. (South Fork), produced flint fire clay. The fire clay was used in manufacturing glass refractories, building brick, vitrified sewer pipe, and miscellaneous refractories. Miscellaneous clay was produced by Triangle Clay Products Co. from an open pit near Johnstown for use in manufacturing building brick.

Nicosia Stone Quarry operated a pit and fixed plant near Johnstown, producing building sand.

Lanzendorfer Trucking Co. produced and marketed crude iron oxide pigments of the yellow sulfur-mud variety from its No. 31 mine near Twin Rocks for paint pigments.

Cameron.—Bituminous coal was produced in 1957 from one strip mine.

Carbon.—Anthracite was produced from underground and strip mines in 1957. The principal producers of anthracite were Coaldale Mining Co., Inc., Panther Valley Coal Co., Valley Stripping Corp., Spearhead Mining Co., and Gravine Coal Co.

North American Refractories produced ganister rock at the Little Gap quarry and crushed it at Palmerton for use in making silica brick.

Alliance Sand Co., Inc. (Palmerton), produced sand and gravel, principally for building and paving material but also for fire or furnace sand and engine sand. Butz Lumber Co. (Palmerton) produced building sand. Wagner Sand Co. recovered building sand and gravel from a pit and fixed plant near Weatherly.

Panther Valley Coal Co., Inc., produced miscellaneous clay as a byproduct of anthracite mining and sold the material for manufacturing lightweight aggregate.

Centre.—Centre County led the State in lime production; however, output decreased slightly compared with 1956. Three companies reported lime production: Standard Lime & Cement Co., Pleasant Gap, (quicklime); and National Gypsum Co. and Warner Co., both of Bellefonte, (quicklime and hydrated lime). The principal uses of lime were for paper manufacture and metallurgical, chemical, and other industrial uses.

Ninety-two percent of the county's production of bituminous coal came from the 22 active strip mines, 7 percent from 17 underground mines, and the rest from 1 auger mine. About 2 percent of the total production was mechanically cleaned. Forty-one power shovels and thirteen draglines were used to produce strip-mine coal.

Six companies reported output of crushed limestone, principally from quarries near Pleasant Gap, Bellefonte, State College, and Howard. The most important uses of the stone were for concrete aggregate, roadstone, open-hearth flux, and cement manufacture.

Flint fire clay was produced from an open pit near Snow Shoe by

J. H. France Refractories Co. for making firebrick and block. Harbison-Walker Refractories Co. produced plastic fire clay 2 miles northeast of Stormstown for use locally in manufacturing firebrick and block. General Refractories Co., a previous large producer of clay, did not report any production from its mines near Orviston.

The United States Army Corps of Engineers used sand and gravel produced by contractors to construct locks.

Chester.—Bradford Hills Quarry, Inc., the leading limestone producer in the county, operated a quarry and crusher near Downingtown, producing limestone for road material. Valley Forge Stone Co. (Malvern) produced crushed limestone for road material and blast-furnace flux. The Cedar Hollow quarry and plant at Devault, operated by Warner Co., Bellefonte Division, yielded limestone which was crushed for use as blast-furnace flux, in refractories, for manufacture of lime, at chemical plants, and for other purposes. Warner Co. also operated a lime plant near Devault producing both quicklime and hydrated lime from a limestone mine at Cedar Hall quarry. W. E. Johnson, Inc. (Howellville), produced dimension limestone for rough construction and crushed limestone for road material. This operation was taken over by Warner Co. in February 1957.

Keystone Trappe Rock Co. quarried and crushed basalt near Glenmoore for use as road material, railroad ballast, and riprap. Some of the basalt was sold to Government agencies for road construction. V. DiFrancesco & Son (Devault) quarried and crushed basalt as road material and railroad ballast.

French Creek Granite Co. produced black diabase dimension stone from a quarry near Saint Peters for use as rough and dressed building stone, monuments and mausoleums, and paving blocks.

Dimension sandstone was quarried by Alfred V. Moulder, Avondale Colonial quarry (Avondale), and Albert Rotunno, Rotunno quarry (West Grove). The stone was sold or used by the two companies as rough construction stone, rubble, and curbing and flagging. Abe Minor quarried dimension sandstone (bluestone) at the Avon-Grove quarry (Avondale) for rubble, rough architectural blocks, and flagging. John Fecondo & Sons (Avondale) quarried irregular-shaped dimension sandstone for building facestone.

McAvoy Vitriified Brick Co. mined miscellaneous clay near Phoenixville for making building brick. Philip D. Cope produced miscellaneous clay near Nottingham for use in making flowerpots.

Marlyn Fabs (Coatesville) reported collecting garnet as a gem stone.

Clarion.—Clarion County ranked second among the counties in strip mining of bituminous coal in 1957, with 13 percent of the State strip-mine tonnage. Seventy-nine power shovels and 39 draglines were used at the 36 active strip mines in 1957. A smaller quantity of coal was produced from 17 underground mines.

Plastic fire clay was produced by New Bethlehem Tile Co. (New Bethlehem) and Harbison-Walker Refractories Co. (Lucinda); Niles Fire Brick Division, Mexico Refractories Co. (Lucinda) produced flint fire clay. Climax Fire Brick Co. (north of Climax in Clarion County) produced both plastic and flint fire clay. In addition to fire clay, the New Bethlehem Tile Co. produced miscellaneous clay. Frank B. Pope Co. also produced flint fire clay, which was sold on the open market. Fire clay was 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 led in production of bituminous coal from strip mines in 1957, with 24 percent of total State output. Output from the 120 active strip mines represented 75 percent of the county's bituminous-coal production in 1957. Clearfield County with 10 auger mines ranked second in auger-mine production. Ninety-three underground mines were active. At the strip mines, 241 power shovels and 85 draglines were used.

Clearfield County was the leading producer of clays in both tonnage and value in 1957; the output comprised fire clay and miscellaneous clay. Tonnage decreased from 630,000 to 577,000 short tons and value from \$5.6 to \$5.1 million. Thirteen companies were active in 1957. Plastic fire clay was produced by 8 companies, operating 42 mines near Clearfield. Companies producing over 50,000 short tons of plastic fire clay were Harbison-Walker Refractories Co., Robinson Clay Products Co., and Williamsgrove Clay Product Co., Inc. The production by Harbison-Walker Refractories Co. was used to manufacture refractories; the other two companies used the clay to make building brick and vitrified sewer pipe. Flint fire clay was produced by North American Refractories Co. (Curwensville) and General Refractories Co. (Clearfield); Laclede-Christy Co., Division of H. K. Porter Co., Inc., produced both plastic and flint clay. These fire clays were used in manufacturing refractories. Union Clay Co., Inc. (Grampian), W. K. Turner & Sons (Wallaceton), and Archie K. Baughman (Bigler) produced clay for sale on the open market. Captive production of miscellaneous clay and plastic fire clay was also recovered by Williamsgrove Clay Products Co., Bigler, for making building brick and by Robinson Clay Products Co., Clearfield, for making vitrified sewer pipe.

Clearfield Lime Corp. produced paving gravel from a pit and fixed plant near Clearfield.

Harbison-Walker Refractories Co. exfoliated vermiculite at its No. 2 works. The exfoliated vermiculite was used to manufacture insulation brick.

Clinton.—In 1957, bituminous coal in Clinton County was mined from 1 auger, 6 underground, and 7 strip mines, producing 1, 6, and 93 percent, respectively, of the total county tonnage. Ten power shovels and 6 draglines were used at the strip mines.

Lycoming Silica Sand Co. crushed and sized limestone for concrete aggregate, roadstone, and railroad ballast at the Salona quarry and plant. Some road material was sold under contract to the Pennsylvania Department of Highways.

Diaspore-type fire clay was produced from an open pit by Kelsey Mining Co. and sold for manufacturing high-alumina brick. Mill Hall Clay Products, Inc., produced miscellaneous clay from an open pit for making heavy clay products. North American Refractories reported that the underground mine near Lock Haven and the open pit near Renovo were closed.

Columbia.—Anthracite was produced from underground and strip mines in 1957. The principal producers were: Raven Run Coal Co.; Junedale Coal Co., Inc.; Susquehanna Collieries, Division of the

M. A. Hanna Coal Co.; Sanchez Construction Company; and L. & M. Coal Co.

Bloomsburg Sand & Gravel Co. produced washed building sand and gravel from a pit and processing plant near Bloomsburg.

The Allied Clay Product Co. leased the open pit previously operated by Lloyd E. Eister and used the miscellaneous clay to produce drain-tile and flue liners.

Crawford.—Sand and gravel was produced from five pits in various sections of the county, principally near Cochranon, Saegertown, Conneaut Lake, and Titusville. Output was used mainly for building and paving material. Some sand and gravel was sold to local Government agencies.

Cumberland.—Valley Quarries, Inc. (Shippensburg), and R. W. Smith & Son (Bowmansdale) quarried and crushed limestone, solely for use as road material. Locust Point Stone Quarries (Mechanicsburg) produced limestone for road material and agricultural purposes.

C. L. Goodhart (Walnut Bottom) produced building sand and paving gravel. Raymond Bender & Son and Hempt Bros. (both near Mount Holly Springs) produced building sand and paving sand and gravel, respectively.

Kaolin used to produce portland and other hydraulic cements, was recovered by Philadelphia Clay Co. from an open pit near Mount Holly Springs.

Dauphin.—The Steelton quarry of Bethlehem Limestone Co. in the southwestern area of the county (near Steelton) yielded limestone which was crushed at the local plant for use as blast-furnace flux, concrete aggregate, roadstone, stone sand, and railroad ballast and in refractories. Hoffman Bros. & Wilson, Inc., produced crushed limestone for road material from the Elder quarry and plant in the southwestern area (near Harrisburg). Crushed basalt for road material was produced near Elizabethville by Faylor Lime & Stone Co., and some was sold under contract to the Pennsylvania Department of Highways.

The major part of the anthracite output of this county in 1957 came from underground mines; a small quantity came from strip mines. The principal producers of anthracite were: Spring Glen Coal Co., Reed & Weist Coal Co., Howard Koppenhaver, J. Troup Co., and Hites Coal Co.

Three clay producers were active in 1957. Bethlehem Limestone Co. recovered miscellaneous clay from an open pit near Steelton, selling the material for use in making foundry refractories and protective coating for pipes. Captive clay was produced by Glen-Gery Shale Brick Corp. from open pits near Harrisburg and Middletown, using the miscellaneous clay to make building brick.

H. E. Millard Lime & Stone Co. operated 8 shaft kilns near Hershey to make quicklime for use in open-hearth furnaces and 1 continuous hydrator to produce hydrated lime for agricultural purposes.

Three companies reported output of sand and gravel: F. H. Downey, Inc. (Harrisburg), Highspire Sand & Gravel Co., Ltd. (High Spire), and Pennsylvania Supply Co. (east of Amity Hall). Production of sand and gravel was used mainly as paving material.

Delaware.—General Crushed Stone Co. (Glen Mills) and V. Di-Francesco (Llanerch) produced crushed basalt for use as road material

and railroad ballast. Media Quarry Co. (Media) quarried dimension sandstone for rough construction. Miscellaneous dimension stone for use as rough and dressed building stone was quarried by Carl Galantino, Inc. (Media). F. Cantano & Sons quarried dimension granite at the Foxcroft quarry (Broomall) for rubble and architectural stone. Lima Building Stone Quarry, Inc. (Lima), produced dimension granite as irregular-shaped construction stone.

Perlite Products Corp. operated a plant at Primos to expand perlite, which was marketed principally as a building plaster aggregate.

Sinclair Refining Co. produced brimstone as a byproduct in the liquid purification of gas by the Claus-type process at its Marcus Hook Refinery.

Elk.—Approximately the same quantity of coal was produced from the 15 underground mines as from the 11 strip mines; also active in 1957 was 1 auger mine.

Plastic fire clay was produced by Saint Marys Sewer Pipe Co. for making vitrified sewer pipe. Meyer Clay Mine was operated by William J. Meyer to produce plastic fire clay which was sold on the open market for making firebrick and block.

Stone Haven Mix produced paving gravel at a pit and fixed plant near Johnsonburg and sold it under contract to local Government agencies.

William DeSalve (Brandy Camp) produced and sold sulfur mud for manufacture of paint pigments.

Erie.—Four companies reported output of sand and gravel—three near Fairview, Lake City, and Springfield and one near Erie. Production was used principally as sand and gravel for building and paving and molding sand.

Reed-sedge and humus peat was recovered from a bog in the southeastern section of the county (near Corry) by Corry Peat Products Co.

Fayette.—Ninety percent of the county coal production came from 54 underground mines in 1957. Also active were 51 strip mines and 1 auger mine. Ninety-one cutting machines were used to produce 98 percent of the underground production. Thirty-three percent of the total county output of coal was mechanically cleaned.

Plastic fire clay was produced by Harbison-Walker Refractories Co. (2 miles east of Ohiopyle) and Big Savage Refractories, Division of Mexico Refractories Co. (Ohiopyle) for local plants to use in making firebrick and block. Miscellaneous clay was produced by Layton Fire Clay Co. for use by a nearby company plant in making building brick. Plastic clay and flint fire clay were produced by Robert N. Matthews (Uniontown) and sold on the open market for use in making firebrick and block.

Vesco Corp. crushed, ground, and sized limestone, recovered from the Lake Lynn quarry near Mercersburg, and marketed the stone for road material, rock dust for coal mines, and agricultural use. Connellsville Bluestone Co., south of Scottdale in Fayette County, crushed and sized sandstone for road material, selling some of the material to the Pennsylvania Department of Highways. General Refractories Co. produced crushed ganister rock at the Childs quarry and plant (Layton) for making silica brick.

McClain Sand Co. recovered sand and gravel by dredging in the

southwestern part of the county at Point Marion and washed it for use as paving and road material.

Forest.—Tionesta Sand & Gravel, Inc., recovered and washed building sand and gravel and paving sand from a dredge in the southwestern section of Forest County at Tionesta.

Franklin.—Five companies produced limestone from 6 quarries—2 in the northeastern section of the county near Shippensburg and Orrstown, 2 in the southeastern section near Zullinger and Chambersburg, 1 in the northwestern area near Dry Run, and 1 in the southwestern area near Williamson. The output of crushed stone was marketed mainly for concrete aggregate, roadstone, and agricultural use.

Mount Cydonia Sand Co., Inc. (Chambersburg), and Caledonia Sand Co. (Fayetteville), produced and washed sand for use as building material.

Frank L. Heinbaugh, Mercersburg, produced quicklime for agricultural purposes, using three shaft kilns.

Fulton.—H. B. Mellott Estate, Inc., operated the Charleston quarry (Warfordsburg) and the Morton quarry (Big Cove Tannery), producing crushed limestone for concrete aggregate, roadstone, and agricultural use. Most of the material was sold under contract to Government agencies for road construction. John P. Martz & Son quarried crushed limestone solely for lime manufacture at the Martz Draw Kiln (Hustontown). Lime produced by John P. Martz & Son was marketed for agricultural use.

Greene.—Greene County ranked second in the production of bituminous coal and in output of underground coal, with 14 and 19 percent of total State production, respectively. At the mines, 190 machines were used to cut 12.3 million short tons of coal. Of the county coal production, 80 percent was mechanically cleaned using jigs and pneumatic and other wet methods. Also active in 1957 were 2 strip mines where 3 power shovels were used to produce 6,000 short tons of coal.

Huntingdon.—Huntingdon County ranked third in the value of sand and gravel produced in the State. Alexandria Fire Clay Co. (Alexandria) produced fire or furnace sand from a pit and fixed plant. Pennsylvania Glass Sand Corp. produced washed sand at its quarry and fixed plant at Mapleton Depot for use as glass, molding, and engine sand and for grinding and polishing and miscellaneous purposes. In addition, the company produced ground sand for use in making enamel, foundry molds, glass, pottery, and abrasives.

Tyrone Lime & Stone Co. recovered limestone from the Stover No. 1 quarry (Warriors Mark Township), crushing it for road material, agricultural use, and dust for coal mines. New Enterprise Stone & Lime Co. produced limestone as concrete aggregate and roadstone at its quarry and plant (McConnellstown). A quantity of the stone was sold under contract to the Pennsylvania Department of Highways. Warner Co., Bellefonte Division, produced crushed and sized limestone at the Union Furnace quarry and plant for use as concrete aggregate, roadstone, railroad ballast, and riprap. Ganister rock, quarried and crushed by Harbison-Walker Refractories Co. (Mount Union) and North American Refractories Co. (Three Springs), was used to manufacture silica brick.

Nine underground and five strip mines were active in 1957.

Two companies produced fire clay for making refractories in 1957. Production by Alexandria Fire Clay Co. was sold on the open market; output of Harbison-Walker Refractories Co. was captive production.

Indiana.—Eighty-four percent of the county's bituminous-coal production came from 86 underground mines, and 98 percent of the coal from these mines was cut mechanically. Of the total county production, 80 percent was mechanically loaded and 70 percent mechanically cleaned. More coal was cleaned by methods other than jigs or pneumatic methods. Also active in 1957 were 40 strip mines and 4 auger mines. Indiana was the third ranking auger producer in 1957.

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.

John Kippert and Paul Kippert (Smicksburg) produced crushed limestone for agricultural use.

Jefferson.—Bituminous coal was produced at forty-three underground mines, 32 strip mines, and 2 auger mines. Thirty-nine percent of the coal came from underground mines and 60 percent from strip mines. Sixty-one power shovels and fourteen draglines were used to produce 969,000 short tons of strip-mine coal. About 10 percent of the total county production of the coal was mechanically cleaned.

Plastic fire clay in 1957 was produced by 3 companies—The Brockway Clay Co. (Brockway), Hanley Co. (Summerville), and Henry O'Neill & Co. (Brookville). Production by the first two companies was captive and used to make heavy clay products, whereas production by the third company was sold on the open market for use in making firebrick and block.

Juniata.—Juniata Limestone Co. (McAlisterville, Fayette Township) and W. N. Quigley (Mifflintown) produced crushed limestone for use as road material and sold some under contract to Government agencies. National Refractories Division, Mexico Refractories Co., recovered ganister rock and crushed and used it at the Van Dyke plant (Thompsonstown) to manufacture silica brick.

Lackawanna.—Anthracite was produced from underground mines, strip mines, and culm banks in 1957. The principal producers were: Hudson Coal Co., Moffatt Coal Co., Diamond Colliery Coal Co., Inc., Village Slope Coal Co., and Turnpike Coal Co.

Lancaster.—Crushed limestone was produced by 12 companies, operating 15 quarries in 1957. Two leading producers were D. M. Stoltzfus & Son, Inc., operating quarries near Talmage and Quarryville, and Ivan M. Martin, Inc. (Blue Ball). Major production was recovered from operations in the northeastern section of the county near Denver, Talmage, Bareville, Blue Ball, and Ephrata. The limestone was used principally as concrete aggregate, roadstone, stone sand, railroad ballast, and agricultural purposes. Quantities of the stone were sold to State and nearby Government agencies mainly for road construction. Some dimension limestone was produced and marketed for use as facing in constructing houses and churches.

The J. E. Baker Co. operated its Billmyer plant near Bainbridge producing dead-burned dolomite as refractory material. Amos K.

Stoltzfus operated a lime plant 2 miles west of Morgantown, producing hydrated lime for agricultural and building use.

Anthracite was recovered by dredging operations in Lancaster County.

Sand for use as paving material was recovered from pits operated by Hempt Bros. (Elizabethtown) and Milton Grove Sand, Inc. (Milton Grove). A. T. Harris Sand Co. produced washed sand and sold it for use as fire or furnace sand.

Miscellaneous clay, used to make building brick, was produced by Glen-Gery Shale Brick Corp. (Ephrata), A. G. Kurtz & Sons, Inc., and Lancaster Brick Co. (Lancaster). Plastic fire clay was mined from an open pit near Narvon by Whitaker Clay Co. for use in making high-alumina brick and foundry refractories.

Marlyn Fabs reported recovering willemite, a semiprecious gem stone from the southern area of the county along the State line.

Lawrence.—Both portland and mortar cements were produced in Lawrence County in 1957. Production at the Bessemer plant of Bessemer Limestone & Cement Co. consisted of Types I-II, Type III, portland and pozzolan, waterproof-portland, and mortar cement. Types I-II, Type III, waterproof-portland, and mortar cement also were produced by Medusa Portland Cement Co. (Wampum).

Lawrence County again ranked second in value of stone among the counties of the State. Limestone production in the county was used mainly for blast-furnace and open-hearth flux and manufacturing cement; smaller quantities were used for road material, dust for coal mines, and agricultural purposes. The limestone was recovered from 3 quarries in the western section of the county near Bessemer, at Hillsville, and in Mahoning Township and from 1 quarry in the southern area near Wampum.

Twenty-four strip mines, 1 underground mine, and 1 auger mine were active in 1957. A total of 34 power shovels and 23 draglines was used at the strip mines to produce 1 million short tons of bituminous coal.

Fenati Brick Co., Inc. (New Castle), and Metropolitan Brick, Inc. (Bessemer), produced both plastic fire and miscellaneous clay, whereas Keystone Loam & Clay Co. (Edinburg) produced only miscellaneous clay. The captive production by the first two companies was used in making building brick whereas the clay sold on the open market was used in making foundry refractories.

Superior Sand & Supply Co. recovered building sand and gravel and paving sand at its New Castle quarry and plant. Mahoning Valley Sand Co. (West Pittsburg, Taylor Township) produced building and paving sand and gravel.

Zonolite Co. operated a plant at Ellwood City for exfoliating vermiculite.

Lebanon.—Lebanon County was the only county in Pennsylvania producing metal in 1957. Iron, copper, cobalt, pyrites, gold, and silver were mined.

The Cornwall mine, 5 miles south of Lebanon, was operated by Bethlehem Cornwall Corp., a subsidiary of Bethlehem Steel Co. Mining was 98 percent by block caving and 2 percent by open stope. Crude ore from the Cornwall mine was crushed to minus 1½ inches at the mine and transported by rail to the Lebanon concentrator. From

the Lebanon concentrator, sinter and pellets were shipped to Steelton, Pa.; pyrite concentrate to Sparrows Point, Md.; and copper concentrates to Laurel Hill, N. Y.

H. E. Millard Lime & Stone Co., the leading limestone producer in the county, operated an underground mine near Palmyra and a quarry near Annville. Chief uses of the output from the company Annville plant were: Blast-furnace flux, road material, manufacture of lime and cement, agricultural purposes, and railroad ballast. In addition to limestone properties, H. E. Millard Lime & Stone Co. operated two lime plants in Lebanon County in 1957. Both quicklime and hydrated lime were manufactured at the Annville plant; the quicklime was marketed principally for metallurgical uses and the hydrated lime for water purification. Quicklime for use in open-hearth furnaces was produced at the Palmyra plant. Limestone also was recovered from 2 other quarries near Annville and Palmyra and from 2 quarries near Cornwall and Lebanon. Output from these four quarries was used principally for blast-furnace and open-hearth flux, concrete aggregate, roadstone, and cement manufacture.

Fialla Crushed Stone Corp. closed the White Hall quarry near Annville owing to the depletion of stone. North American Refractories (Womelsdorf) produced ganister rock, transporting the stone by aerial tram from the quarry to the plant for use in making silica brick.

Anthracite in Lebanon County was recovered solely by dredging.

Lehigh.—Shipments of portland cement from the 5 plants active in 1957 were 17 percent less than in 1956. Types I-II, Type III, and waterproof-portland cement were produced by Coplay Cement Manufacturing Co., Types I-II and Type III by Whitehall Cement Manufacturing Co. (Cementon) and Lehigh Portland Cement Co. (Fogelsville), and only Types I-II by Giant Portland Cement Co. (Egypt) and Lehigh Portland Cement Co. (Ormrod). All plants except the one at Ormrod also produced masonry cements.

The output of crushed limestone and cement rock was used solely for cement manufacture by Lehigh Portland Cement Co. (Ormrod and Fogelsville), Giant Portland Cement Co. (Egypt), and Coplay Cement Manufacturing Co. (Coplay). Lehigh Stone Co. produced limestone at the company quarry and plant at Ormrod, crushing and sizing the material for use as concrete aggregate and roadstone. A quantity was sold under contract to Government agencies. Susquehanna Quarry Co. (Alburtis), produced crushed and broken sandstone for road material. Robert A. Reichard, Inc. (Allentown), crushed oystershell for poultry grit.

Slate was produced from an open quarry and processed by Penn Big Bed Slate Co., Inc.; it was sold for various uses, but primarily for roofing, blackboard, and structural purposes.

The Pennsylvania Perlite Corp. expanded perlite at a plant at Allentown, using crude perlite mined in Nevada and New Mexico.

Luzerne.—Anthracite was produced from underground and strip mines and from banks in 1957. Glen Alden Corp., Lehigh Valley Colliery, Jeddo-Highland Coal Co., M. A. Hanna Co., and Hudson Coal Co. were the principal producers of anthracite in 1957.

Sand and gravel, sold principally for use as building and paving material, was recovered from 5 pits—4 near Wyoming, Forty Fort,

Kingston, and Avoca and 1 in the southern area near Drums. Most of the material was sold under contract to local Government agencies.

The North Mountain quarry (Sweet Valley) of Coon Certified Concrete yielded small quantities of dimension sandstone for rubble and of crushed sandstone for riprap and road material. Hays Bros. Stone Co. (White Haven), produced dimension sandstone (bluestone) for rough construction, dressed architectural, and flagging stone. General Crushed Stone Co. (White Haven), quarried and crushed sandstone for road material and railroad ballast.

Pennsylvania Peat Moss, Inc., recovered humus peat, and Blue Ridge Soil Pep Co. recovered reed-sedge and humus peat from bogs in the southeastern section of the county near White Haven.

Miscellaneous clay was produced from an open pit near Hazleton and used to make building brick by Hazleton Brick Co.

The Beryllium Corp. of Reading, Pa., built a new plant at Ashmore to process beryl to reactor-grade beryllium for the Atomic Energy Commission (AEC). The company converted an old machine shop at an estimated cost of \$1,250,000.

Lycoming.—Lycoming Silica Sand Co. recovered limestone from the Lime Bluff quarry near Muncy and the Pine Creek quarry near Jersey Shore. The stone was crushed and sized at local plants for use as road material and agricultural stone. Susquehanna Quarry Co. operated a quarry and crusher near Jersey Shore and produced limestone for road material. Some of the material was sold to local Government agencies. Dimension sandstone was quarried by John T. Morgan (Slate Run) for flagging. Miscellaneous dimension stone sold or used as rubble was quarried by Callahan & Haines (Slate Run).

J. A. Eck & Sons, Inc. (Montoursville), produced building sand and gravel and paving sand. Lycoming Silica Sand Co. (Montoursville) reported output of building and paving sand and gravel, molding and engine sand, sand for use in preparing anthracite, and gravel for railroad ballast.

Bituminous coal was produced from four underground and two strip mines in 1957. None of the production was mechanically cleaned.

Tripoli was produced from open pits by Keystone Filler & Manufacturing Co. and Muncy & Penn Paint & Filler Co., Antes Fort. After crushing, drying, and pulverizing, the rottenstone was marketed for use as an abrasive and filler.

Keystone Filler & Manufacturing Co. produced shale at the Shedly Quarry near Muncy for use in making paints.

McKean.—Plastic fire clay was produced by Kaul Clay Products Co. from an open pit near Clermont for use at a local plant in manufacturing hot tops for steel mills and vitrified sewer pipes. Plastic fire clay produced by Kness Bros. (Mount Jewett) was marketed for use in manufacturing foundry refractories. Hanley Co. recovered clay from an open pit at Lewis Run for use at a local plant in making building brick and marketed a small quantity for the production of floor and wall tile.

C. L. McGovern, Jr., mined molding sand from a pit at Eldred.

Strip mines were active in 1957, producing bituminous coal.

Mercer.—Ninety percent of the county's bituminous-coal production came from nine strip mines in 1957; the remainder came from

three underground mines where all of the coal was cut by machines. None of the coal produced in the county was mechanically cleaned.

Seeger Sand & Gravel (West Middlesex) produced building sand and gravel and paving gravel. Transfer Sand & Gravel (Transfer, South Pymatuning Township) reported output of building sand and gravel and sand for use as fill. Seidle Sand & Gravel Co. (Mercer) produced building sand and paving sand and gravel.

D. M. Boyd and Moores Peat Humus Co. recovered humus peat from bogs north of New Wilmington.

The Rock Kastle quarry (north of Volant), operated by Welty M. Smeltzer, yielded dimension sandstone sold or used as dressed or cut architectural stone.

Mifflin.—James R. Kline's Sons recovered sand by dredging along the Juniata River near Lewistown and sold it for use as building and paving material. Miller Silica Sand Co. operated a pit and fixed plant near Burnham, producing sand for molding, building, and fire or furnace sand and for other uses. Pennsylvania Glass Sand Corp. (McVeytown) recovered sand from a pit and prepared it at a local plant for use as glass, molding, grinding and polishing, and engine sand and for miscellaneous purposes.

The Naginey quarry (near Milroy), operated by Bethlehem Limestone Co., yielded limestone that was crushed and marketed for use as blast-furnace flux, road material, and stone sand. Haws Refractories Co. (Hawstone) used its output of crushed quartzite to manufacture silica brick at a company refractory plant.

Quicklime for agricultural use was produced by Ehrenzeller Lime Co. near McVeytown.

Monroe.—Hamilton Stone Co. produced limestone for concrete aggregate, roadstone, and cement manufacture at the Bossardsville quarry and crusher. Some road material was sold to the Pennsylvania Department of Highways.

Steward White and Clyde White recovered building sand and gravel from a pit near Stroudsburg. Sheesley Minerals, Inc. (Kunkletown), produced paving sand. Coolbaugh Sand & Stone, Inc. (Tobyhanna), produced building and paving sand and gravel, which was sold under contract to local Government agencies.

Montgomery.—Montgomery County continued to lead in the value of stone production in the State, although tonnage decreased 19 percent and value decreased 15 percent from 1956. Five limestone operations, concentrated in the southeastern section of the county near West Conshohocken, Bridgeport, Norristown, Oreland, and Plymouth Meeting, were active during the year. The chief uses for the output from these operations were: Concrete aggregate, roadstone, blast-furnace and open-hearth flux, agricultural purposes, glassmaking, and lime and cement manufacture. Montgomery Stone Co., Inc. (Montgomeryville), produced dimension basalt for use as rough and dressed building stone and crushed basalt for railroad ballast. R. K. Kibblehouse (Perkiomenville) quarried and crushed basalt for road material and sold some under contract to State and local government agencies. Dimension quartzite for rough architectural blocks and crushed stone for steel furnace and converter linings were produced by Fire Stone Products Co., Inc. (Glenside). Wm. Bambi & Sons, Inc. (Norristown), produced crushed sandstone for use as building material. Miscella-

neous stone (argillite) was mined at Harleysville by M & M Stone Co. for road material. A. Manero & Sons (Glenside) produced miscellaneous dimension stone sold as rough building stone. Marcolina Bros., Inc., operated the Hillcrest quarry (Cheltenham) producing dimension granite for use as irregular-shaped construction stone.

Allentown Portland Cement Co. produced cement rock and limestone at its West Conshohocken quarry for use in manufacturing cements at its No. 2 plant. Types I-II portland cement and masonry cement were produced at the West Conshohocken plant.

Quicklime and hydrated lime were produced by G. & W. H. Corson, Inc., Plymouth Meeting. Hydrated lime was marketed for building, agricultural, and metallurgical use, whereas the quicklime was marketed as agricultural lime and refractory material.

Miscellaneous clay was produced by Lansdale Brick Products Co. (Lansdale), Keller-Whilldin Pottery Co. (North Wales), and Norristown Brick Co. (Norristown). This clay was used at local plants to produce building brick and flowerpots. Robinson Clay Product Co. produced plastic fire clay and miscellaneous clay at Pottstown, using the clays at a local plant to make vitrified sewer pipe.

William Bambi & Sons, Inc. (Norristown), recovered sand for building purposes at its pit and local plant.

The Refractory & Installation Corp. expanded perlite at a plant at Port Kennedy, marketing the expanded perlite for use as a filler in refractory materials.

Magnesium carbonate, magnesium oxide, and magnesia insulation were produced from raw dolomite by Keasbey & Mattison Co. (Ambler) and Philip Carey Manufacturing Co. (Plymouth Meeting).

Montour.—Lycoming Silica Sand Co. produced crushed limestone for road material and agricultural use from a quarry and plant east of Milton. Maudsley Quarry Co. quarried limestone, solely for road material, from the Grovania quarry near Danville. Both companies sold some of the road material to local Government agencies.

Northampton.—Northampton remained the leading cement-producing county in Pennsylvania, but output decreased 17 percent in barrels and 12 percent in value compared with 1956. Ten companies reported manufacturing cements from cement rock and limestone, either purchased or produced at local company quarries. Plants were at Martins Creek, Northampton, Stockertown, Bath, Nazareth, Bethlehem, and Sandts Eddy. Output from these plants was comprised of Types I-II, Type III, white portland, and masonry cements.

Northampton County also led in the total value of slate production in 1957. Twelve producers were active in 1957, 5 at Pen Argyl, 4 at Bangor, 2 at Windgap, and 1 at Bath. In value of production, the 5 largest producers were D. Stoddard & Sons, Inc., Anthony Dally & Sons, Stephens Jackson Co., Diamond Slate Co., and Albion Vein Slate Co. The processed slate was marketed for roofing slate, electrical slate, blackboard slate, flagging stone, billiard tables, grave vaults and covers, and structural and sanitary use.

Twelve active producers reported output of limestone and cement rock in the county during the year. The leading producers were: Penn-Dixie Cement Corp. (plant No. 4 at Nazareth and plant No. 6 at Penn Allen); Keystone Portland Cement Co. (Bath); and Hercules Cement Co., Division of American Cement Corp. (Stockertown).

Other operations were scattered throughout the county near Sandts Eddy, Martins Creek, Northampton, Bethlehem, and Brodhead. Most of the limestone and cement rock was used at the company plants to manufacture cement or crushed and sold for road material, railroad ballast, and agricultural purposes.

Paving sand and gravel was produced at a pit by W. J. Lowe & Sons (Bangor). Houdaille Construction Materials, Inc. (Portland), produced sand and gravel for building and paving material and sold a quantity under contract to local government agencies. Dredging was the only method used to recover anthracite in Northampton County.

Northumberland.—Anthracite came principally from underground and strip mines and smaller quantities from banks. The leading producers were Reading Anthracite Co., M. A. Hanna Coal Co., Mammoth Coal Co., Raven Run Coal Co., and Stevens Coal Co. Three companies—Glen-Gery Shale Brick Corp., Watsonstown Brick Co., and Watsonstown Mineral Products Co.—all at Watsonstown, produced miscellaneous clay from open pits for use in making heavy clay products and as a filler in making linoleum and phonograph records. Eugene Meckley produced limestone at Meckley's quarry near Herndon and crushed and ground the stone at a local company plant for road material and agricultural use. A quantity of the roadstone was sold under contract to local Government agencies. Susquehanna Quarry Co. (Dalmatia) produced crushed sandstone for concrete aggregate and roadstone. Sand for building sand and as a fill was mined by Wilsons Sand Plant (Montandon). Molding sand was mined by M. E. Wallace Co. (Sunbury). Agricultural lime was produced in 1957 by Clyde Starook. F. E. Evans Co. did not operate its kilns in 1957.

Perry.—Limestone, used entirely for road material, was quarried and crushed at the local plant near Newport by Bradford Hills Quarry, Inc. A quantity was sold to local Government agencies for road construction.

Philadelphia.—Dredging operations along the Delaware River by The Liberty Corp. (Philadelphia) yielded sand and gravel for use as building material. Some gravel was sold to local Government agencies. The Atlantic Refining Co. continued to recover hydrogen sulfide as a byproduct in the liquid purification of gas at its plant in Philadelphia. The Girdler System using diethanolamine and monoethanolamine was used.

Potter.—Penn Kress Flagstone Co., Inc. (Wharton), quarried dimension sandstone sold or used for rough construction, rough architectural blocks, and flagging.

Schuylkill.—Underground mines, strip mines, and banks were operated in 1957 to produce anthracite. Leading producers in 1957 were: Reading Anthracite Coal Co., Gilberton Coal Co., New Kirk Mining Co., Coaldale Colliery Corp., and Mammoth Coal Co.

The Andreas quarry, operated by Huss Contracting Co., yielded limestone. The stone was crushed and sized at a local plant at Andreas for concrete aggregate and roadstone. Harbison-Walker Refractories (Andreas) crushed and ground quartzite for manufacturing silica brick. Paving and fire or furnace sand was recovered from a

pit in the eastern section of the county near Andreas by Refractory Sand Co.

Miscellaneous clay was produced from an open pit by Auburn Brick Co. for use at a local plant in making building brick. Coaldale Mining Co., Inc., produced miscellaneous clay from an underground mine at Coaldale and marketed it for use in making lightweight aggregate.

Snyder.—Building bricks were manufactured from clay produced by Glen-Gery Shale Brick Corp. (Beavertown) and Paxton Brick Co. (Paxtonville), both operating open pits. Carton L. Comfort (Mount Pleasant Mills) crushed limestone at the local plant for manufacturing agricultural lime. National Limestone Quarry (near Paxtonville) produced and crushed limestone for road material and agricultural use. Anthracite was recovered by dredging operations in the county.

Somerset.—Somerset County led in number of active underground bituminous-coal mines in Pennsylvania, with 132 active mines. Of the county production, 65 percent came from these mines, 34 percent came from 72 strip mines, and the remainder from 4 auger mines. Ninety-five power shovels and 34 draglines were used at the strip mines in 1957.

Plastic fire clay was produced by Otto Brick & Tile Works (Springs) and W. S. Compton Brick Co., Inc. (Salisbury), for producing tile and by Hiram Swank's Sons, Inc. (Maple Ridge and Holsopple), for use in making pouring pit refractories. Flint fire clay was produced by General Refractories Co. at the Fort Hill underground mine for use in making firebrick.

Keystone Lime Co. (Springs) reported output of crushed limestone for agricultural purposes from a quarry and underground mine. Somerset Limestone Co., Inc. (Bakersville), operated the Bakersville quarry and plant, producing crushed limestone usable as road material. Robert Shaulis (Boswell) produced a small quantity of building sand.

Sullivan.—Anthracite was produced by stripping in 1957. The principal producer of anthracite was Bliss Coal Co.

Susquehanna.—Dimension sandstone (mostly bluestone) was recovered from a quarry in the northern part of the county near New Milford and from three quarries in the southeastern section of the county near Lenoxville, Harford, and Kingsley. Output was used as flagging stone. Edwin J. Evans (Brooklyn Township) quarried dimension sandstone usable for rubble and flagging. Keelor Supply Co. produced crushed sandstone for concrete aggregate and road material at the Bennett quarry (Royal).

Tioga.—Bituminous coal was mined from 7 underground and 5 strip mines in 1957.

Union.—Crushed limestone was produced by John L. Iddings and marketed as road material. Faylor Lime & Stone Co. operated a quarry and crusher near Winfield, producing limestone for road material and agricultural use.

Venango.—One underground and 10 strip mines produced bituminous coal in 1957. Oil City Sand & Gravel Co. recovered sand and gravel (building and paving) and gravel for use as fill and dirt road stabilization by dredging. Some of the material was purchased by the Pennsylvania Highway Department. Industrial Silica Corp.

produced and prepared sand for use as molding sand at its Utica pit and fixed plant.

Warren.—General Concrete Products Corp. (Warren), recovered sand and gravel for building and paving and sold it under contract to local Government agencies for road construction. Walter Schatzle (Warren) produced building sand and gravel.

Washington.—Washington County in 1957 was the leading county in output of bituminous coal and underground coal with 16 percent of the State's total production and 20 percent of its underground production. The county also led in tonnage of coal cut by machine with a total of 13 million tons cut by 206 machines. Besides the 27 underground mines, 24 strip mines and 1 auger mine were active in 1957. Ninety-five percent of the county production was mechanically loaded; 94 percent was mechanically cleaned.

Three companies—Monongahela Clay Products Co. (Monongahela), Donley Brick Co. (Washington), and Westmoreland Clay Products Co. (Washington)—made building brick from miscellaneous clay produced at local open pits.

Wayne.—Crushed sandstone sold or used for road material was quarried by Wayne Concrete & Sand Works (Lake Ariel). W. R. Strong & Son and Paul Tompkins Estate produced dimension sandstone, principally for use as dressed or cut architectural stone and flagging.

Wayne Concrete & Sand Works produced sand and gravel for building and paving and engine sand from a pit and fixed plant near Lake Ariel. Charles Caputo (Honesdale) mined sand for use as fill.

Westmoreland.—Sixty-four underground bituminous mines, 35 strip mines, and 2 auger mines were active in 1957, producing 3.8 million, 165,000, and 4,000 short tons of coal, respectively. Ninety-eight percent of the underground production was cut by machines. Of the county production, 91 percent was mechanically loaded and 55 percent mechanically cleaned. Use of jigs was a common method of cleaning coal, accounting for 42 percent of the cleaned coal.

Eidemiller Enterprises, Inc., produced crushed sandstone for road material at the Blue Rock quarry (Greensburg). Some of the material was sold to local Government and State agencies. Dimension sandstone sold or used as rubble was quarried by John C. Beaumont and Ray Branthoover (both north of Belle Vernon). Latrobe Construction Co. (Long Bridge) produced crushed limestone as concrete aggregate and roadstone. Dimension miscellaneous stone was recovered at Lynns Quarry (north of Belle Vernon in Westmoreland County) and sold as flagging stone.

Regional Refractories, Inc., produced plastic fire clay for use in manufacturing firebrick and block. Miscellaneous clay was produced by the Westmoreland Clay Products Co. at Youngwood and used to manufacture building brick.

Wyoming.—East Falls Sand & Gravel (Falls) and Wyoming Sand & Stone Co. (Falls Township) operated pits in the southeastern section of the county, producing sand and gravel for use as building and paving material. Engine sand was produced and washed at local company plants.

J. G. Robinson purchased sandstone from various stone producers in the county and processed the stone at the Fort Washington (Montgomery County) plant. The stone was sold or used as flagging.

York.—Medusa Portland Cement Co., the only cement producer in York County, manufactured cement by the dry process at its York plant. Types I–II, Type III, waterproof white, gray portland, and masonry cements were produced and sold.

Production of crushed limestone and cement rock was reported by 10 companies. Concrete aggregate, roadstone, cement manufacture, blast-furnace and open-hearth flux, riprap, and agricultural purposes were the chief uses for the output from these operations. Leading producers were Lincoln Stone, Inc., and Thomasville Stone & Lime Co. (both near Thomasville in the southwestern part of the county). Limestone also came from quarries near Wrightsville in the northeastern section of the county, near York, in the southeastern section, and in a few unspecified locations.

National Gypsum Co. operated its York plant to produce both quicklime and hydrated lime for various uses including agricultural lime, insecticides, paper, and water purification. The limestone used to produce the lime came from a nearby quarry. The J. E. Baker Co. produced dead-burned dolomite at its plant near Botts for use as refractory material.

Funkhouser Co., operating an open quarry at Delta, continued to be the only slate producer in York County. The slate was crushed and ground at a local plant for use as granules and flour.

Two captive clay mines were operated in 1957, both by Glen-Gery Shale Brick Corp. The miscellaneous clay was used at company plants to produce building brick.

Pennsylvania Supply Co. recovered paving sand and gravel from a pit near York Haven. Newman Sand & Supply Co. operated a pit and preparation plant at York, producing mostly building sand but also smaller quantities of sand for paving, engine, and miscellaneous uses.

An open pit and processing plant were operated by General Mining Associates (2 miles from Glenville) to produce ground mica.

Calcite, limonite cubes, and pyrite stones were collected near Thomasville and York by Marlyn Fabs.

The Mineral Industry of the Commonwealth of Puerto Rico, the Panama Canal Zone, and the Virgin Islands

The Puerto Rico portion 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 Mort D. Turner ²



PUERTO RICO

PUERTO RICO'S mineral industry established a new record in 1957 for the third consecutive year. Mineral production was valued at \$20.3 million, a \$3.9-million increase over the previous record set in 1956.

By the end of 1957 more than 2 million acres of land were under exclusive prospecting permits to private mining interests. Approximately \$200,000 was spent by private interests on exploration for iron, copper, lead, manganese, and other minerals in Puerto Rico. No commercial mining of metals was reported in Puerto Rico in 1957. Commonwealth Oil Refining Co., Inc., increased the capacity of its refinery to 58,800 barrels per day, and Caribbean Refining Co. operated its 13,500-barrel-per-day plant, giving the island a total crude capacity of 72,300 barrels.³ Gonzales Chemical Industries, Inc., completed a \$13-million ammonia plant with an annual capacity of approximately 47,000 tons of anhydrous ammonia and 125,000 tons of ammonium sulfate.⁴

REVIEW BY MINERAL COMMODITIES

Cement.—The cement industry supplied 85 percent of the total value of mineral production in Puerto Rico in 1957. The steady increase in industrial and defense construction resulted in a sharp increase in production and shipments of cement. About 33 percent of the cement shipments went to the continental United States and 8 percent to foreign countries.

Clays.—The cement industry used most of the clay produced in Puerto Rico in 1957. Production of miscellaneous clay near Carolina

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³ Oil and Gas Journal, vol. 56, No. 12, Mar. 24, 1958, p. 196.

⁴ Oil and Gas Journal, vol. 55, No. 35, Sept. 2, 1957, p. 134.

TABLE 1.—Mineral production in possessions of the United States, 1956–57, by individual minerals ¹

Possession and mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Canal Zone:				
Sand and gravel.....	40,095	\$48,673		
Stone (crushed) ²	177,250	229,750	59,407	\$98,897
Total Canal Zone.....		278,000		99,000
Puerto Rico:				
Cement.....376-pound barrels..	4,254,701	14,064,982	5,552,357	17,231,623
Clays.....	142,666	129,166	158,813	139,813
Salt (common).....	9,936	101,243	9,755	104,324
Sand and gravel.....	183,046	191,485	496,978	753,951
Stone.....	2,076,453	2,555,585	2,452,019	3,505,223
Value of items that cannot be disclosed: Cer- tain nonmetals.....		194,941		180,204
Total Puerto Rico ³.....		16,395,000		20,265,000
Virgin Islands: Stone (basalt).....	11,591	31,983	11,500	31,000

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Includes basalt.

³ The total has been adjusted to eliminate duplication in value of clays and stone.

TABLE 2.—Average unit values of mineral commodities in the Canal Zone, Puerto Rico, and the Virgin Islands, 1953–57 ¹

Area and commodity	1953	1954	1955	1956	1957
Canal Zone:					
Basalt, crushed and broken.....short ton..	\$1.35	\$1.31	\$2.02	\$1.84	\$1.91
Sand and gravel.....do.....	1.11		1.32	1.21	
Stone, miscellaneous, crushed.....do.....			1.10	1.00	1.19
Puerto Rico:					
Cement.....376-pound barrel..	2.56	2.62	3.04	3.31	3.10
Iron ore.....long ton.....	5.75				
Lime.....short ton.....	21.46	23.67	24.45	19.41	20.08
Salt.....do.....	9.60	11.20	10.71	10.19	10.69
Sand.....do.....	1.05	1.07	1.27	.76	1.68
Gravel.....do.....	1.13	2.53	1.72	1.51	1.10
Stone:					
Basalt.....do.....					
Granite, crushed and broken.....do.....	1.00				
Limestone:					
Crushed and broken.....do.....	1.90	² 1.37	² 1.37	² 1.21	² 1.39
Dimension.....do.....	2.04	2.12	2.18	1.90	1.99
Sandstone, crushed and broken.....do.....		2.13			
Miscellaneous stone:					
Crushed and broken.....do.....	1.70	2.42			1.33
Dimension.....do.....		1.09			
Virgin Islands: Stone, miscellaneous, crushed and broken.....short ton.....	4.25	4.35	5.60	2.76	2.70

¹ For greater detail on prices, by grades and markets, see vol. I, Minerals Yearbook, 1957.

² Includes limestone used for cement and lime.

in San Juan District increased in 1957. The output was used to manufacture heavy-clay products. Commercial studio pottery was produced from miscellaneous clay in Hato Rey in San Juan District.

Lime.—Lime was produced in Humacao and Mayaguez Districts in 1957 from very pure limestone. The output of lime in 1957 was less than that in 1956. The principal market for lime remained the raw-sugar industry.

TABLE 3.—Portland cement produced and shipped in Puerto Rico, 1948–52 (average), 1953–57, and total 1939–57, in 376-pound barrels

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1948–52 (average).....	3, 235, 788	3, 218, 013	\$8, 625, 049	\$2. 68
1953.....	3, 655, 614	3, 641, 135	9, 335, 421	2. 56
1954.....	3, 600, 064	3, 682, 187	9, 663, 445	2. 62
1955.....	4, 193, 592	4, 116, 739	12, 506, 784	3. 04
1956.....	4, 234, 284	4, 254, 701	14, 064, 982	3. 31
1957.....	5, 500, 553	5, 552, 357	17, 231, 623	3. 10
1939–57.....	46, 250, 206	46, 228, 213	126, 283, 426	2. 73

Salt.—Salt was produced in Mayaguez District in 1957 by the evaporation of sea water. The 1957 output was smaller than the 1956 output but its value was greater.

Sand and Gravel.—Sand and gravel for use as concrete aggregate was produced from rivers and beaches. Large quantities of sand were obtained from the beach area east of San Juan and from two large beach pits at Ramey Air Force Base. Silica sand was used as an abrasive in polishing imported marble and in the glass and ceramic industries.

Stone.—Crushed and dimension limestone and crushed miscellaneous stone were quarried in Puerto Rico in 1957. Crushed limestone was produced in all 7 districts, dimension limestone in 5 districts, and miscellaneous stone in 1 district. Crushed stone was used mainly for aggregate, and dimension stone was used in rough construction and as rubble.

TABLE 4.—Stone sold or used by producers in Puerto Rico, 1953–57

Year	Dimension lime-stone		Crushed limestone		Other stone ¹		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	16, 552	\$33, 733	631, 848	\$1, 203, 503	(²)	(³)	² 648, 400	² \$1, 237, 236
1954.....	99, 889	211, 476	⁴ 1, 639, 684	⁴ 2, 252, 812	12, 423	\$28, 539	² 1, 751, 996	² 2, 492, 827
1955.....	86, 077	187, 842	⁴ 1, 697, 833	⁴ 2, 327, 918	-----	-----	⁴ 1, 783, 910	⁴ 2, 515, 760
1956.....	75, 168	142, 626	⁴ 2, 001, 285	⁴ 2, 412, 959	-----	-----	⁴ 2, 076, 453	⁴ 2, 555, 585
1957.....	178, 619	356, 132	⁴ 2, 225, 139	⁴ 3, 084, 743	48, 261	64, 348	⁴ 2, 452, 019	⁴ 3, 505, 223

¹ Includes basalt, granite, sandstone, miscellaneous stone.

² Excludes crushed granite and miscellaneous stone (1953) and crushed sandstone (1954).

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Includes limestone for cement and lime.

REVIEW BY DISTRICTS

Aguadilla.—Limestone was quarried and crushed by Rafael Falcon, General Builders Supplies, Inc., Victoria Medina, and Luis Vierra for concrete aggregate, roadstone, and riprap. Eugenio Natali quarried dimension limestone. F. J. Rosello, General Builders Supplies, Inc., and Luis Bobadilla produced sand and gravel for molding, building, and paving.

Arecibo.—Severo O'Neil, Cantera De Casanovas, and Pedro Vega Santos produced crushed limestone for use as aggregate. Pedro Vega Santos quarried dimension limestone for rough construction, and Compania de Ing y Contratistas produced paving gravel.

Guayama.—Limestone and sand and gravel were produced in Guayama District in 1957. Limestone was crushed for concrete aggregate and roadstone by Cantera Bobadilla, Jose R. Nogueras, and Francisco Navarro. Planta de Grava Del Turabo and Francisco Navarro produced building and paving sand and gravel.

Humacao.—Planta de Cal "Hicaco," Inc., quarried limestone for use in manufacturing hydrated lime. Cantera Perez produced crushed and dimension limestone. Sand was recovered from beach areas for use in construction.

TABLE 5.—Value of mineral production in Puerto Rico by districts, 1956-57

District	1956	1957	Minerals produced in 1957 in order of value
Aguadilla.....	\$218, 706	\$223, 897	Stone, sand and gravel.
Arecibo.....	141, 298	87, 433	Do.
Guayama.....	41, 140	57, 021	Do.
Humacao.....	189, 411	411, 118	Sand and gravel, lime, stone.
Mayaguez.....	607, 764	549, 662	Stone, salt, lime, sand and gravel.
Ponce.....	8, 330, 023	12, 238, 479	Cement, stone, sand and gravel.
San Juan.....	6, 866, 697	6, 697, 857	Cement, stone, sand and gravel, clays.
Total.....	16, 395, 000	20, 265, 000	

Mayaguez.—Limestone was quarried and crushed for concrete aggregate and roadstone. Leading producers were Waldemar Bravo, Cantera Bernat, and Julio Agrait. Antonio Santos, Jr., produced crushed and dimension limestone. Liborio Lopez Sanchez produced crushed limestone, dimension limestone, building sand, and paving gravel. Conrado Forestier crushed miscellaneous stone for concrete aggregate and roadstone. South Puerto Rico Sugar Co. manufactured lime. Salt was recovered from sea water by Puerto Rico Salt Works, Inc., at Providence and Cabo Rojo, by Carlos M. Ramirez Acosta at Salina Fortuna, and by Salinas del Papayo, Inc.

Ponce.—Portland cement was produced at Ponce by Ponce Cement Corp. Cement Products Corp., Ismaro Torruellas, and Antonio Padilla quarried and crushed limestone for concrete aggregate and roadstone. Ponce Aggregates Corp. obtained sand and gravel from local deposits.

San Juan.—Puerto Rico Cement Corp. produced portland cement at its Guaynabo plant. Cantera Ferrer and Cantera Diaz quarried undressed dimension limestone for rough architectural and rough construction uses. Crushed limestone was produced for concrete aggregate and roadstone by Ramos Hermanos, Inc., Cantera Diaz, and Compania de Ing y Contratistas. Shale and plastic fire clay were mined by Puerto Rico Clay Products, Inc., for manufacturing heavy-clay products. Las Vegas Sand & Gravel Corp. produced paving sand and gravel. A large tonnage of sand was recovered from two beach-sand pits for use in construction.

PANAMA CANAL ZONE

Production of crushed stone was reported in the Panama Canal Zone in 1957. Output was less than half that in 1956. Principal uses included aggregate for concrete, roadstone, and riprap. No output of sand and gravel was reported.

REVIEW BY MINERAL COMMODITIES

Basalt.—Panama Canal Co. quarried and crushed basalt for concrete aggregate roadstone, and riprap.

Stone.—Miscellaneous stone was quarried and crushed by the United States Army—Caribbean for use as riprap.

VIRGIN ISLANDS

Crushed stone was produced in the Virgin Islands in 1957 for use as aggregate and roadstone. Production in 1957 was approximately the same as in 1956.

REVIEW BY MINERAL COMMODITIES

Basalt.—Basalt was quarried and crushed by the Government of the Virgin Islands, Hams Bay Crushing plant, and Springfield Crushing plant on St. Croix Island and used for concrete aggregate and roadstone.

TABLE 6.—Crushed basalt and miscellaneous stone sold or used by producers in the Panama Canal Zone, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	96, 440	\$155, 720	1955.....	189, 485	\$239, 280
1953.....	171, 908	231, 752	1956.....	177, 250	229, 750
1954.....	187, 446	245, 170	1957.....	59, 407	98, 897

TABLE 7.—Sand and gravel sold or used by producers in the Panama Canal Zone, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	40, 820	\$46, 840	1955.....	35, 910	\$47, 229
1953.....	85, 914	95, 500	1956.....	40, 095	48, 673
1954.....	-----	-----	1957.....	-----	-----

TABLE 8.—Crushed miscellaneous stone sold or used by producers in St. Croix Island, Virgin Islands, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	6, 068	\$14, 870	1955.....	1 875	\$4, 900
1953.....	10, 789	45, 853	1956.....	1 11, 591	31, 983
1954.....	1 3, 939	17, 134	1957.....	1 11, 500	31, 000

¹ Basalt.

The Mineral Industry of Rhode Island

By Joseph Krickich ¹



VALUE of mineral production in Rhode Island in 1957 decreased 16 percent as compared with 1956. The continuing decreased demand for structural and paving material throughout the State resulted in decreased production of sand and gravel and stone—the principal minerals of the State.

TABLE 1.—Value of mineral production in Rhode Island, 1956–57, by counties,¹ in thousand dollars

County	1956	1957	Minerals produced in 1957 in order of value
Kent.....	\$570	\$493	Sand and gravel.
Newport.....	63	(?)	Sand and gravel, stone.
Providence.....	953	761	Sand and gravel, stone, graphite.
Washington.....	40	(?)	Sand and gravel.
Undistributed.....		115	
Total.....	1,627	1,369	

¹ No production was reported from Bristol County.

² Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."

REVIEW BY MINERAL COMMODITIES

NONMETALS

Graphite.—Sales of Rhode Island's natural amorphous graphite increased in 1957. The average value increased more than \$1 per ton in 1957 compared with 1956. The entire output was from a mine formerly worked for metaanthracite in Providence County. Crushed graphite was sold for preparing foundry facings and as a paint pigment.

Sand and Gravel.—Production of sand and gravel in Rhode Island in 1957 totaled 1,058,000 tons valued at \$1,060,000, 19- and 16-percent declines, respectively, as compared with 1956. The decrease was attributed to lower demand for structural and paving material in the State during the year. In addition, Government-and-contractor operations declined and furnished only 2 percent of the State's total production compared with 5 percent of the preceding year. Although most sand and gravel produced was for structural and paving purposes, molding, furnace, and fill sand, and fill gravel also, were produced. Seventy-nine percent of the State's total output was washed, screened, or otherwise prepared. Providence County replaced Kent as the leading sand-and-gravel-producing area and supplied 46 percent

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of the State's total output. Government-contract producers were active only in Providence County.

Stone.—Limestone, granite, and miscellaneous stone, in decreasing order of value, were quarried in Rhode Island in 1957. Total stone production and total value decreased 5 and 19 percent, respectively, in 1957 compared with 1956. The decline was due principally to decreased demand for metallurgical and agricultural limestone and decreased valuation of stone for concrete aggregate and roadstone, the principal use of Rhode Island stone output.

REVIEW BY COUNTIES

Kent.—Kent County ranked second in production among the State's sand and gravel producing counties. The bulk of the output was for structural and paving purposes. Molding, furnace, and other sand as well as fill and other gravel were produced. Five producers were active in the county during the year compared with 7 in 1956. Producers were: Rhode Island Sand & Gravel Co., Inc., and Luigi Vallone, Inc., Warwick; Barber Sand & Gravel, Coventry; Whitehead Bros., Washington; and Pawtucket Ready Mix.

Newport.—Newport County ranked third in valuation among Rhode Island's four mineral-producing counties. Callan Construction Corp. produced paving sand and gravel near Portsmouth. Peckham Bros. Co., Inc., quarried conglomerate and granite near Middletown. The output was crushed and used as concrete aggregate and roadstone.

Providence.—The number of active commercial producers of sand and gravel reporting production in Providence County decreased from 12 in 1956 to 9 in 1957. In spite of the smaller number of producers, Providence County became the leading area in 1957 in the output of sand and gravel. Most sand and gravel producers in the county processed their material by crushing, washing, and sizing. The output was used principally for construction and paving purposes. Producers were: M. A. Gammino Construction Co., A. Cardi Construction Co., Inc., and Del Bonis Sand & Gravel Co., all of Cranston; Courtois Sand & Gravel Co., Providence; Tasca Sand & Gravel Co., Smithfield; Town Line Sand & Gravel, Slatersville; and Silvestri Bros., J. J. McHale & Sons, and L. Romano Construction Co. Paving sand and gravel also were produced under contract for the Division of Roads and Bridges, Department of Public Works of the State of Rhode Island.

Conklin Limestone Co., Inc., Lincoln, quarried and crushed limestone for blast-furnace flux, agricultural purposes, cement, and roofing gravel. Fanning & Doorley Construction Co., Inc., Berkley, produced crushed granite for concrete aggregate and roadstone. Graphite Mines, Inc., operated its natural amorphous graphite mine and crusher near Cranston.

Washington.—Sand and gravel used principally as fill was produced by South County Sand & Gravel Co. and Louis B. Schaeffer, both of Peace Dale; J. Romanelli; and E. R. Viera.

The Mineral Industry of South Carolina

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 South Carolina.

By Fred P. Giese¹ and Laurence L. Smith²



SOUTH CAROLINA mineral production was valued at a record \$22.2 million in 1957, an increase of 4 percent over 1956 and a 10-percent increase over 1955. The increased valuation was attributable largely to rising production of portland cement and crushed granite. Increases in kyanite, monazite, and vermiculite and initial production of zirconium concentrate helped offset losses in barite, clays, mica, and sand and gravel.

South Carolina led the States in producing monazite and ranked second in output of kyanite and vermiculite and fourth in mica production.

The leading industries were manufacturing cement, quarrying stone, and mining and processing clay. Leading companies were Carolina Giant Cement Co. (portland and masonry cements, clay, and lime-

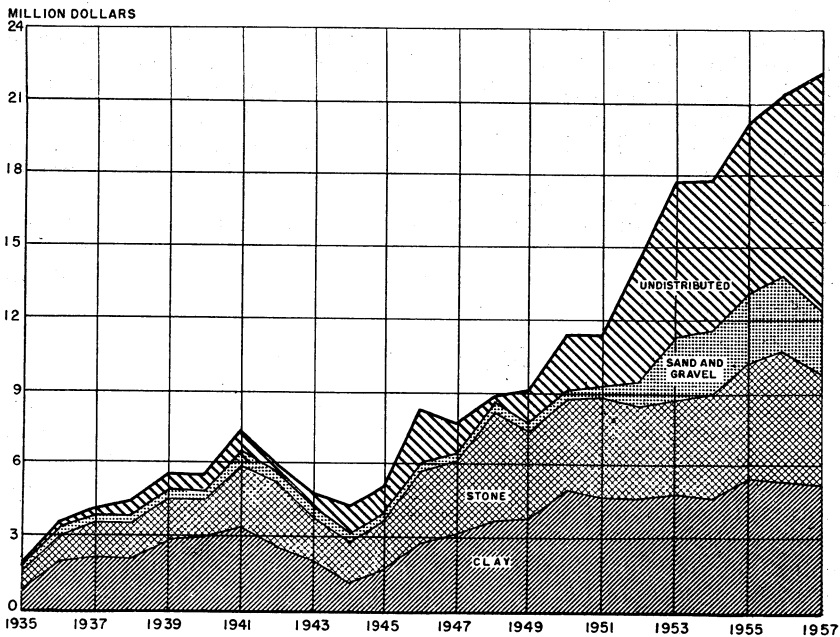


FIGURE 1.—Value of clays, stone, sand and gravel, and total value of minerals produced in South Carolina 1935-57.

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stone), Campbell limestone Co. (crushed granite and limestone), and J. M. Huber Corp. (kaolin).

TABLE 1.—Mineral production in South Carolina, 1956-57 ¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays.....	1,087	\$5,451	937	\$5,161
Mica (sheet).....pounds.....	5,400	14	2,278	12
Sand and gravel.....	3,229	2,926	2,647	2,571
Stone ²	3,304	4,285	3,413	4,581
Titanium concentrate.....	3	326	(³)	(³)
Value of items that cannot be disclosed: Barite, cement, kyanite, mica (scrap), rare-earth-metal concentrate, staurolite (1957), stone (marl, crushed limestone, and dimension granite), zirconium concentrate (1957), and values indicated by footnote 3.....		8,950		10,491
Total South Carolina ⁴		21,342		22,168

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Excludes marl, crushed limestone, and dimension granite, value for which is included with "Items that cannot be disclosed."

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Total adjusted to eliminate duplicating value of clays and stone.

EMPLOYMENT AND INJURIES

Reports submitted to the Bureau of Mines by producers indicate that employment in the mineral industries increased 31 percent over that in 1956. Employment increased 37 percent in nonmetal mines and 62 percent at quarries and mills; it decreased 32 percent at sand and gravel pits. The increased variances in the employment statistics of 1956 and 1957 were due in large part to better coverage in 1957 than in the preceding year.

The overall injury-frequency rate decreased 12 percent compared with 1956. The frequency rate decreased 26 percent at nonmetal mines but increased 20 percent at quarries and mills. As in 1956, no injuries were fatal.

CONSUMPTION, TRADE, AND MARKETS

Mineral production was consumed mostly in the State. Titanium and rare-earth-metals concentrates were shipped to Chattanooga, Tenn., for processing. Barite was shipped to New Orleans, La., to be processed for use as drilling mud. Some cement was shipped to Florida, Georgia, and North Carolina, but the greater part was used in the State. Kaolin was processed within the State and shipped to eastern markets for a variety of uses. Kyanite was shipped to refractory manufacturers for use in refractory cement. Sheet mica was sold to the Government through the Spruce Pine N. C., purchasing depot. Scrap mica was processed within the State and shipped to out-of-State plants for use in paints. Dimension granite for building and monumental use was shipped to many points within the State and also to adjoining States. Screened and cleaned vermiculite was

shipped to 40 processing plants in the United States and Canada, including 1 at Travelers Rest, S. C., for exfoliating.

TRENDS AND DEVELOPMENTS

South Carolina mineral industry has become fairly stable, following closely national trends in the construction industry. New plants constructed during the year included P. & R. Barium Co. near Gaffney (barite) and Oretraction Minerals, Inc., at Andrews (processing zircon, ilmenite, rutile, and monazite). Carolina Giant Cement Co., Harleyville, completed a \$5-million program expanding its annual plant capacity from 1.8 million to 3 million barrels annually. Whitehead Bros. Co., New York City, N. Y., planned to build a plant to produce fine-quality silica sands from deposits at the plant site near Blaney, Kershaw County. Bell Kaolin Co. began stripping overburden preparatory to mining kaolin at Batesburg. Beaufort Mining & Development Co., Beaufort, was granted a 10-year lease over river bottoms and tidelands along the coast of Beaufort County in view of the possibility of restoring the phosphate rock industry to the State. Kaiser aluminum & Chemical Corp. and Piedmont Properties, Inc., subsidiary of Alcoa, conducted exploration for alumina-bearing ores near Spartanburg.

LEGISLATION AND GOVERNMENT PROGRAMS

DMEA activity consisted of two projects for mica in Abbeville and Greenville Counties, amounting to \$5,480 and \$5,948, respectively; the Government share was 75 percent.

TABLE 2.—Average unit value of mineral commodities produced in South Carolina, 1948-52 (average) and 1953-57

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Barite..... short ton	\$7.38	\$6.00	\$6.00	\$5.93	\$20.00	\$17.89
Cement:						
Masonry..... 376-pound barrel						3.73
Portland..... do	2.63	2.80	2.82	2.85	3.09	3.19
Clays:						
Kaolin..... short ton	12.55	12.87	12.32	12.18	12.05	12.98
Miscellaneous..... do	.87	.84	.83	1.13	1.05	.98
Kyanite..... do	34.65	40.00	38.25	45.00	40.68	44.47
Mica:						
Scrap..... do			25.00	24.71	25.49	22.60
Sheet..... pound			16.44	10.24	2.55	5.40
Sand and gravel:						
Gravel..... short ton	.90	1.16	1.30	1.23	1.29	1.40
Sand..... do	.55	.57	.61	.52	.58	.59
Staurolite..... do						11.00
Stone:						
Granite:						
Crushed..... do	1.31	1.35	1.37	1.33	1.30	1.34
Dimension..... do	35.31	39.39	16.15	21.34	21.34	22.31
Limestone:						
Crushed..... do	1.51	1.54	2.00	1.54	1.10	1.11
Titanium concentrate:						
Ilmenite..... do					16.54	19.36
Rutile..... do						190.04
Vermiculite..... do	9.97	13.08	13.05	12.92	12.88	15.53
Zircon..... do						45.00

TABLE 3.—Employment in the mineral industries, 1956-57

Industry	1956 ¹			1957 ²		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Nonmetal mines.....	580	269	155,730	901	238	214,587
Quarries and mills.....	361	268	96,757	601	261	156,571
Sand and gravel mines.....	322	245	78,839	246	219	53,845
Metal mines.....				32	305	9,750
Total.....	1,263	262	331,326	1,780	244	434,753

¹ Final figures.² Preliminary figures.³ Excluding Government-and-contractor operations.

TABLE 4.—Injuries in the mineral industries, 1956-57

Industry	1956 ¹				1957 ²			
	Fatal	Non-fatal	Total	Injuries per million man-days	Fatal	Non-fatal	Total	Injuries per million man-days
Metal mines.....						1	1	103
Nonmetal mines.....		35	35	225		31	31	167
Sand and gravel mines.....	(³)	(³)	(³)	(³)		11	11	204
Quarries and mills.....		26	26	269		29	29	324
Total.....		61	61	242		72	72	213

¹ Final figures.² Preliminary figures.³ Not canvassed.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Industrial Minerals, Inc., the only barite producer in the State, decreased output 13 percent. A new producer, P. & R. Barium Co., began mining operations and building a flotation plant.

Cement.—Carolina Giant Cement Co. produced portland cement in its plant at Harleyville (Dorchester County) throughout the year and reported initial production of masonry cement. Production was 8 percent above 1956.

Clays.—Total clay production, including that used in cement, decreased 14 percent in tonnage and 5 percent in value. Kaolin production decreased 10 percent in tonnage and 3 percent in value.

Kyanite.—Production and value of kyanite increased 3 and 12 percent, respectively.

Mica.—Production of sheet mica was 2,280 pounds valued at \$12,300, declining 58 and 11 percent in quantity and value, respectively. Sheet mica was sold to the Government (GSA), Spruce Pine, N. C., Purchase Depot. Scrap mica declined 36 percent in tonnage and 43 percent in value from 1956. Production of sheet mica was reported from Anderson, Greenville, Oconee, Pickens, and Spartanburg Counties. Scrap mica was mined in Lancaster County.

TABLE 5.—Clays sold or used by producers, 1948-52 (average) and 1953-57, by kinds

Year	Kaolin		Miscellaneous clay		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948-52 (average).....	310	\$3,903	(1)	(1)	2 860	2 \$4,393
1953.....	328	4,213	622	\$544	2 964	2 4,802
1954.....	327	4,030	809	672	1,136	4,702
1955.....	383	4,669	703	794	1,086	5,463
1956.....	392	4,719	695	732	1,087	5,451
1957.....	354	4,590	583	571	937	5,161

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes a small quantity of fire clay.

TABLE 6.—Kaolin sold or used by producers, 1956-57, by uses

Use	1956 (short tons)	1957 (short tons)	Use	1956 (short tons)	1957 (short tons)
Insecticides and fungicides.....	33,102	23,974	Architectural terra cotta.....	2,327	-----
Chemicals.....	1,000	1,572	Absorbent uses.....	1,500	-----
Plaster and plaster products.....	7,517	1,100	Other.....	90,741	110,948
Whiteware, etc.....	14,080	(1)	Total.....	391,724	353,698
Saggers, pins, stilts.....	(1)	(1)			
Firebrick and block.....	12,619	(1)			

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

Sand and Gravel.—Output of sand and gravel for sale or use by producers in 1957 was 2.6 million tons valued at \$2.6 million, a decrease of 18 percent in quantity and 12 percent in value. Twenty-eight commercial producers were active in 15 counties. In addition, the South Carolina State Highway Department produced paving sand from 15 counties, totaling 50,000 tons valued at \$22,000, compared with 38,000 tons valued at \$15,000 in 1956.

Staurolite.—Marine Minerals Co. recovered staurolite as a by-product in processing titanium sands. The staurolite was used in portland cement and in sandblasting.

Stone.—Total stone production increased in tonnage and value. Crushed granite rose 3 percent in tonnage and 7 percent in value; dimension granite production was substantially the same as 1956. Limestone production, which included limerock used in manufacturing cement, increased 24 percent in tonnage. Granite was quarried in six counties: Fairfield, Greenville, Lexington, Pickens, Richland, and Spartanburg. Cherokee and Dorchester Counties produced limestone.

Vermiculite.—Vermiculite production decreased 8 percent, but the value increased 11 percent. Zonolite Co. (Spartanburg County) was the principal producer; output from Southern Vermiculite (Spartanburg County) was small. Alabama Vermiculite Co. and American Vermiculite Co. operated in Laurens County. Zonolite Co. also operated an exfoliating plant at Travelers Rest. Shipments of exfoliated vermiculite were 16 percent less than in 1956.

TABLE 7.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	1,018,419	\$529,997	(1)	(1)	(1)	(1)
Paving.....	(1)	(1)	(1)	(1)	(1)	(1)
Engine.....	(1)	(1)	(1)	(1)	(1)	(1)
Filter.....	(1)	(1)	(1)	(1)	(1)	(1)
Other.....	725,637	475,078	(1)	(1)	(1)	(1)
Total.....	1,744,056	1,005,075	1,484,684	\$1,920,827	3,228,740	\$2,925,902

Use	1957					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	784,454	\$395,316	(1)	(1)	(1)	(1)
Paving.....	361,545	134,432	(1)	(1)	(1)	(1)
Engine.....	35,344	32,087	(1)	(1)	35,344	\$32,087
Filter.....	4,312	15,585	(1)	(1)	4,312	15,585
Other.....	200,652	234,310	(1)	(1)	(1)	(1)
Total.....	1,386,307	811,730	1,261,073	\$1,759,430	2,647,380	\$2,571,160

1 Figure withheld to avoid disclosing individual company confidential data.

TABLE 8.—Paving sand produced by the South Carolina State Highway Department in 1957

County	Short tons	Value	County	Short tons	Value
Aiken.....	6,750	\$2,800	Oconee.....	17,440	\$7,300
Anderson.....	1,110	470	Pickens.....	400	170
Cherokee.....	2,700	2,093	Spartanburg.....	2,475	1,238
Chester.....	3,308	1,323	Sumter.....	3,000	1,300
Chesterfield.....	1,743	436	Union.....	2,500	1,250
Dorchester.....	500	200	York.....	600	250
Greenville.....	4,596	1,900	Total.....	50,222	22,030
Kershaw.....	1,000	420			
Lexington.....	2,100	880			

TABLE 9.—Crushed granite sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Concrete and roadstone.....	2,704,589	\$3,819,944	2,957,570	\$4,254,876
Railroad ballast.....	(1)	(1)	225,600	176,300
Other.....	599,895	465,439	230,259	149,335
Total.....	3,304,484	4,285,383	3,413,429	4,580,511

1 Figure withheld to avoid disclosing individual company confidential data. Included with "Other."

METALS

Ferroalloys.—Production of ferroalloys from raw materials from out of State included ferrosilicon, ferrochromium, chromic-silicide, and ferrophosphorus.

Rare-Earth-Metal Concentrates.—Monazite concentrate was produced as a byproduct with rutile, ilmenite, and zircon concentrates by Marine Minerals at Horse Creek near Aiken. Tonnage increased 30 percent and value rose 33 percent over 1956.

Titanium Concentrates.—Ilmenite and rutile concentrates were produced by Marine Minerals, Inc., Division of Heavy Minerals, Inc., on Horse Creek near Aiken. Dredging was begun in June 1955, and the concentrating plant started operating in December 1955 using a combination of electrostatic, electromagnetic, and gravity techniques to separate monazite, ilmenite, rutile, zircon, and staurolite. (See other metal commodities.) The production of ilmenite and rutile increased but the total value of concentrates decreased.

Zirconium.—At Horse Creek near Aiken Marine Minerals produced zircon sand as one of the products of its heavy-minerals separation plant. This year was the first that the State became a commercial producer of zircon.

REVIEW BY COUNTIES

Mineral production was reported in 26 of the 46 counties in the State. Aiken and Dorchester furnished more than 50 percent of the total mineral-production value; Spartanburg, Fairfield, Pickens, Lexington, and Marlboro Counties each produced more than \$1 million.

Abbeville.—The DMEA mica contract of Harold B. King, Sr., was completed. The contract amount was \$5,948 with Government participation of 75 percent.

Aiken.—Aiken ranked as the second most important mineral-producing county in the State, owing principally to production of heavy-mineral concentrates—clay and sand and gravel.

Marine Minerals, which began dredging and operating a mill at its Horse Creek mine in June and December 1955, respectively, produced monazite, ilmenite, rutile, zircon, and staurolite. The staurolite was used by the portland-cement industry in manufacturing high-early-strength cement and sandblasting sands.

Perry Minerals, an affiliate of Marine Minerals, Inc., produced sand and gravel as a byproduct from concentrating heavy minerals at the Horse Creek mine of the affiliate.

The following 6 companies produced over 95 per cent of the State's kaolin production at 10 properties. Bell Clay Co. (Batesburg mine), Dixie Clay Co. (McNamee mine), J. M. Huber Corp. (Barden and Paragon mines), International Clay Co., National Kaolin Products Co. (Aiken mine), and Southeastern Clay Co. (Flock, Johnson, Rodgers, and Toole mines). The South Carolina State Highway Department mined paving sand for its own use.

Beaufort.—The South Carolina State Budget and Control Board granted a 10-year lease over river bottoms and tidelands along the coast of Beaufort County to the Beaufort Mining & Development Co., with the view of reviving phosphate mining in the State.

TABLE 10.—Value of mineral production in South Carolina, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Abbeville.....	(²)		
Aiken.....	\$5,292,240	(²)	Kaolin, monazite, titanium concentrates, sand and gravel, zircon, staurolite.
Anderson.....	1,757	\$5,482	Mica, sand and gravel.
Bamberg.....	(²)		
Calhoun.....	65		
Charleston.....	(²)	(²)	Sand and gravel.
Cherokee.....	(²)	(²)	Limestone, barite, sand and gravel.
Cherokee.....	900	1,323	Sand and gravel.
Chester.....	289,402	(²)	Do.
Chesterfield.....		(²)	Cement, limestone, miscellaneous clay, sand and gravel.
Dorchester.....	(²)	(²)	Granite, miscellaneous clay.
Fairfield.....	(²)	(²)	Sand and gravel.
Florence.....	(²)	(²)	Sand and gravel.
Greenville.....	45,082	653,205	Granite, sand and gravel, mica.
Greenwood.....	27,186	83,000	Miscellaneous clay.
Horry.....	(²)	(²)	Sand and gravel.
Jasper.....	(²)	(²)	Do.
Kershaw.....	2,000	420	Do.
Lancaster.....	(²)	(²)	Mica, miscellaneous clay.
Laurens.....	(²)	(²)	Vermiculite.
Lexington.....	(²)	(²)	Granite, sand and gravel.
Marion.....	24,034	(²)	Miscellaneous clay, sand and gravel.
Marlboro.....	(²)	(²)	Sand and gravel, miscellaneous clay.
Oconee.....	3,538	7,666	Sand and gravel, mica.
Orangeburg.....	400		
Pickens.....	(²)	(²)	Granite, mica, sand and gravel.
Richland.....	1,113,551	725,107	Granite, miscellaneous clay, sand and gravel, kaolin.
Saluda.....	(²)		
Spartanburg.....	(²)	(²)	Vermiculite, granite, mica, sand and gravel.
Sumter.....	(²)	(²)	Sand and gravel.
Union.....	100	1,250	Do.
York.....	(²)	(²)	Kyanite, sand and gravel.
Undistributed.....	14,541,745	20,690,609	
Total.....	21,342,000	22,168,000	

¹ The following counties are not listed because no production was reported: Allendale, Barnwell, Beaufort, Berkeley, Clarendon, Colleton, Darlington, Dillon, Edgefield, Georgetown, Hampton, Lee, McCormick, Newberry, and Williamsburg.

² Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 11.—Kaolin sold or used by producers in Aiken County, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	301,338	\$3,870,480	1955.....	356,911	\$4,575,877
1953.....	327,594	4,213,431	1956.....	370,858	4,667,001
1954.....	307,816	3,973,970	1957.....	346,925	4,573,232

Charleston.—Edisto Sand & Gravel Co. mined building sand, and the Sandrying Co. produced silica fillers.

Cherokee.—Industrial Minerals, Inc., mined barite at Kings Creek. P. & R. Barium Co. began mining and was building a flotation plant, which was expected to operate early in 1958. Campbell Limestone Co. quarried and crushed limestone at Blacksburg for concrete aggregate, roadstone, and agstone. Paul K. Hines produced hand-cobbed mica. Jobe Sand Co. and the State highway department mined engine and paving sand, respectively.

Chesterfield.—Becker County Sand & Gravel Co. and the State highway department produced sand and gravel for structural and paving uses, respectively.

Dorchester.—Dorchester County led the State in value of mineral products and gained 10 percent over 1956. Carolina Giant Cement Co. mined clay and marl and manufactured portland and masonry cements at its Harleyville plant; a \$5-million expansion program was completed, increasing cement-plant capacity annually from 1.8 to 3 million barrels. Salisbury Brick Corp. mined clay for use in manufacturing heavy clay products at Sommerville, and Volunteer Portland Cement Co. (formerly Carolina Cement & Lime Co.) produced agricultural lime. Hayes Sand Co., Murray Sand Co., and Bailey's Sand Pit produced structural sand. The State highway department produced a small quantity of paving sand.

Fairfield.—Richland Shale Products mined shale for use in its clay-products plant. Palmetto Quarries Co. crushed granite for concrete and roads and for stone sand and Rion Crushed Stone Corp. crushed granite for concrete and roads. Winnsboro Granite Co. was the only producer of dimension granite in the State.

Florence.—Coastal Sand Co. (Johnsonville) produced structural and paving sand.

Georgetown.—Orefraction Minerals, Inc., built a plant at Andrews for grinding and processing zircon, rutile, ilmenite, and monazite. The company will process ores for out-of-State producers, shipping through the Port of Charleston.

Greenville.—The Lakeside Stone Co. produced 444,000 tons of crushed granite. Four operators produced small quantities of sheet mica. Four operators produced sand totaling 96,000 tons valued at \$50,000. R. G. Garrison and Rogers Sand Co. (Greenville) mined structural sand; James F. Zupan (Greenville) produced structural and paving sand; W. A. McDaniel produced paving and road sand; the State highway department produced paving sand. The DMEA mica contract with Ralph Burdette was completed; the amount of the contract was \$5,480, and Government participation was 75 percent.

Greenwood.—Angus Brick & Tile Co. and Southern Brick Co. mined 83,000 tons of miscellaneous clay for heavy clay products.

Horry.—The Dobbs Co. dredged building sand at Myrtle Beach, and E. P. Pitts Sand Corp. produced sand from the Pitts mine at Nichols.

Jasper.—Deerfield Sand Co. was the only mineral producer in the county.

Kershaw.—Whitehead Bros. Co., New York, N. Y., will build a plant to produce fine-quality silica sands from deposits at the plant near Blaney.

Lancaster.—Ashe Brick Co. produced clay at its Van Wyck pit for use in its brick plant, and the Mineral Mining Corp. mined and processed scrap mica near Kershaw.

Laurens.—Alabama Vermiculite Co. produced vermiculite.

Lexington.—Output of sand was 484,000 tons, 15 percent lower in tonnage than in 1956; 90 percent of the total tonnage was marketed as building and paving sand, the remainder composing blast, fire or furnace, engine and filter sands, and fertilizer filler. Producers were: Capitol Sand Co., Columbia Silica & Sand Co., Foster Bros. Dixiana Sand Co., all of Columbia, Southeastern Sand Co. of Cayce, and the State highway department. Weston & Brooker Quarry Co. crushed granite at the Cayce quarry. Production in the county decreased

compared with 1956. Bell Kaolin Co. began stripping overburden preparatory to mining kaolin at Batesburg.

TABLE 12.—Sand sold or used by producers in Lexington County, 1948–52 (average) and 1953–57

Year	Short tons	Value	Year	Short tons	Value
1948–52 (average).....	210, 585	\$107, 842	1955.....	633, 528	\$256, 750
1953.....	632, 497	295, 528	1956.....	579, 838	254, 629
1954.....	576, 970	276, 129	1957.....	459, 635	225, 521

Marion.—J. D. Murchison mined miscellaneous clay for building brick at Pee Dee. Sandy Bluff Sand Co. produced building sand at Mullins.

Marlboro.—Cheraw Brick Works, Inc., and Palmetto Brick Co. (both of Cheraw) mined 99,000 tons of miscellaneous clay, a 30-percent decrease in tonnage from 1956, for use in their brick plants. Becker County Sand & Gravel Co. produced sand and gravel for railroad ballast, building, and paving uses. Lawrence Stone & Gravel Co. mined building sand.

Oconee.—Benny Mason (Kelly and Shirley mines) and L. C. Owens produced a small quantity of sheet mica. The State highway department mined paving sand.

Pickens.—Campbell Limestone Co. sold broken and crushed granite at the Beverly quarry for concrete aggregates, roadstone, and riprap; production was somewhat above the 1956 tonnage. Otis Buchanan (Houser & Powell mines) produced a small quantity of sheet mica; the State highway department produced paving sand.

Richland.—Clay production declined in tonnage and value from 1956. Carolina Ceramics, Inc., and Columbia Pipe Co. mined kaolin and miscellaneous clay for use in firebrick, building brick, and other heavy clay products. R. M. Stork Fire Brick Works mined and used kaolin, and the Guignard Brick Co. mined and used miscellaneous clay. Harrison Sand Corp. (Harrison mine) mined structural sand. The Palmetto Quarries Co. (Palmetto quarry) output of granite for aggregates, roadstone, and railroad ballast dropped to a new low after its peak production year in 1956.

Spartansburg.—The county ranked third in value as a mineral producer in South Carolina, owing principally to the output of vermiculite by the Zonolite Co. and broken and crushed granite by Campbell Limestone Co. at the Paolet quarry. This output was used for riprap, railroad ballast, concrete, and roadstone.

The Southern Vermiculite Co. produced a small quantity of vermiculite. Output of small quantities of mica came from three producers. The State highway department produced paving sand. The Aluminum Co. of America, through its subsidiary, Piedmont Properties, Inc., and Kaiser Aluminum & Chemical Corp., were conducting exploration work near Spartanburg for alumina-bearing ores.

Sumter.—Becker Sand & Gravel Co. (Camden mine) production of sand and gravel decreased for the first time since 1954. The State highway department produced paving sand.

York.—Commercialores, Inc., mined kyanite at the Henry Knob mine near Clover. 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, United States Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen¹ and Allen F. Agnew²



MINERAL production in South Dakota in 1957 was valued at \$40 million, a 5-percent decrease compared with 1956. The drop in value was the first in 6 years. Substantial gains in value of beryllium concentrate, columbium-tantalum concentrate, scrap mica, uranium ore, lime, and petroleum failed to offset declines in value of output of all other mineral commodities. The output of gold and silver was only slightly less than in 1956, but substantial decreases were noted in the value of clays, cement, sheet mica, stone, and coal. During the first full year's operation of the uranium-processing mill at Edgemont, production of uranium ore doubled, and the value increased 60 percent. Petroleum production from the one field in Harding County increased substantially.

The value was 5 percent less, but production of sand and gravel increased 18 percent in 1957, largely because of activity by contractors for State highway construction.

EMPLOYMENT

Employment in the mineral industries in 1957 averaged 2,612 engaged in mining and 9,125 in general and contract construction, compared with 2,500 and 10,000, respectively, in 1956. The latter classification included those contractors building highway bridges and similar structures and involved producing substantial quantities of sand and gravel and stone. Employment in mining in the State was 2 percent of the total nonagricultural employment which averaged 125,950 in 1957. Employees in the mineral industries averaged 44.6 hours per week; the weekly wage averaged \$85.70. In contrast, general- and contract-construction workers averaged 42.7 hours per week, and the weekly wage averaged \$95.21. The weekly wage included base pay, overtime, and night differentials and did not represent take-home pay or wage rates.

GOVERNMENT PROGRAMS

General Services Administration (GSA) operated the Government purchase depot at Custer the entire year. The depot purchased sheet and hand-cobbed mica and beryllium and columbium-tantalum concentrates for the strategic mineral stockpile. The hand-cobbed

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TABLE 1.—Mineral production in South Dakota, 1956-57¹

Minera	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate.....short tons, gross weight..	195	\$95	268	\$145
Clays ²	201	201	176	176
Coal (lignite).....	25	90	21	79
Columbium-tantalum concentrate.....pounds..	237	-----	2,311	6
Feldspar..... thousand long tons..	45	289	41	267
Gem stones.....	(³)	10	(³)	15
Gold (recoverable content of ores, etc.) thousand troy ounces..	569	19,898	568	19,885
Gypsum.....	16	63	13	53
Iron ore (usable)..... thousand long tons, gross weight..	22	100	(⁴)	(⁴)
Mica:				
Scrap.....	1	31	2	43
Sheet..... thousand pounds..	12	67	9	46
Sand and gravel.....	12,539	8,423	14,758	8,001
Silver (recoverable content of ores, etc.) thousand troy ounces..	136	123	135	122
Stone.....	2,200	5,725	1,718	5,068
Uranium ore.....	35	475	70	760
Value of items that cannot be disclosed: Bentonite, cement, lime, petroleum, and value indicated by footnote 4.....	-----	7,548	-----	6,083
Total ⁶	-----	\$42,281	-----	39,990

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 Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

⁵ Revised figure.

⁶ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

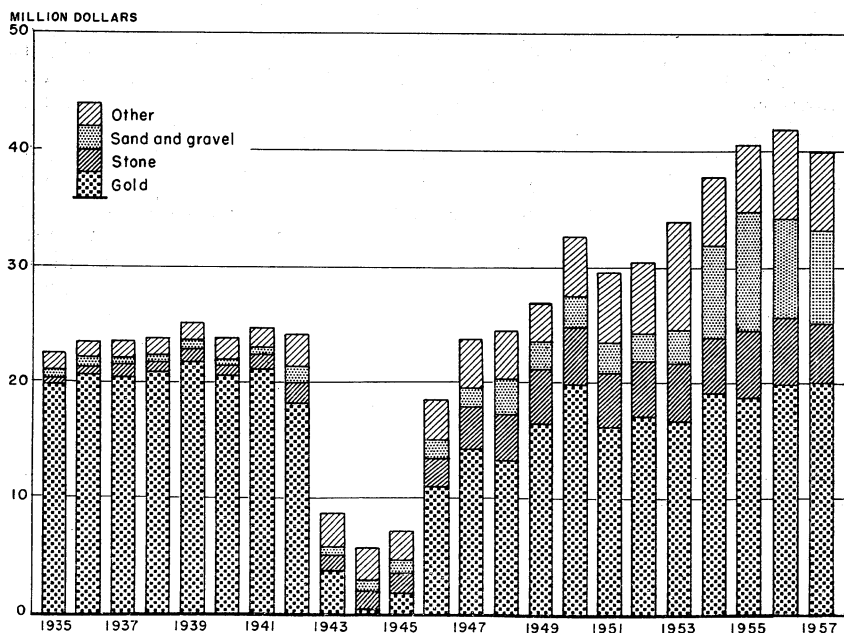


FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935-57.

mica was processed under contract between GSA and a private operator. Beryllium and columbium-tantalum concentrates were purchased by GSA. Two contracts (one each in Fall River and Harding Counties) for Government assistance in the exploration of uranium deposits were approved by Defense Minerals Exploration Administration (DMEA). The contracts totaled \$78,836; Government participation was \$59,127.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Beryllium concentrate (beryl) was hand-sorted from pegmatites in Custer and Pennington Counties as a coproduct of mining feldspar and mica. Production was reported from 106 mines. The greatest output came from Pennington County, with 58 percent of the total value. Virtually the entire production was sold to the Government at the GSA purchase depot at Custer, either directly or to buyers who purchased small lots and in turn sold them to GSA. Production increased 37 percent in quantity and 53 percent in value compared with 1956. The grade of the concentrate offered for purchase was higher in 1957 and supplied the substantial increase in value over 1956.

The Federal Bureau of Mines Experiment Station at Rapid City continued to study the recovery of beryllium oxide from low-grade-beryl-flotation concentrate. The Rapid City station was chiefly concerned with a process that involved roasting and leaching the flotation concentrate and recovering the beryllium oxide from the leach liquors by fractional precipitation and solvent extraction. A report³ on the progress of the investigations was published.

Columbium Tantalum.—Production of columbium-tantalum concentrate rose sharply in 1957 as a direct result of extension of the purchase program provided by Public Law 733, which became effective in 1956. There was no immediate effect of the law in 1956, but production in 1957 increased nearly 10-fold compared with 1956, when production was at its lowest point in 5 years. Columbium-tantalite was recovered by hand-sorting as a coproduct of feldspar and mica mining. Production was reported at 8 operations in Custer and Pennington Counties; the largest part (57 percent) came from Pennington County. The entire quantity was sold to the Government (GSA) purchase depot at Custer.

Gold and Silver.—Production of gold and silver from Homestake Mining Co. and Bald Mountain Mining Co., both in Lawrence County, declined only slightly in 1957 compared with 1956. The output of the 2 metals in value in 1957 represented 96 percent of metal production and 50 percent of mineral production in the State. Homestake Mining Co. continued to be the Nation's leading gold producer.

Iron Ore.—Iron ore was produced from an open-pit mine near Nemo in Lawrence County for manufacturing cement. The deposits have been studied at various times to determine if the material could

Runke, S. M., and Riley, J. M., Progress report on Pegmatite Investigations in South Dakota for Fiscal Years 1954-56; Bureau of Mines Rept. of Investigations 8339, 1957, 18 pp.

be used in blast furnaces, either with or without beneficiation. Again in 1957 several companies were reported to be continuing such investigations.

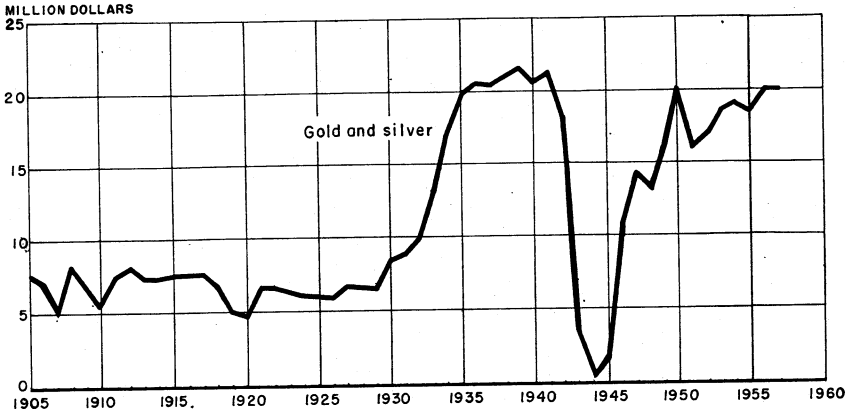


FIGURE 2.—Total value of mine production of gold and silver in South Dakota, 1905-57.

TABLE 2.—Mine production of gold and silver in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Month	Gold (fine ounces)	Silver (fine ounces)
January.....	50,055	12,607	August.....	46,128	10,451
February.....	44,862	10,404	September.....	44,712	9,952
March.....	50,743	11,562	October.....	48,887	12,580
April.....	45,296	10,297	November.....	47,176	12,292
May.....	49,221	11,068	December.....	47,320	12,245
June.....	45,991	10,460	Total.....	568,130	134,737
July.....	47,739	10,789			

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total 1876-1957, in terms of recoverable metals¹

Year	Mines producing		Material sold or treated ² (short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value
	Lode	Placer		Fine ounces	Value	Fine ounces	Value	
1948-52 (average)	5	1	1,223,574	470,226	\$16,457,917	123,567	\$11,834	³ \$16,572,960
1953.....	4		1,479,802	534,987	18,724,545	138,642	125,478	⁴ 18,852,643
1954.....	2		1,600,784	541,445	18,950,575	151,407	137,031	19,087,606
1955.....	2		1,665,341	529,865	18,545,275	154,092	139,461	18,684,736
1956.....	2		1,743,173	568,523	19,898,905	136,118	123,194	20,021,499
1957.....	2		1,778,583	568,130	19,884,550	134,737	121,944	20,006,494
1876-1957.....			(⁵)	26,547,576	710,762,369	11,132,522	8,207,410	⁶ 719,134,403

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 calendar year indicated.

² Does not include gravel washed.

³ Includes 5 short tons of lead valued at \$1,666 and 6 tons of zinc valued at \$1,543.

⁴ Includes 10 short tons of lead valued at \$2,620 in 1953.

⁵ Figure not available.

⁶ 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.

TABLE 4.—Gold and silver bullion produced at mills by amalgamation, 1948–52 (average) and 1953–57

Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)	Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
1948–52 (average).....	1, 106, 095	319, 874	78, 797	1955.....	1, 550, 116	379, 249	76, 312
1953.....	1, 368, 059	365, 442	74, 608	1956.....	1, 627, 719	404, 525	80, 044
1954.....	1, 485, 226	363, 831	80, 168	1957.....	1, 659, 705	404, 581	85, 516

TABLE 5.—Gold and silver bullion produced at mills by cyanidation, 1948–52 (average) and 1953–57

Year	Material treated (short tons)			Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
	Crude ore	Sands and slimes	Total		
1948–52 (average).....	117, 173	1, 105, 827	1, 223, 000	150, 332	44, 381
1953.....	111, 676	1, 368, 059	1, 479, 735	169, 542	63, 434
1954.....	115, 558	1, 485, 226	1, 600, 784	177, 614	71, 239
1955.....	115, 225	1, 550, 116	1, 665, 341	150, 616	77, 780
1956.....	115, 454	¹ 1, 627, 099	¹ 1, 742, 553	163, 998	56, 074
1957.....	118, 878	1, 659, 052	1, 777, 930	163, 549	49, 221

¹ Revised figure.

Uranium.—In 1957 accurate data on the production of uranium ore by calendar years became available for release from the Atomic Energy Commission (AEC). Production in 1957 nearly doubled in quantity and increased 60 percent in value compared with 1956. The uranium oxide content, however, declined from 0.18 percent in 1956 to 0.17 percent in 1957. The first full year's operation of the 300-ton-a-day processing plant at Edgemont, Fall River County, completion of exploration and development programs, and the later production were major factors in the increased output. The number of producing properties decreased from 45 to 30 as a result of consolidations that permitted more efficient operations and increased production.

Exploration and development of uranium-ore deposits continued but not as extensively as in 1956. Major exploration was by diamond and rotary drilling. A total of 159,524 linear feet was drilled, most of which was noncoring. Some stripping and bulldozing were done, and 350 feet of underground development was completed. The major part of the exploratory work took place in Fall River County and the remainder in Harding and Meade Counties. Two contracts for exploration assistance by the Government were approved by the Defense Minerals Exploration Administration (DMEA). The total amount of the contracts was \$78,836; the Government participated to the extent of 75 percent. A technically feasible process to extract uranium oxide from the uraniferous lignites of North and South Dakota was developed, but at a cost higher than for the carnotite-type ores mined in the southwestern counties. A proposal by Ohio Oil-Arthur Pew Associates to build a processing mill to treat the uraniferous lignites was withdrawn after studies indicated that the operation would not be economically feasible. International Resources

TABLE 6.—Mine production of uranium ore, July 1955–December 1957¹

County	July 1–December 31, 1955					1956					1957					
	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²
Butte.....	3	(³)	(³)	(³)	1	(³)	(³)	(³)	2	(³)	(³)	(³)	2	(³)	(³)	(³)
Custer.....	24	12,313	44,410	\$158,126	2	(³)	(³)	(³)	3	(³)	(³)	(³)	3	(³)	(³)	(³)
Fall River.....	3	(³)	(³)	(³)	30	33,847	124,073	\$457,021	29	59,504	197,990	\$647,148	29	59,504	197,990	\$647,148
Harding.....	1	(³)	(³)	(³)	4	(³)	(³)	(³)	3	(³)	(³)	(³)	3	(³)	(³)	(³)
Lawrence.....	2	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)
Pennington.....	1	(³)	(³)	(³)	2	(³)	(³)	(³)	1	(³)	(³)	(³)	1	(³)	(³)	(³)
Unknown.....	1	453	1,015	2,191	1	453	1,015	2,191	1	453	1,015	2,191	1	453	1,015	2,191
Undistributed.....	1	1,227	6,047	24,762	1	1,227	6,047	24,762	1	1,227	6,047	24,762	1	1,227	6,047	24,762
Total.....	34	13,993	51,472	185,079	40	35,302	129,178	475,415	35	69,800	231,918	759,774	35	69,800	231,918	759,774

¹ Based on data supplied to the Bureau of Mines by the Atomic Energy Commission.

² P. c. b. mine value; base price, grade premiums, and exploration allowance.

³ Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."

Corp., a South Dakota firm, also proposed building a processing plant in North or South Dakota if a satisfactory contract with AEC for purchasing the concentrates could be negotiated; AEC was considering the suggestion. In October, AEC announced that no additional contracts for purchasing uranium oxide would be considered, as the milling facilities that were in operation and under construction were enough to process ores currently developed. Because of the possible inadequacy of milling facilities to process known reserves by 1962, in some areas, the AEC began to study the exploration, development, and reserves of uranium-bearing material in the Western States known as of November 1, 1957. The capacity of the plant at Edgemont and its relation to the reserves of the carnotite-type ores tributary to the plant also would be studied. Completion of the study was expected early in 1958.

NONMETALS

Cement.—Portland and masonry cements were produced at the State-owned South Dakota Cement Plant at Rapid City, Pennington County. Shipments declined 19 percent compared with 1956. The average price of portland and masonry cements was \$3.00 and \$3.76 per barrel, respectively, compared with \$2.98 and \$3.73 in 1956.

Clays.—Miscellaneous clay was produced in Butte County for manufacturing building brick and other heavy clay products and in Pennington County for manufacturing cement and lightweight aggregate. Production in 1957 declined 13 percent compared with 1956. One operator in Butte County produced bentonite. Two companies processed bentonite at plants in Belle Fourche, and a third announced plans to construct an additional plant. Crude material processed at the plants came largely from deposits in Wyoming.

Feldspar.—Feldspar production in 1957 from pegmatites in Custer and Pennington Counties declined 9 percent in quantity and 8 percent in value compared with 1956. Output was reported from 40 or more operations, and those in Custer County produced 86 percent of the total. Production from one operation in Custer County was shipped to a grinding mill in Illinois. The remainder was ground at a Custer plant. The grinding plant at Keystone, destroyed by fire in January, was not rebuilt. The ground product from the Custer mill was shipped to consumers in Midwestern and Eastern States for use in glass, pottery, and enamel.

Gem Stones.—Various types of agates, petrified and agatized wood, and such minerals as beryl, rose quartz, and jasper were collected in five counties and sold to polishers and as specimens and souvenirs to tourists. The production came mostly from Custer County. The reported value in 1957 was \$15,000—50-percent increase compared with 1956.

Gypsum.—Gypsum was produced from a deposit near Rapid City, Pennington County, by the South Dakota Cement Plant for manufacturing cement.

Lime.—Quicklime was produced at a plant in Custer County. The entire production was consumed within the State for metallurgical uses. Production in 1957 increased 72 percent compared with 1956.

Mica.—Sheet, hand-cobbed, and scrap mica (important products of pegmatite deposits) were produced from mines in Custer and Pennington Counties. Production of full-trimmed sheet mica in 1957 came from 4 operations and declined a sharp 82 percent from 1956. Production of hand-cobbed mica declined 31 percent, but the percentage recovery of block mica from the hand-cobbed mica accepted at the GSA buying station at Custer was better than in 1956. Although the quantity of block mica recovered also declined 26 percent, the percentage recovery increased from 5.64 percent in 1956 to 6.07 in 1957. The quantity of Good Stained and better quality block recovered increased by nearly 1 percent, and the percentage recovery increased from 2.07 percent to 2.82. The quantity of Stained-quality block recovered declined 35 percent, and the percentage recovery declined from 60.63 percent to 53.36. The average value of block mica recovered decreased 7 percent from \$5.31 to \$4.95 per pound. Full-trimmed and hand-cobbed mica was produced from 38 operations—28 in Custer County and 10 in Pennington County.

TABLE 7.—Production of hand-cobbed mica and yield of sheet mica, 1954–57

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

TABLE 8.—Mica sold or used by producers, 1953–57

	1953	1954	1955	1956	1957
Hand-cobbed mica, total: ¹ Pounds.....	227, 847	207, 221	64, 673	216, 802	149, 163
Sheet mica: ¹					
Full trimmed:					
Pounds.....	921	332	221	256	45
Value.....	\$8, 983	\$3, 056	\$1, 980	\$2, 010	\$756
Average per pound.....	\$9. 75	\$9. 20	\$8. 96	\$7. 85	\$16. 80
From hand-cobbed mica:					
Pounds.....	10, 253	15, 967	4, 633	12, 238	9, 048
Value.....	\$68, 369	\$62, 166	\$19, 403	² \$65, 043	\$44, 751
Average per pound.....	\$6. 67	\$3. 89	\$4. 19	² \$5. 31	\$4. 95
Total:					
Pounds.....	11, 174	16, 299	4, 854	12, 494	9, 093
Value.....	\$77, 352	\$65, 222	\$21, 383	² \$67, 053	\$45, 507
Average per pound.....	\$6. 92	\$4. 00	\$4. 41	² \$5. 37	\$5. 00
Scrap mica, total:					
Short tons.....	1, 687	1, 510	1, 322	1, 268	1, 626
Value.....	\$27, 388	\$26, 943	\$26, 853	\$31, 224	\$43, 142
Average per ton.....	\$16. 23	\$17. 84	\$20. 31	\$24. 62	\$26. 53
Total sheet and scrap mica:					
Short tons.....	1, 693	1, 518	1, 324	1, 274	1, 631
Value.....	\$104, 740	\$92, 165	\$48, 236	² \$98, 277	\$88, 649

¹ Sold to the Government through GSA.

