

**MINERAL INDUSTRY
OF MICHIGAN,
1973**

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Annual Statistical Summary 21

The Mineral Industry of Michigan, 1973

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Cover illustration by James Campbell represents one of the many natural brine wells in Michigan. Chemicals produced from natural salines — or brines — including bromine, calcium chloride, iodine, and magnesium compounds, form the basis of the state's preeminent chemical industry.

Michigan is one of the nation's leading producers of natural brines.

Lansing, Michigan

1976

The Mineral Industry of Michigan

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey Division of the Michigan Department of Natural Resources, under a memorandum of understanding for collecting information on all minerals except coal and liquid fuels.

By Grace N. Broderick ¹

The value of mineral production in Michigan in 1973, \$789.0 million, showed a 13.6% increase over the record \$694.8 million set in 1972. Nonmetals accounted for \$437.9 million, 55.5% of the total; metals were valued at \$268.3 million, 34.0% of the total; and fuels were valued

at \$82.8 million, 10.5% of the total. Iron ore continued to be the leading commodity in terms of mineral value, followed by cement, copper, and sand and gravel.

¹ Physical Scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Michigan ¹

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland	5,901	\$111,410	6,242	\$123,442
Masonry	250	5,959	247	6,185
Clays	2,514	3,715	2,151	3,304
Copper (recoverable content of ores, etc.)				
short tons	67,260	68,874	72,221	85,943
NA	NA	8	NA	8
Gypsum	1,650	7,267	1,882	8,538
Iron ore (usable)				
thousand short tons	12,692	177,461	12,389	180,194
gross weight	1,509	22,753	1,545	26,056
Lime				
thousand short tons				
MgO equivalent	377,675	31,484	455,501	41,790
Natural gas	34,221	10,506	44,579	17,495
Natural gas liquids:				
Natural gasoline:				
thousand 42-gallon barrels	395	1,097	372	1,189
LP gases	833	2,274	691	2,529
do	219	2,190	282	2,172
Peat				
thousand short tons				
Petroleum (crude)	12,990	41,556	14,614	59,413
Salt	4,358	50,761	4,818	53,732
Sand and gravel	59,467	65,445	62,407	73,972
Silver (recoverable content of ores, etc.)				
thousand troy ounces	785	1,323	850	2,175
thousand short tons	39,754	50,317	45,886	60,494
Stone				
thousand short tons				
Value of items that cannot be disclosed:				
Bromine, calcium-magnesium chloride, and iodine	XX	40,367	XX	40,392
Total	XX	694,767	XX	789,022
Total 1967 constant dollars	XX	573,252	XX	^p 579,300

^p Preliminary. NA Not available. XX Not applicable.

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

Table 2.—Value of mineral production in Michigan, by county¹
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Alcona	\$49	\$139	Sand and gravel.
Alger	52	W	Do.
Allegan	999	1,293	Sand and gravel, petroleum, stone, natural gas, peat.
Alpena	49,296	50,072	Cement, stone, clays, sand and gravel.
Antrim	W	W	Clays, sand and gravel, petroleum.
Arenac	1,195	W	Petroleum, stone, sand and gravel.
Baraga	W	W	Sand and gravel.
Barry	W	W	Sand and gravel, petroleum, stone.
Bay	11,796	12,840	Cement, sand and gravel, petroleum, lime.
Benzie	W	20	Sand and gravel.
Berrien	3,088	W	Sand and gravel, stone.
Branch	W	W	Sand and gravel.
Calhoun	5,546	5,705	Petroleum, sand and gravel, stone.
Cass	W	W	Sand and gravel, stone.
Charlevoix	W	W	Cement, stone, sand and gravel.
Cheboygan	W	W	Stone, sand and gravel.
Chippewa	W	W	Do.
Clare	1,390	1,596	Petroleum, sand and gravel, natural gas.
Clinton	616	W	Sand and gravel, clays.
Crawford	W	W	Petroleum, natural gas, sand and gravel.
Delta	W	W	Sand and gravel, stone.
Dickenson	31,998	31,469	Iron ore, sand and gravel, stone.
Eaton	735	1,322	Stone, sand and gravel, natural gas, petroleum, clays, peat.
Emmet	12,299	12,991	Cement, stone, clays, sand and gravel.
Genesee	700	1,101	Sand and gravel, petroleum.
Gladwin	875	1,095	Petroleum.
Gogebic	26	W	Sand and gravel.
Grand Traverse	620	2,651	Natural gas, petroleum, sand and gravel.
Gratiot	6,596	8,537	Magnesium compounds, calcium chlo- ride, salt, bromine, sand and gravel, petroleum, natural gas.
Hillsdale	10,085	10,754	Petroleum, natural gas liquids, nat- ural gas, sand and gravel.
Houghton	296	W	Sand and gravel, stone.
Huron	1,202	W	Stone, sand and gravel, lime, petro- leum.
Ingham	5,548	8,925	Petroleum, natural gas, sand and gravel, natural gas liquids, peat.
Ionia	W	W	Sand and gravel.
Iosco	6,775	W	Gypsum.
Iron	W	W	Iron ore, sand and gravel.
Isabella	649	W	Sand and gravel, petroleum.
Jackson	3,239	4,348	Petroleum, natural gas, sand and gravel, stone.
Kalamazoo	W	W	Sand and gravel, stone.
Kalkaska	W	10,496	Petroleum, natural gas, sand and gravel.
Kent	5,497	5,880	Sand and gravel, gypsum, petro- leum, stone, peat, natural gas.
Keweenaw	2	134	Sand and gravel.
Lake	483	436	Petroleum, sand and gravel.
Lapeer	1,812	2,172	Peat, sand and gravel, calcium chloride, petroleum, natural gas.
Leelanau	W	W	Sand and gravel.
Lenawee	1,335	382	Sand and gravel, clays.
Livingston	W	4,260	Sand and gravel.
Luce	W	95	Do.
Mackinac	W	W	Stone, sand and gravel.
Macomb	W	W	Sand and gravel, natural gas, petroleum.
Manistee	29,258	35,883	Magnesium compounds, salt, sand and gravel, petroleum.
Marquette	142,951	W	Iron ore, sand and gravel, stone.
Mason	30,251	36,508	Magnesium compounds, calcium chloride, lime, bromine, sand and gravel, petroleum.
Mecosta	393	W	Sand and gravel, petroleum, peat, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by county¹—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Menominee	W	\$213	Sand and gravel.
Midland	\$30,937	28,893	Bromine, calcium chloride, magne- sium compounds, salt, iodine, petroleum.
Missaukee	2,167	3,023	Petroleum, natural gas, sand and gravel.
Monroe	24,352	26,542	Cement, stone, clays, sand and grav- el, peat, petroleum.
Montcalm	568	622	Petroleum, sand and gravel.
Montmorency	27	59	Sand and gravel.
Muskegon	2,646	W	Sand and gravel, salt, petroleum.
Newaygo	² 132	W	Sand and gravel, petroleum.
Oakland	W	14,898	Sand and gravel, peat, stone, petro- leum.
Oceana	385	458	Sand and gravel, petroleum.
Ogemaw	2,275	3,330	Petroleum, sand and gravel, natural gas.
Ontonagon	70,444	88,410	Copper, silver, sand and gravel, stone.
Osceola	2,616	2,640	Petroleum, natural gas liquids, sand and gravel, stone.
Oscoda	10	16	Sand and gravel, petroleum.
Otsego	W	11,853	Petroleum, natural gas, sand and gravel.
Ottawa	4,379	4,752	Sand and gravel, petroleum, clays, natural gas, stone.
Presque Isle	21,528	25,736	Stone, sand and gravel.
Roscommon	1,255	1,372	Petroleum, natural gas, sand and gravel.
Saginaw	766	W	Sand and gravel, clays, lime, petro- leum, stone.
St. Clair	26,669	23,854	Salt, petroleum, natural gas, nat- ural gas liquids, cement, stone, sand and gravel.
St. Joseph	269	W	Sand and gravel, peat, stone.
Sanilac	1,546	W	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone, sand and gravel.
Shiawassee	764	W	Sand and gravel, peat, clays, petro- leum.
Tuscola	W	W	Sand and gravel, lime, petroleum.
Van Buren	158	122	Sand and gravel, petroleum.
Washtenaw	W	2,112	Do.
Wayne	61,212	68,638	Cement, lime, salt, stone, sand and gravel, clays, petroleum.
Wexford	W	W	Sand and gravel, natural gas, petro- leum.
Undistributed ³	72,008	230,376	
Total ⁴	694,767	789,022	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
¹ Value of petroleum is based on an average price per barrel for the State.² Excludes value of natural gas.³ Includes values for gem stones, some sand and gravel and stone (1973) that cannot be assigned to specific counties, and values indicated by symbol W.⁴ Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

	1972	1973 ^p	Change, percent
Employment and labor force, annual average:			
Total labor force ----- thousands --	3,728.0	3,801.0	+2.0
Unemployment ----- do -----	260.0	221.0	-15.0
Employment:			
Manufacturing ----- do -----	1,085.6	1,163.6	+7.2
Contract construction ----- do -----	126.0	127.3	+1.0
Mining ----- do -----	12.1	12.5	+3.3
Transportation and public utilities ----- do -----	148.4	153.0	+3.1
Wholesale and retail trade ----- do -----	628.6	647.1	+2.9
Finance, insurance, and real estate ----- do -----	124.4	126.6	+1.8
Services ----- do -----	465.7	491.0	+5.4
Government ----- do -----	526.0	533.7	+1.5
Personal income:			
Total ----- millions --	\$44,325	\$49,190	+11.0
Per capita ----- do -----	\$4,881	\$5,439	+11.4
Construction activity:			
Valuation of nonresidential construction -- millions --	\$596.5	\$674.0	+13.0
Number of private and public residential units authorized -----	76,597	70,397	-8.1
State highway department:			
Contracts awarded ----- millions --	^c \$248.8	\$225.7	-9.3
Portland cement shipments to and within Michigan thousand short tons --	3,231	3,249	+6
Farm marketing receipts ----- millions --	\$1,104.6	\$1,539.1	+39.3
Mineral production value ----- do -----	\$694.8	\$789.0	+13.6

^c Estimate. ^p Preliminary.
Sources: Survey of Current Business, Employment and Earnings, Farm Income Situation, Construction Review, Area Trends in Employment and Unemployment, Roads and Streets, and the U.S. Bureau of Mines.

