

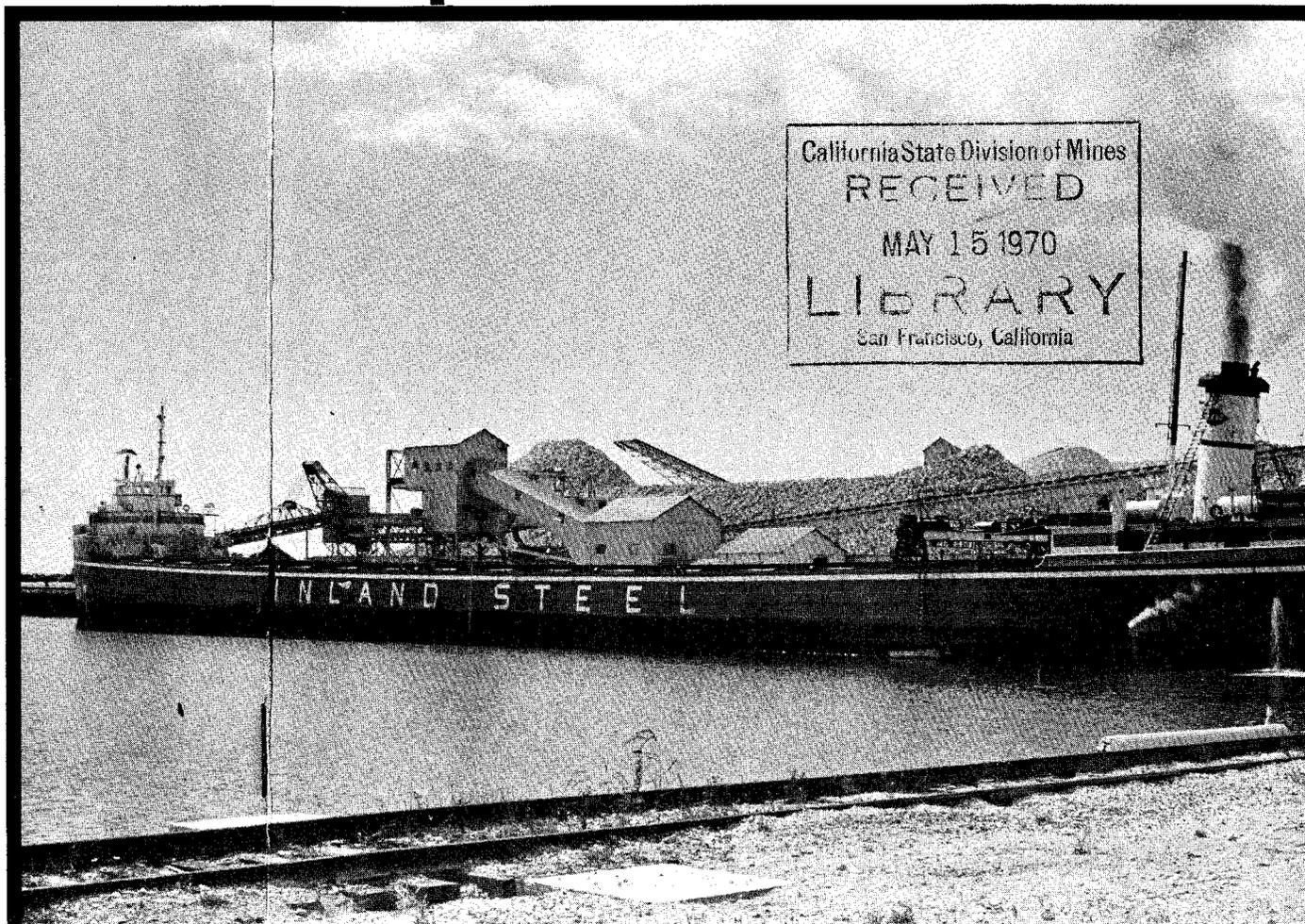


MINERAL INDUSTRY OF MICHIGAN, 1968

1970

ANNUAL STATISTICAL SUMMARY 11
Geological Survey Division

Cover photo—A lake freighter taking on stone at Inland Lime and Stone Company port on Lake Michigan near Gulliver, Schoolcraft County. High grade limestone and dolomite quarried here are used for fluxstone, cement, lime, and aggregate. (1964)



State of Michigan
Department of Natural Resources



Geological Survey Division

ANNUAL STATISTICAL SUMMARY 11

...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

Mineral Industry of Michigan 1968

By
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Prepared in cooperation with
Bureau of Mines
United States Department of the Interior
1970

STATE OF MICHIGAN
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DEPARTMENT OF NATURAL RESOURCES
RALPH A. MACMULLAN, *Director*
GEOLOGICAL SURVEY DIVISION
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FOREWORD

The report reviews the state's mineral output for 1968. Included are official statistics covering the production of metals, nonmetals, and fuels along with some commentary on legislation, employment, late developments, and other information required by industrialists, educators, and others concerned with mineral resources.