² Revised figure.

A contract for operating the mica-processing section of the GSA purchase depot at Custer was awarded to George R. Campbell, Sr., of Custer in April. He succeeded Monarch Mines, Inc., which had held the contract since the depot was opened in 1952. The number of workers at the depot generally ranged from 50 to 100, depending on the volume of receipts.

Scrap mica came from 68 operations in 2 counties—53 in Custer County and 15 in Pennington County. The output in 1957 was 1,626 tons, a 28-percent increase over 1956. The entire production was shipped to grinders in other States or sold to local purchasers, who in turn shipped to grinders.

Sand and Gravel.—Sand and gravel production increased 18 percent in volume but decreased 5 percent in value compared with 1956. Output by commercial producers declined 16 percent; Government-and-contractor production increased 26 percent and furnished the lower total value because of competitive bidding on contracts. Production was reported in all but 1 of the State's 67 counties. Commercial production was reported in 28 counties, and production

TABLE 9.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	465	\$382	\$0.82	328	\$343	\$1.05
Paving.....	160	116	.72	133	101	.77
Filter, railroad ballast, and other sand.....	22	24	1.08	42	24	.57
Total sand.....	647	522	.81	503	468	.93
Gravel:						
Building.....	486	387	.80	78	97	1.25
Paving.....	1,174	818	.70	1,363	836	.61
Railroad ballast.....	77	65	.84	(1)	(1)	(1)
Other.....	4	2	.56	74	44	.59
Total gravel.....	1,741	1,272	.73	1,515	977	.64
Total sand and gravel.....	2,388	1,794	.75	2,018	1,445	.72
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving.....	4	2	.64	375	254	.68
Gravel:						
Building.....	118	84	.71	10	5	.50
Paving.....	10,029	6,543	.65	12,355	6,297	.51
Total gravel.....	10,147	6,627	.65	12,365	6,302	.51
Total sand and gravel.....	10,151	6,629	.65	12,740	6,556	.51
ALL OPERATIONS						
Sand.....	651	524	.80	878	722	.82
Gravel.....	11,888	7,899	.66	13,880	7,279	.52
Grand total.....	12,539	8,423	.67	14,758	8,001	.54

¹ Figures withheld to avoid disclosing individual company confidential data; included with "Other."

by Government-and-contractor operations was reported in 65 counties. County and city highway departments reported production by their own crews in 31 counties. The State highway commission let contracts for production in 61 counties, and a small quantity was produced by State highway crews in various counties for maintenance work.

Of the total production, 14 million tons (95 percent) was used for paving and road building. Contracts for the State highway commission totaled 9.4 million tons (67 percent of the total used in road building). A greater percentage of the sand and gravel produced was being washed, crushed, sized, or otherwise prepared to meet more rigid specifications of all types of construction. In 1957, 85 percent of the total production was prepared: Commercial producers prepared 53 percent of their output; and Government-and-contractors prepared 90 percent. Sand and gravel in South Dakota was largely transported by truck. If the entire Government-and-contractor production was transported by truck, then 98 percent of the total production was so moved. A report by the Bureau of Public Roads, United States Department of Commerce, on the Progress of the National System of Interstate and Defense Highways in South Dakota showed that between July 1, 1956, and December 31, 1957, 62.5 miles of highway had been programed, 34.8 miles had been authorized, and 27.5 miles were under construction. Since July 1, 1956, 97.3 miles of the National Highway System has been completed in South Dakota. On December 31, 1957, \$16.7 million allotted to the State remained for future programing and construction.

Stone.—Dimension granite produced in Grant County in 1957 increased 7 percent in quantity and 14 percent in value compared with 1956. Eight companies operated 10 quarries; the production of 5 quarries was finished at plants in Minnesota. Crushed and broken stone produced in 10 counties consisted of granite, limestone, sandstone, and miscellaneous stone. Production in 1957 declined 22 percent in quantity and 11 percent in value compared with 1956. The entire production of crushed and broken stone was used for concrete aggregate, roadbuilding, and riprap, except the limestone used in manufacturing cement and lime, as railroad ballast, and in sugar refining, and the sandstone used as refractory stone and in foundries.

MINERAL FUELS

Coal (Lignite).—Production of coal from 1 strip mine in Dewey County decreased 14 percent in quantity and 12 percent in value compared with 1956. The output was sold in Dewey and adjoining counties. Other mines producing less than 1,000 tons a year were operated in Dewey, Corson, and Perkins Counties; the coal was consumed locally.

Petroleum.—Petroleum output from the Buffalo field, Harding County, increased 59 percent compared with 1956. Exploration activity rose sharply to nearly double the 23 in 1954—the previous most active year, with 49 completions compared to 37 in 1956. The major part of the exploratory drilling was done in the southwestern counties. Fall River County led the State with 10 completions, followed by Meade and Pennington Counties with 7 each, Harding

County with 6, and Custer County with 5. Drilling in other counties included Tripp and Ziebach Counties with 3 completions each, Corson and Union Counties with 2 each, and Butte, Codington, Hughes, and Perkins Counties with 1 each. Drilling totaled 173,439 feet. One discovery was recorded when the No. 32-17 Graves well, 1 mile west of the Buffalo field in Harding County, was completed in the Red River formation at a depth of 8,824 feet. Initial production was 144 barrels on pump. No development drilling was done during the year.

REVIEW BY COUNTIES

Sand and gravel was produced throughout the State, chiefly for construction of Federal, State, and county highways; in many counties the quantity was substantial. The bulk of the sand and gravel (86 percent) was produced by contractors for the State and county highway departments. Other than sand and gravel throughout the State, dimension granite produced in Grant County and sandstone produced in Hanson and Minnehaha Counties, the bulk of the mineral production of the State was from six western counties. The total value of all minerals produced in these counties was \$30.9 million—77 percent of the total for South Dakota. Only those counties in which there were major mining activities or where the production of a single mineral commodity had outstanding significance are described in detail in the following section.

Butte.—In 1957 Butte County ranked fourth in the State in the value of mineral production. Miscellaneous clay produced by the Black Hills Clay Products Co. was used for building bricks, draitile, and other heavy clay products. American Colloid Co. produced bentonite and operated its processing plant at Belle Fourche. Eastern Clay Products Department, International Minerals & Chemical Corp., also operated mill at Belle Fourche and processed crude bentonite from deposits in Wyoming. Archer-Daniels-Midland Co., Minneapolis, Minn., announced plans to build a third bentonite-processing plant northwest of Belle Fourche. The output of the plant was to be used by the Erie Mining Co. at its Taconite plant at Aurora, Minn.

TABLE 10.—Value of mineral production in South Dakota, 1956-57, by counties ¹

County	1956 ²	1957	Minerals produced in 1957 in order of value
Aurora.....	\$29,000	(³)	Stone, sand and gravel.
Beadle.....	58,509	\$87,800	Sand and gravel.
Bennett.....		4,800	Do.
Bon Homme.....	18,000	175,600	Do.
Brookings.....	396,000	329,000	Do.
Brown.....	347,250	325,800	Do.
Brule.....	(³)	41,100	Do.
Buffalo.....	4,000	16,400	Do.
Butte.....	(³)	(³)	Clays, sand and gravel, uranium ore.
Campbell.....		70,000	Sand and gravel.
Charles Mix.....	61,500	172,600	Do.
Clark.....	61,250	123,700	Do.
Clay.....	44,000	116,900	Do.
Codington.....	316,500	291,100	Do.
Corson.....		101,800	Do.
Custer.....	4 5 366,079	610,874	Feldspar, uranium ore, sand and gravel, lime, beryllium concentrate, mica, stone, gem stones, columbium-tantalum concentrate.
Davison.....	34,750	243,000	Sand and gravel.
Day.....	36,500	171,100	Do.
Deuel.....	12,750	12,000	Do.

See footnotes at end of table.

TABLE 10.—Value of mineral production in South Dakota, 1956–57, by counties ¹—Continued

County	1956 ²	1957	Minerals produced in 1957 in order of value
Dewey.....	\$89,761	\$109,318	Coal, stone, sand and gravel.
Douglas.....	35,000	58,800	Sand and gravel.
Edmunds.....		22,800	Do.
Fall River.....	(³)	872,048	Uranium ore, sand and gravel, stone.
Faulk.....		52,900	Sand and gravel.
Grant.....	2,381,950	2,779,085	Stone, sand and gravel.
Gregory.....	50,500	69,100	Sand and gravel.
Hamlin.....	59,250	98,900	Do.
Hand.....	9,250	53,400	Do.
Hanson.....	499,804	349,200	Stone, sand and gravel.
Harding.....	(³)	(³)	Petroleum, sand and gravel.
Hughes.....	(³)	56,600	Sand and gravel.
Hutchinson.....	40,500	154,300	Do.
Hyde.....	7,500	38,300	Do.
Jackson.....		205,100	Do.
Jerauld.....	19,750	28,700	Do.
Jones.....		180,900	Do.
Kingsbury.....	(³)	78,600	Do.
Lake.....	189,250	138,100	Do.
Lawrence.....	4 20,250,192	20,129,244	Gold, silver, stone, sand and gravel, iron ore gem stones.
Lincoln.....	52,750	116,500	Sand and gravel.
Lyman.....		341,100	Do.
Marshall.....	20,000	158,300	Do.
McCook.....		83,400	Do.
McPherson.....	(³)	73,700	Do.
Meade.....	446,942	623,700	Do.
Melette.....		131,500	Do.
Miner.....	(³)	12,600	Do.
Minnehaha.....	1,013,400	778,200	Stone, sand and gravel.
Moody.....	63,150	132,300	Sand and gravel.
Pennington.....	4 7,910,875	6,823,401	Cement, stone, sand and gravel, clays, beryllium concentrate, gypsum, mica, feldspar, columbium-tantalum, gem stones, uranium ore.
Perkins.....	12,900	6,928	Sand and gravel, gem stones.
Potter.....		61,600	Sand and gravel, stone.
Roberts.....	65,000	108,900	Sand and gravel.
Sandborn.....		29,400	Do.
Shannon.....		75,900	Do.
Spink.....	47,000	180,400	Do.
Stanley.....	(³)	98,400	Do.
Sully.....	72,750	87,700	Do.
Todd.....		10,400	Do.
Tripp.....		55,800	Sand and gravel, stone.
Turner.....	73,750	46,100	Sand and gravel.
Union.....	24,000	102,300	Do.
Walworth.....	23,750	46,400	Do.
Washabaugh.....		9,500	Do.
Yankton.....		1,450	Sand and gravel, gem stones.
Ziebach.....		200	Sand and gravel.
Undistributed ⁶	7,894,128	2,182,700	
Total ⁷	4 42,281,000	39,990,000	

¹ Haakon County not listed because no production was reported.

² Revised to include final value of uranium production.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Uranium value withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Revised figure.

⁶ Includes gem stone and sand and gravel values that cannot be assigned to specific counties, confidential uranium values (1956), and values indicated by footnote 3.

⁷ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

H. W. McDonald and Union Gulf Oil and Mining Corp. produced uranium ore from the Kling No. 1 and No. 2 mines in the Aladdin district. The ore was processed at the mill in Edgemont. Government-and-contractor operators produced 679,600 tons of paving sand and gravel. One unsuccessful exploratory oil well was drilled to a depth of 1,142² feet.

Custer.—The mines and quarries of Custer County produced beryllium and columbium-tantalum concentrates, gem stones, feldspar, mica, lime, uranium ore, sand and gravel, and stone. The county ranked eighth in the State in the value of mineral production.

Beryllium and columbium-tantalum concentrates were obtained as coproducts in the mining of feldspar and mica. Beryllium concentrate was produced at 90 operations and columbium-tantalum concentrate at 5. Beryllium concentrate was sold directly by some producers to the GSA purchase depot at Custer; others sold their output to Gladys Wells and George Bland of Custer, who in turn sold to GSA. The value of production of beryllium concentrate increased 33 percent, and columbium-tantalum concentrate increased over ninefold compared with 1956.

Feldspar was produced at 27 operations compared with 94 in 1956; output increased 22 percent. Abingdon Potteries, Inc., operated the White Elephant mine and shipped the crude ore to its grinding plant at Abingdon, Ill. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated the Ballard, Rachel and Shamrock mines and purchased the output of independent operators in Custer and Pennington Counties; the entire output was ground at its plant at Custer. The ground product was shipped to consumers in the Rocky Mountains, Mississippi Valley, and Eastern States for glass, pottery, and ceramics. The 9 largest operations, producing over 1,000 tons each, supplied 83 percent of the county total. Mica, 1 of the 2 principal commodities from pegmatite deposits, was produced at 78 operations compared with 46 in 1956. Scrap mica was produced at 53 locations, 2 of which also yielded hand-cobbed mica. The Old Mike mine, the leading producer of scrap mica in the county, was acquired by Samica Corp., Rutland, Vt., in March and operated under contract by Mineral Mills, Inc. The output was shipped to Samica Corp. for processing. Scrap mica produced at other operations was shipped to grinding plants in Colorado and Illinois. Hand-cobbed mica was produced by 19 operators; all of it was sold to GSA at Custer. Glen Ventling (at the New York), Walter S. Clifford (at the Red Deer, New York, and Rachel D. mines), George R. Campbell, Sr. (at the Sky Rocket, Red Deer, New York, Rachel D., and White Spar mines), L. R. York (York Minerals; at the Red Deer), and Loren Potter (at the Sky Rocket)—the five leading producers—delivered to GSA 84 percent of all hand-cobbed mica produced in the county. Three operators produced and sold a small quantity of full-trimmed mica to GSA.

Quicklime produced by the Black Hills Lime Co. at its plant at Pringle was consumed within the State for metallurgical uses. The company produced the limestone used at the plant from a nearby quarry. Gem stones, consisting of agates, gem beryl, rose quartz, satin spar, and pudding stone, were collected by Scott's Rose Quartz Co., Black Hills Mineral Society, and individuals for polishing and sale to processors and tourists. The estimated value of gem stones collected in 1957 exceeded \$10,000. Gravel for paving and road-building was produced by contractors for the Forest Service, United States Department of Agriculture, and the State highway commission, and by crews of the county highway department.

Uranium ore produced at the Bud No. 1 by Triangle Enterprises, at the Freezeout No. 2 by Edgemont Mining & Uranium Corp. and Giant Cycle Corp., and at the Caylor lease by Western Giant Oil Co. was shipped to the processing mill at Edgemont.

Five exploratory oil wells ranging in depth from 1,600 to 2,800 feet were completed during the year. None were successful.

Dewey.—Dewey County Coal Co., the only coal operator in the State reporting production over 1,000 tons, mined coal (lignite) at its strip pit at Firesteel. Production declined 12 percent compared with 1956. Paving sand and gravel and broken granite for riprap was produced by contractors for the State highway commission.

Fall River.—The sharp increase in uranium-ore production and the first full year of operating the processing plant at Edgemont were of major importance in 1957. The county ranked fifth in the State in the value of mineral production. The output of uranium ore increased 76 percent compared with 1956, but the average grade declined from 0.18 to 0.17 percent contained uranium oxide. Production came from 35 operations; output was reported from 45 operations in 1956. The Giant Cycle Corp. was formed after Giant Resources, Inc., had acquired all of the assets of Edgemont Mining & Uranium Corp., one of the first large operators in South Dakota and Golden Cycle Corp. had purchased half the assets of Giant Resources, Inc. The leading producers include: Giant Cycle Corp. at the Gould lease, Gould No. 2, and Taylor No. 2; Pictograph Mining & Uranium Co., Inc., at the Buda No. 5 and Dexter No. 4 and 5; Roy Cram at the Roy Martyr lease; and Roy E. Chord and Diamond Mining Co. at the Gertrude JoAnn King, Ophelia, and Pennywitt No. 1. These producers furnished 92 percent of the county value of uranium output. Exploration by 7 operators consisted of diamond and rotary drilling, stripping, and underground openings. Drilling totaled 157,430 feet, of which 46 percent was diamond-core drilling. A contract for assistance in exploring the Star claims by McAlester Fuel Co. was approved by DMEA. Of the \$72,136 contract total, 75 percent was Government participation. Mines Development, Inc., subsidiary of Susquehanna Corp., a Chicago transit company, operated its 300-ton-a-day plant at Edgemont the entire year. The daily throughput of the mill has averaged about 400 tons.

Sand and gravel for building, paving, roadbuilding, railroad ballast, and fills was produced by four operators. Paving sand and gravel was produced by contractors for the State highway commission. Flyte Rock Co. produced crushed limestone for road construction.

Ten exploratory oil wells were completed during the year at depths ranging from 723 to 3,105 feet. None were successful.

Grant.—Grant County ranked third in the State in the value of mineral production. The combined value of dimension granite and sand and gravel produced in 1957 increased 17 percent compared with 1956, and a gain in output was recorded for each commodity. Rough and dressed architectural and monumental granite was produced at 10 quarries near Milbank and Big Stone City. Rough stone from five quarries was finished at Minnesota plants. The granites in Grant County are particularly desirable and were used for monuments because of the deep red and brown mahogany colors. Sand and gravel for paving and road construction was produced by Walter

Lindberg, the county highway department, and contractors for the State highway commission.

Harding.—Petroleum output in the State's only producing field (Buffalo) increased 59 percent compared with 1956. The crude oil was transported by truck to North Dakota and shipped by rail to refineries. Six exploratory wells were completed during the year, and one new field was discovered about 1 mile west of the Buffalo field at a depth of 8,824 feet. Initial daily production was 144 barrels on pump from the Red River formation. All other wells completed were unsuccessful. No development wells were drilled during the year.

Peter Kiewit Sons' Co. did some exploratory drilling for uranium on the Kelley-DeSart and Patterson, Ward, and LeMar leases. A contract for 75-percent participation by the Government through DMEA for exploration of the Jill group of claims by Wesley Anderson was approved. The total amount of the contract was \$6,700.

Paving gravel for road construction was produced by contractors for the State highway commission.

TABLE 11.—Ore milled, receipts, and dividends, Homestake mine, 1953-57

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1953.....	1,368,059	\$18,251,984	\$13.34	\$4,018,560
1954.....	1,485,226	18,409,610	12.40	4,018,560
1955.....	1,550,116	18,055,258	11.65	4,018,560
1956.....	1,627,719	19,354,312	11.89	4,018,560
1957.....	1,659,705	19,479,489	11.74	4,018,560

¹ From 1876 to 1957, inclusive, this mine yielded bullion and concentrates that brought a net return of \$638,794,520 and paid \$198,832,234 in dividends.

Lawrence.—Lawrence County led the State in the value of mineral production and continued to be the Nation's leading gold-producing area. The value of minerals produced in 1957 was slightly (less than 1 percent) below that of 1956, chiefly because of a drop in the total value of gold and silver. The value of the output of sand and gravel increased, but that of iron ore and crushed stone decreased. Homestake Mining Co. operated its mine and mill at Lead at capacity. According to the annual company report, the tons milled increased 31,986 tons (2 percent) compared with 1956. The percentage recovery increased from 97.06 to 97.18 percent, and the value per ton on the basis of recovered metal declined from \$11.89 to \$11.74. Operating costs again increased in 1957. Preliminary development on the 5300 and 5600 levels from the interior shaft sunk from the 5000 level was completed, and the diamond-drilling program was expected to be completed about mid-1958. The ventilation program continued as planned. Results of the exploration program (diamond-drilling) below the 5000 level were not as good as expected. The extent and quantity of the Homestake formation and the grade and mineralogy of ore found were comparable to those above the 5000 level, but the quantity of ore intersected in the drill holes was less. The reserve of proved ore

declined as development of the lower levels had not progressed enough to warrant including any ore below the 5000 level in the reserve.

Bald Mountain Mining Co. operated the Clinton, Portland, Decorah, and Gold Bug group of mines (counted as 1 mine) and the 350-ton all-slime cyanide plant at Trojan. Tons of ore milled increased 3 percent compared with 1956, but the value of the ore declined 23 percent.

Iron ore was mined near Nemo for use in manufacturing cement at the South Dakota Cement Plant at Rapid City. A small quantity of jasper was collected near Moon and Spearfish for specimens. Sand and gravel for road construction was produced by contractors for the State highway commission. The county highway department produced broken porphyry for use as riprap, and Colorado Construction Co. produced crushed limestone for road construction and for sugar refining.

Meade.—Meade County was the leading producer of sand and gravel in the State and ranked seventh in total value of mineral production. The bulk of the sand and gravel was produced by contractors for the State highway commission for use in road construction. Paving gravel was produced by Robert Strong for the county highway department. Henry, Hanson, and Conlon Exploration Co. completed a limited amount of diamond and rotary drilling on the Lamberton property for uranium. Seven exploratory oil wells were drilled, ranging from 2,343 to 6,250 feet in depth; total footage was 29,486. None were successful.

Minnehaha.—Minnehaha, 1 of the 2 counties in the State producing crushed sandstone, ranked sixth in the State in the value of mineral production. The production of crushed sandstone declined more than 50 percent compared with 1956. Output by Concrete Materials Co. was used as refractory stone and in foundries and for riprap and road construction. L. G. Everist, Inc., produced crushed sandstone for road construction and paving sand and gravel for the Federal Bureau of Reclamation. Sand and gravel for building, paving, and fill was produced by Concrete Materials Co., Eagle Sand & Gravel Co., Healy Construction Co., and Wheelborg Bros.

Pennington.—The mines and quarries of Pennington County produced a variety of minerals and mineral products, and the county ranked second in the State in the value of mineral production. Beryllium concentrate, produced at 28 mines and totaling 36 operations, furnished 58 percent of the total value of South Dakota's beryl production. Hough & Judson (at the High Climb), Consolidated Feldspar Department, International Minerals & Chemical Corp. (at the Hugo), Black Hills Keystone Corp. (at the Bob Ingersoll), G. R. Jurisch (from the Bob Ingersoll dump), John Nickels, Jr. (at the Nickels lode), Keystone Feldspar & Chemical Co. (at the Peerless), Alex Zwetzig (at the Putt), and Dale McDermond (at the White Cap) produced 88 percent of the total for the county. The GSA depot at Custer purchased the entire output, either directly from producers or from Gladys Wells and George Bland (who purchased small lots from individual producers). Columbium-tantalum concentrate was obtained as a coproduct in processing other pegmatite minerals by Black Hills Keystone Corp. at the Bob Ingersoll, Keystone Feldspar & Chemical Co. at the Peerless, and Dale McDermond

at the Whitecap. Production in 1957 increased more than twenty-fold compared with 1956 and represented 76 percent of the total production. The entire output was sold by producers to the GSA purchase depot at Custer. Mica (an important pegmatite mineral) was produced by 20 operators. Fifteen produced scrap mica; two also produced hand-cobbed and one full-trimmed sheet mica. Five operators produced only hand-cobbed mica, and the major producers included: Consolidated Feldspar Department, International Minerals & Chemical Corp., hand-cobbed and scrap mica at the Hugo; Dale McDermond, full-trimmed sheet, hand-cobbed, and scrap mica at the Whitecap and Dyke lodes; Ray Darling, hand-cobbed mica at the Hazeltine, Cobb, and Peerless; Keystone Feldspar & Chemical Co., scrap mica at the Peerless. Full-trimmed sheet and hand-cobbed mica was purchased by the GSA purchase depot at Custer, and scrap mica was shipped to grinders in Colorado and Illinois. Production of feldspar as the major mineral recovered from pegmatite deposits was reported from 8 mines; output from 12 others was small. The principal producers were the Consolidated Feldspar Department, International Minerals & Chemical Corp., at the Hugo, Vickers Feldspar Corp. at the Big Chief, and Hough & Judson at the High Climb. The entire output was purchased by Consolidated Feldspar Department, International Minerals & Chemical Corp., for grinding at the corporation Custer mill. The mill at Keystone was completely destroyed by fire in January and not rebuilt; the Custer mill became the only outlet for ore from independent producers. Production in the county declined 63 percent compared with 1956.

Miscellaneous clay and shale were produced at pits near Rapid City for manufacturing cement and lightweight aggregate. Output declined in 1957 because of reduced requirements for cement. Light Aggregates, Inc., operated its bloating plant at Rapid City and produced a lightweight aggregate used largely in manufacturing building blocks. The South Dakota Cement Plant, operated by the State Cement Commission, produced types I, II, III, and V portland cements and masonry cement. Portland-cement clinker was used as a base for the masonry cement. Shipments in 1957 declined 19 percent compared with 1956. The bulk of the cement was shipped to points in South Dakota, North Dakota, Wyoming, Montana, Minnesota, and Nebraska; small quantities went to Illinois, Kansas, Missouri, and Colorado. The Cement Commission announced plans for a substantial expansion of the plant late in 1956. The program consisted of installing a fifth kiln (11 by 375 feet) and the necessary grinding and accessory equipment. The expansion would increase the annual capacity of the plant to 2.5 million barrels. In May 1957 a contract for constructing the new kiln facilities was awarded to the M. A. Garland Construction Co. Completion was expected early in 1958.

Gem stones and mineral specimens were collected by individuals at pegmatite mines and near the Cheyenne River and Iron Creek. The specimens, consisting of agate, petrified wood, jasper, lollingite, iron ore, and columbite, were sold to polishers and to tourists as souvenirs. Gypsum produced by the South Dakota Cement Plant from pits near Rapid City was used in manufacturing cement. L. G. Everist, Inc., Hills Materials Co., Pete Lien & Sons, Summers Co.,

and South Dakota Cement Plant produced crushed and broken limestone for concrete aggregate, roadbuilding, railroad ballast, manufacturing cement, and riprap. Production in 1957 decreased only slightly from that of 1956. Sand for building, paving, and railroad ballast and gravel for building, paving, and fill was produced by Birdsall Sand & Gravel, Ray Hillery, Hills Material Co., Pete Lien & Sons, and Peter Kiewit & Sons' Co. The South Dakota Cement Commission produced sand used in manufacturing cement. Contractors produced paving sand and gravel for the Federal Bureau of Public Roads, the State highway commission, and the county highway department. Production in 1957 increased 26 percent compared with 1956.

Tom Timmons produced a small quantity of uranium ore from the Rube Nos. 1 and 4 claims. The ore was shipped to the processing plant at Edgemont. Seven exploratory oil wells were drilled ranging in depth from 1,000 to 4,882 feet. Total footage drilled was 18,210. None were successful.

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, United States Department of the Interior, and the Tennessee Division of Geology.

By Avery H. Reed, Jr.,¹ William D. Hardeman, Jr.,² and Mildred E. Rivers³



RECORD production of dimension marble, mica, phosphate rock, pyrite, crushed sandstone, and zinc highlighted the mineral industry of the State in 1957. Tennessee led the Nation in the output of dimension marble and pyrite and ranked second in the production of phosphate rock and zinc.

The total value was 7 percent below 1956, the record year, due mainly to decreased production of coal and cement.

The leading activities were coal mining, stone quarrying, cement manufacturing, copper and zinc production, and phosphate-rock mining and processing. The leading companies were: Tennessee

TABLE 1.—Mineral production in Tennessee, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry.....thousand 376-pound barrels.....	705	\$2,421	639	\$2,214
Portland.....do.....	8,050	23,014	6,776	20,592
Clays.....	1,379	4,888	1,154	4,228
Coal.....	8,848	35,609	7,955	31,147
Copper (recoverable content of ores, etc.).....short tons.....	10,449	8,882	9,790	5,894
Gold (recoverable content of ores, etc.).....troy ounces.....	189	7	172	6
Lead (recoverable content of ores, etc.).....short tons.....	5	2		
Lime.....	125	1,436	94	1,134
Manganese ore (35 percent or more Mn).....gross weight.....	18	1,417	13	1,007
Natural gas.....million cubic feet.....	45	6	² 35	² 5
Phosphate rock.....thousand long tons.....	1,685	11,643	1,812	12,514
Sand and gravel.....	5,629	6,481	5,617	6,641
Silver (recoverable content of ores, etc.).....troy ounces.....	64,878	59	54,407	49
Stone.....	³ 15,556	³ 23,796	³ 15,354	³ 24,155
Zinc (recoverable content of ores, etc.).....short tons.....	46,023	12,610	58,063	13,470
Value of items that cannot be disclosed: Barite, fluor-spar, iron ore, mica, petroleum, pyrite, and stone (granite, 1957, and crushed sandstone).....		8,772		8,029
Total Tennessee ⁴		137,846		128,738

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Preliminary figure.

³ Excludes granite (1957) and crushed sandstone (1956-57). Value included with "Items that cannot be disclosed."

⁴ Total adjusted to eliminate duplicating value of clays and stone.

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TABLE 2.—Average unit value of selected mineral commodities produced in Tennessee, 1948-52 (average) and 1953-57

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Barite (crude).....short ton..	(1)	\$14.55	\$16.31	\$16.20	\$13.93	\$13.09
Cement:						
Portland.....376-pound barrel..	\$2.23	2.51	2.61	2.64	2.86	3.04
Masonry.....do.....	(2)	(2)	(2)	3.14	3.43	3.47
Clays:						
Ball.....short ton..	11.55	12.52	12.84	13.13	13.42	13.67
Fuller's earth.....do.....	14.11	13.82	16.33	14.00	13.72	11.73
Miscellaneous.....do.....	.86	.96	.85	.34	.32	.31
Coal.....do.....	5.25	4.60	3.96	4.08	4.02	3.92
Copper.....pound.....	.221	.287	.295	.373	.425	.301
Iron ore.....long ton..	4.41	6.47	5.77	5.78	5.80	6.16
Lime.....short ton..	9.64	10.29	12.04	10.67	11.53	12.11
Manganese ore.....do.....	(1)	76.91	77.81	80.53	79.52	77.83
Mica, scrap.....do.....					26.50	22.55
Phosphate rock (sold or used).....long ton..	7.05	7.55	7.06	7.40	7.69	6.67
Sand and gravel:						
Sand.....short ton..	1.29	1.26	1.35	1.30	1.33	1.49
Gravel.....do.....	.86	.89	1.07	1.01	1.01	1.00
Stone:						
Granite:						
Crushed.....do.....		1.20	1.25	1.00	1.25	1.25
Limestone:						
Crushed.....do.....	1.26	1.24	1.23	1.18	1.22	1.24
Dimension.....do.....	.92	.79	.94	.82	.82	.82
Marble:						
Crushed.....do.....	5.71	5.57	10.15	12.76	13.46	14.30
Dimension.....do.....	87.58	110.51	110.36	105.99	72.23	72.91
Sandstone:						
Crushed.....do.....	1.67	5.84	14.36	3.68	3.48	2.65
Dimension.....do.....	19.54	21.82	24.38	21.90	21.90	21.86
Zinc.....pound.....	.15	.115	.108	.123	.137	.116

1 Figure withheld to avoid disclosing individual company confidential data.

2 Data not available.

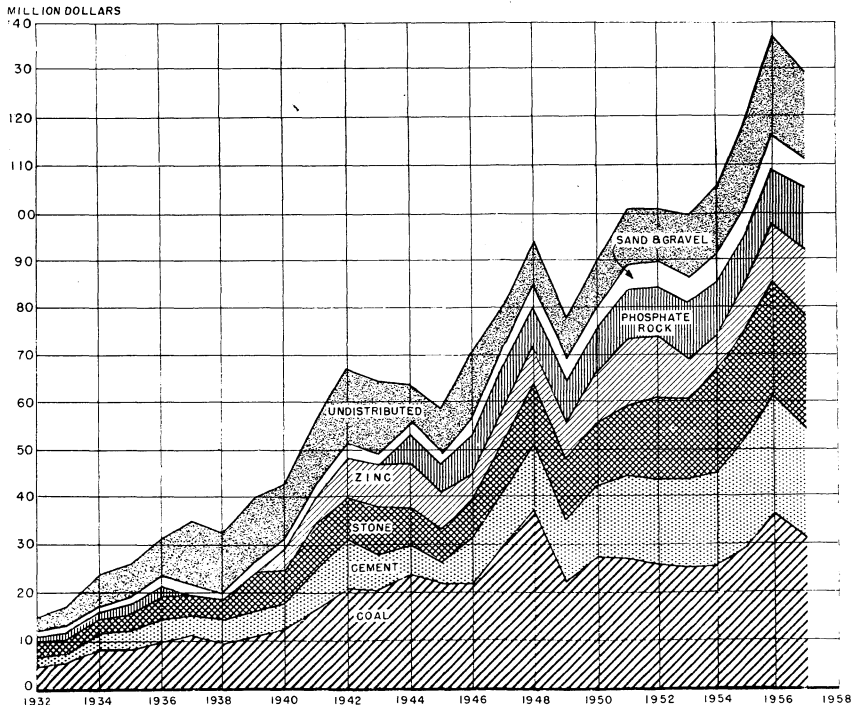


FIGURE 1.—Value of mineral production in Tennessee, 1932-57.

Copper Co. (gold, silver, copper, pyrite, and zinc), American Zinc Co. of Tennessee (limestone and zinc), Marquette Cement Mfg. Co. (cement, clays, limestone, and sand and gravel), Penn-Dixie Cement Corp. (cement, clays, and limestone), and Volunteer Portl and Cement Co. (cement, clays, and limestone).

EMPLOYMENT AND INJURIES

Reports submitted to the Bureau of Mines indicate that employment in the mineral industries was 10 percent below that in 1956 and 6 percent below that in 1955. Employment declined for all industries except metal mines, which increased 3 percent, and nonmetal mines, which increased 33 percent; decreases were 15 percent for coke ovens and smelters, 3 percent for quarries and mills, 15 percent for coal mines, and 20 percent for sand and gravel mines. Most companies worked a regular 5-day week, although cement mills, coke ovens, and smelters worked continuously; however, many coal mines were idle most of the year.

TABLE 3.—Employment in the mineral industries, 1956-57

Industry	1956			1957 ¹		
	Men working daily	Average active days	Man-days worked	Men working daily	Average active days	Man-days worked
Coke ovens and smelters.....	8,180	366	2,992,983	6,981	365	2,547,098
Quarries and mills.....	3,464	255	883,638	3,399	253	859,929
Coal mines.....	4,018	185	741,886	4,648	135	628,924
Metal mines.....	1,680	248	415,989	1,804	238	428,891
Nonmetal mines.....	795	233	185,399	966	255	246,461
Oil and gas.....	562	259	145,633	(3)	(3)	(3)
Sand and gravel mines.....	¹ 650	² 240	² 155,778	535	234	125,185
Total.....	19,349	285	5,521,306	18,333	264	4,836,488

¹ Preliminary figures.

² Excluding Government-and-contractor operations.

³ Data not available.

TABLE 4.—Injuries in the mineral industries, 1956-57

Industry	1956					1957 ¹			
	Fatal	Non-fatal	Total	Injuries per million man-days	Days lost per million man-hours	Fatal	Non-fatal	Total	Injuries per million man-days
Coke ovens and smelters.....		99	99	33	(2)	2	85	87	34
Oil and gas.....		11	11	76	82	(2)	(2)	(2)	(2)
Sand and gravel mines.....	(2)	(2)	(2)	(2)	(2)		20	20	160
Nonmetal mines.....		27	27	146	(2)		40	40	162
Metal mines.....	1	56	57	145	3,307	1	92	93	217
Quarries and mills.....	1	162	163	184	3	3	190	193	224
Coal mines.....	12	213	225	303	14,764	8	180	188	299
Total.....	14	568	582	108	(2)	14	607	621	128

¹ Preliminary figures.

² Data not available.

Injury experience was not as good as in 1956, as the frequency rate increased 19 percent. The frequency rate increased for all industries except coal mines, which decreased 1 percent. The increases were 3 percent for coke ovens and smelters, 11 percent for nonmetal mines, 50 percent for metal mines, and 22 percent for quarries and mills. Fourteen fatalities occurred, the same as in 1956. Nine fatalities had been reported in 1955.

CONSUMPTION, TRADE, AND MARKETS

Most of the mineral production of Tennessee was consumed within the State. Barite was shipped out of the State for use mainly in oil-well drilling. Cement was shipped to the following States: Tennessee (41 percent), North Carolina (27 percent), Georgia (16 percent), South Carolina (5 percent), Alabama (3 percent), Florida (3 percent), Kentucky (2 percent), and other southern States (3 percent). Clays were mainly consumed locally, although some ball clay, fire clay, and fuller's earth was shipped to other States. Most of the coal mined in Tennessee was burned by the Tennessee Valley Authority at the Kingston, Widows Creek, and John Sevier steam plants, although some was used locally, and some was shipped to other States. Gold, silver, copper, and lead were shipped to eastern refineries; zinc was shipped to plants in the East and Midwest. Iron ore was consumed at Rockwood. Lime was shipped as follows: North Carolina (30 percent), Tennessee (21 percent), New York (13 percent), Kentucky (11 percent), Georgia (9 percent), Virginia (7 percent), Florida (4 percent), and other States (5 percent). Manganese ore was sold to Government stockpiles. Sand, gravel, and crushed stone supplied local markets. Dimension marble and sandstone were shipped all over the Eastern United States. Phosphate rock was processed locally and shipped all over the Nation.

TRENDS AND DEVELOPMENTS

Coal has been mined continuously in Tennessee since 1840. Production gradually increased and reached a peak of 8 million tons in 1942. Since 1942, production declined to a low of 4 million tons in 1949 and has recovered for a new record of nearly 9 million tons in 1956. Completion of the large TVA steam plants provided a new market for Tennessee coal; most of the coal mined since 1949 has been sold to TVA. The cement industry continued to grow by adding to existing plants; during the year cement mills at Knoxville and Nashville were enlarged. Tennessee's zinc industry continued the expansion that began in 1954, and the State rose from eighth place in 1954 to second place in 1957; the opening of the new Jefferson City mine of New Jersey Zinc Co. and increased output by other producers furnished the increase. American Zinc Co. of Tennessee completed development in 1957 of its new Coy mine in Jefferson County. New Jersey Zinc Co. completed development of its new Flat Gap mine and construction of a new 2,000-ton flotation mill in Hancock County. The crushed-stone industry continued to expand, and production doubled since 1949. Lambert Bros. Inc., purchased Franklin Limestone Co., the leading producer of crushed limestone,

and became a subsidiary of Vulcan Materials Corp., the leading aggregate producer in the South. The quantity of sand and gravel produced was about 5 million tons a year. American Zinc, Lead & Smelting Co. purchased Knoxville Sand & Gravel Co. and will operate it as a division of American Limestone Co. The phosphate-rock industry continued to increase to a new record in 1957. Victor Chemical Works purchased Federal Chemical Co. Tennessee Products & Chemical Corp. completed an electric-furnace plant at Rockwood for ferroalloys. National Carbon Co., division of Union Carbide Corp., completed a plant at Columbia for producing graphite and carbon electrodes. W. R. Grace & Co. completed a plant at Erwin for producing uranium, thorium, and rare-earths alloys and metals.

LEGISLATION AND GOVERNMENT PROGRAMS

Defense Minerals Exploration Administration (DMEA) activity consisted of 10 projects for zinc.

TABLE 5.—Defense Minerals Exploration Administration projects for zinc, active in 1957

Contractor	Property	County	Amount ¹
American Zinc Co. of Tennessee.....	Strawberry Plains area.....	Knox.....	\$768, 170
National Lead Co.....	Indian Creek area.....	Grainger.....	40, 530
Do.....	Thorn Hill area.....	do.....	57, 490
Do.....	Puncheon Camp Creek area.....	do.....	170, 125
New Jersey Zinc Co.....	Talbot area.....	Jefferson.....	² 156, 250
Do.....	Strawberry Plains area.....	do.....	² 355, 850
Do.....	Independence area.....	Hancock.....	107, 150
Do.....	Edison area.....	Hawkins.....	¹ 107, 150
Do.....	Big War Creek area.....	Hancock.....	107, 150
Do.....	Cedar Springs area.....	Grainger.....	105, 950

¹ Government participation, 50 percent.

² Completed.

³ Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Four companies mined crude barite at 5 mines in 4 counties. The barite was mainly ground and used for well drilling. The leading producers were National Lead Co. and Ba-Flo Co. Shipments declined 23 percent below 1956, the record year.

Cement.—Four companies produced masonry cement at 5 plants in 5 counties. The leading producer was Marquette Cement Manufacturing Co. Shipments decreased 9 percent below 1956 and 20 percent below 1955—the record year.

Four companies produced portland cement at 6 plants in 6 counties. The leading producer was Penn-Dixie Cement Corp. Shipments decreased 16 percent below 1956 (the record year). Raw materials used in cement included limestone (84 percent), clays (10 percent), gypsum (3 percent), sand (2 percent), and other (1 percent).

Clays.—Six companies mined ball clay at nine mines in Henry and Weakley Counties for whiteware, art pottery, enameling, floor and wall tile, firebrick and block, glass refractories, kiln furniture, heavy

clay products, exports, and other uses. The leading producer was H. C. Spinks Clay Co., Inc. Production was the second highest of record but 11 percent below 1956, the record year.

TABLE 6.—Finished portland cement produced, shipped, and in stock, 1948-52 (average) and 1953-57, in 376-pound barrels

Year	Production (thousand barrels)	Shipment from mills		Stocks at mills on Dec. 31 (thousand barrels)
		Thousand barrels	Value (thousands)	
1948-52 (average).....	6,830	6,804	\$15,249	318
1953.....	7,475	7,277	18,283	586
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

TABLE 7.—Ball clay sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Whiteware.....	197,408	\$2,610,394	164,033	\$2,195,546
Floor and wall tile.....	52,576	727,639	45,284	638,158
Heavy clay products.....			3,575	35,750
Exports.....	800	8,000	(¹)	(¹)
Enamel.....	65	650	(¹)	(¹)
Other uses.....	39,243	546,026	46,509	677,290
Total.....	290,092	3,892,709	259,401	3,546,744

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

TABLE 8.—Clays sold or used by producers, 1948-52 (average) and 1953-57

Year	Ball clay		Fire clay		Fuller's earth	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1948-52 (average).....	169,724	\$1,941	27,501	\$199	(¹)	(¹)
1953.....	165,822	2,076	(²)	(²)	30,961	\$428
1954.....	194,072	2,491	15,437	175	27,532	449
1955.....	254,034	3,335	4,604	52	33,791	473
1956.....	290,092	3,893			48,000	659
1957.....	259,401	3,547			35,240	413

Year	Miscellaneous clay		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)
1948-52 (average).....	¹ 846,133	¹ \$980	1,043,358	\$3,120
1953.....	(²)	(²)	1,037,450	3,479
1954.....	778,215	665	1,015,256	3,780
1955.....	915,184	310	1,207,613	4,170
1956.....	1,040,420	336	1,378,512	4,888
1957.....	859,201	268	1,153,842	4,228

¹ Fuller's earth included with miscellaneous clay.

² Figure withheld to avoid disclosing individual company confidential data.

Two companies mined fuller's earth in Henry County for absorbent uses. The leading producer was Southern Clay Co., Inc. Production was the second highest of record but was 27 percent below 1956—the record year.

Fourteen companies mined miscellaneous clay at 17 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 decreased 17 percent below 1956, the record year.

Feldspar.—The Feldspar Corp. ground feldspar at a plant in Erwin, using crude feldspar from North Carolina.

Fluorspar.—Tennessee Mineral Co. mined a small quantity of fluorspar.

Lime.—Three companies produced quick and hydrated lime at Knoxville for building, agricultural, chemical, and industrial uses. The leading producer was Williams Lime Mfg. Co. Production declined 25 percent below 1956 and 9 percent below 1955.

Mica.—International Minerals & Chemical Corp. recovered scrap mica at Greenville from silt deposits in Davy Crockett Lake. Production was more than three times that in 1956.

Perlite.—Tennessee Products & Chemical Corp. expanded perlite at a plant in Nashville, using crude material from Western States.

Phosphate Rock.—Tennessee ranked second in the Nation in producing phosphate rock. Eleven companies mined and processed marketable phosphate rock at 15 mines in 5 counties. The leading producers were Monsanto Chemical Co. and Victor Chemical Works. Marketable production increased 8 percent over 1956, the previous record year.

TABLE 9.—Marketable production of phosphate rock, 1948-52 (average) and 1953-57

Year	Long tons (thousands)	Value ¹ (thousands)	Year	Long tons (thousands)	Value ¹ (thousands)
1948-52 (average).....	1,449	\$10,205	1955.....	1,466	\$10,526
1953.....	1,519	11,305	1956.....	1,685	11,643
1954.....	1,633	11,743	1957.....	1,812	12,514

¹ Estimate based on unit value of material sold or used.

TABLE 10.—Phosphate rock sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Thousand long tons	Value (thousands)	Thousand long tons	Value (thousands)
Elemental phosphorus.....	1,262	\$10,988	1,446	\$10,182
Ordinary and triple superphosphate.....	164	713	132	647
Fertilizer filler and other fertilizers.....	101	453	93	457
Direct application to the soil.....	131	597	84	415
Other.....	5	41	23	156
Total.....	1,663	12,792	1,778	11,857

Pyrite.—Tennessee led the Nation in producing pyrite. Tennessee Copper Co. recovered pyrite concentrate from sulfide ore mined in Polk County. Production increased 1 percent over 1956, the preceding record year.

Sand and Gravel.—Thirty-eight companies mined sand and gravel at 43 mines in 25 counties. The leading producers were Memphis Stone & Gravel Co. in Benton and Shelby Counties, and Sangravl Co., Inc., in Humphreys County. Production decreased slightly below 1956—the record year.

Stone.—Blue Ridge Stone Co. crushed granite in Carter County for concrete and roads.

Seventy-eight companies crushed limestone at 100 quarries in 52 counties. Leading producers were Lambert Bros., Inc. (Blount, Davidson, Hawkins, Humphries, Knox, Sevier, and Williamson Counties), American Zinc Co. of Tennessee (Jefferson and Knox Counties), and Chattanooga Rock Products Co. (Hamilton County). Production decreased 1 percent below 1956—the record year.

TABLE 11.—Sand and gravel sold or used by producers, 1948-52 (average) and 1953-57

Year	Sand		Gravel		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1948-52 (average).....	2,004	\$2,595	2,365	\$2,026	4,369	\$4,621
1953.....	2,604	3,288	2,627	2,342	5,231	5,630
1954.....	2,192	2,962	2,963	3,179	5,155	6,141
1955.....	2,159	2,817	2,977	2,997	5,136	5,814
1956.....	2,421	3,224	3,208	3,257	5,629	6,481
1957.....	2,103	3,134	3,514	3,506	5,617	6,641

TABLE 12.—Sand and gravel sold or used by producers, 1956-57, by uses

Use	1956					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	1,248,234	\$1,519,524	1,162,248	\$1,250,737	2,410,482	\$2,770,261
Paving.....	711,086	706,547	1,662,864	1,622,615	2,373,950	2,329,162
Other.....	461,837	997,911	383,572	383,239	844,909	1,381,150
Total.....	2,420,657	3,223,982	3,208,684	3,256,591	5,629,341	6,480,573
Use	1957					
	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Structural.....	1,233,890	\$1,469,085	1,246,081	\$1,480,735	2,479,971	\$2,949,820
Paving.....	460,019	657,235	2,147,645	1,906,549	2,607,664	2,563,784
Other.....	409,571	1,007,833	120,224	119,038	529,795	1,126,871
Total.....	2,103,480	3,134,153	3,513,950	3,506,322	5,617,430	6,640,475

Davidson County Highway Department quarried a small quantity of dimension limestone for building stone.

Four companies crushed marble at 9 quarries in 3 counties. The leading producer was John J. Craig Co. (Blount County). Output increased 1 percent over 1956 and 12 percent over 1955 but was 51 percent below 1948, the record year.

Six companies quarried dimension marble at 13 quarries in four counties. The leading producer was John J. Craig Co. Production increased 10 percent over 1956, the previous record year. In the Nation, Tennessee led in producing dimension marble.

TABLE 13.—Crushed limestone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Concrete and roads.....	11, 036, 216	\$13, 296, 425	11, 304, 989	\$13, 870, 606
Cement and lime.....	2, 627, 036	3, 120, 566	1, 904, 820	2, 279, 600
Railroad ballast.....	461, 182	441, 112	755, 090	842, 262
Agstone.....	815, 589	1, 112, 065	751, 395	1, 002, 832
Stone sand.....	132, 957	192, 276	226, 441	328, 973
Fluxing stone.....	89, 770	121, 736	101, 753	151, 603
Paper.....	10, 413	15, 862	(1)	(1)
Rock dust for coal mines.....	3, 000	14, 100	(1)	(1)
Riprap.....	7, 595	7, 813	8, 191	11, 061
Glass.....	35, 485	72, 552	5, 000	8, 750
Mineral food.....	21, 000	84, 000		
Other.....	150, 570	205, 466	174, 230	392, 178
Total.....	15, 390, 818	18, 743, 973	15, 231, 909	18, 887, 865

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

Three companies crushed sandstone at 3 quarries in 3 counties for refractories, concrete and roads, abrasives, foundries, and cement. The leading producer was Ayers Mineral Co. (Henderson County). Production expanded 41 percent over 1956, the previous record year.

Seven companies quarried dimension sandstone at seven quarries in Cumberland and Fentress Counties for rough architectural and sawed building stone and for flagging. Production decreased 12 percent below 1956, and 34 percent below 1955, the record year.

Vermiculite.—Zonolite Co. exfoliated vermiculite at its plant at Nashville, using materials from South Carolina and Montana.

TABLE 14.—Crushed and broken stone sold or used by producers, 1948-52 (average) and 1953-57

Year	Limestone		Marble		Sandstone		Total ¹	
	Thou- and short tons	Value (thou- sands)	Thou- sand short tons	Value (thou- sands)	Thou- sand short tons	Value (thou- sands)	Thou- sand short tons	Value (thou- sands)
1948-52 (average) ²	8, 444	\$10, 618	22	\$118	(3)	(3)	8, 466	\$10, 736
1953 ³	10, 373	12, 870	32	174	1	\$7	10, 406	13, 051
1954.....	13, 878	17, 090	18	179	4	65	13, 900	17, 334
1955.....	14, 254	16, 823	16	205	(3)	(3)	14, 270	17, 028
1956.....	15, 390	18, 744	18	238	(3)	(3)	15, 408	18, 982
1957.....	15, 232	18, 888	18	256	(3)	(3)	15, 250	19, 144

¹ Incomplete totals; exclude sandstone, 1948-49 and 1955-57; and granite 1953-57.

² Except limestone for cement or lime.

³ Figure withheld to avoid disclosing individual company confidential data.

TABLE 15.—Dimension stone sold or used by producers, 1948-52 (average) and 1953-57

Year	Limestone		Marble		Sandstone		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1948-52 (average).....	(1)	(1)	35, 873	\$3, 129	(1)	(1)	(1)	(1)
1953.....	2, 214	\$2	24, 826	2, 743	52, 785	\$1, 152	79, 825	\$3, 897
1954.....	4, 292	4	27, 611	3, 047	65, 996	1, 609	97, 899	4, 660
1955.....	1, 632	1	33, 763	3, 579	76, 165	1, 668	111, 560	5, 248
1956.....	1, 848	2	48, 577	3, 509	57, 288	1, 254	107, 713	4, 765
1957.....	430	1	58, 624	3, 909	50, 367	1, 101	104, 421	5, 011

¹ Figure withheld to avoid disclosing individual company confidential data.

TABLE 16.—Dimension marble sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Cubic feet	Value (thousands)	Cubic feet	Value (thousands)
Building stone:				
Interior, cut, dressed.....	156, 174	\$2, 250	(1)	(1)
Interior, sawed, dressed.....	(1)	(1)	123, 980	\$1, 023
Interior, rough.....	(1)	(1)	122, 803	380
Exterior, rough.....	(1)	(1)	18, 858	65
Other uses.....	415, 318	1, 259	366, 489	2, 442
Total.....	571, 492	3, 509	632, 130	3, 909

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

MINERAL FUELS

Coal.—Ten percent less coal was produced than in 1956—the record year. Coal was obtained at 491 mines in 17 counties, compared with 533 mines in 17 counties in 1956. Leading counties were Marion, Anderson, and Campbell. Leading mines were the Dean mine (Wind Rock Coal & Coke Co.), Reels Cove mine (Tennessee Products & Chemical Corp.), and Meadow Creek mine (Clinchfield Coal Corp.). In the northern part of the State (District 8), 293 mines in 9 counties mined 5,394,000 tons, compared with 249 mines, 9 counties, and 5,296,000 tons in 1956; the average production per mine decreased from 21,300 tons to 18,400; of the total, 56 percent was mined underground. In the southern part (District 13), 198 mines in 8 counties mined 2,561,000 tons, compared with 284 mines, 8 counties, and 3,551,000 tons in 1956. The average production per mine increased from 12,500 tons to 12,900; of the total production, 79 percent was mined underground. Of the total State production, only 2 percent was captive tonnage.

Coke.—Tennessee Products & Chemical Corp. produced metallurgical coke at byproduct coke ovens in Chattanooga.

Natural Gas.—Marketed production of natural gas decreased 22 percent below 1956 and 10 percent below 1955.

Petroleum.—Production of crude petroleum decreased 11 percent below 1956 and was 51 percent less than in 1953, the record year.

TABLE 17.—Production of coal, 1948–52 (average) and 1953–57

Year	Short tons (thousands)	Value (thousands)	Year	Short tons (thousands)	Value (thousands)
1948–52 (average).....	5,278	\$27,801	1956.....	8,848	\$35,609
1953.....	5,467	25,152	1957.....	7,955	31,147
1954.....	6,429	25,477	Total production (earliest records to date).....	375,800	(1)
1955.....	7,053	28,747			

¹ Data not available.

METALS

Copper.—Tennessee Copper Co. recovered copper concentrate from sulfide ore mined in Polk County. Production decreased 6 percent below 1956 and 8 percent below 1930—the record year.

Ferroalloys.—Shipments of ferromanganese, ferrosilicon, ferrochromium, chromic silicide, and ferrophosphorus totaled 213,000 tons valued at \$57.6 million, compared with 173,400 tons valued at \$27.7 million in 1956.

Gold.—Tennessee Copper Co. recovered gold as a byproduct from smelting copper and zinc concentrates. Production was 9 percent less than in 1956 and 22 percent less than in 1955.

Iron Ore.—Two companies mined brown iron ore (limonite) in Blount and McMinn Counties, and Rockwood Mining Co. mined red ore (hematite) in Roane County for sale to blast furnaces. Total iron-ore shipments were 10 percent more than in 1956 but were 4 percent below 1955.

Manganese Ore.—Metallurgical-grade manganese ore was mined by 11 producers in Carter, Johnson, and Unicoi Counties. The leading producers were Haile Mines, Inc. (Unicoi County), and Virginia Iron, Coal & Coke Co. (Carter County). Shipments decreased 27 percent below 1956 and 19 percent below 1955.

TABLE 18.—Production of manganese ore, 1948–52 (average) and 1953–57 (35 percent or more Mn)

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1948–52 (average).....	94	(1)	1955.....	15,895	\$1,280
1953.....	2,625	\$202	1956.....	17,821	1,417
1954.....	11,823	920	1957.....	12,938	1,007

¹ Figure withheld to avoid disclosing individual company confidential data.

Pig Iron.—Tennessee Products & Chemical Corp. (Rockwood and Wrigley plants) produced basic, low phosphorus and malleable pig iron. Shipments decreased 19 percent. Iron and manganese ores consumed were 97 percent domestic and 3 percent imported. Foreign imports, from Chile and India, declined 61 percent below 1956.

Silver.—Tennessee Copper Co. recovered silver as a byproduct from smelting copper and zinc concentrates produced in Polk County. Production was 16 percent less than in 1956 and 18 percent less than in 1955.

Zinc.—Tennessee ranked second in the Nation in producing zinc. American Zinc Co. of Tennessee, New Jersey Zinc Co., and Tennessee Coal & Iron Division of United States Steel Corp. 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 expanded 26 percent over 1956—the previous record year.

TABLE 19.—Mine production of recoverable gold, silver, copper, lead, and zinc 1948–52 (average) and 1953–57

Year	Gold		Silver		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Fine ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1948–52 (average)	167	\$5,852	40,802	\$36,928	6,944	\$3,084,184	80	\$24,472	34,259	\$10,392,126	\$13,543,562
1953-----	293	10,255	68,935	62,390	7,829	4,493,846	9	2,358	38,465	8,846,950	13,415,799
1954-----	218	7,630	60,759	54,990	9,087	5,361,861	-----	-----	30,326	6,550,345	11,974,826
1955-----	221	7,735	66,619	60,294	9,911	7,393,569	-----	-----	40,216	9,893,136	17,354,685
1956-----	189	6,615	64,878	58,718	10,449	8,881,650	5	1,570	46,023	12,610,302	21,558,855
1957-----	172	6,020	54,407	49,241	9,790	5,893,580	-----	-----	58,063	13,470,616	19,419,457
1850–1957 (total).	23,200	(¹)	3,637,100	(¹)	474,200	(¹)	16,000	(¹)	1,266,000	(¹)	417,797,000

¹ Included with total value.

REVIEW BY COUNTIES

Production was reported from 76 of the State's 95 counties, led by Knox, Polk, Jefferson, Maury, and Hamilton. In addition to the commodities described in detail in the following county listing, small quantities of oil and gas were produced.

Anderson.—Thirty-five mines produced 1,481,000 tons of coal; the leading producers were Dean mine (Wind Rock Coal & Coke Co.) and Morco and Trimore mines (Mahan-Ellison Coal Corp.). Ralph Rogers & Co., Inc., and Anderson County Highway Department crushed limestone for concrete aggregate and roadstone.

Bedford.—Shelbyville Limestone Co. and Bedford County Highway Department crushed limestone for concrete aggregate, roadstone, and agstone.

Benton.—Hardy Sand Co. (Hardy and Silica mines), Porter-Warner Industries, Inc., Ward & Sullins, Inc., and Hicks Sand Co. mined sand for glass, molding, paving, grinding and polishing, and other uses. Memphis Stone & Gravel Co. and Camden Gravel Co. mined gravel for structural and paving uses. The production of sand and gravel totaled 568,000 tons.

Bledsoe.—Seven mines produced 27,000 tons of coal; the leading producer was the No. 1 mine of I. E. & Landon Brown Coal Co.

Blount.—John J. Craig Co. (Lee, Hamil, Marmor, and Crisp quarries), Gray Knox Marble Co. (Brown and French Pink quarries), and Endsley Marble Co. quarried dimension marble for rough and dressed building stone. John J. Craig Co. crushed marble for terrazzo. Lambert Bros., Inc. (Calderwood quarry), and Sam Lambert & Sons crushed limestone for concrete aggregate and roadstone. The Big Flag Spring Mining Co. (Wilson mine) began mining brown iron ore.

Bradley.—Bradley Limestone Co., Inc. (Welch quarry), crushed limestone for concrete aggregate, roadstone, and agstone.

TABLE 20.—Value of mineral production in Tennessee, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value ²
Anderson	(3)	(3)	Coal, limestone.
Bedford	(3)	(3)	Limestone.
Benton	\$766,223	\$1,083,904	Sand and gravel.
Bledsoe	170,859	78,165	Coal.
Blount	(3)	2,327,938	Marble, limestone, iron ore.
Bradley	270,000	(3)	Limestone.
Campbell	(3)	4,440,870	Coal, limestone, sandstone.
Cannon	(3)	(3)	Limestone.
Carroll	(3)	(3)	(3)
Carter	664,978	702,901	Limestone, manganese ore, granite.
Claiborne	1,649,973	1,749,973	Coal.
Clay	(3)	(3)	Limestone.
Cocke	30,472	(3)	Barite, limestone.
Coffee	(3)	(3)	Limestone.
Cumberland	1,756,640	1,970,118	Sandstone, coal, limestone.
Davidson	6,123,038	5,857,915	Cement, limestone, sand and gravel, phosphate rock, miscellaneous clay.
Decatur	(3)	50,000	Sand and gravel.
De Kalb	18,190	19,000	Limestone.
Dickson	(3)	(3)	Do.
Fayette	18,200	(3)	Sand and gravel.
Fentress	1,481,586	582,169	Coal, limestone, sandstone.
Franklin	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Giles	1,791,884	1,126,247	Phosphate rock, limestone, sand and gravel.
Grainger	44,553	47,690	Marble.
Greene	573,910	260,273	Limestone, sand and gravel, mica.
Grundy	1,704,187	701,576	Coal, limestone.
Hamblen	(3)	(3)	Limestone.
Hamilton	7,156,249	6,973,875	Cement, limestone, coal, sand and gravel, miscellaneous clay.
Hardeman	(3)	(3)	(3)
Hawkins	42,141	(3)	Limestone.
Haywood	19,540	(3)	(3)
Henderson	(3)	(3)	Sandstone.
Henry	(3)	(3)	Ball clay, fuller's earth.
Hickman	580,220	(3)	Phosphate rock.
Humphreys	(3)	(3)	Limestone, sand and gravel.
Jefferson	(3)	(3)	Zinc, limestone.
Johnson	1,067,078	538,596	Manganese ore, limestone.
Knox	15,780,700	14,245,631	Cement, zinc, limestone, marble, lime, sand and gravel, miscellaneous clay.
Lake	(3)	(3)	Sand and gravel.
Lauderdale	17,900	112,046	Do.
Lincoln	(3)	96,900	Limestone.
Loudon	154,953	294,972	Barite, limestone, sand and gravel, miscellaneous clay.
Macon	(3)	(3)	Limestone.
Marion	(3)	(3)	Coal, cement, limestone.
Marshall	(3)	(3)	Limestone.
Maury	7,009,405	9,846,672	Phosphate rock, limestone.
McMinn	(3)	448,500	Limestone, iron ore, barite, sand and gravel.
McNairy	57,840	(3)	Sand and gravel.
Meigs	(3)	(3)	Limestone.
Monroe	(3)	455,349	Barite, limestone, sand and gravel.
Montgomery	(3)	(3)	Limestone.
Morgan	1,904,092	2,433,249	Coal.
Obion	46,866	50,470	Sand and gravel.
Overton	(3)	(3)	Coal, limestone.
Perry	(3)	(3)	Limestone.
Polk	(3)	(3)	Pyrite, copper, zinc, silver, gold.
Putnam	(3)	(3)	Coal, limestone.
Rhea	227,956	171,059	Coal, miscellaneous clay.
Roane	765,599	1,273,697	Limestone, sand and gravel, iron ore.
Robertson	(3)	(3)	Limestone.
Rutherford	264,980	266,000	Do.
Scott	2,171,408	3,287,573	Coal.
Sequatchie	(3)	(3)	Coal, limestone.
Sevier	179,709	(3)	Limestone.
Shelby	1,636,170	1,189,801	Sand and gravel, miscellaneous clay.
Smith	66,804	(3)	Limestone.
Sullivan	(3)	(3)	Cement, limestone, miscellaneous clay, sand and gravel.
Sumner	250,637	412,549	Limestone, sand and gravel.
Tipton	(3)	(3)	Sand and gravel.
Unicoi	(3)	(3)	Manganese ore, sand and gravel.
Union	(3)	(3)	Marble.
Van Buren	333,204	192,886	Coal.
Warren	(3)	(3)	Limestone.

See footnotes at end of table.

TABLE 20.—Value of mineral production in Tennessee, 1956-57, by counties¹—
Continued

County	1956	1957	Minerals produced in 1957 in order of value ²
Washington.....	(3)	(3)	Limestone, miscellaneous clay.
Wayne.....	(3)	(3)	Sand and gravel.
Weakley.....	(3)	(3)	Ball clay.
White.....	\$1, 179, 514	\$787, 339	Coal, limestone.
Williamson.....	(3)	(3)	Phosphate rock, limestone, sand and gravel.
Wilson.....	(3)	(3)	Limestone, fluorspar.
Undistributed ⁴	79, 868, 342	64, 662, 097	
Total.....	137, 846, 000	128, 738, 000	

¹ The following counties are not listed because no production was reported: Cheatham, Chester, Crockett, Dyer, Gibson, Hancock, 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 Includes value of petroleum and natural gas and values indicated by footnote 3.

Campbell.—Coal output was 976,000 tons from 89 mines. The leading producers were: The Red Ash mine (Sun Ray Coal Co.), the Pamco strip mine (Pamco Mining Co.), and Clinchmore Strip mine (West Virginia Coal Co.). Key Limestone Division and Campbell County Highway Department crushed limestone for concrete aggregate, roadstone, railroad ballast, and other uses. One producer crushed sandstone for concrete aggregate, roadstone, abrasives, and cement.

Cannon.—S. N. McPherson (Norvell quarry) crushed limestone for concrete aggregate and roadstone.

Carter.—Watauga Stone Co. crushed limestone for concrete aggregate, roadstone, railroad ballast, and other uses. Virginia Iron, Coal & Coke Co. (Stoney Creek mine) mined Metallurgical-grade manganese ore. Blue Ridge Stone Co. crushed granite for concrete aggregate and roadstone.

Claiborne.—Forty-two mines produced 452,000 tons of coal. The leading producers were: No. 1 strip mine (B. G. Arnold Coal Co.), No. 1 auger mine (Price Coal Co.), and No. 2 strip mine (Dippel & Dippel Coal Co.).

Clay.—Dixon-Stubblefield Limestone Co. crushed limestone for concrete aggregate and roadstone.

Cocke.—Ba-Flo Company began mining barite at the Thornburg mine. Cocke County Highway Department (Briar Thickett and Burnett quarries) crushed 13,000 tons of limestone for concrete aggregate and roadstone.

Coffee.—Ralph Rogers & Co., Inc., crushed limestone for concrete aggregate and roadstone.

Cumberland.—Six companies quarried 48,000 tons of dimension sandstone for rough architectural and dressed building stone and for flagging. The leading producers were: Crab Orchard Stone Co., Inc. (Peck quarry), Turner Bros. Stone Co., Inc., and Tennessee Stone Co., Inc. (McGuire quarry). Turner Bros. Stone Co., Inc., crushed 750 tons of sandstone for refractories. Nineteen mines produced 115,000 tons of coal. The leading producers were: The Crabtree No. 2 strip mine (C & F Coal Co.), No. 1 strip mine (Black Mountain

Coal Co.), and Clear Creek No. 2 mine (Mars Coal Mines). Cumberland County Highway Department and Southern States Lime Mfg. Co. (Crab Orchard quarry) produced 249,000 tons of limestone for riprap, fluxing stone, concrete aggregate, roadstone, railroad ballast, agstone, glass, paper, and rock dust for coal mines.

Davidson.—Marquette Cement Mfg. Co. produced masonry and portland cements at the Nashville mill throughout the year. Lambert Bros., Inc. (Hermitage, Danley, and Old Hickory quarries), Eller & Olson Crushed Stone Co., Inc., and Davidson County Highway Department produced limestone for riprap, fluxing stone, concrete aggregate, roadstone, railroad ballast, agstone, asphalt filler, rock dust for coal mines, poultry grit, and stone sand. Cumberland River Sand & Gravel Co. and T. L. Herbert & Sons mined sand and gravel for structural and paving uses. Harsh Phosphate Co. mined 15,000 tons of marketable phosphate rock for fertilizer filler. W. G. Bush & Co., Inc., mined miscellaneous clay for heavy clay products. Davidson County Highway Department quarried 430 tons of dimension limestone for building stone. Tennessee Products & Chemical Corp. (Nashville plant) expanded perlite, using crude material from deposits in the Western States. Zonolite Co. exfoliated vermiculite at the Nashville mill, using crude material from South Carolina and Montana.

Decatur.—Tinker Sand & Gravel Co. mined structural sand and gravel.

De Kalb.—De Kalb County Highway Department (Sligo quarry) crushed 36,000 tons of limestone for concrete aggregate and roadstone.

Dickson.—Duke Lime & Stone Co. crushed limestone for concrete aggregate, roadstone, agstone, and stone sand.

Fayette.—Fayette County Highway Department and James W. Jones mined paving gravel.

Fentress.—Twenty mines produced 123,000 tons of coal; the leading producers were Bruns Coal Co., Inc. (Wilder strip and Wilder auger mines), and Chapman & Jordan (Horsepound strip mine). Frogge & Williams, Inc. (Wright quarry), crushed 109,000 tons of limestone for concrete aggregate, roadstone, and agstone. Jones Stone Co. (Nash quarry) quarried 2,800 tons of dimension sandstone for rough architectural 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), Franklin County Highway Department (Bostick quarry), and Marquette Cement Mfg. Co. produced limestone for riprap, fluxing stone, concrete aggregate, roadstone, railroad ballast, agstone, cement, and other uses. Sewanee Silica Sand Co. and Estill Springs Sand-Gravel Co. mined glass, molding, structural, paving, and blast sands, and structural gravel. Marquette Cement Mfg. Co. mined miscellaneous clay for use in cement.

Giles.—Victor Chemical Works, International Minerals & Chemical Corp. (Wales mine), and Monsanto Chemical Co. mined 117,000 tons of marketable phosphate rock for direct application to the soil, pig-iron blast furnaces, and elemental phosphorus. Cedar Grove Lime Co. crushed limestone for concrete aggregate and roadstone. Giles County Highway Department mined 113,000 tons of paving gravel.

Grainger.—Imperial Black Marble Co. quarried 900 tons of dimension marble for interior dressed building stone. National Lead Co. and New Jersey Zinc Co. participated in 2 DMEA projects for zinc ores, amounting to \$276,075, of which the Government share was 50 percent, and continued the 2 projects begun in 1956.

Greene.—Agricultural Lime Co., Inc., Greene County Highway Department, and Malone Bros. Co. crushed 195,000 tons of limestone for concrete aggregate, roadstone, and agstone. Nolichucky Sand Co. mined structural and paving sand and structural gravel. International Minerals & Chemical Corp. recovered scrap mica from silt deposits in Davy Crockett Lake.

Grundy.—Coal output was 183,000 tons from 12 mines. The leading producers were: The No. 1 strip mine (E. Ramsey Coal Co.), Commando strip mine (Phipps Coal Co.), and Ramsey No. 1 strip mine (George Ramsey Coal Co.). Viola White Lime Co. crushed 24,500 tons of limestone for concrete aggregate, roadstone, and agstone.

Hamblen.—White Pine Stone Co. (Hamblen quarry) crushed limestone for concrete aggregate and roadstone.

Hamilton.—Hamilton County ranked fifth in the State in total value of mineral production. Signal Mountain Portland Cement Division of General Portland Cement Co. produced portland and masonry cements at the Signal Mountain mill throughout the year. Chattanooga Rock Products Co. (Chattanooga quarry) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. Fourteen coal mines produced a total of 159,000 tons. The leading producers were: Russell Mining Co. (Lakeview Nos. 1 and 4 strip mines) and Walden Ridge Coal Co. (No. 2 strip mine). Dixie Sand & Gravel Co. mined structural and paving sand, and structural, paving, and other gravel. B. Mifflin-Hood Co., Key-James Brick Co., and Signal Mountain Portland Cement Division mined miscellaneous clay for cement, floor and wall tile, and heavy clay products.

Hancock.—New Jersey Zinc Co. completed development of its new Flat Gap zinc mine, and construction of its 2,000-ton flotation mill during the year. Zinc production was not begun owing to the low price of zinc. The company continued two DMEA projects, which had been begun in 1956.

Hawkins.—Lambert Bros., Inc. (McCloud quarry), crushed limestone for concrete aggregate and roadstone. New Jersey Zinc Co. completed a DMEA project for zinc ores, which was begun in 1956.

Henderson.—Ayers Mineral Co. crushed sandstone for foundry uses.

Henry.—Kentucky-Tennessee Clay Co., H. C. Spinks Clay Co. (Puryear, Henry, and Como mines), and Dixie Brick & Tile Co. mined ball clay for whiteware, floor and wall tile, firebrick and block, and kiln furniture. Southern Clay Co., Inc. (Porter's Creek mine), and Tennessee Absorbent Clay Co. mined 35,000 tons of fuller's earth for absorbent uses.

Hickman.—M. C. Boyle Phosphate Co. (Dean's Switch mine) mined marketable phosphate rock for direct application to the soil.

Humphreys.—Lambert Bros., Inc. (Rock Hill quarry), and Waverly Stone & Gravel Co. produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, and agstone. Sangravl Co., Inc., mined

221,000 tons of sand for structural and paving uses and 328,000 tons of gravel for structural, paving, and railroad-ballast purposes.

Jefferson.—Jefferson County ranked third in the State in total value of mineral production. American Zinc Co. of Tennessee (Coy, Grasselli, North Friends Station, and Young 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 ores. American Zinc Co. of Tennessee continued a DMEA project for zinc ore, which was begun in 1956. New Jersey Zinc Co. completed a DMEA project for zinc ore and continued another, both of which were begun in 1956. American Zinc Co. of Tennessee and Tennessee Coal & Iron Division produced limestone as a byproduct from zinc mines; this material was used for concrete aggregate, roadstone, railroad ballast, agstone, and stone sand.

Johnson.—Seven mines produced 4,000 tons of Metallurgical-grade manganese ore for sale to the Government. Leading producers were Valley Mining Co., Ltd. (Blackburn mine), B & T Mining Co. (Davis mine), and Colitz Mining Co. 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 portland and masonry 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. Nine operations produced 1,975,000 tons of crushed limestone for use in concrete aggregate, roadstone, railroad ballast, agstone, cement, lime, and stone sand. The leading producers were Volunteer Portland Cement Co., Lambert Bros., Inc. (Knoxville Biagotti, and Neuberts quarries), and American Zinc Co. of Tennessee. Appalachian Marble Co. (Appalachian and Bond quarries), Gray Knox Marble Co. (Gray Knox quarry), and Tennessee Marble Co. (Eagle quarry) quarried 18,000 tons of dimension marble for rough and dressed building stone and for cut, dressed monumental stone. Appalachian Marble Co., Knoxville Crushed Stone Co., and Tennessee Marble Co. crushed 7,000 tons of marble for terrazzo and other uses. Standard Lime & Stone Co., Williams Lime Mfg. Co., and Knoxville Lime Mfg. Co. produced 94,000 tons of lime for building, agricultural, chemical, and industrial uses. Knoxville Sangravl Materials Co. and Oliver King Sand-Lime Co. mined structural, paving, grinding and polishing, engine, filter, and railroad-ballast sands and structural and paving gravel. Shalite Corp., General Shale Products Corp., Volunteer Portland Cement Co., and Cherokee Shale Brick Co. mined miscellaneous clay for cement, lightweight aggregate, and heavy clay products.

Lake.—Hickman Sand & Gravel Co. mined structural sand.

Lauderdale.—Lauderdale County Highway Department mined 143,000 tons of paving gravel.

Lincoln.—Clark & Stephenson (Fayetteville quarry) crushed limestone for concrete aggregate and roadstone.

Loudon.—National Lead Co. began mining barite at the Richesin mine. Lenoir Asphalt Paving Co., Inc., and Loudon County Road Commission crushed limestone for concrete aggregate and roadstone. Brooks Sand & Gravel Co. mined 31,000 tons of structural sand and

gravel. Old Hickory Brick Co. (Maryville mine) mined 8,000 tons of miscellaneous clay for heavy clay products.

TABLE 21.—Crushed limestone sold or used by producers in Knox County, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average) ¹	(²)	\$1,989,170	1955.....	2,224,048	\$2,544,588
1953 ¹	1,291,678	1,801,016	1956.....	2,155,541	2,662,673
1954.....	1,997,365	2,382,607	1957.....	1,975,228	2,477,573

¹ Except for cement or lime.

² Figure withheld to avoid disclosing individual company confidential data.

Macon.—Dixon & Stubblefield (Langford quarry) crushed limestone for concrete aggregate and roadstone.

Marion.—Ninety-seven operations produced 1,612,000 tons of coal. The leading producers were: Whitwell and Reels Cove mines (Tennessee Products & Chemical Corp.) and Coal Valley mine (Tennessee Consolidated Coal Co.). 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 Marion Stone Co. (Ketchall quarry) crushed limestone for concrete aggregate, roadstone, and cement.

Marshall.—Lewisburg Limestone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Maury.—Maury County ranked fourth in the State in total value of mineral production. The total output of 9 mines was 1,456,000 tons of marketable phosphate rock. The leading producers were: Monsanto Chemical Co., Presnell Phosphate Co., and Victor Chemical Works. Columbia Rock Products Co. (Theta Pike quarry) crushed limestone for concrete aggregate, roadstone, agstone, and stone sand.

McMinn.—Floyd D. Webb Stone Co. and McMinn County Highway Department crushed limestone for concrete aggregate, roadstone, and agstone. Tennessee Mining Co. began mining brown iron ore at the Nonaburg mine. McMinn Barium Corp. began mining barite at the McMinn mine. Hiwassee Sand Co. mined structural sand.

McNairy.—Worsham Bros. mined structural and paving sand and gravel.

Meigs.—Gil Crouch (Carter quarry) and Posey & Caldwell crushed limestone for concrete aggregate, roadstone, and agstone.

Monroe.—National Lead Co. (Stephens and Ballard mines) and Beverly C. Wood (Roy mine) mined barite for well drilling, glass, rubber, paint, and other uses. Creighead Limestone Co. and Monroe County Highway Department (Tallent quarry) crushed 93,000 tons of limestone for concrete aggregate, roadstone, and agstone. Vonore Sand Co. mined 14,000 tons of structural sand.

Montgomery.—Simpson Stone Co. and Clarksville Stone Co. crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone.

Morgan.—Thirty-four companies mined 684,000 tons of coal. The leading producers were Lueking Bros. Coal Co. (No. 3 strip mine),

Allen Bros. Coal Co. (Nos. 5 and 6 strip mines), and Brushy Mountain Coal Mines (No. 7 mine).

Obion.—Obion County Highway Department mined 136,000 tons of paving gravel.

Overton.—Twelve mines supplied the total coal production in 1957. The leading producers were the No. 1 mine (Love & Amos Coal Co.), and Cub Mountain Nos. 1 and 2 mines (Murphy Bros. Coal Co.). Livingston Limestone Co. (East and South quarries) crushed limestone for concrete aggregate and roadstone.

Perry.—Charlie Elkins (Perry quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Polk.—Polk County ranked second in the State in the value of mineral production. Tennessee Copper Co. led the State in producing 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; gold and silver were recovered as byproducts from smelting the copper and zinc concentrates; the pyrite concentrate was roasted, yielding sulfur dioxide, for use mainly in manufacturing sulfuric acid, and iron oxide, which was sintered for use by iron and steel plants. Production of recoverable copper was 9,790 tons; output of pyrite increased 2 percent over 1956; production of recoverable zinc decreased 13 percent; silver recovery was 54,407 fine ounces; and gold recovery was 172 fine ounces.

Putnam.—Three mines furnished all coal production in 1957. The leading producer was the Meadow Creek mine (Clinchfield Coal Co.). Algood Limestone Co. (Poteet quarry) crushed limestone for concrete aggregate and roadstone.

Rhea.—Four companies mined 54,000 tons of coal; the leading producer was the No. 1 mine (E. Campbell Coal Co.). W. S. Dickey Clay Mfg. Co. (Graysville Clay mine) mined 27,000 tons of miscellaneous clay for heavy clay products.

Roane.—Rockwood Slag Products Co. and A. B. Long Construction Co. (Swan Pond quarry) produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, agstone, and stone sand. Rockwood Mining Co. (New Chamberlain mine) mined red iron ore for blast-furnace use.

Robertson.—Porter Brown Limestone Co. crushed limestone for concrete aggregate and roadstone.

Rutherford.—Bilbrey Rock Co. crushed 245,000 tons of limestone for concrete aggregate, roadstone, agstone, and stone sand.

Scott.—Thirty-nine mines produced a total of 962,000 tons of coal. The leading producers were Alcorn strip mine (Alcorn Mining Co.), Straight Fork mine (Straight Fork Coal Co.), and the No. 2 strip mine (H & W Coal Co.).

Sequatchie.—Coal production was 273,000 tons from 51 active mines. The leading producers were Whitco mine (Whitwell Coal Corp.), New No. 1 mine (Testa Bros., Inc.), and Dunlap No. 6 mine (H. A. Worley Coal Co.). Dunlap Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Sevier.—Lambert Bros., Inc. (Sevier quarry), and United States Bureau of Public Roads crushed limestone for concrete aggregate and roadstone.

Shelby.—Seven companies mined 1,281,000 tons of sand and gravel from nine mines for structural, paving, grinding and polishing, and other sands and structural and paving gravel. John A. Denie's Sons Co. and Moss Lightweight Aggregate Co. mined 136,000 tons of miscellaneous clay for heavy clay products and lightweight aggregates.

Smith.—Oldham Limestone Co. (Rome quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Sullivan.—Penn-Dixie Cement Corp. produced portland and masonry cements at the Kingsport Mill throughout the year. Standard Crushed Stone Co. (New Kingsport quarry) and Sullivan County Highway Department (Muddy Creek and Fall Creek quarries) crushed limestone for concrete aggregate and roadstone. Penn-Dixie Cement Corp. and General Shale Products Corp. mined miscellaneous clay for cement and heavy clay products. Afton Good mined 2,000 tons of structural sand.

Sumner.—Ralph Rogers & Co., Inc., Pilot Knob Limestone Co., and L & N Stone Co. crushed 304,000 tons of limestone for concrete aggregate, roadstone, agstone, and stone sand. Sumner County Highway Department mined 101,000 tons of paving gravel.

Tipton.—Owens Sand & Gravel Co. mined structural sand and structural and paving gravel.

Unicoi.—Haile Mines, Inc. (Bumpass Cove mine), Lewis Mining Co., and Ura-Manganese Corp. mined Metallurgical-grade manganese ore. Brooks Sand & Gravel Co. mined 278,000 tons of structural and paving sands and structural, paving, and railroad-ballast gravels. The Feldspar Corp. operated the Erwin plant for ground feldspar.

Union.—Tennessee Marble Co. (Luttrell quarry) quarried dimension marble for rough and dressed building stone and dressed monumental stone.

Van Buren.—Nine mines supplied 58,000 tons of coal; the leading producers were Buckridge mine (Alton Anderson Coal Co.), King strip mine (Nick Istock, Inc.), and Glade Creek mine (Brown Coal Co.).

Warren.—Warren Limestone Co. (McMinnville and Warren quarries) and McMinnville Rock Co., Inc., crushed limestone for concrete aggregate, roadstone, and agstone.

Washington.—Washington County Highway Department crushed 190,000 tons of 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.—Four mines furnished 194,000 tons of coal; the leading producer was O. K. Coal Co. (De Rossett strip and auger mines). Sparta Limestone Co., Thompson-Weinman & Co., and White County Highway Department crushed limestone for concrete aggregate, roadstone, agstone, and whiting.

Williamson.—Monsanto Chemical Co. mined marketable phosphate rock for elemental phosphorus. Lambert Bros., Inc. (Franklin quarry), and Williamson County Highway Department crushed limestone for concrete aggregate, roadstone, railroad ballast, and other uses. The highway department mined 121,000 tons of paving gravel.

Wilson.—Marquette Cement Mfg. Co. (Martha quarry) and Lebanon Limestone Co. crushed limestone for cement, concrete aggregate, and roadstone. Tennessee Mineral Co. (Lebanon mine) mined a small quantity of Metallurgical-grade fluorspar.

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. Netzeband¹ and John T. Lonsdale²



A NEW value record was established by the mineral industry of Texas for the eighth consecutive year in 1957—a total of \$4,497 million, 6 percent more than the 1956 total of \$4,245 million. The 1957 gain was due to value increases of helium, lime, natural gas, crude oil, salt, iron ore, lignite, and magnesium chloride used for metal; however, there were significant declines in the output of cement, clays, crude oil, gypsum, sand and gravel, stone, and sulfur.

TABLE 1.—Mineral production in Texas, 1956–57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry.....376-pound barrels.....	731,840	\$2,625	596,743	\$2,340
Portland.....do.....	25,234,150	73,070	21,546,608	66,201
Clays ²	3,146,201	4,765	2,992,178	4,934
Gem stones.....	(³)	115	(³)	100
Gypsum.....	1,156,956	3,623	1,043,236	3,343
Helium.....cubic feet.....	145,830,220	2,364	204,286,411	3,353
Lime.....	592,136	6,938	796,394	7,489
Natural gas.....million cubic feet.....	4,999,889	434,990	4,525,600	447,800
Natural-gas liquids:				
Natural gasoline and cycle products				
thousand gallons.....	2,964,609	216,378	2,944,381	201,423
do.....	3,731,047	144,745	3,831,664	147,618
LP-gases.....do.....	1,107,808	3,131,225 ⁵	1,083,812 ⁴	3,369,371 ⁴
Petroleum (crude).....thousand 42-gallon barrels.....	3,962,778	14,370	4,612,083	17,104
Salt (common).....	29,335,697	27,213	23,685,200	23,427
Sand and gravel.....	32,772,827	36,350	30,660,445	35,358
Stone.....				
Sulfur:				
Frasch-process.....long tons.....	3,437,061	91,026	2,879,672	70,226
Recovered elemental.....do.....	140,164	3,865	163,571	4,022
Talc and soapstone.....	41,332	244	47,780	199
Value of items that cannot be disclosed: Abrasive stone, native asphalt, bromine, feldspar, fuller's earth, graphite, iron ore, lignite, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, pumice, sodium sulfate, uranium ore (1957).....		62,354		71,511
Total Texas ⁶		4,245,123 ⁵		4,497,264

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 Revised figure.

⁶ Total adjusted to eliminate duplicating value of clays and stone.

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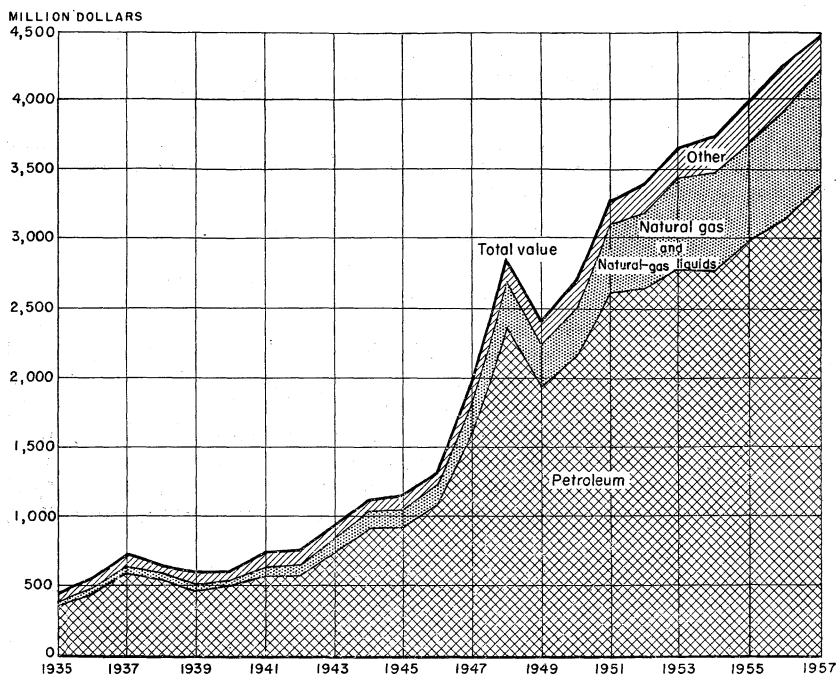


FIGURE 1.—Value of petroleum, natural gas and natural-gas liquids and total value of mineral production in Texas, 1935-57.

The oil and gas industry of Texas faced many problems during 1957. The industry began the year in an expansive mood, in response to an extraordinary emergency demand for oil to help supply the European market when Middle East oil was cut off by closing of the Suez Canal; at the end of the year a staggering oversupply was on hand of both crude oil and products caused by a glut of foreign imports and declining demand. This "feast-to-famine" cycle was caused by the delay in curtailing domestic production after the Suez Canal was reopened, by early resumption of high levels of imports, by the delay in reducing refinery runs, and by diverse pressures from producer and consumer groups and from foreign producing nations.

Demands for materials of construction (cement, gypsum, stone, sand and gravel), were retarded in the early part of 1957 by adverse weather and by marked declines in residential construction but recovered slightly as commercial, industrial and public works construction advanced during the latter part of the year. The physical volumes of these commodities were less in 1957 than in 1956.

The Game and Fish Commission of Texas surveyed shell deposits in the numerous bays along the Gulf coast, using a special electronic device to detect the submerged beds of shell. Areas then were core-drilled to determine their extent and thickness. Several known shell reefs were successfully tested by this method. A survey of shell producers in bays around Galveston revealed an estimated reserve of nearly 200 million cubic yards of shell deposits. Shell is used

chiefly in cement and lime manufacture and also in roads and as an aggregate in concrete.

Exploitation of proved sulfur deposits in the Humble dome by the Frasch process was begun by American Sulfur Royalty Co. Core drilling revealed 22 feet of sulfur-bearing formations from which about 133 million barrels of crude oil had already been extracted.

Iron-ore output maintained its record pace in 1957, notwithstanding an extended strike at the steel plant of one of the producers; and the recovery rate of magnesium from sea water continued at an accelerated pace. Operations at several of the State's 22 smelters were curtailed during the latter part of 1957 as metal prices declined, metal and concentrate stocks rose, and consuming industries continued to liquidate metal inventories.

Defense activities and installations continued as an important factor of the Texas economy. Military bases provided employment for both civilian and military personnel, supported service and manufacturing industries associated with the defense effort, and spent large sums for equipment and supplies.

The economy of each of the 254 counties in Texas was influenced to some degree by the State's mineral industries. In some counties minerals were produced; in others, crude materials were processed. All benefited from industry payrolls and taxes.

In summary, the 1957 mineral economy of Texas continued to progress, though much more slowly than in 1956. Industrial activity reached a peak in the third quarter of 1957 to bring near records in mineral output, consumption, and employment; however, the economic decline in the final quarter canceled many of these earlier gains.

TABLE 2.—Average unit value of selected mineral commodities produced in Texas, 1953-57

Commodity	1953	1954	1955	1956	1957
Cement (portland)..... 376-pound barrel	\$2.53	\$2.58	\$2.70	\$2.90	\$3.07
Gypsum (crude)..... short ton	2.68	3.10	3.13	3.13	3.20
Helium..... thousand cubic feet	13.40	16.94	16.30	16.21	16.41
Lime..... short ton	9.21	9.90	9.49	11.72	9.40
Magnesium ¹ pound	.266	.270	.295	.339	.353
Mercury ² 76-pound flask	193.03	264.39	290.35	259.92	246.98
Natural gas..... thousand cubic feet	.076	.085	.080	.087	.091
Natural-gas liquids:					
Natural gasoline and cycle products..... gallon	.073	.073	.069	.073	.068
LP-gases..... do	.039	.032	.032	.039	.039
Petroleum..... 42-gallon barrel	2.73	2.84	2.84	2.83	³ 3.11
Salt..... short ton	1.76	3.25	3.59	3.63	3.71
Sand and gravel: Commercial..... do	1.05	1.03	1.05	1.09	1.15
Silver ⁴ troy ounce	.905+	.905+	.905+	.905+	.905+
Stone:					
Limestone:					
Crushed..... short ton	.95	1.03	1.08	.94	1.00
Dimension..... do	33.84	22.54	31.02	33.07	24.59
Miscellaneous: Crushed..... do	.54	.86	.97	.91	
Sandstone:					
Crushed..... do	.54	.74	1.00	.96	.88
Dimension..... do	12.76	8.45	7.22	2.81	1.91

¹ Average quoted price f. o. b., Freeport, Tex.

² Average quoted price at New York.

³ Preliminary figure.

⁴ Treasury buying price for newly mined silver: 1952-57—\$.9050505.

EMPLOYMENT AND INJURIES

Employment in the nonagriculture industries of Texas continued to increase until it reached 2,494,000 workers in September; it declined in October and November, but closed the year with a record 2,516,000 persons employed. The December average was nearly 85,000 workers more than that in January, according to the Texas Employment Commission. Employment in the mining industries (including petroleum and natural gas) averaged 132,900 workers in 1957 compared with 132,100 in 1956. Employment in the chemical, smelting, stone, clay, glass, petroleum-refining, and petrochemicals industries gained approximately 3,000 workers to 141,000 in 1957.

Payrolls in the mineral industries in 1957 totaled \$1.4 billion, of which \$729 million represented wages in the mining, petroleum, and natural-gas industries and \$674 million represented payrolls in its smelting, petroleum refining, and chemical industries.

TABLE 3.—Average employment, weekly hours worked, and weekly earnings in selected industries, 1956-57¹

Industry	Employment		Weekly hours worked		Weekly earnings	
	1956	1957	1956	1957	1956	1957
Manufacturing.....	471,900	483,800	41.4	41.2	\$80.32	\$84.46
Primary metals.....	26,300	26,700	40.0	40.1	87.60	96.24
Chemicals.....	46,100	48,500	42.8	42.2	97.16	102.12
Petroleum and coal products.....	47,800	48,700	40.4	40.7	107.06	111.93
Machinery (oil field).....	43,500	46,800	43.7	41.8	93.08	93.21
Transportation equipment.....	65,900	73,000	41.6	40.8	95.26	96.70
Nonmanufacturing.....	1,940,300	1,988,400				
Mining.....	132,100	132,900	43.6	43.4	100.72	105.46
Crude petroleum.....	124,100	125,000	43.5	43.4	102.23	107.20
Sulfur.....	8,000	7,900	40.3	39.8	90.68	94.33
Construction.....	163,100	165,300				

¹ Texas Employment Commission, in cooperation with Bureau of Labor Statistics, U. S. Department of Labor, March 1958.

DEFENSE MINERALS EXPLORATION ADMINISTRATION (DMEA) PROGRAM

Texas had 4 DMEA contracts in force during 1957, including 2 projects for mercury in Brewster County, 1 for copper in Culberson County, and 1 for uranium in Briscoe County. No certification of discoveries was made during the year.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Of the 169 million acres comprising the land area of Texas, 80 million acres (47 percent) was under lease or productive of oil and gas in 1957. These included an estimated 4 million acres productive of oil and/or gas and 76 million acres under lease but not producing.

Texas continued to be the Nation's major source of natural gas and of liquid mineral fuels, with an alltime record value of \$4,197 million in 1957 and 50 percent of the proved United States reserve. The

crude capacity of Texas refineries was 2,508,400 barrels per day—27 percent of the entire domestic refinery capacity. About half of the Nation's petrochemical plants were in Texas. These plants processed hydrocarbons recovered from the State's own crude oils, natural gas, and natural-gas liquids. The oil and gas industry completed 24,134 wells of all types in 1957—6.3 percent under the 1956 completions. This drilling activity led to discovery of 455 new oilfields and 80 new gasfields, as well as to addition of 829 million barrels to the crude-oil reserve, 90.7 million barrels to the natural-gas-liquid reserve, and 5,863 billion cubic feet to the natural-gas reserve. At the end of 1957, there were 187,935 producing oil wells—an increase of 9,840 wells (5.5 percent) over 1956. The daily average production per well was 16.2 barrels of crude oil in 1957 compared with 17.9 barrels in 1956. The daily average crude-oil production was 2,969,348 barrels in 1957, a 2-percent decrease from 3,026,798 barrels in 1956.

In 1957, Texas had approximately 31,000 miles of trunk pipelines in operation carrying oil from fields to storage terminals, to refineries, and to water terminals on the Gulf coast, and nearly 24,500 miles of gathering lines carrying oil from lease tanks to common storage facilities. Of particular note was the more than 1,200 miles of pipelines in the coastal area that transported fuel and products to the many chemical plants in that area.

Carbon Black.—The 1957 output of carbon black declined 3 percent to 960 million pounds when compared with 1956. The use of natural gas as a source of carbon black continued to decline, as the industry consumed 150,165 million cubic feet of gas in 1957 compared with 154,580 million in 1956. Appreciable quantities of black also were recovered from heavy oil residues of refineries, as well as from mixtures of crude and natural gas. The principal use of carbon black was as a filler in manufacturing rubber tires, as each passenger tire required about 4 pounds of carbon black in 1957. Less carbon black per tire became necessary with the introduction of cold rubber.

In 1957, 24 carbon-black plants were operating—12 contact and 12 furnace types. Furnace-type plants supplied 51 percent of the carbon black produced—the first time that refinery residues exceeded natural gas as the source of raw material.

Helium.—Demand for helium exceeded supply for the third consecutive year, notwithstanding extensive expansion of facilities at the Government-operated Exell plant in Moore County during 1957.

TABLE 4.—Helium production, 1956–57, by counties

County	1956		1957	
	Production (cubic feet)	Value	Production (cubic feet)	Value
Moore.....	89,969,500	\$1,458,676	145,909,702	\$2,394,845
Potter.....	¹ 33,054,983	535,920	² 39,366,988	646,138
Total.....	123,024,483	1,994,596	185,276,690	3,040,983

¹ Does not include 24,865,028 cubic feet of helium withdrawn from conservation well in Government-owned Cliffside gasfield.

² Does not include 21,869,100 cubic feet of helium withdrawn from conservation well in Government-owned Cliffside gasfield.

The 1957 shipments of helium gas exceeded those in 1956 by 40 percent to a record 204 million cubic feet. Government sources were considering installing additional facilities to meet the ever-growing demand and, as a conservation measure, to recover the helium content of more of the natural gas being consumed. Many Midcontinent gasfields of Kansas, New Mexico, Colorado, and the Panhandles of Texas and Oklahoma contain significant amounts of helium in the natural gas.

The Government continued as the largest user of helium, commercial uses being restricted in part because of the tight demand situation.

Lignite.—Extensive deposits of lignite (brown coal) in the Eocene Wilcox and Claiborne groups of the Coastal Plains of Texas were mined by open pit methods in Milam and Harrison Counties. Output increased for the third consecutive year. The lignite was used as a fuel and as a raw material for the manufacture of activated carbon.

Natural Gas.—Texas continued to be the first-ranking gas-producing State in the Nation, contributing 50 percent of the marketed production. It also contains 46 percent of the natural-gas reserve; the 1957 marketed output ranked second to crude oil as the State's most valuable mineral. A total of 2,217 billion cubic feet (36 percent) of gas was marketed in Texas, and 2,610 billion cubic feet was exported in 1957. At the end of 1957, there were 13,681 producing gas wells that yielded 4,209 billion cubic feet (69 percent) of gas and 187,935 oil wells that yielded 1,828 billion cubic feet (31 percent) of casing-head gas. Industrial users consumed most of the marketed gas (58 percent), followed by field use (20 percent), residential use (9 percent), manufacture of carbon black (7 percent), and commercial and other uses (3 percent each).

TABLE 5.—Marketed production of natural gas, 1948-52 (average) and 1953-57¹

Year	Million cubic feet	Value (thousands)	Value per thousand cubic feet (cents)	Year	Million cubic feet	Value (thousands)	Value per thousand cubic feet (cents)
1948-52 (average)	3,186,837	\$166,125	5.2	1955.....	4,730,798	\$378,464	8.0
1953.....	4,383,158	333,120	7.6	1956.....	4,999,889	434,990	8.7
1954.....	4,551,232	386,855	8.5	1957 ²	5,256,600	478,400	9.1

¹ Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

² Preliminary figures.

The estimated proved recoverable reserve of natural gas increased from 112,729 billion cubic feet at the end of 1956 to 113,085 billion at the end of 1957, according to the Committee on Natural-Gas Reserves of the American Gas Association. This amounted to 18 cubic feet of gas reserve for each cubic foot produced. Exploratory drilling added 2,665 billion cubic feet through new discoveries; extensions and revisions added another 3,198 billion cubic feet to the gas reserve.

The first natural gas from a Texas Tideland field flowed into a pipeline system the latter part of December, when Standard Oil Co. of Texas completed its gathering system to 15 gas wells in the Chevron field off the coast of Kleberg County. The Chevron field, 1½ miles off Padre Island, was discovered in August 1954, when an exploratory well flowed 348 barrels of oil daily from a depth of 7,760-7,766 feet.

At the close of 1957 the field had 9 oil wells and 15 gas wells. The daily allowable was 1,400 barrels of oil and 500 barrels of distillate from gas production. The gas-gathering system included 3½ miles of 6-inch line from the gas wells to a 10-inch line on a central platform. The latter line transmitted the gas to a new half million dollar gas plant on Padre Island.

The ratio of proved gas reserves to consumption continued to drop significantly; in 1946 the ratio was 49 : 1, in 1957 it was 22 : 1.

Natural-Gas Liquids.—The natural-gas-liquids industry of Texas continued to lead the Nation in 1957, with a new record output of 6,776 million gallons valued at \$349 million. The liquefied-petroleum-gas industry was one of the fastest growing in the Nation in 1957, as demand from established consumers and from new uses increased. Residential heating (the largest single growth factor) improved with the current trend toward winter-summer weather conditioning of homes, businesses, and industrial plants. Other important uses were as motor fuel, as a replacement for gasoline in truck fleets, and in the manufacture of synthetic rubber components and of petrochemicals such as ethylene, polyethylene, and other chemical intermediates.

In 1957, 211 natural-gasoline plants and 29 cycling plants were operating in Texas. The estimated proved recoverable reserve of natural-gas liquids decreased 108 million barrels to 3,272 million at the end of 1957, according to the Committee on Natural-Gas Liquids Reserves of the American Gas Association.

TABLE 6.—Production of natural-gas liquids, 1948–52 (average) and 1953–57

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1948–52 (average).....	2,247,265	\$167,826	1,713,175	\$62,745	3,960,440	\$230,571
1953.....	2,750,370	200,479	2,777,880	109,131	5,528,250	309,610
1954.....	2,732,100	200,559	2,983,962	95,913	5,716,062	296,472
1955.....	2,987,808	206,506	3,450,430	110,414	6,438,238	316,920
1956.....	2,964,609	216,378	3,731,047	144,745	6,695,656	361,123
1957.....	2,944,381	201,423	3,831,664	147,618	6,776,045	349,041

Important industry events in 1957 were completion in June of the \$14 million 6-, 8-, and 10-inch liquefied-petroleum-gas (LP-gas) line from the Monument and Eunice gasfields, New Mexico, to the Barbers Hill plant near Houston by the Gulf Refining Co.; and reconversion of "Little Big Inch," a 20-inch pipeline built by the Government during World War II, from natural gas to petroleum products by Texas Eastern Transmission Corp. upon approval of the Federal Power Commission. The 1,168-mile section for reconversion extended from Baytown, Tex., to Moundsville, W. Va., and will connect with a 14-inch line to be built from Seymour, Ind., to Chicago, Ill. Texas Eastern spent \$35 million to reconvert and extend "Little Big Inch" and another \$61 million to build substitute gas facilities. The "Little Big Inch" and "Big Inch" pipelines were acquired from the Federal Government by Texas Eastern in 1947 at a cost of \$143 million. At that time the lines were converted from oil to natural-gas transportation.

TABLE 7.—Sales of LP-gases by uses, 1956-57

(Thousand gallons)

Use	Butane		Propane		Mixture		Total	
	1956	1957	1956	1957	1956	1957	1956	1957
Domestic uses.....	52, 672	85, 977	123, 039	132, 204	219, 080	203, 704	394, 791	421, 885
Gas manufacturing.....	114	110	137	134	3, 581	3, 262	3, 832	3, 506
Industrial.....	19, 691	36, 266	11, 012	12, 327	18, 126	7, 383	48, 829	55, 976
Synthetic rubber.....	246, 669	295, 712			94, 095	146, 748	340, 764	342, 460
Chemical plants.....	55, 129	84, 901	343, 101	535, 596	² 352, 597	² 387, 989	760, 827	1, 008, 486
Internal combustion.....	49, 374	62, 492	93, 393	103, 248	200, 799	178, 302	343, 566	344, 042
All other.....	1, 482	2, 221	3, 825	4, 530	3, 881	2, 134	9, 188	8, 885
Total.....	425, 131	567, 679	574, 507	788, 039	892, 159	829, 522	³ 1, 891, 797	^{3 4} 2, 185, 240

¹ Includes 5,731,000 gallons of isobutane.² Includes: 1956—15,520,000 gallons of isobutane; 1957—18,116,000 gallons of isobutane.³ Consumption of LP-gases as refinery fuel not included.⁴ Consumption of gases used in secondary recovery of petroleum not included.

Also noteworthy was the increase in underground storage capacity for LP-gas in the salt domes and salt formations of the State as the LP-gas industries sought to provide better movement and supply of this product during the winter peak demand period. Most of this capacity was in the Barbers Hill salt dome, close to Houston and to the head of "Little Big Inch" products pipeline. Cavities in salt formations have proved to be the cheapest storage for LP-gas in Texas, because much of the salt water derived from development of solution cavities was used by the heavy chemical industries.

Industry leaders were concerned over the impact of the "Memphis" decision on the future of the LP-gas industry. This legislation applies utility-type regulations to the natural-gas industry from which most of the LP-gas is derived.