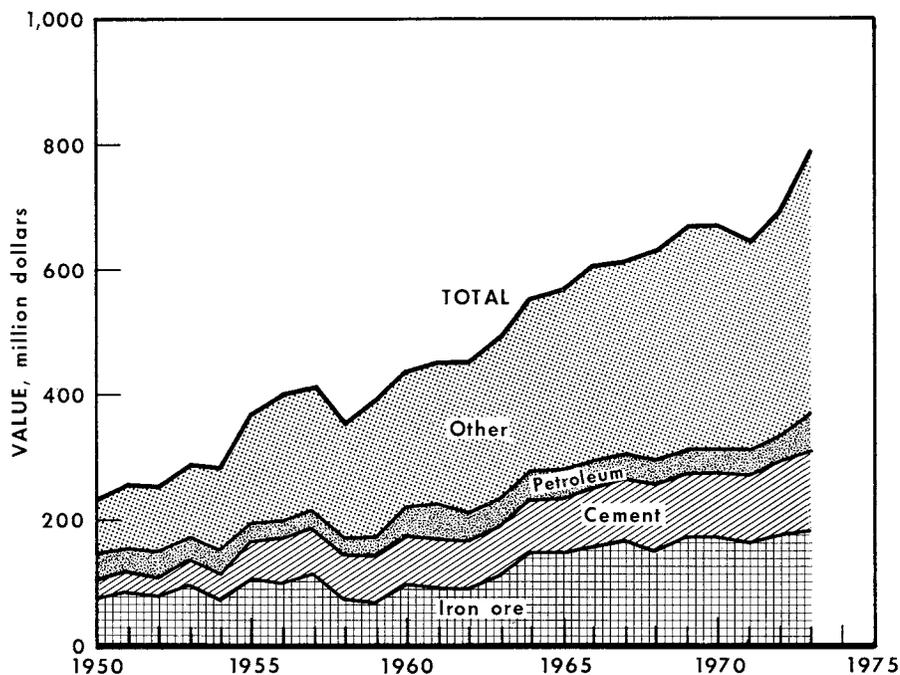


Figure 1.—Value of iron ore, petroleum, cement, and total value of all minerals produced in Michigan.

The major part of the total Michigan mineral value continued to be contributed by nonmetallic mineral commodities. Cement ranked first in value among the nonmetals, followed by sand and gravel, stone, salt, and magnesium compounds. Nationally, Michigan ranked first in production and value of calcium-magnesium chloride and gypsum. It ranked second to Arkansas in value of bromine production, and second to Louisiana in value of salt production. It was the only domestic producer of iodine. Other nonmetallic minerals produced were clays, lime, and gem stones.

Metallic minerals represented 34% of the total value of mineral production in 1973. Iron ore shipments decreased from 12.7 million long tons valued at \$177.5 million in 1972 to 12.4 million long tons valued at \$180.2 million in 1973. Production of copper, in terms of recoverable metal, increased 7.4% over that of 1972. A small amount of silver was recovered from copper ore.

Mineral fuels (natural gas, natural gas liquids, peat, and petroleum) provided 10.5% of the total mineral output value. Oil production was valued at \$59.4 million, an increase of 43% over that of 1972. Value of marketed natural gas production was \$17.5 million, an increase of 66.5%. Output of natural gas liquids declined for the fourth successive year. Production of peat increased in quantity but declined in value in 1973, and Michigan continued to be the largest producer of peat in the Nation. Peat was sold principally for soil improvement; none was sold as a fuel.

In May, Consumers Power Co. received authorization from the Atomic Energy Commission to operate the Palisades nuclear power plant near South Haven at its full 700,000-kilowatt capacity. However, it operated only intermittently and closed down for repairs in August. This plant, which began generating electricity in late 1971, is the second nuclear power plant operated by Consumers Power Co. and has 10 times the generating capability of its Big Rock Point plant, which began operation in 1962. The company's third and largest nuclear plant is under construction on a 1,000-acre site south of The Dow Chemical Co. industrial complex at Midland. The plant, scheduled to begin operation in 1979, will be capable of gen-

erating 1.3 million kilowatts of electricity for the Consumers Power system and will also process steam for industrial use by Dow Chemical.

Work was progressing on two additional generating units at Consumer Power Co.'s Dan E. Karn plant near Essexville. Each of the units will be oil-fired and will have a capacity of 660,000 kilowatts. The first of the units is to begin operation in late 1974, and the second toward the end of 1975.

A coal-fired electric power generating unit will be added to the Port Sheldon (Campbell) plant of Consumers Power Co. The 800,000-kilowatt unit is scheduled for startup late in 1977. It will increase the generating capacity of the Port Sheldon plant to 1,450,000 kilowatts, which will make it the second largest plant in the Consumers Power system.

Detroit Edison Co. has four major conventional power plants planned or under construction. These are a coal-fired plant near Monroe, two coal-fired plants at Belle River in St. Clair County, and an oil-burning plant at the Greenwood complex about 15 miles northwest of Port Huron. It has under construction the Enrico Fermi No. 2 nuclear plant near Monroe and plans to build a sister reactor plant, Fermi No. 3, adjacent to it. The original Fermi plant, a pioneering "breeder" reactor, is being dismantled. Detroit Edison Co. also plans to construct two nuclear plants at its Greenwood complex, with completion of the first unit scheduled for the late 1970's and the second unit for the early 1980's.

Under construction on the shores of Lake Michigan south of Benton Harbor near Bridgman in Berrien County is Indiana & Michigan Electric Co.'s Donald C. Cook nuclear plant. The 2.2-million-kilowatt plant will serve three southwestern Michigan counties, but most of its power will go to Indiana and Kentucky.

At its new Portage station, north of the village of South Range, Upper Peninsula Power Co. has a new oil-fueled, gas turbine generating facility. The package-type 22,600-kilowatt unit is the first of its size in Upper Michigan.

A unique electric generating plant, the Ludington pumped storage hydroelectric plant, jointly owned by Consumers Power

Co. and Detroit Edison Co., was completed in October with the installation of the facility's sixth reversible pump-turbine unit. The plant, said to be the largest of its kind in the world, pumps water from Lake Michigan to a huge storage reservoir at night and on weekends when demand for electricity is low and releases it to flow through the generators during periods of peak electrical demand. The storage pond, which holds more than 27 billion gallons of water, covers 842 acres and has a shoreline more than 6 miles long. When the plant is generating electricity, up to 17.5 billion gallons of water may be transferred between the storage pond and the lake, moving at a maximum rate of more than 33 million gallons per minute. The plant was built at a cost of more than \$340 million. It was designated the Outstanding Civil Engineering Achievement of 1973 by the American Society of Civil Engineers.

Burlington Northern, Inc., added three more unit trains to its coal-hauling service, which involves transporting low-sulfur coal from Montana and Wyoming to electric power plants in Michigan, Indiana, and West Virginia. One of the new operations linked a recently opened coal mine at Decker, Mont., with the Detroit Edison Co. generating plants at St. Clair, Mich. The unit trains haul the coal some 1,000 miles to Superior, Wis., where it is transferred to ships for the 720-mile run to Michigan. By 1976, volume is expected to reach 5 million tons yearly.

According to the district office of the Army Corps of Engineers, cargoes passing through the Soo Locks at Sault Ste. Marie during a record 314-day shipping season totaled 97 million tons, which included 65.2 million tons of iron ore. The season opened April 1, 1972, and closed on February 8, 1973.

The higher-than-normal water levels of Lake Michigan allowed Inland Lime and Stone Co. to set a new record for the most limestone to be loaded on a boat at its Port Inland harbor. On June 22 the steamer *Detroit Edison* loaded 21,795 tons of stone, nearly a thousand tons more than the previous record.

Legislation and Government Programs.—Michigan's Oil and Gas Conservation Law, Public Act 61 of 1939, was again amended by the legislature. One of the amendments was a provision to levy and

collect a fee not in excess of 1% based on the gross cash market value of all oil and gas produced in the State. Another repealed Act 326, Public Acts of 1937, which governed the drilling of natural dry gas wells. The Director of the Department of Natural Resources was designated as the Supervisor of Wells, and the Advisory Board was increased from six to eight members, two of whom were to be chosen from the public. The amended act became effective in July.

