

Cover photo shows shaft building of the Champion Copper Mine at Painesdale. Last shipload of copper ore was raised to the surface September 11, 1967 and marked the end of 67 years of copper operations in Houghton County by the Copper Range Company. The mine is the source of water supply for Houghton, Hancock and the village of South Range.

... the State Geological Survey, shall make an annual report to the Governor, setting forth in detail the mineral statistics for the year; with the progress and development of ... mining and smelting industries.

—Compiled Laws Mich. 1948 s.319.202



Geological Survey

ANNUAL STATISTICAL SUMMARY 9

Mineral Industry of Michigan 1967

By
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Prepared in cooperation with
Bureau of Mines
United States Department of the Interior
1969

STATE OF MICHIGAN
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FOREWORD

This publication contains all the customary statistical data concerning the state's mineral output during 1967. This includes a review of the individual mineral commodities, tables on production and value, county summaries, and bits of information concerning developments, employments, injuries, etc.

The text was prepared by the United States Bureau of Mines from data collected through an annual canvass of all known mineral operations of the state. This text is also included in the Michigan section of the Bureau of Mines 1967 Mineral Yearbook edition. For a limited quantity of preprints, the Michigan Geological Survey has added cover, title page, mineral value map, roster of the State Survey staff, and photo plates of some of the state's mineral operations. A selected list of some of the more recent and more popular Survey publications is again included inside the back cover.

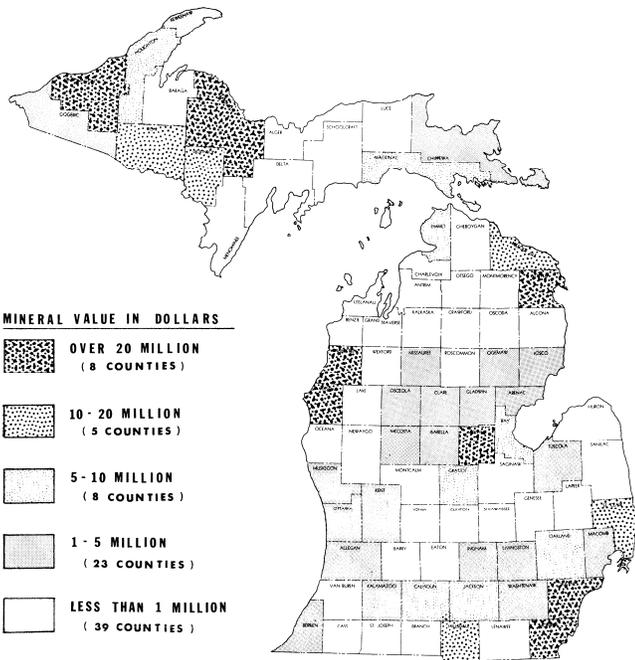
The Michigan Geological Survey expresses appreciation to all the mineral and mineral products producers for the production information they generously submitted. Without their cooperation in complying to the questionnaires sent them this report would not be possible.

Harry O. Sorensen, Geologist
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Mining & Economic Geology
Geological Survey Division
Dept. of Natural Resources
Lansing, Michigan
January, 1960

**MICHIGAN MINERAL VALUE
1967**

Table 1.—Mineral production in Michigan¹



MINERAL VALUE IN DOLLARS

- OVER 20 MILLION (8 COUNTIES)
- 10 - 20 MILLION (5 COUNTIES)
- 5 - 10 MILLION (8 COUNTIES)
- 1 - 5 MILLION (23 COUNTIES)
- LESS THAN 1 MILLION (39 COUNTIES)

COMMODITY	LEADING COUNTY	COMMODITY	LEADING COUNTY
CEMENT	ALPENA	NATURAL GAS	ST. CLAIR
CLAY	ALPENA	NATURAL SALINE	MIDLAND
COPPER	ONTONAGON	PEAT	LAPEER
GYPHUM	IOSCO	PETROLEUM	HILLSDALE
IRON ORE	MARQUETTE	SALT	WAYNE
LIME	WAYNE	SAND & GRAVEL	OAKLAND
MARL	KALAMAZOO	STONE	PRESQUE ISLE

The Mineral Industry of Michigan

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey Division of the Michigan Department of Conservation, for collecting information on all minerals except fuels.

By Donald F. Klyce¹

In 1967 a record high for the value of mineral production in Michigan was set despite reduced output of copper caused by a labor strike in the latter part of the year. The \$610.2 million total was more than 1 percent larger than the previous high established in 1966.

The value of both construction materials and chemicals recovered from natural salines exceeded 1966 values by about 3 percent. These two nonmetallic mineral groups accounted for nearly 57 percent of the value of State mineral production. Metallic minerals (34 percent) and mineral fuels (9 percent) accounted for the remaining value.

¹Industry economist, Bureau of Mines, Minneapolis, Minn.

Mineral	1966		1967	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland..... thousand 376-pound barrels	28,171	\$87,413	29,645	\$94,515
Masonry..... thousand 280-pound barrels	2,032	5,221	1,995	5,296
Clays..... thousand short tons	2,450	2,620	2,466	2,636
Copper (recoverable content of ores, etc.)..... short tons	73,449	53,133	58,458	44,692
Gypsum..... thousand short tons	1,522	5,489	1,422	5,086
Iron ore (usable)..... thousand long tons, gross weight	14,377	157,377	14,130	162,610
Lime..... thousand short tons	1,701	20,016	1,787	21,582
Magnesium compounds..... short tons	342,482	28,105	309,446	26,388
Natural gas..... million cubic feet	34,120	8,598	33,589	8,296
Natural gas liquids:				
Natural gasoline..... thousand gallons	15,703	1,099	47,817	3,491
LP gases..... do	79,719	4,385	59,390	3,444
Peat..... short tons	235,842	2,175	237,107	2,292
Petroleum (crude)..... thousand 42-gallon barrels	14,273	40,913	13,664	39,455
Salt..... thousand short tons	4,465	38,611	4,789	42,389
Sand and gravel..... do	55,123	49,521	52,310	49,616
Silver (recoverable content of ores, etc.)..... thousand troy ounces	483	625	302	468
Stone..... thousand short tons	37,864	40,380	36,432	39,910
Value of items that cannot be disclosed: Bromine, calcium chloride, calcium-magnesium chloride, gem stones, iodine, and potassium salts.....	XX	56,446	XX	58,039
Total.....	XX	602,127	XX	610,204
Total 1957-59 constant dollars.....	XX	556,249	XX	555,433

^P Preliminary. ^R Revised. XX Not applicable.
¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

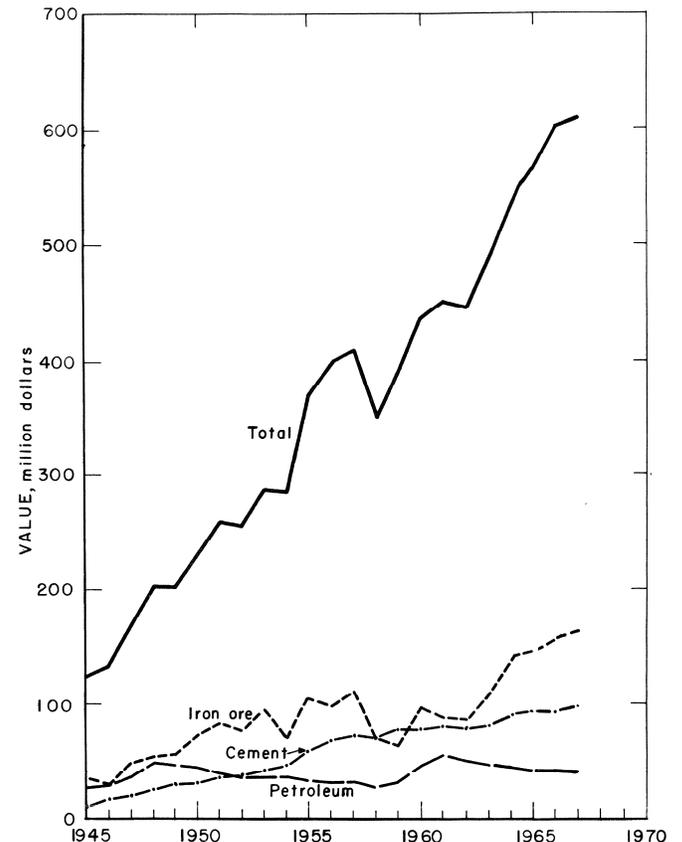


Figure 1.—Value of iron ore, petroleum, cement, and total value of all minerals produced in Michigan.