Petroleum.—The Texas crude-oil industry in 1957 responded to the emergency demand to help fill the slack in European oil supply that resulted from closing of the Suez Canal and dynamiting of the Iraq Petroleum Co. oil pipelines. However, by the close of the year prorated production had been reduced to 171 days (19 days less than in 1956), and stocks of both crude and refined products continued to mount. At the year end, crude-oil stocks had reached a peak of 104 million barrels, and refineries were holding 32.6 million barrels of gasoline and operating at 87 percent of capacity. At first, most of the emergency demand consequent to the Middle East crisis was met from accumulated oil stocks, so at the height of oil movement to Europe in March 1957, crude stocks had declined to the more normal level of 94 million barrels, production had risen to 3.3 million barrels daily, and the momentous task of coordinating inland production with pipeline runs to coastal storage and tankers was well in hand.

With resumption of Middle East supply of oil to Europe the oil industry again confronted growing stocks of crude oil and products, notwithstanding severe cutbacks in production and refinery operations and gasoline price wars at the retail level. While Texas producers were reducing output to the demand levels, imports of foreign crude oil and products continued to climb from 1 million barrels daily in October 1956 to 1.26 million barrels daily in August 1957.

TABLE 8.—Production of crude petroleum, 1948-52 (average) and 1953-57

Year	Thousand 42-gallon barrels	Value		Year	Thousand 42-gallon barrels	Value	
		At wells (thousands)	Average per barrel			At wells (thousands)	Average per barrel
1948-52 (average)	902, 123	\$2, 337, 852	\$2. 59	1955.....	1, 053, 297	\$2, 989, 330	\$2. 84
1953.....	1, 019, 164	2, 777, 900	2. 73	1956.....	1, 107, 808	3, 131, 225	2. 83
1954.....	974, 275	2, 768, 490	2. 84	1957 ²	1, 083, 812	3, 369, 371	3. 11

¹ Revised figures.² Preliminary figures.

TABLE 9.—Production and indicated demand of crude petroleum in 1957, by months

(Thousand barrels)

Month	Production	Indicated demand	Month	Production	Indicated demand
January.....	96, 730	101, 948	September.....	84, 713	86, 446
February.....	90, 243	86, 477	October.....	83, 501	83, 076
March.....	103, 597	103, 110	November.....	81, 609	82, 453
April.....	96, 606	92, 287	December.....	85, 215	86, 490
May.....	97, 611	91, 164	Total: 1957.....	1, 083, 812	1, 074, 312
June.....	92, 498	85, 409	1956.....	1, 107, 808	1, 115, 967
July.....	85, 920	86, 841			
August.....	85, 569	88, 611			

TABLE 10.—Production of crude petroleum in Texas, 1953-57, by districts and fields

(Thousand barrels)

District and field ¹	1953	1954	1955	1956	1957 ²
Gulf Coast:					
Amelia.....	1, 282	1, 161	1, 122	1, 091	(³)
Anahuac.....	6, 453	5, 240	5, 279	5, 165	5, 279
Barbers Hill.....	1, 862	1, 805	1, 959	1, 865	1, 662
Beaumont-West.....	1, 148	1, 035	954	900	(³)
Bloomington.....	1, 535	1, 341	1, 332	1, 276	1, 130
Boling.....	1, 959	1, 763	1, 698	1, 616	1, 433
Chocolate-Bayou.....	4, 531	4, 952	4, 605	4, 118	4, 361
Conroe.....	11, 937	10, 081	10, 376	10, 455	9, 492
Damon Mound.....	605	1, 153	1, 098	907	(³)
Dickinson-Gillock.....	4, 235	4, 030	3, 987	3, 946	3, 571
Dyersdale.....	1, 183	975	841	688	(³)
Esperson.....	1, 365	1, 284	1, 154	1, 023	1, 005
Fairbanks.....	1, 585	1, 426	1, 427	1, 254	1, 054
Falls City.....	1, 059	898	904	854	(³)
Fannette.....	1, 760	1, 380	1, 252	1, 185	1, 511
Francitas.....	962	1, 172	1, 556	1, 540	1, 272
Friendswood.....	12, 398	10, 378	10, 620	10, 515	9, 511
Gohlke, Helen.....	2, 512	2, 478	2, 305	2, 081	1, 715
Goose Creek.....	2, 692	2, 715	3, 007	2, 813	2, 736
Greta.....	2, 871	2, 370	2, 398	2, 371	2, 221
Hankamer.....	1, 072	1, 110	1, 253	1, 118	1, 023
Hastings.....	13, 644	11, 570	11, 649	11, 396	10, 302
Heyser.....	1, 361	1, 064	1, 087	1, 001	(³)
High Island.....	2, 605	2, 819	3, 143	3, 476	3, 554
Houston-North-South.....	1, 286	1, 377	1, 341	1, 285	1, 227
Hull.....	2, 660	4, 411	4, 040	3, 909	3, 668
Humble.....	958	1, 185	1, 185	1, 067	1, 074
Liberty-South.....	2, 011	2, 348	2, 677	3, 324	4, 100
Livingston.....	1, 154	1, 086	1, 152	1, 059	(³)
Lolita.....	1, 476	1, 247	1, 358	1, 459	1, 378
Lovells Lake.....	978	863	860	870	(³)
Manvel.....	2, 058	1, 735	1, 709	1, 649	1, 469
Markham.....	1, 691	1, 548	1, 422	1, 598	1, 819
McFaddin.....	1, 275	1, 076	1, 316	1, 314	1, 138
Old Ocean.....	5, 954	4, 994	5, 378	5, 287	5, 674
Oyster Bayou.....	3, 219	3, 104	3, 080	2, 968	2, 612
Pierce Junction.....	1, 349	1, 036	1, 213	5, 395	6, 720

See footnotes at end of table.

TABLE 10.—Production of crude petroleum in Texas, 1953-57, by districts and fields—Continued

District and field ¹	1953	1954	1955	1956	1957 ²
Gulf Coast—Continued					
Placedo.....	2,210	1,951	1,832	1,716	1,371
Fort Neches.....	1,846	1,687	1,491	1,260	1,002
Raccoon Bend.....	2,225	2,068	2,082	2,084	1,694
Refugio-Fox.....	2,419	2,330	2,422	2,190	2,055
Saratoga.....	2,675	1,417	1,908	1,112	1,618
Silsbee.....	1,398	1,248	1,340	1,284	937
Sour Lake.....	1,576	1,451	1,459	1,408	1,319
Stowell.....	1,936	1,645	1,709	1,738	1,198
Sugarland.....	1,193	933	959	952	853
Sugar Valley.....	1,364	1,143	1,135	1,101	921
Thompson.....	10,563	9,099	8,944	8,990	8,193
Tomball.....	2,085	1,888	2,188	2,242	2,035
Village Mills.....	3,494	2,871	2,519	2,511	2,730
West Columbia.....	2,252	2,344	2,436	2,365	2,475
West Ranch.....	6,652	5,427	5,606	6,314	6,190
Withers-Magnet.....	3,933	3,467	3,273	3,241	3,162
Other Gulf Coast.....	73,120	62,098	78,202	81,254	80,614
Total Gulf Coast.....	227,636	203,159	221,302	225,570	212,080
East Texas:					
East Texas proper.....	90,743	81,364	80,279	77,582	70,783
Cuyuga.....	1,258	1,082	1,078	1,088	999
Ham Gossett.....	1,186	1,039	1,067	871	659
Hawkins.....	18,417	16,589	16,865	16,304	14,786
Long Lake.....	1,230	959	988	1,161	1,779
New Hope.....	2,191	2,451	2,510	2,172	2,162
Fewitt Ranch.....	1,444	1,209	1,117	1,073	927
Pickett.....	1,788	1,477	1,453	1,429	1,189
Quitman.....	2,941	2,230	2,190	2,176	2,192
Talco.....	5,876	4,928	4,994	4,896	4,523
Van.....	10,650	8,850	8,816	8,703	7,823
Waskom.....	1,998	1,049	1,118	1,191	872
Woodlawn.....	411	1,045	919	652	419
Other East Texas.....	13,359	14,321	22,256	21,954	22,722
Total East Texas.....	152,898	138,683	145,650	141,252	131,835
Central Texas:					
Big Foot.....	1,792	2,413	2,455	2,148	1,610
Charlotte.....	1,536	1,760	2,152	2,960	2,071
Darst Creek.....	3,210	3,442	3,487	3,415	3,450
Luling.....	2,410	2,433	2,555	2,699	2,598
Other Central Texas.....	4,733	5,110	7,648	9,225	8,827
Total Central Texas.....	13,681	15,158	18,297	20,447	18,556
South Texas:					
Aqua Dulce.....	1,736	1,500	1,389	1,428	1,479
Flour Bluff.....	1,200	1,286	900	829	872
Fulton Beach.....	2,718	2,985	2,701	2,579	4,340
Garcia.....	1,223	1,057	1,008	931	834
Hoffman.....	1,841	1,500	1,500	1,385	1,440
Kelsey.....	2,243	3,173	3,609	3,833	3,359
London Gin.....	1,106	955	1,101	1,238	1,083
Midway.....	982	928	1,070	1,090	940
Mustang Island.....	2,878	2,697	2,768	2,566	2,246
Plymouth.....	6,915	6,613	6,740	6,043	4,757
Portilla.....	4,373	3,506	3,719	3,144	2,936
Saxet-Saxet Frio.....	998	820	757	1,173	1,312
Stratton.....	2,990	2,403	2,401	2,345	1,990
Sun.....	1,618	1,752	1,360	1,843	1,673
Taft.....	1,491	1,680	1,353	1,251	929
White Point.....	3,319	2,973	3,260	3,444	3,426
Willamer-West.....	2,920	2,434	2,430	2,442	2,072
Other South Texas.....	54,107	50,111	52,130	52,930	48,860
Total South Texas.....	94,658	88,283	90,246	90,494	84,557
North Texas					
Panhandle.....	111,269	114,979	129,701	138,696	132,973
	28,080	30,903	33,400	36,682	39,357
West Texas by fields:					
Abell.....	1,439	1,227	1,497	1,520	1,590
Adair.....	2,915	2,390	2,487	2,392	2,107
Andector.....	6,691	5,580	5,692	5,510	4,500
Anton-Irish-Anton.....	2,914	2,586	2,930	2,933	2,600
Benedum.....	3,444	2,853	2,645	2,225	1,982

See footnotes at end of table.

TABLE 10.—Production of crude petroleum in Texas, 1953–57, by districts and fields—Continued

(Thousand barrels)

District and field ¹	1953	1954	1955	1956	1957 ²
West Texas by fields—Continued					
Big Lake.....	1,018	1,014	921	801	(³)
Block 31.....	5,204	5,182	5,191	5,727	5,690
Bronte.....	(⁴)	906	1,107	1,432	1,865
Cedar Lake.....	1,702	1,544	1,614	1,464	1,385
Cogdell.....	8,171	6,558	6,507	6,848	6,908
Cowden.....	9,219	8,595	10,009	10,769	9,704
Cree-Sykes.....	2,303	1,429	1,230	1,079	1,241
Diamond M.....	10,592	8,920	9,300	9,381	8,465
Dollarhide.....	8,259	6,728	5,944	4,959	4,139
Elkhorn.....	1,579	1,739	1,216	900	(³)
Embar.....	1,080	1,002	1,259	1,704	1,862
Emma.....	(⁴)	(⁴)	2,118	3,259	3,452
Fort Chadborne.....	5,183	5,275	4,516	3,802	3,788
Fort Stockton.....	1,237	1,325	1,264	1,525	1,272
Foster.....	4,326	3,714	4,616	4,816	4,282
Fuhrman.....	1,497	1,671	2,655	3,662	4,471
Fullerton.....	7,862	6,513	6,973	6,495	5,977
Garza.....	3,125	2,899	2,628	2,815	2,635
Goldsmith.....	18,663	14,577	16,212	18,385	20,434
Good.....	1,637	1,290	1,448	1,383	1,248
Harper.....	(⁴)	(⁴)	1,477	2,217	2,424
Hendrick.....	1,225	1,409	1,907	1,263	1,351
Howard-Glasscock.....	6,657	7,488	7,364	6,905	6,683
Hulldale-Hulldale-Penn.....	1,903	1,528	1,824	2,104	1,763
Jameson.....	4,425	5,445	7,694	6,905	4,822
Jordan.....	4,131	3,620	3,481	3,316	3,378
Kelly Snyder.....	25,549	17,035	22,308	25,339	26,827
Kermit.....	(⁴)	1,972	2,834	3,704	4,841
Keystone.....	10,990	13,210	8,848	7,801	7,005
Lea.....	(⁴)	(⁴)	1,363	1,506	1,359
Levelland.....	11,410	9,992	9,504	8,714	7,892
Luther.....	(⁴)	(⁴)	1,136	1,246	1,073
Mabee.....	824	944	1,016	1,024	1,093
Magutex.....	(⁴)	974	1,997	2,232	2,132
Martin.....	2,643	2,026	2,052	2,199	2,067
McCamey.....	2,825	2,497	2,003	1,730	1,881
McElroy.....	7,250	6,718	6,829	9,562	10,751
McFarland.....	(⁴)	(⁴)	(⁴)	2,050	3,708
Means.....	1,523	1,336	2,996	6,421	6,495
Midland Farms.....	6,843	4,953	6,997	7,638	7,143
Pegasus.....	5,706	5,778	5,481	5,165	4,490
Penwell.....	978	1,426	1,612	1,719	2,049
Prentice.....	(⁴)	4,187	5,529	5,753	5,164
Reinecke.....	2,748	1,642	1,572	1,625	1,401
Robertson.....	(⁴)	(⁴)	(⁴)	1,344	1,652
Russell.....	(⁴)	3,474	5,541	7,200	6,874
Salt Creek.....	3,309	3,371	4,180	4,039	3,679
Sand Hills.....	4,065	4,000	5,074	6,800	6,729
Seminole.....	6,673	5,459	5,547	5,584	5,246
Shafter Lake.....	3,044	3,343	3,799	3,444	3,019
Sharon Ridge.....	1,174	1,253	1,348	1,590	1,966
Slaughter.....	13,591	11,370	11,151	11,010	10,180
Spraberry Trend.....	17,015	39,968	22,155	24,010	19,835
Three Bar.....	1,577	2,201	1,214	1,189	1,036
Todd.....	2,997	2,492	2,502	2,435	1,939
Triple N.....	(⁴)	1,046	1,254	1,492	1,342
TXL.....	10,476	8,277	6,146	5,602	5,502
University.....	(⁴)	2,615	2,163	3,704	4,122
Vealmoor-East.....	5,008	3,603	3,440	3,248	2,903
Waddell.....	1,912	1,151	1,849	1,572	2,635
Ward-Estes.....	8,921	7,433	8,713	9,964	14,245
Wasson.....	19,160	15,422	15,752	15,617	14,377
Welch.....	1,074	1,032	1,892	1,835	1,858
Wellman.....	2,077	966	1,163	1,057	(³)
Westbrook.....	(⁴)	(⁴)	(⁴)	1,209	1,869
Wilshire.....	4,620	3,384	2,953	2,174	1,949
World.....	1,519	1,376	1,441	1,903	1,814
Yarbrough.....	2,569	2,023	2,202	2,141	1,900
Yates.....	12,271	9,903	9,878	9,681	8,818
Other West Texas.....	60,200	58,251	85,111	101,499	119,526
Total West Texas.....	390,942	383,110	414,701	454,667	464,454
Total Texas.....	1,019,164	974,275	1,053,297	1,107,808	1,083,812

¹ Texas Railroad Commission districts.² Preliminary figures.³ Included in "Other" fields.⁴ Not available.

Texas had 195 oil-producing counties in 1957 compared with 194 in 1956; 116 reported output over 1 million barrels each.

In summary, the 1957 experience of the Texas oil industry reflected the divergent demand situation existing at the beginning and end of the year and the effect of voluntarily controlled imports and the complexity of problems confronting this vast integrated industry in its attempts to reduce tremendous stocks of crude oil and products while bringing production into balance with diminishing demand.

The daily average production of crude oil during 1957 amounted to 2,969,348 barrels compared with 3,026,798 barrels in 1956; yielded by 187,935 oil wells that averaged 16.1 barrels each per day; this output may be compared with 178,095 wells in 1956 that averaged 17.9 barrels each per day.

The indicated daily demand for Texas crude oil was 2,949,127 barrels, compared with 3,057,482 barrels in 1956. The peak demand occurred in March 1957, when it rose to 3,326,100 barrels; the minimum daily demand—2,697,400 barrels—occurred in October.

Texas refineries had a combined daily crude-oil capacity of 2,508,400 barrels as of January 1, 1957. These refineries (operating at about 89 percent of capacity) processed 815,836,000 barrels of crude oil; this amounted to an average daily run of 2,235,167 barrels or 75 percent of the Texas crude output.

TABLE 11.—Total well completions in 1957, by counties

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Anderson	103	3	31	11	2	74	114	5	105	224
Andrews	659	5	41	27	3	24	686	8	65	759
Angelina	1		2			1	1		3	4
Arañas	1	1	4	1	2	3	2	3	7	12
Archer	224		175	16		69	240		244	484
Atascosa	73	5	24	4		43	77	5	67	149
Austin	4		2	1	2	4	5	2	6	13
Bailey						9			9	9
Bandera						2			2	2
Bastrop	8		7	3		19	11		26	37
Baylor	234		146	2		93	236		239	475
Bee	9	24	51	7	16	22	16	40	73	129
Bell			1						1	1
Bexar	134		26	1		29	135		55	190
Borden	114		5	5		10	119		15	134
Bowie						5			5	5
Brazoria	44	13	40			30	44	13	70	127
Brazos		1			1	2		2	2	4
Brewster						2			2	2
Briscoe						2			2	2
Brooks	14	10	11	7	5	6	21	15	17	53
Brown	70	2	15		1	15	70	3	30	103
Caldwell	131		42	1		13	132		55	187
Calhoun	14	6	8	4	8	20	18	14	28	60
Callahan	126	1	63	2		94	128	1	157	286
Cameron		1	1		1	4		2	5	7
Camp									1	1
Carson	103	11	3			1	103	11	4	118
Cass	54	3	10	2		2	56	3	12	71
Chambers	36	21	21	6	11	20	42	32	41	115
Cherokee	7		6	3	2	48	10	2	54	66
Childress						3			3	3
Clay	157		49	9		41	166		90	256
Cochran	48	3	1	4		10	52	3	11	66
Coke	16		4	6		17	22		21	43
Coleman	136	1	66	5	2	38	141	3	104	248
Collin						4			4	4
Collingsworth		61	7			8		61	15	76
Colorado	8	20	8		5	15	8	25	23	56
Comanche		2	3			6		2	9	11

TABLE 11.—Total well completions in 1957, by counties—Continued

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Concho			1	1	1	15	1	1	16	18
Cooke	132	1	80	12		46	144	1	126	271
Coryell						2			2	2
Cottle						4			4	4
Crane	496	10	38	14	1	23	510	11	61	582
Crockett	94	1	15	5	1	41	99	2	56	157
Crosby	10		1	3		10	13		11	24
Culberson	13		2	1		8	14		10	24
Dallam		2				3			3	7
Dallas					2	2			2	2
Dawson	63		5	7		16	70		21	91
Deaf Smith						1			1	1
Delta						1			1	1
Denton	3		4	1		8	4		12	16
De Witt	7	8	9	2	4	10	9	12	19	40
Dickens				1		4	1		4	5
Dimmit	26		18	9	1	37	35	1	55	91
Donley		1	5			3		1	8	8
Duval	129	20	100	22	4	59	151	24	159	334
Eastland	15	4	31	1		11	16	4	42	62
Ector	656	4	23	16	1	18	672	5	41	718
Edwards			3			2			5	5
Ellis						5			5	5
Erath		1				3		1	3	4
Falls			3			5			8	8
Fannin						3			3	3
Fayette						5			5	5
Fisher	121	1	45	8		38	129	1	83	213
Floyd						1			1	1
Foard	25		9			18	25		27	52
Fort Bend	21	6	20	2	1	23	23	7	43	73
Franklin	3		1			1	3		2	5
Freestone	2	2	2		2	1	3	4	11	18
Frio	24		12	3		15	27		27	54
Gaines	190	3	28	10		30	200	4	58	262
Galveston	33	7	16	3	3	10	36	10	26	72
Garza	152		2	12		22	164		38	202
Glasscock	23		2	3		7	26		9	35
Goliad	5	8	20	4	16	12	9	24	32	65
Gonzales	3		8	3		22	6		11	36
Gray	203	53	10			1	203	53	11	267
Grayson	14	2	16	6		19	20	2	35	57
Gregg	63		1	1		1	64		2	66
Guadalupe	78		11	4		22	82		33	115
Hall						1			1	1
Hamilton			1			1			2	2
Hansford	38	35	9	10	10	1	48	45	18	111
Hardeman			1			1			2	2
Hardin	103		45	1	5	16	104	5	64	173
Harris	156	16	85	4	9	45	160	25	130	315
Harrison	190	29	12	4		10	194	29	22	245
Hartley						6			8	8
Haskell	36		20	8		79	44		99	143
Hemphill		1			5	3		6	3	9
Henderson	11	4	1			24	11	4	25	40
Hidalgo	13	73	34	5	16	23	18	89	57	164
Hill						3			3	3
Hockley	23		5	4		12	27		17	44
Hopkins	2		1			2	2		3	5
Houston			2		1	20		1	22	23
Howard	268		12	9		13	277		25	302
Hunt	2					8	2		8	10
Hutchison	407	15	6			5	55	15	11	433
Irion	48	2	17	7		31	47	2	48	105
Jack	67	22	90	11		14	78	22	104	204
Jackson	37	20	20	4	3	30	41	23	50	114
Jasper	4	8	7	2	1	7	6	9	14	29
Jeff Davis						1			1	1
Jefferson	41	7	31	3	2	20	44	9	60	113
Jim Hogg	36		17	5	5	18	41	5	35	81
Jim Wells	18	10	42	11	11	31	29	21	73	123
Jones	151		69	9		85	160		154	314
Karnes	6	2	7	2	1	15	8	3	22	33
Kaufman			1			11			12	12
Kenedy		1	1		4	10		5	11	16
Kent	12		1	2		15	14		16	30
Kimble		3				3		3	3	6
Kmg.	9		5	2		22	11		27	38
Kleberg	19	8	10	7	8	6	26	16	16	58

TABLE 11.—Total well completions in 1957, by counties—Continued

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Knox	242		327	29		188	271		515	786
Lamar						2			2	2
Lamb	25		3	2		22	27		25	52
Lampasas						2			2	2
La Salle		1	4		1	20		2	24	26
Lavaca	4	8	7		4	4	4	12	11	27
Leon		2	1			5		2	6	8
Liberty	108	17	43	2	2	10	110	19	53	182
Limestone	1		1			14	1		15	16
Lipscomb		4	5	3	16	8	3	20	13	36
Live Oak	49	4	45	6	12	33	55	16	78	149
Loving	47		7	4		18	51		25	76
Lubbock	30		5	1		5	31		10	41
Lynn	14		3			12	14		15	29
Madison				2		3	2		3	5
Marion	30		2	3		4	33		6	39
Martin	1		1	1		2	2		3	5
Matagorda	44	7	21	4	12	21	48	19	42	109
Maverick	16		18	5	1	39	21	1	57	79
McCulloch	3		5	1		9	4		14	18
McLennan	2					4	2		4	6
McMullen	13	30	26	1	10	33	14	40	59	113
Medina	76		4			10	76		14	90
Menard		1				3		1	3	4
Midland	126	4	2	4	3	3	130	7	5	142
Milam	7		6			1	7		7	14
Mills						2			2	2
Mitchell	166		5	3		8	159		13	172
Montague	103	1	53	13		36	116	1	89	206
Montgomery	7	3	15	2	2	13	9	5	23	42
Moore	17	3			1	4	17	4	4	25
Morris						1			1	1
Motley	7		4	1		3	8		7	15
Nacogdoches		2			1	5		3	5	8
Navarro	123		29	1	1	35	124	1	64	189
Newton	21	3	5	4	1	6	25	4	11	40
Nolan	213	3	27	11	2	47	224	5	74	303
Nueces	52	23	60	27	8	29	79	31	89	199
Ochiltree	45	11	15	7	7	13	52	18	23	98
Oldham			2	3		3	3		5	8
Orange	31	2	17			8	31	2	25	58
Palo Pinto	24	1	19	2		12	26	1	31	58
Panola	38	19	15	2		2	40	19	17	76
Parker		12			4	3		16	3	19
Pecos	222	11	33	21	5	37	243	16	70	329
Polk	2	1		1	1		3			5
Potter		8	1			8		8	9	17
Rains						2			2	2
Randall						2			2	2
Reagan	92		6	9		16	101		22	123
Red River	6		3	1		14	7		17	24
Reeves	29	9	13	5	1	17	34	10	30	74
Refugio	30	32	15	7	6	17	37	38	32	107
Roberts	26	15	1	2	3	12	28	18	13	59
Robertson					1	5		1	5	6
Rockwall						2			2	2
Runnels	116	1	45	22	3	61	138	4	106	248
Rusk	61		15	3		11	64		26	90
San Jacinto					2	3		2	3	5
San Patricio	31	19	46	11	11	39	42	30	85	157
San Saba						1			1	1
Schleicher	16	3	5	3	4	19	19	7	24	50
Scurry	289		24	9		20	298		44	342
Shackelford	198	6	132	9		56	207	6	188	401
Shelby	2				1	5	2	1	5	8
Sherman		10	3			1		10	4	14
Smith	54	6	6	1		12	55	6	18	79
Starr	33	13	71	19	7	43	52	20	114	186
Stephens	71	10	68	12	4	41	83	14	109	206
Sterling	15		8			12	15		20	35
Stonewall	69		19	8		30	77		49	126
Sutton		6	2		3	6		9	8	17
Swisher						1			1	1
Taylor	123	1	69	12		100	135	1	169	305
Terrell						2			2	2
Terry	29		4	6		9	35		13	48
Throckmorton	92		47	29		121	121		168	289
Titus						1			1	1

TABLE 11.—Total well completions in 1957, by counties—Continued

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Tom Green.....	36		20	3		44	39		64	103
Travis.....	1		3			8	1		11	12
Trinity.....			1			2			3	3
Tyler.....	2	1	2	3		5	5	1	7	13
Upshur.....						11			11	11
Upton.....	264	13	11	12	1	14	276	14	25	315
Val Verde.....	4	4	2			9		4	9	13
Van Zandt.....	12	28	18	4	11	11	16	39	29	84
Victoria.....						3			3	3
Walker.....	1		4			3	1		7	8
Waller.....	278	2	39	6	1	10	284	3	49	336
Ward.....			2			2			2	2
Washington.....	20	6	19	1	3	32	21	9	51	81
Webb.....	16	15	29	1	6	20	17	21	49	87
Wharton.....	64	15	14		1		64	16	14	94
Wheeler.....	499		139	8		20	507		159	666
Wichita.....	207		186	2		5	209		191	400
Wilbarger.....	2	1				2	2	1	2	5
Willacy.....						15			17	17
Williamson.....	56		31	1		51	57		82	139
Wilson.....	301	23	13	12	1	15	313	24	28	365
Winkler.....	130	75	41	13		10	143	75	51	269
Wise.....	38	1	7	1		17	39	1	24	64
Wood.....	102		8			17	111		25	136
Yoakum.....	234	3	188	35		81	269	3	269	541
Young.....	11	2	15	1		13	11	2	28	41
Zapata.....	1	2	5	1	1	17	2	3	22	27
Zavala.....			3				1	1	3	5
Gulf of Mexico.....										
Total.....	12,389	1,087	4,225	839	346	3,888	13,228	1,433	8,113	22,774

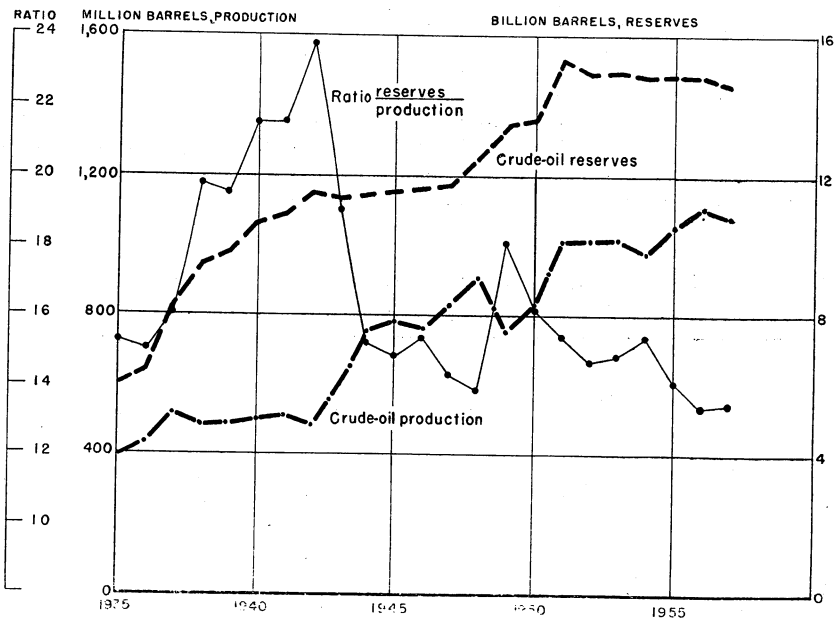


FIGURE 2.—Ratio of proved crude reserves to production, 1935-57.

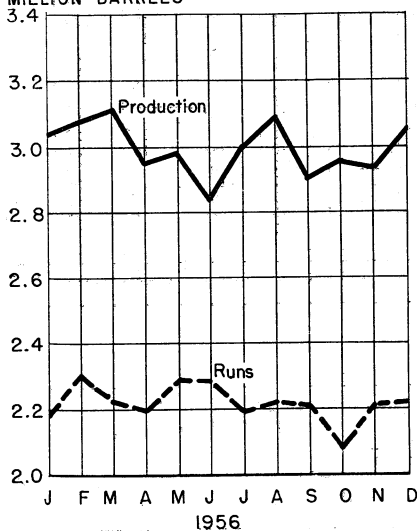
TABLE 12.—Sales of petroleum products, 1953-57

(Thousand barrels)

Product	1953	1954	1955	1956	1957
Gasoline.....	109,848	106,245	105,672	107,045	105,079
Kerosine.....	2,638	2,383	2,309	2,250	1,906
Range oil.....	2,205	1,963	1,941	1,813	1,408
Distillate fuel oil.....	19,046	18,913	20,728	22,258	22,812
Residual fuel oil ²	40,981	35,436	37,512	37,399	37,443

¹ Includes kerosine sold as range oil.² Excludes crude oil used as residual fuel oil as follows (in thousand barrels): 1953—997, 1954—376, 1955—596, 1956—484, and 1957—416.

MILLION BARRELS



MILLION BARRELS

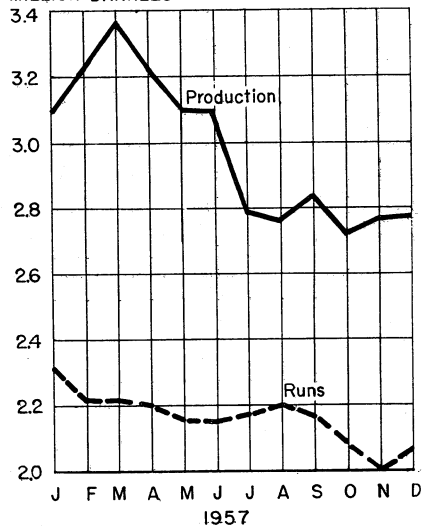


FIGURE 3.—Daily average crude oil production and runs to stills in Texas, 1956-57.

TABLE 13.—Daily average production and runs to stills of petroleum in 1956-57

(Thousand barrels)

Month	1956		1957	
	Crude production	Runs to stills	Crude production	Runs to stills
January.....	3,077	2,187	3,120	2,312
February.....	3,076	2,300	3,226	2,215
March.....	3,099	2,252	3,342	2,222
April.....	2,925	2,204	3,220	2,205
May.....	2,984	2,300	3,156	2,146
June.....	2,891	2,320	3,083	2,144
July.....	3,015	2,187	2,781	2,131
August.....	3,092	2,240	2,771	2,203
September.....	2,892	2,226	2,896	2,175
October.....	2,904	2,085	2,711	2,048
November.....	2,908	2,227	2,728	1,997
December.....	3,069	2,229	2,749	2,073

TABLE 14.—Runs to stills and output of refineries, in 1957, by months

(Thousand barrels)

Month	Runs			Output					
	Crude	Prod-ucts	Rerun	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous
						Distillate	Residual		
January.....	71,676	5,342	214	34,492	4,417	20,081	8,822	1,960	7,460
February.....	62,029	4,724	430	29,859	3,622	17,701	7,437	1,923	6,641
March.....	68,892	5,635	-1,664	33,132	3,572	18,164	8,037	1,880	8,078
April.....	66,158	5,327	-3,094	31,863	2,587	16,342	7,332	2,091	8,176
May.....	66,523	5,447	-1,202	34,201	2,667	16,082	7,660	1,834	8,324
June.....	64,305	5,367	305	34,122	2,467	16,278	7,490	1,597	8,023
July.....	66,067	5,795	-373	34,608	2,667	16,160	8,127	1,716	8,211
August.....	68,302	6,260	212	37,234	3,123	17,297	7,828	1,256	8,036
September.....	65,242	5,952	-537	36,036	3,552	15,093	7,545	968	7,463
October.....	63,488	5,942	-498	35,050	3,264	14,904	7,286	1,112	7,316
November.....	59,905	5,864	-1,568	31,983	3,958	13,996	6,687	1,109	6,468
December.....	64,264	5,854	821	34,513	4,180	16,705	7,341	1,097	7,103
Total: 1957.....	786,851	67,509	-6,954	407,093	40,076	198,803	91,592	18,543	91,299
1956.....	815,836	60,983	-8,903	407,222	44,934	203,977	100,912	17,963	92,908

TABLE 15.—Stocks of crude petroleum at refineries, tank farms, and gathering systems in 1957, by months

(Thousand barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January.....	14,460	68,707	7,050	90,217
February.....	15,494	71,397	6,970	93,861
March.....	14,723	72,027	7,465	94,215
April.....	15,572	75,198	7,275	98,045
May.....	17,125	79,356	7,210	103,691
June.....	18,154	82,907	7,975	109,036
July.....	17,159	85,359	7,640	110,158
August.....	16,414	82,627	7,745	106,786
September.....	15,920	81,699	8,045	105,664
October.....	16,556	82,249	7,920	106,725
November.....	15,546	81,003	7,995	104,544
December.....	16,153	80,291	7,245	103,689

TABLE 16.—Stocks of refined products at refineries in 1957, by months

(Thousand barrels)

Month	Gasoline ¹	Kerosine	Fuel oil		Jet fuel	Natural-gas liquids	Miscellaneous products
			Distillate	Residual			
January.....	36,482	2,980	10,697	7,788	1,601	648	22,238
February.....	38,209	2,886	9,410	7,041	1,673	644	21,172
March.....	35,870	3,116	9,161	6,744	1,189	637	22,812
April.....	34,491	3,025	10,428	6,213	1,612	695	25,046
May.....	34,171	3,745	13,214	7,017	1,778	774	25,700
June.....	31,865	3,981	16,291	8,098	1,953	856	25,132
July.....	30,418	3,926	19,050	9,088	1,927	927	24,493
August.....	30,140	3,744	22,018	9,946	1,664	788	23,554
September.....	30,932	4,490	23,611	9,904	1,546	603	23,282
October.....	31,072	4,437	23,798	9,318	1,323	502	22,961
November.....	31,003	3,917	21,044	9,175	1,307	524	24,409
December.....	34,581	3,197	19,546	8,291	1,259	626	23,385

¹ Includes naphtha.

In 1957, 24,134 wells were completed—a 6.3-percent decrease from the 25,764 completed in 1956. Of the 4,954 exploratory wells completed in 1957, 506 were oil wells, 109 gas wells, and 4,339 dry holes. Of the 19,180 development wells completed, 14,428 were oil wells, 1,816 gas wells, and 2,936 dry holes. The proved recoverable crude-oil reserve of Texas amounted to 14,555 million barrels on January 1, 1958, a decrease of 228 million barrels from the estimated reserve of January 1, 1957; it amounted to about 18 barrels of known crude oil underground for each barrel of oil produced in 1957. Extensions and revisions added nearly 700 million barrels, and new discoveries added approximately 130 million barrels.

The wholesale price index of petroleum and petroleum products was 123.5 in December 1957 compared with 120.9 in December 1956, according to the Bureau of Labor Statistics. This reflected the average 15-cent-per-barrel advance in crude-oil price at midyear and price increases for LP-gases.

The dynamic petrochemical industry of Texas continued to score extensive gains in 1957, with new plants and expansion of existing facilities. The industry developed new products along with its growing output of current products. This new industrial giant (the latest offspring of the oil and gas industries, which originated a mere 7 years ago) already represented about \$2 billion in capital investments. It also was consuming many million dollars of State-produced raw materials creating employment for thousands of workers, and providing millions of dollars in payrolls and tax revenues.

Typical of this rapidly growing industrial complex was the Houston-Freeport-Orange industrial region, where crude oil, gas, and basic minerals began a chain of processing activities to yield products for manufacturing and consuming markets or to supply feedstock for other processing industries. Other multi-million-dollar industrial regions were Corpus Christi, Odessa, Dallas-Fort Worth, San Antonio, Borger, and Longview.

In the Houston-Freeport-Beaumont region 32 plants utilized natural gas and petroleum-refinery gases to produce ethylenes, propylenes, and butylenes. These hydrocarbons were then converted to such intermediates as acetylenes used to produce plastics and synthetic rubbers and fibers. Other important chemicals produced were ammonia for fertilizers and explosives, alcohols for solvents and antifreezes, and glycerin used for explosives and as glycols for anti-freeze, adhesives, detergents, and fibers.

Ethylene (the major product of natural and refinery gases) was produced by the following companies and their subsidiaries: Dow Chemical Co. at Freeport, Union Carbide Co. at Texas City, Gulf Oil Co. at Port Arthur, Phillips Chemical Co. at Sweeny, Humble Oil & Refining Co. at Baytown, and Shell Chemical Corp. at Pasadena. Huge volumes of inorganic chemicals, such as salt in brine (which was converted to chlorine, hydrogen, and hydrogen chloride) and caustic soda (sodium hydroxide) were required to process these chemical intermediates.

The oil and gas industry employed an average of 224,000 workers in 1957 and had an annual payroll of \$1,200 million. Nearly 119,000 of these workers were employed in exploration and production (with

an annual payroll of \$658 million), and 47,000 workers were employed in the refining industry (with an annual payroll of \$294 million).

NONMETALS

The nonmetals produced in Texas were construction materials, such as cement, clays, gypsum, lime, sand and gravel, and stone; and chemical raw materials, such as lime, salt, and sulfur.

Nonmetals produced in Texas in 1957 were valued at \$262 million, or 6 percent of the State total. General construction continued active, although the volume was lower than in 1956 and averaged about \$1 billion annually. Expenditures for highways, buildings, bridges, streets, and dams by local, State, and Federal governments and by industry were only slightly below the record expenditures of 1956. The State's highway program for the next 3 years was augmented by \$392 million in Federal funds (\$270 million for its interstate system and \$122 million for primary- and secondary-road system). The 2,905-mile section of the interstate system is the largest in the Nation. Thus, with State contributions, the annual average highway-construction rate for the 13-year period of the program will be more than double that in preceding years. A significant evaluation of the effect of the program on consumption of materials is given in the following table, prepared by the Texas Highway Department.

TABLE 17.—Estimated material required for 1957-69, Texas Highway construction program

(In thousands)

Item	Total required, 13-year program	Annual average	Fiscal 1955-56 usage
Steel:			
Structural steel.....tons	1,544	119	33
Reinforcing steel.....do	997	77	38
Corrugated metal pipe.....do	176	14	-----
Miscellaneous steel.....do	207	16	-----
Total steel.....	2,924	226	-----
Asphalt.....tons	7,680	590	388
Aggregates.....do	582,600	44,820	1,248
Concrete culvert pipe.....do	2,880	240	-----
Cement.....barrels	84,000	6,500	1,611
Lumber.....board feet	432,000	33,240	956
Petroleum products.....gallons	800,000	61,300	11,038

The indicated benefits to producing industries do not include those from employment, payrolls, and services to be derived both locally and by the State as a whole.

This active demand for construction materials resulted in establishment of several new plants and in increased facilities at existing plants. Ideal Cement Co. completed a \$16 million expansion, begun in 1956, at its Houston plant. This program included dock facilities, four new kilns, and auxiliary equipment. The company also held an option to buy a 1,200-acre tract 5 miles north of Texas City, which contained a clay deposit. A new producer was added to the State cement industry, when output was begun on March 20 at the \$6 million Echo plant of Texas Portland Cement Co. 4 miles south of

Orange. Two new brick plants—one at Cleveland, the other at De Leon—began operations during the year. A new hollow-tile plant was built at Alta. At Houston the United States Gypsum Co. was building a multi-million-dollar plant to produce wallboard, rock lath, plaster, and gypsum sheathing adjacent to its gypsum-wallboard plant. Ceramic tile for indoor finish was being manufactured at a plant in Brownsville. Plants producing lightweight aggregates also expanded their facilities.

Capital expansion in inorganic chemical plants and facilities was continued in 1957, as demand for these products continued high. The first Tideland sulfur plant in Texas (the \$10 million Frasch plant of Texas Gulf Sulphur Co.) was being built 3 miles off Galveston Island in the Gulf of Mexico. Permission to dredge a 4-mile ship channel in Galveston Bay to a point near San Leon had been requested of the United States Army Corps of Engineers. A \$5 million program to construct transportation and storage facilities for this offshore sulfur plant and three other sulfur-recovery plants was in progress. Jefferson Chemical Corp. opened a new chlorine-caustic plant at Port Neches; other new plants included that of Olin Mathieson Chemical Corp. at Pasadena (which produced sodium silicofluoride), Rohm and Haas Co. at Houston (which produced ammonium sulfate), and San Antonio Chemicals Co., Inc., at San Antonio (which produced alkali).

In general, it appeared that overcapacity was beginning to develop in the construction and chemical materials industries in 1957 because of accelerated capital investment in new plants and existing facilities. The outlook, however, was that industrial expansion and demand increases to satisfy growth of population would absorb this new capacity in the very near future.

Abrasives.—Grinding pebbles suitable for use in tube mills were recovered from river gravels in Travis County by the Dezendorf Marble Co.

Barite.—Crude barite from Western States and foreign countries, principally Mexico and Canada, was processed at grinding plants in Cameron, Harris, Maverick, and Nueces Counties. Two new grinding plants of Tejas Barite Co., Ltd., began operations during the year, one at Eagle Pass, the other at Houston. The principal use continued to be in preparation of a heavy drilling mud for the oil and gas industry; other uses were as an additive to clay to prevent scum forming on the surface of brick, as a case-hardening agent in the leather industry, and as an admix in the glass and ceramic manufacturing industry.

Bromine.—Bromine was recovered from sea water at the Freeport plant of Ethyl-Dow Chemical Co. for use in manufacturing ethylene dibromide. A large quantity of this chemical was consumed by Texas oil-refining industry; smaller amounts of bromine were used in manufacturing organic and inorganic chemicals.

Cement.—Production of cement, a major construction material, followed closely the varying activity of the construction industry during the year. In 1957 Texas construction activities, though retarded in the early part of the year by significant declines in residential construction, were able to recover some of the losses as public works, school, office, and industrial construction advanced.

The Texas cement industry was completing a multimillion-dollar expansion program begun several years earlier, when it was confronted with a new experience—surplus stocks and idle plant capacity at varying periods—during 1957. The industry expanded its capacity 13 percent to 32,063,000 barrels annually by 1957 but used only 70 percent of this total capacity compared with 91 percent in 1956. Prolonged spring and fall rains retarded the highway-construction program within the State, and fluctuations in industrial, commercial, and residential construction reduced demands for cement.

The new \$16 million, 2.8-million-barrel cement plant of Ideal Cement Co. at Houston was nearly completed in 1957. The new installation consisted of four 12- by 450-foot kilns and four 11- by 32-foot grinding mills and accessory facilities; it was being built alongside the existing 1.25-million-barrel company plant. Lone Star Cement Corp. continued its expansion program begun in 1954 with additions to both its Dallas and Houston plants. Early in 1957 additions to the Dallas operations were completed, raising production capacity 2.3 million barrels to 3.7 million. New equipment consisted of two 11- by 275-foot kilns, with grate coolers, two 9- by 30-foot finish mills, one 9- by 30-foot raw mill, a 300-foot stack, electrical precipitators for all 6 kilns, and additional slurry tanks and clinker silos. Capacity of the Houston plant was increased 1.1 million barrels to 3.2 million by installing an 11- by 400-foot kiln, a 10- by 156-foot rotary cooler, a ball mill and set tube mill, a 2-compartment finish mill, an electrostatic precipitator for all 3 mills, a clay-wash mill, slurry tanks, and a 300-foot stack.

At San Antonio, Longhorn Portland Cement Co. added three bulk truck-loading silos, reflecting the trend toward truck transportation,

TABLE 18.—Portland cement produced and shipped, 1948-52 (average), 1953-56, and 1957, by months

(376-pound barrels)

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1948-52 (average).....	16,786,219	16,660,456	\$38,826,312	\$2.33
1953.....	19,253,677	19,140,193	48,497,762	2.53
1954.....	21,541,325	21,928,170	56,674,124	2.58
1955.....	24,241,443	24,038,427	64,820,374	2.70
1956.....	25,654,997	25,234,150	73,069,953	2.90
1957:				
January.....	1,785,005	1,545,044	4,715,455	-----
February.....	1,626,000	1,683,047	5,136,645	-----
March.....	2,080,010	1,848,052	5,640,235	-----
April.....	1,833,005	1,751,049	5,326,720	-----
May.....	1,727,000	1,903,054	5,789,120	-----
June.....	1,884,005	1,893,053	5,758,700	-----
July.....	1,787,000	2,126,060	6,594,744	-----
August.....	2,190,011	2,113,060	6,554,415	-----
September.....	2,169,010	1,806,053	5,788,235	-----
October.....	1,829,005	1,893,053	5,853,105	-----
November.....	1,397,000	1,223,035	3,781,485	-----
December.....	1,538,000	1,702,048	5,262,535	-----
Total: 1957.....	21,845,051	21,546,608	66,201,394	3.07

particularly in metropolitan areas. Also at San Antonio the San Antonio Portland Cement Co. enlarged the capacity of its cement plant by installing a 10- by 220-foot kiln and accessory facilities. Production was begun in April at the newest cement plant in the State—the 680,000-barrel wet-process plant of Texas Portland Cement Co. at Orange. The plant will produce several types of portland cement, oil-well cements, and special masonry cements. Equipment consisted of a 10- by 300-foot kiln, a 2-compartment raw mill, a finish mill, an 8- by 60-foot clinker cooler, a 150-foot-diameter thickener, and accessory facilities. A \$43.8 million expansion program was postponed owing to adverse economic conditions.

Cement plants at Dallas, Fort Worth, and Houston of General Portland Cement Co., Trinity Div., and the Waco plant of Universal Atlas Cement Co. were closed by a five-weeks work stoppage beginning July 11. Settlement of the work stoppage resulted in wage increases of 12 to 18 cents per hour with new wage rates ranging from \$1.79 to \$2.42 an hour.

The supreme court ruling entitling cement companies to a 15-percent depletion allowance on the sale price of a finished product rather than on the market value of the raw material was expected to have widespread beneficial effect on the State's cement industry.

Fourteen cement plants were producing in 9 counties in 1957. The five leading counties, in order of output, were Harris, Dallas, Bexar, Nolan, and Tarrant. Approximately 30 percent of the cement was produced from oystershell and the remainder from limestone.

Clays.—The clay industry of Texas curtailed output in 1957 as demand slackened and products inventories rose. Declines of 1 to 21 percent were reported for the 1957 output of bentonite, fire clay, and miscellaneous clay compared with 1956 heavy clay products. Miscellaneous clay for brick, cement, and lightweight aggregate represented 80 percent of the total output. Production was reported from 41 counties, the 5 leaders in order of production being Harris, Palo Pinto, Dallas, Fort Bend, and Bastrop.

Fire-clay deposits suitable for the manufacture of face brick and low-temperature refractory brick and shapes occur in the Eocene Wilcox formation. Production of this clay was reported from 11 counties, the 3 principal counties being Bastrop, Rusk, and Henderson.

Bentonitic type clays and fuller's earth occur in the Upper Claiborne and other Tertiary formations of the Coastal Plain. These clays were used principally as filtering and decolorizing agents for vegetable, mineral, and animal oils, as additives to heavy drilling mud, and as fillers for asphalt. Production was reported from 6 counties, the 2 principal counties being Angelina and Walker.

All three major categories of the clay-products industry were represented in Texas in 1957: Brick and heavy clay products, ceramic and construction products, and chemical and drilling products. About 30 companies produced brick and heavy clay products, about 20 companies produced ceramic, interior tile and plumbing fixtures, and 6 companies produced chemical and drilling clays. The principal brick and heavy-clay-products manufacturers were Acme Brick Co., 6 plants; Barron Brick Co., 2 plants; Ferris Brick Co., 2 plants; Elgin-Butler Brick Co.; Elgin-Standard Brick Manufacturing Co.; and Henderson Clay Products Co. Refractory brick and shapes were

manufactured by General Refractories Co., A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., and National Refractory Co., Inc. Glazed and unglazed ceramic tile was produced by Texeramics, Inc., Royal Tile Co., Santa Anna Tile Co., Monarch Tile Manufacturing Co., Dallas Ceramics Co., and Lone Star Ceramics Co. Plumbing fixtures were made by Universal-Rundle Corp., Kilgore Ceramics Co., and Alliance Ware Corp.

TABLE 19.—Clays sold and used by producers, 1948-52 (average) and 1953-57, by kinds

Year	Bentonite		Fire clay		Fuller's earth	
	Short tons	Value	Short tons	Value	Short tons	Value
1948-52 (average).....	30,382	\$340,675	297,646	\$726,113	110,672	\$1,356,195
1953.....	47,887	670,300	356,211	915,575	106,437	1,277,670
1954.....	105,744	1,299,380	347,247	2,187,866	62,788	590,135
1955.....	155,128	1,461,873	437,595	1,068,664	(1)	(1)
1956.....	160,723	1,182,620	483,417	1,007,188	(1)	(1)
1957.....	126,635	963,147	453,974	1,057,131	(1)	(1)

Year	Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value
1948-52 (average).....	1,508,916	\$1,587,822	1,947,616	\$4,010,805
1953.....	1,860,440	1,815,429	2,370,975	4,678,974
1954.....	1,885,145	2,924,643	2,400,924	7,002,024
1955.....	2,504,236	2,569,385	2,096,959	5,099,322
1956.....	2,502,061	2,575,260	2,146,201	4,765,068
1957.....	2,411,569	2,913,351	2,992,178	4,933,629

¹ Figures withheld to avoid disclosing individual company confidential data.

² Incomplete total excludes fuller's earth.

Feldspar.—Microcline feldspar was mined from pegmatite dikes near Buchanan Lake in Llano County and used principally in the ceramics and glassware industries.

Gem Stones.—A wide variety of gem stones, including agate, amethyst, apatite chrysocolla, fluorite, garnet, jasper, obsidian, opal, and petrified wood valued at an estimated \$100,000 was collected, bartered, and polished by tourists, hobbyists, and dealers. Search for these gem-type minerals centered in Brewster, Culberson, Hudspeth, Jeff Davis, Mason, Presidio, Webb, and Zapata Counties.

Graphite.—Graphite was mined by open-pit methods by the Southwestern Graphite Co. in Burnet County.

Gypsum.—Extensive and widely distributed gypsum deposits occur in Texas. The principal uses were for manufacturing wallboard, lath, and building plasters and as a cement additive. The total output in 1957 was below that in 1956, as demand followed the 1957 decline in building construction. Production was reported from 4 counties—Fisher, Hardeman, Hudspeth, and Nolan—the same as in 1956.

Lime.—The 1957 increase in lime production over 1956 was due principally to more complete coverage. Analysis of reported data, based on the same number of producers in both 1957 and 1956, indicated a slight decline in production, which followed a similar slight decline in general industrial activity in Texas in 1957. Limestone

TABLE 20.—Gypsum mined, 1948-52 (average) and 1953-57

Year	Crude gypsum mined			Year	Crude gypsum mined		
	Short tons	Value			Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948-52 (average).....	994,246	\$2,552,766	\$2.57	1955.....	1,349,434	\$4,219,652	\$3.13
1953.....	1,067,854	2,860,633	2.68	1956.....	1,156,956	3,623,005	3.13
1954.....	1,218,048	3,773,230	3.10	1957.....	1,043,236	3,343,217	3.20

and oystershell were used in approximately equal amounts in manufacturing lime. Production was reported from 8 counties by 10 producers; the 3 leading counties were Comal, Brazoria, and Nueces. Chemical and industrial uses consumed approximately 94 percent of the total output and building plaster the remainder. Also, nearly 90 percent of the lime produced was used within the State.

The principal chemical and industrial uses in 1957 were in manufacturing lithium hydroxide and magnesium, in petroleum refining, as metallurgical lime for the open hearth in electric furnaces, in petrochemicals and paper, and in water purification and softening.

In 1957, 24 shaft kilns and 9 rotary kilns with an annual capacity of approximately 710,000 tons were in operation. Natural gas was the principal fuel used for the kilns; byproduct coke as fuel was used for minor production.

TABLE 21.—Lime (quick and hydrated) sold by producers, 1948-52 (average) and 1953-57

Year	Quick lime (short tons)	Hydrated lime (short tons)	Total	
			Short tons	Value
1948-52 (average).....	165,370	58,722	224,092	\$2,110,528
1953.....	256,000	219,569	475,569	4,380,831
1954.....	306,433	241,003	547,436	5,421,732
1955.....	307,322	277,533	584,855	5,549,309
1956.....	349,693	242,443	592,136	6,937,951
1957.....	559,426	236,968	796,394	7,488,795

Lithium.—Lepidolite ore from Southern Rhodesia was processed to lithium hydroxide at the San Antonio plant of American Lithium Chemicals, Inc. The San Antonio operation was 1 of 5 major domestic producers of lithium compounds.

Magnesium Compounds.—Magnesium compounds and other inorganic chemicals were produced at the Freeport plant of Dow Chemical Co.

Natural Salines.—Natural sodium sulfate was recovered from wells and dry-lake brines in Terry and Ward Counties by Ozark-Mahoning Co. for preparation of salt cake.

Perlite (Expanded).—Crude perlite from New Mexico and Colorado was expanded at several plants in Dallas, Harris, and Midland Counties. The expanded material was used as a lightweight aggregate in concrete and in building plaster. All plants were close to consuming markets in or nearby large urban and industrial areas.

Pumice (Volcanic Ash).—In 1957 pumicite was produced from open pits in Dickens and Starr Counties for use as filler in floor tile, as an insulating medium, as an absorbent for oils and greases, and as a component of acoustic plaster.

Salt.—Salt was extracted through wells from salt domes in Brazoria, Chambers, Duval, Fort Bend, Harris, Jefferson, Ward, and Yoakum Counties and mined by underground methods in Harris and Van Zandt Counties. The 1957 output (recovered mostly through wells as a brine) was 16 percent greater than that in 1956 and totaled 4.6 million tons. The inorganic-chemical industries—principally chlorine and sodium chemicals—continued to be the major consumers and were responsible for the gain in 1957. Other significant quantities were consumed in meat packing, as feed mixers and table salt, and in the oil-refining, rubber, and paper industries.

TABLE 22.—Salt sold or used by producers, 1948–52 (average) and 1953–57

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1948–52 (average).....	1,977,738	\$3,076,211	\$1.56	1955.....	3,583,242	\$12,867,094	\$3.59
1953.....	2,845,190	5,010,624	1.76	1956.....	3,962,778	14,369,558	3.63
1954.....	2,864,312	9,310,339	3.25	1957.....	4,612,033	17,104,385	3.71

Sand and Gravel.—Production in 1957 amounted to 23.7 million tons—22 percent under the record 1955 output. The decline resulted from the delayed highway-construction program, because of adverse weather conditions, and also from the keener competition of substitutes and lightweight aggregates in the building-construction industry. Production was reported from 103 of the State's 254 counties; commercial output represented 81 percent of the total and "Government-and-contractor" production represented the remainder. About 80 percent of the 1957 output (18.8 million tons) was washed, screened, or otherwise prepared. Principal uses were for building (45 percent) and for paving (47 percent). Other important uses included materials for railroad ballast and for glass, molding, and

TABLE 23.—Sand and gravel sold or used by producers, 1948–52 (average) and 1953–57

Year	Commercial		Government-and-contractor		Total sand and gravel		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average per ton
1948–52 (average)....	14,667,167	\$14,406,602	2,384,298	\$575,985	17,051,465	\$14,982,587	\$0.88
1953.....	11,866,963	12,426,922	3,234,263	418,639	15,101,226	12,845,561	.85
1954.....	23,136,286	23,892,530	3,179,349	948,281	26,315,635	24,840,811	.94
1955.....	24,973,270	26,303,453	6,544,853	2,176,897	31,518,123	28,480,350	.90
1956.....	23,311,118	25,511,901	6,024,579	1,700,653	29,335,697	27,212,554	.93
1957.....	19,155,083	21,978,743	4,530,167	1,448,452	23,685,200	23,427,195	.99

blast sands. The washed material was valued at \$1.16 a ton; unprepared or pit-run material was valued at \$0.33 a ton. The Texas Highway Department utilized most of the Government-and-contractor production.

TABLE 24.—Commercial sand and gravel produced in 1957, by uses

Use	Short tons	Value	
		Total	Average per ton
Sand:			
Blast.....	162,043	\$587,101	\$3.62
Engine.....	22,850	15,336	.67
Molding.....	32,256	60,721	1.88
Paving.....	2,962,248	3,216,959	1.09
Structural.....	4,647,826	4,262,098	.92
Other.....	834,066	645,862	.77
Undistributed ¹	243,763	603,855	2.48
Total.....	8,905,052	9,391,932	1.05
Gravel:			
Paving.....	3,709,971	4,645,522	1.25
Railroad ballast.....	112,646	92,601	.82
Structural.....	5,852,411	7,203,410	1.23
Other.....	574,953	645,278	1.12
Total.....	10,249,981	12,586,811	1.23

¹ Includes filter, railroad ballast and glass sand.

Stone.—Stone deposits of Texas include many varieties of igneous, metamorphic, and sedimentary rocks and are widely distributed over the State, except in the Coastal Belt and in parts of the High Plains region. Types of stone produced in 1957 were asphaltic limestone and sandstone, basalt, granite and other igneous rocks, limestone, marble, sandstone, and oystershell. The total output, including limestone and shell used in manufacturing cement and lime, decreased 6 percent to 30.7 million tons from the 1956 record. Of this total, about 30 percent was shell. Crushed stone (53 percent of the total output) consisted of 87 percent limestone and 11 percent sandstone; the remaining 2 percent was distributed among basalt, granite, marble, and miscellaneous stone. Principal uses of crushed stone were for roadstone and aggregate for concrete, for manufacturing cement and lime, and for railroad ballast.

Asphaltic Limestone.—Natural asphaltic limestone used for highway surfacing and maintenance was mined by open-pit methods in Uvalde County.

Basalt.—Basalt in Uvalde County and rhyolite in Hudspeth County were mined by open-pit methods and prepared for use as roadstone and railroad ballast.

Granite.—Several varieties of granite were mined by open-pit methods and prepared as building stone and roadstone in Burnet and Gillespie Counties.

Limestone.—Limestone was mined by open-pit methods in 64 counties of the State. Principal uses were for the manufacture of cement and lime, as aggregate in concrete, for roadstone, for agricultural lime, and as metallurgical flux. In the Coastal Plain area, shell was substituted for limestone for most industrial uses.

Marble.—Marble in a variety of colors and textures was mined by open-pit methods in Llano County and prepared at a mill in Travis County for roofing granules, terrazzo chips, and marble whiting by Dezendorf Marble Co.

Sandstone.—Sandstone was produced by open-pit methods in 20 Texas counties in 1957 and was used principally as aggregate in concrete, as roadstone, and as rubble in the highway construction program of the State.

TABLE 25.—Stone sold or used by producers, 1953–57

Year	Limestone		Sandstone		Shell	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....	6, 251, 667	\$6, 404, 938	(¹)	(¹)	(²)	(²)
1954.....	13, 482, 633	14, 385, 288	(¹)	(¹)	10, 314, 050	\$12, 193, 316
1955.....	14, 102, 882	16, 080, 861	(¹)	(¹)	11, 084, 797	14, 763, 238
1956.....	18, 706, 005	18, 357, 047	1, 286, 476	\$1, 244, 414	12, 017, 873	15, 483, 005
1957.....	19, 423, 388	20, 508, 857	1, 809, 530	1, 586, 945	9, 061, 761	11, 844, 231

Year	Miscellaneous		Total stone	
	Short tons	Value	Short tons	Value
1953.....	2, 022, 271	\$1, 090, 319	3 9, 095, 109	3 \$8, 550, 320
1954.....	1, 297, 563	1, 111, 646	4 25, 840, 338	4 29, 343, 634
1955.....	724, 216	699, 916	27, 321, 444	33, 543, 732
1956.....	700, 490	635, 887	3 32, 772, 827	3 36, 349, 747
1957.....	(¹)	(¹)	3 30, 660, 445	3 35, 358, 192

¹ Included in total; Bureau of Mines not at liberty to publish.

² Data not available.

³ Includes certain stone; Bureau of Mines not at liberty to publish separately.

⁴ Excludes certain stone; Bureau of Mines not at liberty to publish separately.

Shell.—Large deposits of shell in reefs and beds in shallow bays of the Gulf of Mexico were mined by dredges, and the shell was used principally in manufacturing lime and cement. Smaller amounts were used also as roadstone and as aggregate in concrete.

Sulfur.—Native sulfur in the caprock of some salt domes of the Gulf Coastal Plain was recovered in large quantities in 1957 by the Frasch method. Smaller quantities were recovered in purifying sour natural gas and from the hydrogen sulfide wastes of oil refineries. The Texas sulfur industry continued to face keen competition for markets from production of adjoining States and from imports.

Texas remained the Nation's major source of native sulfur. The output in 1957 was 3.4 million long tons, down 16 percent from the record 4 million long tons in 1956; 180,000 long tons additional was recovered from refinery gases and sour natural gas.

Sulfur was used in many industries from fertilizers and wood pulp to rubber, chemicals and medicines, in the production of iron and steel, and in the refining of crude oil.

Exploitation of a proved sulfur deposit on the Humble dome by the Frasch process was begun by American Sulphur Royalty Co. during 1957. This dome had already yielded over 133 million barrels of crude oil.

TABLE 26.—Sulfur produced and shipped from Frasch mines, 1948–52 (average) and 1953–57

Year	Production (long tons)	Shipments		
		Long tons	Value	
			Total	Average per ton
1948–52 (average).....	3,835,818	3,885,418	\$75,757,798	\$19.50
1953.....	3,514,771	3,614,838	97,601,000	27.00
1954.....	3,505,087	3,474,477	92,791,821	26.71
1955.....	3,657,717	3,766,882	105,128,170	27.91
1956.....	3,994,393	3,437,061	91,026,388	26.48
1957.....	3,366,377	2,879,672	70,225,317	24.39

Talc and Soapstone.—Talc and soapstone used principally for insecticides, roofing granules, and in the ceramic and rubber industries were mined by open-pit methods from deposits in Gillespie and Hudspeth Counties.

Vermiculite (Exfoliated).—Crude vermiculite, shipped in from adjoining States, was expanded at plants in Burnet, Dallas, and Harris Counties for use as a lightweight aggregate for plaster, for insulation, and as a soil conditioner.

Water.—Water remained one of the State's major mineral problems, created by the phenomenal growth in demand from industry, agriculture, and homes. The future expansion of Texas economy will be influenced largely by the further development, control, and conservation of this vital resource.

The Texas water problem consisted of (1) flood prevention of floods with attending losses of property, stock, and crops, through control of surface runoff; (2) providing adequate supplies of water of acceptable quality at reasonable cost to municipal, industrial, and agricultural users; (3) conserving water resources by reducing evaporation losses and by reusing industrial water; and (4) control of pollution from industrial and municipal wastes.

Urban and industrial growths and rising per capita consumption of water in recent years have greatly increased water requirements. As this growth is expected to continue at least for the next decade, all Texas water resources need to be improved and conserved. Numerous local, State, and Federal agencies have joined efforts to analyze and resolve this water problem, so that in 1957 4 Federal agencies, 2 State agencies, and numerous local agencies were participating. The State's water problem had been divided into 11 major river basins for study and resolution. Several projects were in progress in 1957 to develop new reservoirs or to enlarge existing reservoir capacities where additional water supplies were urgently needed.

Bountiful rainfall in the spring and summer of 1957 helped to relieve the urgency of many urban centers in central and east Texas. Rainfall in other areas of the State improved subsoil moisture conditions for agriculture but was insufficient to fill reservoirs. The northwestern and southwestern regions of the State, which depend on ground-water reservoirs, still faced the critical problem of replenishing these underground aquifers.

METALS

The metal mining and processing industries retained a significant position in the industrial economy of Texas in 1957 and was of vital importance to the economy in local areas. In 1957 this industry was producing or refining such products as alumina and aluminum from imported bauxite ores of South America and the Caribbean area, antimony from Mexican ores, cadmium from flue dusts of zinc smelters, copper from both foreign and domestic ores, gold and silver from foreign and domestic ores and from zinc residues, iron and steel from Texas brown ores and Mexican hematites, lead from foreign and domestic ores, magnesium from Gulf seawater, tin from foreign ores, and zinc from domestic and foreign ores. An important secondary metals industry in the State recovered metals from scrap and other waste materials.

In general, the 1957 operations of this industry matched its 1956 performance, although there was some consumption during the latter part of the year as manufacturers took advantage of the freer availability of metals, reduced their own inventories, and compelled suppliers to carry the growing expense of stocks. Consequently, these changes in metal inventories during 1957 spread the effect of declines in consuming industries to their suppliers (smelters, refineries) and to raw-material producers.

Metal prices fluctuated widely in 1957; those for light metals advanced, while those for nonferrous metals (copper, lead, and zinc) declined to prices that were realized in 1954.

Aluminum.—Texas remained the second-ranking producer of primary aluminum in the Nation in 1957. Its total annual ingot capacity was 365,000 tons, the same as in 1956.

The price of primary ingot was raised 1 cent a pound to 28.1 cents on August 1, reflecting wage raises and increased costs in operations, materials, and transportation.

Reynolds Metals Co. completed a \$30 million expansion program at its Sherwin alumina plant and raised the capacity to 550,000 tons. The bauxite ore was transshipped by barges from Aransas Pass until a deep-water channel emptying into Matagordo Bay could be completed. Aluminum Company of America was building an alumina plant adjacent to its Point Comfort reduction works. The annual plant capacity was rated at 750,000 tons of alumina. This output from Surinam and Dominican Republic bauxite would be used at the company Point Comfort and Rockdale works.

Antimony.—Primary antimony from Mexican ores was produced at the Laredo (Tex.) smelter of National Lead Co. Output was curtailed late in 1957 as metals stocks mounted and demand declined. The principal uses were in antimonial lead for batteries, in bearing metals, in frits, and as pigment in ceramic enamels, paints, and lacquers. The price of the metal remained unchanged at 33 cents per pound (f. o. b. Laredo, Tex.) throughout 1957.

Cadmium.—Cadmium was recovered as a byproduct of zinc smelting at the Corpus Christi electrolytic zinc plant of American Smelting & Refining Co.

Most of the metal was used for electroplating. Other uses were as a component of bearing and low-melting-point alloys, for soldering

and brazing, and as pigment in paints, plastics, and ceramics. The first price change for cadmium metal since 1954 occurred on December 23, when the quotation was dropped from \$1.70 to \$1.55 per pound.

Copper.—Trans-Pecos Minerals, Inc., was exploring a copper occurrence in Culberson County under a DMEA contract. The project was continued into 1958. Copper ores and concentrates from Western States and from foreign countries were smelted at the El Paso works of American Smelting & Refining Co. Electrolytic-grade copper and fire-refined copper were produced from blister copper at the Nichols refinery of Phelps Dodge Refining Corp. at El Paso.

The continuing imbalance between supply and demand for copper in 1957 forced the price from a 1957 opening quotation of 36 cents per pound through a series of price adjustments to a closing price of 27 cents in December. These frequent cuts in metal price together with mine and smelter curtailments failed to encourage any increase in demand or to reduce metal-stock accumulations.

Production of copper and lead at the El Paso smelter of American Smelter & Refining Co. was halted by an 8-day work stoppage in early May.

Iron and Steel.—The two integrated steel companies of Texas continued to produce iron ores from open pits in Cass, Cherokee, and Morris Counties. Production declined late in the year, as stocks of both pig iron and steel products increased. Additional iron ores imported from Mexico and from South America supplemented the State produced ore as feed for the two blast furnaces. The foundry industry of Texas, which consumed large quantities of scrap in addition to pig iron, produced a wide variety of construction and industrial castings, shapes, and alloy products and increased the capacity of its foundry and steel-fabricating facilities during the year.

TABLE 27.—Consumption of ferrous scrap and pig iron, 1955–57

Year	Total scrap (short tons)	Pig iron (short tons)	Total scrap and pig iron (short tons)
1955.....	1, 671, 036	749, 298	2, 420, 334
1956.....	1, 704, 464	675, 432	2, 379, 896
1957.....	1, 817, 872	913, 087	2, 730, 959

At Daingerfield Lone Star Steel Co. continued the \$8 million expansion of its steel-mill facilities, which included a fifth open-hearth furnace, a new rodmill, and related facilities. The rodmill will permit diversification of its product line. The new open-hearth furnace will raise ingot capacity 133,000 tons to 800,000 annually. Sheffield Steel Division of Armco Steel Corp. completed installation of a fifth open-hearth furnace at its Houston plant.

Lead.—Base bullion was produced at the El Paso smelter of American Smelting & Refining Co. from domestic and foreign ores and concentrates.

Magnesium.—Dow Chemical Co. continued to recover magnesium from sea water by the electrolytic method at its Freeport plant and at the Government-owned Velasco plant. The 1957 output of 81,263

tons of primary metal in the United States was a postwar record. The record output occurred in 1943, when 183,584 tons was produced, principally for war material. Civilian consumption gradually replaced military demands as research provided new products and new markets. Previously, Government stockpiling absorbed most of the surplus metal. In addition to structural uses, significant quantities of magnesium were consumed in aluminum alloys and in the manufacture of titanium; in refining lead, nickel, uranium, and zirconium; and for cathodic protection of marine structures and buried pipelines.

The base price of magnesium ingot (f. o. b. Velasco, Tex.) remained at 35.25 cents per pound throughout 1957.

The Government-owned Velasco plant was purchased by Dow Chemical Co. from General Services Administration for \$20,700,000 on November 4. The company had operated the plant on a lease basis since April, 1951.

Manganese.—Foreign manganese ore was concentrated and processed at the Houston plant of the Tenn-Tex Alloy & Chemical Corp. in 1957 for use as an alloy agent in the State's expanding steel industry.

Mercury.—Intermittent exploratory work was maintained by several mercury interests in the Terlingua area during 1957. Some mercury was recovered from pilot runs of development ore. The price of mercury held at \$255–\$257 per flask during the first half of 1957 and then declined to \$225–\$230 at the close of 1957 to average 5 percent below the 1956 average. The principal uses were in electrical apparatus, in industrial and control instruments, and for agricultural insecticides and fungicides. Two DMEA contracts were active in Brewster County.

Silver.—Silver was recovered in smelting lead and copper ores and concentrates and from residues of zinc smelters. None of the metal was recovered from Texas sources in 1957.

Tin.—The Longhorn tin smelter at Texas City, operated by the Tin Processing Corp. under Government sponsorship, produced 1,564 long tons of metal in 1957 compared with 17,631 long tons in 1956. The plant was sold to the Wah Chang Corp. for \$1,350,000 on February 15, 1957. The purchaser also agreed to make additional payments up to \$2 million, contingent upon the amount of tin-metal alloys and tungsten produced.

Uranium.—About 10 tons of uranium ore was shipped from the Hackney lease near Falls City in Karnes County to a New Mexico mill in 1957. Drilling was increased in the Ecelelo and Gillette areas, as well as in the Fashing area in Atascosa County. Exploration continued on the Palangana dome in Duval County, where uranium minerals were discovered earlier. Drilling depths of oil exploration were reported between 4,000 and 9,500 feet. A DMEA project was active in Briscoe County.

Zinc.—Ores and concentrates from Western States and from foreign countries were treated at three zinc smelters in Texas. American Smelting & Refining Co. operated a horizontal retort plant at Amarillo and an electrolytic plant at Corpus Christi; American Zinc Co. of Illinois operated a horizontal retort smelter at Dumas. The combined rated capacity of the plants totaled 180,000 tons of metal annually, not including a slag-fuming plant.

REVIEW BY COUNTIES

Mineral production was reported from 239 of the 254 counties of Texas in 1957. The output of liquid mineral fuels was reported from 204 counties, nonmetallic minerals from 161, solid fuels from 2, and metallic minerals from 5.

Anderson.—The value of minerals produced in 1957 totaled \$24.8 million, \$7 million more than in 1956. The output of crude oil amounted to 6.7 million barrels and natural gas to 34,394 million cubic feet. The Long Lake cycling plant of Tidewater Associated Oil Co. recovered natural-gas liquids. The oil and gas industry drilled 87 exploratory wells, which resulted in 11 oil producers, 2 gas wells, and 74 dry holes and also spent 117 crew-weeks in geophysical prospecting.

Andrews.—Andrews County led the State in 1957 in total value of minerals produced (\$208.5 million) and in crude-oil output (64.8 million barrels). Natural-gas liquids recovered at the Andrews and Fullerton gasoline plants of Phillips Petroleum Co., the Dollarhide plant of Pure Oil Co., and the South Fullerton, Midland farms, and Three Bar plants of Pan American Petroleum Corp. totaled 129 million gallons.

Sulfur was recovered from natural gas at the Andrews plant of Phillips Petroleum Co. Geophysical prospecting declined 25 percent from 1956 to 128 crew-weeks. Of 54 exploratory wells drilled, 27 were oil wells, 3 gas wells, and 24 dry holes. Thirteen oil wells ranged in depth from 4,451 feet to 12,728.

TABLE 28.—Value of mineral production in Texas, 1956–57, by counties ¹

County	1956 ²	1957	Minerals produced in 1957 in order of value
Anderson.....	\$18, 136, 050	\$24, 828, 010	Petroleum, natural gas, natural-gas liquids.
Andrews.....	193, 830, 266	208, 495, 999	Petroleum, natural-gas liquids, natural gas, recovered sulfur.
Angelina.....	422, 844	894, 470	Clays, natural gas, petroleum, natural-gas liquids, sand and gravel.
Aransas.....	10, 780, 217	12, 680, 047	Petroleum, natural gas, natural-gas liquids, shell.
Archer.....	28, 455, 780	28, 875, 632	Petroleum, natural-gas liquids.
Armstrong.....		20, 321	Stone.
Atascosa.....	22, 647, 767	16, 880, 673	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Austin.....	8, 697, 656	7, 189, 777	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Bastrop.....	1, 226, 580	998, 657	Petroleum, clays.
Baylor.....	4, 874, 470	8, 118, 526	Petroleum.
Bee.....	24, 693, 643	22, 418, 279	Natural-gas liquids, natural gas, petroleum.
Bell.....	439, 850	610, 749	Sand and gravel, stone.
Bexar.....	15, 495, 697	13, 793, 297	Cement, stone, petroleum, sand and gravel, clays, natural gas.
Blanco.....	65, 527	1, 758	Sand and gravel.
Borden.....	25, 571, 580	34, 532, 550	Petroleum, natural-gas liquids.
Bosque.....	19, 429	151, 030	Stone, sand and gravel.
Bowie.....	463, 454	368, 541	Sand and gravel, petroleum, natural gas, natural-gas liquids.
Brazoria.....	227, 475, 906	183, 761, 334	Petroleum, magnesium chloride, natural gas, natural-gas liquids, bromine, salt, Frasch sulfur, lime, magnesium compounds, sand and gravel.
Brazos.....	23, 490	28, 400	Natural gas.
Brewster.....	205, 350	88, 623	Clays, mercury, sand and gravel, gem stones, stone.
Briscoe.....	44, 552	(³)	Clays.
Brooks.....	20, 679, 450	13, 581, 017	Petroleum, natural gas, natural-gas liquids.
Brown.....	2, 364, 498	2, 509, 134	Petroleum, stone, natural gas, natural-gas liquids, clays, sand and gravel.
Burleson.....	38, 251	234, 195	Stone, sand and gravel, petroleum.
Burnet.....	1, 662, 374	(³)	Stone, graphite, sand and gravel.
Caldwell.....	9, 189, 480	11, 705, 360	Petroleum.
Calhoun.....	14, 412, 467	17, 790, 958	Petroleum, natural gas, natural-gas liquids, shell.

See footnotes at end of table.

TABLE 28.—Value of mineral production in Texas, 1956-57, by counties ¹—Con.

County	1956 ²	1957	Minerals produced in 1957 in order of value
Callahan	\$11,362,050	\$10,489,779	Petroleum, natural gas, natural-gas liquids.
Cameron	.....	45,770	Petroleum.
Camp	656,010	637,587	Do.
Carson	23,415,972	33,771,557	Natural gas, petroleum, natural-gas liquids.
Cass	6,858,055	7,251,689	Petroleum, iron ore, natural-gas liquids, natural gas.
Chambers	72,041,302	69,673,881	Petroleum, natural-gas liquids, shell, natural gas, salt.
Cherokee	8,373,263	49,837,678	Petroleum, iron ore, natural gas, natural-gas liquids, clays.
Childress	11,847	65,178	Sand and gravel.
Clay	18,924,320	17,765,685	Petroleum, natural-gas liquids, natural gas.
Cochran	22,265,690	21,808,820	Do.
Coke	43,642,310	23,773,073	Do.
Coleman	10,159,606	12,146,548	Petroleum, sand and gravel, natural gas, stone, natural-gas liquids, clays.
Collin	112,970	107,567	Stone, sand and gravel.
Collinsworth	189,040	756,172	Petroleum, natural gas, petroleum, natural-gas liquids.
Colorado	26,450,525	24,496,263	Natural gas, natural-gas liquids, sand and gravel, petroleum, stone.
Comal	2,729,254	(³)	Lime, stone, sand and gravel.
Comanche	399,650	405,420	Petroleum, natural gas, stone.
Concho	91,980	67,833	Petroleum, natural gas, natural-gas liquids.
Cooke	24,770,750	26,465,916	Petroleum, natural-gas liquids, natural gas.
Correll	161,920	99,646	Stone.
Cottle	103,965	(³)	Sand and gravel, petroleum.
Crane	84,028,134	103,839,039	Petroleum, natural-gas liquids, recovered sulfur, natural gas, stone.
Crockett	28,140,210	30,054,397	Petroleum, natural gas, natural-gas liquids.
Crosby	120,500	120,500	Sand and gravel, petroleum.
Culberson	16,214	112,678	Petroleum, sand and gravel, stone.
Dallam	.....	93,300	Stone, natural gas.
Dallas	20,070,883	17,818,945	Cement, sand and gravel, stone, clays.
Dawson	10,683,786	14,525,462	Petroleum, stone.
Deaf Smith	.....	12,340	Stone, sand and gravel.
Denton	901,103	648,796	Petroleum, clays, sand and gravel.
De Witt	12,608,344	12,433,971	Petroleum, natural gas, natural-gas liquids.
Dickens	71,996	105,069	Sand and gravel, petroleum, pumicite.
Dimmit	918,930	1,576,075	Petroleum, natural gas, natural-gas liquids.
Donley	3,953	79,800	Sand and gravel.
Duval	41,646,857	44,138,010	Petroleum, natural gas, natural-gas liquids, salt.
Eastland	3,480,490	4,486,849	Petroleum, natural-gas liquids, natural gas, clays, stone.
Ector	180,225,310	207,937,413	Petroleum, natural-gas liquids, recovered sulfur, stone, natural gas.
Edwards	.....	4,372	Petroleum.
Ellis	163,149	274,202	Stone, clays, sand and gravel.
El Paso	6,746,982	6,227,864	Cement, stone, sand and gravel, lime.
Erath	155,150	155,736	Petroleum, natural gas, stone, sand and gravel.
Falls	86,412	185,892	Stone, sand and gravel, petroleum.
Fayette	2,141,022	1,524,030	Petroleum, sand and gravel, clays, stone, natural gas.
Fisher	18,758,218	22,058,097	Petroleum, gypsum.
Floyd	41,410	68,057	Petroleum, sand and gravel, stone.
Foard	849,650	1,665,153	Petroleum, natural gas.
Fort Bend	47,980,710	48,019,248	Petroleum, Frasch sulfur, natural gas, salt, natural-gas liquids, clays, sand and gravel.
Franklin	12,666,030	11,481,304	Petroleum, natural gas, natural-gas liquids.
Freestone	1,847,852	2,283,105	Natural gas, petroleum, natural-gas liquids, clays, stone.
Frio	8,852,290	7,631,218	Petroleum, natural gas, natural-gas liquids.
Gaines	73,335,742	86,564,412	Petroleum, natural-gas liquids, natural gas, recovered sulfur.
Galveston	31,062,278	29,699,920	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Garza	16,238,840	18,976,404	Petroleum, uranium ore.
Gillespie	128,552	112,178	Stone, sand and gravel, talc and soapstone.
Glasscock	14,169,650	18,441,406	Petroleum, natural gas, natural-gas liquids.
Goliad	12,576,850	16,679,862	Do.
Gonzales	238,040	342,325	Petroleum, clays, sand and gravel.
Gray	53,382,066	67,368,498	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Grayson	32,491,700	30,102,223	Petroleum, sand and gravel, natural gas, natural-gas liquids, stone.
Gregg	149,086,330	128,283,605	Petroleum, natural-gas liquids, natural gas.
Grimes	104,050	221,534	Stone, natural gas, petroleum, natural-gas liquids
Guadalupe	12,730,960	12,248,479	Petroleum, clays, natural gas.
Hale	7,293,500	6,175,120	Petroleum.
Hall	1,487	(³)	Sand and gravel.
Hamilton	299,621	162,631	Natural gas, natural-gas liquids.

See footnotes at end of table.

TABLE 28.—Value of mineral production in Texas, 1956-57, by counties¹—Con.

County	1956 ²	1957	Minerals produced in 1957 in order of value
Hansford	\$3, 618, 600	\$15, 782, 067	Natural-gas liquids, natural gas, petroleum.
Hardeman	826, 433	(3)	Gypsum, petroleum.
Hardin	37, 133, 250	33, 615, 992	Petroleum, natural-gas liquids, natural gas, stone.
Harris	130, 055, 742	124, 671, 548	Petroleum, cement, natural gas, natural-gas liquids, salt, lime, recovered sulfur, clays, sand and gravel, shell.
Harrison	20, 146, 630	23, 225, 810	Natural-gas liquids, petroleum, natural gas, lignite, clays.
Harley	3, 135, 860	811, 493	Natural gas, petroleum, stone, natural-gas liquids.
Haskell	9, 622, 745	9, 749, 015	Petroleum, natural-gas liquids, natural gas, stone.
Hays	228, 005	571, 650	Stone, sand and gravel.
Hemphill	18, 420	25, 489	Petroleum, natural gas, natural-gas liquids.
Henderson	9, 511, 889	5, 411, 079	Natural gas, petroleum, natural-gas liquids, clays.
Hidalgo	8, 576, 590	26, 506, 888	Natural gas, natural-gas liquids, petroleum, sand and gravel, clays.
Hill	187, 371	525, 829	Stone.
Hockley	48, 437, 285	42, 225, 677	Petroleum, natural-gas liquids, recovered sulfur, natural gas.
Hopkins	8, 111, 355	5, 812, 631	Petroleum, clays.
Houston	3, 831, 430	3, 608, 790	Natural gas, petroleum, natural-gas liquids, stone, sand and gravel.
Howard	43, 494, 982	43, 569, 126	Petroleum, natural-gas liquids, sand and gravel.
Hudspeth	718, 641	540, 846	Stone, talc and soapstone, gypsum, sand and gravel.
Hunt	441, 600	49, 599	Petroleum.
Hutchinson	50, 589, 922	64, 234, 273	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Irion	563, 400	2, 454, 443	Petroleum.
Jack	21, 013, 180	17, 867, 639	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Jackson	50, 760, 850	49, 878, 226	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jasper	857, 392	1, 919, 354	Petroleum, natural gas, natural-gas liquids, clays.
Jeff Davis	206, 181	20, 000	Sand and gravel.
Jefferson	49, 949, 104	43, 441, 578	Petroleum, natural gas, Frasch sulfur, natural-gas liquids, recovered sulfur, sand and gravel, salt, clays, stone.
Jim Hogg	5, 453, 490	14, 488, 369	Petroleum, natural gas, stone, natural-gas liquids.
Jim Wells	53, 155, 660	50, 318, 451	Petroleum, natural gas, natural-gas liquids.
Johnson	1, 193, 087	829, 951	Lime, stone, sand and gravel.
Jones	21, 059, 833	21, 281, 357	Petroleum, natural-gas liquids, sand and gravel, stone.
Karnes	15, 328, 850	11, 372, 123	Petroleum, natural gas, natural-gas liquids.
Kaufman	4, 061, 816	3, 393, 149	Petroleum, stone.
Kenedy	1, 284, 210	2, 058, 684	Petroleum, natural-gas liquids, natural gas.
Kent	17, 830, 090	31, 174, 999	Petroleum, natural-gas liquids.
Kimble	19, 117	31, 576	Sand and gravel, petroleum, natural gas.
King	3, 853, 010	5, 890, 250	Petroleum, natural gas.
Kleberg	17, 310, 223	34, 354, 400	Petroleum, natural gas, natural-gas liquids, stone.
Knox	2, 901, 458	6, 405, 850	Petroleum.
Lamar	14, 050	34, 961	Stone.
Lamb	1, 231, 870	4, 085, 229	Petroleum.
Lampasas	30, 000	31, 049	Sand and gravel.
La Salle	1, 065, 190	970, 529	Petroleum, natural gas.
Lavaca	22, 367, 791	10, 846, 424	Natural-gas liquids, natural gas, petroleum, stone, sand and gravel.
Lee	6, 400	20, 467	Stone, petroleum, natural gas.
Leon	2, 376, 450	2, 991, 839	Natural gas, petroleum, natural-gas liquids.
Liberty	54, 289, 130	57, 331, 738	Petroleum, Frasch sulfur, natural gas, natural-gas liquids, sand and gravel.
Limestone	1, 844, 995	1, 514, 104	Petroleum, natural gas, stone, natural-gas liquids, clays.
Lipscomb	6, 240	51, 587	Natural gas, natural-gas liquids, petroleum.
Live Oak	14, 512, 370	12, 143, 115	Natural gas, petroleum, natural-gas liquids.
Llano	84, 740	583, 239	Stone, feldspar, talc and soapstone.
Loving	4, 489, 260	4, 112, 201	Petroleum, natural-gas liquids.
Lubbock	2, 590, 136	1, 329, 860	Petroleum, sand and gravel, stone.
Lynn	449, 426	1, 174, 033	Petroleum, sand and gravel.
Madison	818, 780	940, 822	Natural gas, natural-gas liquids, petroleum.
Marion	5, 097, 130	10, 379, 774	Petroleum, natural-gas liquids, natural gas.
Martin	1, 844, 330	1, 855, 664	Petroleum, stone, sand and gravel.
Mason	40	56, 885	Stone, sand and gravel.
Matagorda	39, 273, 340	39, 615, 460	Petroleum, natural gas, natural-gas liquids, shell, sand and gravel.
Maverick	46, 780	97, 379	Petroleum, natural gas, natural-gas liquids.
McCulloch	2, 830	52, 229	Petroleum.
McLennan	3, 928, 691	4, 063, 372	Cement, sand and gravel, stone, petroleum.
McMullen	3, 855, 880	7, 365, 306	Natural gas, petroleum, natural-gas liquids.
Medina	155, 970	624, 764	Petroleum, stone, clays, natural gas.
Menard		4, 130	Natural gas.
Midland	59, 982, 503	61, 244, 707	Petroleum, natural-gas liquids, natural gas.

See footnotes at end of table.

TABLE 28.—Value of mineral production in Texas, 1956-57, by counties 1—Con.

County	1956 2	1957	Minerals produced in 1957 in order of value
Milam.....	\$3, 812, 439	\$4, 153, 145	Lignite, petroleum, sand and gravel, stone.
Mills.....	-----	115, 885	Stone.
Mitchell.....	7, 154, 858	9, 814, 221	Petroleum, stone, sand and gravel.
Montague.....	22, 892, 336	22, 466, 254	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Montgomery.....	45, 239, 621	41, 761, 377	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Moore.....	35, 460, 529	35, 727, 120	Natural gas, natural-gas liquids, helium, petroleum, recovered sulfur, stone, sand and gravel.
Morris.....	(3)	(3)	Iron ore.
Motley.....	18, 177	282, 975	Petroleum, sand and gravel.
Nacogdoches.....	1, 709, 720	1, 843, 471	Natural gas, clays, natural-gas liquids, sand and gravel, petroleum.
Navarro.....	8, 232, 255	6, 597, 996	Petroleum, stone, sand and gravel, clays, natural gas, natural-gas liquids.
Newton.....	3, 704, 896	5, 483, 741	Petroleum, natural gas, natural-gas liquids.
Nolan.....	34, 492, 988	38, 145, 979	Petroleum, cement, gypsum, natural-gas liquids, sand and gravel, natural gas.
Nueces.....	84, 307, 603	90, 449, 285	Petroleum, natural gas, natural-gas liquids, cement, shell, lime, sand and gravel.
Ochiltree.....	1, 056, 980	5, 788, 917	Petroleum, natural gas, natural-gas liquids, stone.
Oldham.....	483, 609	(3)	Sand and gravel, petroleum.
Orange.....	17, 568, 860	16, 549, 542	Petroleum, natural gas, cement, natural-gas liquids.
Palo Pinto.....	1, 098, 626	1, 454, 941	Petroleum, clays, natural-gas liquids, sand and gravel, stone, natural gas.
Panola.....	64, 747, 690	87, 666, 371	Natural gas, natural-gas liquids, petroleum.
Parker.....	290, 620	971, 178	Natural-gas liquids, natural gas, clays, petroleum, stone, sand and gravel.
Pecos.....	51, 206, 653	60, 006, 068	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Polk.....	6, 216, 394	5, 632, 625	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Potter.....	7, 502, 542	14, 654, 780	Natural gas, helium, sand and gravel, natural-gas liquids, stone.
Presidio.....	59, 957	17, 750	Sand and gravel.
Rains.....	13, 780	-----	-----
Randall.....	-----	172, 999	Stone.
Reagan.....	51, 930, 340	32, 530, 021	Petroleum, natural-gas liquids, natural gas.
Red River.....	28, 000	45, 413	Petroleum.
Reeves.....	1, 416, 652	2, 549, 452	Petroleum, sand and gravel, natural-gas liquids, stone, natural gas.
Refugio.....	73, 761, 100	74, 767, 216	Petroleum, natural gas, natural-gas liquids.
Roberts.....	4, 900, 510	5, 643, 301	Do.
Robertson.....	567, 705	571, 394	Sand and gravel, petroleum, natural gas, natural-gas liquids.
Rockwall.....	151, 438	16, 250	Stone.
Runnels.....	18, 802, 650	27, 931, 451	Petroleum, natural-gas liquids, natural gas.
Rusk.....	86, 104, 260	13, 087, 345	Natural-gas liquids, petroleum, natural gas, clays.
Sabine.....	-----	2, 000	Sand and gravel.
San Augustine.....	-----	2, 904	Do.
San Jacinto.....	2, 439, 703	2, 483, 576	Petroleum, natural gas, natural-gas liquids, sand and gravel.
San Patricio.....	53, 247, 766	57, 950, 613	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Schleicher.....	10, 065, 000	9, 429, 384	Petroleum, natural-gas liquids, natural gas.
Scurry.....	130, 446, 080	142, 694, 910	Petroleum, natural-gas liquids.
Shackelford.....	8, 444, 214	10, 651, 532	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Shelby.....	2, 091, 840	1, 602, 615	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Sherman.....	11, 422, 570	13, 594, 767	Natural gas, petroleum.
Smith.....	6, 471, 235	12, 218, 056	Petroleum, natural gas, natural-gas liquids, sand and gravel, clays.
Starr.....	24, 022, 044	25, 882, 573	Petroleum, natural gas, natural-gas liquids, sand and gravel, pumicite, stone, clays.
Stephens.....	10, 963, 220	11, 816, 160	Petroleum, natural-gas liquids, natural gas, stone.
Sterling.....	2, 530, 460	1, 871, 088	Petroleum.
Stonewall.....	30, 533, 984	30, 004, 689	Petroleum, natural-gas liquids, sand and gravel.
Sutton.....	473, 430	825, 921	Natural gas, petroleum, sand and gravel, natural-gas liquids.
Swisher.....	3, 370	-----	-----
Tarrant.....	9, 021, 857	8, 101, 152	Cement, sand and gravel, stone.
Taylor.....	8, 346, 609	11, 815, 821	Petroleum, stone, sand and gravel, natural-gas liquids, clays, natural gas.
Terrell.....	5, 803	13, 115	Natural gas, stone.
Terry.....	21, 966, 760	19, 505, 527	Petroleum, natural salines.
Throckmorton.....	10, 097, 010	11, 697, 630	Petroleum, natural gas.
Titus.....	11, 836, 910	12, 577, 071	Petroleum.

See footnotes at end of table.

TABLE 28.—Value of mineral production in Texas, 1956-57, by counties ¹—Con.

County	1956 ²	1957	Minerals produced in 1957 in order of value
Tom Green.....	\$6,900,029	\$7,981,709	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Travis.....	2,520,952	2,400,846	Stone, lime, sand and gravel, petroleum, abrasives.
Trinity.....	16,020	5,880	Natural gas, natural-gas liquids.
Tyler.....	4,153,384	2,540,524	Petroleum, natural gas, natural-gas liquids.
Upshur.....	8,963,220	66,073,024	Petroleum, sand and gravel.
Upton.....	61,724,859	78,835,659	Petroleum, natural-gas liquids, natural gas.
Uvalde.....	2,547,354	(³)	Asphalt, basalt, natural gas.
Val Verde.....		25,448	Stone, natural gas.
Van Zandt.....	29,741,182	30,269,320	Petroleum, salt, natural-gas liquids, natural gas.
Victoria.....	29,956,860	27,956,541	Petroleum, natural gas, sand and gravel, natural-gas liquids, stone.
Walker.....	242,876	203,380	Clays, stone, petroleum.
Waller.....	36,632,754	42,078,973	Natural-gas liquids, natural gas, petroleum, sand and gravel.
Ward.....	37,254,410	24,301,276	Petroleum, natural-gas liquids, natural salines, natural gas, sand and gravel, salt.
Washington.....	858,010	760,197	Petroleum, stone, natural gas.
Webb.....	5,799,932	7,368,590	Petroleum, natural gas, natural-gas liquids, sand and gravel, clays.
Wharton.....	85,888,261	70,572,551	Frasch sulfur, petroleum, natural gas, natural-gas liquids, sand and gravel.
Wheeler.....	5,089,530	7,444,662	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Wichita.....	32,700,974	35,625,569	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Wilbarger.....	16,162,920	20,267,358	Petroleum, natural-gas liquids.
Willacy.....	9,162,350	8,486,699	Petroleum, natural gas, natural-gas liquids.
Williamson.....	989,249	1,712,459	Stone, lime, petroleum.
Wilson.....	2,411,497	3,293,843	Petroleum, clays, natural gas.
Winkler.....	50,791,993	95,009,923	Petroleum, natural gas, natural-gas liquids, recovered sulfur.
Wise.....	7,636,952	13,113,717	Petroleum, stone, natural gas, natural-gas liquids, clays.
Wood.....	67,595,100	66,701,502	Petroleum, natural-gas liquids, natural gas.
Yoakum.....	58,768,444	62,364,373	Petroleum, natural-gas liquids, salt.
Young.....	21,893,070	21,893,682	Petroleum, natural-gas liquids, natural gas.
Zapata.....	3,419,380	2,784,750	Petroleum, natural gas.
Zavala.....	129,460	248,761	Natural gas, sand and gravel, petroleum, natural-gas liquids.
Undistributed.....	9,068,925	18,611,625	Iron ore, stone, asphalt, lime, sand and gravel, petroleum, gypsum, graphite, gem stones, natural-gas liquids, basalt, clays, natural gas.
Total.....	4,245,117,000	4,497,264,000	

¹ The following counties are not listed, because no production was reported in Bailey, Bandera, Castro, Delta, Fannin, Hood, Kendall, Kerr, Kinney, Parmer, Rains, Real, San Saba, Somervell and Swisher.

² Revised.

³ Figure withheld to avoid disclosing individual company data; included with "Undistributed."

Angelina.—The total 1957 value of Angelina County mineral production increased over 100 percent to \$894,000 from 1956. Production of 13,000 barrels of crude oil and 2,884 million cubic feet of natural gas was reported.

The output of natural-gas liquids totaled 211,000 gallons. Bentonite was mined by open-pit methods near Zavalla by Magnet Cove Barium Corp. Sand and gravel for use in concrete was recovered from open pits.

Aransas.—Mineral-fuel production, consisting of 3.5 million barrels of crude oil, 15,196 million cubic feet of natural gas, and 6.2 million gallons of natural-gas liquids was reported from Aransas County in 1957. Of 12 wells drilled in 1957, 6 were exploratory wells that resulted in the discovery of the St. Charles North ("A" Sand) oilfield, 3 were gas wells, and 3 were dry holes.

Carbon black was recovered at the Kosmos "A" channel plant of United Carbon Co., Inc., Shell was dredged from shallow bays bordering Aransas County.

Archer.—Production of 9.1 million barrels of crude oil and 13.3 million gallons of natural-gas liquids was reported. Geophysical exploration totaled 27 crew-weeks in 1957 compared with 19 in 1956. The oil and gas industry drilled 85 exploratory wells, resulting in 16 oil producers and 69 dry holes.

Armstrong.—Crushed limestone used for roadstone and as aggregate in concrete was produced for the Texas Highway Department in 1957. Geophysical prospecting amounted to 48 crew-weeks.

Atascosa.—Mineral production declined nearly \$6 million to \$16.9 million in 1957. This output included 5.1 million barrels of crude oil, 6,116 million cubic feet of natural gas, and 1.1 million gallons of natural-gas liquids; sand and gravel also was produced. Geophysical prospecting amounted to 104 crew-weeks in 1957 compared with 48 in 1956. In 1957 the oil and gas industry drilled 149 wells, including 47 exploratory wells that resulted in 4 oil producers and 43 dry holes.

Austin.—The mineral industry of Austin County produced 1.9 million barrels of crude oil, 8,519 million cubic feet of natural gas, 10.2 million gallons of natural-gas liquids, and a minor quantity of sand and gravel. The oil and gas industry spent 47 crew-weeks in geophysical exploration in 1957, compared with 32 in 1956. Drilling of 7 exploratory wells resulted in discovery of the Sealy (Newsome) oilfield, proved 2 gas wells, and 4 dry holes.

Bastrop.—Elgin Butler Brick Co., Elgin Standard Brick Manufacturing Co., and Payne Brick Co. mined fire clay by open-pit methods near Elgin for manufacturing face brick and heavy clay products. Bastrop County produced 186,000 barrels of crude oil during 1957. Thirty crew-weeks was devoted to geophysical prospecting in 1957—6 less than in 1956. Of 37 wells drilled, 22 were exploratory wells that resulted in 3 oil producers and 19 dry holes.

Baylor.—In all, 2.6 million barrels of crude oil was produced in Baylor County in 1957. Exploration and development drilling by the oil and gas industry totaled 475 wells in 1957; of these, 95 were exploratory wells that resulted in 2 oil producers and 93 dry holes.

Bee.—Mineral-fuel output valued at \$22.4 million (\$2 million less than 1956) was reported from Bee County in 1957. Crude-oil output was 2 million barrels, natural gas 88,483 million cubic feet, and natural-gas liquids 160.7 million gallons. The Danaho Refining Co. operated its 4,000-barrel-per-day crude refinery at Pettus throughout the year. Natural-gas liquids were recovered at the Burnell and North Pettus cycling plants of Pan American Petroleum Corp. and at the Gasoline Production Corp. gasoline plant. Exploratory wells drilled resulted in 7 oil wells (6 discoveries), 16 gas wells, and 22 dry holes. Coastal States Gas Producing Co. began constructing a new \$1 million, 45-mile gas-gathering pipeline system to service 2 proved gas fields that have multi-producing zones. The new pipeline will connect with the main pipeline of Texas Eastern Transmission Co.

Bell.—Crushed limestone and sand and gravel were produced by District 9 of the Texas Highway Department for use in concrete and as roadstone.

Bexar.—Crushed limestone was quarried for manufacture of cement by Longhorn Portland Cement Co. and San Antonio Portland Cement Co. Other producers of crushed limestone were Colglazier Construction Co., McDonough Bros., Inc., and San Marcos Gravel Co. It

was used principally as aggregate for concrete, roadstone, riprap, railroad ballast, and agricultural limestone. The San Antonio Portland Cement Co. began installing a \$1 million electrical dust-precipitator system, which would eliminate approximately 95 percent of the dust carried from the plant. Portland and masonry cements were prepared at plants of Longhorn Portland Cement Co. and San Antonio Cement Co. Sand and gravel for building and paving purposes was produced at a fixed plant of H. B. Zachry Co., at a portable plant of Harris Sand pit near Bon Ormy (Tex.); and by the city of San Antonio. Fire clay and miscellaneous clay were mined from open pits by Alamo Clay Products Co. of Elmendorf, by Barrett Industries of San Antonio, and by the Featherlite Corp. of San Antonio and Converse (Tex.). These clays were used in manufacturing brick and tile and sewer pipe and as a lightweight aggregate.

The oil and gas industry produced 496,000 barrels of crude oil and 3.6 million cubic feet of natural gas during 1957. In all, 190 wells were drilled during the year, of which 30 were exploratory wells that proved 1 oil well.

A new \$750,000 processing plant was being built by San Antonio Chemicals Co., Inc., adjacent to the plant of American Lithium Chemicals, Inc. The new plant will process end liquors from lithium hydroxide manufacturing into a mixed alkali salt composed of the metal carbonates of potassium, rubidium, cesium, sodium, and lithium.

Blanco.—A portable plant of Weirich Bros. near Johnson City produced 1,200 tons of sand and gravel for structural and paving purposes in 1957.

Borden.—The oil and gas industry produced 10.9 million barrels of crude oil and 12.3 million gallons of natural-gas liquids during 1957. Four oilfields in Borden County produced over 1 million barrels of crude oil each. Exploratory wells drilled totaled 15; they resulted in 5 oil producers and 10 dry holes.

Bosque.—Crushed limestone was produced by District 18 of the Texas Highway Department and crushed limestone and sand and gravel by District 9 of the Texas Highway Department for use in concrete and as roadstone.

Bowie.—Crude oil (14,000 barrels), natural gas (299 million cubic feet), and natural-gas liquids (108,000 gallons) were produced in Bowie County in 1957. The oil and gas industry spent 72 crew-weeks in geophysical prospecting in 1957, compared with 17 in 1956. Five exploratory wells were abandoned as dry holes.

Structural and paving sand and gravel were produced at a fixed plant of Gifford-Hill and Co., Inc.

Brazoria.—Mineral-fuel production, consisting of 23 million barrels of crude oil, 276,869 million cubic feet of natural gas, and 464.5 million gallons of natural-gas liquids made Brazoria County the third ranking county in Texas in total value of minerals and of natural gas. Natural-gas liquids were recovered at the Hastings and Old Ocean gasoline plants of Pan American Corp., at the Bayou plant of Phillips Petroleum Co., and at the Pledger plant of Humble Oil and Refining Co. Five oilfields in the county produced more than 1 million barrels of crude each.

The Dow Chemical Co. recovered magnesium from sea water at its Freeport plant and at the Government-owned Velasco plant. The

latter plant, operated under lease since the Korean War and purchased in November 1957, has a rated annual capacity of about 90 million pounds of metal. The property includes the Dorr tanks, magnesium hydrate facilities, evaporation plant, acid plant, electrolytic cell buildings, and alloying facilities which were not bought by the Dow Chemical Co. in 1947, when it purchased the underlying land and some of the buildings.

Dow Chemical Co. spent approximately \$162 million in capital investments in 1957, about one-third of it in Texas. The program resulted in major capacity increases for ethylene and propylene and nominal increases for such products as butadiene, ethylene oxide, triethylene glycol, glycerin, and soda ash. Facilities for the production of acetylene and acrylonitrile, both new products for Dow Chemical Co., were nearing completion in 1957. Ethyl-Dow Chemical Co., a subsidiary, continued to produce ethylene dibromide from sea water. The product serves as an additive in antiknock gasoline fluids. Dow Chemical Co. also completed new facilities for production of ethylene diamine for use in manufacturing textile resins, fungicides, and pharmaceuticals.