New legislation was introduced under the title of the Michigan Energy Resources Act. This act contains essentially the same language as Act 61 but is more comprehensive. It would in effect replace Act 61 and repeal Act 9, now administered by the Public Service Commission. The proposed legislation seeks to clarify ambiguities in responsibility that have grown up through 70 years of piecemeal energy legislation, to provide a continuous information inventory on available energy supplies with an annual Energy Resources Report to the legislature and to the people, and to research new sources of energy and better uses of existing energy. It would give the Department of Natural Resources full and unambiguous authority over oil and gas exploration, drilling, and production, and over the safety aspects of natural gas storage. The Public Service Commission would be responsible for monitoring the supply and distribution of Michigan's energy resources.

A bill to amend Act 326, Public Acts of 1913, was introduced for the purpose of removing from the authority of the Department of Natural Resources the right to permit oil and gas exploration and development on the bottomlands of the Great Lakes. If enacted, the Department of Natural Resources Commission's policy of prohibiting leases on State-owned bottomlands of the Great Lakes would become law.

A land use proposal bill was introduced to regulate the use and development of certain lands, to create a State land use commission, to prescribe its powers and duties, to provide for regional and local planning commissions, to prescribe their powers and duties, to provide for a State land use plan, to provide for a State clearinghouse relative to land planning and development, to create certain councils and adjudicatory boards, to prescribe

duties of the Department of Natural Resources and other State agencies, and to prescribe penalties.

Another bill that was introduced proposes the establishment of a Michigan Solid Waste Authority.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives, Manufactured.—Metallic abrasive producers in 1973 were Abrasive Materials, Inc., at its Hillsdale plant, Hillsdale County; Cleveland Metal Abrasive Co. at its Howell plant, Livingston County; and Ervin Industries, Inc., at its Adrian plant, Lenawee County. The State ranked second to Ohio in the manufacture of metallic abrasives.

Bromine.—Output of elemental bromine decreased 3.8% in quantity and 1.9% in value in 1973. Three companies sold or used elemental bromine. These were The Dow Chemical Co. at its Ludington and Midland plants in Mason and Midland Counties, respectively, Morton Chemical Co. in Manistee County, and Michigan Chemical Corp. in Gratiot County. Michigan ranked second to Arkansas in output and value of elemental bromine. Bromine compounds sold or used by producers in Michigan included ethylene dibromide, hydrobromic acid, ethyl bromide, methyl bromide, ammonium bromide, sodium bromide, potassium bromide, and other bromine compounds.

Calcium-Magnesium Chloride.—Three companies recovered calcium-magnesium chloride from brine: The Dow Chemical Co. at Ludington, Mason County, and Midland, Midland County; Michigan Chemical Corp. at St. Louis, Gratiot County; and Wilkinson Chemical Corp. at Mayville, Lapeer County. Output increased 2.8% in quantity and 4.8% in value.

Cement.—Portland cement shipments increased 5.8%, and value of shipments increased 10.8%. Counties that shipped portland cement were Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne. Average mill value of portland cement increased to \$19.78 per ton from \$18.88 per ton in 1972. Yearend stocks of portland cement at mills were 570,366 tons, compared with 763,454 tons in 1972. Ninety-three percent of the portland cement shipped was Type I and II (general use and moderate heat); the remainder was Type III (high-early strength), white,

slag-pozzolan, block, expansive, and Type V (high-sulfate-resistance). Consumption of portland cement in Michigan totaled 3,198,000 tons. It was consumed by ready-mix concrete companies (67%), concrete product manufacturers (15%), building material dealers (6%), and contractors and other users (12%).

Masonry cement shipments decreased 1.4%, but value rose 3.8%. Masonry cement was produced in Alpena, Bay, Emmet, and Wayne Counties. Average mill value of masonry cement was \$25.04 per ton, compared with \$23.82 per ton in 1972. Yearend stocks of masonry cement at mills were 67,490 tons, compared with 61,709 tons in 1972. Masonry cement consumed in the State totaled 179,000 tons.

Early in 1973, Martin Marietta Cement, Great Lakes Division began taking out its four old kilns, which did not lend themselves to modernization and pollution control requirements. The fifth and largest kiln continued in operation. Two new wet process kilns and related facilities were being planned.

A Federal Trade Commission (FTC) complaint charged that the 1971 purchase by St. Lawrence Cement Co. of BASF Wyandotte's cement operations illegally restrained competition in the Detroit area. As a result of an ensuing FTC order, the St. Lawrence Cement Co. sold its assets in Wyandotte Cement Inc. in Wyandotte, Mich.

At the Wyandotte cement plant, a dust abatement facility said to be the first of its kind in the United States was installed to capture the air pollutants generated during the unloading of basic cement-making materials from lake freighters at the plant's Detroit River dock.³ The dock-side dust collector sucks in dust as the materials move by conveyor from ship to shore. The motor-driven vacuum can draw 22,100 cubic feet per minute. Dacron bags collect the dust.

Huron Cement Division of National Gypsum Co. is building two new kilns to

³ Michigan Manufacturer & Financial Record. V. 131, No. 5, May 1973, p. 15.

replace 12 smaller kilns, some of which were built as long ago as 1923. When the present program is completed in 1975, the Alpena plant will include five nonpolluting, high-capacity kilns, and 22 older kilns will have been replaced since 1966.

Two company name changes that should be noted follow: The America Cement Corp. became Amcord, Inc., and Penn-Dixie Cement Corp. became Penn-Dixie Industries, Inc.

Table 4.—Michigan: Portland cement salient statistics (short tons)

	1972	1973
Number of active plants	9	9
Production	6,180,940	6,006,643
Shipments from mills:		
Quantity	5,901,390	6,242,386
Value	\$111,409,545	\$123,442,328
Stocks at mills, Dec. 31	763,454	570,366

Clays.—Miscellaneous clays and shale were mined at 11 pits in 11 counties. Output of clay and shale decreased 14.4% in quantity and 11.1% in value from that of 1972. Eighty-six percent of the clay or shale was used in cement manufacture in 1973, compared with 81% used for this purpose in 1972. The use of plastic drainage tubing has lessened the use of clay for drain tile. Principal producing counties were Alpena, Antrim, Emmet, Monroe, Ottawa, Saginaw, and Wayne.

Peerless Cement Co., Div. of Amcord, Inc., closed its Smith Creek clay mine in St. Clair County at the end of 1972. In Wayne County, Clippert Brick Co. ceased making brick, and Light Weight Aggregate Corp. discontinued its clay operation. The Ludington clay pit in Mason County was mined in 1971 and 1972 by Walsh-Canonie Co. The clay was used to line the water reservoir constructed for the Ludington hydroelectric generating plant of Consumers Power Co. and Detroit Edison Co. which was completed in 1973.

Gem Stones.—Estimated total value of gem stones gathered in the State was about the same as in 1972. Stones usually found in the State include agate, amethyst, garnets, Petoskey stone, datolite, thompsonite, and rose quartz.

Gypsum.—United States Gypsum Co., National Gypsum Co., Georgia-Pacific Corp., Michigan Gypsum Co., and Grand Rapids Gypsum Co. mined gypsum in

Iosco and Kent Counties. Output increased 14% to 1,882,000 tons, a new annual record for Michigan. Among the States, Michigan ranked first in the production of gypsum. United States Gypsum Co., National Gypsum Co., Georgia-Pacific Corp., and Grand Rapids Gypsum Co. calcined gypsum in Iosco, Kent, and Wayne Counties. Output increased 11% to 596,000 tons, a new annual record.

Iodine.—The Dow Chemical Co., the sole domestic producer, continued to recover crude iodine from natural well brines at Midland. Production decreased nearly 20% in quantity and value from the 1972 figures.

Lime.—Six companies produced lime at nine plants in seven counties. Leading counties were Wayne and Mason. Leading companies were BASF Wyandotte Corp., Marblehead Lime Co., Detroit Lime Co., and The Dow Chemical Co. Output increased 2.4% to 1,545,000 tons, but value was 13% below the 1967 record. The lime was used for alkalies, steel (BOF), petrochemicals, and other uses. Most of the lime was consumed in Michigan, but some was shipped to Ohio and Indiana. Total consumption of lime in the State was 1,945,000 tons. Nationally, Michigan ranked fifth in quantity and fourth in value of lime produced. In 1972, the Wyandotte plant of BASF Wyandotte Corp. was sixth in the United States in order of total lime output.

Magnesium Compounds.—Michigan continued as the Nation's largest producer of magnesium compounds, accounting for over 53% of the U.S. total. Production increased 20.6% in quantity and 32.7% in value over the 1972 figures. Output came from Gratiot, Manistee, Mason, and Midland Counties.

A new plant to produce periclase, a magnesium oxide refractory material, is being built at Manistee for Martin Marietta Corp. The plant, scheduled to be completed in 1975, will have a capacity of 150 tons per day. Plans include a multiple-hearth calcining furnace, briquetting presses, and a high-temperature shaft kiln.

Perlite.—Crude perlite, mined in Western States, was expanded by National Gypsum Co. at its National City plant, Iosco County; by Harborlite Corp. at its Vicksburg plant, Kalamazoo County; and by United States Gypsum Co. at its De-

troit plant, Wayne County. The expanded perlite was used for filter aid and plaster aggregate.

Salt.—Salt was produced from one rock salt mine in Wayne County, the only underground salt mine in the State, and from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties. Output was 10.6% more than in 1972 and value 5.9% more. Nationally, Michigan ranked fourth in output and second in value of salt sold or used.