Legislation and Government Programs.

—The 1967 Michigan Legislature enacted Bill 3008, “Mine Safety Act of 1967,” to provide for the inspection of mines; the health and safety of persons employed in and about mines; mine inspectors; a mine safety board in the Department of Labor, and to prescribe its powers and duties; and penalties for violations.

The act covers mines extracting minerals in solid form, and includes milling, crushing, screening, washing, flotation, pelletizing, smelting, and other preparatory

operations needed to render the minerals marketable. It also covers exploration and development of mineral properties.

The act will supersede legislation that provided for the inspection of metallic mines by county mine inspectors.

Table 2.—Value of mineral production in Michigan, by counties¹

(Thousand dollars)			
County	1966	1967	Minerals produced in 1967 in order of value
Alcona	\$203	\$133	Sand and gravel.
Alger	28	57	Do.
Allegan	1,184	992	Petroleum, sand and gravel, peat, stone, natural gas.
Alpena	W	W	Cement, stone, clays, sand and gravel.
Antrim	336	272	Clays, sand and gravel.
Arenac	1,155	1,081	Petroleum, stone, sand and gravel.
Baraga	W	72	Sand and gravel.
Barry	713	700	Sand and gravel, petroleum, stone.
Bay	10,355	9,637	Cement, petroleum, lime.
Benzie	57		
Berrien	2,065	2,554	Sand and gravel, stone.
Branch	1,089	583	Do.
Calhoun	7,144	7,191	Petroleum, sand and gravel, stone, natural gas.
Cass	235	311	Sand and gravel, stone, petroleum.
Charlevoix	W	906	Cement, sand and gravel, stone, clays.
Cheyboygan	127	69	Stone, sand and gravel.
Chippewa	4,382	W	Do.
Clare	1,761	2,175	Petroleum, sand and gravel, natural gas.
Clinton	399	315	Sand and gravel, clays.
Crawford	522	522	Petroleum, sand and gravel, natural gas.
Delta	354	260	Sand and gravel, stone.
Dickinson	19,631	19,749	Iron ore, sand and gravel, stone.
Eaton	547	603	Stone, sand and gravel, clays, peat.
Emmet	6,104	6,645	Cement, stone, sand and gravel.
Genesee	755	702	Sand and gravel, petroleum.
Gladwin	W	1,027	Petroleum, sand and gravel.
Gogebic	3,021	2,121	Iron ore, sand and gravel.
Grand Traverse	96	W	Sand and gravel.
Gratiot	W	W	Salines, salt, sand and gravel, petroleum, natural gas.
Hillsdale	13,657	12,161	Petroleum, sand and gravel, stone, natural gas.
Houghton	9,390	6,493	Copper, sand and gravel, stone.
Huron	1,256	897	Stone, sand and gravel, lime, petroleum.
Ingham	1,260	1,318	Sand and gravel, peat.
Ionia	854	W	Sand and gravel.
Iosco	4,720	4,401	Gypsum, sand and gravel.
Iron	20,102	14,998	Iron ore, sand and gravel.
Isabella	1,399	1,336	Petroleum, sand and gravel, natural gas.
Jackson	5,165	4,966	Petroleum, sand and gravel, stone, natural gas.
Kalamazoo	1,092	1,239	Sand and gravel, stone, peat.
Kalkaska	74	112	Petroleum, sand and gravel.
Kent	3,124	3,474	Sand and gravel, gypsum, petroleum, peat, natural gas.
Keweenaw	(¹)	W	Copper, sand and gravel.
Lake	50	44	Sand and gravel, petroleum.
Lapeer	1,611	2,148	Peat, petroleum, sand and gravel, salines, natural gas.
Leelanau	113	56	Sand and gravel.
Lenawee	635	2,610	Sand and gravel, petroleum, clays, natural gas.
Livingston	3,561	2,804	Sand and gravel, petroleum, natural gas.
Luce	25	38	Sand and gravel.
Mackinac	W	W	Stone, sand and gravel.
Macomb	2,306	2,011	Sand and gravel, petroleum, natural gas.
Manistee	20,426	22,105	Salt, salines, sand and gravel.
Marquette	115,647	127,026	Iron ore, sand and gravel.
Mason	W	980	Salines, lime, sand and gravel, petroleum.
Mecosta	432	2,980	Petroleum, sand and gravel, peat, natural gas.
Menominee	890	693	Lime, sand and gravel.
Midland	W	W	Salines, salt, petroleum, sand and gravel.
Missaukee	1,291	2,302	Petroleum, sand and gravel, natural gas.
Monroe	W	W	Cement, stone, clays, peat, petroleum.
Montcalm	950	2,714	Petroleum, sand and gravel, natural gas.
Montmorency	19		
Muskegon	2,272	2,244	Salt, sand and gravel, petroleum.
Newaygo	232	173	Sand and gravel, petroleum.
Oakland	8,595	9,939	Sand and gravel, peat, petroleum.
Oceana	523	425	Petroleum, sand and gravel.
Ogemaw	1,201	2,941	Sand and gravel, petroleum, natural gas.
Ontonagon	44,733	36,099	Copper, silver, sand and gravel.
Oscoda	1,601	2,611	Petroleum, sand and gravel, natural gas.
Oscoda	125	76	Sand and gravel, petroleum.
Osego	30	42	Sand and gravel, natural gas.
Ottawa	2,720	2,586	Sand and gravel, petroleum, stone, natural gas.
Presque Isle	W	W	Stone, sand and gravel.
Roscommon	698	2,616	Petroleum, sand and gravel, natural gas.
Saginaw	479	434	Clays, lime, petroleum, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by counties¹—Continued

(Thousand dollars)			
County	1966	1967	Minerals produced in 1967 in order of value
St. Clair	\$16,498	\$14,679	Salt, cement, petroleum, peat, clays, sand and gravel, natural gas.
St. Joseph	262	279	Sand and gravel, peat, stone.
Sanilac	912	1,146	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone, sand and gravel.
Shiawassee	672	632	Sand and gravel, clays, peat, petroleum.
Tuscola	2,152	1,996	Sand and gravel, petroleum, lime, peat.
Van Buren	314	375	Sand and gravel, petroleum.
Washtenaw	1,279	1,974	Sand and gravel, petroleum, natural gas.
Wayne	50,556	55,288	Cement, lime, salt, sand and gravel, salines, stone, clays, petroleum, natural gas.
Wexford	147	284	Sand and gravel, natural gas.
Undistributed ²	194,502	208,162	
Total ⁶	602,127	610,204	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
¹ Values for natural gas and natural gas liquids are not available on a county basis, but are included with "Undistributed."
² Excludes value of natural gas.
³ Includes value of mineral production in Keweenaw County.
⁴ Value of mineral production is included in that of Houghton County.
⁵ Includes values for natural gas, natural gas liquids, gem stones, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.
⁶ Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