Sulfur was mined by the Frasch process from Hoskins mound by Freeport Sulphur Co., from Clemons dome by Jefferson Lake Sulphur Co., and from Damon mound by Standard Sulphur Co.

Salt as brine used in manufacturing sodium and chlorine chemicals was obtained from wells by Dow Chemical Co. One well (Dow No. 5, Stevens fee), 1¼ miles northeast of Lake Barbara, was used to store 150,000 barrels of LP-gas liquids. The company also produced lime from oystershell for use in producing magnesium.

Over 13,000 tons of paving sand was produced for the district engineer by the city of Houston.

The Sweeny oil refinery of Phillips Petroleum Co. operated at capacity throughout the year. These facilities were expanded with addition of the 16,000-barrel-per-day low-end-point catalytic reforming unit and desulfurization equipment.

Production was begun in October at the new Phillips Chemical Co. 180-million-pound-per-year ethylene plant adjacent to its Sweeny refinery. The ethylene product is used to make Phillips marlex, a rigid polyethylene, at the company Adams chemical plant on the Houston ship channel. The capacity of the new ethylene plant could be expanded readily to 290 million pounds a year. This new installation is part of the large petrochemical complex being developed in the Houston-Freeport-Beaumont area.

Brazos.—Natural gas totaling 312 million cubic feet was produced in Brazos County in 1957. Of the 3 exploratory wells drilled, 1 was a gas producer, and 2 were dry holes. Geophysical prospecting amounted to 33 crew-weeks.

Brewster.—Geophysical prospecting by the oil and gas industry amounted to 63 crew-weeks in 1957. A carbonaceous shale, used as a soil conditioner and as an agricultural mineral supplement, was produced by Soy-aid, Inc. District 24 of the Texas Highway Department produced 1,600 tons of structural sand, 4,500 tons of paving gravel, and 1,900 tons of crushed limestone for maintaining roads in Brewster County. Various gem stones were collected by numerous hobbyists, tourists, and gem-stone dealers.

Mercury was recovered from some development ore in the Terlingua district. Core drilling of a mercury lease under DMEA contract was terminated during the year.

Briscoe.—Bentonitic clay was mined from an open pit by Silverton Clay Products Co. of Silverton, Tex. Two exploratory wells were dry holes. Geophysical prospecting amounted to 42 crew-weeks in 1957 compared with 3 in 1956. Stripping and trenching on a uranium prospect under DMEA contract was continued into 1958.

Brooks.—Carbon black was recovered at the Dixie channel plant of United Carbon Co. During the year 2.7 million barrels of crude oil, 55,588 million cubic feet of natural gas, and 4.3 million gallons of natural-gas liquids were produced.

Brown.—The oil and gas industry produced 533,000 barrels of crude oil, 1,419 million cubic feet of natural gas, and 1.1 million gallons of natural-gas liquids in 1957.

Clay from open pits was used to manufacture building brick and heavy clay products by the Brownwood plant of the Texas Brick Co. Ross & Son Construction Co. produced 29,700 tons of structural and paving sand and gravel at a fixed plant near Brownwood. Crushed limestone was produced from a quarry by G. C. McBride, Inc.

Burleson.—Approximately 1,500 barrels of crude oil was produced in Burleson County in 1957. Geophysical prospecting took 28 crew-weeks. Crushed sandstone for concrete and roadstone was produced for District 17 of the Texas Highway Department.

Burnet.—Granite for road construction and for dressed, building, and monumental stone was quarried and prepared by Texas Granite Corp. The company also produced crushed granite for riprap. Texas Crushed Stone Co. produced 12,125 tons of gravel for railroad ballast. The Southwestern Graphite Co. mined graphite by open-pit methods and processed the ore at its plant seven miles west of Burnet. Geophysical prospecting took 17 crew-weeks.

Caldwell.—Crude oil totaling 3.8 million barrels was produced in Caldwell County in 1957. The oil and gas industry completed 187 wells, 7 more than 1956; of these, 14 were exploratory wells, resulting in 1 oil well and 13 dry holes.

Calhoun.—Completion of the \$45 million alumina plant adjacent to the Aluminum Company of America Point Comfort reduction works, previously scheduled for early 1958, had been suspended temporarily because of declining markets for the light metal. Installation of the \$11 million potline, seventh for the Point Comfort reduction works, had also been delayed. The Aluminum Company of America began operating a new gas-processing plant to recover natural-gas liquids. The wet gas from local gas reserve of the company was used as fuel at the Point Comfort electric powerplant.

Production of 3 million barrels of crude oil and 79,138 million cubic feet of natural gas was reported by the oil and gas industry. The Heyser gasoline plant of Humble Oil & Refining Co. recovered natural-gas liquids.

Exploratory drilling resulted in 4 oil wells, 8 gas wells and 20 dry holes. The Seadrift plant of Union Carbide Chemical Co., Division of Union Carbide, added a capacity of 60 million pounds per year for polyethylene. This plant had increased its ethylene capacity to 200 million pounds a year in 1956.

Shell was dredged from shallow bays adjoining Calhoun County by Bauer-Smith Dredging Co. and Smith Bros. Dredging Co.

Callahan.—The oil and gas industry produced 3.4 million barrels of crude oil, 310 million cubic feet of natural gas, and 21,000 gallons of natural-gas liquids valued at \$10.5 million in 1957. One oilfield produced approximately 1 million barrels of crude oil. Crude oil was processed at the Baird refinery of Premier Oil Refining Co. of Texas. Development and exploratory drilling totaled 286 wells in 1957 compared with 517 in 1956; exploratory drilling resulted in 2 oil discoveries.

Cameron.—Nearly 15,000 barrels of crude oil was produced in Cameron County in 1957. Exploratory drilling resulted in 1 gas well and 4 dry holes. The world's first synthetic gasoline plant to utilize natural gas, built in 1950 with the aid of Government funds (\$18.5 million), was closed October 1 by Amoco Chemicals Corp.—operator of the plant and subsidiary of Standard Oil Co. (Indiana). The reason for closing was that the Brownsville plant could not make gasoline and chemicals from natural gas competitively with other processes. About 800 employees were affected by the action. The plant was designed originally to convert 90 million cubic feet of gas and 280 million cubic feet of air daily into 6,000 barrels of gasoline, 900 barrels of diesel fuel, 200 barrels of fuel oil, and 300,000 pounds of chemicals.

Camp.—Production of 205,000 barrels of crude oil was reported from Camp County in 1957. Geophysical prospecting totaled 11 crew-weeks in 1957 compared with 4 in 1956. Exploratory drilling resulted in one dry hole.

Carson.—Carbon black was recovered at the Schafer channel plant of Cabot Carbon Co. The Cargray plant of Dorchester Gasoline Corp., the Bryan No. 17 gasoline plant of Shell Oil Co. and the Schafer gasoline plant of Skelly Oil Co. recovered 70.3 million gallons of natural-gas liquids. Production of 4 million barrels of crude oil and 193,610 million cubic feet of natural gas was reported from Carson County in 1957. The oil and gas industry drilled 118 wells in 1957, compared with 154 in 1956. The only exploratory well was abandoned as a dry hole.

Cass.—Geophysical prospecting totaled 95 crew-weeks in 1957, 61 more than in 1956. Exploratory drilling resulted in 2 oil wells and 2 dry holes. Mineral-fuel production amounted to 1.6 million barrels of crude oil, 5,869 million cubic feet of natural gas, and 10.7 million gallons of natural-gas liquids.

Brown iron ore mined from open pits for the Sheffield Steel Division of Armco Steel Corp. was trucked to the company Houston mill for upgrading for blast-furnace feed.

Chambers.—Salt as brine was produced from wells by Diamond Alkali Co. for use in manufacturing chemicals. Shell was dredged from Trinity and Galveston Bays by W. D. Haden Co., Horton-Horton, and Parker Bros. & Co., Inc. Its principal uses were as aggregate in concrete, in the manufacture of magnesium metal, for poultry grit, and for asphalt filler.

Natural-gas liquids were recovered at the Anahuac gasoline plant of Humble Oil & Refining Co. The oil and gas industry produced

15.1 million barrels of crude oil and 64,227 million cubic feet of natural gas. During 1957, 170 crew-weeks was spent in geophysical prospecting compared with 163 in 1956. In all, 115 wells were drilled in 1957, compared with 82 in 1956; of that total, 37 were exploratory wells that resulted in 6 oil wells, 11 gas wells, and 20 dry holes. The Anahuac, Oyster Bayou, and Barbers Hill oilfields produced over 1 million barrels of crude each.

Cherokee.—Brown iron ore was mined from open pits near Jacksonville by L. B. Haberle and from pits near Rusk by Sheffield Steel Division of Armco Steel Corp.

General Refractories Co. mined fire clay from open pits near Troup.

Cherokee County produced 14.7 million barrels of crude oil, 2,221 million cubic feet of natural gas, and 1.3 million gallons of natural-gas liquids in 1957. Exploratory drilling resulted in 3 oil wells, 2 gas wells, and 48 dry holes. Geophysical prospecting totaled 60 crew-weeks.

Childress.—District 25 of the Texas Highway Department produced 162,945 tons of paving gravel for road maintenance in the County.

Three exploratory wells resulted in dry holes. Geophysical prospecting amounted to 7 crew-weeks.

Clay.—The Ringgold gasoline plant of Otha H. Grimes recovered natural-gas liquids. The oil and gas industry produced 5.7 million barrels of crude oil and 51.6 million cubic feet of natural gas. Of 50 exploratory wells drilled, 9 were oil producers, and 41 were dry holes.

Cochran.—The Lehman gasoline plant, purchased by Cities Service Oil Co. from Llano Grande Corp., produced natural-gas liquids in 1957. This plant, placed on stream early in 1955, could process 25 million cubic feet of gas per day. Production of 6.9 million barrels of crude oil and 59 million cubic feet of natural gas was reported in 1957. Sixty-six wells were drilled; exploratory wells drilled resulted in 4 oil wells and 10 dry holes. Geophysical prospecting consumed 30 crew-weeks.

Coke.—The Jameson gasoline plant of Sun Oil Co. and the Perkins No. 10 plant of Texas Hydrocarbon Co. recovered natural-gas liquids in 1957. Crude oil (7 million barrels) and natural gas (626 million cubic feet) were produced during the year. Exploratory drilling totaled 23 wells, including 5 oil producers, 1 oilfield extension, and 17 dry holes. Geophysical prospecting amounted to 43 crew-weeks.

Coleman.—Exploratory drilling proved 5 oil wells, 2 gas wells, and 38 dry holes. Approximately 2.9 million gallons of natural-gas liquids was recovered by the Coker gasoline plant of Coker Gasoline Co., the Glen Cove plant of Glen Cove Gasoline Co., the Robertson plant of French M. Robertson, and the Sappington plant of Sappington Gasoline Co. Crude-oil production totaled 3.5 million barrels and natural-gas production 3,965 million cubic feet.

Glass and specialty sands were produced by the Santa Ana Silica Sand Co. from deposits in the Santa Ana Mountains. Miscellaneous clay to manufacture brick, tile, and heavy clay products was mined from open pits by the Martin Brick Co. Crushed limestone for concrete and roadstone was contracted for by the Texas Highway Department, District 23.

Collin.—District 18 of the Texas Highway Department contracted for 100,000 tons of paving sand and 150,600 tons of crushed limestone for road maintenance.

Two exploratory wells proved dry.

Collingsworth.—A total of 27 crew-weeks was spent in geophysical prospecting in 1957 compared with 2 in 1956. Exploratory and development drilling totaled 76 wells, of which 8 exploratory wells were dry holes. In all, 600 barrels of crude oil, 8,285 million cubic feet of natural gas, and nearly 6,000 gallons of natural-gas liquids were produced during 1957.

Colorado.—Structural and paving sand and gravel were produced at 2 plants of Horton and Horton, at 3 plants of Thorstenberg & Tamborello, at 3 plants of Texas Construction Material Co., and at 1 plant of Parker Bros. Paving gravel and crushed sandstone were produced by the Colorado County Highway Department and District 13 of the Texas Highway Department for concrete and roadstone.

Natural-gas liquids were recovered at the Chesterville gasoline plant of Tennessee Gas Transmission Co. and by the Sheridan and Eagle Lake plants of Shell Oil Co. Crude-oil production amounted to 1 million barrels and natural-gas production to 100,231 million cubic feet. Geophysical prospecting totaled 70 crew-weeks in 1957 compared with 75 in 1956. Exploratory drilling proved 5 gas wells; 15 were dry holes.

Comal.—Erhardt Kraft produced 22,800 tons of structural and paving sand and gravel. Crushed limestone was mined from open pits near New Braunfels and Ogden by United States Gypsum Co. and Servtex Materials Co. It was used for manufacturing lime and for riprap, metallurgical flux, railroad ballast, and roadstone.

Comanche.—About 86,000 barrels of crude oil and 963 million cubic feet of natural gas were produced in Comanche County in 1957. Five crew-weeks was spent in geophysical prospecting in 1957 compared with 10 in 1956. All six exploratory wells drilled were dry.

Crushed limestone for concrete and roadstone was produced by District 23 of the Texas Highway Department.

Concho.—A total of 31 crew-weeks was spent in geophysical prospecting in 1957 compared with 48 in 1956. Exploratory wells drilled resulted in discovery of the Spect (Jennings) oilfield, 1 gasfield, and 15 dry holes. Production of 17,000 barrels of crude oil, 147 million cubic feet of natural gas, and nearly 2,000 gallons of natural-gas liquids was reported in 1957.

Cooke.—The oil and gas industry drilled 237 wells in 1957 compared with 242 in 1956; of these, 9 were oil producers, 3 oilfield expansions, and 46 dry holes. A total of 8.3 million barrels of crude oil and 71 million cubic feet of natural gas was produced during the year. Natural-gas liquids were recovered by the Sivells Bend gasoline plant of Standard Oil Co. and by the Walnut Bend gasoline plant of Texas Natural Gasoline Corp. The Gainesville refinery of the Tydal Co. operated throughout 1957. The oil and gas industry drilled 237 wells, of which 58 were exploratory wells that resulted in 12 oil producers and 46 dry holes.

Coryell.—Limestone was quarried and prepared for dressed building stone by Mid-Tex Stone Co. Crushed limestone for concrete and

roadstone was prepared by District 9 of the Texas Highway Department.

Geophysical prospecting amounted to 12 crew-weeks in 1957 compared with 26 in 1956.

Cottle.—The oil and gas industry spent 10 crew-weeks in geophysical prospecting in 1957 compared with 3 in 1956. The four exploratory wells drilled were dry. Crude-oil production amounted to 3,000 barrels.

Paving sand and gravel was produced by Childress Sand and Gravel Co.

Crane.—Crane County, credited with a total mineral value of \$103.8 million, was the State's fifth ranking petroleum-producing county, with an output of 31.9 million barrels. Natural-gas production amounted to 1,448 million cubic feet. Approximately 68.3 million gallons of natural-gas liquids was recovered by the Waddell gasoline plant of Gulf Oil Corp., by the Crane plant of Phillips Petroleum Co., by the Cordona Lake plant of the Houston Hydrocarbon Corp., and by Imperial No. 1 plant of Natural Gas Products Co. of America. Atlantic Refining Co., as operator, completed a jointly owned natural-gasoline plant in Crane County. Plant capacity was approximately 23 million cubic feet of gas per day for processing and about 104,000 gallons of natural-gas liquids for recovery. Other owners were Continental Oil Co., Champlin Oil and Refining Co., and Phillips Petroleum Co. El Paso Natural Gas Co. was authorized by the Federal Power Commission to construct \$2,427,000 of natural-gas pipeline facilities in Crane County. These facilities will be used to increase gas deliveries from wells of Phillips Petroleum Co. Geophysical prospecting totaled 26 crew-weeks in 1957 compared with 58 in 1956. Of 582 wells drilled in 1957, 38 were exploratory wells that resulted in 14 oil wells, 1 gas well, and 23 dry holes.

Sulfur was recovered from natural gas by the modified Claus method at the Waddell plant of Gulf Oil Corp. and at the Crane plant of Phillips Chemical Co. Crushed limestone for concrete and roadstone was prepared by District 6 of the Texas Highway Department.

Crockett.—Natural-gas liquids were recovered by the Todd Ranch gasoline plant of Continental Oil Co. Crude-oil production was almost 9.2 million barrels and natural gas 10,618 million cubic feet. A total of 189 crew-weeks was spent in geophysical prospecting in 1957 compared with 290 in 1956. Exploratory drilling proved 5 oil wells, 1 gas well, and 41 dry holes.

Crosby.—Exploratory drilling resulted in the discovery of the Ha-Ra (Clear Fork) and the Ridge (Clear Fork) oilfields, 1 oil well, and 10 dry holes. Crude-oil production amounted to 166,000 barrels.

Structural and paving sand and gravel were prepared at the fixed plant of Janes-Prentice, Inc., Slaton, Tex.

Culberson.—Geophysical prospecting totaled 144 crew-weeks in 1957 compared with 50 in 1956. Exploratory drilling crews discovered the Geraldine (Ford) oilfield, but eight of the holes were dry. Crude-oil production amounted to 32,000 barrels.

Crushed miscellaneous stone was quarried and prepared for concrete and roadstone by Angelo Construction Co. District 24 of the Texas

Highway Department prepared 1,755 tons of structural sand and 2,160 tons of paving gravel for road maintenance.

Core drilling of a copper prospect under DMEA contract was continued into 1958.

Dallam.—Geophysical prospecting amounted to 100 crew-weeks in 1957 compared with 60 in 1956. Exploratory drilling resulted in 2 gas wells and 3 dry holes. Natural-gas production was 177 million cubic feet.

District 4 of the Texas Highway Department prepared 212,190 tons of crushed limestone for concrete and roadstone.

Dallas.—Clay and crushed limestone were produced by Lone Star Cement Corp. and by Trinity Division of General Portland Cement Co. for manufacturing portland and masonry cements at the Dallas plant of Lone Star and at Eagle Ford's Nos. 1 and 2 plants of General Portland. Clay for brick and heavy clay products and for lightweight aggregates was mined from open pits near Mesquite by the Ferris Brick Co. and near Dallas by Dallas Lightweight Aggregate Corp. Crude perlite mined in adjoining States was expanded at Dallas plants of the Texas Lightweight Products Co. and of Texas Vermiculite Co. The latter company also used vermiculite as an expanded raw material. The principal use of the expanded material was as a lightweight aggregate for concrete and building plaster. District 18 of the Texas Highway Department produced 12,000 tons of paving sand and 100,000 tons of crushed limestone for concrete and roadstone for road maintenance.

Dawson.—Geophysical prospecting totaled 42 crew-weeks in 1957 compared with 64 in 1956. Exploratory drilling crews discovered 6 oilfields that produced from depths of 6,568 to 11,140 feet, proved 1 oil-extension well, and drilled 16 dry holes. Crude-oil production amounted to 4.6 million barrels.

Crushed limestone was quarried from open pits near O'Donnell for use in concrete and roadstone by Lone Star Materials, Inc.

Deaf Smith.—The oil and gas industry spent 25 crew-weeks in geophysical prospecting in 1957, compared with 33 in 1956. District 4 of the Texas Highway Department prepared 2,262 tons of paving sand and 32,021 tons of crushed limestone for concrete and roadstone for highway maintenance.

Denton.—Twenty-one crew-weeks was spent in geophysical prospecting in 1957 compared with 30 in 1956. Exploratory drilling resulted in 1 oilfield discovered and 8 dry holes. Crude-oil production totaled 130,000 barrels. Fire clay was mined for brick and heavy clay products by the Acme Brick Co. from the Denton open pits. District 18 of the Texas Highway Department produced 32,000 tons of paving sand and 90,500 tons of paving gravel for road maintenance.

De Witt.—Exploratory drilling resulted in 2 oil wells, 4 gas wells, and 10 dry holes. Natural-gas liquids were recovered at the Gohkle gasoline plant of Shell Oil Co. Production of 2.8 million barrels of crude oil and 28,389 million cubic feet of natural gas was reported during the year.

Dickens.—About 14,000 barrels of crude oil was produced in Dickens County during the year. Exploratory drilling resulted in 1 oil-well completion and 4 dry holes.

Caprock Chemical Co. mined pumicite by open pit methods near McAdoo. There was 191,565 tons of paving gravel produced for District 25 of the Texas Highway Department.

Dimmit.—Exploratory drilling resulted in 9 oil wells (including 8 discovery wells), 1 gas well, and 37 dry holes. Geophysical exploration totaled 21 crew-weeks in 1957 compared with 39 in 1956. The output of 496,000 barrels of crude oil, 365 million cubic feet of natural gas, and 37,000 gallons of natural-gas liquids was valued at \$1.6 million in 1957.

Donley.—The oil and gas industry spent 9 crew-weeks in geophysical exploration in 1957 compared with 33 in 1956. All three exploratory wells were dry holes.

District 25 of the Texas Highway Department produced 179,550 tons of paving gravel for its road maintenance program in 1957.

Duval.—Exploratory drilling by the oil and gas industry resulted in 22 oil wells ranging in depth from 2,130 to 7,171 feet, 4 gas wells, and 59 dry holes. Natural-gas liquids were recovered at the Hagist gasoline plant of Goliad Corp. and Sejita cycling plant of Trinity Gas Corp. Crude-oil production amounted to 11.7 million barrels and natural-gas production to 49,640 million cubic feet.

Salt in brine was produced from wells near Ellis by Columbia Southern Chemical Corp. for use in its chemical plant.

Eastland.—The N. D. Gallagher Clay Products Corp. mined shale by open-pit methods near Cisco for use in manufacturing building brick and tile. American Aggregates Corp. produced 90,000 tons of shale from open pits near Ranger, Tex., for use in manufacturing lightweight aggregate. Shale for use in lightweight aggregate was likewise produced from open pits by Texas Lightweight Aggregate Co. Texeramics, Inc., mined fire clay for use in the manufacture of floor and wall tile. Crushed limestone for concrete and roadstone was prepared by District 23 of the Texas Highway Department.

A total of 23.9 million gallons of natural-gas liquids was recovered from Graridge gasoline plant No. 2 of Graridge Corp., the Pueblo plant of Lone Star Gas Co., plant No. 108 of Lone Star Producing Co., and the Desdemona plant of Magnolia Petroleum Co. The production of 828,000 barrels of crude oil and 4,633 million cubic feet of natural gas was reported in 1957.

Ector.—A new and imposing industrial complex was born in Ector County on October 18 with dedication of the \$32 million butadiene plant of El Paso Natural Gas Products Co. and the synthetic rubber plant of General Tire & Rubber Co. A \$5.5 million plant, capable of furnishing 40 million pounds of styrene to the rubber plant, was under construction as was a refinery-alkylation plant which would convert byproducts from both the butadiene and styrene plants into high-octane gasoline.

A 247-mile, 6-inch products line was built from the 6,500-barrel-per-day El Paso Natural Gas Products Co. Odessa refinery to El Paso. Two pumping stations, remote-controlled from Odessa, were built into the line.

Ector was the second ranking county in Texas in 1957 in total value of minerals produced and in crude-oil output. Crude-oil production amounted to 61.4 million barrels, and natural-gas production totaled 2,589 million cubic feet. Six gasoline plants recovered

302 million gallons of natural-gas liquids. Exploratory drilling totaled 35 wells and resulted in 16 oil wells (4 of which ranged in depth from 8,315 to 12,270 feet), 1 gas well and 18 dry holes.

Over 36,000 tons of sulfur was recovered at 5 plants in the purification of natural gas. The sulfur was recovered by three processes—modified Claus, German Troupe, and partial combustion. Crushed limestone for aggregate and roadstone was quarried near Notrees by Permian Sand & Gravel Co., Inc., and near Odessa by F. M. Reeves & Sons.

Edwards.—The oil and gas industry spent 31 crew-weeks in geophysical prospecting in 1957 compared with 34 in 1956. Crude-oil production totaled 1,400 barrels.

Ellis.—Clay used in manufacturing building brick and heavy clay products was mined from open pits by Acme Brick Co., Barron Brick Co., and Ferris Brick Co. District 18 of the Texas Highway Department produced 241,000 tons of crushed limestone for concrete and roadstone and 66,000 tons of paving gravel for its road-maintenance program.

El Paso.—American Smelting & Refining Co. completed a \$200,000 mineral-dressing and research laboratory at its El Paso smelter. Its western research section was transferred from Salt Lake City to the El Paso facilities. Facilities for recovering germanium from by-products, using a process developed by the research department, were built at the El Paso smelter in 1956.

Construction of a \$200,000 pipeline-research laboratory adjacent to Texas Western College at El Paso was begun in late 1957 by El Paso Natural Gas Co. Faculty members of the college will cooperate in the research work.

Pasotex Pipeline Co. completed another link in its 20-inch crude line between Wink and El Paso. The line serves the three El Paso refineries: The 41,000-barrel-per-day refinery of Standard Oil Co. of Texas, the 13,000-barrel-per-day refinery of The Texas Co., and the 4,000-barrel-per-day refinery of El Paso Natural Gas Products Co.

Crushed limestone and clay were produced by Southwestern Portland Cement Co. for use in manufacturing portland and masonry cements. Crushed limestone for concrete and roadstone, riprap, metallurgical flux, and the manufacture of lime was quarried by A. Courchesne, Inc., by McMillan Quarries, Inc., and by Vowell Material Co. Crushed sandstone for concrete, roadstone, riprap, and roofing granules, and dimension sandstone for rubble was quarried and prepared by Standard Aggregate Co. Structural and paving sand and gravel were prepared at fixed plants of El Paso Sand Products Co. and Bowden Sand & Gravel Co.

Erath.—District 2 of the Texas Highway Department prepared 100,542 tons of paving gravel and 24,324 tons of crushed limestone for concrete and roadstone in 1957.

Approximately 18,000 barrels of crude oil and 607 million cubic feet of natural gas were produced in the county. Geophysical prospecting amounted to 3 crew-weeks, compared with 11 in 1956. Three exploratory well completions were dry holes.

Falls.—District 9 of the Texas Highway Department produced 124,629 tons of paving gravel and 94,248 tons of crushed limestone;

also District 17 of the Texas Highway Department produced 41,500 tons of crushed limestone for road maintenance.

Over 6,000 barrels of crude oil was produced in 1957. Geophysical prospecting amounted to 5 crew-weeks compared with 13 in 1956. The oil and gas industry completed eight wells; all were abandoned as dry holes.

Fayette.—The oil and gas industry spent 93 crew-weeks in geophysical prospecting in 1957 compared with 79 in 1956. All exploratory wells were abandoned as dry holes. Nearly 310,000 barrels of crude oil and 8 million cubic feet of natural gas were produced in Fayette County.

Crushed sandstone for concrete and roadstone was produced by District 22 of the Texas Highway Department. Paving and structural sand and gravel were prepared at a fixed plant by Thorstenberg-Tamborello. Fuller's earth was recovered from open pits near Flatonia by Flatonia Fuller's Earth Co. Bentonitic clay, used principally in preparing heavy drilling mud for the oil and gas industry, was mined by the Milwhite Co., Inc., and Baroid Division of National Lead Co.

Fisher.—Gypsum was mined by open-pit methods near Hamlin and Rotan by Celotex Corp. and National Gypsum Co. A total of 68 crew-weeks was spent in geophysical prospecting in 1957 compared with 82 in 1956. The oil and gas industry made 213 well completions; 46 were exploratory wells, proving 8 oil-well completions and 38 dry holes. Natural-gas liquids from other counties were recovered at the Velta gasoline plant of Texas Pacific Coal & Oil Co., and from the Claytonville plant of the Claytonville Gasoline Co. Crude-oil production in 1957 approximated that in 1956.

Floyd.—The oil and gas industry spent 33 crew-weeks in geophysical prospecting in 1957 compared with 9 in 1956. Crude-oil production totaled 12,000 barrels in 1957.

Structural and paving sand and gravel were prepared at a fixed plant of Quitaque Sand & Gravel Co. Crushed limestone used for concrete and roadstone was prepared by the highway department of the city of Floydada.

Foard.—Mineral production of 532,000 barrels of crude oil and 138 million cubic feet of natural gas and valued at \$1.7 million was reported in Foard County in 1957. Geophysical prospecting amounted to 3 crew-weeks. Eighteen exploratory wells were abandoned as dry holes.

Fort Bend.—The Tuloma Gas Products Co. plan to convert a brine well in the Blue Ridge dome of Fort Bend County for use as LP-gas storage was approved by the Texas Railroad Commission. A total of 66 crew-weeks was spent in geophysical prospecting in 1957 compared with 100 in 1956. The oil and gas industry completed 26 exploratory wells resulting in 2 oil wells (1 of which was an oil discovery), 1 gas well, and 23 dry holes.

Production of 11.5 million barrels of crude oil, 18,254 million cubic feet of natural gas, and 6.9 million gallons of natural-gas liquids was reported in 1957.

Sulfur was mined by the Frasch process from the Orchard dome by Duval Sulphur & Potash Co., from the Nash dome by Freeport

Sulphur Co., and from the Long Point dome by Jefferson Lake Sulphur Co.

District 12 of the Texas Highway Department produced 50,236 tons of paving sand for road maintenance. The Texas Lightweight Aggregate Co., a Division of Kansas Industries, Inc., mined shale from open pits near Missouri City for use in the manufacture of lightweight aggregate.

Salt in brine was obtained from wells by United Salt Corp. at Missouri City and processed to evaporated salt and salt blocks. Salt was used by the chemical and meat packing industry; also as a feed mixture and for table purposes.

Franklin.—Production of 3.6 million barrels of crude oil and 1,280 million cubic feet of natural gas was reported in 1957. Natural-gas liquids were recovered at the New Hope cycling plant of Tidewater Associated Oil Co. Geophysical prospecting amounted to 6 crew-weeks compared with 18 in 1956.

Freestone.—The oil and gas industry spent 53 crew-weeks in geophysical prospecting in 1957 and drilled 12 exploratory wells that resulted in discovery of 1 oilfield and proved 2 gas wells; 9 holes were dry. Approximately 279,000 barrels of crude oil, 11,377 million cubic feet of natural gas, and 5.7 million gallons of natural-gas liquids were produced in Freestone County during 1957.

Miscellaneous clay was mined from open pits by Teague Brick and Tile Co. for use in manufacturing heavy clay products. The United States Forest Service produced over 300 tons of crushed limestone for use in concrete and roadstone for road maintenance.

Frio.—Geophysical prospecting represented 23 crew-weeks in 1957, compared with 4 in 1956. Exploratory drilling resulted in 3 oil wells (2 of which were discovery wells) and 15 dry holes. The oil and gas industry produced 2.4 million barrels of crude oil, 1,568 million cubic feet of natural gas, and 108,000 gallons of natural-gas liquids during 1957.

Gaines.—Natural-gas liquids were recovered at the Seminole gasoline plant of Phillips Petroleum Co. and the West Seminole plant of Cities Service Oil Co. Sulfur and carbon black were recovered from sour gas at the Seminole No. 66 plant of Columbian Carbon Co. A total of 228 crew-weeks was spent in geophysical prospecting in 1957, compared with 360 in 1956. Of 41 exploratory wells completed in Gaines County, 10 proved oil wells (8 of which were oil discoveries ranging in depth from 4,148 to 10,554 feet), 1 proved a gas well, and 30 were dry holes. Crude-oil production totaled 27.3 million barrels and natural-gas production 2,917 million cubic feet.

Galveston.—The total mineral value declined \$1.1 million to \$29.7 million in 1957. Exploratory drilling resulted in 3 oil wells (2 of which were discovery wells), 3 gas wells, and 10 dry holes. Geophysical prospecting declined to 43 crew-weeks in 1957 compared with 101 crew-weeks in 1956. The oil and gas industry produced 9 million barrels of crude oil, 9,499 million cubic feet of natural gas, and 13.5 million gallons of natural-gas liquids.

Paving sand was produced for the city engineer of Galveston and for District 12 of the Texas Highway Department for road construction.

The Texas City tin smelter produced 1,564 tons of tin in January

1957, the last month of its operation as a Government-owned smelter. Millions of pounds of tin and tungsten may be recovered from stock-piled slag if four possible methods for recovering these metals, as developed by Bureau of Mines researchers, prove feasible on a commercial scale.³ The Wah Chang Corp. purchased the Government-built smelter from Federal Facilities Corp. in January for a reported \$1,350,000, with an additional \$2 million contingent on future production. Wah Chang leased the smelter's ore-storage building for a projected \$5.5 million pipemaking operation of the Texas Rolling Mills, Inc. The all-steel warehouse leased by Texas Rolling Mills contains 84,000 square feet of space.

Carbide and Carbon Chemicals Co. doubled the capacity of its ethylene-diamine plant in Texas City. This petrochemical intermediate was used in manufacturing textile resins, polyamide resins, fungicides, and sequestering agents.

Texas City Refining, Inc., increased Houdriform capacity of its Texas City refinery 1,000 barrels per day with no recycle and added a 7,000-barrel-per-day Houdriformer and a 7,000-barrel-per-day Houdry hydrogenation unit. American Oil Co. increased Ultraforming capacity by 21,000 barrels per day and Hydrofining (Ind.) capacity 22,000 barrels per day at its Texas City operations. Monsanto Chemical Co. enlarged the amine capacity of its Texas City petrochemical plant. Its new ethylene plant was put on stream in April of 1957. This company also operated a 25-million-gallon methanol plant, a 66-million-pound polyethylene plant and a 140,000-ton styrene plant.

Other chemical companies in Texas City were American Oil Co., producing benzene, toluene and xylenes; Republic Oil Refining Co., producing 24.4 million pounds of propylene trimer and 16.5 million pounds tetramer; and Union Carbide Co., producing acetaldehyde, acetic acid, acetylene, butadiene, ethanol, ethylene oxide, methanol, and polyethylene.

Garza.—Crude oil and uranium ore valued at more than \$18.9 million was produced in Garza County in 1957. The oil and gas industry spent 42 crew-weeks in geophysical prospecting in 1957, compared with 13 in 1956, and completed 34 exploratory wells that resulted in 12 oil wells (10 of which were oil discoveries ranging in depth from 1,962 to 8,770 feet) and 22 dry holes. Crude-oil output amounted to 6.1 million barrels.

The first production of uranium ore in the county was reported in 1957.

Gillespie.—Soapstone was mined from open pits near Willow City and processed at the Llano County mill of Southwestern Talc Corp. Alvin Usener produced 1,500 tons of structural sand and 4,715 tons of paving sand; 788 tons of paving sand was produced by Weirich Bros. Bear Mountain Quarries prepared rough granite for monumental use. District 14 of the Texas Highway Department produced 94,453 tons of crushed limestone for concrete and roadstone.

Glasscock.—Exploratory drilling resulted in 3 oil-well completions (1 of which was the discovery well of the Carter (Wolfe Camp) oilfield) and 7 dry holes. The oil and gas industry produced 5.9 million barrels

³ Kenworthy, H., Starliper, A. G., and Freeman, L. L., Recovery of Tin and Tungsten From Tin-Smelter Slags: Bureau of Mines Rept. of Investigations 5327, 1957 Supplement, 12 pp.

of crude oil, 231 million cubic feet of natural gas, and nearly 69,000 gallons of natural-gas liquids.

Goliad.—Of 32 exploratory well completions, 4 were oil discoveries ranging in depth from 477 to 8,420 feet, 16 were gas wells, and 12 were dry holes. Production of 2.4 million barrels of crude oil, 80,873 million cubic feet of natural gas, and 35.7 million gallons of natural-gas liquids was reported in 1957.

Gonzales.—The oil and gas industry spent 137 crew-weeks in geophysical prospecting in 1957 compared with 48 in 1956; it also completed 25 exploratory wells, including 3 oil discoveries ranging in depth from 1,387 to 3,169 feet, and 22 dry holes. Approximately 57,000 barrels of crude oil was produced during the year.

Bentonite was mined from open pits by Baroid Division of National Lead Co. for use in heavy drilling mud. Gonzales Sand and Gravel Co. produced 3,375 tons of structural sand and gravel and 19,845 tons of paving sand and gravel during 1957. District 13 of the Texas Highway Department produced 85,372 tons of paving sand.

Gray.—Production was begun at the new 15-million-pound-per-year acrylate ester plant of the Celanese Corp. of America at Pampa. Products include methol, ethyl, and butyl acrylates, used in the paint, leather, textile, paper, and other industries. The new plant is the first application of a process developed by B. F. Goodrich Co. Raw materials are acetic acid and formaldehyde.

Output of nearly 15 million barrels of crude oil and 143,594 million cubic feet of natural gas was reported by the oil and gas industry. Seven gasoline plants recovered 148.5 million gallons of natural-gas liquids during the year.

District 4 of the Texas Highway Department produced 13,000 tons of paving sand and 19,500 tons of paving gravel for its road-maintenance program.

Grayson.—Of 25 exploratory well completions, 6 proved oil discoveries ranging in depth from 3,305 to 6,354 feet, and 19 were dry holes. Natural-gas liquids were recovered at the Sherman gasoline plant of Standard Oil Co. of Texas. The oil and gas industry produced 9.5 million barrels of crude oil and 1,493 million cubic feet of natural gas.

Structural sand and gravel was produced by Wray Wible. Construction of an aluminum fabricating plant covering 70,000 square feet was begun late in the year. The plant will be 2 miles south of Sherman and will serve a 10-State area.

Gregg.—Gregg County was the fourth-ranking Texas county in total mineral production, with a value of \$128.3 million, as well as in petroleum output, totaling 35.5 million barrels. Approximately 246.2 million gallons of natural-gas liquids was recovered at the East Texas gasoline plant of Arkansas Fuel Oil Corp., the Spear plant of Gulf Oil Corp., the Sabine plant of Magnolia Petroleum Co., plant 18 of Sinclair Oil & Gas Co., and plants 31 and 47 of Warren Petroleum Corp. Natural-gas production totaled 57,944 million cubic feet.

Premier Oil Refining Co. added 500-barrel-per-day crude capacity and 300-barrel-per-day thermal processing capacity to its 4,000-barrel refinery at Longview, Tex., with addition of a new 1,500-barrel platformer unit and a 1,500-barrel-per-day Unifiner unit.

Texas Eastman Co. expanded the polyethylene production capacity

of its Longview plant by more than 50 percent to a total of 85 million pounds a year. This included a new medium-density polyethylene.

Grimes.—Production of 14,000 barrels of crude oil, 753 million cubic feet of natural gas, and 482,000 gallons of natural-gas liquids was reported in Grimes County in 1957. Geophysical prospecting amounted to 5 crew-weeks. District 17 of the Texas Highway Department produced 72,860 tons of crushed sandstone for concrete and roadstone.

Guadalupe.—Miscellaneous clay was mined from open pits for use in manufacturing building brick and tile by Fraser Brick Co.

Production of 3.9 million barrels of crude oil and 29 million cubic feet of natural gas was reported in 1957. Exploratory drilling of 26 wells resulted in 4 proved oil-well completions and 22 dry holes.

Hale.—A total of 16 crew-weeks was spent in geophysical prospecting in 1957 compared with 5 in 1956. Production of nearly 2 million barrels of crude oil was reported during the year.

Hall.—Geophysical prospecting amounted to 21 crew-weeks.

Paving sand was contracted for by District 25 of the Texas Highway Department. Gravel was produced by W. F. McElreath.

Hamilton.—Production of 1,780 million cubic feet of natural gas and nearly 13,000 gallons of natural-gas liquids was reported in Hamilton County in 1957.

Hansford.—The oil and gas industry spent 34 crew-weeks in geophysical prospecting in 1957 compared with 24 in 1956. It also drilled 29 exploratory wells: of these, 10 were oil wells (6 of which were oil discoveries ranging in depth from 6,072 to 7,040 feet), 10 were gas wells, and 9 were dry holes. Production of 1.1 million barrels of crude oil and 64,596 million cubic feet of natural gas was reported. Natural-gas liquids were recovered at the Hansford and Sherman gasoline plants of Phillips Petroleum Co.

One of the largest oil discoveries in the Texas Panhandle portion of the Anadarko Basin was completed with the Shamrock Oil & Gas Co. No. 1-B steel well in sec. 50, J Block 45, H and T C survey, in Hansford County. The discovery flowed 2,176 barrels per day from the Atoka formation at 6,666–6,680 feet. The nearest oil production is 3 miles southeast.

Hardeman.—Crude gypsum was mined and calcined near Acme plant by Bestwall Gypsum Co.

Crude-oil production was reported from two oilfields during the year. Geophysical prospecting amounted to 22 crew-weeks, 1 less than 1956.

Hardin.—Of 22 exploratory well completions, 1 proved an oil well, 5 were gas wells, and 16 were dry holes. There was 221 crew-weeks spent in geophysical prospecting in 1957 compared with 108 in 1956. Natural-gas liquids were recovered at the Nos. 25 and 26 cycling plants of Sinclair Oil & Gas Co. Crude-oil production amounted to 8.5 million barrels and natural-gas production to 36,951 million cubic feet.

Miscellaneous stone was quarried and crushed for concrete and roadstone for District 10 of the Texas Highway Department.

Harris.—Harris County ranked fifth in Texas in total mineral production, with a value of \$124.7 million.

Harris County is the apex of a Gulf coast triangle encompassing a

multi-billion-dollar industrial complex which includes such basic raw materials as crude oil, natural gas, natural-gas liquids, sulfur, and shell and such raw-material-consuming industries as oil refining, chemicals, petrochemicals, construction, and metals fabrication. This industrial triangle is composed of Brazoria, Galveston, Jefferson, and Orange Counties, in addition to Harris, with Houston as the nerve center. This industrial complex began with the discovery of oil at Spindle Top dome in 1901, grew with opening of the Houston ship channel during World War I and with dispersion and ultimate location of many defense industries of World War II, and mushroomed to its present colossal size with diversion and rapid expansion of the heavy chemical and petrochemical industries.

Completion of the \$10 million expansion program of the Houston synthetic-rubber plant of Goodyear Tire & Rubber Co. to 220,000 long tons a year made it the world's largest single producer of man-made rubber. The first butadiene plant built by private industry since World War II went on stream at midyear. The \$30 million plant, owned and operated by Texas Butadiene & Chemical Corp., can produce 64,800 tons of butadiene per year and about 2.5 million barrels of high-octane aviation-graded gasoline from butane and isobutane as raw material. Humble Oil and Refining Co. added two 90,000-barrel-per-day hydrodesulfurization units and a 55,000-barrel-per-day fluid catalytic cracker, with no recycle to its Baytown refinery; it also added a 25-million-gallon benzene unit employing the Udex process to turn out 7,000 barrels of aromatics daily. The Celanese Corp. of America completed installing a 100,000-pound-per-day, low-pressure polyethylene plant at Houston. Facilities were so arranged as to permit increase of capacity up to 600 million pounds per year. Consolidated Chemical Industries, Division of Stauffer Chemical Co., began construction to double the sulfur-recovery capacity of its Baytown plant.

Production was begun at the Phillips Chemical Co. new 180-million-pound-per-year ethylene plant at Sweeney and at its 75-million-pound-per-year pure white plastic resin plant on the Houston ship channel. Hydrocarbons used to make the ethylene at the Sweeney plant came by pipeline from the extensive Gulf coast, West Texas, and New Mexico holdings of the company. The ethylene plant was adjacent to the Phillips Petroleum Co. refinery and natural-gas-liquid processing plant at Sweeney. Diamond Alkali Co. completed expanding its polyvinyl chlorine and perchloroethylene plants at Deer Park. A new 5,000-barrel-per-day asphaltic refinery of Texas Asphalt & Refining Co. began producing in February. Products were penetration-grade asphalt, a light front distillate, and a heavy naphtha. Heavy Boscan crude from Venezuela was mixed with Gulf coast distillate for the charge.

Barbers Hill salt dome, a former prolific Gulf coast oil producer, entered a second phase of usefulness, becoming the world's largest underground reservoir for storing up to 6 million barrels of LP-gases. This storage capacity, 25 miles east of Houston, was an important cog in the area's petrochemical complex, being tied to 2 petrochemical plants, 2 fractionating plants, and a host of other industrial operations.

A multi-million-dollar plant to produce gypsum wallboard, rock lath, plaster, and gypsum sheathing is to be built in Galena Park by

United States Gypsum Co. The \$30 million plant will produce enough building materials to finish walls and ceilings of more than 40,000 homes annually.

A million-dollar expansion and modernization program was begun at the Baytown plant of United Rubber & Chemical Co. Facilities include a finishing and drier building, an additional warehouse, and a 50-foot-tall storage tank.

Construction was planned for a multi-million-dollar, 75-million-pound-per-year polyethylene plant on the Houston ship channel by National Petrochemicals Corp., a subsidiary of National Distilleries and Panhandle Eastern Pipeline Co.

Exploratory drilling by the oil and gas industry totaled 58 completions, 4 of which were oil discoveries ranging in depth from 494 to 9,770 feet, 9 were gas wells, and 45 were dry holes. In 1957, 29.8 million barrels of crude oil, 71,248 million cubic feet of natural gas, and 96.7 million gallons of natural-gas liquids were produced.

Sulfur was recovered in purifying natural gas at gasoline plants of Consolidated Chemical Industries, Sinclair Refining Co., and the Shell Chemical Corp. for use in the chemical industry and in manufacturing sulfuric acid for industrial purposes.

Shell was dredged from shallow bays by Shell Builders, Inc., for manufacturing cement and lime and for other purposes. Lime was manufactured by Nyotex Chemical, Inc., Champion Paper & Fibre Co., and Sheffield Steel. Most of it was used for chemical, industrial, and metallurgical purposes. Structural and paving sand and gravel were produced by District 12 of the Texas Highway Department and by five commercial producers. Shale for building brick and heavy clay products was mined from open pits by Acme Brick Co., Cedar Bayou Brick & Tile Co., J. M. Cordell & Sons, Inc., and Houston Brick & Tile Co. Portland and masonry cements were produced by Ideal Cement Co., Lone Star Cement Corp., and Trinity Division of General Portland Cement Co. The \$16 million expansion program of the Ideal Cement Co. new Houston plant was continued into 1957, and a third and a fourth kiln were being built. Rock salt was mined by United Salt Corp. near Hockley, and salt in brine was recovered from wells by the Texas Brine Corp.

The integrated iron and steel plant of Sheffield Steel Division of Armco Steel Corp. operated at near capacity throughout 1957. Brown iron ores from Texas and from foreign countries were used as raw material for the blast furnace. The company installed a new sintering plant and a new ore-bedding system at its Houston works and enlarged the blast furnace hearth from 22 to 25 feet. Limestone reserves of the company were improved during the year by the acquisition of additional property in Texas.

Crude barite shipped from other States and from foreign countries was crushed and ground for use in heavy drilling muds at the Houston plants of Baroid Division, National Lead Co., the Milwhite Co., and a newcomer—the Tejas Barite Co., Ltd. Crude perlite from neighboring States was processed for lightweight aggregate, cement, and plaster by Perlite of Houston, Inc., and the Tri-lite Corp. Crude vermiculite from Montana was expanded for lightweight aggregate, concrete, and plaster by the Tri-lite Corp. and Vermiculite Products, Inc.

Harrison.—Exploratory drilling totaled 14 completions and resulted in 4 oil wells (2 of which were oil discoveries ranging from 6,017 to 6,454 feet in depth), and 10 holes were dry. Production of 2.3 million barrels of crude oil and 75,406 million cubic feet of natural gas was reported. A total of 170.3 million gallons of natural-gas liquids was recovered at 5 gasoline plants in Harrison County. Shale was mined from open pits for building brick and heavy clay products by Acme Brick Co., Marshall Brick Co., and Marshall Pottery. McAlester Fuel Co. produced lignite from open pits for use in preparing activated carbon by the Darco Division of Atlas Powder Co.

Hartley.—The oil and gas industry spent 146 crew-weeks in geophysical prospecting in 1957 compared with 72 in 1956. In all, 52,000 barrels of crude oil, 6,454 million cubic feet of natural gas, and over 2,000 gallons of natural-gas liquids were produced in 1957. The Texas Highway Department produced 171,413 tons of crushed limestone for concrete and roadstone.

Haskell.—Of 87 exploratory well completions, 8 proved oil discoveries ranging in depth from 1,579 to 5,380 feet and 79 were dry holes. Approximately 3.1 million barrels of crude oil was produced during the year.

Hays.—Hays County Gravel Co. produced 148,500 tons of paving sand and gravel. District 14 of the Texas Highway Department produced 581,455 tons of crushed limestone for concrete and roadstone. Seven crew-weeks was spent in geophysical prospecting.

Hemphill.—The oil and gas industry spent 91 crew-weeks in geophysical exploration in 1957 compared with 49 in 1956. Production of nearly 5,000 barrels of crude oil, nearly 100 million cubic feet of natural gas, and 34,000 gallons of natural-gas liquids was reported from Hemphill County. Of the 8 exploratory wells drilled, 5 were gas wells and 3 dry holes.

Henderson.—The Texas Clay Products Co. began expanding its Malakoff brick plant with installation of a new tunnel kiln, a machine shop, and related facilities, which would raise plant production from 2.5 million to 3 million brick monthly. Fire clay was mined from open pits by Harbison-Walker Refractories Co., Athens Tile & Pottery Co., and Texas Clay Products Co. Most of the fire clay was used to manufacture fire brick and shapes. Other uses included heavy clay products. Miscellaneous clay for heavy clay products was mined from open pits by Athens Brick Co.

Henderson County produced 632,000 barrels of crude oil and 26,719 million cubic feet of natural gas in 1957. Natural-gas liquids were recovered at the Trinidad gasoline plant of Lone Star Gas Co. and the Opelika cycling plant of Lone Star Producing Co.

Lone Star Gas Co. converted the old Tri-Cities oilfield in Southwest Henderson County into a 30-billion-cubic-foot underground storage area for natural gas. Six injection wells put gas from Lone Star's main transmission line into the Bacon lime and Rhodessa formations 8,000 feet below the surface. The ultimate capacity of the project may reach 50 billion cubic feet. Geophysical prospecting amounted to 59 crew-weeks.

Hidalgo.—Exploratory drilling resulted in 5 oil discoveries, 16 gas wells, and 23 dry holes. The jointly owned cycle plant of Delhi-Taylor Oil Corp. and Mayfair Minerals Corp. recovered natural-gas

liquids. Crude-oil production totaled 710,000 barrels and natural-gas production 216,600 million cubic feet.

Natural gas from the Brazil, Trevino, and Lomitas fields of Reynosa, Mexico, began flowing across the Rio Grande near McAllen in August 1957 into a 30-inch line of Texas Eastern Transmission Corp. The \$44 million 30-inch line connects the Mexican line with the company main line at Vidor for delivery to points north and east along the company 5,900-mile system.

Shale was mined from open pits by Valley Brick & Tile Co. for building brick and heavy clay products. The Fordyce Gravel Co. produced 44,500 tons of structural and paving sand and gravel at a fixed plant.

Hill.—District 9 of the Texas Highway Department produced 525,829 tons of crushed limestone for concrete and roadstone. The oil and gas industry spent 22 crew-weeks in geophysical prospecting in 1957 compared with 9 in 1956.

Hockley.—Exploratory drilling resulted in 4 oil wells and 12 dry holes. Natural-gas liquids were recovered at the Ropes gasoline plant of Honolulu Oil Corp. and the Levelland and Slaughter gasoline plants of Pan American Petroleum Corp. Approximately 12.6 million barrels of crude oil and 111 million cubic feet of natural gas were produced during the year. Sulfur was recovered at the Slaughter gasoline plant of Pan American Petroleum Corp.

Hopkins.—Approximately 1.9 million barrels of crude oil was produced in Hopkins County in 1957. Natural-gas liquids were recovered at the Pickton gasoline plant of Humble Oil & Refining Co. Geophysical prospecting amounted to 24 crew-weeks compared with 59 in 1956.

Fire clay for firebrick and shapes was mined from open pits by A. P. Green Fire Brick Co. A lightweight-aggregate plant began production near Sulphur Springs, using shale deposits near the plant.

Houston.—Natural-gas liquids were recovered at the Grier-Jackson cycling plant of Grier-Jackson, Inc. Crude-oil production amounted to 489,000 barrels and natural-gas production to 19,448 million cubic feet. Crushed sandstone was produced by District 11 of the Texas Highway Department for concrete and roadstone. The United States Forest Service produced 6,750 tons of paving gravel.

Howard.—A total of 13.7 million barrels of crude oil was processed at the Big Spring, Abilene, and Colorado City refineries at Cosden Petroleum Corp., the last two plants were purchased of Cosden in 1956. Carbon black was recovered from refinery residues. Of 22 exploratory wells completed, 9 proved oil wells (of which 6 were oil discoveries ranging in depth from 1,950 to 7,444 feet), and 13 were dry holes. Natural-gas liquids were recovered at the East Vealmoor gasoline plant of Reef Fields Gasoline Corp. The 20-million-pound-per-year styrene plant at Big Spring substitutes a distillation process for the usual synthesis of ethyl benzene.

Clyde McMahan Sand-Gravel Co. produced 28,311 tons of paving sand and 49,605 tons of paving gravel. The first plant to produce styrene by direct recovery of ethyl benzene from gasoline was reported by Cosden Petroleum Corp.

Hudspeth.—Rhyolite was quarried and crushed by Gifford-Hill & Co., Inc., for concrete aggregate, roadstone, riprap, and railroad ballast and as roofing granules. District 24 of the Texas Highway

Department had 2,700 tons of paving gravel produced for its use. Talc and soapstone were mined from open pits near Allamore by six producers. A report was released on the talc deposits of Hudspeth County.⁴ Gypsum was mined from open pits for use in cement and building plaster and as a soil conditioner by Southwestern Portland Cement Co. and Casner Gypsum Co.

Hunt.—Nearly 16,000 barrels of crude oil was produced in Hunt County in 1957. The oil industry spent 6 crew-weeks in geophysical exploration; all exploratory wells were dry.

Hutchinson.—Thirty-three crew-weeks were spent in geophysical prospecting in 1957 compared with 17 in 1956; all 5 exploratory wells were dry holes.

A total of 7.4 million gallons of natural-gas liquids was recovered at 7 gasoline plants. Crude-oil production amounted to 13.9 million barrels and natural-gas production to 34,874 million cubic feet. A new unit to increase high-octane blending material for motor fuels was installed at the natural-gas-liquid processing plant of Phillips Petroleum Co. near Borger. The new unit will convert normal pentane—a natural-gas liquid material with an 85 octane number—into isopentane with an octane number of 105. The capacity of the new unit was 13,500 barrels of isopentane daily.

Nearly 32,000 tons of paving sand was produced under contract by District 4 of Texas Highway Department.

Irion.—Exploratory drilling of 38 wells resulted in 7 oil wells, 5 of which were discovery wells ranging in depth from 875 to 5,048 feet, and 31 dry holes. Crude-oil production totaled 790,000 barrels. Geophysical prospecting amounted to 11 crew-weeks compared with 36 in 1956.

Jack.—The Texas Railroad Commission approved operation, as a single reservoir, of 29 oil and gas fields containing 219 wells and covering 251,000 acres in Jack and Wise Counties. The new reservoir will be known as the Boonesville (Bend conglomerate-gas) field. The reservoir was about 20 percent developed, gas wells will be drilled on 320-acre spacing, and marketed demand will be prorated among all wells of the field. Exploratory well completions totaling 25 proved 11 oil wells (8 of which were oil discoveries ranging in depth from 1,944 to 6,838 feet) and 14 dry holes. Natural-gas liquids were recovered at the Black Hawk gasoline plant of Black Hawk Gasoline Corp. Crude-oil output was 5.4 million barrels and natural-gas output 6,551 million cubic feet.

Production of 252,588 tons of crushed limestone for concrete and roadstone was reported by District 2 of the Texas Highway Department.

Jackson.—There were 13 million barrels of crude oil, 69,310 million cubic feet of natural gas, and 60.2 million gallons of natural-gas liquids produced in Jackson County in 1957. Exploratory drilling resulted in 4 oil wells, 3 gas wells, and 30 dry holes.

A total of 147,011 tons of paving sand was produced under contract for District 13 of the Texas Highway Department.

Jasper.—Pal-Port Clay Products Corp. produced 9,000 tons of miscellaneous clay for building brick and heavy clay products.

⁴ Flawn, Peter T., Texas Miners Boost Talc Output. Eng. and Min. Jour., vol. 159, No. 1. January 1958, p. 194.

Bennett-Clark Co., Inc., mined bentonite from open pits for use as a filtering medium of mineral and vegetable oils.

The oil and gas industry spent 68 crew-weeks in geophysical prospecting in 1957 compared with 70 crew-weeks in 1956. Of 10 exploratory wells drilled, 2 proved oil wells, 1 a gas-well, and 7 were dry holes. Mineral-fuel production consisted of 407,000 barrels of crude oil, 4,663 million cubic feet of natural gas, and 4.1 million gallons of natural-gas liquids.

Jeff Davis.—District 24 of the Texas Highway Department acquired 10,800 tons of paving gravel under contract for road-maintenance purposes.

Jefferson.—Jefferson County (with the largest concentration of refinery capacity in the State and the Nation, with important and continually growing petrochemical and chemical capacity, and with vital reserves and production capacity of mineral fuels and essential mineral commodities) was an important factor in the huge industrial complex along the eastern Texas Gulf coast. This important industrial complex continued capital investments and industrial expansions begun in previous years, even though weak spots were beginning to develop in many industrial lines in the latter part of the year.

Magnolia Petroleum Co. completed a \$25 million expansion program at its big Beaumont refinery. A year earlier the expansion boosted daily crude capacity from 180,000 barrels to 205,000. New facilities included the world's largest Sovaformer for upgrading 20,000 barrels of naphtha per day into 100 octane gasoline, an LP-gas fractionating section to process 26,700 barrels of butane and propane products daily, and a feed-preparation system to recover naphthas from straight-run gasoline as the Sovaformer charge. Projected installations include a 100,000-barrel atmospheric crude still, a 32,000-barrel vacuum unit, a hydrogen sulfide recovery system, a 30,000-barrel Sovaforming unit, and a second alkylation unit (an 8,000-barrel sulfuric-acid-type plant). E. I. duPont de Nemours & Company, Inc., completed a new 15-million-pound-per-year synthetic rubber plant at Beaumont; initial production began in July. Atlantic Refining Co. installed a 2,100-barrel-a-day alkylation unit at its Port Arthur refinery. The new unit will work in conjunction with a 15,000-barrel-per-day Catformer, which will permit a larger proportion of high-octane gasoline. Pure Oil Co. installed a 15,000-barrel Ultraformer at its 67,000-barrel-per-day Nederlands refinery. The Texas Co. increased the crude capacity of its Port Arthur refinery with a 3,200-barrel-per-day increase in its vacuum unit charging topped crude. Fluid catalytic cracking capacity of the refinery was increased 90,000 barrels per day with 33 percent recycled. An 8 million-pound-per-year di-isobutylene unit also was installed. Gulf Oil Corp. increased output of higher quality home heating oil at its Port Arthur refinery with installation of two Gulfining processing units and constructed a 30-million-gallon-per-year benzene plant. Facilities include a Catalytic reformer, utilizing a platinum catalyst to convert the hexane-rich stream to an enriched benzene mixture and a purification unit employing solvent extraction and distillation to recover pure benzene from the enriched mixture. Substantial amounts of toluene for explosives will be produced as a byproduct of the process. The major application of benzene is in the production of styrene, a com-

ponent of polystyrene plastics, and in the preparation of synthetic detergents, phenol derivatives, insecticides, nylon, drugs, and dyes.

Texas Gulf Sulphur began construction of a multi-million-dollar sulfur plant at the Fannett dome near Beaumont. Of 34 exploratory well completions, 3 were oil wells, 2 gas wells, and 29 dry holes. Jefferson County produced over 7.6 million barrels of crude oil and 94,862 million cubic feet of natural gas. Texas Gas Corp. recovered natural-gas liquids at its gasoline plant.

Building sand was prepared by C. A. McKinley Sons, Inc. Beaumont Brick Co., Inc., mined miscellaneous clay from open pits for manufacturing building brick and heavy clay products. Texas Gulf Sulphur Co. recovered sulfur by the Frasch method from Spindletop dome. Sulfur also was recovered from cracked refinery gases at Gulf Oil Corp. Port Arthur refinery. Crushed limestone for concrete and roadstone was prepared for District 20 of the Texas Highway Department. Salt in brine was produced by Spindletop Minerals Co. of Beaumont, Texas. This company went out of business on October 31, 1957.

Jim Hogg.—District 22 of the Texas Highway Department produced 57,215 tons of crushed sandstone for concrete and roadstone. Exploratory drilling proved 5 oil wells (4 of which were discovery wells ranging in depth from 3,167 to 6,155 feet), 5 gas wells, and 18 dry holes. The oil and gas industry produced 4.6 million barrels of crude oil, 1,060 million cubic feet of natural gas, and over 7,000 gallons of natural-gas liquids.

Jim Wells.—Exploratory drilling proved 11 oil wells (10 of which were discovery wells ranging in depth from 4,045 to 6,379 feet), 11 were gas wells, and 31 were dry holes. Cycling plants of LaGloria Oil & Gas Co. and Magnolia Petroleum Co. recovered natural-gas liquids. Production of 8.1 million barrels of crude oil and 180,713 million cubic feet of natural gas was reported.

Johnson.—The oil and gas industry spent 9 crew-weeks geophysical prospecting in 1957.

Limestone for manufacturing lime was quarried by Texas Lime Co. The lime was used principally for building, chemical, and industrial purposes. There were 120,021 tons of paving gravel produced under contract for District 2 of the Texas Highway Department.

Jones.—Cosden Petroleum Co. shut down its 7,000-barrel-a-day Hawley refinery for an indefinite period. Closing was due to the Government cutback in purchases of aviation gasoline. Exploratory drilling by the oil and gas industry resulted in 9 oil discoveries ranging in depth from 1,974 to 3,032 feet and 85 dry holes.

Texas Natural Gasoline Corp. recovered natural-gas liquids at its Wimberly No. 1 gasoline plant. Crude oil was refined at the Lueders refinery of Petroleum Products Refining & Producing Co. Crude-oil output totaled 6.5 million barrels.

Lueders Limestone Co. produced 45,435 cubic feet of rough architectural and 10,880 cubic feet of dressed building limestone. West Texas Stone Co. produced 12,000 cubic feet of rough architectural and 36,797 cubic feet of cut building stone from quarries near Lueders, Texas. A minor quantity of crushed limestone was produced for riprap by West Texas Stone Co.

Karnes.—Propane-recovery facilities were added to the Cabeza Creek natural-gasoline plant of United Gas Pipeline Co., bringing total propane capacity up to 10,000 gallons. United Gas Pipeline Co. recovered natural-gas liquids at its Cabeza Creek and Karnes City gasoline plants. Exploratory drilling proved 2 oil wells, 1 gas well, and 15 dry holes. Production of 2.4 million barrels of crude oil and 36,787 million cubic feet of natural gas was reported.

Kaufman.—Crushed limestone for concrete and roadstone was prepared by John F. Buckner & Son and by District 18 of the Texas Highway Department. Crude-oil production amounted to 817,000 barrels.

Kenedy.—Humble Oil & Refining Co. recovered natural-gas liquids at its Julian-Pasture cycling plant. Crude-oil production amounted to 255,000 barrels and natural-gas production to 6,768 million cubic feet. Exploratory drilling resulted in 4 gas-well completions and 10 dry holes.

Kent.—Exploratory drilling resulted in the discovery of the Clairemont West (Strawn) oilfield. Mineral-fuel production amounted to nearly 10 million barrels of crude oil and 1.9 million gallons of natural-gas liquids.

Kimble.—Paving gravel was produced by Weirich Bros.

Production of nearly 1,400 barrels of crude oil and 33 million cubic feet of natural gas was reported.

King.—A total of 21 crew-weeks was spent in geophysical prospecting in 1957. The oil and gas industry produced 1.9 million barrels of crude oil and 40 million cubic feet of natural gas.

Kleberg.—Mineral output was valued at \$34.3 million in 1957 compared with \$17.2 million in 1956. The oil and gas industry completed 21 exploratory wells that resulted in 7 oil wells, 8 gas wells, and 6 dry holes. The industry also produced 9.5 million barrels of crude oil, 28,201 million cubic feet of natural gas, and 41.5 million gallons of natural-gas liquids.

Heldenfels Bros. produced crushed limestone from a quarry near Kingsville for concrete and roadstone.

Knox.—Exploratory drilling proved 29 oil wells, but 188 holes were dry. Crude-oil production totaled 2.1 million barrels. Geophysical prospecting amounted to 7 crew-weeks compared with 34 in 1956.

Lamar.—Crushed limestone for concrete and roadstone was prepared for District 1 of the Texas Highway Department.

Lamb.—The oil and gas industry completed 24 exploratory wells that resulted in 2 oil wells (1 of which was the discovery well of Illusion Lake (Sam Andreas) oilfield), and 22 dry holes. Crude-oil output totaled 1.3 million barrels.

Lampasas.—Specialty sand and gravel was produced by Lampasas Sand & Gravel Co.

La Salle.—In all 108 crew-weeks was spent in geophysical prospecting in 1957 compared with 87 in 1956. Crude-oil output amounted to 312,000 barrels and natural-gas output to 16 million cubic feet.

Lavaca.—Exploratory drilling proved 4 gas wells and 4 dry holes. The Wilcox gasoline plant of Goliad Corp. and Provident City gasoline plant of Shell Oil Co. recovered natural-gas liquids. Crude-oil output amounted to 305,000 barrels and natural-gas output to

40,468 million cubic feet. Geophysical prospecting amounted to 81 crew-weeks compared with 60 in 1956.

District 22 of the Texas Highway Department produced 36,904 tons of crushed sandstone for concrete and roadstone. Approximately 141,436 tons of paving sand was produced under contract for District 13 of the Texas Highway Department.

Lee.—Crushed sandstone prepared for District 14 of the Texas Highway Department for concrete and roadstone totaled 25,775 tons. Geophysical prospecting by the oil and gas industry amounted to 28 crew-weeks. Crude-oil production was 1,600 barrels and natural-gas output nearly 1 million cubic feet.

Leon.—Forty-one crew-weeks was spent in geophysical prospecting. Mineral-fuel production amounted to 95,000 barrels of crude oil, 27,055 million cubic feet of natural gas, and 4.5 million gallons of natural-gas liquids.

Liberty.—A total of 211 crew-weeks was spent in geophysical prospecting in 1957. Exploratory well completions resulted in 2 oil discoveries at depths of 6,536 and 7,348 feet, 2 gas wells, and 10 dry holes. The Hull gasoline plant of West Gasoline Co. recovered natural-gas liquids. Production of 14.8 million barrels of crude oil and 17,135 million cubic feet of natural gas was reported.

Sulfur was mined from Moss Bluff dome by the Frasch process by Texas Gulf Sulphur Co. Building and paving sand and gravel were prepared by Coastal Sand-Gravel Co., Inc. Texas Construction Material Co. produced 393,830 tons of paving sand, 84,674 tons of blast sand, and 27,701 tons of building gravel.

Limestone.—Ten crew-weeks was spent in geophysical prospecting. Crude-oil production was 330,000 barrels, and natural gas production 2,799 million cubic feet. Over 864,000 gallons of natural-gas liquids was recovered.

Miscellaneous clay used for building brick and heavy clay products was mined from open pits near Groesbeck by Barron Brick Co. District 9 of the Texas Highway Department produced 68,017 tons of crushed limestone for concrete and roadstone.

Lipscomb.—The oil and gas industry increased geophysical prospecting to 112 crew-weeks in 1957 compared with 35 in 1956. Exploratory drilling resulted in 3 oil discoveries, 16 gas wells, and 8 dry holes. Mineral-fuel production totaled 3,500 barrels of crude oil, 308 million cubic feet of natural gas, and 242,000 gallons of natural-gas liquids.

Live Oak.—The oil and gas industry completed 51 exploratory wells that resulted in 6 oil discoveries (ranging in depth from 2,793 to 5,714 feet), 12 gas wells, and 33 dry holes. Natural-gas liquids were recovered by the Live Oak plants of Continental Oil Co. and Western Natural Gas Co. Crude-oil output amounted to 1.6 million barrels. Natural-gas output was 71,896 million cubic feet.

Llano.—Dezendorf Marble Co. quarried and prepared marble for use as terrazzo, whiting, and roofing granules. A minor quantity of feldspar was shipped from open pits in the county. Talc and soapstone mined in Hudspeth and Gillespie Counties were ground in Llano County. A graphitic schist used as a filtering medium was mined from open pits near Llano by Graphilter Corp.

Loving.—Exploratory drilling proved 4 oil wells (2 of which were oil discoveries), and 18 holes were dry. Mineral-fuel production amounted to 1.3 million barrels of crude oil and 993,000 gallons of natural-gas liquids.

Lubbock.—The oil and gas industry spent 22 crew-weeks in geophysical prospecting and completed 6 exploratory wells, resulting in 1 oil discovery and 5 dry holes. Approximately 411,000 barrels of crude oil was produced.

Crushed limestone for concrete and roadstone was prepared for District 5 of the Texas Highway Department. Caprock Sand & Gravel Co. produced 43,750 tons each of building and paving sand and gravel.

Lynn.—The Lynn County Highway Department produced 2,700 tons of paving gravel for road maintenance.

The oil industry devoted 39 crew-weeks to geophysical prospecting. Crude-oil production amounted to 377,000 barrels.

Madison.—Mineral-fuel production totaled 32,000 barrels of crude oil, 6,774 million cubic feet of natural gas, and 4.3 million gallons of natural-gas liquids.

Marion.—The oil and gas industry spent 11 crew-weeks in geophysical prospecting and completed 7 exploratory wells, resulting in 3 oil wells (2 of which were oil discoveries), and 4 dry holes. Mineral-fuel production amounted to nearly 2 million barrels of crude oil, 21,433 million cubic feet of natural gas, and 44.3 million gallons of natural-gas liquids.

Martin.—The oil and gas industry spent 25 crew-weeks in geophysical prospecting and drilled 3 exploratory wells, resulting in 1 oil well. Crude-oil production amounted to 577,000 barrels.

Structural and paving gravels were prepared for the United States Army Corps of Engineers. Nearly 18,000 tons of crushed limestone was produced for concrete and roadstone for District 6 of the Texas Highway Department.

Mason.—Weirich Bros. produced paving sand and gravel. District 14 of the Texas Highway Department produced 70,050 tons of crushed limestone for concrete and roadstone.

Matagorda.—The oil and gas industry spent 169 crew-weeks in geophysical prospecting and drilled 37 exploratory wells that resulted in 4 oil wells, 12 gas wells, and 21 dry holes.

The Markham gasoline plant of the Ohio Oil Co. and the Blessing cycling plant of the American Petrophenol Co. of Texas recovered natural-gas liquids. Production of 6.2 million barrels of crude oil and 159,763 million cubic feet of natural gas was reported.

Shell for concrete and road surfacing was dredged from bays of Matagorda County by Matagorda Shell Co. There was 23,482 tons of paving sand produced for District 12 of the Texas Highway Department.

Maverick.—Reynolds Metal Corp. began producing Acid-grade fluorspar at its Eagle Pass flotation mill. The crude spar was imported from Mexico and the milled product used in manufacturing cryolite for the company aluminum-reduction works. The Tejas Barite Co., Ltd., ground crude barite from Mexico at its new Eagle Pass mill. The ground barite was used for heavy drilling muds.

The oil industry drilled 45 exploratory wells, resulting in 5 oil discoveries that ranged from 1,228 to 2,759 feet in depth, 1 gas well, and 39 dry holes. Mineral-fuel production amounted to 29,000 barrels of crude oil, 90 million cubic feet of natural gas, and over 3,000 gallons of natural-gas liquids.

McCulloch.—Exploratory drilling resulted in the discovery of the Deitz (Strawn) oilfield. Crude-oil production amounted to nearly 17,000 barrels.

McLennan.—Universal Atlas Cement Co. mined limestone and clay for manufacturing cement. Tonk Quarries prepared 15,945 cubic feet of sawed and 2,731 cubic feet of cut dressed building limestone. District 9 of the Texas Highway Department produced 180,113 tons of crushed limestone for concrete aggregate and roadstone.

Over 5,000 barrels of crude oil was produced. Geophysical prospecting lasted 16 crew-weeks.

McMullen.—The oil and gas industry spent 57 crew-weeks in geophysical prospecting and drilled 44 exploratory wells, resulting in 1 oil well, 10 gas wells, and 33 dry holes. Mineral-fuel production amounted to 841,000 barrels of crude oil, 47,230 million cubic feet of natural gas, and 8.8 million gallons of natural-gas liquids.

Medina.—Miscellaneous clay was mined by the D'Hanis Brick & Tile Co. from open pits for use in building brick, tile, and heavy clay products. A total of 61,320 tons of crushed sandstone was prepared by District 22 of the Texas Highway Department for concrete and roadstone.

Production of 174,000 barrels of crude oil and 45 million cubic feet of natural gas was reported.

Menard.—The gas industry spent 17 crew-weeks in geophysical prospecting during the year. Natural-gas production amounted to 45 million cubic feet.

Midland.—The Parks propane flood, a huge \$3.5 million miscible-phase-displacement project, began with injection of propane through half a dozen of the plant's 25 input wells scattered over the big 8,160-acre Parks Pennsylvanian unit. The project will use a propane slug with a gas drive, using about 6,000 barrels of propane and 16 million cubic feet of gas daily. Magnolia Petroleum Co., unit operator, believed that the program would lengthen the life of the field from 6½ to 12 years and boost oil recovery from 100 to 150 percent of primary production. Exploratory drilling proved 4 oil discoveries, ranging from 7,434 to 11,444 feet, 3 gas discoveries, and 3 dry holes. Five gasoline plants recovered 75.1 million gallons of natural-gas liquids. Crude-oil output amounted to 18.4 million barrels and natural-gas output to 1,901 million cubic feet.

Milam.—A total of 13 crew-weeks was spent in geophysical prospecting. Crude-oil production totaled over 76,000 barrels. Lignite used as fuel was mined by open-pit methods by Industrial Generating Co.

Paving gravel was prepared from open pits by Mrs. W. A. Robinson and W. C. Moody. Production of 3,300 tons of crushed sandstone for concrete and roadstone was reported by District 17 of the Texas Highway Department.

The Aluminum Co. of America operated its Rockdale reduction works at capacity throughout the year.

Mills.—A total of 118,250 tons of crushed limestone used for concrete and roadstone was prepared by District 23 of the Texas Highway Department.

Mitchell.—Exploratory drilling proved 3 oil wells (1 of which was a discovery well) and 8 dry holes. Crude-oil production totaled 3.1 million barrels.

Structural and paving sand and gravel were prepared by R. E. Janes Gravel Co. and Colorado Sand & Gravel Co. The United States Army Corps of Engineers produced 4,200 tons of paving gravel for road maintenance. A total of 24,976 tons of crushed limestone, used for concrete aggregate and roadstone, was produced by District 8 of the Texas Highway Department.

Montague.—The oil and gas industry devoted 48 crew-weeks to geophysical prospecting and drilled 49 exploratory wells, proving 13 oil wells (8 of which were oil discoveries ranging in depth from 3,413 to 6,468 feet) and 36 dry holes. Natural-gas liquids were recovered at the Bowie gasoline plant of Bowie Gasoline Co. An output of 7.1 million barrels of crude oil and 311 million cubic feet of natural gas was reported.

Watson Sand & Gravel Co. produced structural and paving sand and gravel for use in the construction industry.

Montgomery.—The oil and gas industry spent 36 crew-weeks in geophysical prospecting in 1957, compared with 58 in 1956 and drilled 17 exploratory wells, proving 2 oil wells (1 the discovery well of the Rosner Anderson (4,500-foot cockfield) oilfield), 2 gas wells, and 13 dry holes. District 12 of the Texas Highway Department produced 25,504 tons of paving gravel with its own crews and contracted production of 5,698 tons of paving sand and 125,673 tons of paving gravel. Crude-oil production amounted to 10.6 million barrels, natural-gas production to 40,160 million cubic feet, and production of natural-gas liquids to 101.1 million gallons.

Moore.—Crude capacity at the Sunray refinery of Shamrock Oil & Gas Co. was increased 4,000 barrels per day and the sulfuric acid alkylation unit 1,100 barrels per day.

Seven gasoline plants recovered 252.8 million gallons of natural-gas liquids. Crude-oil output amounted to 189,000 barrels and natural-gas output to 216,781 million cubic feet, making Moore County the fourth largest gas-producing county in the State.

The output of the Dumas zinc smelter of American Zinc Co. of Illinois was reduced 15 percent during the latter part of the year because of softening consuming markets and increased metal imports.

Sulfur was recovered from sour natural gas at the McKee plant of Shamrock Oil & Gas Corp. Helium was recovered at the Government-operated Exell plant from natural gas produced in the county.

Carbon black was recovered at the Continental furnace plant of Continental Carbon Co.

Contractors produced 115,037 tons of paving sand for District 4 of the Texas Highway Department and 201,927 tons of crushed limestone for concrete aggregate and roadstone.

Morris.—The oil and gas industry devoted 28 crew-weeks to geophysical prospecting, consisting of 22 weeks on seismic work and 6 on gravimeter work.

Brown iron ore was mined by open-pit methods by Lone Star Steel

Co. for feed to its blast furnace at Daingerfield. The \$8 million expansion program of Lone Star Steel Co., begun in 1957 and due for completion in 1958, included a stretch-reducing mill, a bar mill, and an open-hearth furnace. The stretch-reducing mill will substantially increase Lone Star's supply of oilfield tubing. The bar mill takes the steel strip trim from steel plate to form reinforcing bars for the construction industry. The new open-hearth furnace (the fifth) will increase company production of steel ingot 20 percent to 800,000 tons annually. A 6-week wildcat strike at the Daingerfield works, which began September 21, curtailed operations to a limited extent.

Motley.—The first oil produced in Motley County followed discovery of the Roaring Springs (Perm-Penn) oilfield by Pan American Petroleum Corp. The discovery was 22 miles west of production in Cottle County. Seventeen crew-weeks was devoted to geophysical prospecting. Crude-oil output amounted to 87,000 barrels.

Structural and paving sand and gravel were prepared by Harris Sand Co. and Elliston & Thrasher.

Nacogdoches.—Mineral-fuel production amounted to 132,000 barrels of crude oil, 18,655 million cubic feet of natural gas, and 118,000 gallons of natural-gas liquids.

Miscellaneous clay used in manufacturing building and face brick was mined from open pits by Acme Brick Co. Paving gravel (6,750 tons) was prepared under contract for the United States Forest Service.

Navarro.—Exploratory drilling resulted in discovery of the Nesbett (Woodbine) oilfield, 1 gas well, and 35 dry holes. Miscellaneous clay produced from open pits by Whitsell Brick & Lumber Co. was used in manufacturing heavy clay products. Crushed limestone totaling 57,000 tons, and paving gravel (76,000 tons) were produced under contract for District 18 of the Texas Highway Department for use in concrete and as roadstone. Mineral-fuel production amounted to 2.1 million barrels of crude oil, 3.6 million cubic feet of natural gas, and nearly 3,000 gallons of natural-gas liquids.

The Texas Co. Edens discovery well in central Navarro County adds a new link to the chain of Smackover discoveries stretching along a 200-mile arc from Mexia to Texarkana. The well's importance lies in its location on the erratic Jurassic-Smackover trend in East Texas.

Newton.—The oil and gas industry spent 55 crew-weeks in geophysical prospecting and completed 11 exploratory wells, resulting in 4 oil wells, 1 gas well, and 6 dry holes. Mineral-fuel production consisted of 1.4 million barrels of crude oil, 6,514 million cubic feet of natural gas, and 7.6 million gallons of natural-gas liquids.

Nolan.—Exploratory drilling resulted in 11 oil wells (10 of which were discovery wells ranging in depth from 3,610 to 7,021 feet), 2 gas wells, and 47 dry holes. Six gasoline plants recovered 3.8 million gallons of natural-gas liquids. El Paso Natural Gas Co. completed a 24 million-cubic-foot-per-day gasoline plant in April. The oil and gas industry produced 9.1 million barrels of crude oil and 366 million cubic feet of natural gas.

The Flintkote Co. of Sweetwater produced 8,378 tons of gypsum for the manufacture of plaster, wallboard, lath, and other gypsum products. Crude gypsum also was mined from open pits near Sweetwater by the United States Gypsum Co. Limestone and clay were mined from open pits near the Maryneal plant of Lone Star Cement Co. for manufacturing portland and masonry cement. Hillsdale

Gravel Co. produced over 31,000 tons of structural and paving sand and over 46,000 tons of structural and paving gravel for use by the construction industry.

Nueces.—Special high-grade zinc was recovered from ores and concentrates from Western States and from foreign countries at the electrolytic refinery of American Smelting & Refining Co. Output was reduced 30 percent or 2,700 tons a month the latter part of June because of declining metal markets and mounting stocks of metal and imports. The first shipment of bauxite ore mined in Haiti by the Reynolds Mining Corp. was delivered to the company San Patricio reduction works in July. This shipment climaxed years of development by the company through its subsidiary, the Reynolds Haitian Mines, on the bauxite deposits in Haiti.

Suntide Refining Co. continued expanding its Corpus Christi refinery, with addition of a 15,000-barrel-per-day Rexformer and a 7,500-barrel-per-day Unifiner. Other installations included a 7,500-barrel-per-day BTX Udex unit and an 8,500-barrel-per-day capacity increase of the vacuum unit charging top crude. The plant was idle during this \$560,000 modernization program. Delhi Taylor Oil Corp. completed a \$7 million expansion program at its refinery, with addition of a 50,000-barrel-per-day Uniformer and a new petrochemical plant at Corpus Christi. The new plant can produce 45 million gallons per year of high-purity benzene, toluene, and xylene for plastics, paints, and pharmaceutical and other chemical-processing industries. Plans for a new refinery by North American Petroleum Corp. and for the world's largest cycling plant and pipeline network by Humble Oil and Refining Co. were announced during the year. The proposed cycling plant would process 750 million cubic feet of gas per day and recover 25,000 barrels per day of liquid products—principally propane, butane, and a mixture of natural gasoline and heavier hydrocarbon liquids.

Exploratory drilling by the oil and gas industry proved 27 oil and 8 gas wells; 29 holes were dry. Seven gasoline plants and six cycling plants in the county recovered 269 million gallons of natural-gas liquids. In all, 13 million barrels of crude oil and 336,187 million cubic feet of natural gas were produced. Shell was dredged from the shallow bays bordering Nueces County by Corpus Christi Shell Co. and General Dredging Corp. Shell was used as aggregate in concrete in manufacturing portland and masonry cements and lime and for chemical and industrial purposes. Lime was manufactured from shell by Columbia-Southern Chemical Corp. for chemical and industrial uses. Cement was manufactured from shell by Halliburton Portland Cement Co. Structural and paving sand and gravel were prepared by Heldenfels Bros. from pits near Calallen. Carbon black was recovered at the No. 56 channel plant of Columbian Carbon Co. Baroid Division of National Lead Co. ground and processed barite from other states and foreign countries for use in the manufacture of heavy drilling mud.

Crude oil was processed at six refineries.

Ochiltree.—Nearly 28,000 tons of crushed limestone was quarried by District 4 of the Texas Highway Department for use in concrete and as roadstone. The oil and gas industry drilled 27 exploratory

wells, including 7 oil wells, 6 of which were discovery wells, ranging in depth from 5,710 to 8,139 feet, 7 gas wells, and 13 dry holes. Mineral-fuel production consisted of 1.7 million barrels of crude oil, 5,085 million cubic feet of natural gas, and 923,000 barrels of natural-gas liquids.

Oldham.—Shell Oil Co. reported the first oil production in the Palo Duro basin of Oldham County. The Palo Duro basin, the third Panhandle basin to produce in 8 years, is perhaps the last big geologic basin in Texas to be developed for petroleum. Exploratory drilling resulted in 3 oil discoveries and 3 dry holes; 28 crew-weeks was spent in geophysical prospecting. Crude-oil production amounted to 51,000 barrels.

Structural and paving sand and gravel were recovered from pits near Tascosa by Western Aggregates, Inc., and from pits near Channing by Western Sand & Gravel Co.

Orange.—Operations were begun in March at the 700,000-barrel-per-year Echo plant of the newest cement industry in the State, the Texas Portland Cement Co. at Orange. This made Orange County the ninth ranking cement-producing county within the State. Basic materials for the cement included shell (dredged from the shallow bays of the Gulf of Mexico and brought directly to the plant by barge), clay, and iron ore. The extensive expansion program of industrial building and highway projects of the Sabine Valley area provided an active demand for the various types of cements produced by the plant.

Spencer Chemical Co. installed facilities to double the yearly capacity of its polyethylene plant—from 45 million to 90 million pounds. The new facilities would permit producing both conventional and medium polyethylene by the high pressure process.

Firestone Tire & Rubber Co. began production at its \$10 million petrochemical center on Orange County's Chemical Row. The facilities provide isobutane for another section of the plant to produce 40,000 tons of butadiene yearly and for company butadiene plants at Lake Charles and Akron, Ohio. Further plans called for an increasing butadiene capacity to 60,000 tons annually. Other important petrochemical producers include the 100-million-pound-per-year polyethylene plant of E. I. duPont de Nemours & Co., Inc., and the 12,000 tons-per-year ethylene oxide plant of Allied Chemical & Dye Corp. Ohio Oil Co. began constructing a 10-million-cubic-foot-per-day gasoline plant. Natural-gas liquids are a basic component of the growing petrochemical industry of the area.

Thirty-eight crew-weeks was spent in geophysical prospecting. Mineral fuel production amounted to 3.2 million barrels of crude oil, 49,596 million cubic feet of natural gas, and 16.4 million gallons of natural-gas liquids.

Palo Pinto.—Exploratory drilling by the oil and gas industry resulted in 2 oil discoveries and 12 dry holes; 10 crew-weeks was spent in geophysical prospecting. Natural-gas liquids were recovered at the Gordon gasoline plant of Lone Star Gas Co. The Brazos River Gas Co. expanded its Mineral Wells plant to 30 million cubic feet of gas per day. Crude-oil production amounted to 205,000 barrels and natural-gas production to 1,213 million cubic feet.

Miscellaneous clay used for brick, tile, and heavy clay products

was mined from open pits near Strawn by the Featherlite Corp. and from pits near Mineral Wells by Texeramics, Inc., and Texas Vitrified Pipe Co. Structural and paving sand and gravel were recovered from pits near Mineral Wells by Mineral Wells Sand and Gravel Co. In all 24,700 tons of paving sand and 87,589 tons of paving gravel were produced under contract for District 2 of the Texas Highway Department. National Park Service obtained 6,750 tons of paving gravel for road maintenance work. District 2 of the Texas Highway Department produced 108,000 tons of crushed limestone for use in concrete and as roadstone.

Panola.—Four gasoline plants and one cycling plant recovered 521 million gallons of natural-gas liquids. Production of 2.7 million barrels of crude oil and 574,632 million cubic feet of natural gas was reported. Exploratory drilling resulted in 2 oil wells and 2 dry holes.

Parker.—Miscellaneous clay was mined for building and face brick and building tile by Acme Brick Co. and by Mineral Wells Clay Products Co. Dimension sandstone for rubble was quarried and prepared by Ben Roy Gholson. A total of 56,640 tons of crushed limestone was quarried and prepared by District 2 of the Texas Highway Department. The district also contracted for 7,150 tons of paving gravel for road maintenance.

The Springtown gasoline plant of Lone Star Gas Co. produced natural-gas liquids. Other mineral-fuel output included 18,000 barrels of crude oil and 2,301 million cubic feet of natural gas. Exploratory drilling resulted in 4 gas wells and 3 dry holes.

Pecos.—The deepest test well in Texas (Pan American Petroleum Corp. No. 1—CS University, a wildcat 13 miles southeast of Fort Stockton) was stopped at 21,687 feet after an unsuccessful tool-fishing job. The company planned to perforate at 16,478 feet for an oil test in the Pennsylvanian and Wolfcamp formations.

Permian Basin Pipeline Co. increased the carbon dioxide removal capacity of its Mitchell plant at Fort Stockton to 105 million cubic feet of natural gas per day. Structural sand and structural and paving gravel were produced from pits near Imperial by F. M. Reeves & Sons, Inc. Exploratory drilling by the oil and gas industry resulted in 21 oil wells (12 oil discoveries), 5 gas wells, and 37 dry holes. Geophysical prospecting totaled 450 crew-weeks compared with 661 in 1956. Natural-gas liquids were recovered by the Santa Rosa No. 3 gasoline plant and by the Imperial No. 2 plant of Natural Gas Products Co. Crude-oil output was 16.9 million barrels and natural-gas production 72,095 million cubic feet.

Polk.—Exploratory drilling resulted in discovery of Menard Creek (Cockfield No. 1) oilfield and one gas well. Fifty-five crew-weeks was spent in geophysical prospecting. The plant of Sunshine Gasoline Co. recovered natural-gas liquids. Other mineral fuel production included 1.6 million barrels of crude oil and 3,449 million cubic feet of natural gas.

Texas Construction Material Co. produced 10,450 tons of blast sand and 2,612 tons of filter sand; 48,060 tons of paving gravel was prepared under contract for Polk County Highway Department.

Potter.—Natural-gas liquids were recovered at the Fain and Turkey Creek gasoline plants of Amarillo Oil Co. Natural-gas production amounted to 129,073 million cubic feet. Helium was recovered from

natural gas at the Government-operated Amarillo plant. Crude oil was refined at the Amarillo plant of The Texas Co.

District 4 of the Texas Highway Department produced 56,410 tons of crushed limestone for concrete and roadstone and had 17,849 tons of paving sand produced under contract. Texas Sand & Gravel Co., Ltd., produced 155,900 tons of structural and paving sand, 150,000 tons of structural gravel, and 83,848 tons of paving gravel. Structural and paving sand and gravel also were prepared by Panhandle Gravel, Inc.

Presidio.—Contract for 9,585 tons of paving gravel was let by District 24 of the Texas Highway Department. Mercury development in the famous Terlingua district continued during the year. Some of the old familiar producers were Maggie, Mariposa, Fresno, and California Mountain. Various gem stones, including agate, opal, fossilized wood, fluorite, chalcedony, and jasper, were sought by collectors, tourists, and hobbyists.

Randall.—The oil and gas industries spent 61 crew-weeks in geophysical prospecting during 1957 compared with 12 in 1956. Production of 461,887 tons of crushed limestone for concrete and roadstone was reported by District 4 of the Texas Highway Department.

Reagan.—Exploratory drilling by the oil and gas industry proved 9 oil wells (4 were discovery wells ranging in depth from 1,774 to 10,294 feet), and 16 wells were dry holes. Geophysical prospecting totaled 72 crew-weeks, compared with 102 in 1956. Three gasoline plants recovered 89.5 million gallons of natural-gas liquids. Other mineral-fuel output included 8.9 million barrels of crude oil and 3,571 million cubic feet of natural gas. The 6-million-cubic-foot-daily Texon plant was purchased by Dorchester Corp., and the Barnhart plant was purchased by Northwest Production Corp. The gas-processing capacity of the Barnhart plant was increased 6 million cubic feet daily.

Red River.—The oil and gas industry drilled 15 exploratory wells resulting in 1 oil producer and 14 dry holes. Crude-oil production totaled nearly 15,000 barrels.

Reeves.—The oil and gas industry drilled 23 exploratory wells, proving 5 oil wells (2 oil discoveries), 1 gas well, and 17 dry holes. Geophysical prospecting amounted to 70 crew-weeks. The Tunstill gasoline plant of Pecos Petroleum Co. recovered natural-gas liquids. Nearly 614,000 barrels of crude oil and about 86 million cubic feet of natural gas were produced.

Building and paving sand and gravel were produced by F. M. Reeves & Sons. District 6 of the Texas Highway Department produced 17,500 tons of crushed limestone for concrete and roadstone.

Refugio.—Thirty exploratory wells were drilled and resulted in 7 oil producers, 6 gas producers, and 17 dry holes. Natural-gas liquids were recovered by the Tom O'Connor gasoline plant of Humble Oil & Refining Co. and by the plant of AG & CO Minerals Corp. Crude-oil production amounted to 18.3 million barrels and natural gas to 181,628 million cubic feet.

Roberts.—Exploratory drilling resulted in the discovery of the Brainard (Atoka) oilfield, 1 oil well, 3 gas wells, and 12 dry holes. Forty-three crew-weeks was spent in geophysical prospecting. Mineral-fuel production consisted of 1.5 million barrels of crude oil, 11,568

million cubic feet of natural gas and 1.2 million gallons of natural-gas liquids.

Robertson.—Ten crew-weeks was spent in geophysical exploration in 1957. Exploratory drilling resulted in 1 gas well and 5 dry holes. Mineral-fuel output consisted of 25,000 barrels of crude oil, 25 million cubic feet of natural gas, and 2,000 gallons of natural-gas liquids.

Structural and paving sand and gravel were produced from pits near Hearne by Gifford-Hill & Co., Inc.

Rockwall.—Approximately 25,000 tons of crushed sandstone was prepared by District 18 of the Texas Highway Department for concrete and roadstone.

Runnels.—The oil and gas industry drilled 86 exploratory wells that resulted in 22 oil wells, 3 gas wells, and 61 dry holes. Three gasoline plants recovered 15.5 million gallons of natural-gas liquids. Crude-oil production was 8.7 million barrels; natural gas, 211 million cubic feet.

Rusk.—The oil and gas industry spent 8 crew-weeks in geophysical prospecting and drilled 14 exploratory wells that accounted for 3 oil wells (1 was the discovery well of the Henderson Southwest (Travis Peak) oilfield) and 11 dry holes. Five gasoline plants recovered 231.3 million gallons of natural-gas liquids. Production of 226,000 barrels of crude oil and 3,028 million cubic feet of natural gas was reported.

Sabine.—The oil and gas industry spent 24 crew-weeks in geophysical prospecting.

The United States Forest Service produced 6,750 tons of paving gravel for road maintenance.

San Augustine.—The United States Forest Service acquired 9,801 tons of paving gravel for road maintenance.

The oil and gas industry spent 12 crew-weeks in geophysical prospecting.

San Jacinto.—The oil and gas industry spent 25 crew-weeks in geophysical prospecting and drilled 5 exploratory wells that resulted in 2 gas wells and 3 dry holes. Mineral-fuel production consisted of 547,000 barrels of crude oil, 3,968 million cubic feet of natural gas, and 6.2 million gallons of natural-gas liquids.

Building and paving sand and gravel were dredged from pits near Sheppard by Thorstenberg and Tamborello.

San Patricio.—Reynolds Metals Co. was expanding capacity at both its Sherwin alumina plant and San Patricio reduction works. A \$30-million program would increase alumina capacity of the Sherwin plant from 550,000 to 730,000 tons per year. This latest program was one of a series of expansions by Reynolds Metals Co. since the Korean War.

Of 61 exploratory wells drilled, 11 were oil productive (ranging in depth from 4,205 to 7,502 feet), 11 were gas productive, and 39 were dry holes. Recovery of 58.2 million gallons of natural-gas liquids was reported at 2 gasoline plants and 1 cycling plant. An output of 15.7 million barrels of crude oil and 63,299 million cubic feet of natural gas was reported. Heldenfels Bros. produced crushed limestone from pits near Mathis for use in concrete and as roadstone. Fordyce Gravel Co. produced 117,500 tons of structural and paving sand and 58,500 tons of structural and paving gravel.

Schleicher.—The oil and gas industry devoted 22 crew-weeks to

geophysical prospecting and drilled 26 exploratory wells that resulted in 3 oil wells, 4 gas wells, and 19 dry holes. Plant 23 of Sinclair Oil & Gas Co. recovered natural-gas liquids. Other mineral-fuel production included nearly 3 million barrels of crude oil and 506 million cubic feet of natural gas.

Scurry.—Exploratory drilling resulted in 9 oil wells, 5 of which were oil discoveries ranging in depth from 3,445 to 7,132 feet, and 20 holes were dry; 8 crew-weeks was spent in geophysical prospecting. Four gasoline plants recovered 110.3 million gallons of natural-gas liquids. Crude-oil output was 44.1 million barrels.

Shackelford.—The oil and gas industry spent 67 crew-weeks in geophysical prospecting and drilled 65 exploratory wells resulting in 9 oil producers and 56 dry holes. Natural-gas liquids were recovered by the Grayridge No. 1 gasoline plant of Grayridge Corp. and by the No. 1 plant of Marshall R. Young. Other mineral-fuel output consisted of 3.3 million barrels of crude oil and 3,685 million cubic feet of natural gas.

Taylor Bros. produced 6,335 tons of structural sand and 4,223 tons of structural gravel.

Shelby.—Mineral-fuel production consisted of 9,000 barrels of crude oil, 16,078 million cubic feet of natural gas, and 2.1 million gallons of natural-gas liquids.

The United States Forest Service produced 2,700 tons of paving sand and obtained 6,205 tons of paving gravel under contract.

Sherman.—Mineral-fuel production consisted of 15,000 barrels of crude oil and 148,875 million cubic feet of natural gas. Six crew-weeks was spent in geophysical prospecting.

Smith.—The oil and gas industry devoted 85 crew-weeks to geophysical prospecting and drilled 13 exploratory wells that resulted in 1 oil producer and 12 dry holes. Natural-gas liquids were recovered by the Chapel Hill cycling plant of Lone Star Producing Co. and by the Chapel Hill gasoline plant of ETEXAS Producers Gas Co. Crude-oil output amounted to 2.4 million barrels; natural gas 26,126 million cubic feet.

Tyler Pottery produced fire clay in the county. H. K. Ellis Sand Co. produced 5,250 tons of molding sand.

Starr.—Exploratory drilling proved 19 oil wells ranging in depth from 740 to 6,992 feet, 7 gas wells, and 43 dry holes. Natural-gas liquids were recovered by the Rincon plant of Continental Oil Co. and by the Sun plant of Sun Oil Co. Other mineral-fuel production included nearly 6.5 million barrels of crude oil and 30,952 million cubic feet of natural gas.

Pumicite (volcanic ash) was mined from open pits by Pozzolana, Inc. The Fordyce Gravel Co. produced 75,000 tons of structural and paving sand and 101,000 tons of structural and paving gravel. District 22 of the Texas Highway Department produced 63,735 tons of crushed sandstone for concrete and roadstone. Valley Brick and Tile Co. mined miscellaneous clay from open pits for heavy clay products.

Stephens.—The oil and gas industry devoted 38 crew-weeks to geophysical prospecting and drilled 57 exploratory wells that resulted in 12 oil producers ranging in depth from 2,553 to 4,413 feet, 4 gas wells, and 41 dry holes. Four gasoline plants recovered 14.6 million gallons of natural-gas liquids. Mineral-fuel output included 3.4

million barrels of crude oil and 3,869 million cubic feet of natural gas.

An output of 50,243 tons of crushed limestone was reported by District 23 of the Texas Highway Department for use in concrete and as roadstone.

Sterling.—Geophysical prospecting amounted to 13 crew-weeks. Crude-oil production was about 601,000 barrels.

Stonewall.—The oil and gas industry spent 29 crew-weeks in geophysical prospecting and drilled 38 exploratory wells that proved 8 oil wells ranging in depth from 4,981 to 6,489 feet; 30 holes were dry. Mineral-fuel production consisted of 9.4 million barrels of crude oil and 12.5 million gallons of natural-gas liquids.

Hamlin Sand & Gravel Co., Inc., produced 17,385 tons of structural and paving sand and 66,600 tons of structural and paving gravel.

Sutton.—Weirich Bros. produced 6,140 tons of paving gravel. Mineral-fuel production amounted to 9,000 barrels of crude oil, 8,592 million cubic feet of natural gas, and 47,000 gallons of natural-gas liquids. Exploratory drilling resulted in 3 gas wells and 6 dry holes; 16 crew-weeks was spent in geophysical prospecting.

Swisher.—Forty-four crew-weeks was spent in geophysical prospecting.

Tarrant.—Tarrant County is an important segment of the north central Texas industrial complex, which consists principally of metal fabricating and manufacturing industries. Crushed limestone was prepared by Trinity Division of General Portland Cement Co. for portland and masonry cements. Carruthers Cut Stone Co. quarried and prepared limestone for dressed building stone. Sand and gravel, used principally for structural and paving purposes, was produced under contract by several commercial firms and by District 2 of the Texas Highway Department.

Crude oil was refined at the plant of Premier Petroleum Co.

Taylor.—Exploratory drilling resulted in 12 oil discoveries ranging in depth from 1,768 to 4,692 feet and 100 dry holes. Production of 3.6 million barrels of crude oil and 6 million cubic feet of natural gas was reported. The Eskota gasoline plant of Otha H. Grimes recovered natural-gas liquids. Crude oil was refined at the Abilene plant of Monarch Refining Co.

Abilene Brick Co. produced 24,000 tons of miscellaneous clay for building brick and heavy clay products. Structural and paving sand and gravel were prepared by Atlas Sand-Gravel Co. Caton Sand & Gravel Co. produced 2,700 tons of structural sand and gravel. District 8 of the Texas Highway Department produced 86,060 tons of crushed limestone for concrete and for roadstone.

Terrell.—Geophysical prospecting amounted to 276 crew-weeks compared with 144 in 1956. Natural-gas production amounted to more than 94 million cubic feet.

District 6 of the Texas Highway Department produced 1,505 tons of crushed limestone for concrete and roadstone.

Terry.—The oil and gas industry devoted 30 crew-weeks to geophysical prospecting and drilled 15 exploratory wells that resulted in 6 oil wells (1 was the discovery well of Conoco (Wolfcamp) oilfield) and 9 dry holes. Carbon black was recovered from sour gas at the Seagraves No. 64 furnace plant of Columbian Carbon Co. A large volume of crude oil was produced in 1957.

Natural sodium sulfate was recovered from brine wells near Brownfield and prepared as salt cake by Ozark-Mahoning Co.

Throckmorton.—The oil and gas industry spent 58 crew-weeks in geophysical prospecting and drilled 150 exploratory wells that resulted in 29 oil wells (24 were oil discoveries ranging in depth from 3,648 to 4,796 feet) and 121 dry holes. Mineral-fuel production consisted of 3.7 million barrels of crude oil and 14 million cubic feet of natural gas.

Titus.—A total of 33 crew-weeks was devoted to geophysical prospecting. Crude oil was refined at the plant of American Petrophyna Co. Crude-oil production amounted to 4 million barrels.

Tom Green.—Exploratory drilling resulted in 3 oil discoveries ranging in depth from 1,370 to 5,684 feet and 44 dry holes. Mineral-fuel production consisted of 2.5 million barrels of crude oil, 122 million cubic feet of natural gas, and 984,000 gallons of natural-gas liquids.

Contracted production of 2,100 tons of structural gravel and 9,520 tons of paving gravel was reported by the city engineer of San Angelo, Tex.

Travis.—Crushed limestone was quarried by Texas Crushed Stone Co. for refractory, concrete, roadstone, and railroad ballast; by Austin White Lime Co. for manufacture of lime. Production of 92,000 tons of lime was used principally for agricultural, building, chemical, and industrial purposes. Texas Quarries, Inc., quarried and prepared 33,185 cubic feet of dimension limestone for dressed building stone. Dezendorf Marble Co. prepared marble for terrazzo and roofing granules at its Austin mill. The stone originated in Llano and Burnet Counties. Grinding pebbles were prepared by Dezendorf Marble Co. Structural sand and gravel was prepared by R. E. Janes Gravel Co. Crude oil production amounted to 36,000 barrels.

Trinity.—Forty crew-weeks was spent in geophysical prospecting by the oil and gas industry. Mineral-fuel production consisted of 52 million cubic feet of natural gas and 21,000 gallons of natural-gas liquids.

Tyler.—The oil and gas industry devoted 24 crew-weeks to geophysical prospecting and drilled 8 exploratory wells resulting in 3 oil discoveries and 5 dry holes. Mineral-fuels production consisted of 604,000 barrels of crude oil, 3,658 million cubic feet of natural gas, and 6.4 million gallons of natural-gas liquids.

Upshur.—Big Sandy Sand & Gravel Co. produced 10,000 tons of molding sand and 1,700 tons of engine sand. Crude-oil production amounted to 21.2 million barrels. Thirteen crew-weeks was spent in geophysical prospecting.

Upton.—The oil and gas industry spent 90 crew-weeks in geophysical prospecting and drilled 27 exploratory wells that accounted for 12 oil wells (5 were field-discovery wells), 1 gas well, and 14 dry holes. Four gasoline plants recovered 193.4 million gallons of natural-gas liquids. Additional mineral-fuel output consisted of 21.8 million barrels of crude oil and 12,740 million cubic feet of natural gas.

Uvalde.—Basalt and asphaltic limestone were produced by three companies in 1957. Basalt was used for concrete and roadstone; asphaltic stone for road surfacing and repairing.

Val Verde.—A total of 116 crew-weeks was spent in geophysical prospecting. Natural-gas production amounted to 117 million cubic feet.

District 22 of the Texas Highway Department produced 15,083 tons of crushed sandstone for concrete and roadstone.

Van Zandt.—Salt was recovered from wells and from an underground mine by Morton Salt Co.

The Van gasoline plant of Pure Oil Co. recovered natural-gas liquids. Other mineral-fuel output consisted of 8 million barrels of crude oil and 1,105 million cubic feet of natural gas. Twenty-two crew-weeks was spent in geophysical prospecting.