Sand and Gravel.—Michigan ranked second only to California in production of sand and gravel in the United States. Tonnage increased 4.9% and was valued at \$74 million, an increase of 13% over the 1972 value. Of the State's 83 counties, all but Gladwin, Iosco, and Midland Counties reported sand and gravel production. In each of 11 counties, output exceeded 1 million tons. These counties provided 53% of the State production. Five of these counties make up the metropolitan Detroit

area (Livingston, Macomb, Oakland, Washtenaw, and Wayne Counties) and produced 21.8 million tons.

Permanent magnet separators installed by J. P. Burroughs & Son, Inc., at its Salem and Holly plants in Oakland County have increased magnetite recovery. Old electromagnetic drums were replaced by permanent-magnet wet-drum separators built by Eriez Magnetics. These 30-inch-diameter separators are used to recover magnetite for use in heavy-media sink-float separation. Each drum has a capacity of 400 gallons per minute.³

American Aggregates Corp. plans to build a new gravel plant at Milford. The company also plans to build a new plant at Oxford; the present plant at this location was built in the 1920's. The new Oxford plant will enable the company to transport all of the excavated materials from the pit area to the plant by conveyor.

³ Pit & Quarry. V. 65, No. 10, April 1973, pp. 106-107.

Table 5.—Michigan: Sand and gravel sold or used by producers, by class of operation and use (Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	7,862	7,571	8,381	8,315
Glass	W	W	122	359
Engine	28	73	297	720
Fill	2,610	1,634	2,501	1,344
Molding	2,909	6,694	2,859	7,401
Paving	8,772	8,960	7,517	8,093
Other uses ¹	2,363	4,534	2,194	2,996
Total ²	24,544	29,465	23,900	29,229
Gravel:				
Building	7,344	11,037	8,478	13,571
Fill	288	283	453	383
Paving	17,942	19,204	19,035	21,930
Miscellaneous	1,716	1,464	4,317	3,964
Other uses ³	2,849	2,191	426	868
Total ²	30,139	34,181	32,709	40,716
Government-and-contractor operations:				
Sand:				
Building	4	1	61	45
Fill	349	92	803	437
Paving	700	213	994	712
Other uses	109	69	150	107
Total ²	1,662	375	2,008	1,301
Gravel:				
Building	127	90	—	—
Fill	420	26	672	364
Paving	2,508	1,290	2,923	2,207
Other uses	68	18	196	154
Total ²	3,122	1,424	3,791	2,725
Total sand and gravel ²	59,467	65,445	62,407	73,972

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
¹ Includes abrasives (1972), blast, enamel (1972), foundry, glass (1972), fire or furnace, grinding and polishing (1972), pottery, and other sands.

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

³ Includes railroads ballast and other gravel.

Table 6.—Michigan: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alcona	2	86	49	3	149	139
Alger	1	99	52	2	W	W
Allegan	5	902	542	7	735	785
Alpena	4	W	W	4	226	313
Antrim	2	84	158	2	W	W
Barry	5	387	485	5	417	520
Benzie	1	W	W	1	13	20
Berrien	12	1,483	W	6	1,680	W
Branch	3	249	W	3	360	W
Cass	7	322	238	4	407	417
Charlevoix	4	39	21	4	66	46
Cheboygan	4	91	32	2	W	W
Clare	3	W	W	3	183	113
Clinton	11	499	596	14	1,067	1,019
Crawford	1	48	28	4	W	W
Dickinson	3	W	186	5	306	230
Eaton	8	281	293	5	W	448
Emmet	3	225	148	3	87	108
Genesee	6	553	552	6	785	916
Gogebic	2	77	26	3	W	W
Grand Traverse	4	W	111	4	206	W
Gratiot	3	238	231	3	447	349
Houghton	3	W	W	3	277	299
Huron	6	301	191	8	363	266
Ingham	10	626	W	13	758	626
Ionia	3	294	W	4	W	W
Iron	2	153	159	1	46	97
Isabella	3	309	188	4	W	W
Jackson	4	350	262	4	385	509
Kalamazoo	6	836	1,244	7	983	1,436
Kalkaska	1	22	14	2	W	W
Kent	20	2,761	4,101	14	2,877	4,388
Keweenaw	1	17	2	1	81	134
Lake	2	49	44	1	23	27
Lapeer	9	879	558	7	536	440
Lenawee	7	1,099	1,328	4	385	367
Livingston	6	2,798	W	7	3,515	4,260
Luce	1	W	W	1	157	95
Mackinac	7	188	72	5	W	W
Macomb	11	3,017	2,964	10	2,808	2,765
Manistee	4	399	W	4	W	W
Marquette	8	1,081	817	9	1,079	1,286
Mecosta	2	W	189	2	W	376
Menominee	5	127	114	11	223	213
Montcalm	8	430	226	9	424	263
Montmorency	1	69	27	1	59	59
Newaygo	6	185	92	4	W	W
Oakland	25	12,439	14,198	23	11,754	14,838
Oceana	4	257	221	4	259	294
Ogemaw	3	488	W	5	957	1,471
Oscoda	1	W	W	3	362	W
Oscoda	1	7	5	1	12	11
Ostego	3	74	49	2	W	W
Ottawa	12	3,229	3,852	13	3,236	4,089
Roscommon	5	W	W	3	W	57
Saginaw	3	367	W	4	W	W
St. Joseph	3	W	W	1	213	284
Sanilac	5	W	W	7	650	527
Schoolcraft	1	62	3	1	43	39
Shiawassee	9	520	514	10	1,341	1,594
Tuscola	9	795	1,004	9	752	1,060
Van Buren	4	216	138	3	140	97
Washtenaw	8	1,816	2,285	8	1,777	2,099
Wayne	8	3,000	5,023	5	1,957	2,179
Wexford	2	W	W	3	80	81
Undistributed ¹	59	14,598	21,813	62	16,763	21,921
Total ²	395	59,467	65,445	396	62,407	73,972

¹ Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

² Includes Arenac, Baraga, Bay, Calhoun, Chippewa, Delta, Hillsdale, Iosco (1972), Leelanau, Mason, Midland (1972), Missaukee, Monroe (1973), Muskegon, Ontonagon, Presque Isle, St. Clair, and some sand and gravel that cannot be assigned to specific counties.

³ Data may not add to totals shown because of independent rounding.

Stone.—Michigan, with production of 45.9 million tons, ranked eighth in the Nation in output of stone. Production (principally crushed limestone and dolomite) increased 15.4% over that of 1972. The principal producing counties were Alpena, Chippewa, Mackinac, Monroe, Presque Isle, and Wayne.

Limestone operations are in many areas of the State, but the greatest concentrations of facilities are in southeast Michigan, around Saginaw Bay, on the shore of the northeast tip of the Lower Peninsula, and along the south shore of the Upper Peninsula. Among the leading producers are United States Steel Limestone Operations, United States Steel Corp.; Presque Isle Corp.; Inland Lime & Stone Co., division of Inland Steel Co.; National Gypsum Co., Huron Cement Division; and Bethlehem Mines Corp., Bethlehem Steel Corp. In 1973, these five companies accounted for 80% of the State's total stone production.

A large proportion of the material was

shipped by boat from company-operated ports on Lakes Huron and Michigan to steel mills, cement and lime plants, and other consumers. In table 8, the distribution of crushed and broken stone shipments by type of use is shown.

Small quantities of dimension stone have been produced in recent years for building purposes. Output in 1973 was 10,839 short tons valued at \$164,912.

Michigan remained the leading producer of marl with production reported from seven counties. It was sold for agricultural purposes. Cass, Calhoun, and Kalamazoo Counties provided the bulk of the material.

The France Stone Co.'s plant at Monroe, its largest operation, was being expanded in a \$110,000 project. The plant will be able to produce concrete and asphalt sand. All small products will be washed, and regular stone production will be increased.

Table 7.—Michigan: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension ¹	4	66	11	165
Crushed and broken:				
Limestone	31,301	35,360	36,573	42,515
Dolomite	7,499	12,104	8,448	14,393
Marl	79	81	73	79
Traprock	W	W	21	34
Other ²	870	2,707	760	3,308
Total ³	39,750	50,251	45,875	60,329
Grand total ³	39,754	50,317	45,886	60,494

W Withheld to avoid disclosing individual company confidential data; included with "Other."

¹ Includes limestone, dolomite, and sandstone.

² Includes granite, sandstone, marble (1972), and other stone.

³ Data may not add to totals shown because of independent rounding.

Table 8.—Michigan: Crushed and broken stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	W	1,213	1,225	1,636
Concrete aggregate	3,241	4,022	4,546	5,547
Dense graded roasbase stone	687	1,065	1,434	2,095
Surface treatment aggregate	W	181	353	596
Unspecified construction aggregate and roadstone	1,555	2,034	1,198	1,706
Agricultural purposes ¹	556	651	733	1,080
Cement manufacture	7,184	6,428	8,178	6,633
Flux stone	11,446	15,944	13,241	19,021
Lime manufacture	9,604	10,926	10,555	13,257
Railroad ballast	W	W	246	385
Riprap and jetty stone	353	629	411	612
Terrazzo	4	109	W	W
Other uses ²	5,121	7,051	3,755	7,761
Total ³	39,750	50,251	45,875	60,329

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

¹ Includes data for agricultural limestone, agricultural marl, and other soil conditioners, and poultry grit and mineral food (1973).

² Includes data for macadam aggregate, manufactured fine aggregate, chemical stone, fill, paper manufacture, and use not specified. In 1972 data include poultry grit and mineral food.

³ Data may not add to totals shown because of independent rounding.