	1966	1967	Percent change
Personal income:			
Total	\$27,685	\$29,125	+5.2
Per capita	\$3,269	\$3,393	+3.8
Construction activity:			
Building permits:			
Valuation of authorized residential and nonresidential private construction	\$1,089.6	\$1,248.3	+14.6
Number of private and public residential building permits issued	40,000	46,342	+15.9
Contract construction work performed:			
Total	\$2,098	\$2,215	+5.6
Nonresidential building	\$980	\$847	-11.8
Residential building	\$835	\$929	+11.3
Nonbuilding	\$333	\$339	+1.8
State highway department:			
Contracts awarded	\$131.7	\$112.3	-14.7
Contract work performed	\$149.3	\$125.0	-16.3
Portland cement shipments to and within Michigan			
thousand 376-pound barrels	16,900.1	16,386.4	-3.0
Cash receipts from farm marketings	\$886.4	\$882.1	-0.5
Mineral production	\$602.1	\$610.2	+1.3
Raw steel production	10,004.0	9,247.9	-7.6
Manufacturing payrolls	\$4,682.1	\$4,590.6	-2.0
Annual average labor force and employment:			
Total labor force	3,305.6	3,382.5	+2.3
Agricultural employment	71.7	67.5	-5.9
Nonagricultural employment	3,111.9	3,141.3	+0.9
Manufacturing	1,139.5	1,104.6	-3.1
Motor vehicles and equipment	374.9	352.7	-5.9
Construction	111.7	116.7	+4.5
Mining	13.5	12.6	-6.7
Primary metal products	99.7	93.0	-6.7
Stone, clay, and glass products	21.2	18.9	-10.9
Transportation	76.9	75.1	-2.3

^p Preliminary.
¹ Adjusted to March 1967 benchmark levels.
² Includes nonagricultural, self-employed, and unpaid family workers, and domestic workers in private households.
Sources: Survey of Current Business, Construction Review, Statistical Abstract of the United States, State of Michigan Department of Highways, Farm Income Situation, American Iron & Steel Institute, and Michigan Employment Security Division in cooperation with the United States Department of Labor.

Table 4.—Employment and injury experience in the mineral industries

Year and industry	Average men working daily	Days Active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
1966:								
Peat	162	192	31	281	2	7.11	747	
Metal	5,938	296	1,756	14,039	8	481	34.83	5,093
Nonmetal	1,697	274	466	3,727	34	9.12	864	
Sand and gravel	2,470	232	572	4,872	2	85	17.86	3,542
Stone	3,427	295	1,010	8,115	1	87	10.84	1,454
Total	13,694	280	3,836	31,033	11	689	22.56	3,346
1967: ^p								
Peat	157	184	29	261	2	7.67	31	
Metal	5,660	276	1,565	12,503	11	481	39.35	6,806
Nonmetal	1,670	263	472	3,777	2	54	14.33	3,524
Sand and gravel	2,475	212	526	4,619	93	20.14	705	
Stone	3,390	295	1,000	8,025	62	7.73	373	
Total ¹	13,350	269	3,591	29,184	13	692	24.16	3,586

^p Preliminary.
¹ Data may not add to totals shown because of independent rounding.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement reached a record high, more than 5 percent above 1966 shipments, while the output of masonry cement was slightly lower. Portland cement was produced at nine plants in seven counties, (Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne); masonry cement was produced at five of these plants. Total annual finished Portland cement capacity increased to 39 million barrels. Year-end stocks of portland cement at mills were 3.8 million barrels, compared with 3.2 million barrels in 1966. More than 96 percent of the portland cement shipped was of types I and II (general use and moderate heat); the remainder was of type III (high-early-strength) and portland-pozzolan. About 47 percent of the cement was shipped to consumers within the State. Out-of-State distribution went mostly to Ohio, Illinois, Wisconsin, Indiana, Western New York, and Minnesota. Nearly 61 percent of the shipments were purchased by ready-

mixed concrete companies with the remainder going principally to concrete product manufacturers (14 percent), highway contractors (13 percent), and building material dealers (8 percent). About 2.6 million barrels of cement, mostly portland, were shipped into Michigan. The bulk of the shipments originated in Ohio and Pennsylvania.

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

(Thousand 376-pound barrels and thousand dollars)

Year	Active plants	Production	Shipped from mills		Stocks at mills Dec. 31
			Quantity	Value	
1963	9	24,194	25,016	\$76,944	2,532
1964	9	26,802	26,745	84,316	2,737
1965	8	27,018	27,565	86,996	2,110
1966	8	28,848	28,171	87,413	3,219
1967	9	29,862	29,645	94,515	3,825

* Revised.

Raw materials used in portland-cement manufacture included 6.9 million tons of limestone, and 2.2 million tons of clay or shale, as well as quantities of gypsum, iron ore, sand, slag, mill scale, air-entraining compounds, and grinding aids. About 690 million kilowatt-hours of electrical energy was used. The wet process was used at eight plants and the dry process at one.

The Medusa Portland Cement Co. plant at Charlevoix started producing clinker in August. The \$25 million plant is located in a popular resort area on Lake Michigan; to avoid air pollution and shoreline defacement, the company consulted with local and State officials on all phases of the project during the planning stages. The plant's 580-foot rotary kiln has been designed for production of 4 million barrels of gray cement per year. An electrostatic precipitator removes dust from kiln exhaust gases. The plant is highly automated; two interconnected digital computers in a central control building will oversee operations from the quarry to the finished cement silos. An automatic X-ray spectrometer will analyze the quality of raw materials and the finished product. The plant site is on navigable water, and 12 silos and five interstice bins with a storage capacity of 250,000 barrels are located on an inshore slip. The docking facility was designed to meet objections against structures extending into Lake Michigan which might be unsightly or accumulate debris leading to pollution. Lakeborne shipments will be made on the new 67,000-barrel capacity cement carrier, the *S.S. Medusa Challenger*. Limestone is quarried on the site from a deposit with an estimated 100-year supply. Shale and sand are also available on the site. To help minimize blasting disturbance, a seismograph has been installed 1½ miles from the quarry.

In November, Martin Marietta Corp. announced it has discontinued development of a new cement plant at Milan, in southeastern Michigan. A severe water leakage in the quarry at the new site was instrumental in the decision to halt the project. Instead, it was announced, the company's plant at Essexville, near Bay City, will be modernized and expanded. The plant capacity at Essexville will be increased by 10 percent.

One of the two kilns already delivered to Milan will be moved to Essexville to replace four older, smaller kilns. The second kiln and related equipment will be shipped to a new company plant under development in Colorado. Grinding mills will be moved from Milan to Essexville, a new raw mill will replace five mills, and a new finish mill will replace eight mills now in operation.

The Huron Cement Co. (Division of National Gypsum Co.) plant at Alpena marked its 60th anniversary in January. With an annual rated capacity of 18 million barrels, the plant is said to be the world's largest. Since the first cement shipment in 1908, plant production has totaled nearly 258 million barrels. Plant capacity is 30 times that of 1909, the first full year of production. Future plans call for expansion of the plant to a 24-million-barrel-per-year capacity.

Clays.—Miscellaneous clays and shale were mined in 11 counties from 13 pits. Total output was slightly larger than in 1966. Increases in production of material for manufacturing portland cement and lightweight aggregate offset decreases in output for stoneware and heavy clay products. About 90 percent of the production was used in cement manufacture. Of the remainder, 7 percent was used for lightweight aggregate, and the balance for vitrified tile, other heavy clay products, and stoneware. The largest production was reported from operations in Alpena, Antrim, Monroe, Saginaw, St. Clair, and Wayne Counties.