Victoria.—Exploratory drilling proved 4 oil wells, 11 gas wells, and 11 dry holes. Mineral-fuel production consisted of 5 million barrels of crude oil, 120,099 million cubic feet of natural gas, and 12.1 million gallons of natural-gas liquids.

The Fordyce Gravel Co. produced 188,000 tons of structural and paving sand and 298,500 tons of structural and paving gravel. Structural sand and gravel also was prepared by Heldenfels Bros. Production of 5,397 tons of crushed limestone for concrete and roadstone was reported by District 13 of the Texas Highway Department.

Walker.—Crude-oil output amounted to 6,000 barrels.

Bentonite, used principally in heavy drilling mud, was mined from open pits by Milwhite Co., Inc. Approximately 51,000 tons of crushed sandstone was produced for concrete and roadstone by District 17 of the Texas Highway Department.

Waller.—The bridge department of Hempstead, Tex., produced 78,019 tons of paving gravel for road construction. District 12 of the Texas Highway Department produced 4,294 tons of paving gravel, and an additional 956 tons was produced under contract.

Eighteen crew-weeks was spent in geophysical prospecting by the oil and gas industry. The Katy cycling plant of Humble Oil and Refining Co. recovered natural-gas liquids. Crude-oil production was 813,000 barrels; natural gas 197,295 million cubic feet.

Ward.—Natural sodium sulfate was recovered from brine and dry salt beds 9 miles southeast of Monahans by Ozark-Mahoning Co. for preparation of salt cake. Permian Sand & Gravel Co. prepared structural and paving sand and gravel from open pits near Royalty. F. M. Reeves & Sons leased a 2-acre tract to build a \$50,000 ready-mix concrete plant.

The oil and gas industry devoted 36 crew-weeks to geophysical prospecting and drilled 17 exploratory wells that proved 6 oil wells (4 were oilfield discoveries ranging in depth from 4,756 feet to 8,150), 1 gas well, and 10 dry holes. Natural-gas liquids totaling 21.4 million gallons were recovered by the Monahans gasoline plant of Gulf Oil Corp., by the Seely gas plant of El Paso Natural Gas Co., and by the Estes plant of Cabot Carbon Co. Crude oil was processed at the Wickett Refinery Co. A Catformer and a Unifiner of 1,000-barrel-per-day capacity were added to the refinery. Production of 6.9 million barrels of crude oil and 5,243 million cubic feet of natural gas was reported.

Washington.—Geophysical prospecting amounted to 16 crew-weeks. Mineral-fuel production consisted of 237,000 barrels of crude oil and 13 million cubic feet of natural gas.

An output of 19,700 tons of crushed sandstone for concrete and roadstone was reported by District 17 of the Texas Highway Department.

Webb.—Laredo Brick & Tile Co. produced 10,000 tons of miscellaneous clay from open pits near Laredo for building brick and heavy clay products. Miscellaneous clay was also produced from open pits on Chavana Ranch by E. C. Delachica Clay Co. Laredo Ready-Mix Corp. produced gravel for railroad ballast.

The Laredo smelter of National Lead Co. recovered antimonial metal from Mexican ores.

Mineral fuel output consisted of 2.2 million barrels of crude oil, 5,526 million cubic feet of natural gas, and 1.4 million gallons of natural-gas liquids.

Wharton.—Texas Gulf Sulphur Co. recovered sulfur by the Frasch process at Boling dome. Its new modern storage vats (1,200 feet long, 180 feet wide, and 50 feet high) at New Gulf contained approximately 500,000 long tons of pure sulfur. The company stopped exploratory drilling and surrendered State leases on salt domes off the Gulf coast in September. Approximately 156,000 tons of paving sand and 56,426 tons of paving gravel was produced under contract for District 13 of the Texas Highway Department.

The oil and gas industry devoted 29 crew-weeks to geophysical prospecting and drilled 27 exploratory wells that resulted in 1 oil well, 6 gas wells, and 20 dry holes. Crude-oil production was 6.2 million barrels; natural gas, 107,052 million cubic feet. The West Bernard gasoline plant of Tidewater Associated Oil Co. recovered natural-gas liquids.

Wheeler.—Contract production of 48,762 tons of paving gravel was reported by District 25 of the Texas Highway Department.

The McLean-28 gasoline plant of Warren Petroleum Corp. recovered natural-gas liquids. Carbon black was produced from sour gas at the Norric furnace plant of United Carbon Co., Inc. A total of 211 crew-weeks was spent in geophysical prospecting by the oil and gas industry. Mineral-fuel production consisted of 1.6 million barrels of crude oil and 18,640 million cubic feet of natural gas.

Wichita.—Crude capacity of the Wichita Falls Refinery of Panhandle Oil Co. was increased 1,000 barrels per day; fluid catalytic cracking capacity was increased 500 barrels per day by addition of a 3,000-barrel-per-day platformer.

A 3,500-barrel catalytic reformer unit was added to the Wichita Falls refinery of Continental Oil Co. as part of its \$1.5 million modernization program. Exploratory drilling resulted in 8 oil wells (1 was an oilfield discovery) and 20 dry holes. Four gasoline plants recovered 14.6 million gallons of natural-gas liquids. Crude-oil output was 11.2 million barrels; natural gas 13 million cubic feet.

Combined production of Foley Sand & Gravel Co., Gravel, Inc., and Northwest Materials Co. amounted to 67,939 tons of structural and paving sand and gravel and 653 tons of specialty sand.

Wilbarger.—The oil and gas industry spent 14 crew-weeks in geophysical prospecting and drilled 7 exploratory wells which resulted in 2 oil producers and 5 dry holes. Natural-gas liquids were recovered at the Electra gasoline plant of Magnolia Petroleum Co. and the Rock Crossing gasoline plant of the W. T. Waggoner estate. Crude-oil output amounted to 6.5 million barrels.

Willacy.—Mineral-fuel production consisted of 2.6 million barrels of crude oil, 5,281 million cubic feet of natural gas, and 888,000 gallons of natural-gas liquids.

Williamson.—Round Rock White Lime Co. and Whitestone Lime Co. produced 72,184 tons of lime for building, chemical, and industrial uses. The Leander Limestone Corp. produced 3,000 tons of dimension limestone for rough construction, 500 tons of rubble, 2,759 cubic feet of sawed stone, and 15,000 cubic feet of cut dressed building stone. Texas Quarries, Inc., produced 164,053 cubic feet of rough building stone and 197,660 cubic feet of dressed building stone. Round Rock White Lime Co. produced 39,830 tons of crushed limestone for concrete and roadstone. Crushed limestone for refractory and other general uses was produced by Superior Stone Products, Inc., and by Texas Carbonate Co.

Crude-oil production amounted to more than 39,000 barrels.

Wilson.—The oil and gas industry spent 16 crew-weeks in geophysical prospecting and drilled 52 exploratory wells, resulting in 1 oil discovery and 51 dry holes. Mineral-fuel production amounted to 1 million barrels of crude oil and 16 million cubic feet of natural gas.

Fire clay for building and face brick and tile was mined from open pits near Saspanco by W. S. Dickey Clay Manufacturing Co.

Winkler.—The oil and gas industry devoted 54 crew-weeks to geophysical prospecting and drilled 28 exploratory wells, resulting in 12 oil producers, 1 gas producer, and 15 dry holes. Three gasoline plants recovered 37.6 million gallons of natural-gas liquids. Other mineral-fuel production consisted of 29.2 million barrels of crude oil and 25,006 million cubic feet of natural gas.

Sulfur was recovered at the Keystone plant of Sid Richardson Gasoline Co.

Wise.—In August construction of the \$3 million gasoline plant of Wiseco Processing Plant, Inc., was begun. Plant capacity was rated at 150 million cubic feet of gas daily to yield approximately 220,000 gallons daily of propane, isobutane, butane, and natural gasoline. The Chico gasoline plant of Atlanta Gas Co. was purchased by Cities Service Oil Co. The plant was processing 12 million cubic feet of gas daily from the Alvord, Miles-Jackson, and Caughlin gasfield east of Chico and was recovering approximately 33,000 gallons of gas liquids daily. Crude-oil production was 2.5 million barrels and natural-gas production 18,860 million cubic feet. Exploratory drilling resulted in 13 oil discoveries ranging in depth from 2,046 to 6,200 feet, and 10 dry holes.

Acme Brick Co. mined miscellaneous clay from open pits for building brick and heavy clay products. Crushed limestone used for riprap, railroad ballast, metallurgical flux, concrete, roadstone, and agricultural lime was produced by Bridgeport Stone Co., Gifford-Hill & Co., Inc., and Southwest Stone Co.

Wood.—The oil and gas industry spent 48 crew-weeks in geophysical prospecting and drilled 18 exploratory wells that resulted in 1 oil producer and 17 dry holes. Natural-gas liquids were recovered by the Caska gasoline plant of Caska Corp. and by the Hawkins plant of Natural Gasoline Corp. Other mineral fuels produced were 20.5 million barrels of crude oil and 3,114 million cubic feet of natural gas.

Yoakum.—The oil and gas industry devoted 123 crew-weeks to geophysical prospecting and drilled 26 exploratory wells that resulted in 9 oil producers and 17 dry holes. Natural-gas liquids were recovered at the Wasson gasoline plant of Shell Oil Co. and by the Prentice plant of Honolulu Oil Corp. Crude-oil production totaled 18.7 million barrels.

Salt was produced from wells near Denver City by Frontier Chemical Co. for use in the chemical industry.

Young.—Exploratory drilling proved 35 oil wells, of which 22 were oilfield discoveries ranging in producing depths from 2,125 to 4,893 feet and 81 were dry holes. Geophysical prospecting amounted to 51 crew-weeks. Three gasoline plants recovered 4.3 million gallons of natural-gas liquids. Other mineral-fuel production consisted of 6.9 million barrels of crude oil and 1,024 million cubic feet of natural gas. Crude oil was refined at the Graham refinery of Graytex Corp.

Zapata.—Mineral-fuel production consisted of 774,000 barrels of crude oil and 4,148 million cubic feet of natural gas.

Zavala.—The oil and gas industry devoted 23 crew-weeks to geophysical prospecting and drilled 19 exploratory wells that resulted in 1 oil producer, 1 gas producer, and 17 dry holes. Mineral-fuel production amounted to 9,000 barrels of crude oil, 1,827 million cubic feet of natural gas, and 135,000 gallons of natural-gas liquids. Structural and paving sand and gravel were produced by the D-D Gravel Co.

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.

By William H. Kerns,¹ Frank J. Kelly,¹ and D. H. Mullen¹



THE VALUE of mineral production in Utah in 1957 declined \$43.5 million. This substantial drop resulted from a \$70.7 million decrease in value of metal output that was only partially offset by increases of \$16.7 million in nonmetals and \$10.5 million in mineral-fuels output. This overall decline followed 2 years of value increase; in 1957 the total value was less than it had been since 1954.

Metal output supplied 73 percent of the State's value of mineral production, with copper furnishing 40 percent. Most of the decline in the value of metal output resulted from a \$69.8 million decrease in the value of copper production. This substantial drop in value (33 percent) primarily was due to the fall in the price of copper throughout the year. Copper production actually declined only 5 percent (13,000 tons) in 1957, compared with 1956.

Other major changes in value of output of metals in Utah in 1957 that had significant effect on the total value of mineral production included increases of \$4.6 million in uranium ore and \$2.9 million in iron ore and decreases of \$2.8 million in lead, \$2.1 million in zinc, and \$1.3 million in gold.

Most of the \$16.7 million increase in the value of nonmetals in Utah in 1957 resulted from advances of \$11 million in value of sand and gravel production and \$5.2 million in stone output. Most of this increase in value resulted from the production of sand and gravel and stone used in the construction of the Southern Pacific Co. causeway that spans the north end of Great Salt Lake.

A \$5.8 million increase in the value of coal output and a \$4 million gain in petroleum output furnished most of the \$10.5 million advance in the total value of mineral fuels produced in Utah in 1957. A 5-percent advance in production of coal and a 59-cent rise in the average value per ton of coal supplied the added value for coal in 1957. Most of the advance in value of petroleum output resulted from a threefold increase in production from San Juan County, which was made possible by the completion of a 750-mile 16-inch crude-oil pipeline from the Aneth field to Los Angeles, California. This pipeline provided an additional daily capacity of 160,000 barrels of crude oil.

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TABLE 1.—Mineral production in Utah, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Asphalt and related bitumens, native: Gilsonite.....	(2)	(2)	206,041	\$4,259
Carbon dioxide.....thousand cubic feet.....	(2)	(2)	125,993	9
Clays ².....thousand short tons.....	227	\$492	164	473
Coal.....do.....	6,522	34,436	6,858	40,263
Copper (recoverable content of ores, etc.).....	250,604	213,013	237,857	143,190
Fluorspar.....	10,581	265	11,087	367
Gem stones.....	(4)	10	(4)	12
Gold (recoverable content of ores, etc.).....troy ounces.....	416,031	14,561	378,438	13,245
Iron ore (usable).....thousand long tons, gross weight.....	4,002	27,508	4,156	30,383
Lead (recoverable content of ores, etc.).....	49,555	15,560	44,471	12,719
Lime.....thousand short tons.....	55	830	53	821
Manganese ore ³ (35 percent or more Mn).....gross weight.....	-----	-----	142	12
Natural gas.....million cubic feet.....	17,268	2,435	19,000	2,700
Perlite.....	2,271	9	(2)	(2)
Petroleum (crude).....thousand 42-gallon barrels.....	2,466	5,302	4,093	9,291
Phosphate rock.....thousand long tons.....	125	772	114	756
Pumice.....thousand short tons.....	45	330	36	148
Salt.....do.....	184	1,471	221	2,013
Sand and gravel.....do.....	5,836	4,476	26,958	15,485
Silver (recoverable content of ores, etc.).....	-----	-----	-----	-----
.....thousand troy ounces.....	6,572	5,948	6,198	5,610
.....thousand short tons.....	2,322	3,298	7,854	8,540
Tungsten concentrate.....60-percent WO ₂ basis.....	11	41	-----	-----
Uranium ore.....	7,926,273	725,214	1,075,759	29,774
Vanadium.....thousand pounds.....	1,099	(2)	1,017	(2)
Zinc (recoverable content of ores, etc.).....	42,374	11,610	40,846	9,476
Items that cannot be disclosed: Cement, gypsum (crude), halloysite, molybdenum, natural gasoline, potash (K ₂ O), and values indicated by footnote 2.....	-----	33,352	-----	27,642
Total Utah ⁴	-----	399,759	-----	356,213

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Figure withheld to avoid disclosing confidential data of individual companies; value included with "Items that cannot be disclosed."

³ Excludes halloysite; value included with "Items that cannot be disclosed."

⁴ Weight not recorded.

⁵ Excludes shipments to Government purchase depot under the "low-grade" program; quantity and value for this manganese ore and concentrate are as follows: 1956—3,512 short tons, \$113,740; 1957—1,501 short tons, \$50,311.

⁶ Preliminary figure.

⁷ Revised figure.

⁸ Total adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

A number of new plants and additions to existing plants were completed, started, or planned in Utah in 1957. The Utah Copper Division of the Kennecott Copper Corp. continued work on its new haulage tunnel from the Bingham pit and completed the engineering on a planned addition to its powerplant. It also announced plans for construction of a pilot plant to recover pyrite from the Bingham ore and to produce sulfuric acid and sponge iron from the pyrite. Both products will be used in its copper-leaching operations. A pipeline from the Aneth field to Jal, N. Mex., which will provide an outlet for 50,000 barrels of crude oil, was begun. A 72-mile pipeline to transport gilsonite from the mine at Bonanza to the processing plant near Fruita, Colo., was placed in operation in April. Completion of the 90,000-kilowatt addition to the Utah Power & Light Co. plant at Carbon was largely responsible for the increased output of coal in Utah in 1957. Construction of the Columbia-Geneva Steel Division, United States Steel Corp., multimillion-dollar coal-preparation plant at Wellington was completed. Significant additions and improve-

TABLE 2.—Average unit value of selected mineral commodities produced in Utah, 1948-52 (average) and 1953-57¹

Commodity	1948-52 (average)	1953	1954	1955	1956	1957
Asphalt and related bitumens dollars per short ton..	27.41	36.10	35.87	37.64	42.94	20.67
Carbon dioxide cents per thousand cubic feet..	28.5	11.8	11.8	12.0	12.0	7.0
Cement.....dollars per barrel..	(?)	3.24	3.33	3.42	3.59	3.57
Clays.....dollars per short ton..	4.16	7.69	9.62	7.64	3.17	2.88
Coal.....do.....do.....	4.95	5.76	5.94	6.36	5.28	5.87
Copper.....cents per pound..	22.1	28.7	29.5	37.3	42.5	30.1
Fluorspar.....dollars per short ton..	21.56	24.15	18.70	20.63	25.09	34.61
Gold.....dollars per troy ounce..	35.00	35.00	35.00	35.00	35.00	35.00
Gypsum.....dollars per short ton..	3.29	3.22	3.50	3.68	3.75	3.50
Iron ore.....dollars per long ton..	2.13	5.74	6.34	6.42	6.87	7.31
Lead.....cents per pound..	16.1	13.1	13.7	14.9	15.7	14.3
Lime.....dollars per short ton..	10.07	11.99	14.19	15.06	15.06	15.39
Natural gas, cents per thousand cubic feet..	6.4	11.4	14.1	13.9	14.1	14.2
Natural gasoline.....cents per gallon..	(?)	7.7	6.0	6.7	7.1	6.3
Perlite.....dollars per short ton..	4.92	3.50	3.50	3.75	3.75	3.00
Petroleum.....dollars per barrel..	(?)	(?)	2.35	2.31	2.15	2.27
Phosphate rock.....dollars per long ton..	(?)	8.65	5.94	6.28	6.18	6.61
Potash (K ₂ O).....dollars per short ton..	(?)	33.78	33.67	36.32	33.14	32.60
Pumice.....do.....do.....	(?)	1.13	1.06	9.81	7.36	4.14
Salt.....do.....do.....	4.25	5.01	6.13	6.84	8.01	9.11
Sand and gravel.....cents per short ton..	68.1	68.7	67.4	64.2	76.7	57.4
Silver.....cents per troy ounce..	90.5+	90.5+	90.5+	90.5+	90.5+	90.5+
Stone.....dollars per short ton..	\$ 1.33	\$ 1.45	1.37	1.38	1.42	1.09
Tungsten concentrate dollars per short-ton unit..	(?)	57.72	61.35	58.03	60.61	-----
Zinc.....cents per pound..	14.9	11.5	10.8	12.3	13.7	11.6

¹ Prices discussed in detail in vol. 1, Mineral Yearbook, 1957.

² Figure withheld to avoid disclosing individual company confidential data.

³ Excludes halloysite.

⁴ Preliminary figure.

⁵ Stone for cement and lime excluded.

ments at 4 of the State's 5 oil refineries at Salt Lake City were completed or in progress at the end of the year. Texas-Zinc Minerals Corp. completed work on the 800-ton-per-day federally owned uranium-ore processing mill at Mexican Hat and began operations in November. An expansion and improvement program on the uranium-ore processing plant operated by Vitro Uranium Co. at Salt Lake City, begun in 1956, was completed. Plans were made to add a section to the Calera Mining Co. cobalt refinery at Garfield to extract the 2-percent nickel content in its present finished product.

EMPLOYMENT AND INJURIES

The annual average employment in the mining industry in Utah in 1957 (15,800) was greater than in 1956 (15,600). Average employment in mining was 16,000 for January, rose to a high of 16,200 for September, and dropped to 15,400 for December. The annual average weekly earnings in the mining industry in Utah in 1957 was \$99.40, weekly hours, 39.6, and hourly earnings, \$2.51, compared with \$96.17, 41.1, and \$2.34, respectively, in 1956.

Falling prices for metals in 1957 adversely affected employment in the mining industry in Utah. Major reductions in the labor force, reductions in the days in the workweek, and curtailment and suspension of operations were reported by a number of the principal metal producers. Because of a slackening in demand for some of its pipe-mill products, one steel company had a major layoff, which reflected on its mine producing iron ore.

According to Bureau of Mines preliminary data, 1 fatality occurred in the copper industry in Utah in 1957, 2 in uranium, and 18 in coal; excluding the sand and gravel segment, 570 lost-time injuries were reported in all the mineral industries.

TABLE 3.—Annual average employment in mining and other nonagricultural industries, 1956-57

[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	
	1956	1957	1956	1957
Mining ¹	15,600	15,800	6.7	6.6
Manufacturing ²	35,200	36,500	15.1	15.3
Contract construction ³	16,000	15,400	6.8	6.5
Transportation and public utilities.....	22,400	22,300	9.6	9.3
Wholesale and retail trade.....	54,800	56,400	23.4	23.6
Finance, insurance, and real estate.....	9,400	9,700	4.0	4.1
Service and miscellaneous.....	25,800	26,600	11.0	11.1
Government and education.....	54,700	56,100	23.4	23.5
Total nonagricultural.....	233,900	233,800	100.0	100.0

¹ Includes extraction of minerals occurring naturally, quarrying, well operation, milling, exploration and development of mineral properties, and removal of overburden.

² Includes smelting and refining of ferrous and nonferrous metals from ore which was a part of the mineral industry.

³ Includes some employees engaged in mining, quarrying, and removal of 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.

LEGISLATION AND GOVERNMENT PROGRAMS

The Federal Government continued its assistance in financing exploration projects in search of reserves of strategic and critical minerals in Utah in 1957 with the program administered by the Defense Minerals Exploration Administration (DMEA). During 1957, 9 contracts were executed for work in Utah, 1 for copper-lead-zinc, and 8 for uranium, for a total of \$472,639, compared with \$827,335 in 1956 and \$1,149,612 in 1955.

Manganese ore and concentrates were marketed from Utah under the Federal Government "carlot" and "low-grade" purchase programs administered by the General Services Administration (GSA). Shipments of Metallurgical-grade fluorspar were made from deposits in Utah under the GSA purchase program. Exhaustion of funds in December 1956 for the Government domestic-tungsten purchase program caused the discontinuation of the mining and milling of tungsten ores from Utah deposits in 1957. The uranium-mining and milling industry continued to market its output under the Government's purchase program.

TABLE 4.—DMEA contracts executed during 1957

County and contractor	Property	Commodity	Contract	
			1957	Total amount ¹
<i>Emery</i>				
Four Corners Uranium Corp....	Vanura 2 et al. claims.....	Uranium.....	June 11	\$102,592
<i>Juab</i>				
Western Resources, Inc.....	Sunbeam mine.....	Copper-lead-zinc..	Apr. 25	33,268
<i>San Juan</i>				
Bleak Uranium Co., Inc.....	Picolo Pete et al. claims.....	Uranium.....	Jan. 24	73,600
Dalmeid Oil & Uranium, Inc.....	April, Butte, and Canyon claims.....	do.....	Mar. 7	25,441
Daubert Chemical Co.....	Give Away et al. claims.....	do.....	Sept. 4	26,808
Maxim Exploration Co.....	Wild Horse claims.....	do.....	Nov. 14	103,700
Strategic Minerals Exploration Co. ²	Joan, La Ray, and Ella claims.....	do.....	June 3	6,750
Vanadium Queen Uranium Corp.	Vanadium Queen claims.....	do.....	May 29	53,872
Walter Duncan Mining Co.....	Markey Channel and Markey mine.....	do.....	Jan. 15	46,608
Total.....				472,639

¹ Government participation: Uranium, 75 percent; copper-lead-zinc, 50 percent.

² Property in Montrose County, Colo., and San Juan County, Utah; value of contract split 50-50.

REVIEW BY MINERAL COMMODITIES

METALS

Cobalt.—Calera Mining Co., subsidiary of Howe Sound Co., operated its cobalt refinery at Garfield throughout the year. Mill concentrate for the plant came from Calera's Blackbird mining and milling operation at Cobalt, Idaho. The company switched from the hydrogen-reduction process to the "electro-winning" method of processing concentrates. Plans were made to add a section to the refinery in 1958 to extract the 2-percent nickel now contained in the finished product. Howe Sound Co. announced that it would move its executive offices from New York City to Salt Lake City, effective January 1, 1958.

Copper.—Utah copper production in 1957 decreased 5 percent in quantity and 33 percent in value, compared with 1956. Utah was exceeded only by Arizona in copper output in 1957, and production was 2½ times that of the third largest copper-producing State—Montana. The value of copper output was 40 percent (\$143.2 million) of the total value of mineral production (\$356.2 million) in Utah in 1957.

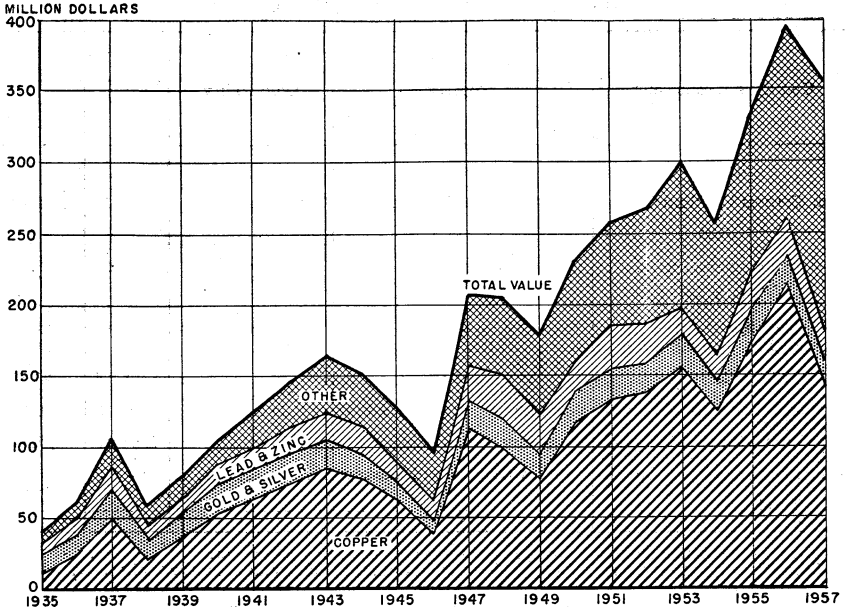


FIGURE 1.—Value of gold, silver, copper, lead, and zinc, and total value of all minerals in Utah, 1935–57.

The substantial decline of \$69.8 million in value of copper output in 1957, compared with 1956, resulted not only from the 13,000-ton decrease in copper production but also from the drop in the price of copper throughout the year. According to the Engineering and Mining Journal quotations the price of domestic refinery copper dropped from a high of 35.6-cents-per-pound average for the week of January 2 to a low of 26.138 cents for the week of November 6. Because of the decline work was discontinued on several copper prospects in the State.

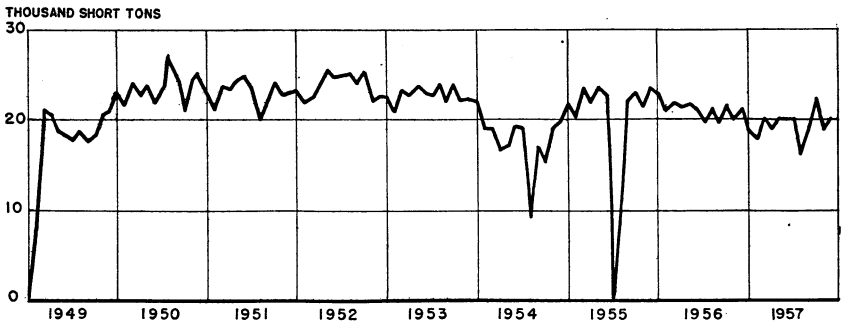


FIGURE 2.—Mine production of copper in Utah, 1949–57, by months, in terms of recoverable metals.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total, 1864-1957, 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		Fine ounces	Value	Fine ounces	Value
1948-52 (average)...	88	1	28,764,570	401,551	\$14,054,278	7,271,758	\$6,581,308
1953.....	55	1	30,682,662	453,430	16,920,050	6,725,807	6,087,195
1954.....	54	-----	24,846,805	403,401	14,119,935	6,179,243	5,592,627
1955.....	63	-----	28,598,662	441,206	15,442,210	6,250,565	5,657,077
1956.....	91	-----	33,232,267	416,031	14,561,085	6,572,041	5,948,029
1957.....	76	1	31,721,990	378,438	13,245,330	6,198,464	5,609,923
1864-1957.....	-----	-----	³ 892,891,038	15,194,900	432,046,540	795,237,462	592,927,984

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average)...	251,372	\$112,054,394	50,887	\$16,501,566	36,220	\$10,709,769	\$159,901,315
1953.....	269,496	154,690,704	41,522	10,878,764	29,184	6,712,320	195,289,033
1954.....	211,835	124,982,650	44,972	12,322,328	34,031	7,350,696	164,367,236
1955.....	232,949	173,779,954	50,452	15,034,696	43,556	10,714,776	220,628,713
1956.....	250,604	213,013,400	49,555	15,560,270	42,374	11,610,476	260,693,260
1957.....	237,857	143,189,914	44,471	12,718,706	40,846	9,476,272	184,240,145
1864-1957.....	7,626,577	2,854,262,939	4,954,146	652,593,190	1,397,777	247,954,191	4,779,764,844

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 6.—Mine production of gold, silver, copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	32,192	483,756	19,817	3,876	3,546
February.....	28,445	450,295	18,820	3,927	3,326
March.....	30,898	510,664	20,047	4,016	3,303
April.....	33,387	530,770	19,570	3,901	3,312
May.....	37,219	593,011	20,249	3,861	3,521
June.....	32,649	565,533	20,348	3,775	3,621
July.....	30,303	485,959	20,229	2,457	2,666
August.....	27,077	514,557	16,701	4,106	3,684
September.....	27,713	503,430	19,619	3,418	3,166
October.....	33,417	541,725	22,300	3,843	3,685
November.....	32,323	504,046	19,900	3,494	3,214
December.....	32,815	514,718	20,257	3,797	3,852
Total.....	378,438	6,198,464	237,857	44,471	40,846

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties and districts, in terms of recoverable metals

County and district	Mines producing (lode and placer) ¹	Lode material sold or treated ² (short tons)	Gold		Silver		Copper		Lead		Zinc		Total value
			Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver County:													
Rocky.....	1	12,738	19	\$665	3,260	\$2,950	89,600	\$26,970	37,600	\$5,377	5,000	\$580	\$30,885
San Francisco.....	2	2,730	27	949	1,757	1,841	110,500	33,260	51,500	7,364	42,500	4,990	41,919
Star and North Star.....	1	1,318	5	175	7,080	6,417	3,700	1,114					20,000
Total.....	4	16,806	51	1,785	11,124	11,291	203,800	61,344	89,100	12,741	47,500	5,510	92,504
Box Elder County: Newfound-land.....	1	51				5	1,800	542					542
Cache County: Box Elder.....	1	5				26	1,100	30					35
Grand County: La Sal.....	1	3				29	600	180					206
Juab County:													
Mount Nebo (Mona).....	1	6,000	1	35	780	706	78,800	23,719	141,600	20,249	961,200	111,499	20,990
Tintic.....	9	39,294	1,192	41,720	158,780	143,704	78,800	23,719	2,908,700	415,044	961,200	111,499	735,886
West Tintic.....	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Total.....	10	45,294	1,193	41,755	159,560	144,410	78,800	23,719	3,050,300	436,193	961,200	111,499	757,876
Millard County:													
Detroit (Drum Mountains).....	1	2			27	24	100	30					54
Sawtooth.....	1		11	385		1							386
Total.....	2	2	11	385	28	25	100	30					440
Morgan County:													
Argenta.....	2	46			104	94	700	211	10,200	1,459			1,553
Morgan.....	1	50			4								215
Total.....	3	96			108	98	700	211	10,200	1,459			1,768
Plute County:													
Gold Mountain.....	1	86	71	2,485	199	180	100	30					2,695
Mount Baldy.....	1	539	108	3,780	13,093	11,823	5,700	1,716	17,400	2,498	800	93	19,800
Ohio.....	2	131	5	175	892	656	900	271					982
Total.....	4	756	184	6,440	13,854	12,539	6,700	2,017	17,400	2,498	800	93	23,577

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, 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 (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold.....	1	186	138	204	100		
Dry gold-silver.....	14	20,852	737	60,839	161,800	820,700	32,000
Dry silver.....	28	103,222	1,869	452,614	717,800	1,173,700	8,300
Total.....	42	124,260	2,744	£13,657	879,700	1,994,400	40,300
Copper.....	10	30,933,883	352,735	2,871,007	460,791,500		1,100
Copper-zinc.....	1	44	15	15	4,100	400	16,700
Lead.....	21	34,680	783	225,684	123,300	5,793,200	518,200
Lead-zinc.....	12	543,577	21,228	2,419,027	3,964,200	79,687,700	77,689,000
Zinc.....	1	20		19		1,800	9,000
Total.....	41	31,512,204	374,746	5,515,752	464,883,100	85,483,100	78,234,000
Other "lode" material:							
Copper precipitates.....	3	6,201			9,777,200		
Mill cleanings (gold).....	1	50	32	42			
Old tailings (silver).....	6	58,789	887	163,818	132,400	1,019,400	
Old slag ²	3	26,687	18	5,194	41,600	445,100	3,417,700
Total.....	13	91,727	937	169,054	9,951,200	1,464,500	3,417,700
Total "lode" material.....	76	31,728,191	378,427	6,198,463	475,714,000	88,942,000	81,692,000
Gravel (placer operations).....	1		11	1			
Grand total.....	77	31,728,191	378,438	6,198,464	475,714,000	88,942,000	81,692,000

¹ Detail will not necessarily add to totals, because some mines produce more than 1 class of material.² Copper, 299 tons; lead, 1,168 tons; zinc, 25,220 tons.**TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery and types of materials processed, in terms of recoverable metals**

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore.....	67	5			
Mill cleanings.....	32	42			
Total recoverable in bullion.....	99	47			
Concentration, and smelting of concentrates:					
Ore.....	374,298	5,486,153	464,665,300	83,563,300	77,980,900
Old tailings.....		25,650	12,300		
Total.....	374,298	5,511,803	464,677,600	83,563,300	77,980,900
Direct-smelting:					
Ore.....	3,125	543,247	1,096,800	3,914,200	293,400
Copper precipitates.....			9,777,200		
Old slag.....	18	5,194	41,600	445,100	3,417,700
Old tailings.....	887	138,168	120,100	1,019,400	
Total.....	4,030	686,609	11,035,700	5,378,700	3,711,100
Other: Straight leaching of copper ore.....		4	700		
Placer.....	11	1			
Grand total.....	378,438	6,198,464	475,714,000	88,942,000	81,692,000

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Beaver.....	13, 974			479	22	8, 439	92, 500	46, 100	40, 400
Juab.....	14, 183			2, 084	238	32, 848	11, 800	908, 800	881, 900
Salt Lake.....	31, 278, 700			875, 740	365, 625	4, 332, 781	463, 116, 700	58, 307, 800	49, 906, 500
Summit.....	91, 379			20, 490	1, 182	565, 446	213, 900	10, 978, 300	15, 396, 500
Tooele.....	37, 613			9, 370	490	263, 848	275, 500	6, 714, 800	2, 516, 300
Utah.....	150	99	47						
Wasatch.....	64, 983			18, 201	6, 738	235, 631	941, 500	6, 607, 500	9, 239, 300
Washington.....	14, 558			173	3	72, 810	25, 700		
Total: 1957.....	31, 515, 540	99	47	926, 537	374, 298	5, 511, 803	464, 677, 600	83, 563, 300	77, 980, 900
1956.....	32, 935, 780			1, 046, 978	409, 996	5, 549, 122	490, 011, 400	91, 010, 700	76, 983, 600
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore.....	100	67	5						
Mill cleanings.....	50	32	42						
Dry silver:									
Crude ore.....	5, 267			92	3	47, 160	13, 400		
Old tailings.....	9, 291			81		25, 650	12, 300		
Copper: Crude ore.....	30, 932, 913			755, 370	352, 725	2, 870, 614	460, 622, 000		1, 100
Lead: Crude ore.....	25, 135			4, 103	382	150, 286	66, 000	4, 010, 900	418, 400
Lead-zinc: Crude ore.....	542, 784			166, 891	21, 188	2, 418, 093	3, 963, 900	79, 552, 400	77, 561, 400
Total: 1957.....	31, 515, 540	99	47	926, 537	374, 298	5, 511, 803	464, 677, 600	83, 563, 300	77, 980, 900
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS									
Copper.....				756, 809	352, 854	2, 969, 137	461, 394, 100	34, 100	
Copper-lead.....				139	265	11, 864	63, 900	33, 600	
Copper-lead-zinc.....				5, 444	4, 418	162, 762	440, 000	5, 488, 400	902, 400
Iron (from lead-zinc ore).....				30, 875	3, 349	87, 159	214, 200	563, 100	658, 300
Lead.....				67, 150	9, 772	1, 943, 123	1, 462, 000	71, 448, 100	6, 264, 900
Lead-zinc.....				815	191	32, 299	7, 800	771, 800	130, 800
Zinc.....				65, 305	3, 449	305, 459	1, 095, 600	5, 224, 200	70, 024, 500
Total: 1957.....				926, 537	374, 298	5, 511, 803	464, 677, 600	83, 563, 300	77, 980, 900

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For copper ore treated by straight leaching

	Ore treated (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Morgan.....	50	-----	4	700	-----	-----
Total: 1957.....	50	-----	4	700	-----	-----

C. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Beaver.....	2,832	29	3,852	111,300	43,000	7,100
Box Elder.....	51	-----	-----	1,800	-----	-----
Cache.....	5	-----	5	100	-----	-----
Grand.....	3	-----	29	600	-----	-----
Juab, Salt Lake, and Wayne ¹	67,327	1,260	239,790	9,929,500	3,180,000	3,135,100
Millard.....	2	-----	27	100	-----	-----
Morgan.....	46	-----	104	-----	10,200	-----
Piute.....	756	184	13,854	6,700	17,400	800
San Juan.....	12,131	3	1,285	508,700	14,300	-----
Summit.....	111,940	2,061	362,755	239,900	1,256,600	6,500
Tooele.....	4,545	53	5,364	39,600	212,300	385,100
Utah.....	11,859	490	58,835	18,900	641,300	159,500
Wasatch.....	48	-----	248	2,900	1,500	300
Washington.....	1,056	5	461	175,600	2,100	16,700
Total: 1957.....	212,601	4,030	686,609	11,035,700	5,378,700	3,711,100
1956.....	302,992	6,035	1,022,919	11,196,600	8,099,300	7,764,400

BY CLASSES OF MATERIAL

Dry gold: Crude ore.....	86	71	199	100	-----	-----
Dry gold-silver: Crude ore.....	20,852	737	60,839	161,800	820,700	32,000
Dry silver:						
Crude ore.....	97,955	1,866	405,454	704,400	1,173,700	8,300
Old tailings.....	49,498	887	138,168	120,100	1,019,400	-----
Copper:						
Crude ore.....	920	10	389	168,800	-----	-----
Precipitates.....	6,201	-----	-----	9,777,200	-----	-----
Old slag.....	299	2	119	19,900	1,700	-----
Copper-zinc: Crude ore.....	44	-----	15	4,100	400	16,700
Lead:						
Crude ore.....	9,545	401	75,398	57,300	1,782,300	99,800
Old slag.....	1,168	6	899	4,200	35,400	-----
Lead-zinc: Crude ore.....	793	40	934	300	135,300	127,600
Zinc:						
Crude ore.....	20	-----	19	-----	1,800	9,000
Old slag.....	25,220	10	4,176	17,500	408,000	3,417,700
Total: 1957.....	212,601	4,030	686,609	11,035,700	5,378,700	3,711,100

¹ Combined to avoid disclosure of confidential data of individual companies.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Copper.....	756, 809	352, 854	2, 969, 137	465, 473, 915	56, 869	66, 738
Copper-lead.....	139	265	11, 864	65, 170	55, 902	42, 761
Copper-lead-zinc.....	5, 444	4, 418	162, 762	578, 881	5, 717, 132	1, 171, 911
Iron (from lead-zinc ore).....	30, 875	3, 349	87, 159	285, 699	686, 826	8, 239, 003
Lead.....	67, 150	9, 772	1, 943, 123	1, 904, 499	73, 730, 840	8, 239, 003
Lead-zinc.....	815	191	32, 299	10, 032	804, 677	165, 848
Zinc.....	65, 305	3, 449	305, 459	1, 276, 456	6, 151, 631	71, 570, 980
Total: 1957.....	926, 537	374, 298	5, 511, 803	469, 594, 652	87, 103, 877	82, 112, 513
1956.....	1, 046, 978	409, 996	5, 549, 122	495, 997, 021	94, 295, 838	88, 801, 457
ORE TO STRAIGHT LEACHING PLANT						
Copper.....	50	-----	4	797	-----	-----
Total: 1957.....	50	-----	4	797	-----	-----
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold: Crude ore.....	86	71	199	142	-----	-----
Dry gold-silver: Crude ore.....	20, 852	737	60, 839	165, 573	1, 317, 547	40, 470
Dry silver:						
Crude ore.....	97, 955	1, 866	405, 454	719, 930	1, 948, 454	10, 615
Old tailings.....	49, 498	887	138, 168	122, 702	1, 698, 943	-----
Copper:						
Crude ore.....	920	10	389	172, 365	22	-----
Precipitates.....	6, 201	-----	-----	9, 863, 799	-----	-----
Old slag.....	299	2	119	20, 282	2, 915	-----
Copper-zinc: Crude ore.....	44	-----	15	4, 865	484	21, 115
Lead:						
Crude ore.....	9, 545	401	75, 398	75, 313	1, 852, 799	126, 774
Old slag.....	1, 168	6	899	5, 606	36, 907	-----
Lead-zinc: Crude ore.....	793	40	934	402	140, 559	161, 484
Zinc:						
Crude ore.....	20	-----	29	348	1, 915	11, 238
Old slag.....	25, 220	12	5, 571	128, 507	430, 972	4, 255, 345
Total: 1957.....	212, 601	4, 032	688, 014	11, 279, 834	7, 431, 517	4, 627, 041
1956.....	302, 992	6, 035	1, 024, 222	11, 604, 176	10, 737, 144	9, 258, 339

Under the pressure of falling metal prices, the Utah Copper Division of the Kennecott Copper Corp., the State's and the Nation's leading copper producer, initiated a strict economy program and shifted the emphasis from maximum output to efficiency and lower costs. Hiring new employees at the Division's operations was discontinued in September, and in November 290 employees at the mine, mills, and refinery were discharged. On December 15 the company announced a production cutback to become effective January 1, 1958. This cutback in production for the corporation's Western Mining Division (comprising Chino, Nevada, Ray, and Utah Copper Divisions) was to be 12 percent or about 3,800 tons of copper per month, accomplished by an overall reduction of the work-week from 7 to 6 days.

According to the Kennecott Copper Corp. annual printed report, 235,135 tons of copper was produced from all sources by the Utah

Copper Division in 1957, compared with 248,158 tons in 1956. The output in 1957 was 99 percent of Utah's total copper output and 22 percent of the United States' total.

The U. S. and Lark mine of the United States Smelting Refining and Mining Co. was the second-ranking copper producer in Utah. Copper was recovered from copper, lead, zinc, and iron (pyrite) concentrates produced from the ore (classed as lead-zinc ore) mined and milled. In addition, copper was recovered from ore (classed as silver and lead ores), and copper precipitate was shipped directly to smelters from this operation. A substantial quantity of copper was recovered as a byproduct of lead-zinc ore mined from the Mayflower mine by the New Park Mining Co. and leasers.

Gold.—Gold output in Utah declined 9 percent in 1957, compared with 1956, but the State continued to rank second only to South Dakota in terms of gold output. Most of the drop in output resulted from a reduction by the State's leading producer, Utah Copper Division, and reflected directly its decreased copper output because the gold was recovered entirely as a byproduct. U. S. and Lark and Mayflower mines were the second and third largest gold producers in the State, respectively. These 3 mines supplied 99 percent of the total gold output in Utah in 1957. Most of the gold output in the State was recovered from ores of copper, lead, and zinc; the remainder came from ores of gold and silver, old tailings, old slag, mill cleanup material, and gravel (placer operations).

Iron Ore.—Output (shipments) of iron ore in Utah in 1957 was 4 percent above 1956 in quantity and 10 percent above 1956 in value. The value of iron-ore output was 9 percent of the total value of mineral production in the State in 1957. Shipments were made from 10 mines, all in Iron County, by 4 operators—3 companies, and 1 individual. Columbia Iron Mining Co. (subsidiary of United States Steel Corp.) was the largest producer of iron ore, followed by Colorado. All the iron ore, with the exception of a small quantity used in cement, was shipped directly to plants for use in making pig iron and steel. The ore shipped had an average iron content of 52 percent.

TABLE 12.—Shipments of usable iron ore, 1948-52 (average), 1953-57, and total 1906-57

Year	Long tons	Value	Year	Long tons	Value
1948-52 (average).....	3,534,133	\$7,848,837	1956.....	4,001,739	\$27,508,089
1953.....	4,617,288	26,496,950	1957.....	4,155,988	30,383,465
1954.....	3,040,646	19,277,434	1906-57.....	50,808,505	187,732,523
1955.....	3,847,402	24,687,485			

Columbia Iron Mining Co. ore shipments (hematite mixed with a small quantity of magnetite) from the Desert Mound and Iron Mountain mines went to the Columbia-Geneva Steel Division, United States Steel Corp., blast and open-hearth furnaces at Geneva and Ironton. Resulting from a decreased demand for some of the products manufactured by this division, steel production was cut on October 13; 2 of the plant's 10 furnaces were idled, and approximately 225 men laid off. Early in December the United States Steel Corp.,

Consolidated Western Pipe Division, with a plant near the Geneva works, laid off 175 men because of a slackening demand for some of its pipe-mill products. Columbia-Genève Division completed the first phase of a project to increase its steel-making capacity of the Geneva works by 20 percent—from 2,077,000 to 2,262,000 ingot tons of steel per year. Eight of the ten Geneva open-hearth furnaces were rebuilt and enlarged to 300-ton-per-day capacity. The No. 1 blast furnace at Ironton was relined and overhauled.

Colorado Fuel & Iron Corp. shipped magnetite ore (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 hematite ore from the Excelsior mine to consumers in Utah and California. Helene E. Beatty shipped magnetite ore from the Great Western Placer, Juniper, Monta Rose, and Sandstone Nos. 1-8 mines in 1957. The ore, a float-material, was recovered from the surface by using an electromagnet mounted on the boom of a dragline, picked up and loaded into trucks with this equipment, and hauled to the nearest railhead spur that had car-loading facilities.

Lead.—Compared with 1956, the quantity of lead produced in Utah in 1957 decreased 12 percent, but the value declined 18 percent because of the continuing drop in the price for lead (and zinc) throughout the year.

The U. S. & Lark mine at Bingham, operated by United States Smelting Refining and Mining Co., was again by far the leading lead producer in Utah. It was followed in order of output by United Park City Mines Co., New Park Mining Co., Combined Metals Reduction Co., and United States Smelting Refining & Mining Co. Ophir Unit mines. These 5 operations supplied 95 percent of the total production of lead in Utah in 1957.

Operations at the U. S. & Lark mine continued throughout the year on an alternate 5- and 6-day-week basis. The Lark section was operated on a 2-shift-per-day basis, and the U. S. section on day shift only. Tonnage of ore produced was slightly less than for 1956, and the grade was somewhat lower. Work continued in the deepest levels at the U. S. section in search of ore-bearing formations, which have been productive on the upper levels of the mine.

According to the company annual report, United Park City Mines Co. found it necessary to eliminate most of the long-range development work and lay off about 20 percent of its employees to continue operating because of the decline in metal prices. Most of the 1957 production came from the Ontario section of the mine, where development resulted in finding additional ore. A small production was maintained from the Park Utah and Daly West sections throughout the year.

New Park Mining Co. stated in its annual printed report that it was able to show a profit from the operation of the Mayflower mine during the first 5 months of 1957 through a program of increased efficiency of operation by decreasing service personnel and by encouraging individual initiative. This changed to an operating loss by mid-September, and the mine was closed to protect the cash account and maintain the ore reserve. A group of about 60 former employees of the company was granted a lease on the mine, and production was

resumed in October. By late November the leasers had built the production to about two cars of ore per day.

Combined Metals Reduction Co. Calumet mine and Bauer mill and the United States Smelting Refining and Mining Co. Ophir Unit mine were operated by leasers throughout the year.

Bear Creek Mining Co., exploration subsidiary of Kennecott Copper Corp., continued its lead-zinc-copper-gold-silver exploration project on 10,000 acres of claims in the East Tintic district throughout the year. Centennial Development Co., contractor for the company, completed a 2½-compartment shaft 1,080 feet deep and was granted another contract covering 2,000 feet of exploratory drifting. More than 800 feet of the drifting was completed by the close of the year. Bear Creek also continued its diamond core drilling program in the area.

Manganese and Manganiferous Ore and Concentrate.—The recorded production of manganese ore and concentrate (35 percent or more manganese) was shipped by the Zenda Manganese Co. from the Zenda mine in Grand County to the Government under the "carlot" program administered by GSA. This ore had an average manganese content of 41.6 percent.

In addition, a total of 1,340 long dry tons of manganiferous ore and concentrate containing an average of 25.6 percent manganese and valued at \$50,311 was shipped from 4 mines in the State—2 in Juab and 1 each in Millard and Weber Counties—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.—In 1957 as in past years since the mine began molybdenum production in 1936, the Utah Copper mine (a Utah Copper Division, Kennecott Copper Corp. operation) was the sole producer of molybdenum in Utah. Molybdenum concentrate was recovered as a flotation byproduct of the treatment of copper ore from this mine at the company Arthur and Magna concentration mills. Because the output of molybdenum is dependent on production of copper and the copper output was down at this mine, production of molybdenum in 1957 was less than 1956.

Silver.—In 1957 in terms of silver output, Utah ranked second to Idaho and was followed by Montana. Production of silver declined 6 percent in 1957, compared with 1956. Eighty-nine percent of the silver output was recovered as a byproduct of ores of copper, lead, and zinc; 8 percent came from ores of gold and silver; and the remaining 3 percent was derived from mill cleanings, old tailings, old slag, and gravel (placer operations). The leading 5 silver producers in order of output—Utah Copper, U. S. & Lark, United Park City, Mayflower, and Calumet—supplied 87 percent of the State's silver in 1957.

Tungsten.—No production (shipments) of tungsten concentrate and no activity at tungsten mines were recorded in Utah in 1957. This resulted primarily from the exhaustion of funds in December 1956 for the Government domestic-tungsten purchase program, which paid \$55 per short-ton unit of WO_3 for tungsten concentrate. Salt Lake Tungsten Co. continued to operate its Salt Lake City refinery all

year except for a short period at the end of April and the beginning of May on high-grade tungsten ore from the Calvert Creek and Red Button properties at Glen, Mont., to produce tungsten concentrate under contract for domestic consumers. In December the company announced that the refinery would be closed shortly after the end of the year because of the low World price for tungsten concentrate which according to the Engineering and Mining Journal quotations declined from \$27.25-\$27.75 per short-ton unit of WO_3 on January 3 to \$11-\$13 on December 19, 1957, c. i. f., United States ports, duty extra.

Uranium.—Production of uranium ore in 1957 from 10 counties increased 16 percent in quantity and 29 percent in value compared with 1956. Major production was from San Juan, Emery, and Grand Counties. Shipments were made from 377 operations in 1957 and 510 operations in 1956. The 1,500-ton-a-day processing plant of Uranium Reduction Co. was dedicated on September 13, although the plant began operations in November 1956. Texas-Zinc Minerals Corp. completed construction of its 775-ton-a-day mill at Mexican Hat and began operations in November. The 600-ton-a-day Government-owned mill at Monticello, operated by National Lead Co., Inc., and the 550-ton-a-day plant of Vitro Uranium Co. at Salt Lake City were active the entire year.

Exploration and development activities continued at a high rate with the major portion in San Juan and Emery Counties. A total of 281,000 feet of drilling was completed in the State. Utah deposits were found generally at some depth and most of the development was through underground openings; 5,210 feet of shafts and winzes were sunk; and 73,726 feet of adits, drifts, and crosscuts were driven. Stripping operations for exploratory and development purposes removed 760,000 cubic yards of overburden. The estimate of ore reserves by AEC showed no increase at the end of the year over the estimate of 5.7 million tons on June 30; however the estimated grade increased from 0.36 to 0.37 percent uranium oxide. The ore-reserve estimate represented 7.3 percent of the total reserve in States west of the Mississippi River.

Federal Bureau of Mines data from 59 operations, which produced 85 percent of the uranium ore, showed an average employment on active days of 1,381 workers. A total of 3.2 million man-hours were worked with 2 fatal and 134 lost-time injuries, of which 2 were classified as permanent partial injuries.

Vanadium.—Some Utah uranium ores contained enough vanadium to warrant processing for recovery of the vanadium oxide. Vanadium was recovered from Utah ores processed at mills in southwestern Colorado. Processing mills in Utah were not equipped to recover vanadium. The quantity of recoverable vanadium in ores in 1957 was 1 million pounds, a decline of 7 percent from the 1.1 million pounds of recoverable vanadium in ores in 1956.

Zinc.—Zinc output in Utah in 1957 was 4 percent below that in 1956, but the value decreased 18 percent as a result of the drop in price of zinc during the year. For the first 4 months of the year the Engineering and Mining Journal quotation remained at 13.5 cents per pound. By the end of the first week in July the price had dropped to 10 cents per pound, where it stayed throughout the year. These

TABLE 13.—Mine production of uranium ore, July 1955—December 1957 1

County	July 1—December 31, 1955					1956					1957					
	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2
Beaver.....	2	(³)	(³)	(³)	8	1,487	6,607	\$26,073	5	4,047	17,520	\$71,386				
Box Elder.....	1	(³)	(³)	(³)	73	115,391	608,492	2,538,547	55	81,625	411,893	1,688,389				
Davis.....	1	(³)	(³)	(³)	67	6,869	51,842	225,103	55	4,401	44,221	198,687				
Emery.....	51	62,338	322,193	\$1,345,094	86	26,274	142,339	586,338	60	32,101	159,017	650,097				
Garfield.....	54	3,194	20,832	87,821	2	(³)	(³)	(³)	2	(³)	(³)	(³)				
Grand.....	52	13,297	82,666	351,016	2	(³)	(³)	(³)	6	(³)	(³)	(³)				
Juab.....	1	(³)	(³)	(³)	2	41,529	178,954	704,028	184	913,705	6,721,327	26,562,663				
Kane.....	4	(³)	(³)	(³)	240	732,124	4,920,368	21,097,057	2	(³)	(³)	(³)				
Piute.....	153	256,887	1,714,331	7,349,915	1	(³)	(³)	(³)	7	39,409	153,867	591,532				
San Juan.....	1	(³)	(³)	(³)	3	564	370	9,430	1	471	2,973	11,266				
Sevier.....	1	(³)	(³)	(³)	28	1,242	7,268	25,912	2	263	1,111	4,433				
Utah.....	11	445	2,384	9,718	510	926,273	5,918,975	25,214,942	377	1,075,769	7,510,008	29,774,340				
Washington.....		16,995	70,468	310,550												
Wayne.....																
Undistributed.....																
Total.....	380	353,166	2,218,874	9,454,114	510	926,273	5,918,975	25,214,942	377	1,075,769	7,510,008	29,774,340				

1 Based upon data supplied to the Bureau of Mines by A.R.C.

2 F. o. b. mine value: Base price, grade premiums, and exploration allowance.

3 Figure withheld to avoid disclosing confidential data of individual companies; included with "Undistributed."

falling metal prices for zinc (and lead) caused the curtailment of operations at some of the lead-zinc mines in Utah and cessation of company operations at others. Five operations in order of zinc output—U. S. & Lark, United Park City, and Mayflower mines, United States Smelting Refining and Mining Co. Midvale slag dump, and Ophir Unit mine—furnished 97 percent of the total zinc production in Utah in 1957. Ninety-five percent of the zinc was recovered from ore classed as lead-zinc ore; 1 percent came from gold-silver, silver, copper, copper-zinc, lead, and zinc ores; and 4 percent was produced from old slag.

MINERAL FUELS

The mineral fuels as a group represented 16 percent of the value of the State's mineral production. Of this, coal represented 11 percent and petroleum, 3 percent.

Asphalt and Related Bitumens.—The value of Uintahite (gilsonite) produced at mines in Uintah County increased in 1957. American Gilsonite Co. completed shaft sinking and construction of surface and underground facilities at its mine at Bonanza. A pipeline to transport the gilsonite to the processing plant near Fruita, Colo., was completed, and after a period of testing operations began in April. The crude gilsonite was processed to produce a high-grade metallurgical coke and high-octane gasoline. Standard Oil Co. of Ohio, through its subsidiary Sohio Petroleum Co., began a 2-year exploration program of the tar sands near Vernal in Uintah County. Preliminary estimates indicated a reserve of 2 to 3 billion tons of asphalt-bearing sand.

Carbon Dioxide.—Natural carbon dioxide gas produced at the Farnham Dome field in Carbon County decreased in 1957. The gas, transported by pipeline to Wellington, was converted into dry ice.

Coal.—Production of coal from 48 active underground mines in 1957 was 6.9 million tons, a 5-percent increase over the 6.5 million produced in 1956. Coal used at coke ovens in 1957 in Utah and California was 3.2 million tons, of which 1.6 million was in Utah and 1.6 million in California, an increase of 400,000 tons compared with

TABLE 14.—Production of coal, 1956–57, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1956		1957	
	Short tons	Average value per ton ¹	Short tons	Average value per ton ¹
Carbon.....	4,937,335	\$5.46	5,341,221	\$6.17
Emery.....	1,480,145	4.67	1,407,828	4.82
Garfield.....	1,352	4.85	1,213	4.71
Iron.....	36,996	5.15	39,612	4.65
Kane.....	2,269	4.85	1,228	4.71
Sevier.....	46,700	5.65	48,500	5.40
Summit.....	17,367	4.04	18,695	4.44
Total.....	6,522,164	5.28	6,858,297	5.87

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.)

1956. The demand for coal for thermal-power generation within the State was 370,000 tons, an increase of 64,000 over the previous year. The completion of the 90,000-kilowatt addition to the Utah Power & Light Co. Carbon plant at Castle Gate was largely responsible for the increase. The production of heat energy derived from coal at thermal-power plants in 1957 was 34 percent compared with 32 percent in 1956. The average employment, per active day, at 43 mines (which supplied 99 percent of the State's coal production) reporting to the Federal Bureau of Mines was 2,967 men—a 3-percent increase over 1956. A total of 5.2 million man-hours was worked with 18 fatalities and 211 lost-time injuries.

Natural Gas and Natural Gasoline.—Natural gas marketed from Utah wells in 1957 increased 10 percent compared with 1956. Production was from fields in 7 counties with 76 percent of the total from the Clear Creek field in Carbon and Emery Counties. Other important fields were Clay Basin in Daggett County, Bar X in Grand, Joe's Valley in Sanpete, and Red Wash in Uintah. In 1957 there were 7 gas discoveries—3 in Grand County, 2 in Uintah, and 1 each in Emery and San Juan Counties. Five successful development wells were completed. Natural gas from the Clay Basin field was processed at a plant in Daggett County for recovering natural gasoline. The quantity of natural gas used for thermal-power generation in 1957 was 8.6 million cubic feet, a decrease of 3.2 million from the previous year. The proportion of gas used for generating power was 29 percent in 1957 and 44 percent in 1956.

Petroleum.—Production of petroleum in 1957 was 4.1 million barrels, an increase of 1.6 million or 66 percent compared with 1956. Uintah County continued to lead the State in petroleum production, and in 1957 output increased substantially. Production from San Juan County increased more than threefold compared with 1956. Exploratory drilling, most of which was in the Paradox basin in San Juan County, increased from 86 completions in 1956 to 121 in 1957. Twelve new fields were discovered—10 in San Juan County and 1 each in Grand and Uintah Counties. Development drilling also was mostly in San Juan County and increased from 55 completions in 1956 to 146 in 1957, of which 121 were oil wells. Total drilling in 1957 was 1.4 million feet compared with 690,000 feet in 1956. The use of petroleum products for thermal-power generation increased from 892,000 barrels in 1956 to 1.5 million in 1957. The proportion of heat energy from petroleum for thermal-power generation in 1957 was 37 percent compared with 24 percent in 1956. Completion by the Four Corners Pipeline Co. of a 750-mile, 16-inch crude-oil line from Aneth field to Los Angeles, Calif., was of considerable impetus in increasing production. The line began filling in November. Capacity of the line will be 70,000 barrels a day, and 750,000 barrels will be required to fill the line. The Texas-New Mexico Pipeline Co. began construction of a 512-mile, 16-inch crude-oil pipeline from Aneth field to Jal, N. Mex., where it will connect with existing facilities to the Gulf Coast area. Capacity of the line will be 50,000 barrels a day; completion was expected early in 1958. The Salt Lake Pipeline Co. completed a 100-mile 10-inch crude-oil pipeline from the Rangely field in Colorado to Salt Lake City. Capacity of the line was 70,000 barrels

TABLE 15.—Production of crude petroleum, 1956-57, by counties ¹

(Thousand barrels)

County	1956	1957 (preliminary)	Principal fields in 1957 in order of production
Daggett.....		2	Clay Basin.
Duchesne.....	18	6	Flat Mesa, Duchesne.
Grand.....	2	15	Big Flat, Seiber Nose, Cisco.
San Juan.....	475	1,524	Aneth, Ratherford, McElmo, White Mesa, Ismay.
Uintah.....	1,774	2,543	Red Wash, Ashley Valley, Roosevelt, Brennan Bottom.
Washington.....		3	Virgin.
Undistributed.....	197		
Total.....	2,466	4,093	

¹ Distribution by counties effected by use of Utah Oil & Gas Conservation Commission data, adjusted to Bureau of Mines total.

a day, and additional pumping facilities could increase the capacity to 84,000 barrels a day.

A number of improvements and additions to refining plants in the Salt Lake City area were completed and under construction at the end of the year. Throughput of the 5 refineries in Utah (4 in the Salt Lake City area and 1 at Jensen) was 31.3 million barrels in 1957 compared to 31.2 million processed in 1956. Total daily capacity of the refineries at year end was 86,500 barrels.

TABLE 16.—Wildcat- and development-well completions in 1957, by counties

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage (in thousands)
Wildcat:					
Box Elder.....			2	2	1
Cache.....			2	2	11
Duchesne.....			1	1	2
Emery.....		1	7	8	34
Garfield.....			2	2	17
Grand.....	1	3	13	17	66
Kane.....			1	1	6
Millard.....			1	1	8
Salt Lake.....			1	1	4
San Juan.....	10	1	55	66	375
Sevier.....			3	3	11
Summit.....			1	1	4
Tooele.....			1	1	8
Uintah.....	1	2	8	11	50
Utah.....			1	1	8
Wayne.....			3	3	12
Total.....	12	7	102	121	617
Development:					
Carbon.....		1		1	12
Emery.....		1	1	2	4
Grand.....	1	2	2	5	14
San Juan.....	108		14	122	704
Sanpete.....			1	1	5
Uintah.....	12	1	2	15	92
Total.....	121	5	20	146	831
Total all drilling.....	133	12	122	267	1,448

NONMETALS

Anhydrous Ammonia.—On June 28, the nitrogen plant of the United States Steel Corp., Columbia-Geneva Steel Division, near Provo, was formally opened. The plant was designed for the production of anhydrous ammonia, nitric acid, and ammonium nitrate for the fertilizer industry.

Cement.—For the first time in several years shipments of cement declined. Sales of types I, II, III, V, waterproof-portland, and masonry cements in 1957 were 1 percent below 1956. The 4 kilns operated by Ideal Cement Co. and Portland Cement Co. of Utah were engaged for 327 and 318 days, respectively, in 1957 compared with 330 and 326 days in 1956. Cement rock mined by both companies supplied the requirements for limestone and shale; gypsum, slag, sand, sandstone, iron ore, and miscellaneous other raw materials were purchased from various other producers. The finished cements were distributed to consumers in Arizona, Colorado, Idaho, Nevada, New Mexico, and Wyoming, as well as points in Utah.

Clays.—In terms of value, halloysite from the Dragon mine operated by Filtrol Corp. was the most important type of clay produced in Utah during 1957; however, the total quantity of halloysite mined as well as the quantity of fire clay and shale sold or used was considerably below 1956 levels. A cutback in building construction, particularly during the last half of 1957, was one of the principal reasons for the decline.

Miscellaneous clay continued to supply the bulk of the total clay tonnage produced in 1957. Mine production was reported by Interstate Brick Co. in Morgan County; Utah Fire Clay Co. in Summit County; Interstate Brick Co. and Utah Fire Clay in Tooele County; Interstate Brick Co., United Brick Co., and Lloyd R. Stubbs in Utah County; and Harrisville Brick Co. in Weber County. Western Clay & Minerals Co. continued to produce fuller's earth and bentonite at its Redmond and Aurora pits; and Wadley Clay Co., Western Fire Clay Co., and Utah Fire Clay Co. reported output of fire clay in Utah County.

Five brick plants operated during 1957, the newest the United Brick Co. plant at Lehi. Utah Fire Clay Co. and Interstate Brick Co., with plants at Salt Lake City, were the principal operators. Brick plants were active at Ogden and Provo.

Fluorspar.—Shipments of Metallurgical-grade fluorspar continued to increase during 1957, and by year end reached 11,100 tons, 5 percent more than in 1956. Willden Bros., operating the Lost Sheep mine, and Chesley & Black, the Fluorine Queen, were the principal shippers, furnishing 70 percent of total shipments. Other mine operators were T. A. Claridge, Blowout mine; George P. Spor, Fluoride mine; and Quo Vadis Mines, Inc., Bell Hill mine. The latter company purchased the Bell Hill mine from the Bell Hill Mining Co. during the first quarter of 1957. The company also constructed an Acid-grade mill at Delta, but, according to reports, no shipments of Acid-grade fluorspar were made in 1957. Fifty-five tons of Metallurgical-grade spar was shipped to a steel plant.

Gem Stones.—The value of gem and ornamental stones and mineral specimens collected in Utah continued to rise and in 1957 reached

\$12,000. Material was reportedly collected in seven counties as well as an abundance of stones, origin unknown. In terms of value petrified wood was the most important stone, followed by variscite (green hydrous phosphate of aluminum). The latter gem was collected in the Lucin area of Box Elder County. Jasper, agate, calcite, dinosaur bone, obsidian, and miscellaneous mineral specimens also were collected.

Gypsum.—The production of crude gypsum from deposits in the Sigurd (Sevier County) region increased 2 percent in 1957 and thus reversed somewhat the sharp decline reported in 1956. United States Gypsum Co. continued to operate its mine and calcining plant at Sigurd. Western Gypsum Co. was absorbed by the Bestwall Gypsum Co. in January 1957, and the latter company mined and calcined gypsum throughout 1957. The Bestwall calcining plant consisted of 3 kettles and 3 beehive calciners, which produced calcine material used in manufacturing building products, pottery, dental and orthopedic plaster, and for industrial molding, art, and casting plaster. Crude gypsum was sold as a portland-cement retarder, for agricultural use, and as a filler.

Lime.—Kennecott Copper Corp. continued to be the principal producer of lime in Utah. Total output for the year declined slightly as a result of a cutback in consumption of lime by Kennecott Copper Corp. in the treatment of base-metal ores. Open-market lime was produced by Utah Lime & Stone Co. at Grantsville and Lakeside Lime & Stone Co. at Lehi. Two rotary kilns and two continuous hydrators were operated during 1957 by Kennecott, using natural gas and bituminous coal as fuel. Eleven shaft kilns, 1 batch, and 1 continuous hydrator using coke and oil as fuel were operated by the 2 open-market producers. The Marblehead Lime Co. of Chicago announced its plans to construct a lime plant at a site 3 miles northwest of Delle, Tooele County.

Perlite.—Output of crude perlite by Acme Lite Wate Products, Inc., the only producer in 1957, continued to decline. Crude material from the company's Beaver County deposit was used at its own expanding plant at Salt Lake City. Bestwall Gypsum Co. expanded perlite at the company's plant at Sigurd, Sevier County. The principal use for the expanded product was building plaster, although small quantities were used in concrete aggregate and as a soil conditioner.

Phosphate Rock.—Construction of a new beneficiation plant by San Francisco Chemical Co. at Leefe, Wyo., resulted in a temporary reduction in the need for crude rock from the company's Utah mine. Output in 1957 dropped 8 percent to 114,000 tons. San Francisco Chemical Co. began extensive preparations for exploiting the Humphreys phosphate deposit 15 miles north of Vernal. The ore reserve was reported to be 700 million tons of 21 percent P_2O_5 . Initially, the project will have a production of 2,000 tons per day, treated by flotation. Most of the resulting concentrate will go to an electric furnace for producing elemental phosphorus, but some will be shipped to the Western Phosphates, Inc., plant at Garfield for conversion to commercial fertilizer.

Potash.—Production of potassium salts in Utah during 1957 continued to climb and was 29 percent greater than in 1956. Bonneville,

Ltd., was the only potash producer and during 1957 realized first production from its quarter-million-dollar prilling plant. No crude alunite was mined, but the Calunite Corp. reported the sale of 1,200 tons of processed alunite valued at \$19,800. Delhi-Taylor Oil Co. continued exploration and development work on its potash deposit in the Seven Mile anticline area near Moab, Grand County. The company controlled 25,000 acres in potash leases and arrangements were made to provide power, water, and tailing facilities for the operation.

Pumice.—Although production of scoria, pumicite, and pumice fell 20 percent below 1956, output was considerably above the average of the previous several years. Christensen Construction Co., operating the Red Dome claims near Fillmore, was the principal producer; the scoria mined was used as concrete aggregate. Utah Lavalite, Inc., produced expanded lava from its property near Milford for use as an abrasive. William H. Prince & Sons Block Co., Inc., reduced shipments from its Utah Pink Pumice claims; the company substituted lightweight aggregate for block manufacturing.

Salt.—Salt continued to be one of the more important commodities produced by the mineral industry of Utah. Sales of rock and solar-evaporated salt rose to 221,000 tons valued at \$2 million, 20 and 37 percent greater than in 1956. The bulk of the salt produced was solar evaporated and came from ponds operated by Morton Salt Co., Salt Lake County, Deseret Salt Co. and Solar Salt Co. in Tooele County, and Lake Crystal Salt Co. in Box Elder County. Stansbury Salt Co. merged with a new firm on January 1, 1957, to form the Solar Salt Co., which operated the former company's Grantsville facility. Output of rock salt was reported by Royal Crystal Salt Co., Sanpete County, and Poulson Bros. Salt Co. in Sevier County.

Sand and Gravel.—The rise in the output of sand and gravel in 1957 (27 million tons) compared with 1956 (6 million tons) was due almost entirely to the activities of Morrison-Knudsen Co., Inc., at the Southern Pacific Co.'s causeway spanning the north end of Great Salt Lake. At the beginning of 1957, Morrison-Knudsen Co., Inc., according to reports, began moving the first 19 million yards of sand and gravel over its 2-mile-long conveyor system. The aggregate was excavated from the mountains rimming the Upper Little Valley and discharged onto the 54-inch conveyor belt for ultimate delivery to the trench dredged in the bottom of Salt Lake.

Output of sand and gravel for building and highway construction alone exceeded the 1956 level by a substantial margin. Paving sand and gravel produced by commercial and Government-and-contractor operators supplied the bulk of the output; the major portion was produced and consumed in Salt Lake County. Utah County was the second-ranking producing region, and Cache County third most important. Utah Sand & Gravel Products Corp., Vernal Sand & Gravel Co., Gibbons & Reed, Thorn Rock Products Co., and Wangsgaard Construction Co. were some of the principal producers. Sand and gravel was produced in 23 counties from 49 commercial and 40 Government-and-contractor operations. Washed, screened, or otherwise prepared material comprised 42 percent of the Government-and-contractor production. Comparable figures for commercial out-

TABLE 17.—Sand and gravel sold or used by producers, 1956-57 by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton ¹		Total (thousands)	Average per ton ¹
COMMERCIAL OPERATIONS						
Sand:						
Molding.....	(²)	(²)	(²)	(²)	(²)	(²)
Building.....	878	\$650	\$0.74	653	\$567	\$0.87
Paving.....	298	304	1.02	361	350	.97
Grinding and polishing.....	(²)	(²)	(²)			
Blast.....	(²)	(²)	(²)			
Fire or furnace.....	20	10	.50	(²)	(²)	(²)
Engine.....	(²)	(²)	(²)	(²)	(²)	(²)
Other.....	61	82	1.36	9,070	4,619	.51
Total.....	1,257	1,046	.83	10,084	5,536	.55
Gravel:						
Building.....	811	614	.76	815	713	.88
Paving.....	1,222	976	.80	1,906	1,579	.83
Railroad ballast.....	69	41	.59	(²)	(²)	(²)
Other.....	270	146	.54	11,124	5,567	.50
Total.....	2,372	1,777	.75	13,845	7,859	.57
Total sand and gravel.....	3,629	2,823	.78	23,929	13,395	.56
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	71	116	1.63	3	6	2.22
Paving.....	182	126	.69	32	39	1.22
Total.....	253	242	.95	35	45	1.30
Gravel:						
Building.....	298	256	.86	753	636	.84
Paving.....	1,656	1,155	.70	2,241	1,409	.63
Total.....	1,954	1,411	.72	2,994	2,045	.68
Total sand and gravel.....	2,207	1,653	.75	3,029	2,090	.69
ALL OPERATIONS						
Sand.....	1,510	1,288	.85	10,119	5,581	.55
Gravel.....	4,326	3,188	.74	16,839	9,904	.59
Grand total.....	5,836	4,476	.77	26,958	15,485	.57

¹ Calculated before rounding.² Figure withheld to avoid disclosing confidential data of individual companies; included with "Other."

put were not available due to the inclusion of vast quantities of aggregate used as fill.

In the highway-construction category (the major factor affecting sand and gravel production) Utah was not as active a participant in the national highway program as were most of the other Rocky Mountain States. In its December 31 report the Federal Bureau of Public Roads showed that Utah ranked 45th in the nation in mileage of all construction underway on the interstate system, with one-tenth of a mile. In all mileage completed on the 41,000-mile superhighway network, Utah ranked 24th, with 12.8 miles. For total work programmed in all stages of planning and construction since the Federal Aid effort began in July 1956, Utah was 27th, with 77.4 miles. In

construction-contract mileage approved since July 1956, Utah was 33d, with 21.6 miles.

Stone.—Although crushed limestone for cement, flux, as a refractory, for sugar refining, and concrete aggregate was the most widely used by the industries of Utah, crushed miscellaneous stone was the ranking stone in 1957. Total output of stone for the year reached 7.9 million tons. The construction of a causeway for the Southern Pacific Co. across North Great Salt Lake was the reason for the tremendous increase in output. The bulk of the stone—9 million yards—required for the causeway was removed from the No. 2 quarry, a short distance east of the Little Valley shoreline. The rock was moved by truck to the shoreline and discharged into barges for the trip to the causeway. Crushed-limestone production was 1.72 million tons in 1957 compared with 1.69 million tons in 1956. The principal operator was United States Steel Corp., Columbia-Geneva Division, followed by Ideal Cement Co., Portland Cement Co. of Utah, and Utah Lime & Stone Co. Crushed sandstone used as a refractory and concrete aggregate totaled 122,000 tons; it was supplemented by 1,100 tons of dimension sandstone quarried by Otto Buehner, Mountain Park Quarries, and Utah Scenic Stone Corp.

TABLE 18.—Production of stone in 1957, by counties

County	Short tons	Value	County	Short tons	Value
Box Elder.....	5,983,800	\$5,983,800	Tooele.....	(1)	(1)
Cache.....	146,900	198,800	Utah.....	(1)	(1)
Daggett.....	800	5,200	Wasatch.....	21,000	\$33,600
Davis.....	2,200	6,200	Washington.....	(1)	(1)
Juab.....	(1)	(1)	Weber.....	15,900	40,700
Morgan.....	(1)	(1)	Other counties.....	1,435,312	1,842,900
Salt Lake.....	245,325	401,000	Total.....	7,853,875	8,540,050
Summit.....	2,638	27,850			

¹ Figure withheld to avoid disclosing confidential data of individual companies; included with "Other counties."

TABLE 19.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....			¹ 947,129	¹ \$1,288,444	33,645	\$128,004
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
Year	Other stone		Total			
	Short tons	Value	Short tons	Value		
1953.....	16,556	\$30,146	¹ 997,330	¹ \$1,446,594		
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		

¹ Excludes stone used for cement and lime.

TABLE 20.—Stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble.....short tons..	(1)	(1)	(1)	(1)
Dressed stone.....cubic feet..	(1)	(1)	(1)	(1)
Approximate equivalent in short tons.....	-----	-----	-----	-----
Sawed stone.....cubic feet..	(1)	(1)	(1)	(1)
Approximate equivalent in short tons.....	-----	-----	-----	-----
Flagging.....cubic feet..	(1)	(1)	(1)	(1)
Approximate equivalent in short tons.....	-----	-----	-----	-----
Total dimension stone (quantities approxi- mate in short tons).....	2,706	\$54,268	1,075	\$28,350
Crushed and broken stone:				
Riprap.....short tons..	202,521	149,539	27,300	59,800
Metallurgical.....do.....	796,110	1,071,421	876,900	1,148,400
Concrete and roadstone.....do.....	44,981	67,471	130,900	80,600
Railroad ballast.....do.....	38,512	119,120	2,500	2,000
Chemical.....do.....	1,236,806	1,836,187	49,800	153,900
Miscellaneous.....do.....	1,236,806	1,836,187	6,765,400	7,067,000
Total crushed and broken stone.....do.....	2,318,930	3,243,738	7,852,800	8,511,700
Grand total (quantities approximate in short tons).....	2,321,636	3,298,006	7,853,875	8,540,050

¹ Figure withheld to avoid disclosing confidential data of individual companies.

² Includes limestone used in coal dust, poultry grit, cement, lime, roofing granules, asphalt, filler beds, oil mat, and rock fill.

³ Includes limestone used in coal dust, poultry grit, cement, lime, roofing chips, and rock fill.

Sulfuric Acid.—New supplies of sulfuric acid were in the offing for the Salt Lake Valley and the chemical industry of Utah. During 1957 Kennecott Copper Corp. announced its plans for constructing a pilot plant, which will test flotation of pyritic materials from tailings at its Arthur and Magna mills. Pyrites so removed would be treated for the sulfur and iron content, which would be transformed by carbonization to sponge iron. The sponge iron would replace “detinned” tin cans used in the company’s precipitation plant. Garfield Chemical & Manufacturing Corp. continued to operate its sulfuric-acid plant at Garfield using smelter gases as a source material.

Talc.—The Ogden plant of Tri-State Minerals Co. operated throughout 1957 on ore received from the company’s mines in California and Montana. A brief description of Tri-State operations in Montana and Utah was published.²

Vermiculite.—Exfoliated vermiculite marketed under the trade name Zonolite was produced by Vermiculite-Intermountain, Inc., at its Salt Lake City plant. The company used crude material received from Montana, and the finished product was used for insulation, fireproofing, plaster, and acoustic material.

REVIEW BY COUNTIES

Beaver.—Gold, silver, copper, lead, and zinc output furnished 52 percent of the total value of mineral production in Beaver County in 1957; uranium ore, 39 percent, and perlite and sand and gravel, the remainder.

² Pit and Quarry, Extensive Talc Deposits Supply Utah, Montana Plants: Vol. 50 No. 2, Aug. 1957, pp. 90, 91, 120.

TABLE 21.—Value of mineral production in Utah, 1956–57, by counties

County	1956 ¹	1957 ²	Minerals produced in 1957 in order of value
Beaver.....	\$148,315	\$180,218	Uranium ore, copper, perlite, lead, silver, zinc, sand and gravel, gold.
Box Elder.....	775,421	16,300,907	Sand and gravel, stone, salt, gem stones, copper.
Cache.....	450,186	987,035	Sand and gravel, stone, copper, silver.
Carbon.....	28,973,450	35,129,943	Coal, natural gas, sand and gravel, carbon dioxide.
Daggett ³	210,628	251,595	Natural gas, sand and gravel, stone, petroleum.
Davis.....	485,319	267,800	Sand and gravel, stone.
Duchesne.....	40,075	12,264	Petroleum.
Emery ⁴	9,529,260	8,482,198	Coal, uranium ore, natural gas.
Garfield ⁴	273,759	207,456	Uranium ore, coal, gem stones.
Grand ⁴	708,157	808,350	Uranium ore, natural gas, sand and gravel, petroleum, manganese ore and concentrates, copper, gem stones, silver.
Iron.....	27,784,673	30,650,540	Iron ore, coal, sand and gravel, gem stones.
Juab ⁴	⁶ 3,821,918	2,599,942	Clays, lead, fluor spar, silver, zinc, stone, uranium ore, gold, copper.
Kane.....	⁶ 36,315	22,134	Sand and gravel, coal, gem stones.
Millard ⁵	385,811	184,909	Pumice, sand and gravel, gem stones, gold, copper, silver.
Morgan.....	6,915,427	6,481,694	Cement, stone, sand and gravel, clays, lead, copper, silver.
Piute.....	⁷ 708,325	(⁸)	Uranium ore, silver, gold, lead, copper, zinc.
Rich.....	774,585	775,602	Phosphate rock, sand and gravel.
Salt Lake.....	269,428,127	194,608,203	Copper, molybdenum, gold, lead, zinc, silver, sand and gravel, cement, salt, stone, lime.
San Juan ⁴	22,278,326	32,479,966	Uranium ore, petroleum, copper, sand and gravel, natural gas, lead, silver, gold.
Sanpete.....	124,538	176,848	Natural gas, sand and gravel, salt.
Sevier.....	⁶ 1,106,363	1,067,880	Gypsum, coal, clays, sand and gravel, salt.
Summit.....	5,569,691	4,795,778	Zinc, lead, silver, copper, gold, coal, sand and gravel, stone, clays.
Tooele.....	⁷ 4,146,997	4,419,688	Potash, lead, salt, lime, zinc, stone, silver, clays, copper, gold, sand and gravel.
Uintah.....	⁹ 4,108,434	10,905,964	Petroleum, gilsonite, sand and gravel, natural gas, uranium ore.
Utah.....	2,575,985	2,384,193	Stone, sand and gravel, clays, lime, lead, silver, gold, zinc, copper, pumice.
Wasatch.....	2,955,678	2,800,557	Zinc, lead, copper, gold, silver, stone, sand and gravel.
Washington.....	143,653	167,609	Silver, copper, sand and gravel, uranium ore, petroleum, stone, zinc, lead, gold, gem stones.
Wayne ⁴	30,712	(⁸)	Uranium ore, copper, silver.
Weber ⁵	304,700	381,201	Sand and gravel, stone, clays.
Undistributed ¹⁰	6,138,904	2,406,023	
Total ¹¹	399,759,000	356,213,000	

¹ Revised to include uranium and natural gas, except as indicated by footnotes 6 and 9.

² Natural gas and petroleum are preliminary.

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 Uranium withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁷ Revised figure.

⁸ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁹ Gilonite and uranium withheld to avoid disclosing individual company confidential data; included with "Undistributed."

¹⁰ Includes all gilsonite (1956), vanadium, natural gasoline, and some petroleum (1956), sand and gravel (1956), gem stones, uranium (1956), and values indicated by footnote 8.

¹¹ Total adjusted to eliminate duplication in value of raw materials used in manufacture of cement and lime.

The Harrington Hickory mine operated by Metcalf Mining Co. was the major producer of silver, lead, and zinc in the county in 1957, and the Newhouse-Cactus mine operated by Norman Rodgers Mining Co. ranked first in gold and copper output. Two other active mines that produced these metals in the county in 1957 were the Old Hickory mine (Metcalf Mining Co.) and Horn Silver (P. S. Martin).

Uranium ore produced at five operations was shipped to Marysvale and Salt Lake City for processing. Ore came from the Daisy and Monarch groups, operated by Fred Staats, and the Mystery

Sniffer mine, operated by Wallace R. O'Keefe. Exploration and development of uranium deposits continued; 236 feet of shafts and winzes was sunk, and 948 feet of drifts, adits, and crosscuts driven.

Nonmetal output consisted of crude perlite mined by Acme Lite Wate Products, Inc., and 3,000 tons of commercial sand and gravel.

Box Elder.—The activities of Morrison-Knudsen Co., Inc., at the No. 2 quarry and the areas near Promontory Point were responsible for nearly all the output of minerals produced in Box Elder County during 1957. The production of rock salt was reported by Lake Crystal Salt Co. from its mine near Saline. In the gem-stone field, variscite was the second most important mineral in the State and the most important in the county. Ken Stewart's Gem Shop reported the only collection of this type of material.

Cache.—Sand and gravel and stone supplied all but a small portion of the total value of mineral production in Cache County in 1957. The Utah State Road Commission, through LeGrand Johnson Construction Co., its contractor, produced 680,100 tons of paving and structural sand and gravel, whereas the county highway department reported the quarrying of 172,100 tons of paving gravel. Six commercial producers supplied the remaining 289,800 tons of material produced in 1957, and the principal operators were Wangsgaard Construction Co. and Johnson Ready Mix Concrete Co. Crushed limestone used for refining sugar was produced by LeGrand Johnson Construction Co., and the Cache County Highway Department quarried 100,400 tons of crushed sandstone for concrete aggregate.

Carbon.—Production of coal from 27 active underground mines increased from 4.9 million tons in 1956 to 5.3 million tons in 1957. Average employment was 2,329 men on active days. Construction of the Columbia-Geneva Steel Division, United States Steel Corp., multi-million-dollar coal-preparation plant at Wellington was completed. Trial runs began on March 24, and by mid-April the plant was operating near its rated capacity of 600 tons per hour. Raw coal processed at the plant was from the corporation's Columbia and Geneva mines near Dragerton and from the Somerset mine at Paonia, Colo. Coal was cleaned in transit for the corporation's coke ovens at its Geneva works near Provo. The cleaned coal produced better coke yields and improved blast-furnace operation because of the reduced ash and sulfur content.

Carbon dioxide was produced at the Farnham Dome field and transported through a pipeline to Wellington where it was processed at the dry-ice plant operated by the Carbon Dioxide & Chemical Co. Natural gas from the Clear Creek field was transported to consumers in the Salt Lake City area by pipeline. One successful development gas well was completed in the Clear Creek field.

Road construction by the Utah State Road Commission prompted the production of 23,000 tons of structural and paving sand and gravel by crews of the road commission and the Eastern Utah Development Co.

Daggett.—Natural gas from the Clay Basin field was processed at the Mountain Fuel Supply Co. plant for the recovery of natural gasoline, and residual gas was transported via company pipeline for consumption in the Salt Lake City area. The natural gasoline and distillate recovered at the plant was used at refineries as blending

stock. A Federal Bureau of Reclamation project underway in the county resulted in the production of a small quantity of structural gravel and crushed sandstone; actual quarrying resulted from the activities of contractors for the Federal Bureau of Reclamation.

Davis.—Four sand and gravel operations furnished all the \$267,800 worth of mineral production in 1957. All production was commercial, and Foss Lewis Sand & Gravel Co. and White Hill Sand & Gravel Co. were the principal operators. The United Concrete Pipe Corp. quarried 2,200 tons of miscellaneous stone for use as a rock backfill on a Federal Bureau of Reclamation project.

Emery.—The county was second in the State in the production of uranium ore. Production in 1957, reported from 55 operations, dropped 29 percent from 1956. The grade of the ore shipped also declined from 0.26 percent U_3O_8 in 1956 to 0.25 percent in 1957. Four Corners Uranium Corp. was the principal producer and operated the Incline group in the Green River district. Union Carbide Nuclear Co. operated AEC leases 8, 10, and 11 and the Flat Top No. 2 mines in the Temple Mountain district. Hidden Splendor Mining Co., another major producer, operated the Delta mine in the San Rafael district. The latter operation was terminated in June because the ore body was exhausted. Total production of the mine has been about 100,000 tons of uranium ore. Exploration and development activities by the uranium industry in the county continued; 113,000 feet of drilling was completed, 546 feet of shafts and winzes sunk, and 10,556 feet of adits, drifts, and crosscuts driven. Mining methods and costs at the Calyx Nos. 3 and 8 mines were described.³ Uranium resources of the San Rafael district were studied and a report published.⁴

Output of coal from 14 active mines decreased slightly compared with 1956. Average employment was 615 workers in the coal mines of the county. Natural gas was produced at the Flat Canyon field. One new gasfield, the Ferron, was discovered at a depth of 1,700 feet. Initial production was 4.7 million cubic feet a day.

Garfield.—Uranium ore shipped from 55 operations fell 36 percent below 1956, when shipments were reported from 67 operations. Principal producers were Rocky Mountain Uranium Co., operating the Rainy Day mine in the Circle Cliffs district; Vanadium Corp. of America, Trachyte Nos. 1 and 8; Industries & Mines, Inc., Daisy June group; and Harold Ekker, Agate, Lone Eagle, and Lucky Strike groups. Exploration activities throughout the county continued, and 5,000 feet of drilling was completed; 808 feet of adits, drifts, and crosscuts driven; and 16,000 cubic yards of overburden removed. Lovell M. Twitchell produced coal at the Alvey mine.

A small quantity of jasper and petrified wood was collected according to a report from the Dog House Rock Shop.

Grand.—Grand County ranked third in the State in the production of uranium ore, and output in 1957 was from 60 operations. Total shipments reached 32,000 tons—an increase of 22 percent over 1956. Major production was from the Yellow Cat, Polar Mesa, and Seven Mile Canyon districts. Among the principal producers were Union Carbide Nuclear Co. working the Thompson C, Petrified Tree Nos.

³ Dare, W. L., Mining Methods and Costs, Calyx Nos. 3 and 8 Uranium Mines, Temple Mountain District, Emery County, Utah: Bureau of Mines Inf. Circ. 7811, 1957, 36 pp.

⁴ Johnson, H. S., Jr., Uranium Resources of the San Rafael District, Emery County, Utah—A Regional Synthesis: Geol. Survey Bull. 1046-D, 1957, 17 pp.

8 and 9, Elva M, Effie F, and other mines; E. E. Lewis & Associates at the Blackstone mine; Utah Alloy Ores Co. from the Parco group and other mines; Thornburg Mining Co. at the Corral Nos. 1 and 3 and Shinarump No. 3 mine; and Norbute Corp. at the Utah State Lease 3971 mine. The 1,500-ton-a-day processing plant at Moab, operated by Uranium Reduction Co., was active the entire year. The plant was officially dedicated in September.

Petroleum was produced at the Big Flat (a 1957 discovery), Seiber, and Cisco fields; and natural gas was produced at the Bar X field. In addition to the discovery of the Big Flat field, where initial production was 319 barrels a day, 3 gasfields also were discovered. The Bar X-SW field, discovered at a depth of 2,870 feet in the Morrison formation, flowed 12 million cubic feet of gas a day; Westwater field flowed 1.5 million cubic feet a day from a depth of 5,167 feet in the Dakota formation; and an unnamed field flowed less than 1 million cubic feet a day from the Castlegate formation at a depth of 817 feet. Discovery of the Big Flat field was of considerable significance to the industry because the discovery was in Mississippian formations—the first successful completion in formations below Pennsylvanian in the Paradox basin. Additional successful development wells were completed in the Cisco and Bar X gasfields.

Output of sand and gravel for highway-construction use dropped to 60,000 tons compared with 75,500 tons in 1956. Gregerson & Jensen, contractors for the Federal Bureau of Public Roads, and Kent Johnson, contractor for the county highway department, were responsible for the Government-and-contractor output; whereas Eastern Utah Development Co. produced the commercial material.

In 1957 manganese concentrate (142 short wet tons) valued at \$11,671 and having an average manganese content of 41.6 percent was shipped from the Zenda mine in Grand County by Zenda Manganese Co. under the "carlot" Government purchase program administered by GSA.

Iron.—The entire output (shipments) of iron ore in Utah in 1957 came from 10 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; Utah Construction Co. mined and shipped ore from the Blowout, Comstock, and Duncan mines for Colorado Fuel & Iron Corp. and from its mine, Excelsior; and Helene E. Beatty recovered and shipped iron ore (float material) on a royalty basis from four separate mines or groups of claims.

Coal produced in 1957 by the Koal Kreek Coal Co., Tucker Coal Co., and Louis Webster increased slightly compared with 1956.

Without the production of sand and gravel in 1957, the output for nonmetals (their value dropped to \$82,900) consisted of paving gravel quarried by crews of the State road commission and Union Construction Co. as its contractor, and molding sand by Cedar Silica Sand Co. One hundred pounds of agate was reportedly collected north of Cedar City and the Brian Head area.

Juab.—Nonmetal output consisted only of clays, fluorspar, and stone, yet furnished over half the total value of all minerals reported for 1957. The Dragon mine of Filtról Corp. was the only producer of clay (halloysite) in the county, whereas fluorspar was mined by five operators. Shipments of Metallurgical-grade fluorspar were 5

percent greater in 1957 and the mines operated included Fluorine Queen, Fluoride, Lost Sheep, Blowout, and Bell Hill. Murray Refractories Co. and General Refractories Co. were the only stone producers in the county. Crushed sandstone quarried by these firms was used by them in manufacturing refractories.

The combined value of output of the metals, gold, silver, copper, lead, and zinc, in Juab County in 1957 (\$758,000) was one-half that of 1956. This decline reflected directly the drop in prices of copper, lead, and zinc during the year, which caused the curtailment of operations at the major producing mines. Operations were suspended at the Eagle & Blue Bell mine, one of the major producers of these metals, on August 15 by the Eagle & Blue Bell Mining Co. (subsidiary of Chief Consolidated Mining Co.). Chief Consolidated Mining Co. closed its Chief No. 1 mine (formerly a major metal producer in the county and State) on June 15 because of the decline in metal prices. The Centennial-Beck-Victoria mine, owned by United States Smelting Refining & Mining Co. and operated under lease by Brennan Hannifin, had a substantial output of lead and silver ores containing gold and copper in addition to lead and silver. In addition to these 3 mines, 8 other metal mines were active in the county in 1957, of which the Vagabond, Empire, Godiva, and Plutus were the major gold, silver, copper, and lead producers.

Uranium ore produced at the Yellow Chief mine by Topaz Uranium Co. and W. S. Good-Leland Anderson was shipped to Salt Lake City for processing.

Millard.—The total value of minerals produced in Millard County fell to less than one-half the 1956 total and resulted mainly from a decline in the shipments of pumic and sand and gravel. Christensen Construction Co., operating the Red Dome claims, was the principal pumice producer, although a small quantity of expanded lava was quarried by Utah Lavalite, Inc., from a deposit near Milford. Sand and gravel output was 23,800 tons of paving gravel, produced by construction crews of the Utah State Road Commission, and 2,800 tons of paving gravel, prepared by Whiting & Haymond.

Obsidian was the dominant gem stone collected in 1957, although silver, lead, and azurite and other copper specimens were collected from the New House mine.

No tungsten was produced in 1957, but small quantities of copper, gold, and silver were produced from 1 lode and 1 placer operation.

Morgan.—Cement was the most important product of the mineral industry of Morgan County in 1957. The Devil's Slide plant of Ideal Cement Co. operated 361 days and produced both portland and masonry cements. The same company operated a cement-rock quarry, which supplied the plant's limestone and shale requirements and all the stone produced in the county. The bulk of the 157,000 tons of sand and gravel was quarried by Floyd S. Whiting as contractor for the Utah State Road Commission and construction crews of the commission; Wilkerson Construction Co. was the commercial supplier of 65,000 tons of structural gravel. Miscellaneous clay was the only type mined during the year, and the Henefer open-pit mine of Interstate Brick Co. was the only active operation.

In 1957 small quantities of silver, copper, and lead, with a combined value of \$1,768, were produced from three mines, Carbonate Hill, Lucky Boy, and Strawberry No. 1, in the county.

Piute.—Uranium ore produced at six operations was shipped to mills at Salt Lake City and Grand Junction, Colo., and to the Government stockpile at Marysvale. Vanadium Corp. of America, operating the Farmer John, Freedom, and Prospector mines, and Black Bear Consolidated Mining Co. and Golden Cycle Corp., operating the Potts Fraction, were the major producers. Uranium-development in the county consisted of 550 feet of shafts and winzes and 750 feet of adits, drifts, and crosscuts.

Deer Trail mine, owned by Deer Trail Mines and operated under lease by Arundel Mining Co., was the major producer of gold, silver, and copper and the only producer of lead and zinc in Piute County in 1957. Small quantities of ore containing gold, silver, and copper were shipped directly to smelters from the Annie Laurie, Huber, and Iris mines.

Rich.—Phosphate-rock mining continued to be the principal activity in Rich County in 1957. San Francisco Chemical Co. operated its open-pit mine and shipped crude ore to Lefe, Wyo., for milling. LeGrand Johnson Corp. produced 14,200 tons of structural gravel for the Utah State Road Commission, and commission construction and maintenance crews quarried 3,800 tons of paving gravel.

Salt Lake.—In 1957 Salt Lake County continued as one of the most important metal mining, milling, smelting, and refining areas in the United States. The total value of mineral output in the county declined from \$269 million in 1956 to \$195 million in 1957, a 28-percent reduction. Most of this drop resulted from a 33-percent decrease (\$70 million) in value of output of copper. Other commodities with substantial decreases in value of output in the county included gold (\$1 million), lead (\$2 million), zinc (\$1.5 million), and molybdenum (\$1.6 million).

Utah Copper and U. S. & Lark mines were Utah's and Salt Lake County's largest and next to largest gold, silver, and copper producers, respectively. U. S. & Lark mine was also the leading lead and zinc producer in the State and county in 1957. A substantial quantity of zinc was recovered from slag from the Midvale smelter dump shipped to the International Smelting and Refining Co. zinc-fuming plant at Tooele by United States Smelting Refining and Mining Co. Small quantities of gold, silver, copper, lead, and zinc were recovered from ores produced from four other active mines in the county in 1957.

According to the Kennecott Copper Corp. annual printed report, 30,919,900 tons of ore was mined and milled from the Utah Copper mine in 1957, compared with 32,321,100 tons in 1956. The content of the ore mined in 1957 was 16.5 pounds of copper per ton, compared with 16.6 pounds in 1956. The ore also contained gold and silver recovered during the copper-refining process and molybdenum recovered as molybdenum concentrate from the copper concentrate.

Work begun in October 1956 on an 18,000-foot-long concrete-lined ore-haulage tunnel to cost \$11 million from the mouth of Bingham Canyon to the bottom of the Utah Copper open-pit mine was continued throughout the year. According to the contractor, Utah

Construction Co., one-half of the project was done by the end of 1957 with completion scheduled for 1959. The tunnel will accommodate standard-size electric locomotives and 100-ton cars and will eliminate uphill hauling of the ore from the pit and thereby reduce the cost of mining, which includes haulage. Engineering work was completed on a contemplated project to cost \$16 million to increase the capacity of the present power plant. This project will increase power-generating capacity from 100,000 to 175,000 kilowatts and produce power at a lower cost. The company spent \$11.6 million during the year on construction and new equipment, including the new tunnel, contract stripping at the mine, an experimental rod mill, new turbine generator for pumping and distributing tailing on the dike, and for additional pressure conduit to the cooling system at the power plant.

Ore from the U. S. & Lark mine was concentrated in the United States Smelting Refining and Mining Co. 1,700-ton-per-day mill at Midvale. Custom ore from Utah and other States was accepted and treated at this mill. Lead concentrate produced from the company and custom ore was smelted in the company's Midvale smelter and granulated zinc-bearing slag was shipped to the International Smelting and Refining Co. zinc-fuming plant at Tooele. Copper, zinc, and iron (pyrite) concentrates produced from ore treated at the Midvale concentration mill was shipped to smelters for the recovery of the contained metals.

The 550-ton uranium-processing plant at Salt Lake City operated by Vitro Uranium Co., a division of Vitro Corp., was active the entire year. The program of expansion and improvement of the processing plant, begun in 1956, was completed in 1957. The installation of a solvent-extraction process for recovering uranium from sulfuric acid solution was completed in August and began operating in October. By December the plant was operating at designed capacity. The installation was expected to increase efficiency and materially reduce the cost of uranium concentration. Crude ore for the plant came from the San Rafael-Green River and Marysvale district in Utah, from the company's mine in Wyoming, as well as from deposits in the Colorado Front Range.

Four of the State's five oil refineries in the Salt Lake City area operated continuously throughout 1957. Daily capacity of the 4 plants was 85,500 barrels. Throughput in 1957 was 31 million barrels, a slight increase over the 1956 throughput of 30.9 million barrels. Significant additions and improvements at all four plants were completed or under construction at the end of the year. Western States Refining Co. completed a 1,000-barrel houdriformer at its North Salt Lake plant. Utah Oil Refining Co. began a program of improvements, estimated to cost \$8 million, at its Salt Lake refinery. Included in the improvements was a 35,000-barrel-a-day pipe still. Salt Lake Refining Co., a subsidiary of Standard Oil Co. of California, added 3,000-barrel-a-day crude-still capacity to its North Salt Lake plant thereby boosting daily capacity to 42,000 barrels. Phillips Petroleum Co. began the installation of a 3,700-barrel-a-day platforming unit at its plant at Woods Cross—completion expected early in 1958.

The nonmetal segment of the county's mineral industry produced products valued at \$5.8 million in 1957 compared with \$4.9 million in 1956, but nonmetal output comprised only 3 percent of the total county value. In terms of value, sand and gravel was the most important commodity. Of the 2.3-million-ton production in 1957, 2 million tons or 85 percent was quarried by 11 companies. Utah Sand & Gravel Co., the largest individual producer, mined and prepared structural and paving sand and gravel. In addition to the commercial output, the Salt Lake County Department of Roads and Bridges produced 340,000 tons of paving sand and gravel for its own use. The Salt Lake cement plant, Portland Cement Co. of Utah, supplied the entire production of cement; this company was also the principal quarry operator, supplying all its needs for cement rock (limestone). American Smelting and Refining Co. mined oolitic limesand from Saltair Beach sands and Kennecott Copper Corp. quarried limestone for use in manufacturing lime. Otto Beuhner produced 125 tons of dimension sandstone for rough-construction stone. The Morton Salt Co. furnished all the salt recorded for Salt Lake County during 1957. The company operated its Saltair solar-evaporation facility and was the principal producer in the State. Lime output declined somewhat owing to a decrease in the quantity of this commodity used in the recovery of base metals. Kennecott Copper Corp. operated its limekiln and used limestone quarried by the company as well as purchased from a local producer; 25,600 tons of quicklime was used at its Salt Lake ore-processing facilities.

San Juan.—San Juan County ranked first among the counties in Utah reporting uranium output. Production in 1957 from 184 operations increased 25 percent compared with 1956 and furnished 85 percent of the State's total production. The major productive properties were:

Property:	Operator	Locality
Big Buck Group-----	Standard Uranium Corp-----	Lisbon Valley.
Bullseye-----	COG Minerals Corp-----	Red Canyon.
Dissipation-----	La Sal Mining & Development Co.	Lisbon Valley.
Divide-----	International Oil & Metals Corp.	Do.
Far West-----	Hidden Splendor Mining Co---	Do.
Happy Jack-----	Texas-Zinc Minerals Co-----	White Canyon.
Hersey-----	Radium King Mines-----	Red Canyon.
Jen Jackie-----	Jen, Inc., and E. L. Cord-----	Lisbon Valley.
Mi Vida-----	Utex Exploration Co-----	Do.
Nixon-----	Lisbon Uranium Co-----	Do.
North Alice-----	Homestake Mining Co. and La Sal Mining & Development Co.	Do.
Pasco Jen Jackie-----	Jen, Inc-----	Do.
Radon-----	Hecla Mining Co-----	Do.
Rattlesnake Group---	Woodmont, Inc-----	Do.
Richardson-----	La Sal Mining & Development Co. and Uranium Reduction.	Do.
Section 36-----	Continental Materials Corp---	Do.
Skunkovich and Skunkovich No. 2.	Little Beaver Mining Co-----	Do.

These 17 operations produced 85 percent of the uranium ore in the county and 72 percent of the uranium ore in the State.

Mining methods and costs at the Continental No. 1 mine and the La Sal Uranium mine were described.⁵

Exploration and development of deposits continued at a high rate; 209,000 feet of drilling was completed, 2,571 feet of shafts and winzes was sunk, 50,659 feet of adits, drifts, and crosscuts was driven, and 700,000 cubic yards of overburden removed. The 600-ton-a-day Government-owned processing plant at Monticello, operated by National Lead Co., Inc., was active the entire year, and construction of the 775-ton-a-day plant at Mexican Hat was completed and began operating late in the year. The plant owned and operated by Texas-Zinc Minerals Co. was designed to leach the uranium with sulfuric acid and to extract the uranium from the solution by solvent extraction with an organic amine dissolved in kerosene.