Sulfur (Recovered).—Byproduct sulfur was recovered from crude petroleum by TOTAL Leonard, Inc. (Alma) and by Marathon Oil Co. (Detroit); a small amount was produced and shipped by Mobil Oil Corp. (Woodhaven) before operations were discontinued at this facility. Shipments decreased 22.4% in quantity and 28.3% in value.

Vermiculite.—Crude vermiculite, mined outside the State, was exfoliated at a plant in the Detroit area. It was sold for use in loose fill insulation, concrete aggregate, plaster aggregate, fireproofing, horticulture, and other uses.

METALS

Aluminum.—Martin Marietta Aluminum Inc. continued to operate its aluminum fabricating plant at Adrian, Mich. This plant, designed and built in World War II, has produced hard-alloy products for aircraft, military, and other governmental requirements. The company plans to close the facility because of factors that include a shortage of available primary metal and a dwindling demand for the military products that are the plant's specialty.

Copper.—Production of copper, in terms of recoverable metal, was 7.4% more than in 1972, and its value was 24.8% higher. The White Pine mine of White Pine Copper Co., Michigan's only productive copper mine, produced 8,935,480 tons of ore for an average production rate of 25,029 tons of ore per day, according to the 1973 Annual Report of The Copper Range Co., of which the White Pine Copper Co. is a subsidiary. This production exceeded the previous record high of 1969 by 735,564 tons. Refined copper production was 157,011,226 pounds, which exceeded the 1969 record by 301,532 pounds. Shipments of refined copper were 164,205,690 pounds, more than 8 million pounds greater than the 1969 record. The mill (concentrator) operated without interruption throughout the year and established a new record by treating 8,884,136 tons of ore, for an average of 24,886 tons of ore per day, and exceeding the previous record established in 1972 by 633,785 tons, or 1,840 tons per day. The mill recovered 86.22% of the copper contained in concentrates, which represented an improvement in recovery of 0.45% over that of 1972.

Table 9.—Michigan: Mine production (recoverable) of silver and copper

	1971	1972	1973
Mines producing: Lode	1	2	1
Material sold or treated:			
Copper ore	6,891	8,250	8,884
Copper tailings	--	40	--
Production (recoverable):			
Quantity:			
Silver	670,052	785,100	850,273
Copper	56,005	67,260	72,221
Value:			
Silver	\$1,036	\$1,323	\$2,175
Copper	58,245	68,874	85,943
Total	59,281	70,197	88,118

Of the 16 States that produced copper in 1973, Michigan ranked sixth, following Arizona, Utah, New Mexico, Montana, and Nevada; its production was 4.2% of the Nation's total.

Results of a Bureau of Mines study of fracturing and associated damage occurring in the vicinity of blastholes from five shots fired in the shale pillars in the White Pine mine were published.⁴

Homestake Copper Co., in conjunction with Michigan Technological University's Institute of Mineral Research and the

Bureau of Mines, is investigating the development of new mining techniques and processing procedures. Investigations on situ leaching procedures and on electronic sorting equipment are among those underway. The company's options to conduct exploration and research on Michigan copper properties owned by Universal Oil Products Co. were extended for another 3 years. More than 52 million gallons of

⁴ Siskind, D. E., R. C. Steckley, and J. J. Olson. Fracturing in the Zone Around a Blasthole, White Pine, Mich. BuMines RI 7753, 1973, 20 pp.

water were pumped from the Centennial No. 6 mine, near Calumet, and a shaft that is to be sunk to the 45th level was started on November 20.

The Department of Natural Resources leased about 26 square miles (16,941 acres) of State Forest land in Dickinson, Gogebic, and Iron Counties in the southwestern Upper Peninsula to three mining companies interested in searching for copper. The three mining companies (Cleveland Cliffs Iron Co., International Minerals & Chemical Co., and I & L Hardwood Uranium Co.) paid \$6,250 for the exploratory leases. They are required to restore to natural conditions any lands that their exploratory activity disturbs, and in the event copper deposits are discovered, the leases stipulate that no mining will be allowed until the companies prove that their operations will not have a substantial adverse effect on the environment. Exploration for new copper formations on State land started in 1965, when the Department of Natural Resources leased 4,941 acres in the southwestern Upper Peninsula, followed by leasing 240 acres, 1,000 acres, and 2,287 acres from 1966 through 1970.

A \$49,000 grant to support research on the in situ leaching of native copper and copper sulfide ores of the Upper Peninsula was received by Michigan Technological University's Institute of Mineral Research from the National Science Foundation and the Quincy Mining Co.

Iron Ore.—Iron ore shipments in 1973 were 12.4 million long tons, a slight decrease from the 12.7 million long tons shipped in 1972. The average weighted mine value for Michigan usable iron ore shipments in 1973 was \$14.54 compared with \$13.98 in 1972.

Production, measured as shipments,

came from the Mather and Sherwood underground mines and from the Empire, Groveland, and Republic open pit mines.

According to the Geological Survey Division of the Michigan Department of Natural Resources,⁵ shipments of iron ore on the Marquette range totaled 9,940,525 tons. The Pioneer pellet plant at Eagle Mills shipped 1,670,646 tons, of which 1,577,611 tons were pellets produced from Mather ore; the Empire mine shipped 3,688,854 tons; the Mather mine shipped 666,180 tons; and the Republic-Humboldt shipped 3,914,845 tons. On the Menominee range the Groveland mine shipped 1,969,354 tons and the Sherwood mine shipped 404,277 tons.

The Cleveland-Cliffs Iron Co. continued construction of the Tilden project and expansion of the Empire facility; these projects will increase the company's pellet-making capacity by 5.8 million tons per year.

A \$2.6 million oil storage terminal and truck loading station will be built at Rapid River by Cleveland-Cliffs to serve mining operations (principally the new Tilden mine) managed by the company in nearby Marquette County. The terminal will receive oil by pipeline from Alberta, Canada, and move it by truck to mine properties; it will be operated by Cliffs Fuel Service Co., a subsidiary.

For the first time in its history The Cleveland-Cliffs Iron Co. hired women as general laborers, who worked at cleanup, hosing, shoveling, general maintenance, and filling in on other jobs. Some worked as assistants to male welders and repairmen, and two are pellet cooler attendants.

⁵ Hardenberg, H. J., and R. C. Reed. 1973 General Statistics Covering Production of Michigan Iron Mines. Department of Natural Resources Geological Survey Division, 1973, table 1.

Table 10.—Usable iron ore¹ produced (direct-shipping and all forms of concentrates), by range
(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total		
				Gross weight		Iron content (percent)
				Ore ²	Iron content	
1854-1968	369,686	287,163	249,625	906,475	NA	NA
1969	10,048	3,869	—	13,417	8,183	60.99
1970	10,363	2,394	—	12,757	7,950	62.31
1971	9,495	2,424	—	11,919	7,384	61.95
1972	9,131	2,533	—	11,664	7,332	65.94
1973	9,036	2,404	—	11,440	7,210	63.02
Total ³	417,759	300,289	³ 249,625	967,672	NA	NA

NA Not available.

¹ Exclusive, after 1905, of iron ore containing 5% or more manganese.

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

³ Distribution by range partly estimated before 1906.

Table 11.—Michigan: Iron ore shipped from mines
(Thousand long tons)

Year	Direct-shipping ore ¹	Total concentrates and agglomerates	Total usable ore ²	Proportion of beneficiated ore to total usable ore (percent)
1969	1,972	12,086	14,058	86.0
1970	1,512	11,588	13,100	88.5
1971	1,439	10,393	11,833	87.8
1972	727	11,965	12,692	94.3
1973	463	11,927	12,389	96.3

¹ Includes crushed, screened, and sized ore not further treated.

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

Iron Oxide Pigments.—Iron oxide pigments were produced in Marquette County by the Cleveland-Cliffs Iron Co. Shipments increased substantially in quantity and value over those of 1972.

Pig Iron and Steel.—Pig iron and steel were manufactured in the Detroit area. Pig iron shipments and value increased 15.5% and 22.7%, respectively, compared with those of 1972. According to the American Iron and Steel Institute, Michigan produced 10,945,000 short tons of steel in 1973, compared with 9,380,000 short tons in 1972.

The Steel Division of Ford Motor Co. is substantially increasing its steelmaking capacity with a major expansion and modernization program at its Rouge manufacturing complex in Dearborn. The new hot strip mill, scheduled for operation by mid-1974, is the largest facility in Ford's operation. Slabs of steel will be heated at the new mill and then rolled into coiled strips from which automotive parts will be stamped. Construction was started on a new electric furnace shop, additional soak-

ing pits and annealing furnaces, and new processing and shipping facilities. The program, when completed, will increase Ford's steelmaking capacity by about 750,000 tons annually.

Cannon Muskegon Corp. installed three new 8,500-pound electric furnaces, one vacuum and two air-melt, to increase productive capacity at its specialty alloys melter at Muskegon. The company produces nickel, cobalt, stainless, and tool steel alloys in various ingot forms.

Jones & Laughlin Steel Corp. announced it would close the alloy bar production facility at its Warren plant by yearend. Steel melting capacity made available by this closing will be used for producing stainless products, which comprise the bulk of the Warren plant's output.

Saginaw Casting Division (formerly known as Valley Grey Iron Foundry) of Wilson Engineering, Saginaw, completed new electric melting facilities. This improvement, along with a recent plant expansion from 18,000 to 26,000 square feet,

has more than tripled Saginaw Casting's production capacity in the past year.