Gem Stones.—Agates, thomsonite, and other semiprecious stones, as well as specimens of native copper and hematite, were collected by hobbyists. Most of the gem stones were found along Lake Superior beaches in the Upper Peninsula.

Gypsum.—Smaller demand for building materials caused a decline in crude gypsum output of more than 6 percent. Crude gypsum was produced in Kent County from underground mines and processed at plants in Grand Rapids, principally for plaster, lath, and wallboard.

In Iosco County, gypsum was quarried at Whittemore for portland cement retarder. Quarries at Tawas City and Alabaster supplied crude gypsum for building material plants at National City, Detroit, and in Ohio and Wisconsin. Two deep water ports were maintained at National City and Alabaster for lake transport of gypsum materials.

Lime.—Increased demand for lime in basic oxygen converters and open-hearth furnaces in steel plants, as well as in chemical manufacture, caused a 5-percent increase in State lime production. In addition to these major consumers, smaller quantities of lime were used in sugar refining, paper manufacture, water purification, and sewage treatment. Lime plants were operated in eight counties, but four-fifths of the State output was concentrated in Wayne County to meet requirements of steel mills and chemical plants in the Detroit area. About 55 percent of the production was used by the producers, and the remainder sold. Only 8 percent of the total production was shipped to consumers outside the State.

About 262,000 tons of lime (more than three-quarters of it quicklime) were shipped into Michigan. Shipments originating in Ohio comprised most of the imports. Data for lime regenerated at papermills, water purification plants, and acetylene processors are excluded from total State production.

Natural Salines.—Bromine, calcium chloride, calcium-magnesium chloride, iodine, magnesium compounds, and potash were extracted from natural well brines at chemical plants in Gratiot, Lapeer, Manistee, Mason, Midland, and Wayne Counties. The total value of chemicals produced from natural salines, excluding salt which is discussed below, was about the same as in 1966. In June, Great Lakes Chemical Corp. closed its Filer City plant at which the company produced elemental bromine.

Perlite.—Crude perlite, mined in Western States, was expanded at plants in Iosco, Kent, and Wayne Counties. The material was used principally for building-plaster aggregate.

Salt.—Salt was produced from an underground mine in Detroit, and recovered from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties. Increased demand for salt by major consumers in chemical manufacture, for road use, animal feed, and water softening resulted in a 7-percent increase in production. Michigan salt was distributed to 44 States and Canada. The largest out-of-State shipments were to Illinois, Indiana, Minnesota, Ohio, and Wisconsin.

Sand and Gravel.—Michigan continued to be a leading source of sand and gravel production, the second highest in the Nation (after California). Although tonnage was down about 5 percent, the increase in unit value from \$0.90 to \$0.95 per ton raised total value to a record high of \$49.6 million. Demand for sand and gravel for building use increased about 3 percent; other major uses registered declines—for paving material and fill (7 percent), industrial sand (nearly 10 percent). Sand and gravel production was reported from all counties except Bay, Benzie, Monroe, and Montmorency. The Detroit area (Livingston, Macomb, Oakland, Washtenaw, and Wayne Counties) produced 19.5 million tons, or 37 percent of the State total. Production of more than 1 million tons was also reported from each of the following counties: Berrien, Ingham, Kalamazoo, Kent, Ogemaw, Ottawa, and Tuscola. Over 93 percent of the sand and gravel was processed. About 90 percent was moved by truck and the remainder by rail and water. Production was reported from 374 commercial and 108 Government-and-contractor operations.

Table 6.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1966		1967	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	6,350	\$5,093	6,508	\$5,990
Paving	5,469	4,645	5,565	4,550
Fill	3,639	1,659	3,401	1,601
Molding	3,611	6,735	3,231	6,198
Other ¹	868	2,002	810	2,111
Total	19,937	20,134	19,515	20,450
Gravel:				
Building	6,385	8,329	6,585	9,198
Paving	17,533	14,849	16,604	14,514
Railroad ballast	201	212	W	W
Fill	353	205	419	300
Other	56	70	120	184
Total	24,528	23,665	23,728	24,196
Total sand and gravel	44,465	43,799	43,243	44,646
Government-and-contractor operations:				
Sand:				
Building			90	49
Paving	2,115	1,008	2,291	1,121
Fill	1,116	397	919	373
Other	114	42	102	44
Total	3,345	1,447	3,402	1,587
Gravel:				
Building	87	48		
Paving	6,828	4,088	5,301	3,225
Fill	396	137	364	158
Other	2	2		
Total	7,313	4,275	5,665	3,383
Total sand and gravel	10,658	5,722	9,067	4,970
All operations:				
Sand	23,282	21,581	22,917	22,037
Gravel	31,841	27,940	29,393	27,579
Total	55,123	49,521	52,310	49,616

¹ W Withheld to avoid disclosing individual company confidential data; included with "Other."
² Includes fire or furnace and railroad ballast (1966), blast and foundry (1967), abrasives, enamel, engine, glass, pottery, porcelain, tile, and other construction and industrial uses.

Table 7.—Production of sand and gravel in 1967, by counties¹

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alcona	274	\$138	Leelanau	105	\$56
Alger	93	57	Lenawee	579	478
Allegan	401	278	Livingston	2,810	2,802
Alpena	187	W	Luce	35	58
Antrim	92	W	Macinac	W	W
Arenac	W	W	Macomb	2,524	2,004
Baraga	152	72	Manistee	W	W
Barry	639	668	Marquette	377	741
Berrien	2,595	2,550	Mason	975	W
Branch	589	W	Mecosta	186	W
Calhoun	978	485	Menominee	417	W
Cass	326	285	Midland	W	242
Charlevoix	190	W	Missaukee	17	11
Cheboygan	17	21	Montcalm	411	215
Chippewa	W	W	Muskegon	477	W
Clare	203	W	Newaygo	184	113
Clinton	354	W	Oakland	9,707	9,889
Crawford	88	53	Oceana	329	210
Delta	334	W	Ogemaw	1,238	1,050
Dickinson	293	218	Ontonagon	230	W
Eaton	416	W	Osceloa	218	143
Emmet	364	W	Oscoda	136	71
Genesee	897	696	Otsego	66	42
Gladwin	24	10	Ottawa	2,462	2,275
Gogebic	151	W	Presque Isle	521	W
Grand Traverse	172	W	Roscommon	212	127
Gratiot	279	W	Saginaw	W	W
Hillsdale	399	476	St. Clair	W	W
Houghton	W	W	St. Joseph	336	269
Huron	193	101	Sauvage	395	W
Ingham	1,372	1,316	Schoolcraft	151	W
Ionia	435	W	Shawassee	745	512
Iosco	77	31	Tuscola	1,475	1,714
Iron	94	W	Van Buren	414	345
Isabella	665	612	Washtenaw	1,912	1,903
Jackson	306	268	Wayne	2,511	4,349
Kalamazoo	1,120	1,182	Wexford	97	84
Kalkaska	W	W	Undistributed ²	2,210	7,694
Kent	2,224	2,483			
Keveenaw	66	34	Total	52,310	49,616
Lake	34	30			
Lapeer	265	155			

¹ W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
² No sand and gravel production reported from the following counties: Bay, Benzie, Monroe, and Montmorency.
³ Includes production for which no county breakdown is available, and data indicated by symbol W.