San Juan County was probably the most active area for petroleum exploration and development in the Rocky Mountain region. Production of petroleum from nine fields in the Paradox basin increased more than threefold—from less than $\frac{1}{2}$ million barrels in 1956 to $1\frac{1}{2}$ million in 1957. The major portion of the output was from the Aneth field. The Ratherford field, a 1956 discovery, also was a substantial producer. Completion of the Four Corners pipeline from the Aneth field to refineries in Los Angeles, Calif., provided the outlet necessary to continued exploration and development of the area. Filling the line began in November at an initial capacity of 70,000 barrels a day; the line has possible potential daily capacity of 750,000 barrels through additional pumping stations. Texas-New Mexico Pipeline Co. began the construction of an additional pipeline from Aneth to connect existing facilities at Jal, N. Mex. Completion of the line, expected in 1958, will provide an outlet for 50,000 barrels a day to refineries in the Gulf Coast area. Exploration in the county was nearly double that of 1956 with 66 completions. Eleven new fields were discovered—10 oilfields and 1 gasfield—during the year. The most outstanding discovery of the year was McElmo Creek by Carter Oil Co. The discovery well, Navajo No. 1, southeast of the Aneth field (sec. 8, T. 41 S., R. 25 E.) was completed in May at a depth of 5,688 feet. Initial production was 2,330 barrels of oil from the Paradox formation through perforations at a depth of 5,546–5,596 feet. The Tohonadla field, the most westerly in the Paradox basin, was discovered in June. Initial flow was 1,450 barrels of oil and 1.2 million cubic feet of gas from the Paradox formation. White Mesa field, south of the Aneth field, was discovered in February with an initial flow of 1,680 barrels of oil from the Paradox formation. Turner Bluff, Gothic Mesa, and Bluff Bench fields were discoveries west of the Aneth field. Initial flow from discovery wells in the Turner Bluff and Gothic Mesa fields was 192 barrels from the Ismay formation and 263 barrels from the Hermosa. Upon completion the discovery well at the Bluff Bench field produced 250 barrels of oil on pump from the Paradox formation. The Hatch field, the most northerly (12 miles north of the Aneth field) in the basin, was discovered by Reynolds Mining Co.

⁵ Dare, W. L., Mining Methods and Costs, Continental Uranium, Inc., Continental No. 1 Mine, San Juan County, Utah: Bureau of Mines Inf. Circ. 7801, 1957, 20 pp.

Dare, W. L., and Delicate, D. T., Mining Methods and Costs—La Sal Mining & Development Co., La Sal Uranium Mine, San Juan County, Utah: Bureau of Mines Inf. Circ. 7803, 1957, 48 pp.

in November. The discovery well flowed 733 barrels of oil a day from the Paradox formation. The discovery well in the Cahone Mesa field east of Aneth, flowed 192 barrels of oil also from the Paradox formation. Superior Oil Co. completed a wildcat well between the Aneth and McElmo Creek fields. No data were released, but the company reported that the well was successful. This well could connect the Aneth and McElmo Creek fields. An unnamed field, discovered by the Petro-Atlas Corp. near the southwest edge of the Aneth field, pumped 54 barrels of oil from the Paradox formation. United States Smelting Refining and Mining Co. discovered the Chinle Wash gasfield west of Boundary Butte field; initial flow was 9.7 million cubic feet of gas from the Paradox formation.

Development drilling was at a high rate during the year; 122 wells were completed and 108 were successful. The bulk of development drilling was in the Aneth, Rutherford, McElmo Creek, White Mesa, and Cahone Mesa fields. Field limits between the Aneth, Cahone Mesa, McElmo Creek, and Recapture Creek fields had not been determined, but development drilling completed and in progress indicated that the fields ultimately would join. Development in the Aneth area was mostly infield, although the limits of the field established in 1956 were extended eastward from the southeast corner for $2\frac{1}{2}$ miles. On the western side of the field production was extended approximately 1 mile. Development at the Rutherford field was substantial. At the close of 1956 only the discovery and confirmation wells had been completed, but by the end of 1957 there were 17 producing wells and 12 locations staked in and near producing areas. Flowing wells completed during the year were producing from 314 to 2,184 barrels of oil a day.

McFarland & Hullinger leased the Climax mine near La Sal on May 27 and operated it from July 1 throughout the remainder of the year. A total of 12,131 tons of ore containing 3 ounces of gold, 1,285 ounces of silver, 260 tons of copper, and 12 tons of lead was mined and shipped to American Smelting and Refining Co. smelter at Garfield.

Sand and gravel production consisted of 88,700 tons of Government-and-contractor production, quarried by Dudley, Jensen & Johnson, contractors for the Federal Bureau of Public Roads, and construction and maintenance crews of the State road commission.

Sanpete.—Sand and gravel was one of the more important commodities in Sanpete County in 1957. Cox Bros. and Ephraim City Corp. were the only producers reporting activity, and output reached 56,300 tons valued at \$56,800. Rock salt from the Axtell mine of Royal Crystal Salt Co. dropped below the 1956 total, according to data supplied by Albert Poulson, operator of the property. The salt was shipped to feed dealers and stockmen in Arizona, Colorado, Idaho, Montana, Nevada, Pennsylvania, Wyoming, and Utah for use as cattle salt.

Natural gas produced at Joe's Valley field by Three States Natural Gas Co. was marketed through a pipeline to the Clear Creek gas system.

Sevier.—Nonmetals provided the bulk of the value in Sevier County again in 1956. Crude gypsum, the principal commodity, was mined by Bestwall Gypsum Co. and United States Gypsum Co., both operating mines in the Sigurd area. Western Clay & Metals Co.

continued to be the only clay producer; it mined bentonite and fuller's earth from its Aurora and Redmond deposits. Salt production remained at the same level as that reported for 1956, and the Redmond rock-salt mine of Poulson Bros. Salt Co. was the sole source of supply. Elmo R. Herring and Redmond Sand & Gravel Co. were the only producers of sand and gravel and 37,100 tons of structural and paving sand and gravel were reported.

Coal produced by the Southern Utah Fuel Co. at its No. 1 Hiawatha mine increased 4 percent compared with 1956.

Summit.—The total value of the output of gold, silver, copper, lead, and zinc produced from deposits in Summit County in 1957 was \$4.6 million of the \$4.8 million combined value of all minerals produced in the county.

The United Park City group of mines operated by United Park City Mines Co. was the major producer of metals (gold, silver, copper, lead, and zinc) in the county in 1957 and second largest lead and zinc producer in the State. George W. Wortley shipped material to the American Smelting and Refining Co. Garfield smelter from the Atkinson, Clegg, Gilmore, Grasselli-Pacific Bridge, and United Park City tailings dumps. McFarland & Hullinger shipped material to this smelter from the Daly, Ontario, and Park Flag mine dumps owned by United Park City Mines Co.

Construction-material output was comprised of 45,700 tons of paving gravel, quarried by Albert Gibbons, Whiting & Haymond, and R. M. Jensen; 938 tons of dimension sandstone, produced by Mountain Park Quarries; and 1,700 tons of crushed sandstone, mined for the Federal Bureau of Reclamation. Miscellaneous-clay production was reported by Utah Fire Clay Co. from its Henefer pit.

Tooele.—Declines in value of output of each of the metals, gold, silver, copper, lead, and zinc, in the county was reported in 1957. Production of these metals was recorded from 14 active mines. Two of these mines, Ophir Unit and Calumet, were the major producers. The Ophir Unit mine, owned by United States Smelting Refining and Mining Co., was operated throughout the year by McFarland & Hullinger, lessees, and the ore mined was treated in the company's mill. Combined Metals Reduction Co. Calumet mine was operated by leasers throughout the year. The ore from the mine was treated in the Bauer mill owned by the company and operated by leasers.

In 1957 Tooele County continued to be an important lead-zinc milling and smelting area. The International Smelting and Refining Co. 1,500-ton-per-day concentrator, lead smelter, and zinc-slag fuming plant at Tooele were operated on ore, concentrate, and slag from Utah and other States throughout the year.

In contrast to the decline in metal output, substantial gains were noted for most of the nonmetals produced in 1956. Clay production was reported by Interstate Brick Co. and Utah Fire Clay Co. from the Five-Mile Pass area. Output of lime from the plant of Utah Lime & Stone Co. was 18 percent greater in 1957. Salt production reported by Deseret Salt Co. and Solar Salt Co. increased as did limestone and limesand quarried by United States Smelting Refining and Mining Co., Utah Calcium Products Co., and Utah Lime & Stone Co. The principal use for this commodity was as a flux. Shipments of potash from the Bonneville, Ltd., plant near Wendover were 28 percent

greater than in 1956. Sand and gravel totaling 8,500 tons was reported by Elmo England. No pumice, gem stones, ornamental stones, or mineral specimens were reported in 1957.

Uintah.—Uintah County again led the State in the production of petroleum. Output was from six fields; the Red Wash and Ashley Valley were the most important. Total production in 1957 was 2.5 million barrels, a 43-percent increase over the 1.8 million barrels produced in 1956. Exploratory drilling discovered two gasfields. Sun Oil Co. worked over a well drilled in 1952 at the Ouray-S field; the original well, drilled to a depth of 10,498 feet, was plugged back and perforated at 6,075–6,135 feet in the Wasatch formation. After acid treatment and fracturing, the well flowed 301,000 cubic feet of gas a day. El Paso Natural Gas Co. completed a well at the Southman Canyon field with gasflows ranging from 125,000 to 1.7 million cubic feet a day measured during testing and drilling. Upon completion, the well flowed 971,000 cubic feet of gas a day from the Mesaverde formation through perforation at 6,748–6,823 feet. Of 15 development wells completed, 12 were successful—10 in the Red Wash field and 1 each in the Gusher and Brennan Bottom fields. A successful gas well was completed in the Ute Trail gasfield. The Utah Cooperative Refining Co. operated its 1,500-barrel-a-day refinery at Jensen the entire year, and throughput in 1957 increased 4 percent over 1956.

Upon completion of its refinery in Colorado and the 72-mile pipeline from the mine at Bonanza in April, American Gilsonite Co. began full-scale operations. The crude gilsonite was processed at the Colorado refinery to produce high-octane gasoline and a high-grade metallurgical coke.

A small quantity of uranium ore was produced at the Sandy and Susie Bell mines.

Sand and gravel output increased substantially over 1956, owing almost entirely to the purchase of pit-run paving gravel by the Utah State Road Commission from Vernal Sand & Gravel Co. A contract let by the Federal Bureau of Public Roads resulted in the production of paving gravel by W. W. Clyde & Co.

Utah.—Of the \$2.4 million value of mineral production in Utah County in 1957, nonmetals supplied 92 percent or \$2.2 million. The principal commodity continued to be limestone, which was used mainly as a flux and refractory. Lakeside Lime & Stone Co. and United States Steel Corp. were the principal quarry operators. Utah County was second among the counties in which sand and gravel production was reported; output rose to 1.2 million tons. The major portion of the production (935,500 tons) was Government-and-contractor output, quarried by contractors for the Federal Bureau of Reclamation (W. W. Clyde & Co.), Utah State Road Commission (Thorn Construction Co.), and the county highway department (Giles Sand & Gravel Co.). Utah County was the principal source of clays in 1957, but output compared with 1956 decreased 60 percent. Interstate Brick Co., Utah Fire Clay Co., and Western Fire Clay Co. were the principal producers. Lakeside Lime & Stone Co. quarried its own limestone used for the production of lime at its Lehi plant; output of hydrated and quicklime in 1957 was less than in 1956. William H. Prince & Sons Block Co., Inc., reported the only pumice produced in the county during the year. The company operated the

Utah Pink Pumice claim near Cedar Valley for only a short period, shipping 136 tons to its Salt Lake City plant.

Eight mines with a combined \$188,000 output of gold, silver, copper, lead, and zinc were operated in Utah County in 1957. Of these, the three major producers were the Colorado Consolidated and Iron Blossom mines and the Tintic Standard dump. Colorado Consolidated mine was operated by Elmer Westerland & Ralph C. Hopes, lessees. Iron Blossom mine, owned by Tintic Standard Mining Co., was operated throughout the year by lessees, Duke Page, Glen Larsen, and George W. Wortley. Don R. Giles, lessee, shipped a substantial quantity of material from the Tintic Standard dump directly to smelters without beneficiation.

Wasatch.—All but \$50,000 (value of sand and gravel and stone output) of the \$2.8 million total value of mineral production in Wasatch County in 1957 came from gold, silver, copper, lead, and zinc output. Most of the county's metal production came from the Mayflower mine operated by the owners, New Park Mining Co., from the beginning of the year until October 3, when the Mayflower lease took over the mine and operated it for the remainder of the year. All the ore mined was shipped to United States Smelting Refining and Mining Co. mill at Midvale for treatment. This mine was the State's third leading gold, copper, lead, and zinc producer; it ranked fourth in output of silver.

The mines in the United Park City group of mines operated by the United Park City Mines Co. are located in three different counties—Salt Lake, Summit, and Wasatch. Most of the company output came from the mines in Summit County in 1957; a small quantity came from Wasatch County, but none from Salt Lake County.

Sand and gravel production was reported by the Utah State Road Commission, who had construction and maintenance crews engaged in quarrying activities. The only stone produced in 1957 came from a quarry operated by The Contracting Corp., which utilized 10,500 tons of miscellaneous stone for rockfill on a Federal Bureau of Reclamation project.

Washington.—The value of gold, silver, copper, lead, and zinc output in Washington County made up \$129,000 of the \$168,000 total value of mineral production in 1957. These metals were recovered from ore from 4 mines, tailing from 1 mill, and copper slag from the Apex smelter dump. In 1957 Western Gold & Uranium, Inc., expanded the capacity of its mill from 75 tons per day to 200 tons to handle low-grade ore, tailing, and dump material, and made provisions to treat custom ore. It treated ore from its Silver Reef mine and re-treated old tailing from the mill. No custom ore was received for treatment during the year. Emerald L. Cox shipped zinc and copper ores from the Apex mine during the first half of the year. Ivor Clove shipped 1 truckload of silver ore from the Old Holt mine. A small quantity of silver ore containing some copper was marketed from the Blue Jay claims during 1957.

Uranium ore produced at the Silverman No. 2 mine by Western Gold & Uranium, Inc., was shipped to Salt Lake City for processing. Development completed 560 feet of underground openings.

All petroleum produced in Washington County came from wells exploiting the Virgin field.

Construction materials produced in 1957 consisted of 22,400 tons of Government-and-contractor sand and gravel and a small quantity of dimension sandstone

Wayne.—In 1957 a small quantity of ore containing some silver and copper was mined from a new development on the Old Faithful group of claims near Torrey by Osborn Bros. and shipped to the American Smelting and Refining Co. smelter at Garfield.

Uranium ore produced at seven operations was shipped to mills at Salt Lake City, Thompson, Green River, and Grand Junction, Colo., for treatment. The major producer was Mio Dio Uranium Co., operating the Billy's Dream mine.

Weber.—Nonmetals continued to be the only mineral products of Weber County, and total output for this group was 6 percent greater in 1957 than in 1956. Three commercial operators produced 206,800 tons of structural and paving gravel and structural sand. Crews of the Federal Forest Service and the Ogden city engineer produced 67,000 tons of structural and paving gravel, and contractors for the Utah State Road Commission and the Ogden city engineer supplied the remaining 137,600 tons. The need for riprap by Lee Moulding Construction Co. and Mountain States Construction Co., in connection with their contract with the Federal Bureau of Reclamation, resulted in the quarrying of 15,900 tons of limestone. Harrisville Brick Co. increased its output of miscellaneous clay by 7,100 tons in 1957 as a result of an increase in the demand for brick and other structural-clay products in the Ogden area.

The Mineral Industry of Vermont

By James R. Kerr¹



THE VALUE of Vermont's mineral production in 1957 was \$21.9 million, a drop of \$1.2 million (5 percent) below 1956. A depressed copper market in which the average price per pound dropped from \$0.42 in 1956 to \$0.30 in 1957, was the principal cause of the decrease. Other commodities with notably decreased valuation in 1957 were pyrites (48 percent), lime (34 percent), and slate (12 percent). Production of sand and gravel increased 16 percent, attesting to increased road-building activity in the State.

The important Rutland County slate and marble deposits again led in total mineral value, followed by Washington, Orleans, and Orange Counties.

TABLE 1.—Mineral production in Vermont, 1956-57¹

Mineral	1956		1957	
	Short tons (unless other- wise stated)	Value (thou- sands)	Short tons (unless other- wise stated)	Value (thou- sands)
Copper (recoverable content of ores, etc.).....	3, 403	\$2, 893	3, 405	\$2, 050
Gold (recoverable content of ores, etc.).....troy ounces	(?)	(?)	62	2
Pyrites.....long tons	22, 537	107	9, 609	56
Sand and gravel.....	1, 909, 778	905	2, 215, 553	1, 051
Silver (recoverable content of ores, etc.).....troy ounces	(?)	(?)	36, 794	33
Slate.....	162, 239	3, 722	(?)	3, 269
Stone.....	620, 510	11, 622	556, 999	11, 404
Value of items that cannot be disclosed: Asbestos, clays, lime, and talc.....		3, 915		4, 053
Total Vermont ³		23, 131		21, 893

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

METALS

Copper.—Production of copper in 1957 remained about the same as in the preceding year, but value decreased 29 percent, as the unit price per pound dropped repeatedly during the year. The copper content of the crude ore was higher in 1957, and the yield of copper concentrate from total millfeed increased to 6 percent compared with 5 percent in 1956.

¹ Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

Gold and Silver.—Gold and silver were recovered as byproducts of smelting-copper concentrate. The quantity of gold recovered decreased; silver recovery increased.

TABLE 2.—Mine production of recoverable copper, gold, and silver, 1948–52 (average) and 1953–57, in terms of recoverable metals

Year	Copper		Gold		Silver	
	Short tons	Value	Fine ounces	Value	Fine ounces	Value
1948–52 (average).....	3, 249	\$1, 449, 130	138	\$4, 816	33, 444	\$30, 269
1953.....	3, 947	2, 265, 578	171	5, 985	43, 128	39, 033
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

¹ Figure withheld to avoid disclosing individual company confidential data.

NONMETALS

Asbestos.—The bulk of United States asbestos output was mined at an open pit on Belvidere Mountain near Lowell (Orleans County). The chrysotile was treated at the company mill about one-half mile from the quarry. Output of asbestos increased 4 percent during the year, and the average price per ton increased to \$94.20 per ton, compared with \$91.26 in 1956.

Clays.—The output of miscellaneous clay for manufacturing building brick and mortar, reported by producers in Chittenden, Rutland, and Bennington Counties, decreased slightly in 1957.

Lime.—Both quick and hydrated lime were produced in Vermont chiefly for chemical uses, although some mason's lime was produced. Production dropped during the year as customer demand decreased.

Pyrites.—The output of pyrrhotite concentrate recovered from copper ore decreased 57 percent. It was sold to a paper manufacturer for producing sulfur dioxide gas used in its papermaking processes.

Sand and Gravel.—The output of commercial sand and gravel increased 52 percent in tonnage and 22 in value in 1957. Production of Government-and-contractor crews decreased slightly (6 percent). Sand and gravel was mined in 13 of the 14 counties in Vermont—Windsor, Caledonia, Chittenden, Windham, Franklin, and Washington Counties, in order of decreasing output. Forty-two percent of the commercial sand and gravel output was washed, screened, or otherwise prepared. Expanded street and highway construction created heavy demand; paving uses supplied 89 percent of the total sand and gravel output compared with 75 percent in 1956.

Slate.—The declining slate industry in Vermont centered in the southwestern part of the State in Rutland County. Output of slate in the State has decreased each year since 1950, except in 1954. Vermont slate deposits were among the few in the Nation yielding a varicolored product (greens, purples, and variegated). Demand for slate products, particularly roofing material, declined. Wages increased, and prices were reported generally higher during the year.

Stone.—Stone continued to be the leading mineral produced in Vermont, contributing 52 percent of the total State mineral wealth.

The output of stone in 1957 dropped 10 percent in tonnage and 2 percent in value chiefly owing to a 25-percent decline in output of crushed limestone, which is used mostly for chemical purposes. Output of crushed granite increased, but production of dimension granite, the higher priced commodity, decreased causing an overall reduction in total granite valuation.

Marble production increased slightly during the year.

Talc.—The output of talc in Vermont decreased again in 1957 following a downward trend evident since 1954. Mines were active in four counties; production was concentrated in Washington and Lamoille Counties in the north central part of the State. Plants processed ground talc for use in rubber, roofing, paper, insecticides, paint, and other applications. One plant produced talc crayons.

REVIEW BY COUNTIES

More than 1 million tons of sand and gravel was produced by Government-and-contractor crews in the State in 1957 as road construction and improvement created a heavy demand for paving sand and gravel. The Commissioner of Highways at Montpelier reported output of sand and gravel from each county, except Lamoille. The city of Montpelier reported output of paving sand and gravel from Washington County.

Addison.—Limestone for agstone and roadstone was produced at the New Haven quarry of Vermont Associated Lime Industry, Inc. The lime-burning equipment at the New Haven plant was not usable during the year, but a batch-type hydrator at this plant produced chemical hydrated lime from quicklime shipped from the Winooski plant in Chittenden County. Sand and gravel was mined at scattered places in the county.

Bennington.—Output of sand and gravel for structural and road construction purposes came from three commercial producers in 1957.

The Bennington Brick Company, 1 of 3 clay producers in the State, mined miscellaneous clay near Bennington for manufacturing building brick.

No output of miscellaneous stone was reported.

Caledonia.—Caledonia County led in value of sand and gravel output in 1957. Output reported by three producers near St. Johnsbury was used entirely for paving and roadbuilding purposes.

Chittenden.—Sand and gravel for structural, paving, and other uses was produced at four fixed plants near Hinesburg and Burlington. The county ranked second in the State in sand and gravel output.

Vermont Associated Lime Industries, Inc., produced limestone for agstone, roadstone, flux, and lime and began installing an 8- by 10- by 125-foot rotary kiln and attendant facilities at the Winooski plant.

Drury Brick Co. mined miscellaneous clay from an open pit near Essex Junction for use in brickmaking.

Essex.—Sand and gravel was produced at unspecified places in the county for paving and road construction.

Franklin.—At Swanton, the Swanton Lime Works, Inc., quarried and crushed limestone, chiefly for roadstone, agstone, and chemical uses.

TABLE 3.—Value of mineral production in Vermont, 1956–57, by counties

County	1956	1957	Minerals produced in 1957 in order of value
Addison.....	\$138,048	\$116,571	Lime, stone, sand and gravel.
Bennington.....	73,195	(¹)	Sand and gravel, clays.
Caledonia.....	138,871	(¹)	Sand and gravel.
Chittenden.....	353,316	381,778	Sand and gravel, stone, clays, lime and limestone.
Essex.....	12,850	50,469	Sand and gravel.
Franklin.....	(¹)	(¹)	Stone, sand and gravel.
Grand Isle.....	(¹)	(¹)	Stone.
Lamoille.....	(¹)	(¹)	Talc, sand and gravel.
Orange.....	(¹)	2,925,344	Copper, stone, pyrites, silver, sand and gravel, gold.
Orleans.....	12,550	(¹)	Asbestos, sand and gravel, stone.
Rutland.....	9,693,744	9,077,469	Stone, slate, sand and gravel, clays.
Washington.....	(¹)	(¹)	Stone, talc, sand and gravel.
Windham.....	(¹)	(¹)	Sand and gravel, talc.
Windsor.....	139,902	175,673	Sand and gravel, talc, stone.
Undistributed ²	12,568,054	9,165,984	
Total.....	23,131,000	21,893,000	

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

² Includes value for counties indicated by footnote 1.

Grand Isle.—The Vermont Marble Co. quarried rough dimension marble at its Isle La Motte quarry for building exteriors.

Lamoille.—The Eastern Magnesia Talc Co., Inc., underground mine near Johnson produced talc. Some crude material was shipped to consumers, but it was mostly ground by the company for rubber, paper, insecticides, paint, asphalt filler, and other miscellaneous uses.

Structural and paving sand and gravel were produced at two fixed plants in the central part of the county, near Johnson and Morrisville.

Orange.—Appalachian Sulphides, Inc., continued to mine copper ore at the Elizabeth mine near South Stratford. The crude ore was fed to a 950-ton flotation mill adjacent to the mine; copper concentrate, averaging 26 percent copper, was recovered. The pyrrhotite concentrate also recovered averaged 35-percent sulfur content and was sold to the Brown Co., Berlin, N. H. The Phelps Dodge Refining Corp. smelted the copper concentrate and recovered gold and silver at its Laurel Hill, Long Island, N. Y., refinery.

The Rock of Ages Corp. produced rough dimension granite for monuments and mausoleums from the Pirie quarry near Williamstown.

Gravel for road fill and surfacing was also produced in 1957.

Orleans.—Chrysotile asbestos was mined at an open pit on Belvidere Mountain near Lowell, a short distance north of Lamoille County. The ore was processed at the company mill one-half mile from the mine and was used in a variety of asbestos products.

Lyell & Howard Reed, Partners, produced rough dressed dimension granite for building and road work.

Rutland.—Rutland County again led the State in value of mineral output chiefly because of its valuable marble and slate deposits. Slate was mined by 16 producers on the western edge of the county adjoining New York State. Chief uses for the product were roofing, granules, and structural and sanitary slate and flagging.

The Green Mountain Marble Corp. and Vermont Marble Co. output of marble came from the central part of the county at West Rutland and Clarendon. Rough blocks and cut and dressed stone for

both exterior and interior building purposes and for monumental uses were produced by these companies.

The White Pigment Corp. produced limestone, chiefly for whitening and also for metallurgical and filler purposes.

Rutland Fire Clay Co. produced miscellaneous clay for refractory mortar from a quarry near Rutland.

Sand for sawing and rubbing marble was produced by the Vermont Marble Co. at Brandon. Paving sand and gravel and other gravels were produced by two other operators in the county.

Washington.—Washington County led Vermont in the production of granite in 1957. The south-central tip of the county at Graniteville and Websterville was the center of granite production. Output was mostly rough dimension stone for monuments and mausoleums, although some crushed and broken stone for roadstone was also produced. The Rock of Ages Corp. (three quarries) and Wells Lamson Quarry Co. produced most of the granite in the county.

Talc was produced by Eastern Magnesia Talc Co., Inc., at an underground mine near Waterbury. Most crude material was ground and sold for a wide variety of uses. The remainder was sawed and used to make marking crayons. The five structural and paving gravel operations in the county centered around Montpelier. Small quantities of building and paving sand were also produced.

Windham.—Vermont Talc Co. mined talc near Windham and ground it at the company mill near Chester, Windsor County, for use in insecticides, rubber, paper, and insulation.

Sand and gravel for structural and paving uses was produced by two operators in 1957.

Windsor.—Eastern Magnesia reopened the Hammondsville quarry (formerly the Reading quarry of Minerals Products Co.) and produced crude talc, which was ground at the Gassetts mill for use as roofing material.

The Vermont Marble Co. quarried rough block marble for exterior building purposes.

Structural and paving sand and gravel were produced in 1957 by three commercial operators.

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, United States Department of the Interior, and the Virginia Division of Mineral Resources.

By Robert W. Metcalf,¹ James L. Calver,² and Mary E. Otte³



MINERALS produced in Virginia in 1957 rose to \$225 million in value, a new record and 8 percent higher than that in the former top year—1956. Rising demand for Virginia coal for export and the continuing Federal and State highway and local road-construction programs resulted in record yields of coal and cement.

The value of crude apilite, kyanite, lime, petroleum, and zinc ore production was higher in 1957 than in 1956, whereas that of most other minerals showed small to moderate declines. Leading in order of value of product in Virginia in 1957 were coal, stone, cement, sand and gravel, and lime. Over two-thirds of the total value of mineral production was supplied by coal; the tonnage totaled more than twice that of stone, the second-ranking commodity in quantity produced.

The value of fuels produced rose to 69 percent of the total value of Virginia minerals—a 2-percent increase compared with 1956. The value of nonmetals in 1957 declined by a similar percentage, and the value of metals remained about the same (4 percent).

Consumption, Trade, and Markets.—Although Virginia stone, sand and gravel, and clays were used mostly within the State, Virginia coal was consumed not only in the State, but in nearby States for space heating and industrial use. Sizable tonnages were shipped by water to New England and foreign destinations. The high- and low-volatile coals were used for steam raising, coking, and space heating. Petroleum was consumed locally, but natural gas was used in southwestern Virginia or in neighboring Tennessee, Kentucky, or West Virginia.

Portland and masonry cements were used mostly in Virginia, North Carolina, West Virginia, and Tennessee, and small quantities were exported. Chemical and industrial lime was produced and utilized in Virginia and shipped to neighboring southern States for use in various manufacturing processes, including water purification, paper manufacture, and tanneries, the making of calcium carbide and cyanamid, and other purposes. Sizable tonnages also were shipped to Pennsylvania, Ohio, and other States for metallurgical use in making steel in open hearths and electric furnaces.

¹ Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

² State geologist, Virginia Division of Mineral Resources, Charlottesville, Va.

³ Statistical clerk, Region V, Bureau of Mines, Pittsburgh, Pa.

Kyanite produced in Virginia was consumed by ceramic and refractories manufacturers, mostly outside the State. Gypsum and salt were utilized at the plant sites in manufacturing calcined gypsum, gypsum board, and other building products and in manufacturing chlorine and soda ash, respectively. Ilmenite produced in Virginia also was used at the plant site in pigment manufacture. Aplite was ground and sold to various glass manufacturers, mostly outside the State.

Zinc concentrate from the Austinville mill was shipped to smelters at Palmerton, Pa., and East Chicago, Ind., for metal recovery; and lead concentrate from the same mill went to Palmerton, Pa., and Federal, Ill. Zinc concentrate from Timberville was sent to Joseph-ton, Pa., for smelting.

Trends and Developments.—Among new plants put in operation in 1957 was the Southern Lightweight Aggregate Corp. (Richmond) mill near Bremono Bluff, Buckingham County, which expanded shale in rotary kilns. A new plant also was being built at Cascade, Va., in Pittsylvania County near Danville. Kyanite Mining Corp. developed a new mine and built a new processing mill at Dillwyn for treating kyanite for refractories and high-grade ceramics.

The New Jersey Zinc Co. put its Ivanhoe lead-zinc mine into full production in 1957. Ore was shipped through a 13,000-foot tunnel to the company beneficiation plant at Austinville. The Tri-State Zinc Co. in 1957 began to mine and mill zinc ore at Timberville, Rockingham County.

The General Chemical Co., in addition to the recovery of sulfur from pyrites at Galax, Carroll County, operated a pilot plant to test the recovery of copper and perhaps zinc. It was reported that certain areas in Virginia and nearby States were surveyed in 1957 by ground and airborne electromagnetic methods and by airborne scintillometer.

Metal & Thermit Corp. built a new plant at Montpelier near Beaverdam, Hanover County, to recover rutile and ilmenite. Plant operation was begun in October. Roanoke-Webster Brick Co. also was building a new structural brick plant at Somerset, Orange County. Products manufactured which will include standard size, oversize Roman, and Norman brick, will be made from shale mined nearby.

Legislation and Government Programs.—Five Defense Minerals Exploration Administration (DMEA) projects were completed during 1957 at a cost of \$58,813 to the Government. Four others were active during the year at an estimated cost of \$68,630 to the Government. A tabulation of these exploration contracts follows:

Operator	County	Commodity	State of contract
New Jersey Zinc Co.....	Buckingham.....	Zinc, lead, copper.....	Completed.
Do.....	Spotsylvania.....	do.....	Do.
Do.....	Smyth.....	Zinc, lead.....	Do.
Do.....	do.....	Zinc.....	Do.
Ronald F. Beers, Inc.....	Buckingham.....	Copper, lead, zinc.....	Do.
Craven, Shuffelbarger, and Patteson.....	Nelson.....	Rutile.....	Active.
New Jersey Zinc Co.....	Louisa.....	Zinc, lead, copper.....	Do.
Do.....	Smyth and Wythe.....	Zinc, lead.....	Do.
Do.....	Wythe.....	do.....	Do.

Mica was purchased by the Government through the General Services Administration (GSA) Spruce Pine (N. C.) Materials Purchase Depot. Metallurgical manganese ore of 35-percent or more manganese content was delivered to the Government under the Defense Production Act carlot purchase program.

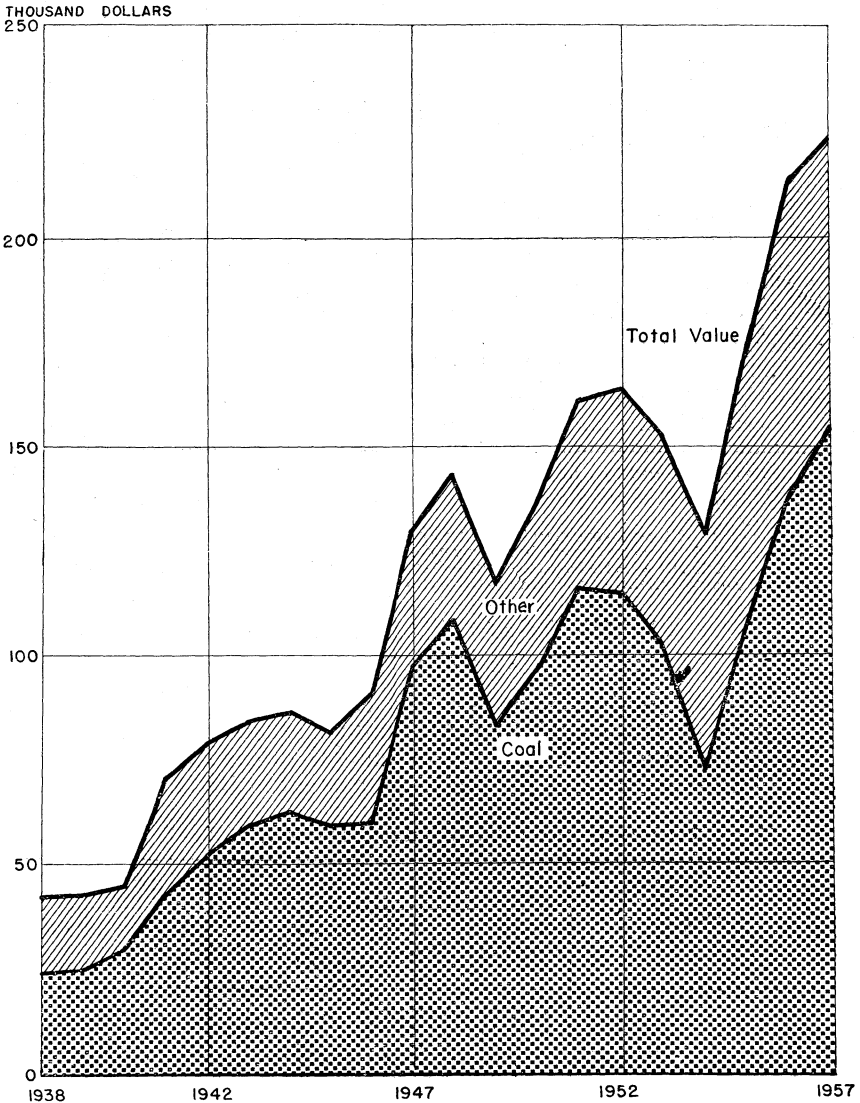


FIGURE 1.—Value of coal and total value of mineral production in Virginia, 1938-57.

TABLE 1.—Mineral production in Virginia, 1956–57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate.....pounds..	1,349	(²)		
Clays.....	1,000,019	\$1,033	893,255	\$986
Coal.....	28,062,775	138,127	29,505,579	153,959
Lead (recoverable content of ores, etc.).....	3,035	953	3,143	899
Lime.....	512,346	5,926	510,216	6,029
Manganese ore (35 percent or more Mn).....gross weight..	20,231	1,902	12,655	1,058
Marl, calcareous.....	10,522	12	(³)	(⁴)
Mica, sheet.....pounds..	396	6	529	6
Natural gas.....million cubic feet..	2,926	811	\$2,500	\$700
Sand and gravel.....	7,783,103	9,240	6,298,269	8,854
Silver (recoverable content of ores, etc.).....troy ounces..	1,874	2	(⁵)	(⁶)
Slate.....	31,894	1,035	(⁵)	1,003
Stone.....	14,081,904	23,076	\$14,243,510	\$21,158
Zinc (recoverable content of ores, etc.).....	19,196	5,181	23,080	5,277
Value of items that cannot be disclosed:				
Aplite, portland cement, masonry cement, hydraulic lime (1956), feldspar, gem stones (1957), gypsum, iron oxide pigments, kyanite, manganese ore-ferruginous (1956), petroleum, pyrites, salt, soapstone, stone (dimension miscellaneous, and dimension sandstone 1957), titanium concentrate, and values indicated by footnote 5.....				
		24,930		28,154
Total Virginia ⁷		208,806		224,531

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Less than \$500.

³ Preliminary figure.

⁴ Beginning with 1957 calcareous marl included with stone.

⁵ Figure withheld to avoid disclosing individual company confidential data.

⁶ Excludes certain stone, value for which is included with "Items that cannot be disclosed."

⁷ Total adjusted to eliminate duplicating value of clays and stone.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Coal production in Virginia continued to rise and totaled 29.5 million short tons valued at \$154 million, a new record—5 percent higher in tonnage and 11 percent in value than the former peak year 1956. The average value per ton rose 6 percent in 1957. The value of

TABLE 2.—Production and value of bituminous coal, 1956–57, by counties

County	1956			1957		
	Short tons	Value	Average value per ton ¹	Short tons	Value	Average value per ton ¹
Buchanan.....	9,430,237	\$45,599,393	\$4.84	10,481,001	\$50,178,827	\$4.79
Dickenson.....	4,792,884	25,460,407	5.31	5,267,736	28,336,606	5.38
Lee.....	761,584	4,636,273	6.09	550,133	3,380,377	6.14
Montgomery.....	7,340	44,627	6.08	24,832	190,493	7.67
Russell.....	1,471,111	6,661,502	4.53	2,745,060	14,306,507	5.21
Scott.....	7,300	34,310	4.70	16,184	55,337	3.42
Tazewell.....	3,542,464	21,464,700	6.06	3,993,979	26,354,927	6.60
Wise.....	8,049,855	34,225,365	4.94	6,426,654	31,155,622	4.25
Total.....	28,062,775	138,126,577	4.92	29,505,579	153,958,696	5.22

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).

coal output was 69 percent of the value of all mineral output in Virginia in 1957. The State maintained its rank as the sixth ranking coal producer in the United States. Virginia output included high- and low-volatile coals for domestic and industrial use and some semi-anthracite from Montgomery County, mostly for domestic purposes.

The bulk of the Virginia production was mined in the extreme southwestern part of the State, and the combined output of 4 counties—Buchanan, Wise, Dickenson, and Tazewell—totaled 89 percent of the tonnage and 88 percent of the value of the State total. Most of the coal was mined underground, but sizable tonnages were also mined by strip and auger methods.

Petroleum and Natural Gas.—The total quantity of petroleum and natural gas produced was small compared with other States, although the output of petroleum in Virginia in 1957 increased 50 percent. Production was confined to the Rose Hill field in Lee County. No new oil wells were drilled during 1957.

The output of natural gas decreased about 15 percent. The largest part came from Dickenson and Buchanan Counties, and smaller quantities from Wise, Russell, and Scott Counties. Natural gas produced by United Producing Co. in Buchanan County was mostly delivered to the Hope Natural Gas Co.; that produced by the Clinchfield Coal Co. in Dickenson County to the Kentucky-West Virginia Gas Co.; and the small output from the Early Grove field in Scott and Washington Counties to the Bristol Coal Corp.⁴ Eight wells were completed in 1957 in Buchanan and Dickenson Counties by 3 companies and 2 each in Russell and Wise Counties by Clinchfield Coal Co. Depths of wells in Buchanan County varied from about 4,850 feet to 5,662 and in Dickenson County from about 4,900 feet to 7,245. Production in Buchanan County came from the Berea sandstone formation, while most of the output in Dickenson County came from Devonian shale and some from the Berea (Mississippian) sand.⁵

A detailed study of the oil and gas possibilities in southwestern Virginia, as determined by deep-drilling tests, was published.⁶

NONMETALS

Aplite.—Output of crude aplite in Amherst and Nelson Counties increased slightly in 1957 compared with 1956. Aplite was mined, ground, and sold to glass manufacturers for its alumina content by two producers near Piney River. These two firms were the only producers of aplite in the United States. Production of ground aplite was about one-eighth less than in 1956.

Cement.—Shipments of portland cement in 1957 in Virginia rose 11 percent in quantity and 17 percent in value compared with 1956. Shipments of masonry cement were 64 percent greater than in 1956. However, this figure in 1957 included hydraulic lime, formerly classified as a natural cement. Using comparable data, shipments of hydraulic lime and masonry cement combined increased 6 percent in quantity and decreased 3 percent in value in 1957 compared with 1956.

⁴ Young, David M., *Oil and Gas Development in Virginia During 1957*: Virginia State Dept. of Labor and Industry, Ann. Rept., 1957, Richmond, Va., 1957, pp. 101-103.

⁵ Richard, Horace G., *Developments in Atlantic Coastal States Between New Jersey and South Carolina in 1957*: Bull. Am. Assoc. Petrol. Geol., vol. 42, No. 6, June 1958, p. 1339.

⁶ Young, D. M., *Deep Drilling Through Cumberland Overthrust Block in Southwestern Virginia*: Am. Assoc. Petrol. Geol. vol. 41, No. 11, 1957, pp. 2567-2573.

Two companies operating 3 plants produced portland and masonry cements in 1957, and 1 firm produced masonry cement only. Two of the plants were dry-process plants—at Fordwick, Augusta County, and at Cloverdale, Botetourt County—and one a wet-process plant—at South Norfolk, Norfolk County. Production at these plants, although hindered by a work stoppage in July, continued to grow, owing largely to installation of new facilities the preceding year. The fourth plant—at Riverton, Warren County—operated throughout the year and used local shales in preparing its masonry cement. The South Norfolk plant utilized company-mined calcareous marl and clays; the Cloverdale plant, company-mined limestone; and the Fordwick plant, company-mined limestone and shale. Types of portland cement produced were predominantly general-use and moderate-heat, and smaller amounts of high-early-strength cements.

Clays.—Owing to decreased building activity in 1957, the output of clays in Virginia dropped 11 percent in tonnage to the lowest point since 1954. All of the clay produced in the State in 1957 was common or miscellaneous clay or shale and was consumed in heavy clay products (including building brick, drain tile, and flue linings), lightweight aggregate, and portland cement. Thirteen companies produced clays at 15 plants in 13 counties. One firm's output was transferred to another area, however, and one new plant began operations in 1957. The leading clay-mining counties were: Botetourt, Henrico, Chesterfield, and Frederick.

TABLE 3.—Clays sold or used by producers, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year	Short tons	Value
1948-52 (average).....	691, 226	\$673, 703	1955.....	935, 941	\$873, 348
1953.....	952, 266	927, 571	1956.....	1, 000, 019	1, 032, 665
1954.....	704, 843	723, 292	1957.....	893, 255	986, 302

Feldspar.—Owing to the competition of aplite, nephelite syenite and to the higher importation of foreign china, the production of both crude and ground feldspar in Virginia in 1957 dropped sharply. Both potash and soda feldspar were mined by 1 firm from 3 mines in Bedford County. After grinding in the company mill, it was consumed mostly by pottery and enamel manufacturers. A small quantity of North Carolina feldspar also was ground.

Gem Stones.—A small quantity of amazonite, unakite, and epidote from Amelia and Madison Counties was marketed in 1957.

Gypsum.—Mine production of crude gypsum in 1957 at Plasterco (Washington County) by United States Gypsum Co. declined owing to the lowered construction activity compared with 1956. This company also operated a mill and plasterboard plant at Plasterco and a calcining plant at Norfolk. The Norfolk plant used both domestic and imported gypsum. Three fertilizer companies in Norfolk County sold imported gypsum for use as land plaster.

Iron Oxide Pigments.—American Pigments Corp. produced iron oxide pigments in 1957 in Virginia at Hiwassee, Pulaski County. Output consisted of sienna, umber, ocher, and natural yellow oxides. American Pigment Corp. plants at Pulaski and Hiwassee (Pulaski

County) and the Blue Ridge Talc Co., Inc., plant at Henry (Franklin County), produced natural and manufactured finished pigments. Sales consisted of mineral blacks, browns, reds, and yellows, including ochers, siennas, and umbers.

Kyanite.—Kyanite Mining Corp. increased its output substantially in 1957 owing principally to development of a new mine and mill on Willis Mountain near Dillwyn, Buckingham County. Production continued at its Baker Mountain property in Prince Edward County. Part of the product was processed at Pamplin. Kyanite was used for special refractories and in ceramic bodies, including insulators and porcelain. A detailed description of the development of mining and of the milling processes, including flotation, at the Dillwyn plant was published.⁷

Lime.—Production of lime in 1957 in Virginia again surpassed 500,000 short tons valued at over \$6 million. Most of the lime produced (94 percent) was used for chemical and industrial purposes, and 89 percent of the total sold or used was quicklime. Sales of building and agricultural lime in Virginia in 1957 were higher than in 1956, although chemical and industrial sales were slightly less in 1957 than in 1956. Prices remained about the same as in 1956.

Limestone suitable for manufacturing lime is abundant in Virginia, particularly in the Shenandoah and other valleys west of the Blue Ridge. Shell was used for limemaking by two companies near Chesapeake Bay in southeastern Virginia. (Leading lime producers in 1957 were: National Gypsum Co. and Standard Lime & Cement Co., Giles County; Chemstone Corp., Shenandoah County (2 plants); and M. J. Grove Lime Co., Frederick County.) Lime was produced in Frederick, Giles, Isle of Wight, Norfolk, Shenandoah, and Tazewell Counties.

TABLE 4.—Lime (quick and hydrated) sold and used by producers, 1948–52 (average) and 1953–57, by types

Year	Agricultural		Building		Chemical and other industries		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	21, 126	\$253, 895	10, 103	\$114, 779	379, 917	\$3, 500, 819	411, 146	\$3, 869, 492
1953.....	19, 215	243, 030	10, 819	117, 477	447, 350	4, 586, 911	477, 384	4, 947, 418
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.....	17, 897	354, 287	14, 190	51, 995	135, 250	5, 622, 860	510, 216	6, 029, 142

¹ Excludes production of quicklime to avoid disclosing individual company confidential data; included in total.

Marl, Calcareous.—Calcareous marl output for 1957 is included with stone production. Most of it was used in manufacturing cement in Norfolk County. Some was crushed, dried, and pulverized for agricultural use in Clarke and Surry Counties.

Mica.—Although larger than in 1956, the output of sheet mica in Virginia in 1957 was small and was all sold for the Government stockpile through the Government GSA Spruce Pine (N. C.) Purchase

⁷ Pit and Quarry, Kyanite Mining Corp.'s New Mine, Plant: Vol. 50, No. 3, September 1957, pp. 118–120, 122.

Depot. Hand-cobbed and full-trimmed mica was sold from Amelia County and full-trimmed mica from Goochland and Henry Counties. No scrap mica was reported during 1957.

One firm ground mica by wet process at Newport News for use in paint, rubber, wallpaper, plasters, and other products not specified.

Nitrogen Compounds.—Allied Chemical & Dye Corp., Nitrogen Division, in 1957 continued to manufacture nitrogen compounds at Hopewell (Prince George County). Synthetic sodium nitrate, ammonia, urea solutions, ammonium sulfate, solid ammonium nitrate, and other nitrogen products were manufactured. The chief outlet for these materials was as fertilizers and fertilizer components.

Perlite.—One firm expanded perlite at Hopewell, Prince George County. The crude material was obtained from New Mexico. Most of the expanded product was sold for building plaster and smaller tonnages for concrete aggregate and soil conditioning. Because of slower residential construction activity, production in 1957 was less than in 1956.

Pyrites.—Lump and fine pyrites concentrate was produced at the Gosson mine in Carroll County by General Chemical Division, Allied Chemical & Dye Corp. Due to the lower industrial production in 1957, output was less than in 1956. Production was used in manufacturing sulfuric acid at its plant at Pulaski.

Salt.—Salt was produced by the Olin-Mathieson Chemical Corp. at Saltville from brines pumped from underground rock-salt beds. Recovery of brines in 1957 was 12 percent less than in 1956. The brines were used as raw material in making chlorine, soda ash, and other chemicals.

Sand and Gravel.—Owing to reduced business activity and lower construction starts, both in domestic housing and in industrial and commercial building, the output of Virginia sand and gravel in 1957 decreased 19 percent compared with 1956. Production totaled 6.3 million short tons, valued at \$8.9 million. The average value per ton, however, rose 18 percent—from \$1.19 per ton in 1956 to \$1.41 per ton in 1957. Only 3 percent of the total sand and gravel output was mined by Government agencies. The major share of the total output was consumed in building and paving. Other than building and paving sand and gravel, which constituted the bulk of the total sand and gravel mined, glass, engine, railroad ballast, and "Other" sands were produced. "Other" sands included mostly fill and sand for ice control and fertilizer filler. The output of sand and gravel was reported from 26 counties in 1957—4 less than in 1956. The chief sand-and-gravel-producing counties in 1957 included Henrico, Chesterfield, Fairfax, Prince George, and Rockbridge.

Slate.—The production of slate in Virginia in 1957 increased, owing to the higher output of granules, although the total value in 1957 declined slightly from 1956 but was still more than \$1 million. Because of lower building activity in 1957, sales of roofing and flagging were substantially less than in 1956—34 and 10 percent, respectively. Virginia slate was quarried by 4 companies, 1 of which prepared granules in Albemarle and Buckingham Counties and the other marketed roofing and flagging slate from Buckingham County.

Soapstone.—Mine production of soapstone used for grinding purposes decreased in 1957 compared with 1956. Sales of ground

TABLE 5.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Use	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	(1)	(1)	(1)	1,291,435	\$1,661,867	\$1.29
Paving.....	1,456,852	\$1,094,523	\$0.75	710,067	751,637	1.06
Engine.....	81,089	81,510	1.01	80,879	93,251	1.15
Railroad ballast.....				35,258	34,100	.97
Other.....	26,294	29,592	1.13	325,322	167,257	.51
Total.....	1,564,235	1,205,625	.77	2,442,961	2,708,112	1.11
Gravel:						
Building.....	1,788,653	2,840,894	1.59	(1)	(1)	(1)
Paving.....	2,475,759	2,689,551	1.09	(1)	(1)	(1)
Other.....	8,500	15,300	1.80			
Total.....	4,272,912	5,545,745	1.30	(1)	(1)	(1)
Undistributed ²	1,795,302	2,379,964	1.33	3,645,916	6,017,000	1.65
Total sand and gravel.....	7,632,449	9,131,334	1.20	6,088,877	8,725,112	1.43
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	30,056	15,281	.51			
Paving.....	22,393	8,553	.38	57,924	33,905	.59
Total.....	52,449	23,834	.45	57,924	33,905	.59
Gravel: Paving.....	98,205	85,239	.87	151,468	94,492	.62
Total sand and gravel.....	150,654	109,073	.72	209,392	128,397	.61
Grand total.....	7,783,103	9,240,407	1.19	6,298,269	8,853,509	1.41

¹ Figure withheld to avoid disclosing individual company confidential data.

² Includes glass, filter sand (1957), and those uses indicated by footnote 1.

TABLE 6.—Production of sand and gravel by Government-and-contractor operations, 1956-57, by counties, in short tons

County	1956	1957	County	1956	1957
Allegheny.....	4,455		Henrico.....	47,440	50,084
Amherst.....	400		Nansemond.....		15,922
Appomattox.....	1,480		Nelson.....	27,000	22,300
Augusta.....	22,477	55,166	Page.....		3,336
Buckingham.....	13,201	3,140	Pittsylvania.....	540	81C
Campbell.....	1,349	3,607	Prince Edward.....	6,007	4,621
Charlottesville.....		680	Rockbridge.....	4,500	18,279
Cumberland.....	10,848	21,924	Rockingham.....	8,130	7,323
Frederick.....		1,000			
Halifax.....	2,827	1,300	Total.....	150,654	209,392

soapstone were consumed mostly for roofing, rubber, foundry facings, and insecticides. Producers were Blue Ridge Talc Co., Inc., Henry, Franklin County; and Alberene Stone Corp. of Virginia, Schuyler, Nelson County. Statistics on dimension soapstone are included under the Stone section in this chapter, which follows.

Stone.—Stone ranked second in both production and value among Virginia minerals. The output was slightly larger than in 1956 and attested to the continued active road and highway consumption

of stone in concrete aggregate and roadstone, the chief use for Virginia Stone. Types of stone quarried or mined in Virginia in 1957 were: Basalt, granite, marble, sandstone, and miscellaneous stone. Also included under stone was some production of oyster and other shell for agstone, lime production, and other uses. Of these, limestone supplied 75 percent of the Virginia total stone output, and granite and basalt comprised the bulk of the remainder. Leading stone-producing counties were: Botetourt, Nelson, Campbell, Giles, and Frederick.

Stone was quarried or mined in 34 counties by 66 commercial operators and 7 State and municipal agencies from 68 operations; in addition, 4 firms produced shell. Commercial stone producers were divided as follows: 44 produced limestone at 47 plants, 5 quarried basalt, 1 marble, 5 sandstone, and 3 miscellaneous stone, 1 each dimension soapstone and greenstone, and 1 crushed stone. An output of limestone was reported from 22 of the 64 mineral-producing counties in the State.

TABLE 7.—Stone sold or used by producers, 1956–57, by kinds and uses

Kind and use	1956		1957	
	Short tons	Value	Short tons	Value
Dimension stone: Sandstone, all uses.....	507	\$4, 895	(1)	(1)
Crushed and broken stone:				
Granite:				
Riprap.....	135, 798	225, 947		
Concrete and roadstone.....	1, 425, 662	2, 268, 458	} 2, 416, 689	} \$3, 508, 744
Other uses.....	² 399, 790	² 453, 880		
Basalt and related rocks: Concrete and roadstone..	743, 884	1, 249, 759	³ 973, 568	³ 1, 609, 120
Limestone:				
Fluxing stone.....	578, 099	962, 951	564, 491	945, 608
Concrete and roadstone.....	5, 432, 119	7, 298, 612	5, 325, 510	7, 451, 638
Railroad ballast.....	472, 758	551, 394	⁴ 489, 225	⁴ 577, 704
Agriculture.....	593, 481	1, 132, 630	585, 751	1, 131, 716
Miscellaneous.....	⁴ 4, 035, 141	⁴ 5, 889, 277	3, 678, 358	5, 103, 158
Sandstone: All uses.....	(5)	(5)	131, 508	382, 346
Shell: Miscellaneous uses.....	(5)	(5)	19, 874	215, 939
Undistributed ⁶	264, 665	3, 037, 792	58, 536	231, 794
Total.....	14, 081, 904	23, 075, 595	⁷ 14, 243, 510	⁷ 21, 157, 767

¹ Figure withheld to avoid disclosing individual company confidential data; not included in total.

² Includes railroad ballast.

³ Includes riprap and railroad ballast.

⁴ Includes riprap.

⁵ Figure withheld to avoid disclosing individual company confidential data.

⁶ Includes miscellaneous dimension stone (1956), miscellaneous crushed and broken stone including concrete and roadstone, crushed and broken marble, and those materials indicated by footnote 5.

⁷ Incomplete total—excludes dimension miscellaneous stone, dimension sandstone, and calcareous marl.

METALS

Iron Ore.—A comprehensive and detailed report on the iron-ore deposits in the Clifton Forge area included a description of the extent and quality of the deposits and maps showing geological and topographic features of the region containing them.⁸

Lead and Zinc Ores.—The output of recoverable lead in Virginia in 1957 increased slightly, although the value was less than in 1956, due to the lower price for lead in 1957 compared with 1956. The production of recoverable zinc, however, continued to expand, al-

⁸ Lesure, F. G., *Geology of the Clifton Forge Iron District, Virginia*: Virginia Polytech. Inst. Eng. Exp. Sta. Ser., Bull. 118, 1957, 79 pp.

though the average value per ton declined appreciably. Lead and zinc were recovered from ore mined at Austinville, Wythe County. In late September ore also began to flow through a 13,000-foot tunnel to the Austinville mill from the new Ivanhoe mine. Part of the lead and zinc concentrate from the Austinville mill was shipped to Palmer-ton, Pa. Some zinc concentrate also was shipped to East Chicago and some lead concentrate to Federal, Ill. At the Arminius mine (Mineral, Louisa County) exploration continued below the 1200-foot level, and mining operations will depend upon the results of this testing and zinc market conditions. Tri-State Zinc, Inc., Timberville, began to produce zinc ore at its Bowers-Campbell mine in north-western Rockingham County in early 1957. Zinc concentrate from the nearby mill was shipped to Josephstown, Pa., for recovery of zinc values.

TABLE 8.—Mine production of recoverable silver, lead, and zinc, 1948-52 (average) and 1953-57

Year	Silver		Lead		Zinc	
	Troy ounces	Value	Short tons	Value	Short tons	Value
1948-52 (average).....			3,314	\$1,070,391	12,437	\$3,626,176
1953.....	1,169	\$1,058	2,788	730,456	16,676	3,835,480
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)	(1)	3,143	898,898	23,080	5,277,476

¹ Figure withheld to avoid disclosing individual company confidential data.

Manganese Ore.—The output of manganese ore in 1957 declined 37 percent in tonnage and 44 percent in value compared with 1956. One large producer discontinued mining, and others shipped less than in 1956. All the ore produced was Metallurgical grade of 35 percent or better manganese content. This ore was shipped to GSA under the Government carlot program. Washing and dense-medium separation were commonly used to remove impurities and to upgrade the ore. Seventeen firms or individuals made shipments. The principal producing counties were Smyth, Augusta, and Appomattox. Manganese ore also was mined in 1957 in the following counties: Bland, Campbell, Frederick, Giles, and Rockingham.

Occurrence and mineral associations of manganese ores in Virginia, methods of beneficiation, output, and estimates of reserves were discussed in an illustrated article also containing a map showing the localities in which deposits are found.⁹

TABLE 9.—Manganese and manganiferous ores shipped from mines, 1948-52 (average) and 1953-57

Year	Short tons	Value	Year		
			Short tons	Value	Value
1948-52 (average).....	1,213	\$17,923	1955.....	32,654	\$2,779,337
1953.....	8,454	635,926	1956 ²	20,231	1,901,983
1954.....	22,678	1,780,934	1957.....	12,655	1,057,462

¹ In addition, in 1948-52 there was an average output of 748 tons of ferruginous manganese ore valued at \$7,796 and an average output of 130 tons of miscellaneous ore valued at \$3,398.

² Incomplete total; excludes a small quantity of ferruginous manganese ore.

⁹ Sears, C. E. Jr., Manganese Deposits of the Appalachian Area of Virginia: Min. Ind. Jour., vol. 4, No. 1, March 1957, pp. 1-4.

Silver.—Silver was recovered as a byproduct of the milling and beneficiation of zinc-lead ore mined at Austinville (Wythe County). The output was somewhat smaller in 1957 than in 1956.

Titanium Concentrate.—American Cyanamid Co. continued to produce ilmenite at its Piney River (Amherst County) mine; output was used to manufacture titanium pigments at its adjacent plant and declined slightly in 1957 compared with 1956. The new Metal & Thermit plant near Beaver Dam (Hanover County) was nearly completed by the end of 1957 and was scheduled for commercial operation in the early part of 1958. Production in 1957 was small and consisted of sample shipments only. Both ilmenite and rutile will be recovered.

REVIEW BY COUNTIES

Albemarle.—S. L. Williamson Co. Inc. (Charlottesville), recovered sand from dredging for use as paving material. S. A. Jessup (Charlottesville) produced a quantity of sand for miscellaneous uses.

Charlottesville Stone Corp. produced crushed and broken basalt for concrete aggregate and roadstone at its quarry and crusher at Charlottesville. Superior Stone Co. produced and crushed granite for concrete, roadstone, and riprap at the Red Hill operation (North Garden).

Slate was quarried and crushed for granules by Blue Ridge Slate Co. at Esmont in the southern part of the county.

Amelia.—Small quantities of hand-cobbed and full-trimmed mica were produced in Amelia County in 1957 by 4 miners operating 5 mines. Sales were made to the Government Materials Purchase Depot at Spruce Pine, N. C., through GSA. Two dealers marketed a small amount of amazonite from near Amelia Courthouse as semi-precious gem material.

Amherst.—The Riverton Lime & Stone Co. Division, Chadbourn-Gotham, Inc., mined aplite from open-pit operations on the northern edge of Amherst County near Piney River. This product was prepared for shipment to glassmakers by grinding and magnetic separation at a mill in Nelson County.

TABLE 10.—Value of mineral production in Virginia, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value ²
Albemarle.....	(*)	(*)	Stone, slate, sand and gravel.
Alleghany.....	\$1,559		
Amelia.....		\$3,252	Mica, gem stones.
Amherst.....	(*)	(*)	Titanium, aplite, sand and gravel.
Appomattox.....	(*)	(*)	Manganese, stone.
Augusta.....	(*)	(*)	Cement, stone, manganese ore, clays, sand and gravel.
Bedford.....	(*)	(*)	Feldspar.
Bland.....	63,007	(*)	Manganese ore.
Botetourt.....	(*)	(*)	Cement, stone, clays.
Brunswick.....	(*)	(*)	Stone.
Buchanan.....	45,599,393	50,173,827	Coal.
Buckingham.....	(*)	(*)	Slate, kyanite, clays, sand and gravel.
Campbell.....	(*)	(*)	Stone, manganese ore, sand and gravel.
Caroline.....		6,850	Sand and gravel.
Carroll.....	(*)	(*)	Pyrites, stone.
Charlotte.....	55	34	Sand and gravel.
Chesterfield.....	(*)	(*)	Sand and gravel, clays.
Clarke.....	12,000	13,500	Calcareous marl.
Culpeper.....	184,000	(*)	Stone, sand and gravel.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Virginia, 1956–57, by counties¹—Con.

County	1956	1957	Minerals produced in 1957 in order of value ²
Cumberland.....	\$5,260	(0)	Sand and gravel.
Dickenson.....	25,460,407	\$28,336,606	Coal.
Fairfax.....	2,195,050	1,325,771	Sand and gravel, stone, shell.
Fauquier.....	500,168	(0)	Stone.
Franklin.....	(0)	(0)	Soapstone.
Frederick.....	1,611,669	1,720,849	Stone, lime, sand and gravel, clays, manganese ore.
Giles.....	(0)	(0)	Lime, stone, manganese ore.
Goochland.....	650,641	(0)	Stone, mica.
Greensville.....	1,031,002	(0)	Stone.
Halifax.....	989	65	Sand and gravel.
Hanover.....	(0)	(0)	Stone, titanium.
Henrico.....	(0)	(0)	Sand and gravel, clays.
Henry.....	(0)	28,341	Stone, mica.
Isle of Wight.....	78,017	(0)	Lime, shell.
King William.....	(0)	(0)	
Lee.....	(0)	4 3,380,377	Coal, stone.
Loudoun.....	444,822	444,612	Stone.
Madison.....		60	Gem stones.
Mecklenburg.....		415,000	Stone.
Montgomery.....	680,589	731,791	Stone, coal, clays.
Nansmond.....	(0)	(0)	Clays, sand and gravel.
Nelson.....	(0)	(0)	Stone, aplite, sand and gravel, soapstone.
Norfolk.....	(0)	(0)	Cement, calcareous marl, lime, sand and gravel, shell.
Nottoway.....	175,000	225,000	Stone.
Orange.....	(0)	(0)	Do.
Page.....	3,235	658	Sand and gravel.
Pittsylvania.....	115,151	(0)	Stone, sand and gravel.
Powhatan.....	3,301		
Prince Edward.....	(0)	(0)	Kyanite, sand and gravel.
Prince George.....	706,403	(0)	Sand and gravel.
Prince William.....	(0)	(0)	Clays.
Princess Anne.....	255,885	326,982	Sand and gravel.
Pulaski.....	(0)	(0)	Iron oxide pigments.
Roanoke.....	(0)	(0)	Stone, clays.
Rockbridge.....	1,324,551	987,368	Stone, sand and gravel, clays.
Rockingham.....	(0)	(0)	Zinc, stone, manganese ore, sand and gravel.
Russell.....	(0)	14,306,507	Coal.
Scott.....	(0)	4 55,337	Stone, coal.
Shenandoah.....	1,549,408	1,938,195	Lime, stone.
Smyth.....	4,944,989	1,445,508	Salt, manganese ore, stone, sand and gravel, clays.
Spotsylvania.....	273,406	329,185	Sand and gravel.
Stafford.....	220	2,640	Calcareous marl.
Stafford.....	22,324,738	27,334,703	Coal, stone, lime, clays.
Warren.....	(0)	1,319,361	Cement, stone.
Washington.....	2,063,915	(0)	Gypsum, stone.
Westmoreland.....	(0)		
Wise.....	(0)	31,155,622	Coal.
Wythe.....	(0)	(0)	Zinc, lead, stone, silver.
York.....	(0)		
Undistributed ³	96,547,092	58,517,642	
Total ⁴	208,806,000	224,531,000	

¹ The following counties are not listed, because no production was reported: Accomack, Arlington, Bath, Charles City, Craig, Dinwiddie, Essex, Floyd, Fluvanna, Gloucester, Grayson, Greene, Highland, James City, King and Queen, King George, Lancaster, Louisa, Lunenburg, Mathews, Middlesex, New Kent, Northampton, Northumberland, Patrick, Rappahannock, Richmond, Southampton, Stafford, and Sussex.

² Value of fuels, including natural gas and petroleum, included with "Undistributed."

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Coal only; value of stone included with "Undistributed."

⁵ Includes natural gas and petroleum and part of the value of mica (1956), ferruginous manganiferous ore (10 to 35 percent Mn, 1956), manganese ore (35 percent or more Mn, 1957), stone (1957), and gem stones (1957) and values indicated by footnote 3; for these commodities complete distribution by counties was not available.

⁶ Total adjusted to eliminate duplicating value of clays and stone.

Ilmenite was produced by American Cyanamid Co. at Piney River in the northern part of the county. The output decreased somewhat in 1957 and was consumed in the company titanium-pigments mill.

J. M. Smiley recovered building sand by dredging north of Lynchburg in Amherst County.

Appomattox.—Metallurgical manganese ore of 35 percent or more Mn content was mined by Southeastern Manganese Co. from its Nuttall mine near Lynchburg in the extreme western part of the

county. A new log washer was added to this firm's facilities during 1957.

Virginia Department of Agriculture and Immigration produced crushed limestone for agricultural purposes.

Augusta.—Parker Manganese Co., Crimora mine, Crimora, and South River Mining Co., Inc., South River mine, Vesuvius, in the eastern part of the county produced metallurgical manganese ore of 35 percent or more manganese content. This ore was purchased through GSA under the Government carlot program.

Lehigh Portland Cement Co. produced portland cement and masonry mortar at a six-kilo, dry-process plant at Fordwick. The portland cement shipped mostly was general-use and moderate-heat cement and smaller amounts of high-early-strength material. Finished cement was shipped mostly to Virginia and North Carolina and smaller quantities to other Southern States.

Miscellaneous clay and shale were mined by North American Brick Co. near Staunton for manufacturing building brick.

Crushed limestone for use in manufacturing cement was produced by Lehigh Portland Cement Co. (Fordwick). Three other companies produced crushed limestone for concrete aggregate and roadstone at quarries near Staunton, in the central portion of the county. Virginia Department of Agriculture and Immigration quarried and crushed limestone for agricultural purposes. The Virginia Highway Department reported output of crushed limestone, quarried at various locations in the Staunton district, for use as concrete aggregate and roadstone.

Paving gravel was produced by the Virginia Department of Highways.

Bedford.—The Clinchfield Sand & Feldspar Corp. mined feldspar at the Claytor, Coles, and Peaksville mines near Bedford. Potash and soda feldspar were produced. This feldspar (including the product of one North Carolina mine) was ground at the company mill at Bedford and marketed for pottery, enamel, and welding rods. Shipments of ground feldspar were made mostly to Maryland, Ohio, New York, and Pennsylvania. In 1957 production decreased sharply owing to slackened business activity and foreign china imports.

Bland.—Bluefield Mining Corp. mined manganese ore from its Dismal Creek mine for sale to the GSA. Some ore also was marketed to the GSA from a now inactive mill near Hollybrook.

Botetourt.—Botetourt County led all Virginia counties in clay production. Virginia Lightweight Aggregate Corp. and Roanoke-Webster Brick Co., Inc., mined miscellaneous clay or shale at Webster, about 10 miles east of Roanoke, for use in lightweight aggregate and heavy clay products, respectively.

Botetourt County continued to rank first in the State in value of stone in 1957, although there was a slight decrease compared with 1956. Two companies were the leading limestone producers in the county. Lone Star Cement Corp. (Cloverdale) crushed limestone for use in manufacturing cement; and Blue Ridge Stone Corp. (Blue Ridge) produced crushed limestone for use as concrete aggregate, roadstone, and railroad ballast. Two other companies operated three quarries in the eastern section of the county near Rocky Point and Buchanan, producing crushed limestone, principally for concrete

aggregate, roadstone, agstone, railroad ballast, and blast-furnace flux.

General-use and moderate-heat, high-early-strength and masonry cements were produced at a four-kiln, dry-process plant at Cloverdale by Lone Star Cement Corp. Finished cement was distributed largely to Virginia and North Carolina, with smaller amounts to other Southern States.

Brunswick.—Crushed and broken granite for use as road material was produced at the Rawlings quarry by Bryan Rock & Sand Co.

Buchanan.—Buchanan County ranked first among Virginia coal-producing counties in 1957 and produced over one-third of the total Virginia coal, valued at nearly one-third of the total coal value. The output surpassed 10 million short tons, valued at more than \$50 million, and was 11 and 10 percent greater, respectively, in quantity and value than in 1956. The number of mines likewise increased 33 percent in 1957 compared with 1956. Ninety-eight percent of the coal was mined at underground operations. Both strip and auger coal also was recovered. Among the leading producers in 1957 were Island Creek Coal Co. (Keen Mountain mine), Harman Mining Corp. (Harman mine), Jewell Ridge Coal Co. (Nos. 2 and 3 mines), and Sycamore Coal Co. (Buccaneer mine). Natural gas also was produced in Buchanan County.

Buckingham.—Slate granules were produced by Blue Ridge Slate Corp. at its Dutch Gap quarry at Bremono Bluff in the northeastern part of the county. Arvonian-Buckingham Slate Co., Inc., LeSueur-Richmond Slate Corp., and Williams Slate Co. produced roofing and flagging slate at Arvonian, also in the northeastern part of the county. Kyanite Mining Corp. opened its new mine and mill on Willis Mountain near Dillwyn in the central eastern part of the county. Shipments were mostly for refractory and ceramic use. A new company, Southern Lightweight Aggregate Corp., in 1957 began mining miscellaneous clay and shale and preparing lightweight aggregate at New Canton, in the extreme northeastern corner of the county. Commonwealth Sand & Gravel Corp. (address, Richmond), produced a quantity of building sand. Paving sand was produced by the Virginia Department of Highways.

Campbell.—Limestone was quarried and crushed for use as concrete aggregate and roadstone by Rockydale Stone Service Corp. (Concord) and Blue Ridge Stone Corp. (Lynchburg). Virginia Greenstone Co., Inc. (Lynchburg), quarried miscellaneous stone under the trade name "Virginia greenstone." Dimension stone for use as dressed building stone and rubble and some crushed and broken stone for miscellaneous uses were produced. William H. Ervine produced some manganese ore near Evington. Virginia Department of Highways produced some sand for paving and road maintenance.

Caroline.—Building sand and gravel was recovered by Dyson Sand & Gravel from a pit at Milford.

Carroll.—General Chemical Division, Allied Chemical & Dye Corp., mined pyrites at its Gossan mine at Cliffview near Galax in the southwestern part of the county on the Norfolk and Western Railway. The pyrites was consumed in making sulfuric acid.

Crews of the city of Galax produced crushed limestone for road material.

Charlotte.—Virginia Department of Highways produced sand for use as paving and road material.

Chesterfield.—Southern Materials Co., Inc., recovered filter sand and sand and gravel for building and paving purposes by dredging along the James River 10 miles south of Richmond in Chesterfield County. Southside Brick Works, Inc., mined miscellaneous clay from an open pit across the James River from Richmond for use in making heavy clay products.

Clarke.—J. C. Digges & Sons (White Post, near Berryville) and Amie Strother & Brother mined, dried, and pulverized calcareous marl for use as soil dressing.

Culpeper.—Building and paving sand was produced by Culpeper Sand Co. at a pit and preparation plant at Culpeper. Culpeper Stone Co. (Culpeper) produced some riprap and crushed stone for use as concrete aggregate and roadstone.

Cumberland.—Cumberland Sand & Gravel Corp. produced a quantity of paving sand at an unspecified location in the county and sold it to the Virginia Department of Highways. The latter also produced paving and road sand.

Dickenson.—Dickenson County was the third-ranking coal-producing county in Virginia in 1957. Production rose 10 percent in quantity and 11 percent in value to over 5.2 million short tons valued at more than \$28.3 million. Notwithstanding this increase in tonnage, the number of active mines decreased in 1957 to 64 from 184 in 1956. Nearly 90 percent of the output came from underground mines. Strip and auger mining also produced sizable tonnages. Strip coal almost doubled in volume compared with 1956. Leading producers in 1957 were Clinchfield Coal Co. (1 auger mine, operated under contract by Daniel Crisp Corp., and 5 underground mines), Bolling Coal Co. (1 strip mine), Contracting Enterprises, Inc. (1 strip mine), and Cassell Coal Co. (1 underground mine). Some natural gas also was recovered from wells in Dickenson County.

Fairfax.—Sand and gravel for building and paving purposes was produced in this county by several large companies, mostly near Alexandria and Springfield. Fairfax Quarries, Inc., produced and crushed basalt for concrete aggregate and roadstone at the Bull Run quarry and plant near Fairfax. Graham Virginia Quarries, Inc., produced crushed and broken granite for concrete aggregate, roadstone, and riprap at a quarry in the Lee district of Fairfax County along the Occoquan Creek. Crushed shell for use in poultry grit and lime was sold by Herbert Bryant, Inc., near Alexandria. Statistics for this material were included with stone.

Fauquier.—Millbrook Quarries produced crushed limestone at the Broad Run quarry, and W. W. Saunders (Warrenton), produced crushed basalt; both materials were used for concrete aggregate and roadstone. W. W. Saunders converted the stone crushers at his plant from roll to cone type. Dimension sandstone for rough construction and flagging was quarried by J. W. Costello (The Plains) and by James E. Corum (Broad Run) for flagging.

Franklin.—Finished red iron oxides, ochers, blended colors, and smaller quantities of siennas, umbers, and browns were marketed by Blue Ridge Talc Co., Inc., at Henry on the southern edge of the county. The same company mined crude soapstone from its King-Ramsey quarry and ground it for use in foundry facings, insecticides, and other products.

Frederick.—Virginia Glass Sand Corp. produced and processed sand usable for glass and building and paving material, from a pit and local plant at Gore. This company also purchased property containing additional sand reserves in September 1957. The Virginia Department of Highways produced paving and road sand supplied under contract. Two companies quarried and crushed limestone principally for use as road material, blast-furnace and open-hearth flux, agricultural purposes, manufacture of lime, glass, and some miscellaneous uses. Producers were: Stuart M. Perry, Inc. (Winchester), and M. J. Grove Lime Co. (Middletown and Stephens City). M. J. Grove Lime Co. operated a quarry and underground mine. The underground mine had 2 inclines 65 feet in length at a 30° angle and 4 horizontal tunnels 135 to 320 feet in length. This company also constructed an impactor and screening plant in 1957 to produce high-calcium glass and agricultural limestone.

M. J. Grove Lime Co. produced lime for building, agricultural, and chemical use at its Stephens City plant in the southern part of the county.

Miscellaneous clay from the Shenandoah Brick & Tile Corp. open-pit mine near Winchester was consumed in making heavy clay products.

Old Dominion Manganese Co., Inc., took over the former Hott & Miller manganese-ore mine at Star Tannery and mined and sold metallurgical manganese ore of 35 percent or more manganese content to GSA under the Government carlot purchase program.

Giles.—Giles County ranked first among Virginia counties in lime output. Lime was produced in 1957 by National Gypsum Co. (Kimballton), Standard Lime & Cement Co. (Kimballton), and Ripplemead Lime Co., Inc. (Ripplemead). Uses included building, agricultural, and predominantly chemical and industrial purposes.

In terms of value, Giles County was the second-ranking stone-producing county in Virginia in 1957. Four limestone operations were concentrated in the central northern section of the county near Kimballton, Klotz, and Ripplemead. Concrete aggregate, roadstone, railroad ballast, agricultural purposes, and lime manufacture were the chief uses of the crushed limestone.

J. Gordon Gusler produced manganese ore from the H. M. Reynolds mine near Newport in northeastern Giles County.

Goochland.—Crushed and broken granite for concrete aggregate and roadstone was quarried in the southeastern portion of the county near Manakin by Boscobel Granite Corp.

W. O. Baltsley and Piedmont Mining Co., Inc., sold small quantities of full-trim mica for the Government stockpile through GSA, at the Spruce Pine, N. C., Materials Purchase Depot.

Greensville.—Granite, quarried and crushed by Trego Stone Corp. (Emporia), was marketed for concrete aggregate, road material, riprap, and railroad ballast.

Halifax.—Virginia Department of Highways produced sand for paving and road purposes.

Hanover.—The new titanium-concentrate plant erected by Metal & Thermit Corp., New York, N. Y., at Montpelier near Beaverdam in the northwest corner of the county was scheduled for operation

early in 1958. Estimated to cost about \$1¼ million, the mill will recover both ilmenite and rutile.

The Vernon quarry of J. E. Baker Co., in the northern section of the county near Doswell, yielded basalt, which was crushed at the local plant for use as road material, railroad ballast, and riprap.

Henrico.—In terms of value, Henrico was the leading sand-and-gravel-producing county in Virginia. Southern Materials Co., Inc., operated a dredge 10 miles southeast of Richmond, and West Sand & Gravel Co., Inc., operated a pit and fixed plant at Richmond. The major output of sand and gravel was for use as building and paving material and some filter sand and sand for fill. Paving sand and gravel was produced by Henrico County Highway Department.

Daniels Brick & Tile Co. and Redford Brick Co., Richmond, mined river clay and shale (miscellaneous clay) from open pits for use in making building brick, draitile, flue linings, and other heavy clay products. Daniels Brick & Tile Co. sold its brick plant in August to Southside Brick Works, Richmond, but retained ownership of its tile plant.

Henry.—A small quantity of full-trim mica was sold by one operator to the GSA, Spruce Pine (N. C.) Purchase Depot.

Crews of the city of Martinsville produced and crushed granite for use as road material.

Isle of Wight.—Battery Park Fish and Oyster Co. (Battery Park) calcined shell at Smithfield for sale as agricultural lime.

Lee.—Except for Wise County, Lee was the only county in which coal output was less in 1957 than in 1956. Production and value declined more than one-fourth. The number of mines that reported output also dropped nearly one-fourth—from 47 to 36. Virtually all coal was mined from underground mines, although a small tonnage was strip-mined. The leading producers in 1957 were Blue Diamond Coal Co., Benvir Coal Co., Virginia Lee Coal Co., and Penn Darby Coal Co. A small output of petroleum was produced from the Rose Hill field in the extreme southwestern corner of Lee County.

Kentucky-Virginia Stone Co., Inc. (Gibson Station), produced crushed and broken limestone for road material, railroad ballast, and some riprap. Woodway Stone Co. (Woodway) produced crushed limestone for concrete aggregate and road material.

Loudoun.—The Palmer quarry, operated by crews of the Virginia State Highway Department, yielded a quantity of limestone conglomerate for miscellaneous uses. Arlington Stone Co. (Leesburg) produced crushed basalt for concrete aggregate and roadstone.

Louisa.—Exploration continued below the 1,200-foot level at the Arminius mine of the New Jersey Zinc Co. at Mineral in central Louisa County.

Madison.—A small amount of gem-quality unakite and epidote was obtained from Madison County and marketed as semiprecious stones.

Mecklenburg.—The Buggs Island granite quarry and plant of Marks Wicker (Boydton) produced broken and crushed stone for concrete aggregate, roadstone, riprap, and railroad ballast.

Montgomery.—Crushed and broken limestone for use as concrete aggregate, roadstone, railroad ballast, stone sand, and other uses was quarried by Radford Limestone Co., Inc. (Radford), and Montgomery

Lime, Inc. (Ellett). Velvet Sand Co. (Ironto) crushed sandstone, principally for building material.

The Old Virginia Brick Co., Inc., Salem, mined open-pit miscellaneous clay (shale) at Elliston for consumption in heavy-clay products.

Production of coal in Montgomery County, although small, more than tripled in both tonnage and value in 1957 compared with 1956. Montgomery was the only Virginia county in which semianthracite was produced and all output came from two deep mines.

Nansemond.—Paving gravel was produced by Virginia Department of highways, and some paving sand by contractors. Miscellaneous clay for heavy clay products was mined near Suffolk by Roanoke-Webster Brick Co.

Nelson.—Aplite was mined and ground at Piney River on the southern border of Nelson County by Consolidated Feldspar Department, International Minerals & Chemical Corp. Riverton Lime & Stone Co. Division, Chadbourn Gotham, Inc., processed apelite mined in Amherst County at its nearby mill, also at Piney River, Nelson County. Both firms sold their product to glass manufacturers in Ohio, West Virginia, New Jersey, and other States.

Alberene Stone Corp. of Virginia quarried soapstone near Schuyler in northeastern Nelson County. Most of the output was sold as a dressed dimension stone for flagging, laboratory, and architectural uses. Some of the stone, however, was crushed or ground for use in rubber and roofing compositions and other purposes.

The Virginia Department of Highways produced paving gravel in 1957.

Norfolk.—Lone Star Cement Corp., Virginia Division, mined calcareous marl from its own mines for use in making portland and masonry cements at its nearby wet-process, three-kiln cement plant at South Norfolk. General-use and moderate-heat cements were produced. Shipments of processed cement were mostly to Virginia and North Carolina.

Interstate Sand & Gravel, Division of Commonwealth Sand & Gravel Corp., produced building and paving sand and sand for use as fill by dredging in Norfolk County.

Reliance Fertilizer & Lime Corp. (South Norfolk) burned shell for sale as agricultural lime.

Ballard Fish & Oyster Co., Inc. (Norfolk), marketed shell as a byproduct of oyster fishing for use in filter beds. J. H. Miles Co., Inc. (Norfolk) also sold oystershell for use in lime manufacture and road building.

Both domestic and imported gypsum was calcined by United States Gypsum Co. at a plant at Norfolk. Baugh & Sons, Inc. (Portsmouth), Charles W. Priddy & Co., Inc. (South Norfolk), and F. S. Royster Guano Co. (Norfolk) all imported raw gypsum from Nova Scotia for use principally as land plaster.

Nottoway.—Burkeville Stone Corp. produced and crushed granite for concrete aggregate and road material at a quarry and plant near Burkeville.

Orange.—Royal Stone Corp. (Orange) quarried and crushed epidote-type stone for use as concrete aggregate and roadstone.

Page.—Paving sand and gravel was produced under contract for the Virginia Department of Highways.

Pittsylvania.—Paving sand was produced by Kendall Sand Works at its portable plant at Danville. Marshall Sand & Gravel Co. recovered sand, primarily by dredging, at Sandy River (near Danville) for use as building material, sand for fill, and miscellaneous uses. Virginia Department of Highways produced some paving sand.

Barnes Stone Co. operated a granite quarry near Danville, producing crushed stone and screenings for concrete aggregate and roadstone. This company enlarged its plant by installing a new cone-type crusher, conveyors, screening and loading bins to improve service to customers. The city of Danville produced granite riprap.

Prince Edward.—Kyanite Mining Corp. mined kyanite on Baker Mountain near Farmville. This product was prepared for sale at grinding mills at Cullen and Pamplin and sold for use in high-grade refractories and ceramic bodies, including firebrick, porcelain and insulators.

The Virginia Department of Highways produced paving sand in the county in 1957.

Prince George.—Perlite was expanded by Virginia Perlite Corp. at Hopewell in the northwestern part of the county. Crude material was obtained from New Mexico in 1957. The processed product was sold for plaster and concrete aggregate and soil conditioning.

Nitrogen compounds were manufactured at Hopewell by the Nitrogen Division, Allied Chemical & Dye Corp. Products included ammonia, ammonium nitrate-limestone, solid and liquid ammonium nitrate, and urea solutions.

Arthur Hitch operated the Powell's Creek gravel pit about 18 miles from Hopewell, producing unwashed paving and road gravel. Bryan Rock & Sand Co. recovered building and paving sand and gravel from its Puddledock open pit east of Petersburg.

Princess Anne.—Tidewater Sand Co. (Little Creek) and E. V. Williams Co., Inc. (address Norfolk), recovered sand from dredging operations in Princess Anne County. J. C. Jones Sand Co., Inc. (Oceana) produced sand from a pit and fixed plant. Output was utilized as building, engine, fill, and fertilizer filler.

Prince William.—Woodbridge Clay Products Co., Inc., mined miscellaneous clay for making heavy clay products at an open pit at Woodbridge.

Pulaski.—Crude iron oxide pigments were mined in southern Pulaski County at Hiwassee by Hiwassee Pigments Corp. Pigments produced included sienna, ocher, umber, and natural yellow. Finished natural and manufactured iron oxide pigments were prepared at the American Pigment Corp. mills at Hiwassee and Pulaski, the latter in the central part of Pulaski County. Pigments marketed included finished natural browns, raw and burnt siennas and umbers, ochers, and manufactured reds and yellows.

Roanoke.—Rockydale Quarries Corp. (Roanoke) quarried and crushed limestone for concrete aggregate, roadstone, agricultural purposes, and stone sand. Miscellaneous clay for heavy clay products was recovered by the Old Virginia Brick Co., Inc., at an open pit mine near Salem.

Rockbridge.—Lone Jack Limestone Co. (Glasgow) reported the

output of crushed limestone for concrete aggregate, roadstone, and railroad ballast. Quartzite was recovered from a quarry near Greenlee by W. G. Matthews, Jr., Inc., and crushed at a local plant for use in making ferrosilicon and as railroad ballast. A quantity of sand as a byproduct of the crushing plant was used for mixing mortar and cement.

Glass, building, and engine sand was mined by Locher Silica Corp. (Glasgow). Paving gravel was produced under contract for the Virginia Department of Highways.

Locher Brick Co., Inc., used surface (miscellaneous) clay from an open pit mine near Glasgow for making heavy clay products.

Rockingham.—Tri-State Zinc Co., Inc., began producing zinc ore and concentrates on April 1 at its Bowers-Campbell mine and mill 2½ miles north of Timberville. The concentrate was shipped to the Josephstown (Pa.) smelter of the St. Joseph Lead Co. to recover the metal.

Blue Ridge Mineral & Mining Co., Inc., produced manganese ore of 35 percent or more Mn content at its Sellers mine near Elkton in the western part of the county.

Three companies quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Producers were: C. S. Mundy Quarries, Inc. (7 miles west of Broadway); Fred K. Betts, III, and R. Y. Frazier (both of Harrisonburg). Jamison Black Marble Co., the only producer of marble in the State, quarried the stone at Harrisonburg for terrazzo and other uses. Bureau of Public Roads produced sandstone for use as masonry stone in the county.

Paving gravel was produced in the county by contractors for the Virginia Department of Highways.

Russell.—Bituminous-coal output in Russell County in 1957 rose to nearly 2¾ million short tons, a 47-percent gain in quantity and 115-percent in value compared with 1956. Ninety-one percent of the tonnage came from underground mines in 1957 and the balance from strip and auger mines. The number of mines in 1957 also rose from 45 in 1956 to 68 in 1957, of which 3 each were strip and auger, respectively. The leading coal producers in 1957 were Clinchfield Coal Co. (underground mines), Stallard Bros. Co. (strip and auger mines), Smith Coal Co. (underground mines), Red Oak Coal Co. (auger mine), and Lucas Coal Co. (underground mine). Natural-gas production in Russell County was small.

Scott.—Penn-Dixie Cement Corp. mined and crushed limestone from an underground mine by the room-and-pillar method and shipped the material to Kingsport, Tenn., for use in its cement plant. Natural Tunnel Stone Co. (Clinchport) quarried and crushed limestone for road material and railroad ballast. Foote Mineral Co., at its Sunbright mines near Duffield produced crushed limestone for use in manufacturing lithium hydroxide monohydrates. A study of mining methods and costs at this mine was published.¹⁰ Coal in 1957 was produced from six small underground mines in Scott County. Output in 1957 more than doubled compared with 1956. A very small output of natural gas was produced in the Early Grove field in the southeastern part of the county.

¹⁰ Evans, T. B., and Ellertsen, N. A., Mining Methods and Costs at the Sunbright Limestone Mine, Foote Mineral Co., Sunbright, Va.: Bureau of Mines Inf. Circ. 7793, 1957, 44 pp.

Shenandoah.—Crushed limestone, sold primarily for use as blast-furnace and open-hearth flux, concrete aggregate, roadstone, and agricultural purposes, was recovered by 4 operators of 5 quarries; 1 was 5 miles north of Timberville in the southern area of the county, and 4 were in the northeastern area near Toms Brook and Strasburg.

Chemstone Corp. produced lime for chemical and industrial use at its two plants near Strasburg. Uses included water purification and metallurgy.

Smyth.—Smyth County ranked first in output of manganese ore in 1957. All the manganese ore produced was Metallurgical grade and consisted entirely of 35 percent or more Mn content. The leading producers were Sidney Manganese Corp. and Macion Manganese Ore Co., both near Marion. Manganese was sold to the Government through GSA under the Defense Production Act carlot purchase program. The Olin Mathieson Chemical Co. produced chlorine, soda ash, and other chemicals at Saltville in northwestern Smyth County from brines recovered from underground rock-salt deposits. Three companies operated pits and fixed plants in the central section of the county near Marion, producing building sand and gravel and paving gravel. Holston River Quarry, Inc., and E. P. Ellis quarry (both at Marion) produced crushed limestone for concrete aggregate and roadstone. The Appalachian Shale Products Co., Marion, mined shales from an open-pit mine for use in making heavy clay products.

Spotsylvania.—Diamond Construction Co. (Fredericksburg) produced building sand and gravel. Massaponax Sand & Gravel Corp. (also of Fredericksburg) produced washed building and paving sand and gravel from its pit and processing plant.

Surry.—Calcareous marl was produced near Spring Grove by Paul Miller. The product was dried, pulverized, and bagged for sale for agricultural use.

Tazewell.—Tazewell County ranked fourth in 1957 among Virginia coal-producing counties. The county increased its production in 1957 to nearly 4 million short tons valued at over \$26.3 million, a rise of 13 percent in tonnage and 23 percent in value compared with 1956. By far the most of the tonnage was obtained from underground mines, although some auger and some strip coal were recovered. The number of active mines dropped from 83 in 1956 to 64 in 1957, (23 percent). Leading producers were Pocahontas Fuel Co., Inc. (Amomate, Bishop, Boissevain, and Jenkinjones mines), Jewell Ridge Coal Corp. (No. 1 mine), Cox & Cooper Coal Co. (No. 3 and No. 6 mines), and Alfredton Coal Co. (Alfredton mine).

Peery Lime Co., Inc. (North Tazewell) reported a quantity of crushed limestone for road material. Pounding Mill Quarry Corp. (Pounding Mill) produced crushed limestone for concrete aggregate, roadstone, rock dust for coal mines, railroad ballast, blast-furnace flux, and agricultural purposes.

Peery Lime Co., Inc., North Tazewell, and Blue Grass Lime Co., Tazewell, produced building, agricultural, and chemical lime in 1957.

General Shale Products Corp. recovered miscellaneous clay from its Richland open-pit mine for use in manufacturing heavy clay products.

Warren.—Limestone for use as concrete aggregate, roadstone, and railroad ballast and for agricultural purposes was quarried and crushed at Riverton by Riverton Lime & Stone Co., Division of Chadbourn Gotham, Inc. Masonry cement (formerly classified as a natural cement or hydraulic lime) also was produced by this firm at a six-pot kiln at Riverton.

Washington.—Lambert Bros., Inc., produced the major portion of the crushed limestone from the Bristol quarry, for use as concrete aggregate and roadstone. Two new companies in the county—Washington County Stone Co. and Meadowview Lime Co. (both near Meadowview)—produced some crushed limestone for road material and agricultural purposes.

The United States Gypsum Co. was the only miner of crude gypsum in Virginia. The mine and adjacent plasterboard plant were at Plasterco, in the northeastern corner of the county.

The Colitz Mining Co., Inc., a major producer of manganese ore in 1956, had no production in 1957.

A very small output of natural gas was obtained from the Early Grove field near Benham in the southwestern part of the county.

Wise.—Wise County remained in second place among Virginia's eight coal-producing counties, although its output of coal in 1957 dropped 20 percent in tonnage and 9 percent in value to 6.4 million short tons valued at \$31.2 million. Nearly 80 percent of the coal was extracted from underground mines and most of the remainder from strip operations although a considerable tonnage was obtained by augers. Leading producers in 1957 were Stonega Coke & Coal Co. (6 underground mines, 2 strip operations and 1 auger mine), Coal Processing Corp. (1 underground mine), Central Pennsylvania Quarry, Strip & Construction Co. (1 strip and 1 auger), and Wise Coal & Coke Co. (1 underground mine). Contributing largely to the decrease in tonnage in Wise County was the holing through into Dickenson County of one very large underground mine and the consequent crediting of this tonnage to Dickenson County rather than to Wise County. A small quantity of natural gas was produced in Wise County in 1957.

Wythe.—Production of lead and zinc ore at Austinville in 1957 rose compared with 1956. Mining was by open stope from 3 vertical shafts 650 to 1,250 feet deep. The Ivanhoe mine was brought into production in September 1957. Ore from this mine was trammed through a 2½-mile tunnel to the Austinville mill, where it was concentrated and shipped to smelters for recovery of metals. Silver and dolomite were obtained as byproducts of this zinc-lead ore beneficiation. The dolomite was sold for road-building and agricultural purposes, including land dressing and fertilizer filler.

Pendleton Construction Corp. (Wytheville) quarried and crushed limestone for road material. Wytheville town quarry, operated by its own crews, yielded limestone that was crushed and used for road material. An output of crushed sandstone for use as concrete aggregate and roadstone was reported by Silica Products Co. (Wytheville).

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, United States Department of the Interior, and the State of Washington Division of Mines and Geology.

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URANIUM added significant values to Washington mineral production following completion in midyear of a \$3 million processing plant at Ford, Stevens County, and petroleum was recovered commercially for the first time in State history from a well near Ocean City, Grays Harbor County. However, the overall trend in mineral output was downward. Substantially lower values for coal, copper, zinc, stone, and cement resulted in a decline from \$61.7 million to \$58.7 million in the State total for products of mines and quarries. Magnesite-production value also dropped, but the decrease was more moderate than for the other commodities. Sand and gravel was the only major product that rose in value over the preceding year.

The value of lead remained about the same as in 1956, despite an advance to a new high in tonnage mined. Expanded production from the Pend Oreille and Grandview mines, Pend Oreille County, resulted in increased tonnage of lead despite a sharp drop in prices for the metal in 1957. Two mines were closed as the result of declining base-metal prices. In Chelan County the Holden mine—the only large copper mine in Washington—was closed indefinitely, and in Stevens County the Van Stone operation was suspended until the zinc market improves.

Plant expansion continued in mineral-manufacturing industries. A Seattle steel company was enlarging facilities at a cost of \$25 million, and a \$50-million petroleum refinery was under construction at Anacortes. Production of aluminum dropped substantially for the first time in 11 years because of power shortages and lower market demand.

Consumption, Trade, and Markets.—National conditions influencing mineral markets were mostly unfavorable in 1957, particularly those demand factors relating to lead-zinc and copper mining as well as aluminum and copper smelting and refining. Production for local markets was affected by a slowing down of the rate of economic growth in Washington by the end of the year. Lessened building construction, lowered demand for nonferrous metals, and particularly a cut-back of defense procurement, that affected the State aircraft industry

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led to this lowered rate of expansion when added to the lumber-industry recession, which began in 1956.

Construction of highways and dams was a bright spot in the economic outlook. This activity maintained sand and gravel and stone production near record highs in 1957 and except for strikes at several cement plants undoubtedly would have increased cement output, as evidenced by the fact that cement shipments gained 9 percent, including shipments from nearby States to Washington destinations. Large power dams under construction were Ice Harbor (United States Army Corps of Engineers), Rocky Reach (Chelan County Public Utility District), Priest Rapids (Grant County Public Utility District),

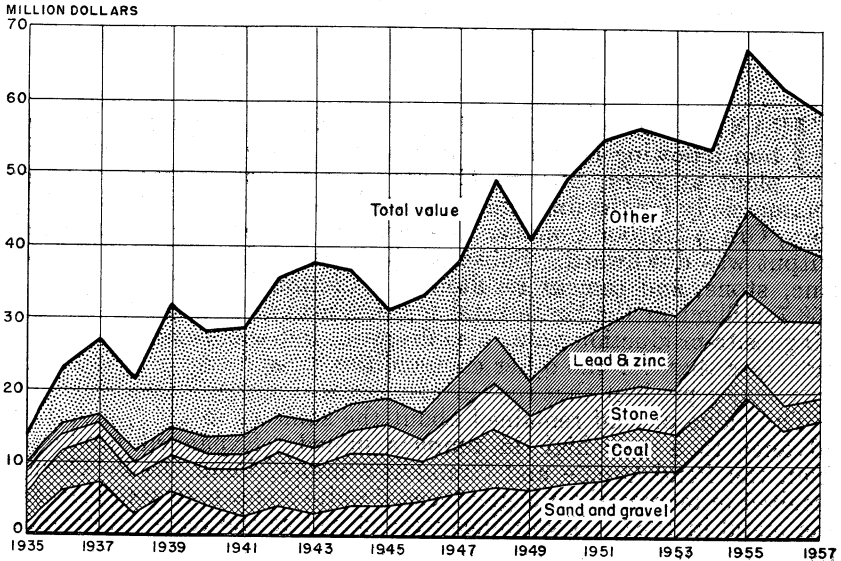


FIGURE 1.—Value of sand and gravel, stone, coal, lead and zinc and total value of mineral production in Washington, 1935-57.

Swift (Pacific Power & Light Co.), and Baker (Puget Sound Power & Light Co.).

Overall construction activity was slightly below 1956 totals because of decreased building, particularly residential. As measured by employment, the decline was 3 percent. However, in the Seattle and Tacoma areas construction employment rose 9 and 14 percent, respectively, owing to heavy construction, mainly on highways and streets, and work on multiple dwellings in the Seattle area. State building-permit total values for municipalities were 14 percent below 1956 figures. Construction costs increased 4 percent in 1957; building construction dropped to an even greater extent than was shown by the decline in value of permits issued. Building improved somewhat toward the end of the year.

Trends and Developments.—Uranium-ore production and processing became established in 1957 and along with exploration of uranium deposits added a stimulus to economic activity in northeastern Washington. Two mines were producing at the end of the

TABLE 1.—Mineral production in Washington, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones (grinding pebbles).....	25	(²)	25	(²)
Chromite.....gross weight.....	30	\$3	-----	-----
Clays.....thousand short tons.....	320	440	268	\$488
Coal.....do.....	473	3,432	360	2,760
Copper (recoverable content of ores, etc.).....	2,926	2,487	1,700	1,023
Gold (recoverable content of ores, etc.).....troy ounces.....	70,669	2,473	(³)	(³)
Gypsum.....	(²)	(²)	6,000	(²)
Iron ore, usable (hematite).....long tons, gross weight.....	(²)	(²)	3,591	(²)
Lead (recoverable content of ores, etc.).....	11,657	3,660	12,734	3,642
Peat.....	37,043	129	39,364	153
Pumice.....	5,291	15	(²)	(²)
Sand and gravel.....thousand short tons.....	16,842	15,037	19,924	16,775
Silver (recoverable content of ores, etc.).....troy ounces.....	448,442	496	(²)	(²)
Stone.....thousand short tons.....	3,057	11,660	8,454	10,600
Talc and soapstone.....	(²)	(²)	4,065	25
Tungsten ore and concentrate...60-percent WO ₃ basis.....	2	(²)	(³)	(³)
Zinc (recoverable content of ores, etc.).....	25,809	7,017	24,000	5,568
Value of items that cannot be disclosed: Barite (1957), carbon dioxide, cement, diatomite, epsomite, gem stones, lime (1956), magnesite, mercury (1957), olivine, petroleum (1957), strontium, uranium, and values indicated by footnote 2.....	-----	17,811	-----	19,025
Total Washington ⁴	-----	61,723	-----	53,690

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 1 ton.

⁴ Total has been adjusted to eliminate duplicating value of clays and stone. 1956 figure revised.

year. The immediate outlook was for this industry to stabilize somewhat below lead-zinc mining in importance.

Any improvement in prices will have immediate beneficial effects on lead-zinc mining, which has been in a depression almost continually since 1953, particularly at the small mines. Similarly any prospect of higher copper prices should bring about a recurrence of exploration and development similar to that in 1956, when copper prices were at a near alltime high.

Coal mining, although depressed, was still one of the leading employers. The producers and the State were making efforts to revive output through obtaining a share of markets now served by out-of-State producers, such as the Hanford atomic works, and through long-term projects seeking to establish electric-power plants burning coal.

Employment and Payrolls.—Mining employment dropped 13 percent as the result of lessened activity in nearly all phases of the industry; however, lower employment in copper, lead and zinc, and bituminous coal led to most of the decline. Curtailment in employment at mineral-manufacturing plants also was reflected in the figures for the year, but the decreases were more moderate. Although the number of workers in the aluminum industry declined from a January total of 10,000—equal to the alltime high—to 7,900 in December, the monthly average in this industry was only 5 percent below 1956 because most of the contraction did not take place until the fourth quarter. Also among industry groups with lower employment were smelting and refining other nonferrous metals; stone,

clay, and glass products; and industrial inorganic chemicals. Two industry classifications—(1) blast furnaces, steel works, and rolling mills and (2) products of petroleum and coal—recorded increased average employment as compared with 1956, but layoffs were made in the steel industry in the last quarter.

TABLE 2.—Average monthly employment and total wages in mining and mineral manufacturing, 1956–57, by industry ¹

Industry	1956		1957	
	Average monthly employment	Total wages (thousands)	Average monthly employment	Total wages (thousands)
Mining:				
Metal mining:				
Copper ore.....	246	\$1,434	154	\$853
Lead and zinc ore.....	415	2,350	347	2,117
Gold and silver ore.....	175	963	172	1,016
Metal mining not elsewhere classified and metal-mining contract services.....	135	597	131	673
Bituminous coal.....	513	2,473	371	1,842
Crude petroleum and natural gas.....	76	437	78	494
Nonmetallic mining and quarrying:				
Dimension-stone quarries.....	82	408	46	219
Crushed-stone quarries other than limestone.....	130	684	229	1,343
Crushed-limestone quarries.....	102	486	103	474
Sand and gravel quarries, pits and dredges.....	397	2,130	334	1,836
Clay, ceramic, and refractory materials.....	164	761	155	787
Nonmetallic minerals not elsewhere classified.....	14	54	19	67
Total mining.....	2,449	12,777	2,139	11,721
Mineral manufacturing:				
Stone, clay, and glass products:				
Glass products.....	265	1,439	261	1,540
Cement, hydraulic.....	732	3,611	630	3,306
Structural clay products.....	575	2,617	490	2,332
Pottery and related products.....	24	70	26	73
Concrete, gypsum, and plaster products.....	1,451	6,824	1,475	7,235
Cut-stone and stone products.....	33	103	25	90
Miscellaneous nonmetallic mineral products.....	365	1,718	375	1,879
Total stone, clay, and glass products.....	3,445	16,382	3,282	16,455
Smelting, refining, and casting:				
Blast furnaces, steelworks, and rolling mills.....	2,358	12,534	2,472	13,774
Iron and steel foundries.....	1,189	5,786	1,030	5,229
Smelting and refining of nonferrous metals, except aluminum.....	1,269	6,168	1,157	5,844
Smelting, rolling, drawing, and alloying of aluminum.....	9,792	56,026	9,255	55,416
Nonferrous foundries.....	259	1,341	224	1,234
Miscellaneous primary metal industries.....	122	671	100	623
Total smelting, refining, and casting.....	14,989	82,526	14,238	82,120
Industrial inorganic chemicals.....	9,910	60,576	9,698	63,311
Products of petroleum and coal.....	1,042	6,391	1,255	7,725
Total mineral manufacturing.....	29,386	165,875	28,473	169,611
Total mining and mineral manufacturing.....	31,835	178,652	30,612	181,332

¹ Washington State Employment Security Department. Data in this series are published quarterly in Employment and Payrolls in Washington State by County and by Industry—Industries Covered by the Employment Security Act. "Covered" employment in Washington applies to all services performed with the principal exceptions of agricultural labor, domestic service, Governmental service, and railroads. The size of firm or payroll is not limited. These industry groups may vary from those in the Bureau of Mines canvass.

Because of higher hourly earnings (the average was \$2.66 for the year compared with \$2.49 in 1956), mining-industry payrolls dropped only 8 percent compared with the 13-percent drop in employment.

Overall employment was lower, but payrolls of mineral-manufacturing firms gained 2 percent owing to higher hourly rates. The biggest increases in payrolls were in industrial inorganic chemicals and petroleum and coal-products categories.