Hoskins Manufacturing Co., Detroit, manufacturer of metal alloys for the automotive industry, purchased a 20-acre site near Hamburg, for a new \$4.5 million melt shop and hot-rolling mill facility. The melt shop and hot-rolling processes located in part of Hoskin's Detroit plant will be relocated to the Hamburg facility.

Upper Peninsula Industries, Inc., a subsidiary of Zalk-Joseph Steel Co. of Duluth, established a new steel-fabricating plant in the Iron River area. The company will be located in the 12,500-square-foot former Cannon mine engine house.

Silver.—Silver was recovered from copper ore mined at the White Pine mine in Ontonagon County. Concentrates from a silver-recovery circuit in the White Pine mill were shipped to an outside smelter for silver recovery. Output of silver in 1973 was 8.3% more than in 1972, while value was 64.4% more than in 1972.

MINERAL FUELS

Coke.—Three companies operated oven-coke plants in Michigan in 1973. Total production of 3,871,000 short tons represented an increase of 5.3% over the 3,677,000 short tons produced in 1972. The majority of the coke was consumed by blast furnaces. Michigan ranked fifth among the States in coke production and fourth in coke consumption.

Natural Gas.—Marketed production of natural gas increased substantially, from 34,221 million cubic feet in 1972 to 44,579 million cubic feet in 1973, the largest volume ever produced in a single year in Michigan. Value was \$17,495,000, a 66.5% increase over that of 1972. To meet its needs, however, Michigan relies heavily on imports which, according to compilations by the Gas Section, Public Utilities Division, Michigan Department of Commerce, increased slightly from 906,684,020,000 cubic feet in 1972 to 907,122,475,000 cubic feet in 1973.

Proved recoverable reserves of natural gas in Michigan as of December 31, 1973, according to the American Gas Association, Inc. (AGA), totaled 1,548,508 million cubic feet, compared with 1,296,815 million cubic feet on December 31, 1972.

Consumers Power Co. started production at its synthetic-natural-gas (SNG)

plant at Marysville. The plant has an output of more than 100 million cubic feet of natural gas daily, which will be doubled when a second unit comes on stream in 1974. The plant is reported to be the largest gas-reforming facility in the world and the first large one of its kind to go into service in the Western Hemisphere. Feedstock for the plant comes from Alberta, Canada. Some liquids probably will be brought over to Marysville from northern Michigan wells, including strip-off from the gas-processing plants of Consumers Power Co. and Shell Oil Co. that are under construction at Kalkaska.

In South Chester Township, Otsego County, Michigan Hydrocarbons, Inc., has under construction a gas-processing plant with a rated capacity of about 15 million cubic feet of gas per day.

Mobil Oil Corp. opened its Aurelius plant in Ingham County in 1972; it also has a second gas-processing plant planned for Eaton Rapids.

Two natural-gas-processing plants that have shut down are Michigan Consolidated Gas Co.'s Willow Station plant, Washtenaw County, which closed at the end of 1972, and Consumers Power Co.'s St. Clair plant, St. Clair County, which closed as of July 1, 1973.

The Federal Power Commission (FPC) in April approved a settlement involving delivery of up to 3 million cubic feet of natural gas daily to be sold to the city of Manistique on Michigan's Upper Peninsula. In 1967, when the FPC authorized Great Lakes Gas Transmission Co. to build facilities to transport Canadian gas, it also provided for the delivery of 57 million cubic feet of gas daily to Michigan Consolidated Gas Co., of which 3 million cubic feet per day were allocated for resale to Manistique. None of the allocated gas, however, had been delivered to the city. The settlement provides for the residential and commercial customers of Manistique to start receiving natural gas service.

A \$1.2 million damage suit was filed by the State of Michigan against Amoco Production Co. and Cactus Drilling Corp. The companies were charged with negligence in connection with the drilling of Amoco's 1-22-E State-Whitewater wildcat in Grand Traverse County. A series of craters and gas blowholes developed near the drill site last April, and about 80 families were evacuated from the town of

Williamsburg and nearby areas. As a result of the incident, the Department of Natural Resources issued a Special Order requiring an intermediate casing string in wells drilled for oil and gas in the State.

Natural Gas Liquids.—Production of natural gas liquids decreased 13.4% from that of 1972, to 1,063,000 barrels. Of the total production, 372,000 barrels was natural gasoline and 691,000 barrels was liquefied petroleum (LP) gas. LP gases averaged \$3.66 per barrel, compared with \$2.73 in 1972, and natural gasoline averaged \$3.20 per barrel, compared with \$2.78 in 1972.

According to the AGA, proved reserves of natural gas liquids totaled 25,046,000 barrels at yearend 1973, compared with 19,026,000 barrels at yearend 1972.

Peat.—Michigan continued to lead the Nation in peat production, accounting for 37.2% of the U.S. total. Production, which increased from 208,691 short tons in 1972 to 236,340 short tons in 1973, was obtained from 11 counties. Lapeer and Sanilac Counties continued to be the leading producing counties. Production also came from Allegan, Eaton, Ingham, Kent, Mecosta, Monroe, Oakland, St. Joseph, and Shiawassee Counties.

Sales totaled 232,330 short tons in 1973, compared with 219,251 short tons in 1972. Reed-sedge peat accounted for 79.6% of the total sales, moss peat for 5.7%, and humus peat for 14.6%. Over 87% of the sales was in packaged form. Of the total output, 96.5% was used for general soil improvement, with the remainder being used as an ingredient for potting soils, mushroom beds, packing flowers, etc.

Petroleum.—Crude oil production in Michigan increased for the third consecutive year. Output in 1973 was 14.6 million barrels, or 12.5% above the 1972 level, and was valued at \$59.4 million. This production, however, was far short of the State's needs, and imports in 1973 amounted to 39,775,383 barrels, of which 22,826,153 million barrels came from Canada. In 1972, imports were 47,481,425 barrels.

Reserves of crude oil, according to the

American Petroleum Institute (API), were 72,444,000 barrels on December 31, 1973, compared with 62,002,000 barrels on December 31, 1972.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Michigan, according to the API, decreased from 309 wells in 1972 to 278 wells in 1973. Of the 278 wells drilled, 73 were completed as oil wells, 41 as gas wells, and 164 as dry holes. Overall success record was 41%; 39% of the exploratory wells were completed as oil and gas producers. The total footage drilled in new wells was 1,468,962 feet, of which 515,651 feet was in development completions and 953,311 feet was in exploratory completions.

Kalkaska, Otsego, Grand Traverse, and Manistee Counties in the northern part of Michigan's Lower Peninsula led the State in exploratory activity with a total of 84 exploratory well completions, of which 44 were successful (25 oil and 19 gas) for a success record of 52%. Kalkaska County had 29 exploratory completions with 16 discoveries (7 oil and 9 gas). Otsego County was second with 23 exploratory completions resulting in 10 oil wells and 13 dry holes; Grand Traverse County had 19 exploratory completions with 9 successes (2 oil and 7 gas); and Manistee County had 9 discoveries (6 oil and 3 gas) in 13 attempts.

Ingham, Calhoun, and Eaton Counties were active in exploration in the southern part of the Lower Peninsula. A total of 35 exploratory wells were completed in these 3 counties; 9 were completed as oil wells, 3 as gas wells, and 23 as dry holes for an overall success record of 34%.

Although interest in the Niagaran reef continued to dominate the State's activity, a completion in Hillsdale County (United Petroleum Co. and Earl Majeske's #1 May in NW¼ SW¼ NW¼ sec 14T, 6S, R2W, Adams Township), southeast of the famed Albion-Scipio trend, may renew interest in the Trenton Ordovician rocks in southern Michigan. The Albion-Scipio trend is the State's first and only 100-million-barrel oilfield.

Table 12.—Michigan: Oil and gas well drilling completions, by county, in 1973

County	Proved field wells ¹			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegan	---	---	1	---	---	---	1	1,161
Alpena	---	---	1	---	1	---	2	7,775
Antrim	---	---	---	---	---	1	1	6,860
Barry	---	---	---	---	---	1	1	3,410
Bay	---	---	---	---	---	2	2	7,704
Calhoun	---	2	6	2	2	7	19	66,421
Charlevoix	---	---	---	---	---	2	2	10,048
Chippewa	---	---	---	---	---	1	1	1,305
Clare	1	---	---	---	---	2	3	13,340
Crawford	---	---	---	2	2	1	5	86,836
Eaton	2	1	1	1	1	4	10	40,583
Gladwin	---	---	2	---	---	---	2	7,808
Grand Traverse	1	1	6	2	7	10	27	171,940
Hillsdale	2	---	1	---	---	5	8	32,162
Huron	---	---	---	---	---	1	1	9,038
Ingham	6	---	11	6	---	12	35	148,117
Jackson	---	---	---	---	---	3	3	11,765
Kalkaska	10	3	10	7	9	13	52	356,358
Livingston	---	1	5	---	---	---	6	25,195
Macomb	---	---	---	---	---	4	4	14,184
Manistee	1	---	---	6	3	4	14	75,585
Mason	2	---	---	1	2	4	9	44,537
Mecosta	---	---	---	---	---	3	3	10,901
Montcalm	---	---	1	---	---	4	5	17,529
Montmorency	---	---	---	---	---	1	1	5,875
Muskegon	---	---	1	---	---	---	1	1,710
Oceana	---	---	1	---	---	1	2	6,552
Osceola	---	---	---	---	---	1	1	4,135
Otsego	9	1	8	10	---	13	41	251,872
Presque Isle	---	---	---	---	---	3	3	13,248
St. Clair	1	---	1	---	---	2	4	9,863
Sanilac	---	---	---	---	---	1	1	7,554
Tuscola	---	---	1	1	---	---	2	15,689
Van Buren	---	---	1	---	---	---	1	1,196
Wexford	---	1	---	---	3	1	5	31,206
Total	35	10	57	38	31	107	278	1,468,962

¹ Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Major oil companies, who hold the largest blocks of acreage under lease, were again the most successful in finding oil and gas. In the northern area, Shell Oil Co. continued to lead the way, followed by Amoco Production Co., a Standard affiliate; in the southern area, Mobil Oil Corp. continued to be the leader. Michigan-based independents, long the mainstay and backbone of the State's oil and gas industry, also found new fields in the northern and southern regions.