The new aggregate plant of Gil Brown Constructors, Inc., at West Branch employed a sink-float process for removal of chert and lightweight particles from gravel. According to company reports, approximately 7 percent of the 150-ton-per-hour feed to its heavy-media separation system is rejected in the form of chert and soft stone.

Stone.—Limestone was quarried in 17 counties by 24 commercial producers and four county highway departments. Limestone, which accounted for nearly all of the State stone output, came from large quarries in

Alpena, Chippewa, Mackinac, Monroe, and Presque Isle Counties. Nearly 77 percent of the material was moved by water from company-operated ports on Lakes Huron and Michigan to cement and lime plants, steel mills, and other consumers.

Demand for limestone decreased, with smaller requirements of the steel industry for fluxstone, of roadbuilding for aggregates, and of cement plants for cement stone, being responsible for much of the loss. The only major increase was in limestone for manufacturing lime.

Small quantities of dimension limestone and sandstone were produced for building purposes. The limestone was quarried and processed in Eaton, Huron, and Presque Isle Counties. The sandstone was produced in Jackson County. A small quantity of granite was quarried and crushed in Dickinson County for use as facing aggregate in architectural concrete. In Houghton County, basalt was quarried and crushed for road use. Marl was produced in 11 counties and sold for agricultural use.

Table 8.—Dimension stone sold or used by producers, by kinds

Year	Basalt		Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1963	---	---	4,938	\$60,371	8,937	\$62,348	13,875	\$122,719
1964	150	\$150	5,383	68,711	8,306	62,030	13,839	130,891
1965	---	---	5,286	75,989	6,396	42,760	11,682	119,749
1966	---	---	4,266	64,166	8,109	53,510	12,375	117,676
1967	---	---	3,241	61,150	2,770	16,690	6,011	77,840

Table 9.—Crushed and broken stone sold or used by producers, by kinds and uses

(Thousand short tons and thousand dollars)

Kind and use	1966		1967	
	Quantity	Value	Quantity	Value
Basalt: Concrete aggregate and roadstone	5	\$6	27	\$35
Granite: Exposed aggregate	---	---	3	62
Limestone:				
Riprap	109	173	W	W
Flux	13,391	15,789	11,270	13,638
Concrete aggregate and roadstone	6,479	7,748	5,952	7,313
Railroad ballast	W	W	308	380
Agriculture	669	1,040	757	1,093
Cement	9,443	7,786	9,080	7,570
Lime	5,560	5,125	6,224	6,615
Other ¹	2,053	2,495	2,673	3,025
Total ²	37,703	40,156	36,265	39,633
Marl: Agriculture	143	100	132	103
Grand total ²	37,852	40,262	36,426	39,832

W Withheld to avoid disclosing individual company confidential data; included with "Other."
¹ Includes limestone used for asphalt and other miscellaneous filler, chemicals, dust for coal mines, mineral food, poultry grit, stone sand, whitening or whitening substitutes, other uses, and uses indicated by symbol W.
² Data may not add to totals shown because of independent rounding.

Table 10.—Mine production of copper, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (thousand short tons)	Tailing (thousand short tons)	Short tons	Value (thousands)
1963	10	3	7,211	3,226	75,362	\$46,361
1964	9	3	6,718	2,174	69,040	45,914
1965	10	3	7,368	1,611	71,749	50,798
1966	10	3	8,000	1,851	73,449	53,133
1967	8	3	6,091	1,307	58,458	44,692

Sulfur.—Byproduct sulfur was recovered from crude petroleum at oil refineries in Alma, Detroit, and Trenton. Output increased over that of 1966.

Vermiculite.—Crude vermiculite, mined in Southern and Western States, was exfoliated at a plant in Dearborn

and used for insulation, plaster, concrete aggregate, agricultural application, and other uses.

METALS

Copper.—Production of copper in terms of recoverable metal was 20 percent less than in 1966, due chiefly to a 4-month-long labor strike at the White Pine Copper Co. property in Ontonagon County, and a strike, lasting nearly 3 weeks, at the Calumet Division of Calumet & Hecla, Inc., at Calumet. The average weighted price for copper increased to 38.2 cents per pound.

On May 6, the Quincy Mining Co. closed its dredge and copper reclamation plant at Torch Lake. The Quincy smelter was closed down with the discontinuation of the reclamation plant, but the furnace is being rebuilt, connected to gas firing instead of coal, and will be used to smelt copper scrap.

Copper Range Co. closed its Champion mine in September and discontinued its tailings-reclamation program in November.

Calumet & Hecla, Inc., closed the Centennial No. 2 mine, but continued development of the Kingston and Centennial No. 6 mines during the year. Diamond drilling of the Hills Creek project was started in 1967 with holes located to intersect the lode substantially below and northerly from the old workings in the Calumet conglomerate lode. One drill hole from the surface was completed with satisfactory results, and the second was at a depth of 2,000 feet at yearend. Further drilling is planned.

According to company reports, exploration was designed to determine the degree of mineralization to the north as well as to give an indication of the grade and thickness of the vein. At the White Pine mine a new conveyor system is being installed capable of transporting ore, materials, or personnel horizontally, on an incline, or vertically without changing the mode of transportation.

The White Pine Copper Co. is carrying on research in cooperation with the Institute of Mineral Research at the Michigan Technological University that has resulted in a process for 90 percent recovery of residual copper lost in tailings. In the process, sand tailings are treated in three continuous stages of leaching, precipitation, and regeneration. The process was made economically feasible on a 7,000-ton-per-day basis by the exclusion of air from the process, thereby reducing reagent loss by oxidation. The White Pine Copper Co. has been undergoing a three-way expansion encompassing mining, milling, and refining operations. The new milling and smelting facilities were operational in April. A new selective mining method called "values only" is being tested in several development areas of the mine. Essentially, the method is a refinement of techniques that enables miners to take less of the surrounding rock, increasing the copper yield per ton of ore.

Two companies, Bear Creek Mining Co. and Copper Range Co., had geological teams searching for ore and

performing analytical work at different sites of the Indiana copper tract in Ontonagon County.

Iron Ore.—Iron-ore shipments in 1967 reflected a larger proportion of pellets (73 percent) than in previous years. Consequently, although total shipments decreased by nearly 2 percent, value of shipments increased by more than 3 percent. Average weighted mine value for Michigan usable ore in 1967 was \$11.51 per ton compared with \$10.95 in 1966.

About 82 percent of the crude ore mined came from four open-pit mines, and the remainder from eight underground mines. Average iron content of usable ore produced was 60.25 percent natural, compared with 58.87 percent in 1966.

Michigan iron ore was shipped to producers of pig iron and steel, except for a small quantity used in manufacturing iron oxide pigments. About 98 percent of the ore was shipped by rail to ore docks in Escanaba and Marquette and then by water to lower Lake ports. The remainder was shipped by rail to consuming districts. The lake shipping season for Michigan iron ores opened at Escanaba on April 7, and closed at the same port on December 22.

For the first time since 1883, there was no production from the Gogebic Range, and the last shipment from remaining stocks left the Peterson mine at Bessemer in August. The Hanna Mining Co. began an expansion program at its Groveland plant that included increasing the output to 2.1 million tons of pellets per year from 1.6 million.

Table 11.—Crude iron ore data, in 1967, by counties and ranges

(Thousand long tons)						
County and range	Stocks Jan. 1	Production		Shipments		Stocks Dec. 31
		Under-ground	Open pit	Direct to consumers	To concentrators	
County:						
Dickinson	190	149	3,686	239	3,686	
Gogebic	850	2,216		2,065		1,001
Marquette	692	2,917	19,770	707	22,006	665
Total ¹	1,731	5,182	23,456	3,011	25,692	1,666
Range:						
Gogebic	190	149		239		
Marquette	692	2,917	19,770	707	22,006	665
Menominee	850	2,216	3,686	2,065	3,686	1,001
Total ²	1,731	5,182	23,456	3,011	25,692	1,666

¹ Stockpile overrun.
² Data may not add to totals shown because of independent rounding.