TABLE 3.—Defense Minerals Exploration Administration contracts active during 1957

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
CHELAN					
Howe Sound Co.....	Holden.....	Copper.....	Dec. 7, 1953	¹ \$363,840	50
CLALLAM					
New Wellington Mines, Ltd....	Bear Creek.....	Manganese....	Apr. 2, 1957	14,880	75
PEND OREILLE					
LaSota-Jones Lead & Zinc Corp.	LaSota-Jones.....	Lead-zinc....	Aug. 13, 1956	11,310	50
SKAGIT					
Twin Sisters Magnesium & Chrome Corp.	Alamether, Begonia and Shaft deposits.	Chromium....	May 26, 1955	24,175	50
SNOHOMISH					
Howe Sound Co.....	Calumet claims...	Copper.....	July 22, 1957	23,560	50
SPOKANE					
Mudhole Exploration, Inc.....	Hanson lease....	Uranium.....	Nov. 14, 1957	9,520	75
North Star Uranium, Inc.....	Lehmbecker lease.....	do.....	July 30, 1957	2,772	75
STEVENS					
Geo-Resource Corp.....	Blue Mountain...	Uranium.....	July 24, 1957	45,960	75
Grandview Mines (assignee of Scandia Mining Group).	Scandia.....	Zinc.....	Aug. 15, 1952	¹ 44,922	50
Northwest Uranium Mines, Inc.	Peters and Boyd permits.	Uranium.....	June 15, 1956	¹ 49,352	75
Pacific Northwest Mining Co..	Lucille.....	Lead-zinc....	Dec. 14, 1951	¹ 29,210	50

¹ Amended.

Legislation and Government Programs.—The State legislature passed legislation enabling the city of Seattle Light Department to build a hydroelectric dam at the Boundary site on the Pend Oreille River in northeastern Washington. Seattle Light later filed an application with the Federal Power Commission (FPC) for a license to build the dam. However, late in the year seven mining companies with holdings in the area filed a preliminary petition asking that the FPC hold hearings in the Pacific Northwest and contended that the raised water level caused by construction of the dam would endanger or destroy lead-zinc mining through flooding in subterranean channels.

Eleven contracts were active under the Defense Minerals Exploration Administration (DMEA) program to encourage systematic investigation of strategic and critical mineral occurrences.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Mineral Products Corp. produced grinding pebbles at a deposit near Chewelah, Stevens County, for use in tube mills. Quartz and silica sand for refractory, foundry, filter, and abrasive purposes were crushed by Manufacturers Mineral Co., Seattle.

Silica mined in Stevens County and in Oregon was converted to silicon carbide by Carborundum Co., Vancouver, Clark County. This product was used both as an abrasive and as a refractory. Work was begun on a million-dollar expansion by Carborundum Co. to raise output of silicon carbide. Plans called for constructing new buildings, remodeling some older ones, and rearranging furnaces.

Barite.—A small tonnage of crude barite produced at the Bobcat mine by Big Red Uranium Co. of Vancouver was shipped for test purposes to a chemical plant in Illinois. This was the initial production from the deposit on the South Fork of Skookum Creek near Chewelah, Stevens County.

Cement.—Continuing the decline begun in 1956, production and shipments of cement were 15 and 17 percent lower, respectively, in 1957. The depressed condition of the building industry, coupled with a strike at three of the larger plants, strongly influenced the reduced output, which was only about 58 percent of capacity. Year-end stocks increased substantially over those at the close of the last year.

Four companies operated six cement plants in the State. Ninety-four percent of the output was consumed within the State. Cement was shipped from the four plants in western Washington to Alaska, Canada, and Minnesota. Shipments from the two plants in eastern Washington were made to Idaho, Montana, Oregon, and Canada. Ideal Cement Co., with plants at Grotto (King County) and Irvin (Spokane County), had the largest production, followed closely by The Olympic Portland Cement Co., Ltd., Bellingham (Whatcom County). Lehigh Portland Cement Co. was active at Metaline Falls, Pend Oreille County.

Assets of Superior Portland Cement, Inc., including plants at Concrete (Skagit County) and Seattle (King County), were acquired early in the year by Lone Star Cement Corp., New York, N. Y. Ideal Cement Co. obtained by exchange of stock the Northwestern Portland Cement Co. plant at Grotto in September.

Pacific coast cement plants were the subject of an article.³

Clays.—The combined output of miscellaneous and fire clays was 7 percent less than in 1956. King County maintained its position as the major clay-producing county, followed closely by Spokane County. Clay production was reported also from Whatcom, Pierce, Snohomish, Lewis, Yakima, Clark, and Chelan Counties.

Output of fire clay for firebrick and other refractory products was recorded from King and Spokane Counties. Clay from 12 pits in 7 counties was used to make heavy clay products. Three cement

³ Lenhart, Walter B., Portland Cement Goes by Truck: Rock Products, vol. 60, No. 1, January 1957, pp. 128-138.

companies produced clay for use in cement making. Bentonite for lining irrigation canals was mined near Naches, Yakima County.

Firebrick and other refractory products were made at plants in King and Spokane Counties. Face and common brick, partition tile, and drantile were manufactured at 4 plants in King County, 2 in Clark County, and 1 each in Chelan, Lewis, Pierce, Snohomish, and Yakima Counties. Flowerpots were made at a plant in King County.

Diatomite.—An increase of about 14 percent in the quantity of diatomite produced was accompanied by a 9-percent advance in value. Kenite Corp., Quincy, Grant County, mined and prepared a product for filtration, filler, and miscellaneous purposes. The other producer, Western Ventures, Inc., Ellensburg, Kittitas County, marketed diatomite for use as a filler in insecticides. This plant was closed on October 15 after a change of ownership. The new management planned to reopen and use the same name.

Gypsum.—Output of gypsite by Agro Minerals, Inc., was 20 percent higher than in 1956. The product obtained from a deposit at Poison Lake near Tonasket, Okanogan County, was sold for agricultural purposes.

Gypsum from Mexico was processed to wallboard, lath, and plaster by a company in Seattle, and Canadian gypsum was marketed as land plaster by a Spokane concern.

Lime.—There was no lime production in 1957. Roche Harbor Lime & Cement Co. closed its plant in September 1956, and Edna Bay Pure Stone Co. did not begin constructing its proposed plant at Vancouver. The latter company had announced plans to construct a lime plant for processing high-calcium limestone from Alaska.

Magnesium Minerals.—Output of magnesite by Northwest Magnesite Co., the largest producer of crude magnesite in the United States and the only source of the mineral in the Pacific Northwest, was 6 percent less than in 1956. The crude material mined at company quarries near Chewelah, Stevens County, was beneficiated and calcined to refractory magnesia. The principal market for the calcined product continued to be the steel industry.

Olivine output at the Twin Sisters quarry, Skagit County, by Northwest Olivine Co. increased sharply compared with 1956. After crushing and screening, the product was marketed mainly as foundry sand. Twin Sisters Magnesium & Chrome Corp. began developing an olivine deposit near Hamilton (Skagit County) in 1956 but did not get into production in 1957.

Recovery of epsomite (hydrous magnesium sulfate) from the Poison Lake deposit of Agro Minerals, Inc., was much greater than in 1956. It was used as an ingredient in chemical fertilizer.

Pumice.—Sharply increased production of pumice and pumicite resulted from output of Butte Pozzolan Co., a new operation near Sunnyside, Yakima County. The material (pumicite) was a constituent of concrete used at the Priest Rapids Dam project. Arne Sorlie (Sorlie pit, Chelan County) prepared and marketed for use in concrete building blocks considerably more pumice than in 1956. One other company produced a small quantity for plaster aggregate. Lone Star Cement Corp. acquired the Sentinel Mountain pit (near Beverly,

Grant County) from Superior Portland Cement, Inc., but had no production.

Sand and Gravel.—Tonnage and value of sand and gravel produced in 1957 increased 18 and 12 percent, respectively, compared with 1956. Continued and beginning activity at various dam sites under construction plus the increased tempo of the highway-building program furnished this advance.

Sand and gravel production was reported from 33 of the 39 counties in the State. King County became the leading source, with an output of 3.9 million tons, followed by Pierce County (3.2 million tons). Other counties reporting more than 1 million tons were Klickitat, Grant, and Spokane. Total tonnage distribution was roadbuilding and maintenance, 56 percent; construction, 36 percent; and miscellaneous, 8 percent.

Stone.—The total quantity of stone quarried was about 5 percent greater than in 1956, but value was about \$1 million less. The decreased valuation is attributed in part to large quantities of low-cost fill material used at various State and Federal construction projects. Stone was quarried in 34 of the 39 counties in the State. King was the leading county and the only one with an output value of over \$1 million. Smaller quantities quarried in Yakima, Pierce, and Kittitas Counties ranked them second, third, and fourth, respectively. The output of basalt, granite, and marble increased in contrast to a decline in limestone and sandstone production. The largest use of stone quarried in Washington was for concrete aggregate and roadstone, which furnished nearly 70 percent of the stone quarried in 1957, compared with 57 percent in 1956. Riprap output increased to 16 percent of the stone produced in 1957 compared with 14 percent for the previous year. The increased use of riprap at heavy engineering construction projects in the State was the reason for the large advance. Continuing its downward trend, limestone output was 28 percent, less than in 1956; production was reported from Chelan, Pend Oreille, Skagit, Snohomish, Stevens, and Whatcom Counties. The leading use of limestone was for making cement. Pacific Silica Co. produced quartzite (silica) for abrasive and metallurgical applications from a newly acquired deposit on Cottonwood Creek southeast of Chewelah, Stevens County. The company also operated the Latshaw quarry in Spokane County. Smith Bros. Silica Sand Co., put into operation a new plant 10 miles east of Auburn, King County, to produce glass and building sands from a loosely consolidated sandstone. Sand was shipped to Seattle by truck for use in making container glass.

A report on industrial silica, its properties and uses, was published.⁴

Strontium.—The output of strontium minerals by Manufacturers Mineral Co., the only producer in the State, was at the 1956 rate. The product, from a deposit on Fidalgo Island, Skagit County, was used by the chemical industry for purification purposes.

Talc and Soapstone.—Production of soapstone, down moderately in quantity and up slightly in value, was credited to four companies in Skagit County. Northwest Talc & Magnesium Co. and Manufacturers Mineral Co. operated grinding plants. Most of the ground product was used as a carrier in insecticides; other applications in-

⁴ Mueller, E. E., *Industrial Silica in the Pacific Northwest: The Trend in Engineering*, University of Washington, January 1957, pp. 22-25.

cluded fertilizer mix and paint filler. Almost half of the soapstone mined in Washington was sold to grinders in Oregon.

TABLE 4.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

	1956			1957			Change in tonnage (percent)
	Short tons	Value		Short tons	Value		
		Total	Average per ton		Total	Average per ton	
COMMERCIAL OPERATIONS							
Sand and gravel:							
Building.....	4,477,346	\$4,458,263	\$1.00	4,823,330	\$5,268,535	\$1.09	+8
Road material.....	3,266,682	2,971,760	.91	3,676,420	3,735,731	1.02	+12
Railroad ballast.....	574,438	391,064	.68	(1)	(1)		
Other ²	516,938	435,986	.84	1,598,826	1,453,480	.91	+209
Total.....	8,835,304	8,257,073	.93	10,098,576	10,457,746	1.04	+14
GOVERNMENT-AND-CONTRACTOR OPERATIONS							
Sand and gravel:							
Building.....	500,551	552,854	1.10	2,329,677	1,348,578	.58	+365
Road material.....	7,505,937	6,227,201	.83	7,495,368	4,968,197	.66	0
Total.....	8,006,488	6,780,055	.85	9,825,045	6,316,775	.64	+23
ALL OPERATIONS							
Sand and gravel:							
Building.....	4,977,897	5,011,117	1.01	7,153,007	6,617,113	.92	+44
Road material.....	10,772,519	9,198,961	.85	11,171,788	8,703,928	.78	+4
Railroad ballast.....	574,438	391,064	.68	(1)	(1)		
Other ²	516,938	435,986	.84	1,598,826	1,453,480	.91	+209
Grand total.....	16,841,792	15,037,128	.89	19,923,621	16,774,521	.84	+18

¹ Included with "Other" to avoid disclosing individual company confidential data.

² Includes molding, engine sands, and sand and gravel for ballast and miscellaneous unspecified purposes.

TABLE 5.—Stone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Building (dimension stone).....	(1)	(1)	(1)	(1)
Concrete, roadstone, and screening.....	4,609,482	\$5,601,685	5,852,114	\$6,144,899
Riprap.....	1,101,286	1,138,649	1,429,898	1,999,616
Railroad ballast.....	535,991	564,388	(1)	(1)
Other ²	1,810,579	4,354,876	1,171,528	2,455,982
Total.....	8,057,338	11,659,598	8,453,540	10,600,497

¹ Included with "Other" to avoid disclosing individual company confidential data.

² Used at cement, paper, metallurgical, and chemical plants, and sugar refineries and for other unspecified purposes.

Development mining was begun by Southern California Minerals Co. (Los Angeles) at a talc deposit in Totem Gulch about 15 miles north of Metaline Falls, Pend Oreille County. Activity was reported at talc deposits on a group of claims in Ferry County, about 10 miles east of Republic. The interested group, headed by Troy Sheffield of Tacoma, investigated mill sites in the Republic area.

Vermiculite (Exfoliated).—Exfoliation of vermiculite purchased from Montana by Vermiculite-Northwest, Inc. (Spokane), increased slightly over 1956. Most of the expanded product was used for insulation and as concrete and plaster aggregate.

METALS

Aluminum.—Production of primary aluminum declined from 486,200 short tons valued at \$233.6 million in 1956 to 445,700 short tons with a value of \$227.4 million in 1957. The decrease, reversing almost continuous gains since World War II, resulted both from a cutback of interruptible power in January–March and September–December and a poorer market for aluminum in the latter half of 1957, particularly in the building and aircraft industries.

Primary aluminum producers in Washington nearly doubled capacity from 1947 to 1957 to meet increased demand resulting from industrial growth and new uses developed by their own research. In 1957 the producers faced a temporary readjustment owing to tapering of the quantity of aluminum demanded by industry because of a general business slowdown. Despite this decline of demand, the companies raised the base price for aluminum ingot from 27.1 to 28.1 cents per pound in August, as the result of higher operating costs.

TABLE 6.—Salient statistics of the aluminum industry, 1947–57

Year	Rated primary capacity, thousand short tons	Primary production			Average ingot price per pound, cents
		Short tons	Percent of national total	Value (thousands)	
1947.....	245	191,330	33	\$53,672	15.0
1948.....	245	232,067	37	67,411	15.7
1949.....	239	238,812	40	76,164	17.0
1950.....	282	267,107	37	87,812	17.7
1951.....	330	285,855	34	103,542	19.0
1952.....	330	272,329	29	98,561	19.4
1953.....	415	398,781	32	158,507	20.9
1954.....	415	432,534	30	175,338	21.8
1955.....	453	452,874	29	197,837	23.7
1956.....	481	486,204	29	233,632	26.0
1957.....	483	445,709	27	227,383	27.5

Low water in the Columbia River caused a shortage of interruptible power for aluminum-reduction plants both early in the year and at the close. The plants obtained over one-third of their power from interruptible sources. Companies maintained capacity operations during part of the low-water period by purchasing high-cost provisional power; however, several potlines were shut down from January to late March and during the last quarter.

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.).

In 1957 the Pacific Northwest aluminum industry paid \$63.5 million in wages; employed an average of 10,400 people; purchased \$22.5 million of electric power and \$25.8 million of Pacific Northwest materials, supplies, and services; and paid \$35.1 million for rail and

truck freight, according to totals compiled by Raw Materials Survey (Portland, Oreg.). Net additions to plant costs totaled \$5.4 million. Approximately 42 percent of the aluminum produced at the plants was processed beyond the primary stage.

Kaiser Aluminum & Chemical Corp. withdrew from participation in the proposed Wells Dam of the Douglas County Public Utilities District.

Alcoa agreed to pay 23 percent of the cost of the Chelan County PUD Rocky Reach Dam under construction north of Wenatchee in return for 23 percent of the power to be generated by the 710,000-kw. project. This move was directed toward providing additional power for the Wenatchee aluminum-reduction plant and would replace interruptible power from Bonneville Power Administration, as well as provide energy for a planned fifth potline. Power from the Rocky Reach Dam was to be on the line in 1961.

Copper.—Howe Sound Co. closed its Holden mine, Chelan County, on June 28. The operation had been unprofitable, except in periods of high copper prices. The Holden mine had been the only major copper producer in Washington. Salvage operations substantially were completed in August. Mining and milling equipment was crated and shipped by barge down Lake Chelan for sale or storage. Salvage of company- and worker-owned homes and buildings also was carried out so far as possible. Howe Sound Co. had owned the mine for 30 years. Metal production, begun in 1938, totaled 100,000 tons of copper, 20,000 tons of zinc, and a relatively large output of gold and silver. The mine and town of Holden, 25 miles up Lake Chelan and 12 miles by mountain road from the lake, included a 2,000-ton concentrator, a store, bunkhouses, 20 company-owned residences, and 100 private homes. At peak production more than 300 men were employed, and town population was 600. The mine was allowed to flood, and there was little likelihood that the operation would be resumed in the foreseeable future. Provisions of the company lease with the United States Forest Service called for removal of all buildings upon termination of mining and allowing the land to revert to its natural state.

Decision to close the mine was made early in 1957 when the copper price had dropped from 46 cents in April 1956 to 32 cents. At the end of 1957 the copper quotation was 27 cents.

The Anaconda Co. announced that it had optioned a group of copper claims in the Cascade Mountains 2½ miles north of Snoqualmie Pass and a property 16 miles northeast of North Bend owned by Western States Copper & Uranium Corp.

Howe Sound Co. executed a contract with the DMEA for exploring the optioned Calumet copper claims, Snohomish County.

A report on the Miners Queen copper mine was published.⁵

Ferroalloys.—Three plants in Douglas, Pierce, and Spokane Counties produced ferroalloys. Products were ferrosilicon, silvery iron, ferrochromium, and silicon. Keokuk Electro-Metals Co. placed a fourth electric furnace in operation at its plant at Rock Island, Douglas County.

⁵ Magill, E. A., and Appling, R. N., Jr., The Miners Queen Copper Deposit, Skamania County, Wash.: Bureau of Mines Rept. of Investigations 5343, 1957, 16 pp.

Gold.—Two lode mines—the Knob Hill, Ferry County, and the Gold King, Chelan County—produced most of the gold output. Gold was recovered from lead-zinc ore produced from several mines in northeastern Washington and as a byproduct of copper ore.

Iron Ore.—The Kulzer mine, Stevens County, shipped iron ore to a Spokane cement plant for use in making special types of cement.

Lead.—State output of lead, produced in 1957 almost entirely from two mines near Metaline Falls, Pend Oreille County, increased to a new record high. Full-scale operations at the Pend Oreille mine (Pend Oreille Mines & Metals Co.) and the Grandview mine (American Zinc, Lead & Smelting Co.) were carried out the entire year. Progress on an extensive mine-development program at the former property and increased mechanization at both mines enabled these low-cost operations to remain in production despite the decline of the lead and zinc market. A planned cutback was announced by Pend Oreille Mines & Metals Co. at the year end because of decreased income in 1957.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total 1860-1957, in terms of recoverable metals¹

Year	Mines producing ²		Material sold or treated ³ (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1948-52 (average)	29	2	1,194,603	71,273	\$2,494,569	349,587	\$316,394
1953	33	2	1,706,410	62,560	2,189,600	321,202	290,704
1954	21	6	1,552,141	66,740	2,335,900	313,735	283,946
1955	16	1	1,712,113	74,360	2,602,600	436,348	394,917
1956	34	1	1,697,099	70,669	2,473,415	448,442	405,863
1957	19	1	1,494,525	(4)	(4)	(4)	(4)
1860-1957			(4)	(4)	(4)	(4)	(4)

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1948-52 (average)	4,889	\$2,145,707	8,729	\$2,785,368	15,295	\$4,705,015	\$12,447,053
1953	3,740	2,146,760	11,064	2,893,768	32,786	7,540,780	15,066,612
1954	3,636	2,145,240	9,938	2,723,012	22,304	4,817,664	12,305,762
1955	3,958	2,952,668	10,340	3,081,320	29,536	7,265,856	16,297,361
1956	2,926	2,487,100	11,657	3,660,298	25,609	7,016,866	16,043,542
1957	1,700	1,023,400	12,734	3,641,924	24,000	5,568,000	13,766,098
1860-1957	121,569	43,125,013	180,499	41,622,576	362,326	81,452,490	260,372,503

¹ Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore 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 withheld to avoid disclosing individual company confidential data.

⁵ 1860-1903: Figure not available; 1904-57, 27,336,903 tons produced.

The price of refined lead dropped 1 cent per pound in May after remaining at 16 cents since January 1956. Further price reductions by smelting and refining companies in the year (owing to a heavy lead output, decrease in demand, and a drop in the quantity purchased by the Government) brought the price to 13 cents at the close of 1957.

The city of Seattle proposal to build a dam at the Boundary site on the Pend Oreille River was opposed by seven mining companies

holding interests in the area. The companies filed a petition with the FPC, contending that construction of the dam would increase the flow of water into mine workings and would render impossible the mining of much if not all of the ore below the 1,900-foot elevation of the pool that would be created. The firms pointed to a United States Army Corps of Engineers hearing in 1957 at Metaline Falls that resulted in a recommendation by the Corps that the project at the site not be considered until large lead-zinc ore reserves had been mined out. Since 1947, it was contended in the petition, work by the industry and the Federal Government resulted in greatly enlarging the ore reserves until they were estimated to total 25 million tons or more. The companies pointed to large capital investment in mining in the affected area and also noted that the powerplant operated by Pend Oreille Mines & Metals Co. under FPC license on the Pend Oreille River would be inundated by backwaters from the dam. The petition also asserted that 95 percent of the reserve in the Metaline mining district was below the elevation of the pool that would be created by the Boundary dam.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1957, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Chelan.....	2	-----	35,952	\$1,253,320	66,508	\$60,193
Pend Oreille.....	3	-----	-----	-----	38,821	35,135
Undistributed ¹	14	1	(?)	(?)	(?)	(?)
Total.....	19	1	(?)	(?)	(?)	(?)

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Chelan.....	1,571	\$945,742	2	\$572	546	\$126,672	\$2,391,499
Pend Oreille.....	36	21,672	11,971	3,423,706	17,244	4,000,608	7,481,121
Undistributed ¹	93	55,986	761	217,646	6,210	1,440,720	3,893,478
Total.....	1,700	1,023,400	12,734	3,641,924	24,000	5,568,000	13,766,098

¹ Includes values and quantities which cannot be shown separately for Benton, Ferry, Okanogan, Snohomish, and Stevens Counties.

² Figures withheld to avoid disclosing individual company confidential data.

TABLE 9.—Mine production of copper, lead, and zinc in 1957, by months, in terms of recoverable metals

Month	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Month	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January.....	115	928	2,563	August.....	6	912	1,381
February.....	187	995	2,111	September.....	23	857	1,508
March.....	253	1,274	2,371	October.....	3	1,340	1,595
April.....	237	1,007	2,306	November.....	3	852	1,528
May.....	333	1,294	2,635	December.....	3	1,155	1,685
June.....	422	1,015	2,289	Total.....	1,700	12,734	24,000
July.....	115	1,105	2,118				

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1957, by classes of ore or other source material in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold and copper ¹	9	304, 753	(?)	(?)	3, 313, 900	4, 000	1, 092, 000
Dry silver.....	2	84	-----	(?)	300	4, 500	1, 400
Lead.....	3	110	-----	48	-----	143, 400	800
Lead-zinc.....	5	1, 189, 578	1	48, 858	85, 800	25, 316, 100	46, 905, 800
Total "lode material".....	19	1, 494, 525	(?)	(?)	3, 400, 000	25, 468, 000	48, 000, 000
Gravel (placer operations).....	1	(?)	(?)	(?)	-----	-----	-----
Total, all sources.....	20	1, 494, 525	(?)	(?)	3, 400, 000	25, 468, 000	48, 000, 000

¹ Combined to avoid disclosing individual company confidential data.

² Figures withheld to avoid disclosing individual company confidential data.

³ 60 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1957, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation.....	(1)	(1)	-----	-----	-----
Cyanidation.....	(1)	(1)	-----	-----	-----
Concentration and smelting of concentrates.....	(1)	(1)	3, 398, 200	25, 324, 600	47, 999, 200
Direct smelting.....	(1)	(1)	1, 800	143, 400	800
Total lode.....	(1)	(1)	3, 400, 000	25, 468, 000	48, 000, 000
Placer.....	(1)	(1)	-----	-----	-----
Grand total.....	(1)	(1)	3, 400, 000	25, 468, 000	48, 000, 000

¹ Figures withheld to avoid disclosing individual company confidential data.

Manganese.—New Wellington Mines, Ltd., explored the Bear Creek claims, Clallam County, under a DMEA contract.

Mercury.—Mercury recovered by Washington Mining Corp. at the Royal Reward mine, Enumclaw district, King County, represented the first production in the State since 1942 and the first output in King County.

Silver.—Mines producing silver included the Knob Hill (gold-silver ore), Ferry County; Gold King (gold ore), Chelan County; and the Pend Oreille (lead-zinc ore), Pend Oreille County.

Steel.—An expansion and modernization program, announced late in 1956, was undertaken in 1957 by Bethlehem Pacific Coast Steel Corp. at its Seattle plant and was nearly 50 percent complete at year end. New steelmaking facilities included two 100-ton electric furnaces, the largest of their kind in the West. The reported capacity of the furnaces was to be 420,000 net tons of ingots annually, compared with the 246,000-ton capability of the 5 open-hearth furnaces previously used. Also to be added were new rolling-mill facilities.

Tungsten.—A small concentrate shipment was reported from the Kelly Camp, a mine in Ferry County.

Uranium.—Dawn Mining Co. completed constructing a uranium mill at Ford, Stevens County, and began producing concentrate in August. The ion-exchange process was described in a paper.⁶ Ore was processed from the company Midnite mine on the Spokane Indian Reservation, and some custom ore was handled. Plant capacity was 400 tons daily. Provision was made in the company contract with the Atomic Energy Commission for acceptance of custom ore up to one-fourth of this capacity. However, the mill accepted only ore of grade 0.20 percent U_3O_8 or better and meeting amenability requirements for the process. In addition, only shipments of 500 tons or more were purchased. Because of these limitations, small operators lacked a nearby market for development ore.

Exploration continued to decline from the initial pitch of 1955 and was centered in the Mount Spokane area. The principal producing operation in this area was that of Daybreak Uranium, Inc., at the Dahl open pit. North Star Uranium, Inc., shipped a small tonnage from the Lehmbecker lease.

A bulletin on uranium occurrences in Washington was issued.⁷

Zinc.—American Smelting and Refining Co. suspended operations in July at the Van Stone open-pit mine and mill, Stevens County, pending improvement in zinc prices. The company began production at the Van Stone unit in 1952, and the 1,000-ton mill had been operating at capacity 7 days weekly, treating 30,000 tons of ore each month. About 65 employees were affected by the shutdown. The mine, the largest zinc producer in Washington in 1956, was unprofitable, except when zinc prices were high.

State zinc output was about 6 percent under 1956. The Pend Oreille and Grandview lead-zinc mines (Pend Oreille County) were the principal producers.

The zinc price experienced the same trend as lead, and similar factors—world overproduction, decreased demand, and a drop in Government purchases—affected the market for the two metals. The price of zinc was 13½ cents per pound (East St. Louis) through 1956 and until January 1957. The major mining and processing companies reduced prices to 10 cents by early July. The 10-cent quotation—lowest since early 1954—was in effect at the year end.

MINERAL FUELS

Carbon Dioxide.—Recovery of carbon dioxide from mineral waters in Klickitat County dropped 22 percent compared with 1956. Gas-Ice Corp., operator of the facility, constructed a plant at Finley, Benton County, to produce liquid carbon dioxide from an ammonia-plant waste product for use at the Hanford engineering works at Richland. Plans called for adding dry-icemaking facilities in 1958. The company also operated a plant at Ashland, Ore.

Coal.—Production of coal, continuing its decline for the ninth consecutive year, was 360,000 tons compared with 473,000 in 1956; 10 mines in Kittitas, King, Thurston, and Lewis Counties contributed

⁶ Hargrove, Don, Dawn Mining Co. Uranium-Concentrating Plant: Pres. at Northwest Min. Assoc. meeting, Spokane, Wash., Dec. 6, 1957, 18 pp.

⁷ Huntington, Marshall T., Uranium in Washington: Washington Div. Mines and Geol. Inf. Circ. 26, 1957, 10 pp. (Extract from Inventory of Washington Minerals, part II, Metallic Minerals, 1956).

to the total. Underground mining supplied 93 percent of the coal produced.

Late in the year the depressed condition of the coal industry was lifted temporarily when a compromise agreement was reached calling for Washington mines to furnish approximately 48,000 tons to Hanford engineering works at Richland, and orders were received for 25,000 tons to be exported to Japan.

Washington Water Power Co., Spokane, and Pacific Power & Light Co., Portland, Oreg., in a joint venture surveyed coal reserves in eastern Lewis and Thurston Counties. The companies were looking ahead to the time when coal from these deposits might be used for steam-electric generation. Considerable exploratory work was done on the Big Dirty bed, a layer of subbituminous coal of varying thickness. Drilling began near Tono in the Skookumchuck Valley and continued southwestward toward the Hannaford Valley.

Peat.—Peat was produced at about the 1956 rate. About a dozen companies in five counties dug this product, which was used chiefly for soil improvement.

Petroleum and Natural Gas.—The first commercially producing oil well in Washington began flowing in August. The Medina No. 1, drilled near Ocean City, Grays Harbor County, by Sunshine Mining Co. and other participants, according to the company annual report to stockholders, produced during August and October before being shut down awaiting negotiation of a contract for sale of the crude oil. After an agreement had been reached with a refinery at Tacoma in December, production was resumed, and by the end of the year 4,973 barrels had been recovered. Another well was drilled by the company on its Ocean City block of leases, and good oil shows reportedly were found. A production string of casing collapsed opposite what was described as the most promising horizon, making it uneconomical to complete the well; work was suspended, and the well was abandoned (at least temporarily). Geophysical and geological examinations were made on the most promising acreage under lease. Other mining companies and several major oil companies indicated their interest in discovering petroleum by starting exploration and drilling programs.

Construction of a refinery at Anacortes was well under way by The Texas Co.; and, in the same vicinity, work was ahead of schedule on the Shell Oil Co. alkylation unit at its refinery. Standard Oil Co. of California and Richfield Oil Co. announced plans for constructing refineries in the Puget Sound area.

Phillips Pacific Chemical Co. opened an anhydrous ammonia plant southeast of Pasco, Franklin County, along the Columbia River. This installation was believed to be the first industrial plant built as a direct result of the availability of natural gas in the area. A 75-mile pipeline from Spokane to Kellogg, Idaho, was constructed by Pacific Northwest Pipeline Corp. to supply natural gas to The Bunker Hill Co. smelter. Plans also were announced for providing a line to supply the Pullman-Moscow area.

REVIEW BY COUNTIES

In eastern Washington mining areas, two counties suffered steep declines in mineral-production values as the result of metal-mine closures and reduced activity in nonmetal. The value of output dropped from \$7.2 to \$4.5 million in Stevens County and from \$4.5 to \$3.1 million in Chelan County.

Sand and gravel and stone were among the principal mineral commodities in Washington in point of value and were produced in nearly every county in the State. The totals for counties producing these products entirely or mainly were subject to extreme variation as the result of beginning and completion of work on roads and dams. The value of production in Skamania County, southwestern Washington, rose from \$30,000 to \$1.7 million from 1956 to 1957, owing to an increase in heavy construction, which required large tonnages of sand and gravel and stone.

The northeastern corner of the State, formed by Spokane, Stevens, and Pend Oreille Counties, continued to be the most important mineral-producing area, with output of such metals as lead, zinc, and uranium and a variety of nonmetals, including magnesite, cement, clays, sand and gravel, and stone. Western Washington industrial areas in Pierce, King, Snohomish, Skagit, and Whatcom Counties also supplied a large share of the State value, principally from cement, sand and gravel, and stone production.

Asotin.—Gravel and basalt for roadwork were produced for the State and county highway departments. It was reported that Ideal Cement Co. purchased a large limestone deposit near Rogersburg about 24 miles up the Snake River from Asotin.

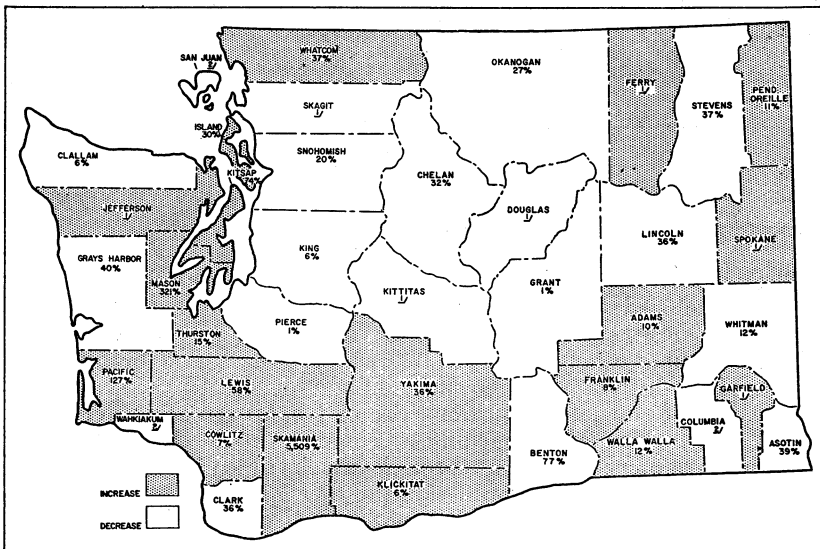


FIGURE 2.—Change in value of county mineral production, 1956-57.

¹ Figure withheld to avoid disclosing individual company confidential data.

² No production in 1957.

TABLE 12.—Value of mineral production in Washington, 1956-57, by counties¹

County	1956	1957	Minerals produced in 1957 in order of value
Adams.....	\$540, 873	\$594, 546	Sand and gravel, stone.
Asotin.....	261, 885	159, 848	Do.
Benton.....	492, 588	115, 286	Sand and gravel, stone, gold, silver.
Chelan.....	4, 521, 695	3, 066, 019	Gold, copper, stone, sand and gravel, zinc, silver, pumice, clays, lead.
Clallam.....	552, 720	521, 930	Sand and gravel, stone.
Clark.....	375, 866	241, 222	Sand and gravel, stone, clays.
Cowlitz.....	535, 599	572, 161	Stone, sand and gravel.
Douglas.....	(²)	673, 805	Do.
Ferry.....	(²)	(²)	Gold, silver, copper, tungsten.
Franklin.....	492, 742	530, 553	Sand and gravel, stone.
Garfield.....	48, 222	(²)	Stone.
Grant.....	2, 076, 128	2, 053, 480	Sand and gravel, diatomite, stone, pumice.
Grays Harbor.....	310, 992	186, 753	Stone, sand and gravel.
Island.....	147, 780	192, 520	Sand and gravel, stone.
Jefferson.....	219, 835	(²)	Stone, sand and gravel.
King.....	8, 713, 784	8, 172, 856	Cement, sand and gravel, stone, coal, clays, peat, mercury.
Kitsap.....	154, 641	269, 698	Sand and gravel, stone, peat.
Kititas.....	(²)	2, 253, 234	Coal, stone, sand and gravel, diatomite.
Klickitat.....	1, 136, 909	1, 202, 694	Sand and gravel, stone, carbon dioxide.
Lewis.....	543, 143	858, 244	Sand and gravel, stone, coal, clays.
Lincoln.....	431, 483	274, 779	Sand and gravel.
Mason.....	24, 150	101, 698	Stone, sand and gravel.
Okanogan.....	393, 963	289, 019	Sand and gravel, stone, epsomite, gypsum, lead, zinc, silver, copper, gold.
Pacific.....	293, 923	544, 669	Stone.
Pend Oreille.....	(²)	(²)	Zinc, lead, cement, stone, silver, sand and gravel, copper.
Pierce.....	2, 609, 384	2, 596, 292	Sand and gravel, stone, clays, peat.
San Juan.....	(²)	(²)	(²)
Skagit.....	(²)	2, 245, 647	Cement, sand and gravel, stone, olivine, talc and soapstone, strontium.
Skamania.....	30, 029	1, 684, 232	Sand and gravel, stone.
Snohomish.....	1, 626, 611	1, 294, 517	Sand and gravel, stone, peat, clays, silver.
Spokane.....	(²)	4, 364, 503	Cement, sand and gravel, stone, clays, uranium.
Stevens.....	7, 221, 675	4, 538, 191	Magnesite, zinc, stone, uranium, lead, sand and gravel, copper, silver, iron ore, barite, gold, grinding pebbles.
Thurston.....	185, 315	213, 645	Sand and gravel, coal, stone, peat.
Wahkiakum.....	200, 180	(²)	(²)
Walla Walla.....	212, 553	239, 103	Sand and gravel, stone.
Whatcom.....	(²)	(²)	Cement, stone, sand and gravel, clays.
Whitman.....	323, 351	285, 100	Stone, sand and gravel.
Yakima.....	837, 689	1, 138, 331	Sand and gravel, pumice, stone, clays.
Undistributed ³	29, 108, 617	18, 585, 320	Sand and gravel, stone, gem stones.
Total ⁴	61, 723, 000	58, 690, 000	

¹ Columbia 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, and gem stones that cannot be assigned to specific counties and value of minerals for counties indicated by footnote 2.

⁴ Adjusted to eliminate duplicating value of clays and stone. 1956 figure revised.

Chelan.—After 20 years of metal production the Holden copper mine was closed permanently in 1957. The Gold King mine, 1 of 2 large gold producers in Washington, shipped gold ore crude to the Tacoma copper smelter, where it was used as a flux because of its high silica content. Ore production averaged 240 tons per day.

Because of the poorer power year and a tapering of demand for metal a reduction of operations was in effect at the Alcoa Wenatchee aluminum-reduction works through much of 1957.

The output value of nonmetals produced in the county was considerably less than in 1956 due mainly to a smaller quantity of limestone quarried for cement production. Limestone was shipped from the Soda Springs quarry near Leavenworth to the Grotto plant (King County) of Ideal Cement Co. Basalt for roadstone comprised the bulk of the rest of the stone produced. Structural and paving sand

and gravel and gravel for railroad ballast also were prepared. Pumice for use in making lightweight-concrete aggregate was mined near Lakeside. Wenatchee Brick & Tile Co. resumed production of clay for use at its plant.

Clark.—Aluminum Company of America reduced production at the Vancouver aluminum-reduction plant from January through March and in the last 4 months of the year because of power shortages induced by critically low-water in the Columbia River and because of rising metal inventories. One and one-third of the five potlines were shut down. In the fabrication department, a 100,000-pound-capacity horizontal cable-testing machine was installed for testing cable products. The machine was to provide data for design and engineering of power-transmission lines. Natural gas was used for the first time in February in the carbon-baking furnaces, main boilers, and melting furnaces, after completing a feeder line by Portland Gas & Coke Co. Office and shop buildings were completed.

Sand and gravel for construction and road maintenance, basalt for riprap and roadstone, and molding sand were produced in smaller quantities than in 1956. Two companies mined clay for making building brick and draintile. The Edna Bay Pure Stone Co. selected a site and completed processing-engineering work for its lime plant to be constructed near Vancouver. In 1956 the company announced that it would build a plant to process limestone from Edna Bay, Alaska.

Cowlitz.—At Longview operations at Reynolds Metals Co. aluminum-reduction plant were reduced by a shortage of interruptible power.

Douglas.—Keokuk Electro-Metals Co. expanded capacity by installing a fourth electric furnace, which operated when interruptible power was available. Production was mainly silicon metal, which was marketed for use in producing aluminum alloys.

The county was not a ranking source of sand and gravel. The output of this commodity was almost \$1 million less than in 1956, due mainly to decreased demand by the State highway department. Sand and gravel was used in constructing the Rocky Reach Dam, and granite for riprap was furnished to the United States Army Corps of Engineers.

Ferry.—Knob Hill Mines, Inc., reported some increase in development at its gold mine at Republic, which included the adjoining Gold Dollar deposit owned by Day Mines, Inc., and operated from Knob Hill workings.

Grant.—Grant County ranked third in order of sand and gravel output valued at \$1.6 million. Paving and structural gravel was used by the State highway department and at the Priest Rapids development project, respectively. Basalt was furnished to the Bureau of Reclamation for riprap and roadstone at its Columbia Basin Project (Ephrata) and to the highway department for riprap. There was a 6-percent increase in the quantity of diatomite mined by Kenite Corp. at its Quincy operation. Output was used mainly for filler and filtration purposes. A small quantity of pumice was produced for making lightweight plaster. Entiat Pumice Co. was not active at the Stormy Creek deposit.

King.—Bethlehem Pacific Coast Steel Corp. began a \$25-million expansion program to enlarge its steelmaking capacity 70 percent to 420,000 tons annually at its Seattle plant. Employment in primary-metals manufacturing in the county averaged 2,600 as compared with 2,500 in 1956.

King County continued to lead the State in nonmetal production despite the decline in total value of these commodities. Substantial advances in production of sand and gravel and stone were not enough to offset the sharp drop in cement output. Continuing the upward trend sand and gravel and stone went into first position; cement slipped to second position; while coal and clay remained unchanged.

Two significant changes took place in the cement industry during the year. In April, Lone Star Cement Co., New York, N. Y., leading independent cement producer in the Western Hemisphere, acquired assets of Superior Portland Cement, Inc., including the plants at Seattle and at Concrete, Skagit County. Ideal Cement Co., Denver, Colo., expanding its holdings in the Pacific Northwest, obtained by stock exchange the Northwestern Portland Cement Co. plant at Grotto. Production was increased almost to capacity because of construction at the Rocky Reach Dam, and the shutdown of the Lone Star plants resulted in additional sales. Plans for increasing the present plant capacity 50 percent were announced by Ideal. On May 1 the Lone Star Cement Co. contract with the United Cement, Lime, and Gypsum Workers International Union expired, and the company would not negotiate a new contract that included provisions contained in the old agreement. The strike, which lasted 5½ months, did not involve a wage increase, but rather fringe benefits and conditions of employment, including overtime, seniority, and union shop. Permanente Cement Co. built a cement-distribution plant in Seattle. The plant has a storage capacity of 120,000 barrels and will furnish cement that will be shipped by barge to Anchorage, Alaska.

Sand and gravel, processed by 15 commercial operators, was used for paving and construction. Basalt and granite were marketed for riprap and roadstone. A quantity of basalt was used for landscaping. Glass and building sands were produced near Auburn. Limestone for the cement plants came from deposits in Skagit and Chelan Counties.

Coal output from 5 mines dropped from 107,000 tons in 1956 to 79,000 tons in 1957. The Franklin No. 12 mine of Palmer Coking Coal Co., Inc., continued to be the leading producer in the county and ranked second in the State.

Clays produced in the county were consumed by the cement industry and for making firebrick and tile, heavy clay products, and flowerpots and pottery.

Kaiser Gypsum Co., Inc., continued to play an important role in the mineral industry of the highly industrialized Seattle area. Gypsum building products valued at several million dollars were made from gypsum from company-owned deposits in Baja California (Mexico). Some 60 million sq. ft. of wallboard, 12 million sq. ft. of lath, and 1 million sq. ft. of laminated gypsum board were manufactured during 1957.

Kittitas.—The output of coal from the Roslyn strip and underground mines (Northern Pacific Railway Coal Department) and the No. 4 mine (Roslyn Cascade Coal Co.) caused Kittitas to rank as the leading coal-producing county in the State. Total tonnage was 261,000 compared with 343,000 in 1956; valuation was about \$489,000 less than in the preceding year. The county dropped from sixth place to seventh in order of total nonmetal production. State highway crews were furnished basalt for riprap and paving sand and gravel. Granite and sandstone were used by the county highway department for road maintenance, and the United States Forest Service maintained access roads with crushed limestone. A small quantity of gravel was produced for railroad ballast. Diatomite was mined at the Squaw Creek deposit by Western Ventures, Inc. The raw material was dried, milled, and sized for use as a filler.

Klickitat.—Sand and gravel was prepared for structural work at The Dalles Dam by the United States Army Corps of Engineers and for the State and county highway departments. Basalt was quarried for road metal. Mineral waters from wells near Klickitat were processed to recover natural carbon dioxide.

Lewis.—Sand and gravel for structural and paving purposes, stone (basalt) for riprap and road metal, clay for making heavy clay products, and coal were mined in the county. Road materials were used by the United States Forest Service, Bureau of Public Roads, and the State and county highway departments.

Okanogan.—Production of development ore from the Peacock lead-zinc mine near Conconully was recorded.

Four commercial concerns produced structural sand and gravel and paving gravel. Granite as riprap was used by the United States Forest Service and the State highway department. In addition to these agencies, county highway crews consumed paving gravel. Epsomite and gypsum were recovered by Agro Minerals, Inc., from Poison Lake deposits.

Pend Oreille.—The Pend Oreille mine and the Grandview mine near Metaline Falls were the only base-metal mines in production in the State at the end of 1957. Both recorded increased metal output as the result of development, including mechanization. Pend Oreille Mines & Metals Co. announced in December, however, that the work-week at the Pend Oreille mine would be reduced from 6 days to 5 effective January 1, 1958, because of the depressed market for lead and zinc. Throughout 1957 the 2,400-ton East mill was operated at capacity rate. Ore production was increased 170,200 tons over 1956. Mine development consisted of 8,329 feet of drifting, 405 feet of raising, and 774 feet of incline shaft. The American Zinc, Lead & Smelting Co. Grandview mine continued on the 5-day week that was begun in 1953, when the long-term decline in lead and zinc prices began. Mine development on the lower levels indicated a larger tonnage of better grade ore than had been anticipated. The company concluded an agreement to purchase the Grandview mine from Grandview Mines, Inc. American Zinc had operated the property since 1936 under leasing and profit-sharing agreements.

Although total value of nonmetal commodity output was slightly below 1956, the county ranked fifth as a source of nonmetals, the same as in 1954. The decreased value of stone production was

almost offset by increased cement and sand and gravel output. Lehigh Portland Cement Co. continued to be the principal nonmetal mineral industry in the county. Limestone quarried at Metaline Falls was processed to cement at the company plant. County highway crews used basalt and gravel for roadwork.

Pierce.—American Smelting and Refining Co. reduced the work force of the 1,200-man crew at its Tacoma smelter by 200 following closure of 2 mines early in 1957—the Holden mine in Chelan County and the Granby Consolidated Mine at Copper Mountain, British Columbia. Most of the ore and concentrate received at the smelter came from foreign sources. Natural gas was substituted for oil in meeting requirements of the smelter, refinery, and arsenic plant.

At the Tacoma plant of Kaiser Aluminum & Chemical Corp. the carbon-electrode plant was rebuilt completely, and new high-efficiency equipment was installed. The low water in the Columbia River resulted in curtailment of interruptible power to the plant.

Ohio Ferro-Alloys Corp. continuously operated two 8,500-kw.-hr. furnaces at Tacoma, producing silicon metal and all grades of ferro-silicon. Power was obtained from the city of Tacoma; and raw materials, particularly quartz, were received from within the State and from British Columbia. Part of the carbon was shipped to the plant from Portland (Oreg.), and Pocahontas coal and coke were received from the East. Employment averaged 100.

The county moved from seventh position to fourth as a source of nonmetals, although the value of these commodities remained virtually unchanged (\$2.60 million in 1957 and \$2.61 million in 1956) but slipped to second place in sand and gravel production. Commercial operators and contractors produced sand and gravel for construction and paving purposes. A small quantity of gravel for railroad ballast and sand for air blasting were processed also. County and municipal road departments, Bureau of Public Roads, and the United States Army Corps of Engineers used paving sand and gravel. Basalt for road metal was furnished to the various road building and maintenance agencies. The United States Forest Service used limestone for maintaining access roads. One company marketed rough and dressed architectural sandstone. Heavy clay products were made from clay dug near Eatonville. Phosphate fertilizers were produced from imported phosphate rock at a plant at Tacoma.

Skagit.—The value of cement and stone decreased substantially. Skagit County dropped from second place to seventh in value of all nonmetals and from second to fifth for cement and declined sharply from a leading place to over \$1 million below 1956 in stone production. A labor disagreement that lasted 5½ months at the concrete plant of Lone Star Cement Co. was a major factor in bringing about this depressed condition. Shortly after the Lone Star company took over the Superior Portland Cement, Inc., facilities, the labor contract expired. The company would not negotiate a new contract that contained the provisions of the old agreement. There was no dispute over wages. Sand and gravel was produced for construction and paving purposes. Great Northern Railway Co. used gravel for railroad ballast, and the United States Forest Service and State and county road departments consumed gravel and basalt for road building and maintenance. Basalt also was used for riprap.

Olivine mined at the Twin Sisters quarry by Northwest Olivine Co. was processed and marketed as foundry sand. Soapstone was mined by William Soren (Marblemount), Herman Smith (Clear Lake), Northwest Talc & Magnesium Co. (Clear Lake), and Cascade Talc & Silica Co. (Marblemount). Production by the latter company resulted from development during 1956 at the deposit on the Cascade highway about 10 miles from Marblemount. Strontium minerals were recovered at the La Conner deposit on Fidalgo Island.

Skamania.—Work at the Swift Hydroelectric Project for Pacific Power & Light Co. (Cowlitz Utility District No. 1) resulted in an unusual increase in output value of sand and gravel and stone. The value of these commodities soared from \$30,000 in 1956 to \$1.7 million in 1957.

Snohomish.—Structural and paving sand and gravel were produced by six commercial companies. Great Northern Railway Co. used gravel for ballast and granite for ballast and fill. State, county, and municipal highway groups employed road metal (basalt) and gravel for road maintenance. The United States Forest Service was furnished basalt for riprap and roadbuilding. Manufacturers Mineral Co. ground granite for poultry grit and roofing granules, and Miller Lime Co. processed limestone for agricultural applications. Lowell Brick & Tile Co. manufactured building brick from locally mined clay.

Spokane.—Employment in primary-metals processing, the principal manufacturing industry of Spokane County, reached an alltime high of 6,800 in March but declined to 5,100 in December—the steepest decline in county manufacturing industries.

The decline in the aluminum market and a poorer power year in the Pacific Northwest affected the operations of Kaiser Aluminum & Chemical Corp. The work force at the Trentwood rolling mill was reduced owing to leveling of the metal market. At the Mead reduction works lack of power during part of 1957 resulted in partial closing of the plant several times from January to late March and from September through December. One potline was shut down on December 20, and a second line was closed on December 31.

At the Trentwood mill improvements included installing a continuous heat-treatment furnace for large plate, an aluminum-tube forming mill that could produce 6- to 10-inch-diameter welded tubing, and a quantometer spectograph to improve quality control in producing aluminum-alloy sheet and plate. Casting improvements at the Mead works, second largest aluminum-reduction plant in the United States, were continued; and new equipment, including a 50-pound pig-casting machine of new design, was placed in full operation.

Pacific Northwest Alloys, Inc., reduced operations at its Mead plant in the last 6 months of 1957 because of market conditions. Ferrochrome, ferrosilicon, and other alloys were produced.

Daybreak Uranium, Inc., shipped uranium ore to the new plant at Ford, Stevens County, from its Dahl open-pit mine on Mount Spokane. The company also sank an 80-foot inclined shaft and drove drifts and crosscuts on the Lowley lease, 7 or 8 miles south of the Dahl mine near the Spokane River. The Lehmbecker uranium holdings were explored and developed by North Star Uranium, Inc., and some ore was shipped. Development ore was stockpiled at the Clayloon Uranium Co. lease. Both operations were open pit. The Defense Minerals

Exploration Administration (DMEA) approved an application for exploration at the Mudhole Exploration Co. uranium prospect in the same area.

The county continued to rank third in the State in value of non-metal-commodity output, and the relative standing of cement (third), sand and gravel (fourth), and clay (first) did not change. Again the Ideal Cement Co. operation at Irvin was the principal nonmetal industry in the county. Limestone from the Limerock quarry in Stevens County, iron ore from the same county, and clay and shale mined locally were used in manufacturing cement at the plant. Eight commercial concerns operated 11 pits to provide sand and gravel for structural and paving purposes. State and county road crews used gravel and basalt for highway work, and Great Northern Railway Co. used basalt for railroad ballast. Granite was cut for rough architectural stone, dressed for monumental stone, and crushed for poultry grit. Pacific Silica Co. mined vein quartz (silica) at the Latshaw quarry. The ground product was used for making ferro-silicon and for manufacturing cement.

About midyear Gladding, McBean & Co. purchased facilities of Washington Brick & Lime Co. in the Spokane area. Plants at Dishman and Clayton were closed, but plans were to reopen the structural glazed-tile plant at Dishman as soon as possible. Reopening of the Clayton operation was to depend upon market conditions. Gladding, McBean & Co. began making superduty refractories at a recently completed plant at Mica. This construction was part of a \$3-million-expansion program. The company conducted extensive exploration in the Spokane area to find new clay deposits to supply its brick plants. The Mica, Deer Park, and Clayton deposits were core-drilled. Plans were announced by a new firm—Norlite Products Co.—to build a clay-shale expansion plant at Spokane to make lightweight aggregate.

Vermiculite from Montana was expanded at a plant in Spokane. Columbia Gypsum Co., Ltd., marketed gypsum from Canada for agricultural applications.

Field offices of the Bureau of Mines, Geological Survey, and DMEA 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 DMEA program of loans for mineral exploration. The AEC also maintained an office in Spokane.

Stevens.—Bonanza Consolidated Mining Co. acquired the Admiral lead-zinc mine north of Leadpoint under lease-and-profit-sharing agreement late in 1957. The mill at the Admiral mine was not included in the agreement. The Admiral property has produced intermittently since 1947. Goldfield Consolidated Mines Co. diamond-drilled near its Anderson open pit. The company Deep Creek mine and Sierra Zinc mill near Northport had been closed in 1956 after a drop in lead and zinc prices. American Smelting and Refining Co. ceased production at its Northport unit. The mine and mill were placed on a standby basis, and operations were to be resumed when conditions of the base-metal market warranted.

Production of uranium ore was carried out at the Midnite mine on the Spokane Indian Reservation by Dawn Mining Co., principal producer of the metal in Washington. Ore, mined by a contractor

from open pits, was trucked to Ford, 45 miles northwest of Spokane, after completion of the new company mill in August.

Geo-Resource Corp. entered into a contract with the DMEA for diamond-drilling and bulldozing uranium claims on Blue Mountain north of the Spokane Indian Reservation. Northwest Uranium Mines, Inc., explored holdings under a DMEA contract on the reservation.

A general decline in output value of magnesite, sand and gravel, and stone resulted in Stevens County going from fifth place to sixth as a source of nonmetals in the State. Northwest Magnesite Co. continued to be the leading producer of crude magnesite in Washington as well as in the Nation. The company operated quarries near Chewelah. Limestone was quarried near Marble for use at Ideal Cement Co. plant in Spokane County. Limestone also was mined for use in the paper and metallurgical industries. Sand and gravel for structural and paving purposes was produced by one company. Sandstone was quarried for use as an abrasive, filter medium, and foundry sand and for making ferrosilicon and silicon carbide. Two companies produced marble at six quarries for various purposes, including terrazzo chips, roofing granules, stucco, and whitening.

Thurston.—Sand and gravel, coal, and stone were produced in the county. Tests were made on siltstone from a roadcut north of Tenino to determine its suitability for expanding to lightweight aggregate.

Whatcom.—A large increase in cement output advanced Whatcom County from fourth place to second in the State as a source of nonmetal commodities and resulted in the county taking the lead in cement production. The Olympic Portland Cement Co., Ltd., the principal mineral industry in the county, quarried limestone at the Kendall site and mined clays locally for use at the Bellingham plant. The company announced plans for a \$2-million-expansion program that would double plant capacity. During the past 10 years the plant virtually has been rebuilt and modernized to permit expansion and cost cutting. The contemplated expansion was based upon a long-range Pacific Northwest market survey.

Structural and paving sand and gravel were produced by four commercial operators, and State, county, and municipal road and street departments used the commodity for maintenance. The United States Forest Service maintained access roads with crushed granite and gravel.

Yakima.—Nine commercial concerns produced sand and gravel for structural and paving purposes. The United States Forest Service and the State highway department were furnished gravel for road work. Output of pumicite from a new deposit near Sunnyside resulted in a substantial increase in the State production of that commodity. Basalt was used by the Bureau of Reclamation for riprap and by the State and county highway crews for maintenance. Granite was cut for rough architectural stone and for curbing and flagging. Heavy clay products were made from local clays, and Calco Industrial Minerals Co. dug a small quantity of bentonite from a deposit 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 mineral production in 1957 increased 5 percent in value compared with 1956. An increase of \$51 million in bituminous-coal output was the chief factor contributing to the increased State mineral value. Petroleum and stone production each increased \$1 million in value over 1956. Although coal was by far the leading mineral produced (comprising 89 percent of the State's mineral wealth) 13 other minerals were produced in the State in 1957.

Counties leading in value of mineral output were McDowell, Logan, Wyoming, Raleigh, Marion, Kanawha, and Monongalia.

TABLE 1.—Mineral production in West Virginia, 1956-57 ¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays.....	769,518	\$2,449	707,533	\$2,691
Coal.....	155,890,449	324,043	156,842,038	875,587
Marl (calcareous).....	1,685	(²)	(²)	(²)
Natural gas..... million cubic feet...	204,717	48,518	4 204,900	4 49,200
Natural-gas liquids:				
Natural gasoline..... thousand gallons...	35,728	2,594	30,435	2,185
L.P.gases..... do.....	240,989	12,031	235,881	6,543
Petroleum (crude)..... thousand 42-gallon barrels...	2,179	8,411	4 2,215	4 9,436
Salt (common).....	680,964	3,453	648,139	2,641
Sand and gravel.....	5,110,056	10,711	5,353,527	9,893
Stone.....	6,579,271	10,766	6,989,043	11,934
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, cement, lime, manganese ore (1957), and recovered elemental sulfur.....		14,590		14,985
Total, West Virginia ⁴		935,074		982,719

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Less than \$1,000.

³ Included with stone.

⁴ Preliminary figure.

⁵ Total adjusted to avoid duplicating value of clays and stone used in cement and lime.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—The output and value of bituminous coal increased 1 and 6 percent, respectively, in 1957. Increased underground mining was noted; 1,324 underground mines, an increase of 46 over 1956, were reported active. Underground mining predominated, and supplied 90 percent of total State output. Strip mining made up 7 percent and auger mining 3 percent.

Ninety-eight percent of the total underground tonnage was cut by machines, including 12 percent prepared by continuous miners. Seventy-three percent was drilled by hand-held or post-mounted drills and 12 percent by mobile drills. Ninety percent was loaded mechanically, usually by mobile loading machines. This device loaded into shuttle cars (67 percent), into mine cars (7 percent), and onto conveyors (7 percent). Continuous miners supplied 13 percent; 5 percent was hand-loaded onto face or room conveyors, and 1 percent was loaded by duckbills and self-loading conveyors.

TABLE 2.—Coal production in 1956-57, by counties, in short tons

County	1956		1957	
	Total production	Average value per ton	Total production	Average value per ton
Barbour.....	3,810,696	\$4.30	3,808,997	\$4.73
Boone.....	6,936,083	5.12	7,344,010	5.02
Braxton.....	102,743	4.45	220,872	4.14
Brooke.....	1,149,285	4.22	1,110,114	4.53
Clay.....	1,284,942	5.17	(¹)	(¹)
Fayette.....	8,096,501	5.78	7,118,769	5.98
Gilmer.....	265,483	4.27	394,890	3.90
Grant.....	67,420	4.73	93,954	3.84
Greenbrier.....	1,573,089	5.37	1,340,265	5.41
Hancock.....	(¹)	(¹)	8,071	5.06
Harrison.....	10,062,494	4.16	9,193,139	4.65
Kanawha.....	10,623,660	4.81	10,867,876	5.03
Lewis.....	1,383,115	3.43	1,059,510	3.74
Logan.....	22,139,897	5.11	22,518,288	5.31
Marion.....	10,292,362	5.24	11,970,907	5.68
Mason.....	194,417	3.45	195,031	4.13
McDowell.....	19,923,834	6.48	19,023,435	7.00
Mercer.....	1,910,123	6.25	1,442,327	6.55
Mineral.....	132,514	4.11	(¹)	(¹)
Mingo.....	8,774,182	5.08	7,667,629	5.26
Monongalia.....	8,663,219	4.51	10,160,807	5.11
Nicholas.....	6,066,431	5.38	5,893,328	5.57
Pocahontas.....	479,035	5.74	564,798	4.04
Preston.....	2,742,249	3.53	2,450,810	3.76
Putnam.....	147,553	4.52	158,657	4.22
Raleigh.....	10,764,791	6.19	11,566,776	6.55
Randolph.....	1,027,129	5.64	1,017,937	5.82
Taylor.....	366,229	3.58	514,119	3.79
Tucker.....	135,266	3.53	355,663	4.00
Upshur.....	1,407,518	4.00	1,429,636	4.63
Wayne.....	108,816	3.75	172,046	4.14
Webster.....	1,212,848	5.60	1,126,069	5.58
Wyoming.....	12,250,204	5.86	12,892,434	6.16
Undistributed.....	1,796,321	4.57	3,166,321	4.81
Total.....	155,890,449	5.29	156,842,038	5.58

¹ Included with "Undistributed," which also includes data for Marshall, Ohio, and Summers Counties (1956).

Ninety-six percent of the total output was shipped by rail and the remainder by truck or consumed locally. Twenty-eight percent was crushed and 14 percent treated with oil before shipment. Sixty-five percent was cleaned mechanically. Of this, jigs cleaned 42 percent; wet washing other than jigs, 45 percent; and pneumatic methods, 13 percent.

Logan County led in coal production, followed by McDowell, Wyoming, Marion, Raleigh, Kanawha, Monongalia, and Harrison Counties. Production was reported from 35 of the State's 46 mineral-producing counties.

TABLE 3.—Coal production in West Virginia, 1948–52 (average) and 1953–57

Year	Short tons (thousands)	Value (thousands)	Average value per ton	Year	Short tons (thousands)	Value (thousands)	Average value per ton
1948–52 (average)	148, 122	\$786, 598	\$5. 31	1955	139, 168	\$653, 388	\$4. 70
1953	134, 105	693, 594	5. 17	1956	155, 890	824, 043	5. 29
1954	115, 996	541, 370	4. 67	1957	156, 842	875, 587	5. 58

Coke and Coal Chemicals.—Five oven-coke plants (813 ovens) were active in 1957, producing 3,938,002 tons of coke—(259,398 tons less than in 1956).

Recovered products at coke ovens included 232,210 tons of coke breeze; 63,246,726 thousand cubic feet of coke-oven gas; 106,295,000 pounds of ammonium sulfate; 57,431,000 gallons of coke-oven tar; and 17,021,000 crude gallons of light oil, which includes 9,293,000 gallons of benzene, 2,563,000 gallons of toluene, 790,000 gallons of xylene, and 195,000 gallons of solvent naphtha.

Petroleum and Natural Gas.—The production of petroleum and natural gas both increased slightly (1 percent) during the year. The number of well completions (680) was fewer than in 1956. Of the total completions, 88 were oil, 466 gas, and 126 dry. The total footage drilled was 1,870,797, averaging 2,751 feet per well. Thirty-three wildcat completions (resulting in 17 gas wells and 16 dry holes) were reported. Cable-tool rigs accounted for 659 well completions and rotary rigs, 21. In 1957, 14,349 oil wells produced 6,107 barrels daily, an average of 0.4 barrels daily. In 1900 (the year of record oil production) 16,196,000 barrels of oil was produced, compared with 2,215,000 barrels in 1957.

Forty-six of the State's 55 counties have produced petroleum and natural gas.

A gas well drilled 8,410 feet into the Oriskany sand in the Dry Fork district in Tucker County in 1946 holds the State record for the deepest producing well. The deepest nonproducing well drilled (in 1955) was the 13,331-foot Hope 9634 in Wood County.³

According to the American Petroleum Institute and American Gas Association, reserves of natural gas as of January 1, 1958, were 1,561 billion cubic feet; petroleum, 52 million barrels; and natural-gas liquids, 22.9 million barrels.

³ Oil and Gas Journal, Review-Forecast: Vol. 56, No. 4, Jan. 27, 1958, p. 154.

NONMETALS

Cement.—The output of portland and masonry cements increased 7 percent in 1957. The value of cement shipments rose 14 percent, however, as the average price per barrel increased during the year. The bulk of cement shipped (97 percent) was portland. Two companies were active in 2 counties, Berkeley and Preston, operating 12 kilns. Production was consumed chiefly in Maryland, Virginia, West Virginia, and the District of Columbia.

Clays.—Clay production decreased 8 percent in 1957, but the value increased 10 percent, as the average price per ton increased from \$3.18 in 1956 to \$3.80 in 1957. Fire clay comprised 57 percent and miscellaneous clay 43 percent of the total output. Four underground mines, using the room-and-pillar-mining system, and seven open-pit mines were reported active. Fire clay was used chiefly for firebrick and block, also for foundries and steelworks, heavy clay products, and miscellaneous uses. Miscellaneous clay was used for heavy clay products and for portland and other hydraulic cements.

A depressed market was noted by most producers, particularly during the fourth quarter, but economic conditions were reported favorable for the overall yearly picture.

TABLE 4.—Clays sold or used by producers, 1948–52 (average) and 1953–57

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948–52 (average).....	443,409	\$1,214,941	337,747	\$287,969	781,156	\$1,502,910
1953.....	677,005	2,213,376	291,833	275,562	968,838	2,488,938
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

Lime.—Production and value of lime decreased 27 and 22 percent, respectively, in 1957. The chief use for West Virginia lime was for open-hearth steel-furnace flux and for refractory purposes (dead-burned dolomite). As lime output depended largely on activity in the steel industry, the depressed steel market in late 1957 contributed most to decreased lime output in the State. Two producers operated 5 plants, with 10 pot-type and 6 rotary-type kilns producing 66 percent of the rated capacity.

Natural Salines.—Bromine compounds and calcium-magnesium chloride were prepared from well brines produced near South Charleston. The combined output decreased 6 percent below that in 1956.

Salt.—The output of salt decreased 5 percent owing to a 9-percent drop in consumption of salt in brine for manufacturing chemicals. Evaporated-salt production increased 12 percent, but its value per ton was only about half that in 1956; this explains the 24-percent decline in value of total West Virginia salt output. Of the total salt produced, 78 percent was used in brine form for manufacturing chemicals, and 22 percent was processed by open- and vacuum-pan methods to produce evaporated salt. Output was reported by four producers in Marshall, Kanawha, and Mason Counties.

Sand and Gravel.—The output of sand and gravel increased 5 percent, but its value decreased 8 percent, as the average price per ton dropped from \$2.10 to \$1.85. This was due to decreased output of industrial and ground sand, the higher price commodity types. Structural and paving uses again dominated use patterns, comprising 69 percent of the total output. Considerable tonnages of glass sand also were produced. Decreased roadbuilding activity was indicated by a 48-percent decrease in the output of paving gravel; conversely, the output of structural gravel increased 92 percent, reflecting increased building activity. Twenty-six operations were reported in 17 counties—13 dredges and 13 fixed plants. Hancock was the leading county; Morgan County ranked second.

TABLE 5.—Sand and gravel sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Sand:				
Building.....	(1)	(1)	973, 526	\$1, 228, 895
Paving.....	965, 409	\$1, 013, 275	909, 529	1, 130, 924
Fire or furnace.....	36, 993	46, 411	54, 295	86, 607
Gravel:				
Building.....	726, 116	815, 899	1, 392, 791	1, 445, 064
Paving.....	820, 870	1, 067, 090	424, 061	729, 378
Railroad ballast.....	(1)	(1)	14, 899	17, 134
Other.....	16, 590	20, 627	109, 752	209, 271
Undistributed ²	2, 544, 078	7, 747, 541	1, 474, 674	5, 045, 450
Total.....	5, 110, 056	10, 710, 843	5, 353, 527	9, 892, 723

¹ Figure withheld to avoid disclosing confidential data of individual companies; included with "Undistributed."

² Includes glass, building (1956), molding, grinding and polishing, engine, ground, and other sands and railroad-ballast gravel (1956).

Stone.—The output of stone, consisting almost entirely of limestone, increased 6 percent in 1957. Prices rose from \$1.64 to \$1.71 per ton, supplying an 11-percent increase in the total value.

The most important use for limestone again in 1957 was as metallurgical flux in blast and open-hearth furnaces. Concrete and roadstone and cement and lime uses also consumed considerable tonnages. Twenty-one mines were reported active in 11 counties.

TABLE 6.—Crushed and broken stone sold or used by producers, 1956–57, by uses

Use	1956		1957	
	Short tons	Value	Short tons	Value
Flux.....	2, 864, 147	\$5, 001, 336	2, 879, 829	\$5, 145, 448
Concrete and roadstone.....	1, 198, 804	2, 038, 075	1, 719, 360	2, 939, 972
Railroad ballast.....	562, 947	538, 156	(1)	(1)
Agricultural (limestone).....	61, 487	136, 192	51, 694	125, 143
Other ¹	240, 725	674, 446	380, 383	840, 335
Undistributed ²	1, 651, 161	2, 377, 434	1, 957, 777	2, 883, 489
Total.....	6, 579, 271	10, 765, 639	6, 989, 043	11, 934, 387

¹ Figure withheld to avoid disclosing confidential data of individual companies; included with "Undistributed."

² Limestone for miscellaneous uses (rock dust, glass, asphalt filler, stone sand, and chemical) and calcareous marl (1957).

³ Limestone for cement and lime, dimension sandstone, and railroad ballast (1957).

No crushed sandstone was produced in 1957, but small amounts of dimension sandstone for rough architectural uses and rubble were quarried.

Recovered Elemental Sulfur.—Brimstone was recovered as a by-product in the liquid purification of gas in Kanawha and Monongalia Counties.

METALS

Aluminum.—In November 1957 Kaiser Aluminum Co., at its Ravenswood (W. Va.) plant, initiated primary aluminum production in the Ohio Valley, when metal was poured from the first potline. The annual capacity of this first line was 36,250 tons. A second line of similar capacity will be put into production early in 1958. Cold-rolling facilities were placed in operation, and a hotline was scheduled for operation in 1958. Coal-generated electric power was used at the Ravenswood plant.

Iron and Steel.—Weirton Steel Co. Division National Steel Corp., and Wheeling Steel Corp., with 4 and 1 blast furnaces, respectively, had an operating capacity of 2,546,000 tons of pig iron, as of January 1, 1958. Weirton Steel Co. Division also had 14 open-hearth furnaces with a capacity of 3,300,000 tons of steel. Connors Steel Division of H. K. Porter Co., Inc., at Huntington (with 84,000 tons capacity) was the remaining steel producer.⁴

Manganese.—The output of manganese ore was reported through General Services Administration (GSA), which purchased manganese ore mined in Monroe County.

Electro Metallurgical Co., Division of Union Carbide Corp., completed new ferromanganese-production facilities at Alloy, W. Va. Capacity was increased because of increased demand for exothermic ferromanganese specially designed for ladle additions of 1 to 2 percent manganese in open-hearth steel production.

Zinc.—Because of the low selling price of zinc during 1957, the St. Joseph Lead Co. closed its Moundsville plant, which had been recovering zinc oxide from residues. The Meadowbrook Corp. operated its vertical-retort zinc smelter at Spelter in Harrison County throughout the year.

Zirconium.—Carborundum Metals Co. began to operate its new zirconium plant at Washington, Wood County, during the year. The plant will produce zirconium sponge metal from Florida zircon beach sands for the Atomic Energy Commission (AEC).

REVIEW BY COUNTIES

Barbour.—Although the number of active bituminous-coal mines in Barbour County increased from 48 to 50 in 1957, the total production dropped slightly owing to a 19-percent decrease in strip output. Underground mining increased 11 percent, as the number of mines increased from 32 to 36. Underground production comprised 74 percent of the total output. Auger production, which decreased 62 percent, comprised less than 1 percent of the county total.

⁴ American Iron and Steel Institute, Annual Capacities of Coke Ovens, Blast Furnaces, and Steelmaking Furnaces as of Jan. 1, 1958.

Mechanical loading, reported by 10 companies for 12 mines, increased 14 percent in 1957. Six new mobile loading machines increased the total to 27. Four continuous miners were active, as in 1956.

The Badger Coal Co. reported dense-medium and feldspar-jig cleaning equipment, and Simpson Creek collieries reported dense-medium facilities at the Galloway plant for the first time. Forty-two percent of the county output was cleaned chiefly by wet-washing methods.

TABLE 7.—Value of mineral production in West Virginia, 1956–57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value ²
Barbour.....	\$16,403,853	\$18,007,519	Coal.
Berkeley.....	11,166,896	12,329,764	Cement, stone, lime, clays.
Boone.....	35,532,340	36,885,160	Coal.
Braxton.....	456,921	913,704	Do.
Brooke.....	4,917,172	5,092,611	Coal, sand and gravel.
Cabell.....	628,599	(3)	Sand and gravel, clays.
Clay.....	6,639,908	(3)	Coal.
Fayette.....	46,824,387	42,575,944	Do.
Gilmer.....	1,133,567	1,533,899	Do.
Grant.....	(3)	(3)	Coal, stone.
Greenbrier.....	(3)	(3)	Do.
Hancock.....	(3)	(3)	Clays, sand and gravel, coal.
Hardy.....	(3)	(3)	Limestone.
Harrison.....	41,827,138	42,719,577	Coal.
Jackson.....	19,346	875	Sand and gravel.
Jefferson.....	(3)	(3)	Stone, lime.
Kanawha.....	53,677,100	56,636,664	Coal, salt, sand and gravel, bromine, clays, calcium chloride, stone, recovered elemental sulfur.
Lewis.....	4,753,105	3,960,803	Coal, clays.
Lincoln.....	28,321	23,641	Sand and gravel.
Logan.....	113,196,260	119,672,148	Coal.
Marion.....	53,918,497	63,032,242	Do.
Marshall.....	(3)	(3)	Coal, salt.
Mason.....	(3)	(3)	Do.
McDowell.....	129,101,318	133,170,580	Coal.
Mercer.....	12,028,159	9,512,954	Coal, stone, clays.
Mineral.....	560,859	(3)	Coal, stone.
Mingo.....	44,590,749	40,349,214	Coal, sand and gravel.
Monongalia.....	39,987,329	(3)	Coal, stone, sand and gravel, recovered elemental sulfur.
Monroe.....	(3)	(3)	Manganese.
Morgan.....	(3)	(3)	Sand and gravel.
Nicholas.....	(3)	32,866,701	Coal, sand and gravel.
Ohio.....	(3)	(3)	Do.
Pendleton.....	(3)	11,672	Stone.
Pocahontas.....	2,748,213	2,283,069	Coal.
Preston.....	11,945,437	(3)	Coal, cement, stone.
Putnam.....	667,124	669,061	Coal.
Raleigh.....	66,649,707	75,751,347	Coal, sand and gravel.
Randolph.....	(3)	(3)	Coal, stone.
Summers.....	(3)	(3)	Coal.
Taylor.....	1,311,734	1,946,369	Coal, sand and gravel.
Tucker.....	484,292	1,427,694	Coal, sand and gravel.
Upshur.....	(3)	6,620,733	Coal.
Wayne.....	431,541	733,929	Coal, sand and gravel.
Webster.....	6,796,401	6,284,818	Coal.
Wetzel.....	(3)	975,999	Sand and gravel.
Wood.....	736,338	(3)	Do.
Wyoming.....	71,777,127	79,402,505	Coal, sand and gravel.
Total.....	780,939,788	800,396,296	
Total fuels.....	71,554,000	67,364,000	
Undistributed.....	82,580,618	114,953,654	
Grand total.....	935,074,000	982,719,000	

¹ The following counties were not listed because no tonnage was reported: Calhoun, Doddridge, Hampshire, Pleasants, Ritchie, Roane, Tyler, and Wirt.

² Fuels, including natural gas, natural-gas liquids, and petroleum, are not listed by counties but given as State "Total fuels."

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Clinchfield Coal Co. took over operation of two Compass Coal Co. mines and added a new mine in the county in February. The Compass B mine was closed in July. Simpson Coal & Chemical Corp. closed indefinitely the Galloway No. 3 mine in October.

Berkeley.—The production and value of cement in Berkeley, the larger of the two cement-producing counties, increased 12 and 19 percent, respectively, compared with 1956. The county output of cement (portland, 96 percent; and masonry, 4 percent) was manufactured at the Martinsburg plant of the Standard Lime & Cement Co. Maryland used most of the output, but considerable quantities were also consumed within West Virginia. Virginia, the District of Columbia, North Carolina, Delaware, and Pennsylvania also received cement shipments in 1957.

Limestone—primarily for cement and lime manufacture, but also for metallurgy, concrete aggregate and roadstone, and railroad ballast—increased slightly in both production and value. Jones & Laughlin Steel Corp., Blair Limestone Division, Standard Lime & Cement Co. (both of Martinsburg), and J. E. Baker Co. (Inwood) reported output in 1957.

Jones & Laughlin and Standard Lime & Stone Co. produced lime and shipped most of it to Pennsylvania and Maryland, where it was used for chemical and industrial purposes (primarily in open-hearth and electric furnaces).

The output of miscellaneous clay for building brick decreased slightly. Output was mined from United Clay Products Co. open pit near North Mountain and from the open pit of Continental Clay Production Co. at Martinsburg. Berkeley ranked second among the six clay-producing counties.

Boone.—The total coal production reported from 55 mines increased 6 percent, raising Boone County to 10th in the coal-producing area in 1957. Underground production, which comprised 91 percent of the total tonnage, increased 4 percent. Strip production reported by 3 companies increased 88 percent. Auger tonnage decreased 6 percent, even though the number of reporting mines increased from 3 to 4. The average value per ton assigned to strip and auger production decreased sharply—\$1.00 and \$1.28 per ton, respectively.

Eastern Gas & Fuel Associates added a second continuous mining machine. Mechanical loading increased 5 percent. Almost nine-tenths of total underground production was loaded by mechanical methods.

Spruce River Coal Co. cleaned mechanically for the first time by the Daniels dense-medium process. Mechanical cleaning was widely practiced in the county; 88 percent of the total output was cleaned.

Braxton.—Coal production (as reported from 9 underground mines) doubled in 1957. Over 72 percent of the output was loaded mechanically. Cedar Creek Coal Co. increased mechanical loading significantly with addition of two mobile loaders and a revised mining system of mobile loading onto shuttle cars and conveyors, in addition to mobile loading into mine cars. This company also operated a Belknap Chloride cleaning plant.

Brooke.—Coal production in Brooke County dropped 3 percent in 1957. Underground mining, which comprised more than three-fourths

of the total output, increased 7 percent but was offset by a 29-percent drop in strip mining. One auger mine was active during the year.

Mechanical loading increased 15 percent over 1956. Liberty Colliery Co. reported mobile-loading its entire production into a shuttle car. Cove Hill Coal Co. reported mechanical cleaning for the first time, using a Jeffrey jig.

Sand and gravel production decreased in 1957; however, its value increased slightly over 1956. The county output was fire or furnace sand produced by the Brilliant Sand Co. at Follansbee.

Cabell.—Sand and gravel production and value decreased 7 and 8 percent, respectively, in 1957, compared with 1956. The county output was dredged from the Ohio River near Huntington by the Ohio River Dredging Co. and the Union Sand and Gravel Co. for building and paving purposes.

Miscellaneous clay of the red-shale variety was mined by the Barboursville Clay Manufacturing Co., Barboursville. The output was less than in 1956.

Clay.—Although three more coal mines were reported active in Clay County in 1957, the tonnage dropped below 1956. Underground production predominated, comprising 97 percent of total tonnage. Two strip mines and one auger mine produced in 1957, compared with one strip and no auger mines in 1956.

Tonnage mechanically loaded decreased 20 percent in 1957. Elk River Coal & Lumber Co. reported a revised mining plan, in which the entire production was loaded into shuttle cars, while in 1956 mobile loaders also loaded into mine cars and onto conveyors.

Fayette.—Coal production in Fayette County decreased 12 percent in 1957. Output was reported from 146 underground mines, which comprised 91 percent of the total tonnage. Strip and auger production dropped 19 and 18 percent, respectively, from 1956.

Tonnage mechanically loaded dropped 5 percent during the year, even though there were 4 continuous mining machines operating in 1957, compared with none in 1956. Royalty Smokeless Coal Co. reported 3 continuous miners at the Royalty mine, and Semet-Solvay Division of Allied Chemical & Dye Corp. reported 1 at the Harewood mine.

Branch Fuel Co. and Laurel Smokeless Coal Co. reported mechanical cleaning for the first time; both used hydroseparators.

Electro-Metallurgical Co. discontinued operating the Hernshaw mine in March and the Alloy No. 2 mine in June. The New River Co. closed its Whipple mine in September.

Gilmer.—Bituminous-coal-mining activity increased in Gilmer County in 1957; 3 new mines were reported active, and production increased 49 percent. Strip and auger mining (which increased 27 and 8 percent, respectively) were more important types of mining in the county, comprising 44 and 29 percent respectively of the total output. Underground production increased almost 5 times that of 1956 to make up 27 percent of the total 1957 county production, compared with only 8 percent in 1956.

Rochester & Pittsburgh Coal Co. opened a new mine (O'Donnell No. 2) early in 1957. No mechanical loading was reported in 1956, but in 1957 the O'Donnell mine utilized a mining plan of mobile loading into shuttle cars.

No mechanical cleaning was reported in the county in 1957; however, Rochester & Pittsburgh Coal Co. announced plans for construction of a modern tippie and cleaning plant near the mine entrance. Until final completion, coal is being cleaned at the Erie No. 5 plant at Walkersville in transit.

Grant.—Bituminous-coal production in Grant County increased 39 percent because of an almost seven fold increase in strip mining. Strip tonnage comprised 45 percent of the total county output, compared with only 10 percent in 1956. The Buffalo Coal Co. began strip mining in 1957 and supplied most strip tonnage. Four fewer underground mines were reported active in 1957, and underground production dropped 15 percent.

Limestone production continued at virtually the same rate as 1956. Bean's Lime & Stone Co. operated a quarry near Petersburg and produced the bulk of the county output for concrete aggregate and roadstone and for agstone.

Greenbrier.—Decreased coal-mining activity was noted in Greenbrier County—production dropped 15 percent. Nine more underground mines were reported active in 1957, bringing the total to 95; but tonnage decreased 8 percent. Strip-mined production dropped 35 percent.

The county ranked second in limestone production. Quarries of two producers, Acme Limestone Co. and H. Frazier Co., Inc., were in the southern part of the county near Fort Spring. Output was used for concrete aggregate, railroad ballast, and chemical and agricultural purposes.

The Greenbrier Quarries, which purchased the property of Hoffman Bros. in 1956, produced a small quantity of dimension sandstone for architectural purposes.

Hancock.—Although clay mining decreased 3 percent in 1957, compared with 1956, the county continued to rank first in the State. The value of output increased 16 percent over 1956. Globe Brick Co. (Newell), the largest producer, and West Virginia Fire Clay Manufacturing Co. and Crescent Brick Co., Inc. (both of New Cumberland), produced fire clay for firebrick and block, mortar, foundries, and glass refractories.

Sand and gravel production and value increased 11 percent in 1957, as favorable economic conditions were reported by Dravo Corp. Its Nos. 8 and 9 mines continued production near Moscow, producing large quantities of building and paving sand and building gravel. The county ranked first in sand and gravel output in 1957.

There were 2 coal mines in Hancock County again this year (1 strip and 1 underground). Output dropped considerably below that of 1956.

Hardy.—West Virginia Soil Conservation quarried limestone near Baker for use in manufacturing lime.

Harrison.—Coal production decreased 9 percent in Harrison County in 1957, but the county remained 10th among 36 coal-producing counties. Underground mining was the most important, comprising 76 percent of total output in 1957. Strip and auger tonnage made up the remaining 17 and 7 percent, respectively. Underground mining increased 3 percent, as 2 more mines were reported active, bringing the total to 74. Strip production dropped

31 percent, but the county retained first place in strip output. A 34-percent drop in auger production, however, caused the county to fall to second place in auger output.

Mechanical loading increased in 1957. Consolidation Coal Co. reported adding 2 continuous miners, bringing the county total to 3. Mobile loading into shuttle cars was the most widely used system, furnishing 93 percent of the mechanically loaded total.

Galloway Land Co. and Petitto Coal Co. reported mechanical cleaning for the first time, using dense-medium and calcium chloride processes, respectively. Slightly more than one-half the county output was cleaned. Dense-medium processes supplied the bulk of cleaned output.

Acme Coal Co. closed the Acme mine indefinitely in May. Clinchfield Coal Co. operated the Mars mine, formerly owned by Compass Coal Co., until June, when activities were discontinued.

The Meadowbrook Corp. operated its vertical-retort zinc smelter at Spelter throughout the year.

Jackson.—Ravenswood Sand & Gravel Co. (Ravenswood) produced only a small quantity of paving sand and building gravel, as the company operated only a few days in 1957 before finally abandoning its property in April.

Jefferson.—Three producers maintained the leading position held by Jefferson County in limestone production—Michigan Limestone Division of the United States Steel Corp., Millville; Jones & Laughlin Steel Corp., Harpers Ferry; and Standard Lime & Cement Co., Engle and Millville. Seventy-eight percent of the county production was used for metallurgical flux for blast furnaces and open-hearth plants. The balance was used in manufacturing lime, for railroad ballast, as an ingredient of cement, and for agricultural purposes. County production and value decreased 5 and 3 percent, respectively.

Lime for refractory material was produced at Millville, and lime (chiefly for open-hearth flux) was produced at Bakerton by the Standard Lime & Cement Co. Jones & Laughlin Steel Corp. calcined dolomite, chiefly for refractory uses.

The West Virginia Lime Co. mined calcareous marl for agricultural purposes near Charles Town.

Kanawha.—Kanawha County ranked sixth in the State in coal production in 1957. Production increased 2 percent because of a 4-percent increase in underground output. Strip and auger mining decreased 26 and 3 percent, respectively. The county, however, took the leading position in auger mining. Underground mining was the most important, comprising 91 percent of the total output. Auger and strip mining made up 7 and 2 percent, respectively.

Mechanical loading increased 3 percent over 1956, even though fewer loading machines were employed. Electro-Metallurgical Co. did not employ the 4 continuous miners used the preceding year, and Valley Camp Coal Co., KC No. 6 mine (which used 4 continuous miners in 1956) did not operate in 1957. The company opened a new mine, Kelly's Creek No. 7, in December. In 1957 Imperial Colliery Co. added a continuous mining machine to its Imperial No. 8 gas mine, and Wyatt Coal Co. added one to its No. 2 gas mine. Truax-Traer closed the Racoon No. 5 Block mine in July.

Wyatt-Seanor Coal Co. reported operating a dense-medium cleaning plant in 1957. The Carbon Fuel Co. No. 12 plant did not operate during the year. Jigs cleaned more coal than did any other process. Coalburgh Kanawha Mining Co. indefinitely closed the Belmont No. 8 mine in June. Fields Creek Coal Co. opened a new mine near Marmet in March.

Westvaco Chlor-Alkali Division of Food Machinery & Chemical Corp. reported a 12-percent increase in salt production in 1957. The output was consumed within the State in chlorine manufacture. In addition, the company purchased a considerable quantity of rock salt from Michigan and Pennsylvania. The company wells were near South Charleston, natural salines were refined to obtain bromine compounds and calcium-magnesium chloride.

Pfaff & Smith Builders Supply Co. near Washington produced building sand and gravel; St. Albans Sand Co. (St. Albans) produced engine sand; and Charleston Sand Corp. (Big Chimney) produced building sand. County production and value decreased slightly in 1957, compared with the preceding year.

Fire-clay production and value in the county decreased sharply (21 percent) in 1957. Output used for building brick was reported by Charleston Clay Products Co. and West Virginia Brick Co., both of Charleston.

A small quantity of sandstone for use as concrete aggregate and roadstone and for riprap was reported by the Conservation Commission of West Virginia.

The E. I. du Pont de Nemours & Co. continued to operate the Belle Works plant, Belle, and recovered sulfur in the liquid purification of gas.

Lewis.—Bituminous-coal production decreased 23 percent in 1957. A 32-percent decrease in strip-mined output (76 percent of the county total) more than offset increased auger and underground production (23 and 1 percent, respectively). Three more auger mines were reported active during the year.

Keely Construction Co. reported mechanically cleaned coal in 1957, using a McNally-Pittsburgh washer.

The Weston Brick & Coal Co. and Jane Lew Brick & Tile Co. (incorporated as of July 1, 1957, under the name of Weston-Jane Lew Brick & Tile Co.) produced miscellaneous clay for building brick.

Lincoln.—Davis & Adkins Sand Co. dredged engine sand from the Guyandot River near Ferrellsburg. A small quantity of fire or furnace sand was produced by Dean Coal & Sand Co., Ferrellsburg. Guyan River Co. and Hal Dial & Sons were idle during 1957.

Logan.—The county continued as the leading coal-producing area in the State in 1957; production increased 2 percent. Underground production (97 percent of the total tonnage) was reported by 89 producers—17 more than in 1956. Boone County Coal Corp. reported the only strip mine in the county in 1957. Six auger-mining companies reported 16 percent less production than in 1956.

Omar Mining Co. added a continuous mining machine to the Sterratt No. 19-C mine in 1957. Mechanical loading increased slightly during the year, so that more than 98 percent of the total underground production in Logan County in 1957 was loaded mechanically.

Twenty-six cleaning plants in the county cleaned over 19.6 million tons of coal. Jigs were most prevalent, cleaning 12.7 million tons.

Amherst Coal Co. reported closing the Amherst 1A mine in March. This company opened an auger mine in June and closed it in December.

Marion.—Although only 15 coal mines were reported active in 1957, the county ranked fourth in the State, producing almost 12 million tons of coal. Production increased 16 percent over 1956. The underground mines were large, and 6 of the 14 mines produced over 1 million tons of coal. Ninety-nine percent of the underground production was loaded mechanically. Continuous mining was widely practiced in the county; Bethlehem Cuba Iron Mines added 3 continuous miners to the Ida May No. 44 mine and 2 to the Barrackville No. 41 mine. Consolidation Coal Co. initiated continuous mining at the Loveridge mine in 1957. Of the mechanically loaded total, 27 percent was mined by continuous miners and 73 percent by mobile loaders into shuttle cars.

Eight cleaning plants employing chiefly jigs and Diester tables cleaned 60 percent of the county output.

Marshall.—Coal production in Marshall County increased 80 percent in 1957. The Ireland mine of Hanna Coal Co. produced for its first full year. Only three underground mines were reported active. Valley Camp Coal Co. added a fourth continuous miner, and Hanna Coal Co. reported using three continuous miners with mobile loaders.

Marshall County led in salt production. Columbia Southern Chemical Corp. (Natrium) and the Solvay Process Division of Allied Chemical & Dye Corp. (Moundsville) produced well brines, chiefly for manufacturing chlorine.

Mason.—Coal production in Mason County remained about the same as in 1956. Five underground producers were active—one more than in the preceding year. Over 82 percent of production was loaded mechanically, chiefly by mobile loaders, into mine cars and onto conveyors.

Evaporated salt was produced by the Liverpool Salt Co., Hartford, for use by feed dealers and meat packers, for water softening, and for ceramic- and metal-processing uses. The output was consumed chiefly within the State, but quantities were shipped to Ohio, Indiana, and Kentucky.

McDowell.—Coal production decreased 5 percent in McDowell County, even though 21 more mines were reported active in 1957. Underground mining produced 92 percent of the total county output in 1957, strip, 6 percent, and auger, 2 percent. Strip production increased 43 percent, as the number of mines doubled from 10 to 20. The county ranked second in strip-coal production. Four new auger mines increased production 28 percent ranking the county third in auger mining.

Forty-one continuous mining machines of 14 companies loaded almost 3.5 million tons. The No. 2 mine of United States Steel Corp., where 36 continuous miners had been employed in 1956, reported only 17 in 1957. Mines at which continuous mining was reported for the first time were the No. 1 and Algoma mines of Island Creek Coal Co., the Black Wolfe mine of Nassau Coal Co., the Peerless Coal & Coke Co. and the No. 14 mine of United States Steel Corp.

Twenty-one plants reported mechanical cleaning in 1957. The following companies cleaned mechanically for the first time: Elkhorn Pocahontas Coal Co. (Menzie Hydro), Lake Superior Coal Co. (Baum jig), and Pais Pocahontas Coal Co. (Magnetite dense medium). More than 13.4 million tons of coal were cleaned. Jigs cleaned over 6.6 million; wet washing other than jigs, 3.8 million; and air cleaning, 3.0 million tons.

The sandstone quarry of Brown & Wright near Princeton was idle in 1957.

Mercer.—Low tonnages of underground-and-auger-mined coal decreased production 24 percent in Mercer County. Strip production increased 23 percent; however, the increased strip-mined total did not similarly affect the county total since underground mining comprised 80 percent of the total output. Only 19 underground mines were reported active—7 less than the preceding year. Auger production dropped 50 percent with 2 less auger mines reported active during the year.

No continuous mining was reported in the county, but 84 percent of the underground production was mechanically loaded, chiefly by mobile loading machines into shuttle cars.

Limestone was produced from a quarry near Bluefield by Bluefield Limestone Co., Inc., for use as concrete aggregate and roadstone.

Miscellaneous clay (shale) was mined by Virginian Brick & Tile Co. near Princeton for building brick.

Mineral.—Coal production decreased considerably in 1957; the number of active mines dropped from 7 to 3. One strip mine and two small hand-loading underground mines were in production in 1957.

Spencer Limestone Co. increased production of limestone for use chiefly by the State roads commission for paving. The remainder was utilized as agstone.

Mingo.—Coal production reported by 57 producing mines decreased 13 percent in 1957. Underground mining (90 percent of the total output) decreased 14 percent, even though 2 more underground mines were reported active in 1957. Strip tonnage more than doubled, as one more strip mine operated by Gay Mining Co. produced in 1957. Auger-mined tonnage dropped 29 percent; 3 fewer auger mines were reported active during the year.

No continuous mining was reported in the county, although 94 percent of the underground output was loaded mechanically, chiefly by mobile loaders into shuttle cars.

C. & R. Coal Co. abandoned its No. 8 mine, Sycamore Coal Co. closed indefinitely the Cinderella mine in February, Peter White Coal Co. closed the Peter White mine in September, and Island Creek closed the Mitchell Branch mine.

Engine sand was produced by the Guyan Valley Sand Co. near Gilbert.

Monongalia.—Ten more coal mines were active in Monongalia County in 1957, bringing the total to seventy-two. Coal production increased 17 percent, ranking the county seventh, compared with ninth in 1956. Underground mining comprised 99 percent of the total output. Strip-mined tonnage increased more than four times the 1956 total.

Six more continuous mining machines were reported in 1957, bringing the total to 24; Christopher Coal Co. added 2 to its Humphrey mine and 1 each to the Arkwright and Pursglove mines, and South Union Coal Co. and Valley Camp Coal Co. each added 1. Ninety-five percent of the underground production was loaded mechanically.

Tasa Coal Co. for the first time reported cleaning, using a Jeffrey jig. Ten cleaning plants cleaned 69 percent of county output. Chance cones were the leading type of cleaning equipment.

Crushed limestone for concrete, aggregate, and roadstone was produced by Lambert Bros., Inc., Morgantown.

Deckers Creek Sand Co., Morgantown, produced glass, engine, and grinding sands.

Olin Mathieson Chemical Corp. recovered sulfur in the liquid purification of gas at Morgantown.

Monroe.—The Government (through GSA) purchased manganese ore from Simmons Associates Mining Co.

Morgan.—Pennsylvania Glass Sand Corp. ground a large quantity of sandstone at its fixed plant near Hancock. Most of it was used as glass sand, and the remainder for molding, grinding and polishing, and engine sands, pottery, foundry uses, filler, and abrasives and enamel.

Nicholas.—Bituminous-coal production decreased 3 percent in 1957. The number of reporting mines increased from 66 to 81. Underground tonnage (90 percent of the total output) increased slightly, and auger tonnage was almost eight times greater in 1957. Strip mining decreased 50 percent, offsetting the increased underground- and auger-mining activity.

Ogleby Norton Coal Co. assumed operation of the Richwood Sewell Coal Co. Burton mine late in the year. Otter Creek Coal Co. discontinued its Nos. 1 and 3 mines in August.

Nettie Sand Co., Nettie, produced sand for structural uses.

Ohio.—Output from the 3 underground coal mines in the county decreased 8 percent in 1957. No mechanical loading or cleaning was reported.

H. I. Seabright Co. dredged building sand and gravel from the Ohio River near Wheeling.

Pendleton.—North Fork Lime Producers Cooperative, Inc., opened a limestone quarry at Riverton and produced crushed stone for agricultural purposes. Limestone output was reported in Pendleton County in 1957 for the first time.

Pocahontas.—Coal production increased 18 percent, even though the number of mines dropped from 8 to 6. Ninety-five percent of the output was mined by underground methods. Over 96 percent of the underground production was loaded mechanically, chiefly by hand-loaded room or face conveyors.

Preston.—A drop of 17 in the number of active coal mines decreased production 11 percent in 1957. Decreased activity in underground mining caused the drop in county output; strip-mined tonnage remained virtually the same as the previous year. Underground mining comprised 66 percent of total tonnage and strip mining, 34 percent.

Hartman Coal Co. reported the only continuous miner in the county. Tri-State Mining Co. closed its No. 1 mine in November.

The Alpha Portland Cement Co. continued operations at Manheim, where limestone was quarried, crushed, and used in the company

cement-manufacturing plant. A new limestone quarry was opened at Terra Alta by Terra Alta Limestone Co. Output was used for concrete aggregate and asphalt filler. Paul E. Garbart closed his sandstone quarry.

Putnam.—Coal mining in Putnam County was characterized by small nonmechanized operations. More coal was produced by strip mining (56 percent) than by underground (25 percent) or auger mining (19 percent). Auger production in 1957 was more than four times larger than in 1956.

Raleigh.—Coal production increased 7 percent, but the county dropped from fourth to fifth place in State rankings. Ninety percent of the county total was loaded by underground methods, 9 percent by strip mining, and 1 percent by auger mining; 144 mines were reported active in 1957, compared with 128 in 1956.

Continuous mining increased considerably with the addition of 7 new machines; Raleigh Eagle Coal Co. added 1 to their Ameagle No. 70 mine, Truax-Traer added 2 to the Eunice mine, and the T & W Coal Co. and Meade Coal Co. each added 2.

Twenty-two cleaning plants were active in the county, cleaning more than 6 million tons of coal—over half the county output. More coal was cleaned by jigs than by any other method, but considerable tonnage was cleaned by pneumatic methods.

Admiral Smokeless Coal Co. opened a new mine at Eccles in October and was beginning development work. The New River Co. closed the Skelton mine early in 1957.

The Beaver Block Co. (formerly Grandview Sand) and Table Rock Sand Co. produced sand for building purposes at virtually the same rate as in 1956.

Randolph.—Underground mining of coal increased 8 percent but was offset by a 33-percent decline in strip mining and a 63-percent decrease in auger mining. L. E. Cleghorn added a continuous mining machine. Tonnage mechanically loaded increased 18 percent. Eighty percent of the underground output was loaded mechanically.

Elkins Limestone Co. increased production of crushed limestone for concrete aggregate and for road construction and repair.

Taylor.—Coal was produced at 10 underground, 4 strip, and 2 auger mines in 1957. Production increased 40 percent. Strip mining furnished 65 percent of the total tonnage; underground, 32 percent; and auger, 3 percent.

Tucker.—Output of coal was over 2.5 times greater than in 1956. Strip mining furnished 99 percent of the total output. Only one small hand-loaded underground mine was active.

Sand and gravel for road paving was produced by the Fairfax Sand & Crushed Stone Co. near Thomas.

Upshur.—Coal production was reported by 1 auger, 7 strip, and 26 underground operators. Production increased 2 percent owing to a 31-percent increase in strip-mined tonnage. Underground mining decreased 2 percent, and auger tonnage 44 percent.

Pecks Run Coal Co. reported using the only two continuous mining machines in the county at their Kano mine. The remainder of the mechanically loaded tonnage was mobile loaded into shuttle cars.

No clay was produced in the county, as Buckhannon Brick Co. reported its plant closed and for sale.

Wayne.—Five underground mines produced 58 percent more coal in 1957 than 10 had produced in 1956. The mines were small. No mechanical cleaning or loading was reported.

Sand was dredged from the Big Sandy River near Fort Gay by Laval Sand Co. for traction sand (engine sand) for use in coal mines.

Webster.—Coal was produced at 14 underground mines. There were 2 strip mines in 1957, compared with none in 1956; there were no auger mines in 1957, compared with 3 in 1956. Total production decreased 7 percent.

Pardee & Curtin Lumber Co. mined continuously in 1956 but not in 1957. Williams River Coal Co. added R & S Airflow to their Crichton No. 5 plant, which formerly had only Belknap Chloride equipment.

Wetzel.—Sand and gravel production increased considerably. Wetzel County replaced Wood County as third in State production. Output of building and paving material was reported by Ohio River Sand & Gravel Corp. and Ohio Valley Sand Co., both of New Martinsville. Railroad-ballast gravel also was produced by Ohio Valley Sand Co. Fill gravel was produced by the Ohio River Sand & Gravel Corp.

Wood.—Sand and gravel production in Wood County dropped 19 percent. Kanawha Sand Co. (Parkersburg) was the leading producer, followed by Duquesne Sand Co. (Wellsburg), and Ohio River Sand & Gravel Corp. (Parkersburg). Except for a medial amount for fill, output was used for building and paving purposes.

Wyoming.—The county remained third in coal production in the State. Production as reported by 58 underground, 7 strip, and 6 auger mines increased 5 percent in 1957.

Two more continuous miners were added, bringing the county total to 10; the Kopperston No. 2 mine of Eastern Gas & Fuel Co. and the Tralee mine of Semet-Solvay Co. each added one.

Brule Smokeless Coal Co. added Deister Tables to the Brule plant, which formerly used a Belknap Chloride system. The Buckeye Coal & Coke Co. started mechanical cleaning in 1957 using a Diaphragm jig. Over three-fourths of the total county output was prepared at 17 mechanical-cleaning plants.

Amigo Smokeless took over operation of Jones & Laughlin's Black Eagle No. 2 mine the first of the year. Oceana Coal Corp. took over the operation of Redyard Coal Co.'s Huff Mountain mine in June. Island Creek took over all Red Jacket Coal Corp. mines in Wyoming County and the Marianna mine of Pond Creek Pocahontas Coal Co. Brule Smokeless opened a strip mine near Ostego in April.

Casto & Lackey Sand Co., Baileysville, produced engine sand and reported output and value virtually the same as in 1956.

The Mineral Industry of Wisconsin

This chapter has been prepared under a cooperative agreement for the collection of mineral data, between the Bureau of Mines, Department of the Interior, and the Geological Survey of Wisconsin.

By Lenox H. Rand¹



WISCONSIN'S mineral production in 1957, valued at about \$68.6 million, was approximately \$2.8 million over that of 1956. In contrast to the situation in 1956, sharp declines in the prices of lead and zinc were more than offset by substantial increases in the value of iron ore, cement, and stone. The rise in the tonnage and value of shipments of iron ore from Wisconsin did not reflect improvement in the steel industry but was rather only a comparison with the strike-interrupted year of 1956. Heavy shipments of iron ore in the first half of 1957 from the Lake Superior districts, plus declining consumption by the steel mills, led to large accumulations of stocks at the lower Lake ports by the end of the year. As a result of steadily falling prices for lead and zinc, many mines and mills ceased operations. The increase in production of sand and gravel at a generally lower unit price indicated greater activity by Government-and-contractor operations for road-building purposes.

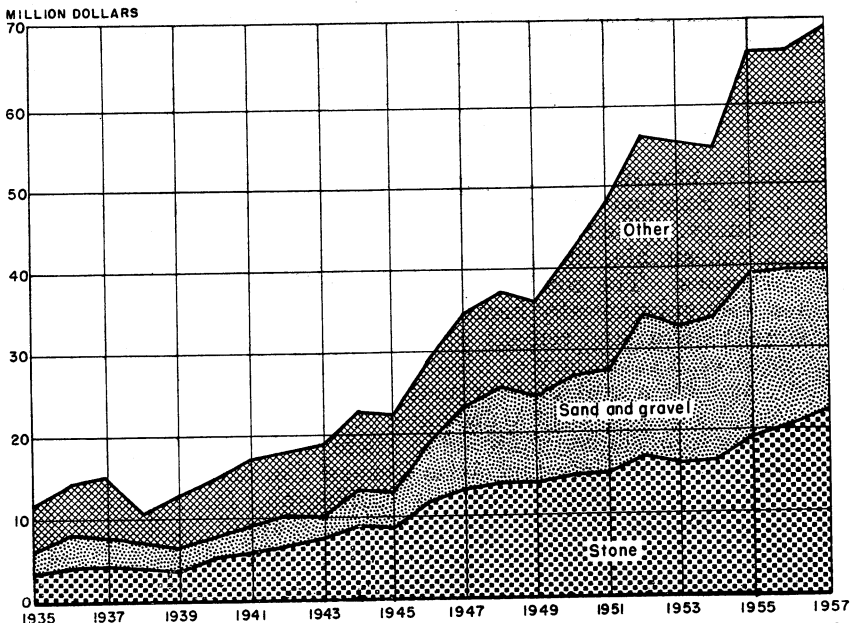


FIGURE 1.—Value of sand and gravel, stone, and total value of all minerals produced in Wisconsin, 1935-57.