A new portable, self-propelled drilling rig was acquired by Wagner Drilling Co. for drilling in Michigan's oilfields. The new unit, manufactured by Ideco, Oilfield Products Division of Dresser Industries, Inc., is reported to be the first of its kind in Michigan. The 80,000-pound rig is capable of drilling to about 6,500 feet with 4½-inch drillpipe and to depths of about 8,000 feet with 3½-inch drillpipe. It is 59 feet, 6 inches long when ready for the road, and is capable of road speeds up to 45 miles per hour.

Petroleum Refineries.—Michigan had six active refineries in 1973. The plants are scattered across the Lower Peninsula in Bay, Gratiot, Kalamazoo, Montcalm, Ogemaw, and Wayne Counties. They have a total capacity of 142,000 barrels of crude oil per day, with an actual current throughput of about 132,000 barrels daily.⁶ They all produce gasoline motor fuel, home heating oils, and residual industrial fuels; several also manufacture asphalt, jet fuels, solvents, and petrochemical industry feedstocks.

The Marathon Oil Co. refinery in Detroit, rated at 62,000 barrels per day, is the largest of the group. TOTAL Leonard, Inc.'s, refinery in Alma, rated at 43,000 barrels daily, is the next largest. Marathon Oil Co. uses crude from Michigan and also from Wyoming and Louisiana. TOTAL Leonard, Inc., uses about 50% Michigan production and imports the remainder from Canada. The Dow Chemical

⁶ Oil and Gas News. Michigan Plants Run 132,000 Barrels Daily. V. 80, No. 5, Feb. 1, 1974, pp. 10, 14.

Co. Bay Refining Div. in Bay City, rated at 17,000 barrels daily, uses some crude oil from Michigan, but its main source of supply is Canada.

The smaller refineries are Crystal Refining Co.'s operation in Carson City, Lakeside Refining Co.'s operation in Kalamazoo, and Osceola Refining Co.'s plant in West Branch. The latter company has been purchased by United Refining Co. of Warren, Pa., and plans are to increase its current capacity of about 9,500 barrels of crude per day to about 19,000 barrels daily when installation of new equipment is complete.

Pipeline Construction.—Shell Pipe Line Corp., at yearend, was about half finished with construction of its 85-mile crude oil pipeline system to transport oil from the Kalkaska area to the existing Lewiston facility of the Lakehead Pipeline Co. in Crawford County; the line connects with refineries in West Branch, Alma, and Marysville, near Port Huron.

Michigan Consolidated Gas Co., a Detroit-based utility, has under construction a pipeline that is to run from their South Kalkaska regulator station to their Woolfolk station near Big Rapids; existing lines will move the gas from there to Detroit. The company also has planned a 20-inch pipeline that is to run 10.7 miles from the

Fowlerville field to their Austin storage field, where it will tie in with existing 24- and 30-inch pipelines that connect the storage field with Detroit.

Construction was started on a 44-mile pipeline by Michigan-Ohio Pipeline Corp., a subsidiary of TOTAL Leonard, Inc. The 8-inch pipeline will run from TOTAL Leonard's refinery in Alma to its terminal in Bay City. It will carry petroleum products except liquefied petroleum gases.

Construction was completed on Consumers Power Co.'s 18.5-mile line connecting their Kalkaska processing plant with their Muskegon River line; the line will be put in use upon completion of the Kalkaska plant. Capacity of the 12-inch line is reported to be 117 million cubic feet per day without compression and 150 million cubic feet per day under full compression. In constructing this pipeline, a technique used in other parts of the country but never before used in Michigan was applied in running a section of gas pipeline under the North Branch of the Manistee River. Key to the new technique is a specially designed plow, designed to run as much as 6 feet underground, that simply pulls the pipe along behind as it breaks a subterranean passageway.⁷

⁷ Oil and Gas News, Consumers Pipeline Tests New Method. V. 79, No. 26, June 24, 1973, pp. 14, 19-20.

Table 13.—Principal producers¹

Commodity and company	Address	Type of activity	County
Abrasives, metallic:			
Abrasive Materials, Inc -----	Box 291 Hillsdale, Mich. 49242	Plant -----	Hillsdale.
Cleveland Metal Abrasive Co --	887 East 67th St. Cleveland, Ohio 44103	---- do -----	Livingston.
Ervin Industries, Inc -----	Box 1168 Ann Arbor, Mich. 48106	---- do -----	Lenawee.
Cement:			
Dundee Cement Co -----	Box 122 Dundee, Mich. 48131	Portland, wet process.	Monroe.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Portland and ma- sonry, wet process.	Bay.
Medusa Cement Co., Div. Medu- sa Corp.	Box 5668 Cleveland, Ohio 44101	Portland, wet process.	Charlevoix.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Portland and ma- sonry, dry process.	Alpena.
Peerless Cement Co., div. of Amcord, Inc.: Detroit plant -----	2000 The Executive Plaza Detroit, Mich. 48226	Portland and ma- sonry, wet process.	Wayne.
Penn-Dixie Industries, Inc ---	Box 307 Petoskey, Mich. 49770	---- do -----	Emmet.
Wyandotte Cement Inc -----	3505 Biddle Ave. Wyandotte, Mich. 48192	---- do -----	Wayne.

See footnote at end of table.

Table 13.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Clays and shale:			
Construction Aggregates Corp -	13600 104th Ave. Grand Haven, Mich. 49417	Pit and plant ----	Ottawa.
Dundee Cement Co -----	Box 122 Dundee, Mich. 48131	Pit -----	Monroe.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Pit -----	Saginaw.
Medusa Cement Co., Div. Medu- sa Corp.	Box 5668 Cleveland, Ohio 44101	Pit -----	Antrim.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Pit -----	Alpena.
Peerless Cement Co., div. of Amcord Inc.	2000 The Executive Plaza Detroit, Mich. 48226	Pit -----	Wayne.
Penn-Dixie Industries, Inc ----	Box 307 Petoskey, Mich. 49770	Pit -----	Emmet.
Coke:			
Semet-Solvay Div., Allied Chem- ical Corp.	Box 70 Morristown, N.J. 07960	Coke ovens -----	Wayne.
Ford Motor Co -----	The American Rd. Dearborn, Mich. 48121	---- do -----	Do.
National Steel Corp., Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	---- do -----	Do.
Copper:			
White Pine Copper Co., subsidi- ary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Mine and mill ----	Ontonagon.
Gypsum:			
Georgia-Pacific Corp., Gypsum Div.	900 SW 5th Ave. Portland, Oreg. 97204	Underground mine and calcining and board plant.	Kent.
Grand Rapids Gypsum Co ----	Box 1674 Grand Rapids, Mich. 49501	---- do -----	Do.
Michigan Gypsum Co -----	2840 Bay Rd. Saginaw, Mich. 48601	Open pit mine ----	Iosco.
National Gypsum Co -----	325 Delaware Ave. Buffalo, N.Y. 14202	Open pit mine and calcining and board plant.	Do.
United States Gypsum Co ----	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine ---- Calcining and board plant.	Do. Wayne.
Iron ore:			
Cleveland-Cliffs Iron Co -----	1460 Union Commerce Bldg. Cleveland, Ohio 44115	Open pit mine, con- centrator, and agglomerator.	Marquette.
Empire -----		Underground mine.	Do.
Mather -----		Ore treated at the ore improvement plant and Pioneer pellet plant.	Do.
Ore improvement plant ---		Processes Mather ore.	Do.
Pioneer pellet plant -----		Pelletizes ore from the Mather mine.	Do.
Republic -----		Open pit mine, con- centrator, and ag- glomerator. Part of the concentra- tes pelletized at the Humboldt plant.	Do.
Hanna Mining Co: Groveland --	100 Erieview Plaza Cleveland, Ohio 44114	Open pit mine, con- centrator, and agglomerator.	Dickinson.
Inland Steel Co.: Sherwood ---	30 West Monroe St. Chicago, Ill. 60603	Underground mine -	Iron.
Iron and steel:			
Ford Motor Co -----	The American Rd. Dearborn, Mich. 48121	Iron blast furnaces and open-hearth steel furnaces.	Wayne.
McLouth Steel Corp -----	300 South Livernois Ave. Detroit, Mich. 48217	---- do -----	Do.
National Steel Corp., Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	---- do -----	Do.

See footnote at end of table.