Table 12.—Usable iron ore produced (direct-shipping and all forms of concentrate), by ranges

(Thousand long tons)					
Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total ²	
1854-1962	317,203	262,234	246,582	826,019	
1963	5,706	3,729	902	10,336	
1964	7,898	4,651	1,227	13,776	
1965	8,973	4,595	753	14,322	
1966	9,589	4,620	113	14,322	
1967	10,231	3,750	³ 49	14,030	
Total ²	359,601	⁴ 283,478	⁴ 249,626	892,705	

¹ Exclusive, after 1905, of iron ore containing 5 percent or more manganese.
² Data may not add to totals shown because of independent rounding.
³ Stockpile overrun.
⁴ Distribution by range partly estimated before 1906.

Table 13.—Usable iron ore shipped from mines, by ranges¹

(Thousand long tons)				
Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total ²
1963	5,809	4,168	813	10,789
1964	7,909	4,560	1,403	13,871
1965	8,303	4,451	773	13,527
1966	9,686	4,327	364	14,377
1967	10,260	3,631	239	14,130

¹ Exclusive of iron ore containing 5 percent or more manganese.
² Data may not add to totals shown because of independent rounding.

Table 14.—Production of usable iron ore

(Thousand long tons)			
Year	Gross weight		Iron content (percent)
	Ore	Iron content	
1963	10,336	5,913	57.21
1964	13,676	7,923	57.93
1965	14,322	8,343	58.25
1966	14,322	8,432	58.87
1967	14,030	8,453	60.25

Table 15.—Iron ore¹ shipped from mines

(Thousand long tons)						
Year	Direct-shipping ore ²	Concentrates			Total usable ore ³	Proportion of concentrates to total usable ore (percent)
		Agglomerates	Other	Total ³		
1963	4,852	4,364	1,574	5,938	10,789	55.03
1964	5,753	6,573	1,546	8,118	13,871	58.53
1965	4,969	7,554	1,004	8,558	13,527	63.26
1966	4,272	8,630	1,415	10,106	14,377	70.25
1967	3,011	10,336	783	11,119	14,130	78.69

¹ Exclusive of ore containing 5 percent or more manganese.
² Includes crushed, screened, and sized ore not further treated.
³ Data may not add to totals shown because of independent rounding.

According to the Michigan Department of Conservation², the average cost per ton for underground mines was \$9.07 in 1967, compared with \$9.15 in 1966. Labor costs decreased to \$2.45 per ton, while taxes (excluding Federal income tax) decreased to \$0.32 per ton. Deferred costs per ton were \$0.47, and other costs were as follows: General overhead, \$1.28; royalty, \$0.42; and marketing, \$0.05.

² Geological Survey Division, Michigan Department of Conservation. General Statistics Covering Cost and Production of Michigan Iron Mines. 1968, 5 pp.

Pig Iron and Steel.—Pig iron and steel were manufactured at plants in Ecorse, Dearborn, and Trenton in the Detroit area. Pig iron shipments and value were nearly 5 percent smaller than in 1966. Basic and foundry grades were produced, and shipments included these grades as well as low phosphorus grade shipped from stocks.

About 2.3 million tons of iron and manganiferous ores, mostly domestic, were consumed in agglomerating plants and blast and steel furnaces.

The American Iron & Steel Institute reported Michigan steel production of 9.2 million tons, nearly 8 percent less than in 1966.

Silver.—Silver was recovered from copper ore mined and milled by the White Pine Copper Co. Concentrate from its silver-recovery circuit was smelted separately for delivery to electrolytic refineries where the silver was recovered. Silver contained in fire-refined copper was not recovered but was marketed as a constituent of Lake copper. Output in 1967 dropped substantially because of the labor strike at the White Pine operations.

MINERAL FUELS

Natural Gas and Natural Gas Products.—Natural gas was produced from both oil and gas wells in 25 counties. About 87 percent of the production came from five counties, with St. Clair County supplying 45 percent of the total State output.

Natural gas liquids were stripped from Michigan gas principally at the Albion-Scipio, Bell River Mills, Boyd, and Reed City gas plants. Additional natural gas liquids were stripped from gas delivered by interstate pipeline from out-of-State gas-fields at a plant in Washtenaw County.

Peat.—Michigan led the Nation in peat production with 38 percent of the total. Peat was produced in 14 counties, with nearly one-half of the State output from Lapeer County; Oakland, St. Clair, and Sanilac Counties accounted for much of the remainder. Peat was marketed principally as a soil conditioner, and nearly three-quarters of the output was sold in packaged form. None was sold for fuel. About 80 percent of the peat mined was reed-sedge, and the remainder was moss and humus.

Table 16.—Oil and gas wells drilled in 1967

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage ¹
Alcona						1	1	2,318
Alcona	8		1			8	12	25,897
Arenac						2	2	6,015
Bay						2	2	6,258
Branch						3	3	12,130
Calhoun	13	1	30			4	48	210,851
Clare			1			1	1	3,942
Crawford						1	1	4,592
Genesee	1					1	1	1,646
Gladwin						1	1	3,539
Grafton						2	2	6,743
Hillsdale	5		6			9	20	81,283
Ionia						2	2	12,403
Isabella						1	1	8,160
Jackson	1	1	6			3	11	33,614
Kent						6	6	22,954
Lake			3			1	5	24,940
Lapeer	2		3			2	4	13,561
Lenawee		7	3			3	13	19,615
Livingston						1	1	10,118
Macomb	1		6			17	24	73,142
Manistee			7			7	15	21,025
Mercola	11		3			6	20	65,015
Midland						2	3	10,531
Missaukee	3		2			1	6	23,220
Monroe			4			1	1	2,146
Montcalm	2		2			6	12	35,464
Muskegon	4		8			4	16	29,294
Newaygo	1		2			7	10	36,047
Oakland	1		2			2	3	13,226
Oceana			1			9	10	19,011
Ogemaw	4		2			1	7	26,592
Oscoda	2		7			4	12	34,457
Otsego		10	1			4	11	16,469
Ottawa						4	4	9,055
Roscommon						1	1	4,572
Saginaw						1	1	4,240
Shiawassee	2		2			1	4	6,314
St. Clair	3	18	22			1	40	254,302
Tuscola	1		1			1	2	5,292
Van Buren						1	1	1,205
Washtenaw						1	1	3,984
Total	61	37	118	7	2	168	393	1,206,062

¹ Includes only wells drilled and completed for oil and gas.

Petroleum.—Petroleum was produced in 44 counties, with the largest output reported from fields in the Albion-Pulaski-Scipio trend in Calhoun, Hillsdale, and Jackson Counties. According to the Geological Survey Division, Michigan Department of Conservation, the most active regions of new field exploration and field development drilling were in Macomb and St. Clair Counties and the area along the Albion-Pulaski-Scipio oilfield trend.

Statewide, the discovery-to-dry hole ratio for new field wildcat wells was 1:20 compared with 1:17 in 1966. About 22 percent of the exploratory wells bottomed out in Traverse Group Limestones (Devonian), 10 percent for the Dundee Limestone (Devonian), 7 percent in the Reed City zone of Devonian age, 35 percent in Silurian age rocks of the Clinton and Niagaran Groups, and

about 17 percent in Ordovician age (or older) rocks of the Black River and Trenton Groups. The remainder reached total depth in rocks younger than Devonian in age. No Precambrian or basement tests were drilled during the year. Nine new fields were discovered in 1967 and one new pool discovery was reported. Ten refineries had an operating capacity of 168,000 barrels per day.