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The production and value of cement rose owing to an increase in unit price and to production beginning in February at the new plant of Marquette Cement Manufacturing Co. in Milwaukee.

In early May 1957 a major blast of some 93,000 pounds of explosives brought down an estimated 870,000 tons of broken basalt at the quarry of the Dresser Trap Rock Co. in Polk County. The coyote-hole method of blasting was used.

TABLE 1.—Mineral production in Wisconsin, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Abrasive stones (grinding pebbles and tube-mill liners).....	2 1,093	\$31,150	1,790	\$43,328
Clays.....	163,089	172,087	131,007	153,854
Iron ore (usable).....long tons, gross weight.....	1,488,361	(*)	1,576,057	(*)
Lead (recoverable content of ores, etc.).....	2,582	810,748	1,900	543,400
Marl. calcareous.....	11,074	5,603	(*)	(*)
Peat.....			400	(*)
Sand and gravel.....	27,715,171	19,097,155	29,393,525	18,693,454
Stone.....	11,125,875	20,401,884	12,433,779	22,454,598
Zinc (recoverable content of ores, etc.).....	23,890	6,545,800	21,575	5,005,400
Value of items that cannot be disclosed: Abrasive stone (tube-mill liners, 1956), cement, lime, and values indicated by footnote ¹		19,450,726		22,590,776
Total Wisconsin ²		65,860,000		68,644,000

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Grinding pebbles only (1956).

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Included in stone total (1957).

⁵ Total adjusted to eliminate duplicating value of clays and stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grinding pebbles and tube-mill liners were produced by Baraboo Quartzite Co. from a hard-quartzite deposit in Sauk County. When contamination of the ground product by metallic iron is undesirable, the use of such grinding pebbles is particularly advantageous. The combined tonnage and value of these abrasive stones were substantially higher than in 1956.

Cement.—Portland cement was produced by Manitowoc Portland Cement Co., a subsidiary of Medusa Portland Cement Co., in Manitowoc, and by a unit of Marquette Cement Manufacturing Co. of Chicago at a new plant in Milwaukee. Cement clinker was ground at Green Bay from clinker produced in Michigan by the Huron Portland Cement Co. The Universal Atlas Cement Co. new grinding unit in Milwaukee used clinker from its Buffington, Ind., plant. This cement is credited to the originating State to avoid duplicating data. The entire output was types I and II, general-use and moderate-heat cements. Some of the portland cement made in Milwaukee was used to manufacture masonry cement.

The Marquette Cement Co. plant was the first in the United States to use the ACL (Allis-Chalmers-Lellep) process. Its performance will interest the cement industry.

The total shipments of cement increased, owing principally to the advent of the new producer. Average mill value per barrel also increased from \$2.98 in 1956 to \$3.20 in 1957.

Clays.—The production of miscellaneous clay in 1957 for manufacturing cement and heavy clay products fell approximately 20 percent below 1956 in both quantity and value. Production was reported from 10 companies from pits in Brown, Dunn, Fond du Lac, La Crosse, Manitowoc, Marathon, Racine, and Waupaca Counties. This decline followed the trend of the building industries.

Lime.—The total shipments and value of quick and hydrated lime declined slightly in 1957. Production was reported from Brown, Dodge, Douglas, Fond du Lac, and Manitowoc Counties by 5 companies operating 7 plants. Nearly 75 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; 23 percent was used for construction including masonry mortar and finishing lime; and the remainder was used in agriculture. The average value per ton of lime sold in Wisconsin in 1957 was \$14.50 compared with \$14.70 in 1956.

Perlite.—Crude perlite from Colorado was expanded at plants in Milwaukee and Outagamie Counties for use chiefly in plaster and concrete.

Sand and Gravel.—Total production of sand and gravel in Wisconsin was nearly 29.4 million tons, an increase of about 6 percent over 1956; however, the total value of approximately \$18.7 million represented a decline of some 2.1 percent from 1956. Production was reported from 56 of the 71 counties. Approximately 55 percent was produced commercially and 45 percent by Government-and-contractor, compared with 58 and 42 percent, respectively, in 1956.

About 87 percent of the total output of sand and gravel was used in building and paving, declining nearly 11.5 percent and increasing 10 percent, respectively, compared with 1956. Considerable quantities were used for railroad ballast, fill, and molding, but the production and total value of molding sand sharply declined. Smaller quantities of special-type sands were consumed in sand blasting, engine use, filler, glass manufacture, and filter uses.

These data, with the figures shown in table 2, give reasons for the decline in value of sand and gravel in 1957. The higher proportion of Government-and-contractor production increased the tonnage of lower price material. The sharply declining use of molding sand further reduced the total value of sand produced. The production and value of sand and gravel declined in building and industrial uses about 20 and 25 percent, respectively. Similar figures for sand and gravel used in paving or road construction indicated increases of about 10 and 7 percent.

In 1957 approximately 95 percent (88 percent in 1956) of the sand and gravel produced in the State was hauled by truck; the remainder was transported by rail.

The 10 leading commercial producers, in alphabetical order, were: Consumers Co., Racine; Hartland Sand & Gravel Co., Hartland; Jaeger Sand & Gravel Co., Inc., Milwaukee; Janesville Sand & Gravel Co., Janesville; Edw. Lutz Sand & Gravel Co., Milwaukee; Ozaukee Sand & Gravel Co., Ozaukee; A. J. Reiske Sons Co., Milwaukee;

TABLE 2.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

	1956			1957		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand: 1						
Molding.....	913,030	\$1,758,440	\$1.93	240,159	\$468,145	\$1.95
Building.....	2,489,064	2,051,064	.82	2,483,539	2,101,977	.85
Engine.....	(2)	(2)		(2)	(2)	
Paving.....	*1,532,493	*1,154,889	.75	1,747,097	1,388,962	.80
Blast.....	(2)	(2)		(2)	(2)	
Filter.....	(2)	(2)		(2)	(2)	
Railroad ballast.....	(2)	(2)		(2)	(2)	
Filler.....	(2)	(2)		(2)	(2)	
Fill.....				1,044,821	545,439	.52
Other.....	685,677	411,284	.60	77,447	28,557	.37
Undistributed 4.....	144,714	203,596		183,272	216,101	
Total sand.....	5,764,973	5,579,273	.97	5,776,335	4,749,181	.82
Gravel:						
Building.....	3,166,769	2,635,983	.83	2,862,228	2,456,075	.86
Paving.....	5,483,759	4,173,792	.76	5,197,403	3,885,619	.75
Railroad ballast.....	821,067	413,587	.50	947,703	507,536	.54
Fill.....				825,543	315,444	.38
Other.....	761,901	498,689	.65	359,497	359,384	.65
Total gravel.....	10,233,496	7,722,051	.75	10,383,372	7,524,058	.72
Total sand and gravel.....	15,998,474	13,301,324	.83	16,159,707	12,273,239	.76
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	53,393	31,288	.59	3,463	866	.25
Paving.....	4,371,022	1,635,876	.35	6,679,539	2,884,020	.43
Total sand.....	4,424,415	1,567,164	.35	6,683,002	2,884,886	.43
Gravel:						
Building.....	342,657	145,955	.43	10,679	3,204	.30
Paving.....	6,949,625	4,082,712	.59	6,540,137	3,532,125	.54
Total gravel.....	7,292,282	4,228,667	.58	6,550,816	3,535,329	.54
Total sand and gravel.....	11,716,697	5,795,831	.49	13,233,818	6,420,215	.49
ALL OPERATIONS						
Sand.....	10,189,393	7,146,437	.70	12,459,337	7,634,067	.61
Gravel.....	17,525,778	11,950,718	.68	16,934,188	11,059,387	.65
Grand total.....	27,715,171	19,097,155	.69	29,393,525	18,693,454	.64

1 Includes friable sandstone.

2 Figure withheld to avoid disclosing individual company confidential data included with "Undistributed."

3 Revised figure.

4 Includes grinding and polishing (1956); blast, engine, filler, filter and railroad-ballast sand (1956-57).

Schuster Construction Co., Green Bay; Valley Sand & Gravel Co., Waukesha; and Wissota Sand & Gravel Co., Eau Claire.

Stone.—Stone output in Wisconsin included limestone, granite, sandstone and quartzite, basalt, marl, and miscellaneous stone. Total production approached 12.5 million tons—an increase of about 12 percent over 1956.

Limestone occurs in many areas throughout the State, but deposits of good dimension-stone quality are not widespread. Output of this type of limestone for rubble, flagging, and structural and architectural use was reported by 25 producers in Brown, Dane, Door, Fond du Lac, Manitowoc, and Waukesha Counties.

Crushed or broken limestone was produced in 41 counties, chiefly for concrete aggregate and roadstone; smaller quantities were used for agricultural, industrial, and chemical purposes. The 10 leading commercial producers that crushed limestone for construction and roadbuilding are listed alphabetically: Consumers Co., Chicago; The Consumers Lutz Co., Oshkosh; Courtney & Plummer, Inc., Neenah; Franklin Stone Products, Milwaukee; Edward Kraemer & Sons, Plain; Landwehr & Hackle, Seymour; Quality Limestone Products, Inc., Sussex; P. W. Ryan Sons, Janesville; E. C. Schroeder Co., Inc., McGregor; and Waukesha Lime & Stone Co., Inc., Waukesha.

TABLE 3.—Limestone sold or used by producers in 1956-57, by uses ¹

Use	1956			1957		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension:						
Rough construction short tons..	6,004	\$75,154	\$12.52	2,458	\$15,741	\$6.40
Rubble.....do.....	9,311	29,713	3.19	10,676	32,386	3.03
Rough architectural cubic feet..	38,083	27,936	.73	33,146	24,437	.74
Dressed (cut and sawed) cubic feet..	844,731	1,444,120	1.71	726,244	1,250,427	1.72
Flagging.....do.....	108,595	127,579	1.17	111,989	159,185	1.42
Total dimension equivalent short tons ² ..	94,628	1,704,502	18.01	82,844	1,482,176	17.89
Crushed and broken:						
Riprap.....short tons..	112,254	110,642	.99	116,007	138,670	1.20
Flux.....do.....	(³)	(³)	(³)	26,965	37,981	1.41
Concrete aggregate and roadstone.....short tons..	8,224,587	8,305,414	1.01	8,319,137	8,251,175	.99
Railroad ballast.....do.....	225,918	269,416	1.19	589,309	692,181	1.17
Agriculture.....do.....	1,090,045	1,472,126	1.35	1,167,538	1,587,462	1.36
Other uses.....do.....	346,800	431,484	1.24	213,190	294,176	1.38
Total crushed and broken short tons..	9,999,604	10,589,082	1.06	10,432,146	11,001,645	1.05
Grand total.....do.....	10,094,232	12,293,584	1.22	10,514,990	12,483,821	1.19

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.

In Marathon, Marinette, Marquette, and Waushara Counties, nine companies produced dimension granite chiefly for building and monumental purposes. Crushed granite for concrete aggregate and road surfacing was produced in Waushara and Wood Counties.

Dimension sandstone was reported by three producers from Marathon, Portage, Waushara, and Wood Counties. The relatively small output of this product was used for flagging, rubble, rough construction, and dressed stone. A greater quantity of crushed sandstone and quartzite was produced for abrasives, concrete aggregate, fillers, filters, glass, refractories, and roofing granules by five companies in Columbia, Marathon, and Sauk Counties. Production of sandstone and quartzite totaled 1,285,657 short tons and \$6,984,600 in value.

Crushed basalt was produced in Marinette and Polk Counties for roofing granules, concrete aggregate, railroad ballast, and filter rock. Some basalt from Polk County was used in manufacturing rock wool. At the Dresser Trap Rock Co. quarry in Polk County, coyote holes 4 by 4 feet in cross section and aggregating 920 feet in length were used to contain the explosives for a major blast. These holes were driven at right angles and then parallel to the face of the quarry at floor level at regularly spaced intervals. The results of this blast, both in tonnage and breakage, were reported as excellent. This method of blasting is now relatively uncommon.

Some miscellaneous stone, used for concrete aggregate and road surfacing, was produced in Brown County in 1957.

The production and price of marl decreased slightly, compared with 1956. This material, an intimate mixture of clay and particles of limestone or dolomite, occurs in bedded deposits. In Wisconsin it is used entirely for agricultural purposes. Some 10,500 tons were reported from 7 producers in Portage, Waupaca, and Waushara Counties. The average value per ton was 49 cents, compared with 51 cents in 1956. This year, for the first time, the production and value of marl are included with stone in table 1.

METALS

Iron Ore.—Shipments of iron ore from Wisconsin were about 6 percent greater than in 1956. The adverse effects of a prolonged steel strike in mid-1956 were continued by an economic decline in the latter part of 1957. Production of steel fell from 89.8 percent of average rated ingot capacity in 1956 to 84.5 percent in 1957. Decreasing iron-ore consumption resulted in heavy accumulations of stocks at lower Lake ports at the end of the year.

The entire output of iron ore in Wisconsin again came from the mines of three companies. Oglebay, Norton & Co. and Pickands Mather & Co. produced underground on the Gogebic range in Iron County at the Montreal mine and the Cary mine, respectively. The Meress open-pit mine on the Menominee range in Florence County was operated by Zontelli Brothers, Inc., division of Pittsburgh Pacific Company; the merger of the two companies was effected in 1957.

Iron-ore production exceeded shipments by 42,290 tons; thus, year-end stocks at the mines increased to 204,797 long tons. All ore produced in 1957 was of direct shipping grade.

The bulk of the iron ore from Wisconsin mines was shipped by rail to ore docks at Ashland, Wis., and Escanaba, Mich., thence by vessel to lower Lake ports. Less than 4 percent was transported entirely by rail to consuming centers. Shipments from the port of Ashland began April 28 and ended November 23. At Escanaba, Mich., iron-ore shipments began April 1 and ended November 29.

The base prices of iron ores per long ton posted January 30 and in effect throughout 1957 were: High Phosphorus, \$11.45; Mesabi Non-Bessemer, \$11.45; Mesabi Bessemer and Old Range Non-Bessemer, \$11.70, and Old Range Bessemer, \$11.85. These prices represent an increase of 60 cents per ton for each of the listed grades. Prices for iron ore include all shipping costs from the mines to lower Lake

TABLE 4.—Iron-ore production and shipments, 1953-57, in long tons

Year	Number of mines	Production	Shipments	Iron content of shipments natural (percent)
1953.....	3	1,756,150	1,655,331	52.48
1954.....	2	1,491,470	1,428,910	52.81
1955.....	3	1,588,523	1,886,029	52.03
1956.....	3	1,551,438	1,428,361	52.49
1957.....	3	1,618,347	1,576,057	52.32

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 phosphorus (dry) are classed as High Phosphorus. Variations in grade from this base, as well as changes in physical structure from established standards, call for premiums or penalties

During 1957 exploration and testing of iron-bearing formations in an area of high anomalies near Butternut in Ashland County were continued by the Ashland Mining Corp. Substantial tonnages of low-grade iron ore that can be concentrated to acceptable grades have been indicated. Late in the year a half interest in the Ashland Mining Corp. was acquired by the McLouth Steel Corp. of Detroit. Full exploration of the property will await further study of the many problems involved, including general economic conditions and satisfactory financial arrangements.

Lead and Zinc.—The sharp declines in the prices for lead and zinc during 1957 seriously affected the production of these metals in Wisconsin. An output of 1,900 tons of lead and 21,575 tons of zinc (in terms of recoverable metal) represented a decrease of about 26 and 10 percent in tonnage and 33 and 24 percent in value, respectively, from the 1956 figures. The average weighted yearly prices per pound were 14.3 cents for lead and 11.6 for zinc, compared with 15.7 and 13.7 cents in 1956. Lead price quotations fell to 13 cents a pound in December and zinc reached a low of 10 cents a pound in July.

Early in the year 16 lode mines and 3 tailings dumps were active. Among the leading producers were: American Zinc, Lead and Smelting

TABLE 5.—Mine production of lead and zinc, 1948-52 (average) and 1953-57, in terms of recoverable metals

	Mines producing		Material treated		Lead		Zinc		Total value
	Lode	Tailings	Ore (short tons)	Tailings ¹ (short tons)	Short tons	Value	Short tons	Value	
1948-52 (average).....	28	3	336,964	29,850	1,128	\$369,595	11,045	\$3,519,941	\$3,889,536
1953.....	29	3	534,882	19,133	2,094	548,628	16,830	3,870,900	4,419,528
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

¹ Partly estimated.

Company (Vinegar Hill Division); Mining and Smelting Division, Eagle Picher Company; Ivey Construction Co.; New Teasdale Mining Co.; and Piquette Mining & Milling Co. However, due principally to the low prices for lead and particularly zinc, virtually the only producing mines at the end of the year were those of the Mining and Smelting Division, Eagle Picher Company.

TABLE 6.—Mine production of lead and zinc in 1957, by months, in terms of recoverable metals, in short tons

Month	Lead	Zinc	Month	Lead	Zinc
January.....	160	2,255	August.....	150	1,405
February.....	155	2,165	September.....	125	1,145
March.....	230	2,435	October.....	160	1,405
April.....	210	2,310	November.....	110	1,355
May.....	195	2,110	December.....	80	1,140
June.....	170	2,355	Total.....	1,900	21,575
July.....	165	1,445			

REVIEW BY COUNTIES

Mineral production was reported from 66 of 71 counties in Wisconsin during 1957. All productive counties except Florence had outputs of sand and gravel or crushed stone or both for use in construction and roadbuilding. In all, 194 operators reported commercial output of sand and gravel, and 109 producers crushed limestone; corresponding figures reported for noncommercial or Government-and-contractor operations were 48 and 18. This latter group includes State and county highway departments, cities, towns, and full-time contractors for Federal or State projects.

In view of the widespread occurrence and production of these materials, the temporary nature of many of the portable processing plants, and the fact that this output is common to virtually all counties, a detailed listing of each producer has not been made. Therefore, in the following review, only those counties that produced minerals other than sand and gravel and crushed stone are mentioned.

Brown.—Ray De Cleene and Scray Quarries (De Pere) mined dimension limestone for rough architectural use, flagging, and house-stone veneer.

The Western Lime & Cement Co., Milwaukee, manufactured quick and hydrated lime at its Green Bay plant, using five shaft kilns and a batch-type hydrator. Sales were for chemical and industrial uses.

Columbia.—Crushed sandstone for manufacture of glass and molding uses was produced near Portage by Portage-Manley Sand Co. of Rockton, Ill.

Dodge.—Lime for building and chemical uses was produced at two plants in the county. Mayville White Lime Works produced quicklime at Mayville and Western Lime and Cement Company of Milwaukee made both quick and hydrated lime at its plant at Knowles.

Douglas.—Cutler-LaLiberte-McDougall Corp., at Superior sold quicklime for building, chemical, and industrial uses. The plant had 2 rotary kilns and was 1 of 2 companies in Wisconsin reporting this type of equipment.

TABLE 7.—Value of mineral production in Wisconsin, 1956-57, by counties ¹

County	1956	1957	Minerals produced in 1957 in order of value
Adams.....	(2)	-----	Sand and gravel.
Barron.....	(2)	\$69,923	Do.
Brown.....	\$932,160	1,234,328	Sand and gravel, stone, lime, clays.
Buffalo.....	164,697	238,013	Stone.
Burnett.....	47,464	87,377	Sand and gravel.
Calumet.....	104,790	133,021	Sand and gravel, stone.
Chippewa.....	12,375	12,336	Sand and gravel.
Clark.....	139,905	127,999	Do.
Columbia.....	(2)	(2)	Stone, sand and gravel.
Crawford.....	81,014	(2)	Do.
Dane.....	1,252,801	1,381,703	Sand and gravel, stone.
Dodge.....	735,146	605,453	Lime, stone, sand and gravel.
Door.....	129,596	(2)	Sand and gravel, stone.
Douglas.....	(2)	(2)	Lime, sand and gravel.
Dunn.....	(2)	(2)	Stone, sand and gravel, clays.
Eau Claire.....	-----	625,792	Sand and gravel.
Florence.....	(2)	(2)	Iron.
Fond du Lac.....	992,725	1,040,729	Stone, sand and gravel, lime, clays.
Forest.....	48,151	84,133	Sand and gravel.
Grant.....	1,855,685	1,708,932	Stone, zinc, lead, sand and gravel.
Green.....	379,873	402,927	Stone, sand and gravel.
Green Lake.....	473,818	501,066	Sand and gravel.
Iowa.....	916,278	735,979	Zinc, stone, sand and gravel, lead.
Iron.....	(2)	(2)	Iron, sand and gravel.
Jackson.....	27,777	(2)	Stone.
Jefferson.....	135,748	(2)	Sand and gravel.
Juneau.....	85,091	57,801	Sand and gravel, stone.
Kenosha.....	151,246	222,098	Sand and gravel.
La Crosse.....	133,291	161,956	Stone, sand and gravel, clays.
Lafayette.....	5,374,963	4,321,712	Zinc, lead, sand and gravel, stone.
Langlade.....	141,540	140,960	Sand and gravel.
Lincoln.....	92,684	92,387	Do.
Manitowoc.....	6,616,324	7,041,990	Cement, sand and gravel, lime, stone, clays.
Marathon.....	4,782,256	6,808,717	Stone, sand and gravel, clays.
Marinette.....	(2)	(2)	Stone.
Marquette.....	(2)	(2)	Stone, sand and gravel.
Milwaukee.....	1,768,056	3,352,596	Cement, sand and gravel, stone.
Monroe.....	146,442	127,589	Stone.
Oconto.....	227,202	266,634	Sand and gravel, stone.
Oenida.....	160,338	169,077	Do.
Outagamie.....	426,786	652,400	Sand and gravel, stone, peat.
Ozaukee.....	283,953	232,674	Sand and gravel.
Pepin.....	(2)	25,401	Stone.
Pierce.....	368,160	392,941	Sand and gravel, stone.
Polk.....	567,562	489,534	Stone, sand and gravel.
Portage.....	(2)	(2)	Sand and gravel, stone.
Price.....	4,713	(2)	Sand and gravel.
Racine.....	(2)	1,272,641	Stone, sand and gravel, clays.
Richland.....	(2)	(2)	Stone.
Rock.....	1,349,234	1,218,194	Sand and gravel, stone.
Rusk.....	91,165	73,608	Sand and gravel.
St. Croix.....	348,668	426,242	Stone, sand and gravel.
Sauk.....	2,290,910	1,408,087	Stone, sand and gravel, abrasives.
Sawyer.....	43,444	64,654	Sand and gravel.
Shawano.....	346,603	276,780	Sand and gravel, stone.
Sheboygan.....	301,943	393,612	Do.
Taylor.....	(2)	(2)	Sand and gravel.
Trempealeau.....	139,774	214,628	Stone.
Vernon.....	(2)	(2)	Stone, sand and gravel.
Vilas.....	42,324	27,492	Sand and gravel.
Walworth.....	285,405	180,356	Do.
Washington.....	659,260	543,357	Sand and gravel, stone.
Waukesha.....	5,347,862	4,487,473	Do.
Waupaca.....	(2)	(2)	Stone, sand and gravel, clays.
Waushara.....	(2)	(2)	Stone.
Winnebago.....	1,543,948	1,455,719	Sand and gravel, stone.
Wood.....	151,131	(2)	Stone.
Undistributed ²	23,552,872	22,877,189	.....
Total ⁴	65,860,000	68,644,000	

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.

Florence.—Iron ore was the only mineral commodity reported from this county. Production came from the Meress open-pit mine near Florence on the Menominee range. Late in July, Zontelli Brothers, Inc., former operator of this mine, merged with the Pittsburgh Pacific Company of Hibbing, Minn., to become a division of the latter company.

Fond du Lac.—Limestone deposits structurally favorable for producing dimension stone occur in this country. Fond du Lac Stone Co. and Hamilton Stone Co. quarried this stone for construction and architectural uses.

Grant.—This county was 1 of 3 in Wisconsin reporting output of lead and zinc. The Piquette Mining & Milling Co. (St. Louis, Mo.) operated the Piquette No. 2 mine and its mill throughout the year. However, mainly due to the low price for zinc, all operations ceased at the end of December.

Green Lake.—Output of sand for molding uses was reported from this county by Chier St. Marie Sand Co. and F. B. Dubberstein & Sons, Inc. Several other operators were credited with production of this special sand.

Iowa.—Production of lead and zinc was reported from this county. The Eagle Picher Co. (Miami, Okla.) operated the Kickapoo-Alden Thomson mine and the Linden mill near Linden. Ore produced by the Ivey Construction Co. from its D. H. & S. mine was milled on a custom basis at the Linden mill. A small shipment of lead-zinc concentrate was made by H. Turner & Sons from the Cocker mine near Midland. Because of the falling prices for lead and zinc, all operations in this area were closed before the end of July.

Iron.—Direct-shipment iron ore was produced from the Montreal and Cary underground mines by Oglebay Norton & Co. and Pickands Mather & Co. Both of these properties are on the Gogebic range not far from Hurley. The Montreal mine has been active for over 50 years and has a production record of more than 41 million tons. It is the deepest mine on the Gogebic range and the second largest producer.

Lafayette.—This county led all others in the output of lead and zinc in Wisconsin. The Eagle Picher Co. operated mines near Benton and Shullsburg. Crude ore from Birkett-Bastian-Andrews mine near Benton was hauled by truck to the company Graham custom mill just north of Galena, Ill. At Shullsburg this company operated its Shullsburg and Winskell mines and mill. These operations continued throughout the year but on a basis reduced from 6 to 5 days per week during the latter half of 1957. The Vinegar Hill Division of American Zinc, Lead & Smelting Co. operated its mill and the Hancock, Blackstone, Coulthard and Temperly-Thomson mines part of the year; however, all these operations had ceased by the end of the third quarter. Murray & Richards Mining Co. and New Teasdale Mining Co. reported production early in the year but had closed down by midyear.

Manitowoc.—This county was the leader in Wisconsin in producing cement. The Manitowoc Portland Cement Co. produced portland cement at Manitowoc. The plant has 4 rotary kilns ranging in length from 160 to 350 feet and all 10 feet in diameter. The clay for making cement also was produced by the company.

Production of quicklime and hydrated lime were reported by the Rockwell Lime Co. (Chicago, Ill.) for building, chemical, and industrial purposes. The plant, with one rotary kiln and a batch-type hydrator, is situated near Francis Creek. Quicklime for building and agricultural purposes was reported by Valders Lime & Stone Co. The company plant at Valders had five shaft kilns. This company also reported production of dimension stone for construction and architectural uses.

Marathon.—Argillaceous sandstone for roofing granules and quartzite for abrasives were produced from the Greystone and Rib Mountain Quarries near Wausau. The crude rock was mined and crushed by Foley Bros., Inc., under contract with Minnesota Mining and Manufacturing Co. of St. Paul, Minn., and shipped to its finishing plants for final processing.

Rough and dressed 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., all of Wausau, and Cold Spring Granite Co. of Cold Spring, Minn.

Marinette.—Crushed basalt for both natural and artificially colored roofing granules was reported by Central Commercial Co. of Chicago, Ill.

Milwaukee.—Early in February 1957 the new plant of Marquette Cement Mfg. Co. of Chicago, Ill., began production in Milwaukee. This plant had 1 rotary kiln 175 feet long and 13 feet in diameter. A preheating grate 82 feet in length is a feature of the ACL (Allis-Chalmers-Lellep) process in use for the first time in this country. This traveling grate moves pelletized raw material through drying and partial burning units and then into the feed end of the rotary kiln. Milwaukee is the second county in Wisconsin to produce cement.

Pierce.—Output of special sands for molding, sand blasting, and foundry purposes was reported by Maiden Rock Silica Sand Co. and Bay City Sand Co., Inc.

Polk.—Considerable publicity attended a major blast at the quarry of the Dresser Trap Rock Co. near Dresser in May 1957. The rock was a tough, dense basalt that has superior qualities for concrete aggregates.

Sauk.—Quartzite for silica, brick, and other refractory purposes was produced by General Refractories Co., Harbison-Walker Refractories Co., and Baraboo Quartzite Co. The last company also produced grinding pebbles and tube-mill liners.

Waukesha.—Eighteen operators reported production of dimension stone for construction and architectural uses. The quality and structure of the limestone deposits in this area are favorable for producing stone of this type. The larger producers included: Conco Lannon Quarry, Milwaukee Lannon Stone Co., Midwest Lannon Stone Co., Joecks Bros. Stone Co., and Lisbon Lannon Stone Co., all of Lannon; and Halquist Lannon Stone Co., Sussex.

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, United States Department of the Interior, and the Geological Survey of Wyoming.

By Frank J. Kelly¹ and D. H. Mullen¹



VALUE created by the productive activities of the mineral industry of Wyoming reached \$345.6 million in 1957; this value of output was 9 percent greater than the \$317.6 million reported for 1956. Wyoming is mainly a liquid-fuels and nonmetal producer, with metals contributing only a small portion of the total output. Therefore, the fluctuation in demand for the principal commodities determines the fate of the mineral industry, as measured each year by totaling the value of each mineral produced. In 1957 an increase in the output of liquid fuels, uranium, and iron ore more than offset declines in coal, sulfur, and certain construction materials and was the principal reason for continued growth of the industry.

In the fuels group, petroleum, natural gas, and liquid-petroleum gases increased in value of output and accounted for 97 percent of the total fuels value and 85 percent of the total value of all minerals. Wyoming was still the leading producer of petroleum in the Rocky Mountain States and ranked 6th among the 30 petroleum-producing States. Coal output continued to decline—dropping 17 percent below 1956, and production of natural gasoline declined slightly.

The nonmetal segment of the mineral industry was influenced by cutbacks in various elements of the economy of Wyoming and the Nation, as reflected in the 4-percent decline in the value of output. The total for this group of minerals was \$31.3 million in 1957, compared with \$32.7 million in 1956.

The continued growth of the uranium industry in Wyoming was the principal reason for the 38-percent gain in the value of metals in 1957. The output of iron ore also showed a substantial gain, whereas that of copper, gold, and silver production declined.

The mineral industry of Wyoming changed somewhat during 1957. In the fuels field construction of the Dave Johnson 100,000-kilowatt coal-fired powerplant neared completion. A discovery well in the Mesaverde formation in the Powder River basin early in 1957 resulted in concentration of development drilling in that area. The number of refineries operating in the State was reduced to 9 in 1957 owing to cessation of plant operations at Glenrock and Lovell.

During the year, the San Francisco Chemical Co. placed its 1,000-ton-per-day phosphate-rock flotation plant in operation at Leefe, and the Intermountain Chemical Co. completed equipping its No. 3 shaft. Sunk in 1956.

Columbia Geneva Steel Division of United States Steel Corp. continued to gather data for its proposed iron-ore beneficiation plant at Atlantic City. Additional exploration and development by the

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

TABLE 1.—Mineral production in Wyoming, 1956-57¹

Mineral	1956		1957	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate..... gross weight..	(?)	(?)	5	\$3
Clays..... thousand short tons..	² 1,086	² \$11,864	⁴ 1,069	⁴ 11,973
Coal..... do	2,553	9,920	2,117	7,777
Copper (recoverable content of ores, etc.).....	3	3	4	2
Feldspar..... thousand long tons..	1	8	(?)	(?)
Gem stones.....	(5)	75	(5)	55
Gold (recoverable content of ores, etc.).....				
troy ounces..	762	27	573	20
Gypsum.....	11,380	46	(?)	(?)
Iron ore (usable)				
thousand long tons, gross weight..	(?)	(?)	736	(?)
Natural gas..... million cubic feet..	84,398	7,258	⁶ 90,000	⁶ 8,400
Natural-gas liquids:				
LP-gases..... thousand gallons..	49,838	2,337	57,805	2,566
Natural gasoline..... do	48,859	3,160	47,709	2,866
Petroleum (crude)..... thousand 42-gallon barrels..	104,830	255,785	⁶ 106,616	⁶ 283,599
Phosphate rock..... thousand long tons..	119	721	18	121
Pumice.....	45,517	38	49,254	41
Rare-earth metals concentrate.....			2	5
Sand and gravel..... thousand short tons..	3,904	2,936	2,425	1,905
Silver (recoverable content of ores, etc.).....				
troy ounces..	154		126	
Sodium carbonates..... thousand short tons..	⁷ 338	78,345	(?)	(?)
Stone..... do	1,333	2,076	1,291	2,266
Sulfur (recovered elemental)				
thousand long tons..	121	3,214	107	2,767
Tungsten concentrate... 60-percent WO ₃ basis..	2	6		
Uranium ore.....	³ 156,509	³ 2,765	274,669	4,669
Value of items that cannot be disclosed: Cement, sodium sulfate, vanadium, and values indicated by footnote 2.....		7,824		17,527
Total Wyoming ⁸		³ 317,594		345,604

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 Revised figure.

⁴ Excludes fire clay; value included with "Items that cannot be disclosed."

⁵ Weight not recorded.

⁶ Preliminary figure.

⁷ Includes crude and calcined trona.

⁸ Total adjusted to eliminate duplicating value of raw materials used in manufacturing cement.

TABLE 2.—Average unit value of selected mineral commodities produced in Wyoming, 1953-57¹

Commodity	1953	1954	1955	1956	1957
Beryl..... dollars per short ton..				436.50	525.20
Cement..... dollars per barrel..	2.90	3.01	3.11	3.49	3.53
Coal..... dollars per short ton..	4.53	4.08	4.05	3.89	3.67
Feldspar..... dollars per long ton..	5.60			6.82	6.87
Gypsum..... dollars per short ton..	4.00	4.00	4.00	4.00	3.11
Natural gas..... cents per thousand cubic feet..	7.9	8.4	8.5	8.6	9.3
Natural-gas liquids:					
LP-gases..... cents per gallon..	4.9	4.6	4.3	4.7	4.4
Natural gasoline..... do	7.3	6.7	6.9	6.5	6.0
Petroleum..... dollars per 42-gallon barrel..	2.37	2.45	2.41	2.44	2.66
Phosphate rock..... dollars per long ton..	6.37	6.27	6.29	6.05	6.65
Pumice..... dollars per short ton..	2.93	.75	.92	.83	.82
Sand and gravel..... do	.64	.64	1.01	.75	.79
Silver..... cents per troy ounce..	90.5+	90.5+	90.5+	90.5+	90.5+
Sodium carbonate..... dollars per short ton..	23.59	23.49	22.00	24.70	25.00
Sodium sulfate..... do	26.91	25.43	34.42	36.30	33.12
Stone..... do	1.29	1.03	1.56	1.56	1.76
Sulfur..... dollars per long ton..	20.89	26.33	26.57	26.53	25.77

¹ Prices discussed in detail in the commodity chapters, vol. I, Minerals Yearbook, 1957.

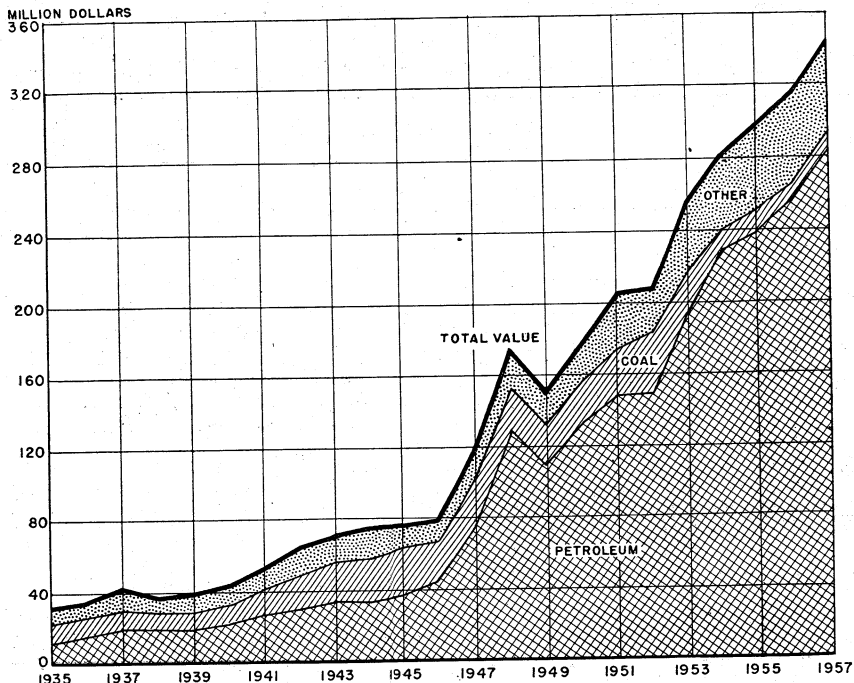


FIGURE 1.—Value of petroleum, coal, and other minerals, and total value of all minerals produced in Wyoming, 1935-57.

uranium industry and Government resulted in a revision in the estimated ore reserve from 2.3 million tons at an average grade containing 0.22 percent U_3O_8 in 1956 to 9.2 million tons containing 0.26 percent U_3O_8 in 1957. The 400-ton-per-day mill of Western Nuclear Corp. at Jeffrey City was completed in August, and the construction of a 750-ton-per-day processing plant by Lucky Mc Uranium Co. in the Gas Hills area was begun in March. Plans for a plant at Riverton, rated at 500 tons per day, were approved by the Atomic Energy Commission (AEC). The contracting firm was Fremont Minerals, Inc.

EMPLOYMENT AND INJURIES

All data on employment in Wyoming were obtained from the Bureau of Labor Statistics, United States Department of Labor, in cooperation with the Employment Security Commission of Wyoming. Annual average employment in the mining industry decreased to 8,500 in 1957 (a 2-percent drop from 1956), but the ratio to total nonagricultural employment remained virtually unchanged from 1956. The average earnings for all the extractive industries in 1957 increased 3 to 14 cents per hour. On the other hand, the average weekly hours worked by Wyoming mineral-industry employees declined for all mining groups except crude petroleum and natural gas.

TABLE 3.—Annual average employment in mining and other nonagricultural industries, 1956-57 ¹

[Bureau of Labor Statistics, U. S. Department of Labor and Employment Security Commission of Wyoming]

Industry	Annual average employment		Percent of total nonagricultural	
	1956	1957	1956	1957
Mining ²	8,700	8,500	10	10
Contract construction ³	6,900	6,800	8	8
Manufacturing.....	6,700	6,700	8	8
Transportation and public utilities.....	13,300	12,900	15	15
Wholesale and retail trade.....	19,100	19,300	22	22
Finance, insurance, and real estate.....	2,300	2,300	2	2
Service and miscellaneous.....	11,500	11,300	13	13
Government ⁴ and education.....	19,300	19,800	22	22
Total nonagricultural.....	87,800	87,600	100	100

¹ Excludes administrative and nonworking supervisory personnel, domestic servants, and personnel of the Armed Forces.² Includes extraction of minerals occurring naturally, quarrying, well operation, milling, exploration and development of mineral properties, and removal of overburden.³ Includes some employees engaged in mining, quarrying, and removing overburden where work was done by contractors conducting other types of construction work other than mining and separate records were not kept for work in connection with the mineral industry.⁴ Federal, State, and local.**TABLE 4.—Mining and contract construction employment, 1953-57 ¹**
(Thousands)

[Bureau of Labor Statistics, U. S. Department of Labor and Employment Security Commission of Wyoming]

	1953	1954	1955	1956	1957
Mining.....	10.5	9.4	8.9	8.7	8.5
Bituminous and other soft coal.....	2.5	1.2	.9	.7	.7
Crude petroleum and natural gas.....	6.7	7.0	6.7	6.5	6.2
Other.....	1.3	1.2	1.3	1.5	1.6
Contract construction.....	6.2	6.2	6.3	6.9	6.8

¹ Excludes administrative and nonworking supervisory personnel, domestic servants, and personnel of the Armed Forces.**TABLE 5.—Average hours and earnings for mining and construction employees, 1956-57 ¹**

[Bureau of Labor Statistics, U. S. Department of Labor and Employment Security Commission of Wyoming]

	Average weekly earnings		Average weekly hours		Average hourly earnings	
	1956	1957	1956	1957	1956	1957
Mining.....	\$101.18	\$99.20	41.3	40.0	\$2.45	\$2.48
Bituminous and other soft coal.....	69.94	93.11	32.9	24.2	2.83	2.89
Crude petroleum and natural gas.....	103.94	106.64	42.6	43.0	2.44	2.48
Other.....	97.38	95.98	42.9	40.5	2.27	2.37
Contract construction.....	98.85	97.54	39.7	38.4	2.49	2.54

¹ Excludes administrative and nonworking supervisory personnel. Average weekly earnings are gross amounts, including overtime, paid vacations, etc.

The Wyoming State Inspector of Mines reported ² 8 fatal accidents in 1957; 2 in coal mines and 6 in noncoal mines. The report also showed 18 nonfatal accidents at coal mines and 42 at noncoal mines.

² Fearn, Lyman (State mine inspector), Annual Report of the State Inspector of Mines of Wyoming, Year Ending December 31, 1957: 81 pp.

Fatal accidents were as follows: 1 occurred from a fall; 1, falling rock; 1, fracture of high wall; 1, haulage (trammig machine); 3, mechanical; and 1, pulmonary edema. The classification of causes of nonfatal accidents was as follows: Flying and falling objects, 21; haulage, 5; mechanical, 8; miscellaneous, 15; slipping and falling, 6; and straining, 5.

DEFENSE MINERALS EXPLORATION ADMINISTRATION (DMEA)

The participation in exploration projects in search of reserves of strategic and critical minerals by the DMEA rose to \$239,700 in 1957, compared with \$173,204 in 1956. As in the past year, all contracts in 1957 were for uranium, with 75-percent Government participation in each instance.

TABLE 6.—DMEA contracts executed in 1957

County and contractor	Property	Commodity	Contract	
			Date 1957	Total amount ¹
BIG HORN				
Modern Mines Development Co.-----	Jet claims.-----	Uranium-----	May 31	\$40,870
FREMONT				
W. H. Gaddis et al.-----	Pay Dirt claims group.-----	do-----	Apr. 8	64,784
Little Mo Mining, Inc.-----	Mint et al. claims-----	do-----	Sept. 26	21,120
P-C Mining Co.-----	Thunderbird claims-----	do-----	July 29	81,200
NATRONA				
Metals, Inc.-----	Skyline claims-----	Uranium and selenium.	May 29	31,732
Total-----				239,706

¹ Government participation, 75 percent.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value (\$305.2 million) of the mineral fuels—coal, natural gas, natural-gas liquids, and petroleum—increased 10 percent in 1957, compared with 1956, and represented 88 percent of the value of all minerals produced in the State. Wyoming continued to be the leading producer of petroleum in the Rocky Mountain States and ranked 6th among the 30 petroleum-producing States. Petroleum was the most important mineral product of the State in terms of value and represented 93 percent of the total value of the mineral fuels.

Coal.—Coal production from 19 active mines (12 underground and 7 strip mines, producing 1,000 tons or more) in 8 counties was 2.1 million tons, a 17-percent decline as compared with 1956. The greatest drop was in Sweetwater County, where the number of operating mines decreased from 8 to 5. The lower output reflected increased use of hydroelectric power, greater use of natural gas and oil for thermal-power generation, and nearly complete dieselization of railroads. The 100,000-kilowatt-capacity Dave Johnston coal-fired generating plant being built at Glenrock in Converse County by Pacific Power & Light Co. was expected to be completed in 1958. The Union Pacific Railroad Co., through its subsidiary the Union Pacific Coal Co., and the Husky Oil Co. considered a long-range syn-

thetic-fuels program based on coal. The program would involve an initial installation for the lower temperature carbonization of Wyoming coal and the production of char for thermal-power generation, blending for metallurgical coke, and specialty carbons for electrochemical industries. Residual tar would be hydrogenated to produce liquid fuels. Consummation of the program would be contingent on a favorable economic analysis and on changes in the present Coal-Leasing Act that would permit 1 operator in any 1 State to hold under lease 10,280 acres instead of 5,140 acres. Additional legislature to permit railroads holding leases on public land to use the coal for purposes other than in their locomotives also would be required.

Bureau of Mines data show that there were 1,022 employed at the major mines (813 at underground mines and 209 at strip mines). There were 2 fatalities; 1 at an underground mine and 1 at a strip mine. There were 22 lost-time injuries at underground mines and 4 at strip mines.

TABLE 7.—Production of coal, 1956–57, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1956		1957	
	Short tons	Average value per ton ¹	Short tons	Average value per ton ¹
Campbell.....	373,958	\$1.21	365,859	\$1.27
Carbon.....	164,003	3.88	119,744	3.17
Converse.....	6,608	3.26	6,250	3.35
Fremont.....	2,061	6.60	1,220	5.67
Hot Springs.....	16,425	7.69	16,439	6.23
Johnson.....	1,177	4.50	.....	.....
Lincoln.....	690,097	2.91	647,284	2.86
Sheridan.....	411,407	3.26	408,748	3.40
Sweetwater.....	887,644	5.99	851,722	6.46
Total.....	2,553,380	3.89	2,117,266	3.67

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.—Marketed natural gas in 1957 from gasfields producing dry gas and from plants processing wet petroleum gas was estimated at 90 billion cubic feet—a 7-percent increase as compared with 1956. Production originated from fields in 15 counties. Sweetwater County led in quantity produced, followed by Washakie, Fremont, Natrona, and Park Counties. Ten new gasfields were discovered—four in Fremont County in the Wind River basin, five in the Green River basin in Sweetwater, Lincoln, and Sublette Counties, and 1 in Niobrara County. Development drilling recorded 36 successful completions—32 in Sublette County in the Green River Basin.

Natural-Gas Liquids.—Natural-gas liquids (natural gasoline, propane, butane, and other fractions) were recovered at 11 plants in 10 counties. The quantity recovered increased 7 percent, although the value declined 1 percent as compared with 1956. The quantity and value of the liquid-petroleum gases increased 16 and 10 percent, whereas natural gasoline declined 2 and 9 percent, respectively, compared with 1956.

Petroleum.—Petroleum production in 1957 from fields in 21 of the State's 23 counties was estimated at 106.6 million barrels—a 2-percent

increase compared with 1956. This was the second year in which crude-oil production exceeded 100 million barrels. Major increases exceeding 100,000 barrels were recorded in 7 counties, and major declines of the same magnitude in 7 counties. The 4 leading counties—producing more than 10 million barrels in both 1956 and 1957—were Park, Hot Springs, Fremont, and Big Horn, in that order. The principal producing area continued to be, as in previous years, from the Big Horn Basin. Exploration in 1957 continued at high rate with 310 completions, compared with 289 in 1956. The total exploration footage drilled was 1.6 million. In all, 33 oilfields and 10 gasfields were discovered during the year, compared with 18 and 12, respectively, in 1956. An early successful well in the Mesaverde formation in the Powder River basin had considerable influence on exploratory drilling during the year, and a substantial program for exploration of the formation developed. Of the 33 oil discoveries during the year, 17 were in the Powder River basin, 7 in the Big Horn basin, 3 in the Wind River basin, and 2 each in the Green River basin, the Laramie-Hanna basin, and the southeastern Wyoming part of the Denver-Julesburg basin. Development drilling in 1957 declined to 553 completions, compared with 641 completions in 1956; the percentage of successful wells dropped from 73 percent to 66.

The bulk of the development drilling was in the Powder River basin (with 109 completions), Green River basin (with 50), and the Wind River basin (with 35). Nine refineries operated the entire year, with an estimated throughput of 34.7 million barrels, compared with 34.8 million in 1956 (a decline of less than 1 percent) when 11 refineries were operating. Colorado Interstate Gas Co. completed most of its new gasline across the southern part of the State, con-

TABLE 8.—Production of crude petroleum, 1956-57, by counties

(Thousand barrels)

County	1956	1957 (preliminary)	Principal fields in 1957 in order of production
Albany.....	436	410	Quealy, Herrick Dome, Little Laramie.
Big Horn.....	12,804	11,878	Garland, Garland-S, Bonanza, Byron.
Campbell.....	7	111	Dead Horse Creek.
Carbon.....	2,408	3,354	Wertz, Bailey Dome, Rock River, Big Medicine Bow.
Converse.....	6,275	5,428	Glenrock-S, Big Muddy, Cole Creek-S.
Crook.....	189	717	Donkey Creek, Moorcroft-W.
Fremont.....	14,140	14,065	Steamboat Butte, Winkleman, Big Sand Draw, Beaver Creek.
Goshen.....	88	60	Torrington.
Hot Springs.....	14,396	16,332	Hamilton Dome, Grass Creek, Murphy Dome.
Johnson.....	7,307	6,377	Sussex, Meadow Creek, Sussex-W.
Laramie.....	468	387	Horse Creek, Borie, Pine Bluffs
Lincoln.....	87	84	La Barge.
Natrona.....	7,234	9,623	Salt Creek, Grieve, Salt Creek-E, Teapot-E.
Niobrara.....	1,684	571	Lance Creek-E, Lance Creek, Little Buck Creek.
Park.....	22,655	23,251	Elk Basin, Oregon Basin, Frannie, Badger Basin
Sheridan.....	1,203	1,077	Ash Creek, Ash Creek-S.
Sublette.....	389	449	La Barge, Tiptop.
Sweetwater.....	4,828	3,886	Lost Soldier.
Uinta.....	88	79	Church Buttes.
Washakie.....	3,787	5,522	Cottonwood Creek, Worland, Slick Creek.
Weston.....	4,010	2,955	Clareton, Skull Creek, Fiddler Creek, Mush Creek.
Other fields.....	347	-----	
Total.....	104,830	106,616	

TABLE 9.—Wildcat- and development-well completions in 1957, by counties
[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage (in thousands)
Wildcat:					
Albany.....			3	3	10
Big Horn.....	5		14	19	68
Campbell.....	4		30	34	260
Carbon.....	2		16	18	110
Converse.....	1		15	16	95
Crook.....	5		22	27	83
Fremont.....	3	4	25	32	118
Goshen.....			4	4	30
Hot Springs.....	1		10	11	39
Johnson.....			12	12	60
Laramie.....	2		11	13	95
Lincoln.....		1	6	7	41
Natrona.....	4		38	42	151
Niobrara.....	1	1	12	14	45
Park.....	1		3	4	31
Platte.....			6	6	28
Sheridan.....			3	3	10
Sublette.....	2	3	2	7	53
Sweetwater.....		1	12	13	94
Teton.....			2	2	15
Washakie.....			10	10	72
Weston.....	2		11	13	52
Total.....	33	10	267	310	1,560
Development:					
Big Horn.....	8		19	27	89
Campbell.....	19		2	21	149
Carbon.....	2		3	5	33
Converse.....	16		22	38	130
Crook.....	23		24	47	171
Fremont.....	27	2	6	35	129
Hot Springs.....	31		4	35	122
Johnson.....	30		16	46	244
Laramie.....	1		3	4	30
Lincoln.....			1	1	9
Natrona.....	80	1	22	103	296
Niobrara.....	8		7	15	36
Park.....	5		5	10	55
Sheridan.....	1			1	5
Sublette.....	5	32	7	44	227
Sweetwater.....	3	1	1	5	36
Washakie.....	28		9	37	284
Weston.....	41		38	79	232
Total.....	328	36	189	553	2,277
Total all drilling.....	361	46	456	863	3,837

necting with the Pacific Northwest system at Green River. Mountain Fuel Supply Co. completed several miles of connections to existing lines in Sweetwater County. Construction was started on an 8-inch pipeline from the Grieve field in Natrona County to join with facilities of the Platte Pipeline Co. at Casper. The line was designed to transport 5,000 barrels of oil daily. An outlet for the Donkey Creek field in Natrona County was proposed by Belle Fourche Pipeline Co. The line would connect with the Plains Pipeline at the Fiddler Creek field.

NONMETALS

Cement.—Despite a tapering off of production and shipments of portland cement in 1957, plant output and sales were 2 percent greater than in 1956, and the upward trend of the past few years continued. The total value of types I, II, and III, high-sulfate-resistance (type V), oil-well, and waterproof-portland continued to climb as the result

of a rise in the average unit price from \$3.49 to \$3.53. Monolith Portland Midwest Co. was the only company operating a cement plant, and in addition to the production of cement, the company quarried shale and limestone and purchased sandstone, gypsum, fluorspar, and other raw materials for use at its Laramie facility.

Clays.—Bentonite, mined by eight companies in Big Horn County of northern Wyoming and Natrona County in the central part of the State, was the principal type of clay produced in 1957. Output reached 822,000 tons valued at \$11.7 million. Wyoming continued to rank first among the States reporting bentonite production, and Crook County was the major producing area. The mining companies that shipped 100,000 tons or more were Baroid Division (National Lead Co.), Magnet Cove Barium Corp., and American Colloid Co.; these companies supplied 66 percent of total output. Stripping operations were the only activities reported by the Benton Clay Co. in Johnson County; therefore, no bentonite was produced in this area in 1957.

TABLE 10.—Shipments of bentonite, 1952-57

Year	Short tons	Value	Year	Short tons	Value
1952.....	692,853	\$9,168,708	1955.....	825,810	\$10,721,577
1953.....	670,756	9,861,321	1956.....	847,266	11,624,185
1954.....	742,453	9,339,755	1957.....	822,163	11,724,855

Of the total output of bentonite in 1957, 453,000 tons was used as rotary-drilling mud, 223,000 tons at foundries and steelworks, 51,000 tons for export, and 4,600 tons for insecticides and fungicides. The remainder was used in chemicals, as a filler, in cement, and for other miscellaneous uses. In July the Federal Foundry Supply Co. was purchased by Archer-Daniels-Midland Co. The Wyodak Chemical Division of Federal Foundry Supply Co. has been a major producer of bentonite in Crook and Weston Counties for a number of years.

Miscellaneous clay continued to be mined in Albany County by Great Western Aggregates, Inc., and Monolith Portland Midwest Co. and used in producing lightweight aggregate and cement. Lovell Clay Products Co. mined shale in Big Horn County for use at its brick plant, as did the Sheridan Press Brick & Tile Co. in Sheridan County.

Employment in the clay industry averaged 286 men during the year; according to Federal Bureau of Mines data, no fatalities occurred, but 17 lost-time accidents were reported.

Feldspar.—Feldspar produced in Wyoming came from the Casper Mountain mine of International Minerals & Chemical Corp. in Natrona County. The Crude material was shipped to the company Denver (Colo.) plant for grinding.

Gem Stones.—A reduction in the quantity of jade produced in Wyoming was the principal reason for the decline in the value of gem stones and mineral specimens from \$75,000 in 1956 to \$55,000 in 1957. Fremont County was again the center of production and collection activities. Jade was the most important stone collected during the year in value. Marion Sales Agency and Rocky Mountain

Jade Shop were two of the leading dealers in jade, according to reports received. Besides jade, agate and petrified wood were also collected. According to company reports, the Imperial Jade, Ltd., mine in Fremont County has been depleted. Petrified wood, agate, jasper, turritella, and some jade were the gem and ornamental stones collected in Sweetwater County in 1957. Material suitable as mineral specimens and ornamental stones was also reported in Albany, Carbon, Crook Natrona, and Uinta Counties.

Gypsum.—Wyoming Construction Co. of Laramie was the only gypsum producer in Wyoming during 1957. The company operated an open-pit mine, and all output was used by Monolith Portland Midwest Co. as a retarder in manufacturing cement. Five men worked 150 days, and no lost-time accidents were reported. Wyoming Gulf Sulphur Corp. of Cody reported shipment of agricultural gypsum from stockpiled ore mined in 1955.

Phosphate Rock.—Mine production of phosphate rock in Wyoming in 1957 fell to 18,000 tons, compared with 119,000 in 1956. Sales of crude and processed rock also dropped, but total shipments in 1957 did not decrease as much as production because of a withdrawal from stocks that made up the deficiency between mine production and sales. The output of crude rock mined in Wyoming came from the Leefe mine of the San Francisco Chemical Co. and was supplemented by phosphate rock received from company-owned mines in Utah. Fifty men were employed at the mine and the mill for an average of 234 days. Injuries consisted of three lost-time accidents.

In September, San Francisco Chemical Co. placed its 1,000-ton-per-day flotation plant in operation at Leefe. The plant was built to treat rock with a P_2O_5 content of 18 to 24 percent and upgrade it to the 31.5-percent minimum usually demanded for fertilizer manufacture. Beneficiation was considered the best alternative, as the 5-foot-thick high-grade rock was no longer economically available. With installation of the beneficiation plant and the new calcining facilities to be constructed, it will be possible for the company to mine seams of phosphate rock up to 22 feet thick. The calcining facility will be composed of two 14-foot-diameter triple-bed Dorroc Fluosolid reactors to burn off hydrocarbons.

TABLE 11.—Production of sand and gravel, in 1957, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Albany.....	387	\$206	Sheridan.....	26	\$43
Big Horn.....	97	146	Sublette.....	190	76
Carbon.....	201	153	Sweetwater.....	173	184
Converse.....	18	36	Teton.....	102	108
Fremont.....	613	360	Washakie.....	(¹)	(¹)
Goshen.....	30	44	Weston.....	9	8
Hot Springs.....	14	21	Yellowstone National Park.....	38	91
Lincoln.....	5	12	Undistributed.....	186	122
Natrona.....	190	198			
Park.....	14	14	Total.....	2,425	1,905
Platte.....	132	83			

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

Pumice.—The Tongue River Stone Co. was the only producer of volcanic scoria in Wyoming in 1957; it employed 4 men for 121 days. The output rose slightly to 49,000 tons, compared with 46,000 in 1956. The demand for scoria as ballast by railroads continued as the only outlet for this commodity.

Sand and Gravel.—The recorded production of sand and gravel in 1957 amounted to 2.4 million tons, compared with 3.9 million in 1956. The decline was due principally to the reporting method of the State highway department. Productive activities by 23 commercial producers were reported in 14 counties, and Government-and-contractor producers quarried sand and gravel in 10 counties and Yellowstone National Park. Commercial production was 1.4 million tons valued at \$1.1 million, whereas Government-and-contractor output was recorded at 1.1 million tons valued at \$816,000. In 1957 only 66 percent of the commercial and 63 percent of the noncommercial output was washed, crushed, screened, or otherwise prepared. This compared with 93 and 90 percent, respectively, for 1956, indicating

TABLE 12.—Sand and gravel sold or used by producers, 1956–57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building.....	36	\$125	\$1.45	77	\$104	\$1.35
Paving.....	32	34	1.05	57	53	.93
Blast.....				3	6	2.00
Other.....	7	1	.14	26	29	1.10
Total.....	125	160	1.27	163	192	1.18
Gravel:						
Building.....	142	185	1.30	168	213	1.27
Paving.....	500	368	.74	917	626	.68
Railroad ballast.....	34	9	.26	116	58	.50
Total.....	676	562	.83	1,201	897	.75
Total sand and gravel.....	801	722	.90	1,364	1,089	.80
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building.....	2	2	1.00	2	4	2.25
Paving.....	24	36	1.50	14	7	.52
Total.....	26	38	1.47	16	11	.69
Gravel:						
Building.....	25	26	1.04	10	7	.68
Paving.....	3,052	2,150	.70	1,035	798	.77
Total.....	3,077	2,176	.71	1,045	805	.77
Total sand and gravel.....	3,103	2,214	.71	1,061	816	.77
ALL OPERATIONS						
Sand.....	151	198	1.31	179	203	1.13
Gravel.....	3,753	2,738	.73	2,246	1,702	.76
Grand total.....	3,904	2,936	.75	2,425	1,905	.79

that the work requiring sand and gravel was of the type which used more pit-run material.

The major commercial operators were Gilpatrick Construction Co., Inc., W. E. Barling, Inc., and Union Pacific Railroad Co. In the Government-and-contractor group, Woodward Construction Co., Dean R. Rounds, and J. F. England Sons, Inc., were the more active operators.

Sodium Carbonate and Sulfate.—The Intermountain Chemical Co. Westvaco trona deposit produced soda ash, which ranked third (in terms of value) among the minerals produced in the State during 1957. Both crude and calcined trona and refined soda ash comprised the products sold in 1957. Experimentation continued on the recovery of soda ash from well brine. Changes and improvements during the year consisted mainly of equipment for the No. 3 shaft and the mine-ventilation system.³

Sodium sulfate production was reported by Iowa Soda Products Co. and Sweetwater Chemical Co. The latter company succeeded Iowa Soda Products Co. on April 1 and continued operation of the Carbon County deposit for the rest of the year. William E. Pratt of Casper reported shipments of sodium sulfate from his deposit near Casper. Only 1 permanent partial injury was reported for the entire year for the 341 men employed at the Intermountain Chemical Co. mine and surface plant. No other lost-time injuries occurred. No lost-time accidents were reported among the three men mining sodium sulfate.

Stone.—The output of all types of stone in 1957 fell to 1.29 million tons, compared with 1.33 million tons in 1956; this decline was due almost entirely to a cutback in the production of crushed granite by Morrison-Knudson Co., Inc. Crushed limestone was the most important stone, in terms of quantity and value with an output of 1.1 million tons worth \$2.1 million. Crushed-granite production was 135,600 tons, and dimension limestone totaled 25 tons. The remaining output consisted of crushed miscellaneous stone and crushed sandstone.

TABLE 13.—Production of stone in 1957, by counties

County	Short tons	Value	County	Short tons	Value
Albany.....	(¹)	(¹)	Sheridan.....	(¹)	(¹)
Fremont.....	2,500	\$6,100	Teton.....	13,700	\$13,700
Laramie.....	(¹)	(¹)	Washakie.....	1,125	4,025
Natrona.....	2,800	2,100	Other counties.....	699,400	1,431,800
Park.....	300	300			
Platte.....	571,100	808,100	Total.....	1,290,925	2,266,125

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

Crushed limestone was quarried in seven counties; the major producers were Guernsey Stone Co., Monolith Portland Midwest Co., and Great Western Sugar Co. The bulk of the crushed granite was mined by Morrison-Knudsen Co., Inc., in Laramie County. Crushed miscellaneous stone was produced by Sheridan Wyoming Coal Co. in Sheridan County, dimension limestone in Washakie

³ Work cited in footnote 2.

TABLE 14.—Stone sold or used by producers, 1953-57, by kinds

Year	Granite		Limestone	
	Short tons	Value	Short tons	Value
1953.....	458, 087	\$594, 539	¹ 820, 401	¹ \$1, 138, 664
1954.....	510, 085	420, 981	1, 081, 890	1, 230, 171
1955.....	398, 385	351, 111	833, 783	1, 595, 354
1956.....	216, 037	259, 562	1, 053, 348	1, 760, 566
1957.....	135, 600	144, 600	1, 098, 425	2, 073, 325

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953.....			152, 884	\$106, 719	¹ 1, 431, 372	¹ \$1, 839, 922
1954.....	21, 000	\$12, 600	3, 040	1, 550	1, 616, 015	1, 665, 302
1955.....	39, 756	47, 365	31, 475	39, 970	1, 303, 399	2, 033, 900
1956.....	7, 239	13, 280	56, 242	42, 884	1, 332, 866	2, 076, 282
1957.....	(²)	(²)	56, 900	48, 200	1, 290, 925	2, 266, 125

¹ Excludes limestone for cement.

² Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

TABLE 15.—Stone sold or used by producers, 1956-57, by uses

Use	1956		1957	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction..... short tons.....	78	\$500	25	\$25
Dressed construction..... cubic feet.....	1, 176	500		
Approximate equivalent in short tons.....	100			
Total dimension stone (approximate quantities in short tons).....	178	1, 000	25	25
Crushed and broken stone:				
Riprap..... short tons.....	79, 639	260, 404	219, 700	345, 900
Metallurgical..... do.....	(¹)	(¹)	(¹)	(¹)
Concrete and roadstone..... do.....	329, 252	219, 415	177, 500	104, 700
Railroad ballast..... do.....	500, 160	609, 058	442, 500	590, 900
Chemical..... do.....	111, 627	334, 881	128, 600	358, 400
Miscellaneous ² do.....	312, 010	651, 524	322, 600	866, 200
Total crushed and broken stone..... do.....	1, 332, 688	2, 075, 282	1, 290, 900	2, 266, 100
Grand total (approximate quantities in short tons).....	1, 332, 866	2, 076, 282	1, 290, 925	2, 266, 125

¹ Figure withheld to avoid disclosing individual company confidential data; included with "Miscellaneous."

² Includes stone used in metallurgy and the manufacture of cement and as mineral food, waste, grit, and chips.

County by Husman Bros., Inc., and crushed sandstone in Park and Washakie Counties by the Federal Bureau of Reclamation and private contractors for this Agency.

Sulfur.—Shipments of elemental sulfur in 1957 fell 11 percent below 1956 and totaled 107,000 tons valued at \$2.8 million; however, production recorded a 1-percent gain, and the difference between production and shipments went into stocks. Shipments by Seaboard Oil Co. and Stanolind Oil & Gas Co. in 1957 were approximately the same as in 1956, whereas shipments by Jefferson Lake Sulphur Co.

and Texas Gulf Sulphur Co. declined. Output was reported by Signal Oil & Gas Co. at its Neiber Dome plant, but no shipments were made. Sour gas from the one-well Stockham Federal field did not contain sufficient H_2SO_4 to support the Signal plant in that area; therefore the operation of the recovery unit was discontinued.

Vermiculite.—Golden Earth, Inc., of Encampment reported the sale of 10 tons of vermiculite for use as potting material.

METALS

Beryllium.—Beryl (beryllium concentrate) production in 1957 consisted of 9,498 pounds valued at \$2,626. Sleeper Nos. 1 and 2 claims and the White Giant No. 1 claim were worked for beryl.

Gold, Copper, and Silver.—Production of gold, copper, and silver in Wyoming was valued at \$22,600 in 1957 and came from 1 mine each in Carbon and Fremont Counties and 2 mines in Converse County. The Trans-State Mining Co. operated the Kurtz-Chatterton mine near Encampment. The Great Western Drilling Co. and Minnkota Mining Co. produced copper ore at the Big Creek and Black King mines, respectively. The Atlantic Western Mining Co. produced gold ore from the Duncan mine near Atlantic City.

Iron Ore.—Mine production in Wyoming in 1957 consisted of 702,000 tons of hematite from the Sunrise mine of the Colorado Fuel & Iron Corp. The crude ore was shipped to the corporation steel plant at Pueblo, Colo. Magnetite Products Corp. reported production of 34,000 tons of magnetite from the Cobar No. 1 mine in Albany County. This material was used as a coating of underwater pipe and transmission lines.

Investigations and testwork continued on the low-grade iron-ore deposits in the Atlantic City area, as United States Steel Columbia-Geneva Steel Division obtained more basic data for its proposed beneficiation plant.

TABLE 16.—Mine production of gold, silver, copper, and lead, 1948–52 (average), 1953–57, and total 1867–1957, 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		Lead		Total value
	Lode ³	Placer		Fine ounces	Value	Fine ounces	Value	Short tons	Value	Short tons	Value	
1948–52 (average).....	1	1	535	103	\$3,598	7	\$6					\$3,604
1953.....	1	1	2	1	35	11	10	1	\$574			619
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
1867–1957.....			(³)	81,836	1,972,588	75,206	52,262	16,335	5,690,494	14	\$1,486	7,716,830

¹ Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped directly to smelters during the calendar year indicated.

² Does not include gravel washed.

³ Figure not available.

TABLE 17.—Shipments of iron ore, total 1900-52 and 1953-57

Year	Long tons	Year	Long tons
1900-52.....	25, 156, 550	1955.....	748, 831
1953.....	654, 285	1956.....	(3)
1954.....	458, 237	1957.....	736, 134

¹ Figure withheld to avoid disclosing individual company confidential data.

Rare-Earth Metals.—The output of rare-earth metals in 1957 was reported by Ralph Platt of Encampment. Shipments consisted of 3,115 pounds of euxenite, which was sold to Rocky Mountain Research, Inc., of Denver, Colo.

Tungsten.—The old Robeson tungsten mines on Hoodoo Creek, Fremont County, the only source of tungsten in 1956, were idle throughout 1957.

Uranium.—Production of uranium ore in 1957 from mines in 10 counties was 274,699 tons averaging 4.4 pounds of uranium oxide per ton compared with 156,509 tons averaging 4.5 pounds in 1956. The value (f. o. b. mine) of the uranium ore produced was \$4.7 million—a 69-percent increase over 1956. Although major production was from the Gas Hills and Crooks Gap areas in Fremont and Natrona Counties, substantial production also was reported from Converse and Crook Counties.

The ore reserve in the State, as estimated by AEC ⁴ on December 31, was 9.2 million tons, containing 0.26 percent U_3O_8 . The increase in tonnage of 74 percent over the June 30 estimate of 5.3 million tons, containing 0.24 percent U_3O_8 represented 12 percent of the total reserve in States west of the Mississippi River. Construction of a 400-ton-a-day processing plant at Jeffrey City (Split Rock) in Fremont County by Western Nuclear Corp. was completed; operations began in August. Construction of the 750-ton-a-day processing plant in the Gas Hills area, acquired by Utah Construction Co. from Lucky Mc Uranium Co. in March, continued; completion was expected early in 1958. A third concentrate purchase contract was approved, and construction of a 500-ton-a-day plant at Riverton was planned; completion of this plant was expected late in 1958. The contract was with Fremont Minerals, Inc.—a subsidiary of the Susquehanna Corp. (a Chicago transit company), which also owns the plant operated by Mines Development Co., Inc., at Edgemont, S. Dak.

Exploration of uranium-ore bodies by companies and individuals continued at approximately the same rate as in 1956 and was reported in 10 counties, although, as in previous years, the major activity was in Fremont and Converse Counties. In 1957 exploration consisted of 1 million feet of drilling of all types—88 percent was noncore. Underground exploration included 1,291 feet of shafts, raises, and winzes and 2,025 feet of drifts, adits, and crosscuts. Over 1.8 million cubic yards of material was stripped in the course of exploration and development. The Federal Government assisted in exploration of uranium-ore deposits through contracts with DMEA. Five such contracts (3 in Fremont County and 1 each in Big Horn and Natrona

⁴ AEC, Additional Domestic Uranium Production Statistics for 1957: Press Release 208 (Grand Junction, Colo., office), Mar. 7, 1958, 4 pp.

TABLE 18.—Mine production of uranium ore, July 1955–December 1957 1

County	July 1–Dec. 31, 1955					1956					1957					
	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	F. o. b. mine value 2
Albany.....	2	(3)	(3)	(3)	2	(4)	(3)	(3)	5	(3)	(3)	(3)	5	(3)	(3)	(3)
Big Horn.....	1	(3)	(3)	(3)	6	(4)	(3)	(3)	6	(3)	(3)	(3)	6	(3)	(3)	(3)
Campbell.....	23	2,867	15,715	\$73,814	35	9,277	44,049	\$175,451	29	6,103	34,442	\$145,443	29	6,103	34,442	\$145,443
Carbon.....	3	(3)	(3)	(3)	6	(3)	(3)	(3)	6	(3)	(3)	(3)	6	(3)	(3)	(3)
Converse.....	10	(3)	(3)	(3)	20	12,674	61,963	249,451	23	(3)	(3)	(3)	23	(3)	(3)	(3)
Crook.....	9	(3)	(3)	(3)	10	20,656	78,877	292,423	12	10,704	40,804	151,687	12	10,704	40,804	151,687
Fremont.....	47	28,355	121,111	479,013	46	98,483	435,077	1,705,194	28	192,226	800,226	3,128,959	28	192,226	800,226	3,128,959
Johnson.....	5	214	441	619	12	2,199	6,488	19,104	5	(3)	(3)	(3)	5	(3)	(3)	(3)
Laramie.....	3	(3)	(3)	(3)	4	(3)	(3)	(3)	11	(3)	(3)	(3)	11	(3)	(3)	(3)
Natrona.....	3	65	138	288	2	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Niobrara.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	2	(3)	(3)	(3)	2	(3)	(3)	(3)
Sweetwater.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Washakie.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Weston.....	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Undistributed.....		9,864	41,025	163,277												
Total.....	108	41,365	182,030	722,011	145	156,509	702,882	2,764,730	122	274,699	1,189,947	4,668,681	122	274,699	1,189,947	4,668,681

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 expiration allowance.

3 Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Counties) were approved. Total amount of the contracts was \$239,706, the Government contributing 75 percent.

In October the AEC announced that no new concentrate-purchase contracts would be considered, because the capacity of the mills operated and being built was deemed adequate to meet anticipated demands until 1962. Because of the limited outlet for ores in some areas, AEC began a study to determine the extent of exploration, developed ore reserves, and availability of milling capacity in various producing areas. The purpose of the study was to determine the advisability of increasing milling capacity in certain areas. Completion of the study was expected early in 1958.

Federal Bureau of Mines data from 29 major producers showed a daily average employment of 232 workers. These operators reported 9 lost-time injuries during the year.

Vanadium.—A few deposits of uranium ore in Fremont, Campbell, and Big Horn Counties contain over 1 percent vanadium oxide; however, only those ores shipped to mills in Colorado were treated to recover vanadium. The quantity so recovered was credited to Wyoming.

REVIEW BY COUNTIES

Albany.—A general increase in the value of nonmetals boosted the total value of all minerals produced in 1957 to \$6.1 million, compared with \$5.4 million in 1956. Portland-cement shipments contributed most of the total value, and Monolith Portland Midwest Co. reported sales of cement to consumers in Colorado, Idaho, and New Mexico, as well as Wyoming. Shale and limestone, quarried near the plant, supplied the bulk of the raw-material requirements. Gypsum mined by Wyoming Construction Co. accounted for the supply of this material needed as a retarder. Fluorspar, mill scale, pyrite cinder, and other miscellaneous raw materials continued to be purchased from outside the county.

Petroleum production from 5 fields, of which the Quealy was the most important, declined 6 percent compared with 1956. Natural gas was produced at the Seven Mile field. Ohio Oil Co. operated its plant at Rock River to recover natural gasoline and liquefied-petroleum gases. Three exploration wells were drilled; all were unsuccessful.

A limited amount of drilling for uranium was completed.

The commercial output of sand and gravel in 1957 totaled 138,000 tons, and Government-and-contractor production reached 249,000 tons. The principal commercial operators were Union Pacific Railroad Co. and M. C. Justesen. J. A. McPherson & Co., Inc., was the Government-and-contractor producer.

Agate, jade, jasper, petrified wood, and fossils comprised the ornamental stone production in Albany County during 1957, the Laramie Rockologists Club reported.

A small quantity of magnetite from the Cobar No. 1 mine was used by Magnetite Products Corp. as an aggregate in concrete used for coating underwater pipelines and transmission lines.

Big Horn.—Big Horn County ranked fourth in the State in the production of petroleum, with output from 18 fields; Garland, Bonanza, and Byron were the principal producers. Of 19 exploratory wells drilled, 5 were new discoveries. The discovery well at the

TABLE 19.—Value of mineral production in Wyoming, 1956-57, by counties

County	1956 ¹	1957 ²	Minerals produced in 1957 in order of value
Albany ³	⁴ \$5,397,247	\$6,080,708	Cement, petroleum, stone, clays, sand and gravel, iron ore, gypsum, gem stones.
Big Horn ⁶	⁴ 34,593,845	35,367,819	Petroleum, clays, uranium ore, sulfur, sand and gravel.
Campbell ⁷	799,892	902,168	Coal, petroleum, uranium ore.
Carbon ⁸	⁴ 6,713,246	9,580,032	Petroleum, coal, sand and gravel, uranium ore, sodium sulfate, rare-earth-metals concentrate, copper, gem stones, gold, silver.
Converse.....	15,590,019	15,202,681	Petroleum, uranium ore, sand and gravel, coal, copper, silver.
Crook.....	6,249,227	7,853,470	Clays, petroleum, uranium ore, gem stones.
Fremont ⁶	36,593,700	40,963,957	Petroleum, uranium ore, sand and gravel, gem stones, gold, coal, stone, beryllium concentrate, copper, silver.
Goshen.....	377,650	203,074	Petroleum, sand and gravel.
Hot Springs ⁸	35,369,539	43,568,196	Petroleum, coal, sand and gravel.
Johnson ⁹	18,032,017	16,981,181	Petroleum, uranium ore.
Laramie.....	2,039,512	⁽¹⁰⁾	Petroleum, stone, uranium ore.
Lincoln.....	3,088,868	2,205,814	Coal, petroleum, phosphate rock, sand and gravel.
Natrona ⁶	⁴ 18,101,568	26,124,564	Petroleum, sand and gravel, clays, uranium ore, sodium sulfate, stone, feldspar, gem stones.
Niobrara ⁶	⁴ 4,149,325	⁽¹⁰⁾	Petroleum, uranium ore.
Park ⁶	56,045,075	⁽¹⁰⁾	Petroleum, sulfur, sand and gravel, stone.
Platte.....	4,923,367	⁽¹⁰⁾	Iron ore, stone, sand and gravel.
Sheridan.....	4,423,113	4,384,466	Petroleum, coal, stone, sand and gravel, pumice, clays.
Sublette ⁸	1,018,320	1,270,888	Petroleum, sand and gravel.
Sweetwater ⁶	⁴ 25,526,781	22,746,027	Petroleum, sodium carbonate, coal, sand and gravel, gem stones.
Teton.....	119,255	121,300	Sand and gravel, stone.
Uinta ³	229,220	209,352	Petroleum, gem stones.
Washakie ⁶	11,657,056	16,617,086	Petroleum, sulfur, sand and gravel, stone.
Weston ³	⁴ 12,955,598	10,610,898	Petroleum, clays, sand and gravel.
Yellowstone National Park.....		90,600	Sand and gravel.
Undistributed ¹¹	14,415,055	85,477,868	
Total ¹²	³ 317,594,000	345,604,000	

¹ Revised to include uranium, except as indicated by footnote 4.

² Natural gas and petroleum preliminary.

³ Excludes natural-gas liquids.

⁴ Uranium value withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Revised figure.

⁶ Excludes natural gas and natural-gas liquids.

⁷ Excludes vanadium.

⁸ Excludes natural gas.

⁹ Excludes natural gas and vanadium.

¹⁰ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

¹¹ Includes all natural gas, natural-gas liquids, and vanadium and some petroleum (1956), sand and gravel, uranium ore (1956), stone (1956), gem stones, and values indicated by footnote 10.

¹² Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement.

Alkali Anticline field was completed in both the Phosphoria and Tensleep formations. Wells at the Byron-SE field and at an unnamed field were completed in the Phosphoria formation. Wells at the Crystal Creek and Spence Dome fields were completed as new producing horizons in the Amsden formation. Of 27 development wells completed, 8 were successful. Natural gas was produced at 6 fields, of which the Manderson was most important. Mobile Producing Co. processed natural gas at its Manderson plant to recover natural gasoline and liquefied-petroleum gases. Sulfur was extracted from the residual gas by the Jefferson Lake Sulphur Co.

Uranium ore was produced by 4 operators at 5 operations; Lisbon Uranium Corp. was the major producer. All production was shipped to the Government stockpile at Riverton. Exploration and develop-

ment consisted of 15,000 feet of drilling and 1,352 feet of underground openings.

Bentonite from deposits in the Big Horn basin was the leading nonmetal produced in 1957. Magnet Cove Barium Corp. and Wyoben Products Co. were the mine operators, as well as the producers of ground bentonite. Output in 1957 was relatively the same as in 1956, but a slightly higher average price in 1957 resulted in a higher total value. Shale was mined by Lovell Clay Products Co. for use at its Lovell brick plant. Sand and gravel produced in 1957 consisted of 97,000 tons of paving gravel quarried by Asbell Bros. Construction Co.

Campbell.—Coal production by the Wyodak Resources Development Corp. (a subsidiary of the Black Hills Power & Light Co.) at the Wyodak strip mine declined slightly from the preceding year. Petroleum was produced at 3 fields, 2 of which were 1957 discoveries. Thirty-four exploratory wells were completed; four were listed as discoveries. Wildcat wells in the Barber Creek and Dead Horse Creek fields were completed in the Parkman formation at depths of 7,200 feet. The Raven Creek field was in the Dakota formation and the Slattery field in the Newcastle. A fifth successful wildcat in the Newcastle formation was combined with the Slattery field. In all 21 development wells were completed, with 19 successes.

Uranium ore was produced at 29 operations and shipped to mills in South Dakota and Colorado and to the Government stockpile at Riverton. Exploration and development of uranium-ore bodies continued; 46,000 feet of drilling was completed, and 49,000 cubic yards of overburden was removed.

Carbon.—Coal was produced from 2 strip mines and 1 underground mine. Monolith Portland Midwest Co. operated the Hanna No. 2 strip mine; all of the production was used at the company plant as fuel in manufacturing cement. Nugget Coal & Timber Co. operated the Nugget No. 1 strip mine, and Mike and Harry Thomas operated the Thomas underground mine. Petroleum production from 13 fields increased 39 percent compared with 1956. Of 18 exploratory wells completed, 2 were successful. The Diamond Ranch field produced 384 barrels of oil daily from a discovery well in the Lakota formation at a depth of 5,821 feet, and the discovery well at the Elk Mountain field produced 534 barrels a day from the Sundance formation at a depth of 6,552 feet. Five development wells were completed; two in the Diamond Ranch field were successful. Sinclair Refining Co. operated its 25,000-barrel-a-day refinery at Sinclair. Natural gas was produced from six fields. The Oil Springs and Rock River fields were the major producers.

Uranium ore produced at six operations was shipped to mills in Colorado and Utah and to the Government stockpile at Riverton. Major producers were King Oil Co. and Shawano Development Corp. In the exploration and development of uranium ores, 170,000 feet of drilling, 225 feet of underground openings, and 208,000 cubic yards of stripping were completed.

Sand and gravel output consisted of quarrying and preparational activities of Boatwright & Smith, R. J. Voerding Co., and W. E. Barling, Inc.; production totaled 201,200 tons of structural and paving sand and gravel.

Iowa Soda Products Co. was succeeded by Sweetwater Chemical Co. in April, and the latter company continued to mine sodium sulfate from a deposit near Rawlins.

Rare-earth production was reported by Ralph Platt of Encampment and consisted of 2 tons of euxenite sold to a Denver, Colo., consumer.

Trans-State Mining Co. shipped a small quantity of ore containing gold, silver, and copper from the Kurtz-Chatterton mine directly to a smelter.

Converse.—Coal production from the Antelope strip mine operated by Best Coal Co. was approximately the same as in 1956. Petroleum production from 9 fields declined more than 800,000 barrels from the previous year. The principal producing fields were the Glenrock-S and Big Muddy. Exploratory drilling was greater in 1957 than in 1956. One new field (Twenty Mile Creek) was discovered, compared with 2 in 1956. Thirty-eight development wells were completed; 16 were successful. The Glenrock field also produced natural gas. The Continental Oil Co. refinery at Glenrock was being dismantled.

Uranium ore produced at 23 operations increased more than threefold compared with 1956. The entire production was shipped to the processing mill at Edgemont, S. Dak., for treatment. Jenkins & Hand—operating the Anomaly D-85, Pat No. 8, and Pat No. 9 mines—and Loma Uranium Corp.—operating the Hardee lease, Lamb, and Zee No. 4—were the major producers. Exploration and development activities consisted of 132,000 feet of drilling; 107,000 cubic yards of overburden was removed.

F. M. Ready Mix Co. was the only sand and gravel producer in 1957; output consisted of 17,900 tons of structural sand and gravel.

Great Western Drilling Co. and Minnkota Mining Co. each made one shipment of ore containing silver and copper to a smelter from the Big Creek and Black King mines, respectively.

Crook.—Bentonite continued to be the most important commodity, in terms of value, in Crook County during 1957. American Colloid Co., Black Hills Bentonite Co., Federal Foundry Supply Co., International Minerals & Chemical Corp., and National Lead Co. all reported mining activity. Total shipments of ground bentonite rose to 414,000 tons valued at \$5.8 million.

Production of petroleum from two fields increased nearly fourfold compared with 1956. A new producing horizon (Minnelusa) was discovered in the Donkey Creek field. The Donkey Creek-S field was a 1957 discovery in the Dakota sandstone, and 2 other wells were listed as discoveries—1 each in the Lakota and Dakota formations. Twenty-seven exploratory wells were completed. Forty-seven development wells also were completed, with 23 (nearly 50 percent) successful.

Uranium ore produced in 1957 at 12 operations and shipped to the processing mill at Edgemont, S. Dak., declined 48 percent, compared with 1956. Exploration and development consisted of 66,000 feet of drilling and 28 feet of underground openings. Homestake Mining Co., operating the New Haven group, and Quad Mining Co., operating the Ackerman lease and Myers No. 1 operation, were the major producers.

Fremont.—The mineral industry of Fremont County in 1957 produced 10 minerals (excluding natural gas and natural-gas liquids) valued at nearly \$41 million, an 11-percent increase over 1956. Crude

petroleum valued at \$37.4 million was the most important followed by uranium ore valued at \$3.1 million.

Approximately the same quantity of petroleum was produced from 21 fields as in 1956. The county ranked third in the State in petroleum output. The major producing fields were Steamboat Butte, Winkleman, Big Sand Draw, and Beaver Creek; all produced over 2 million barrels each. The county also was third in the State in footage of exploratory wells drilled; 7 of 32 completed wells were successful. New oilfields included the Bison Basin in the Morrison formation and Rolff Lake in the Phosphoria and Curtis formations. New oil-producing horizons were discovered at the Pilot Butte field in the Crow Mountain formation, at the Sheldon Dome in the Curtis and Tensleep formations, and at Sheldon Dome-NW in the Phosphoria formation. Gas was discovered in the Lost Cabin field in upper Cretaceous formations and the Trail Ridge in Dakota formations. A new producing horizon was found in the Mount Rogers gasfield in the Cloverly formation. Development completions totaled 35; 27 were oil producers and 2 gas producers. Natural gas was produced at the Long Creek gasfield and at 9 oilfields. Major production was wet petroleum gas from the Beaver Creek and Big Sand Draw fields. Northern Utilities Co. operated its natural-gas plant at the Sand Draw field to extract natural gasoline and liquefied petroleum gases. Coal was produced at the George underground mine.

The county was the major producer of uranium ore. Production in 1957 from 28 operations almost doubled that in 1956. The principal producers—Vitro Uranium Corp., Western Nuclear Corp., Outwest Uranium & Oil Co., Globe Mining Co. and Harold Reach, and Valley Dean Corp.—produced 79 percent of the county uranium. Exploration and development of uranium ores continued at a high rate, with 641,000 feet of drilling and 1,144 feet of underground openings completed; 1.4 million cubic yards of waste material was removed in exploration and development.

Atlantic Western Mining Co. operated the Duncan mine from July to November and was the principal producer of gold and silver in the State.

Nonmetal output consisted of 613,000 tons of sand and gravel and 2,500 tons of crushed granite and limestone; \$26,400 worth of gem stones was also collected. Sand and gravel production was reported by 2 commercial operators—Gilpatrick Construction Co., Inc., and Raecke & Scott—and 10 Government-and-contractor operations. In the latter group J. F. England Sons, Inc., contractor for the Federal Bureau of Public Roads, was the principal producer. Contractors for the Federal Bureau of Reclamation produced 1,100 tons of crushed granite and 1,400 tons of crushed limestone. Jade continued to be the most important gem stone produced and collected in Fremont County. Besides jade, agate and petrified wood were collected by rock-shop operators and hobbyists.

No tungsten was produced in 1957, compared with 2 tons in 1956. A small quantity of beryl was shipped to the Government depot at Custer, S. Dak., from the Sleeper Nos. 1 and 2 and White Gaint No. 1 mines.

Goshen.—Sixty thousand barrels of petroleum was removed from the Torrington field during 1957 and was valued at \$159,000. The

search for oil continued, and four unsuccessful exploratory wells were completed.

Sand and gravel output consisted of 30,500 tons of paving and structural gravel and structural sand quarried by the crews of the Federal Bureau of Reclamation and the Goshen Irrigation District.

Hot Springs.—The county ranked second in the State in the production of petroleum from 17 fields. The major producing field was the Hamilton Dome, with more than 6 million barrels. Five other fields produced over 1 million barrels each. Eleven exploratory wells were completed. Development drilling was particularly rewarding, with 31 producers from 35 completed wells. Dry natural gas was produced at the Little Grass Creek field, and wet petroleum gas was produced at five fields. The Little Buffalo field was the major producer of wet gas. Empire State Oil Co. operated its 5,000-barrel-a-day refinery at Thermopolis. Crude oil for the plant was from the Hamilton Dome field. Throughput in 1957 declined 8 percent compared with 1956.

Coal was produced at the Grass Creek, Roncco, and Coleman (formerly T & T) mines, and the total output for the county remained at the 1956 level. However, sand and gravel sold or used in 1957 dropped to 14,400 tons, compared with 89,000 tons in 1956. The lack of any State-highway-department work in the county during 1957 caused the decline. Charles M. Smith was the only producer, and he reported the production of paving sand and gravel.

Johnson.—Petroleum produced at 7 fields declined 13 percent compared with 1956. Two fields (Sussex and Meadow Creek) produced over 2 million barrels each and supplied 84 percent of the county production. Twelve unsuccessful exploratory wells were completed. Development drilling in the Sussex, Meadow Creek, North Fork, and Meadow Creek-N fields produced 30 successful oil wells and 16 failures. Wet petroleum gas was produced at 3 fields, the Meadow Creek being the leading producer.

Uranium ore produced at five operations was shipped to the processing mill at Edgemont, S. Dak., and to the Government stockpile at Riverton. A small lot of high-grade ore was shipped to Grand Junction, Colo., for treatment. Exploration and development included 28,000 feet of drilling and 340 feet of underground openings. Sixty thousand cubic yards of overburden was removed.

The Benton Clay Co. of Casper continued to develop its bentonite properties. Some bentonite was mined in 1957 but stockpiled at the mine.

Laramie.—Petroleum production from 3 fields declined 81,000 barrels compared with 1956. Major production was from the Horse Creek field. Thirteen exploratory wells and four development wells were completed. Two new fields (Golden Prairie and an unnamed field) were discovered; both were 7,700 feet deep and were completed in the "J" sandstone. One development well in the Horse Creek field was successful. Frontier Refining Co. operated its 20,000-barrel-a-day refinery at Cheyenne. Crude oil for the plant came from fields in the Big Horn, Powder River, and Denver-Julesburg basins. Additions at the plant included a thermal unit to the topping and cracking units, which increased the daily capacity 4,500 barrels. The capacity

of the asphalt plant was doubled to 10,000 barrels a day by installation of a barometric condenser.

A small quantity of uranium ore was shipped to Rifle, Colo., for processing.

Nonmetal production consisted of crushed limestone quarried by the Great Western Sugar Co. for use in sugar refining, as concrete aggregate, railroad ballast, flux, and riprap. Crushed granite was mined by Morrison-Knudsen Co., Inc., and used principally as railroad ballast.

Lincoln.—Lincoln County led the State in the production of coal. The Kemmerer Coal Co. operated the No. 8 Brilliant underground mine and the Elkol strip mine. The company was awarded a contract to supply 234,000 tons of coal to the AEC plant at Hanford, Wash. Petroleum and natural gas were produced at the La Barge field, which lies in both Lincoln and Sublette Counties. One of the seven exploratory wells drilled was a gas discovery at the Willow Creek field. Initial production was 3.6 million cubic feet a day from the lower Fort Union formation. One development well was a failure.

The decline in total value of all minerals produced in the county resulted from a drop in the output of phosphate rock, sand and gravel, and stone. Phosphate rock was produced at the Leefe mine of San Francisco Chemical Co. Commercial sand and gravel output was reported by the Spencer Call Sand & Gravel Co.; the Eagle Construction Co., contractor for the Federal Bureau of Public Roads, was responsible for the Government-and-contractor output. No stone was produced in 1957, compared with 6,100 tons of crushed limestone in 1956.

Natrona.—Petroleum production from 23 fields increased 33 percent compared with 1956 and furnished 98 percent of the total value of all mineral production. The Salt Creek field was the largest producer, with more than 4 million barrels, followed by the Grieve and Salt Creek-E fields, with production exceeding 1 million barrels each. The county led the State in the number of wildcat and development wells completed; of 42 wildcat wells drilled, 4 were new discoveries. The discovery well at the Brooks Ranch field was completed at a depth of 4,300 feet in the second Frontier formation. Initial production was 183 barrels of oil a day on pump. New producing horizons were found in the Crow Mountain and Tensleep formations at the Casper Creek-N field and in a stray sandstone of the Steel formation at the Government Bridge field. Development drilling of 296,000 feet in 103 completed wells produced 80 successful oil wells and 1 successful gas well. Wet petroleum gas produced at the Salt Creek and Salt Creek-E fields was processed at the Stanolind Oil & Gas Co. plant at Midwest to recover natural gasoline and liquefied-petroleum gases. The residual gas was an important source of natural gas. Three refineries at Casper—the 8,900-barrel-a-day plant of Socony-Mobil Oil Co., the 21,000-barrel-a-day plant of Standard Oil Co. of Indiana, and the 17,000-barrel-a-day plant of The Texas Co.—operated the entire year. Throughput of the 3 plants was 14.5 million barrels in 1957, a slight decline from the 14.8 million-barrel throughput in 1956. Standard Oil Co. of Indiana began operations at its new lubricating-oil

plant at Casper. Four new units installed to replace equipment that had been in use 38 years included a 4,800-barrel, vacuum-pipe still; a 1,000-barrel, 2-stage deasphalting plant; a 1,500-barrel extraction plant; and a 2,000-barrel dewaxing plant. Daily capacity of the plant, the only one of its kind in the Rocky Mountain area, was 800 barrels of lubricating oil. Construction of a 33-mile, 8-inch, crude-oil pipeline from the Grieve field to Casper began in October. The line will connect with Platte Pipe Line Co. facilities at Casper.

The county was the third ranking producer of uranium ore. Production from 11 operations was shipped to mills at Split Rock (Jeffrey City), Edgemont, S. Dak., and Rifle, Colo., and to the Government stockpile at Riverton. Production increased considerably over 1956. Operators reported 41,000 feet of drilling, driving of 215 feet of underground openings, and the removal of 56,000 cubic yards of overburden in the exploration and development of uranium-ore bodies.

Nonmetals composed only 2 percent of the total value of mineral production in 1957; bentonite and sand and gravel provided the bulk of this total. The Benton Clay Co., sole producer of bentonite, continued to operate its Casper grinding plant. Sand and gravel consisted of 132,800 tons of commercial output reported by Casper Concrete Co. and Platte Sand & Gravel Co. of Casper. Knisely-Moore Co. and W. C. & R. C. Tucker Construction Co., as contractors for the Federal Bureau of Reclamation and crews of the Casper city engineer, were responsible for the Government-and-contractor production. W. C. & R. C. Tucker Construction Co. and construction crews of the Federal Bureau of Reclamation also quarried 2,800 tons of limestone for use as riprap. Crude feldspar was mined by International Minerals & Chemical Corp. at its Casper Mountain property. William E. Pratt continued to produce sodium sulfate (Glauber salt) from a deposit near Casper.

Niobrara.—Production of crude oil at 8 fields in Niobrara County declined 66 percent in 1957, compared with 1956. Three fields produced wet petroleum gas that was processed at the Continental Oil Co. plant at Manville to recover natural gasoline and liquefied-petroleum gases. The Lance Creek, Lance Creek-E, and Little Buck fields were the major producers of both petroleum and wet petroleum gas. One small oilfield was discovered, and a new gas-producing horizon was found at the Mule Creek-W field. The gas well, completed at a depth of 2,774 feet in the first Leo sandstone, flowed 1.7 million cubic feet. The gas contained 61 percent nitrogen and was shut in. Fifteen development wells were completed; eight of them, mostly in the Lightning Creek field, were successful. The C & H Refinery Co. operated its 175-barrel-a-day refinery at Lusk, processing crude oil from the Lance Creek field.

A small quantity of uranium ore produced at two operations was shipped to the mill at Edgemont, S. Dak. A limited amount of drilling (2,400 feet) was done during exploration for uranium-ore bodies.

Park.—Park County led the State in the production of petroleum. Output was reported from 24 fields and increased 3 percent compared with 1956. The Elk Basin field was the major producer, with more than 11 million barrels. Three other fields, Oregon Basin, Frannie,

and Badger Basin, produced over 2 million barrels each. Natural gas was produced at eight fields, the Elk Basin field being the largest producer. Four exploratory wells were completed; one was successful. Wells at the Rose Creek and Sheep Point fields, completed in the Phosphoria formation, pumped initially, 248 and 92 barrels of oil a day, respectively. Five of the ten development wells completed were successful. Stanolind Oil & Gas Co. operated its natural-gas plant at Elk Basin to recover natural gasoline and liquified petroleum gases. Husky Oil Co. operated its 5,500-barrel-a-day refinery at Cody; the throughput was slightly below that of 1956.

Nonmetal production in Park County was centered around sulfur-recovery plants of Seaboard Oil Co. and Stanolind Oil & Gas Co. Elemental sulfur was recovered from sour natural gas processed at plants at Silvertip and Elk Basin, and total shipments in 1957 were relatively the same as in 1956. Construction-material output consisted of 12,600 tons of commercial and 1,200 tons of Government-and-contractor paving sand and gravel. The Federal Bureau of Reclamation quarried a small quantity of granite and sandstone for use as riprap on Bureau projects.

Platte.—The Colorado Fuel & Iron Corp. continued to mine iron ore (hematite) from its Sunrise mine and ship it directly to its plant at Pueblo, Colo., for production of pig iron and steel.

The Guernsey Stone Co. operated its Guernsey limestone quarry, producing 423,700 tons of crushed and broken stone, which was used as railroad ballast, concrete aggregate, and riprap. All sand and gravel produced in 1957 was used by contractors for the Federal Bureau of Reclamation in conjunction with construction contracts. These contractors were Husman, Inc., Peter Kiewit Sons' Co., and Platte Valley Construction Co.

Exploration for oil in 1957 consisted of the drilling of six wells, all of which were considered failures.

Sheridan.—Sheridan County ranked third in the State in the production of coal. Production from the Big Horn No. 1 and Welch strip mines and the Storm King underground mine declined slightly compared with 1956. Petroleum was produced at the Ash Creek and Ash Creek-S fields. Three exploratory wells and one development well were completed; only the development well in the Ash Creek-S field was successful.

The value of construction materials produced in Sheridan County declined in 1957, compared with the year before. Output of miscellaneous clay used in manufacturing building brick by the Sheridan Press Brick & Tile Co. was only half the 1956 total, whereas sand and gravel sold or used dropped to 26,300 tons—one-third the 1956 level of output. Mullinax Engineering Co. and Sheridan Sand & Gravel Co. were the producers, and production was classified as structural and paving sand and gravel.

Mine production of volcanic scoria rose to 49,000 tons—8 percent greater than in 1956—and was produced by the Tongue River Stone Co. of Sheridan. The Sheridan Wyoming Coal Co. quarried miscellaneous stone for the Chicago, Burlington & Quincy Railroad for use as riprap.

Sublette.—Petroleum and natural gas were produced at five fields. Principal production came from the La Barge and Tiptop fields. The La Barge field lies in both Sublette and Lincoln Counties, but only the output produced in Sublette County is included in this section. Petroleum production in the county increased 15 percent compared with 1956. Continued increase in output was virtually assured by successful completion of 5 out of 7 exploration wells drilled in 1957. New fields and initial daily production of the discovery wells were the Big Piney in the Mesaverde formation with 140 barrels of oil, Birch Creek in the Bear River formation with 1.4 million cubic feet of gas and some distillate, Chimney Butte in the Frontier formation with 1.6 million cubic feet of gas, Dry Piney in the Frontier formation with 7.4 million cubic feet of gas and 85 barrels of distillate, and the La Barge-E in the Frontier formation with 4.5 million cubic feet of gas. Of 44 development wells completed, 5 were oil and 32 gas wells.

Sand and gravel output consisted of 190,000 tons of commercial pit-run paving gravel produced by the Studer Construction Co.

Sweetwater.—Sweetwater County ranked second in the State in the production of coal and was the leading producer of natural gas. Production of coal from 5 underground mines declined 40 percent compared with 1956. Union Pacific Coal Co. operated the Rock Springs No. 8, the Stansbury group, and Superior D. O. Clark group. Operations at the Stansbury group were suspended early in the year. Gunn-Quealy Coal Co. operated the Rainbow No. 6 mine and Swanson Mining Co. the Swanson No. 2 mine.

Natural gas was produced at 10 fields; the Church Buttes field (which lies in both Sweetwater and Uinta Counties) and the Baxter Basin field (in Sweetwater County) were the major producers. Sinclair Oil & Gas Co. operated its Baroil natural-gas plant to recover natural gasoline and liquefied-petroleum gases. Petroleum output from 4 fields declined 20 percent compared with 1956. The major producing field (Lost Soldier) yielded 3.8 million barrels during the year. Thirteen exploratory wells were completed, with 1 gas discovery; 5 development wells were drilled, with 3 successful oil wells and 1 gas well. An unnamed gasfield was discovered in the Lakota formation; its initial flow was 12.5 million cubic feet. A new producing horizon was found in the Mesaverde formation at the Tablerock field. Successful development wells were in the Tablerock and Lost Soldier fields.

Extraction of trona at the Westvaco mine of Intermountain Chemical Co. and production of soda ash at its chemical plant continued to be one of the most important activities of the mineral industry in Sweetwater County. The company employed 341 men at its mine and refinery, and an estimated \$2.5 million was paid in wages.

The letting of highway-construction contracts by the Wyoming State Highway Commission stimulated output of sand and gravel to 172,900 tons. Woodward Construction Co., as contractor for the highway department, was the principal producer, although Sharrock & Pursel quarried some sand and gravel for use on a Federal Bureau of Reclamation project. No stone or uranium was produced in 1957.

Teton.—The only mineral-industry activity in Teton County during 1957 was quarrying sand and gravel by Etlin E. Peterson and Strong

& Co., contractors for the Bureau of Public Roads, and Utah Idaho Sugar Co., which operated its Fox Creek limestone quarry. Two exploratory wells were drilled in the search for oil or gas, but both were failures.

Uinta.—Natural gas from the Church Buttes field, in Uinta and Sweetwater Counties, was the most important product in Uinta County in 1957. Mountain Fuel Supply Co. recovered natural gasoline at its plant at Church Buttes. Dry gas from the Church Buttes field and residual gas from the plant were transported through the company pipeline to Salt Lake City, Utah. Petroleum was produced at the Church Buttes, Spring Valley, and Sulfur Creek fields.

Washakie.—Petroleum produced at 13 fields increased 46 percent compared with 1956. The major producing field (Cottonwood Creek) produced over 4 million barrels and accounted for 82 percent of the 5.5 million barrels of crude oil produced in the county. Natural gas was extracted from the Worland field (the largest producer in the State), the Neiber Dome field (the third largest), and 4 other fields. Pure Oil Co. operated its natural-gas plant at Worland for the recovery of natural gasoline and liquid-petroleum gases. Gas from the Worland field contained a substantial amount of hydrogen sulfide. The hydrogen sulfide gas was extracted and transported to the nearby plant of the Texas Gulf Sulphur Co. for the recovery of elemental sulfur. Signal Oil & Gas Co. produced elemental sulfur at its Neiber Dome plant, but no shipments were made. The company Stockham Federal plant was abandoned, owing to the low sulfur content of the Stockham Federal pool. Ten exploratory wells were drilled during the year, but none were successful. Of 37 development wells completed, 28 were successful oil wells.

Although no uranium ore was shipped, exploration continued. Operators reported 1,700 feet of drilling, 40 feet of underground openings driven, and 2,300 cubic yards of overburden removed.

Construction-material production consisted of 17,900 tons of sand and gravel produced by Larsen-Meyer Construction Co. and Long Construction Co., contractor for the Federal Bureau of Reclamation; crude limestone and sandstone quarried and used on Government projects; and dimension limestone used for commercial rough construction.

Weston.—Petroleum production from 12 fields in Weston County declined 26 percent compared with 1956. The Clareton field (largest in the county) produced over 1 million barrels, accounting for 53 percent of the county petroleum production. Natural gas from the Fiddler Creek and Skull Creek fields was processed at natural-gas plants operated by Sioux Oil Co. and the Mountain Valley Corp. at Newcastle to recover natural gasoline and liquefied-petroleum gases. Sioux Oil Co. also operated its 4,000-barrel-a-day refinery at Newcastle. The company increased the daily crude-oil capacity of the plant 500 barrels. Thirteen exploratory wells were completed, and 41 of 79 development wells completed were successful.

Weston County was the third-ranking producer of bentonite in 1957; three companies supplied the entire output—National Lead Co. (Baroid Division), Federal Foundry Supply Co., and American Colloid

Co. Mines were operated at Osage and Upton, and two grinding plants at Clay Spur and Upton processed the crude ore.

Sand and gravel production was reported by the Weston County Highway Department and the Newcastle City Highway Department as well as the Black Hills Sand & Gravel Co.