Table 13.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Iron oxide pigments, crude: Cleveland-Cliffs Iron Co.	1460 Union Commerce Bldg. Cleveland, Ohio 44115	Mine	Marquette.
Lime:			
Detroit Lime Co., Subsidiary of Edward C. Levy Co.	8800 Dix Ave. Detroit, Mich. 48209	Quicklime, shaft and rotary kilns.	Do.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	Quicklime, 3 rotary kilns, continuous hydrator.	Mason.
Marblehead Lime Co., Div. General Dynamics Corp.	300 West Washington St. Chicago, Ill. 60606	Quicklime, 2 rotary kilns.	Wayne.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48192	Quicklime, 9 shaft kilns.	Do.
Natural gas processors:			
Consumers Power Co	212 West Michigan Jackson, Mich. 49201	Plant	St. Clair.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	do	Crawford.
Marathon Oil Co	539 South Main St. Findlay, Ohio 45840	do	Hillsdale.
Michigan Wisconsin Pipe Line Co.	1 Woodward Ave. Detroit, Mich. 48226	do	Osceola.
Mobil Oil Corp	P.O. Box 258 Mason, Mich. 48854	do	Ingham.
Peat:			
Anderson Peat Co	332 Graham Rd. Imlay City, Mich. 48444	Bog, processing plant.	Lapeer.
Fletcher & Rickard	54001 Grand River Rd. New Hudson, Mich. 48165	do	Oakland.
Huber Peat Co., Bay Houston Towing Co.	P.O. Box 812 Sandusky, Mich. 48471	do	Sanilac.
Michigan Peat, Bay Houston Towing Co.	P.O. Box 3006 Houston, Tex. 77001	Bogs, processing plant.	Do.
Scenic Lakes, Inc	Box 926 East Lansing, Mich. 48823	Bog, processing plant.	Shiawassee.
Expanded perlite:			
Harborlite Corp	P.O. Box 458 Escondido, Calif. 92025	Processing plant	Kalamazoo.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Iosco.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Wayne.
Petroleum refineries:			
Bay Refining Div., The Dow Chemical Co.	4868 Wilder Rd. Bay City, Mich. 48709		Bay.
Crystal Refining Co	901 North Williams Carson City, Mich. 48811		Montcalm.
Lakeside Refining Co	2705 East Cork Kalamazoo, Mich. 49001		Kalamazoo.
Marathon Oil Co	1300 South Fort St. Detroit, Mich. 48217		Wayne.
Osceola Refining Co	Box 178 Reed City, Mich. 49677		Ogemaw.
TOTAL Leonard, Inc., Alma Division.	East Superior St. Alma, Mich. 48801		Gratiot.
Salt and salines:			
Diamond Crystal Salt Co	916 South Riverside St. Clair, Mich. 48079	Brine wells and processing plant: Salt.	St. Clair.
The Dow Chemical Co.: Ludington plant	Midland, Mich. 48640	Brine wells and processing plant: Bromine, calcium-magnesium compounds, magnesium compounds.	Mason.
Midland plant		Brine wells and processing plant: Bromine, calcium-magnesium compounds, iodine, magnesium compounds, salt.	Midland.
Harbison-Walker Refractories Co.	2 Gateway Center Pittsburg, Pa. 15222	Processing plant: Magnesium compounds.	Mason.

See footnote at end of table.

Table 13.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Salt and salines—Continued			
Hardy Salt Co	P.O. Drawer 449 St. Louis, Mo. 61366	Processing plant: Salt.	Manistee.
Hooker Chemical Corp	Box 295 Montague, Mich. 49437	Brine wells and processing plant: Salt.	Muskegon.
International Salt Co., Inc	Clarks Summit, Pa. 18411	Underground salt mine.	Wayne.
Martin Marietta Chemicals, Refractories Div.	Executive Plaza II Hunt Valley, Md. 21030	Brine wells and processing plant: Magnesium compounds.	Manistee.
Michigan Chemical Corp.: St. Louis Plant	351 East Ohio St. Chicago, Ill. 60611	Brine wells and processing plant: Bromine, calcium magnesium compounds, magnesium compounds, salt.	Gratiot.
Morton Chemical Co., div. Morton-Norwich Products, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	Brine wells and processing plant: Bromine, magnesium compounds.	Manistee.
Morton Salt Co., div. of Morton-Norwich Products, Inc.: Manistee plant	do	Brine wells and processing plant: Salt.	Do.
Port Huron plant	do	do	St. Clair.
Pennwalt Corp	3 Penn Center Philadelphia, Pa. 19102	do	Wayne.
Wilkinson Chemical Corp	Mayville, Mich. 48744	Brine wells and processing plant: Calcium-magnesium compounds.	Lapeer.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48744	Brine wells and processing plant: Salt.	Wayne.
Sand and gravel:			
American Aggregates Corp	Drawer 160 Greenville, Ohio 45331	Pits and stationary plants.	Kalamazoo, Livingston, Macomb, Oakland.
Construction Aggregates Corp	120 South LaSalle St. Chicago, Ill. 60603	do	Ottawa.
Grand Rapids Gravel Co	2700 28th St., SW. Grand Rapids, Mich. 49509	do	Kent.
Holloway Sand & Gravel Co	29250 Wixom Rd. Box 247 Wixom, Mich. 48096	Pits and portable plants.	Genesee, Oakland, Ogemaw, Otsego.
Holly Sand & Gravel Div., J. P. Burroughs & Son, Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Pit and stationary plant.	Oakland.
McCormick Sand Corp	P.O. Box 506 Muskegon, Mich.	Stationary plant	Ottawa.
Mickelson Corp	435 Granger Rd. Oxford, Mich. 48051	Pit, dredges, portable plant.	Do.
Moleworth Contracting Co	321 Park Ave. Yale, Mich. 48097	Pits and portable plants.	Lapeer, Macomb, St. Clair, Sanilac.
Natural Aggregates Corp	65545 Mound Rd. Romeo, Mich. 48065	Pits, dredge, portable and stationary plants.	Livingston, Macomb.
New Hudson Sand & Gravel, Inc.	Box 174 New Hudson, Mich. 48165	Pits and stationary plants.	Oakland.
Sargent Sand Co	2840 Bay Rd. Saginaw, Mich. 48604	do	Bay, Mason, Saginaw, Tuscola.
Spartan Aggregates	P.O. Box 25 Holt, Mich. 48842	do	Clinton, Ingham, Oakland.
Standard Sand Co	P.O. Box 290 Grand Haven, Mich. 49417	Stationary plant	Ottawa.

See footnote at end of table.

Table 13.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Silver:			
White Pine Copper Co. subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Byproduct silver	Ontonagon.
Smelters:			
White Pine Copper Co., subsidiary of Copper Range Co.	do	Primary copper smelter.	Do.
Stone:			
Granite:			
Caspian Construction Co.	100 West Caspian Caspian, Mich. 49915	Quarries and portable plant.	Dickinson.
George Hocking Construction Co.	Box 488 South Range, Mich. 49963	do	Houghton, Ontonagon.
Limestone and dolomite:			
Bethlehem Mines Corp., Bethlehem Steel Corp.	701 East Third St. Bethlehem, Pa. 18016	Quarry and stationary plant.	Chippewa.
Cheney Limestone Co.	Box 6 Bellevue, Mich. 49021	do	Eaton.
Dundee Cement Co.	Box 122 Dundee, Mich. 48131	do	Monroe.
The France Stone Co.	1800 Toledo Trust Bldg. Toledo, Ohio 43603	do	Do.
Inland Lime & Stone Co., div. of Inland Steel Co.	Gulliver, Mich. 49840	Quarries and stationary plants.	Mackinac, Schoolcraft.
Medusa Cement Co., div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Quarry and stationary plant.	Charlevoix.
Michigan Foundation Quarry Co., Inc.	110 West Jefferson Ave. Trenton, Mich. 48183	do	Wayne.
The Michigan Stone Co.	Ottawa Lake, Mich. 49267	Quarries and stationary plants.	Monroe.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 49840	do	Alpena.
Penn-Dixie Industries, Inc.	Box 307 Petoskey, Mich. 49770	Quarry and stationary plant.	Emmet.
Presque Isle Corp.	Box 426 Alpena, Mich. 49707	do	Presque Isle.
United States Steel Limestone Operations, United States Steel Corp.	Rogers City, Mich. 49779	Quarries and stationary plants.	Mackinac, Presque Isle.
Wallace Stone Co., div. of J. P. Burroughs & Son, Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Quarry and stationary plant.	Huron.
Marl:			
Case Brothers	Route 2, Box 136 Union City, Mich. 49094	Pit	Calhoun.
Hayward Dry Marl	Route 2 Vicksburg, Mich. 49097	Pit	Kalamazoo.
Poehlman & Son	Route 2 Cassopolis, Mich. 49081	Pit	Cass.
Sandstone:			
Ottawa Silica Co.	33620 Streicher Rd. Rockwood, Mich. 48173	Pit and stationary plant.	Wayne.
Napoleon Stone Quarry	331 Austin Rd. Napoleon, Mich. 49261	Quarry and finishing plant.	Jackson.
Jude Stone Quarry	338 Austin Rd. Napoleon, Mich. 49261	do	Do.
Sulfur, recovered elemental:			
TOTAL Leonard Inc., Alma Div.	East Superior St. Alma, Mich. 48801	Byproduct sulfur recovery.	Gratiot.
Marathon Oil Co.	1300 South Fort St. Detroit, Mich. 48217	do	Wayne.
Exfoliated vermiculite:			
Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	Processing plant	Do.

¹ A number of oil and gas producing companies operate in Michigan and they are listed in several commercial directories.

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