Table 17.—Principal producers and processors of metals, minerals, and mineral fuels¹

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Cement:			
Acina Portland Cement Co., Division of Martin Marietta Corp.	Bay City	Bay	Portland and masonry, wet process.
Dundee Cement Co.	Dundee	Monroe	Do.
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	Portland and masonry, dry process.
Medusa Portland Cement Co.	Charlevoix	Charlevoix	Portland and masonry, wet process.
Pauline Cement Co., Division of American Cement Corp.	Port Huron	St. Clair	Portland, wet process.
Port Huron plant	Detroit	Wayne	Do.
Bresnan Avenue plant	Detroit	Wayne	Portland and masonry, wet process.
Jefferson Avenue plant	Wayne	Wayne	Do.
Peen-Dixie Cement Corp.	Wyandotte	Wayne	Do.
Wyandotte Chemicals Corp.	Wyandotte	Wayne	Do.
Clays and shales:			
Acina Portland Cement Co., Division of Martin Marietta Corp.	Saginaw	Saginaw	Cement.
Dundee Cement Co.	Dundee	Monroe	Do.
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	Do.
Light Weight Aggregate Corp.	Livonia	Wayne	Lightweight aggregate.
Pauline Cement Co., Division of American Cement Corp.	Du.	St. Clair	Do.
Peen-Dixie Cement Corp.	Allen Park	Wayne	Do.
Alfred Chemical Corp.	Detroit	Wayne	Do.
Ford Motor Co.	River Rouge	Wayne	Do.
National Steel Corp., Great Lakes Steel Division	Ecorse	Wayne	Do.
Copper:			
Calumet & Hecla, Inc.	Calumet	Houghton	On strike August 29-September 11.
Coseochee Nos. 2, 3, and 6.	Algonquin	Algonquin	Do.
Oscoda No. 13	Hubbell	Algonquin	Operation closed in December.
Tamarack Reclamation	Algonquin	Keweenaw	Do.
Algonquin Nos. 3 and Kingston	Algonquin	Algonquin	Do.
Algonquin Nos. 2 and No. 4	Algonquin	Algonquin	"Four rock" only.
Copper Range Co.	Mohawk	Do.	Do.
Atlantic Tailings	Freda	Houghton	Operation closed in November.
Champion	Palmer	Algonquin	Operation closed in November.
Farm Hill	Palmer	Algonquin	Operation closed in November.
Quincy Mining Co.	Massena	Algonquin	Operation closed in May.
White Pine Copper Co.	White Pine	Ontonagon	Mine and mill. On strike August 21 throughout balance of year.

See footnotes at end of table.

Table 17.—Principal producers and processors of metals, minerals, and mineral fuels—Continued

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Gypsum:			
Bestall Gypsum Division, Georgia-Pacific Corp.	Grand Rapids	Kent	Mining, calcining, and fabricating.
Grand Rapids Gypsum Co.	Grand Rapids	Kent	Mining (underground), calcining, and fabricating.
Michigan Gypsum Co.	Whitewater	Iosco	Mining.
National Gypsum Co.	Whitewater	Iosco	Mining.
United States Gypsum Co.	Tawas City	Wayne	Mining and fabricating.
Do.	Albion	Wayne	Mining.
Do.	Detroit	Wayne	Calcining and fabricating.
Iron ore:			
Cleveland-Cliffs Iron Co.	Negaunee	Marquette	Stockpile shipments only.
Duquesne Hill and Mesabi	Isipeming	Do.	Ore treated at the Ore Improvement Plant. Underground mine closed in December.
Cliffs shaft	Negaunee	Do.	Pellets one from the Republic mine.
Engle Mills pellet plant	Isipeming	Do.	Open-pit mine, concentrator, and agglomerator.
Empire	Isipeming	Do.	Do.
Farm Hill	Isipeming	Do.	Underground mine. Ore treated at the Ore Improvement Plant and Finner Pellet Plant.
Mather	Negaunee	Do.	Pellets one from the Mather mine.
Ore improvement plant	Negaunee	Do.	Open-pit mine, concentrator, and agglomerator. Part of the concentrate pelleted at the Engle Mills Plant.
Republic	Republic	Do.	Stockpile shipments only.
Tilden	Isipeming	Do.	Stockpile shipments only.
The Hanna Mining Co.	Iron Mountain	Dickinson	Open-pit mine, concentrator, and agglomerator.
Crowland	Stambaugh	Iron	Stockpile shipments only.
Hawthorn	Mineral Hill	Do.	Underground mine.
Inland Steel Co.	Iron River	Do.	Do.
Brumley	Crosby Falls	Do.	Do.
Sherwood	Iron River	Do.	Do.
Young & Langille Steel Corp.	Iron River	Do.	Do.
North Range Mining Co.	Negaunee	Marquette	Do.
Pickands Mather & Co.	Champion	Do.	Underground mine closed in August.
Peterson	Bessemer	Gogebic	Stockpile shipments only.
Iron and steel:			
Ford Motor Co.	Dearborn	Wayne	Iron blast furnaces and open-hearth steel furnaces.
McLaurin Steel Corp.	Trenton	Do.	Do.
National Steel Corp., Great Lakes Steel Division	Ecorse	Do.	Do.
Liberal Lime Co.	River Rouge	Do.	Quicklime, one shaft; and one rotary kiln.
The Dow Chemical Co.	Lodi	Manistee	Quicklime, three rotary kilns, one continuous hydrator.
Hemlock Chemicals Division, Allied Chemical Corp.	Detroit	Wayne	Quicklime, pot kiln.
Marblehead Lime Co.	River Rouge	Do.	Quicklime, two rotary kilns.
Wyandotte Chemicals Corp.	Wyandotte	Do.	Quicklime, nine shaft kilns.
Petroleum refiners:			
Bay Refining	Bay City	Bay	Do.
Cuyahoga Refining Co.	Carson City	Montcalm	Do.
Lakeland Refining Co.	Kalamazoo	Do.	Do.
Leonard Refining, Inc.	Alma	Groton	Do.
Roscoff Division	St. Ignace	Isabella	Do.
Marathon Oil Co.	Eastport	Wayne	Do.
Naph-Sol Refining Co.	Manistee	Manistee	Do.
Oscoda Refining Co.	West Branch	Saginaw	Do.
Petroleum Refining, Inc.	Flat Rock	Wayne	Do.
Secum Malth Oil Co.	Trenton	Do.	Do.
Peat:			
Anderson Peat Co.	Imley City	Lapeer	Reed-sedge.
Fletcher & Ripart	New Hudson	Sanilac	Moss and reed-sedge.
J. M. Hunter Peat Co., Inc.	Sandusky	Huron	Do.
Michigan Peat Co.	Imley City	Lapeer	Reed-sedge.
Do.	Imley City	St. Clair	Reed-sedge bog extends into St. Clair County.
Do.	Minden City	Sanilac	Reed-sedge bog extends into Lapeer County.
Do.	Minden City	Sanilac	Reed-sedge.
Expanded perlite:			
Bestall Gypsum Division, Georgia-Pacific Corp.	Grand Rapids	Kent	Do.
National Gypsum Co.	Grand Rapids	Kent	Do.
United States Gypsum Co.	Detroit	Wayne	Do.
Salt and minerals:			
American Salt Corp.	Midland	Midland	Salt.
Huron Crystal Salt Co.	St. Clair	St. Clair	Do.
The Dow Chemical Co.	Ludington	Manistee	Bromine, calcium compounds, and magnesium compounds.
Do.	Midland	Midland	Bromine, calcium compounds, iodine, and magnesium compounds.
Do.	Flint City	Manistee	Bromine, plant closed in June.
Great Lakes Chemical Corp.	Flint City	Manistee	Magnesium compounds.
Huron Chemical Refractories Co.	Flint City	Manistee	Underground salt mine.
International Salt Co., Inc.	Detroit	Wayne	Magnesium compounds.
River Aluminum & Chemical Corp.	Midland	Midland	Salt.
Manitowac Salt Works, Division Hardy Salt Co.	Manistee	Manistee	Salt.
Michigan Chemical Corp.	East Lake	St. Louis	Bromine.
Do.	St. Louis	Gratiot	Bromine, calcium compounds, magnesium compounds, and salt.
Morton Chemical Co., Division Morton International, Inc.	Manistee	Manistee	Bromine, calcium compounds, and magnesium compounds.
Morton Salt Co., Division Morton International, Inc.	Do.	Do.	Salt.
Do.	Port Huron	St. Clair	Do.
Do.	Wayne	Wayne	Do.
Standard Lime & Refractories Co., Division of Martin Marietta Corp.	Manistee	Manistee	Magnesium compounds.
Wilkinson Chemical Corp.	Wayne	Wayne	Do.
Wyandotte Chemicals Corp.	Wyandotte	Wayne	Calcium compounds and salt.

See footnotes at end of table.

Table 17.—Principal producers and processors of metals, minerals, and mineral fuels 1—Continued

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Sand and gravel: ¹			
American Aggregates Corp.	Kalamazoo	Kalamazoo	Stationary plant.
Do.	Brighton	Livingston	Do.
Do.	Romeo	Macomb	Do.
Arrowhead Silica Corp., Manley Bros. Division	Orford	Oakland	Stationary plant, industrial sand.
J. V. Burkett	St. Joseph	Do.	Do.
Construction Aggregates Corp.	Grand Haven	Oakland	Stationary plant.
Grand Haven Quarry Co.	Grand Haven and Grand Rapids	Oakland	Stationary plant, industrial sand.
Great Lakes Foundry Sand Co.	Ypsilanti	Washtenaw	Stationary plant.
Highway Sand & Gravel Co., Inc.	Various locations	Genesee	Do.
Do.	Do.	Livingston	Do.
Do.	Do.	Oakland	Do.
Do.	Do.	Washtenaw	Do.
Highway Sand & Gravel Plant, T. F. Burroughs & Son, Inc.	Davidsburg	Washtenaw	Stationary plant.
Manley Sand Division, Martin Marietta Corp.	Bridgman	Berrien	Stationary plant, industrial sand.
Michigan Silica Division, Ottawa Silica Co.	Rockwood	Wayne	Stationary plant and dredge.
Mickelson Corp.	Detroit	Oakland	Do.
Natural Aggregates Corp.	Brighton	Livingston	One stationary and one portable plant.
Do.	Romeo	Macomb	Stationary plant.
New Hudson Sand & Gravel, Inc., Texas Industries, Inc.	New Hudson	Oakland	Do.
The Nugent Sand Co., Inc.	Muskegon	Muskegon	Stationary plant, industrial sand.
Ford & Scherer, Inc.	Various locations	Allegan	Do.
Do.	Do.	Berrien	Do.
Do.	Do.	Calhoun	Do.
Do.	Do.	Kalamazoo	Do.
Do.	Do.	Kenosha	Do.
Do.	Do.	Ottawa	Do.
Do.	Do.	Washtenaw	Do.
Sand Products Corp.	Marlette	Manistee	Stationary plant, industrial sand.
Do.	Marquette	Manistee	Do.
Sargent Sand Co.	Ludington	Mason	Do.
Do.	Ypsilanti	Township	Do.
Standard Sand Co.	Grand Haven	Oakland	Do.
Do.	South Haven	Oakland	Do.
John G. Yerington	Otsego	Allegan	Do.
Do.	Hawling and Middleville	Berrien	Do.
Do.	Berrie Springs, Pechanga, East Chilo, and Waterford	Berrien	Do.
Do.	Burlington	Calhoun	Do.
Do.	Dowagiac and Marcellus	Washtenaw	Do.
Do.	Charlotte	Easton	Do.
Do.	Kalamazoo	Kalamazoo	Do.
Do.	St. Joseph	St. Joseph	Do.
Do.	Keesler and Lawrence	Van Buren	Do.
Silver:			
White Pine Copper Co.	White Pine	Ontonagon	Primary copper smelter.
Smelters:			
Colwell & Healy, Inc.	Calumet	Houghton	Do.
Quincy Mining Co.	Hubbell	Houghton	Do.
White Pine Copper Co.	White Pine	Ontonagon	Do.
Stones:			
Limestone: ²			
Diamond Dolomite, Inc.	De Tour Village	Chippewa	Do.
Dunham Cement Co.	Dunham	Manistee	Do.
The Payne Stone Co.	Monroe	Monroe	Do.
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	Do.
Inland Lime & Stone Co., Division of Inland Steel Co.	Manistique	Manistique	Do.
Do.	do.	Schoolcraft	Do.
The Michigan Stone Co.	Mayhew and Ottawa Lake	Monroe	Do.
Penn-Dixie Cement Corp.	Potosi	Presque Isle	Do.
Progress Limestone	Alpena	Presque Isle	Do.
United States Steel Corp.	Calmarville	Manistee	Do.
Do.	Rogers City	Presque Isle	Do.
Refractories: ³			
Lehigh Refractories, Inc.	Alma	Genesee	Hydroforming process.
Marathon Oil Co.	Detroit	Wayne	Parsons process.
Marshall Oil Co., Inc.	Trenton	Washtenaw	Glass process.
Exfoliated vermiculite:			
Zeolite Division, W. R. Grace & Co.	Dearborn	do.	do.

¹ Data regarding producers of natural gas, natural gas liquids, and petroleum are not available.
² All companies listed under "Clays and shale" operated pits and processing plants; products manufactured are shown under "Remarks" column.
³ Except for International Salt Co., Inc., who operated an underground salt mine, all companies listed processed wet brines and recovered the products shown under "Remarks" column.
⁴ Portable plants were operated at the listed locations unless otherwise specified.
⁵ All companies operated stationary plants at the listed locations and produced crushed limestone.

PLATES

Photographs of several mineral operations taken during 1968



Photo 1—Quincy Mining Company's Reclamation Plant at Hubbell. Prior to closing in 1967 this plant reclaimed copper from coarse rejects of the old Quincy Mill.



Photo 2—Portable plant of Superior Sand and Gravel Company operating in glacial outwash material just outside of city of Hancock, Houghton County.



Photo 3—Peat operation of Michigan Peat Company, about 3 miles southwest of Minden, Sanilac County. After aging, this mountain of peat will be processed, packaged and marketed for garden and soil conditioning.



Photo 4—Rock from this recently opened quarry near Coffey Corner, Mackinac County is for construction of harbor facilities at Sand Products' new sand plant to be some ten miles southeast on Lake Michigan.



Photo 5—New shale quarry of Medusa Portland Cement Company, about one mile southeast of Ellsworth, Antrim County. Shale is that of the Ellsworth Formation of Early Mississippian Age.



Photo 6—View of Standard Lime & Refractories Company's plant near Stronach, Manistee County. Expansion currently underway includes facilities for production of a high purity periclase and present product line to include highburn magnesia production.

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