The center section consists of a 20-page preprint of the Michigan Chapter in the Minerals Yearbook published annually by the United States Bureau of Mines. To this we have added the several photographs, resource maps, and bibliography.

As always, the wholehearted cooperation of the Michigan mineral industry made this report possible.

Harry O. Sorensen, Geologist
R. Thomas Segall, Geologist

Mining & Economic Geology
Geological Survey Division
Dept. of Natural Resources

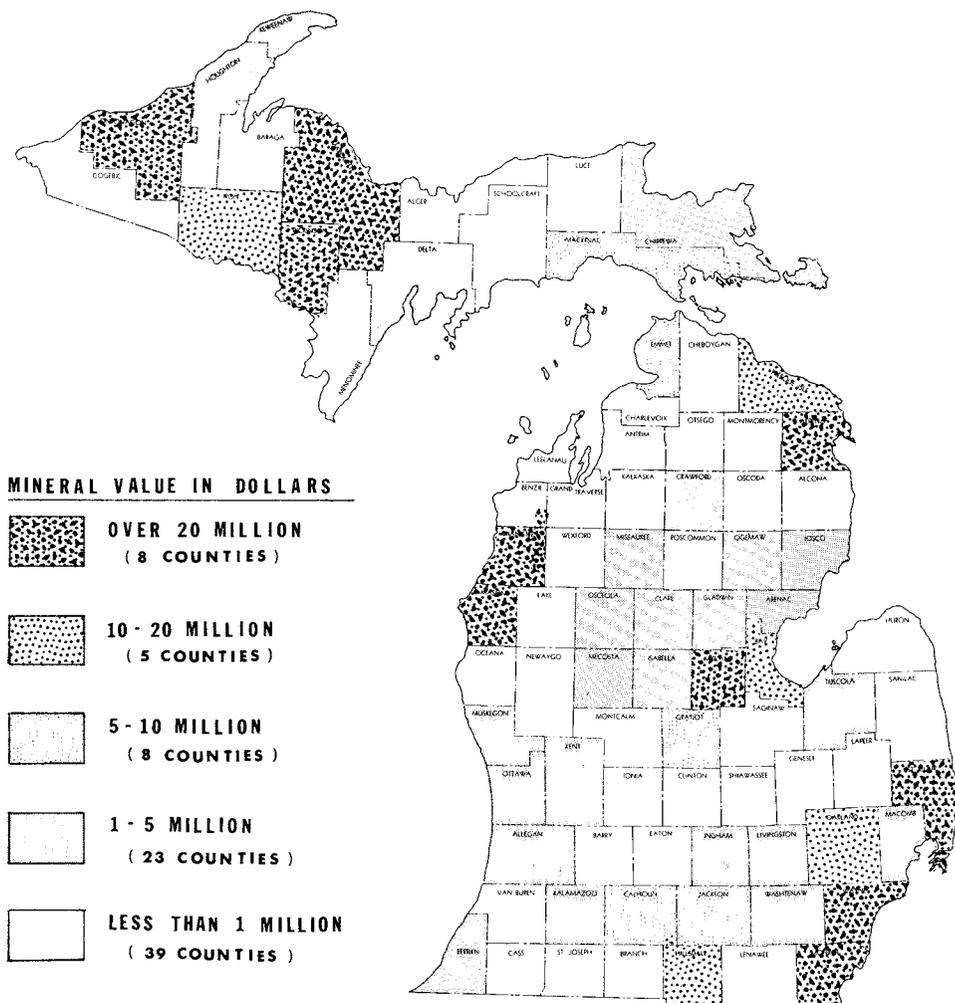
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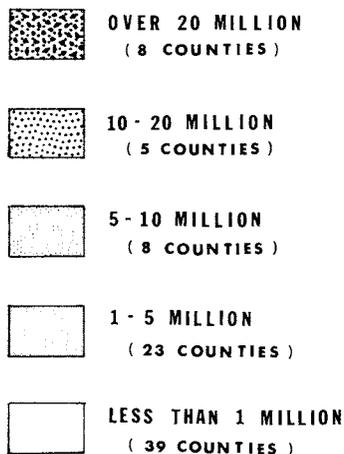
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MICHIGAN MINERAL VALUE 1968



MINERAL VALUE IN DOLLARS



COMMODITY	LEADING COUNTY	COMMODITY	LEADING COUNTY
CEMENT	ALPENA	NATURAL GAS	ST. CLAIR
CLAY	ALPENA	NATURAL SALINE	MIDLAND
COPPER	ONTONAGON	PEAT	LAPEER
GYPSUM	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 Natural Resources, for collecting information on all minerals except fuels.

By Donald F. Klyce ¹

In 1968 the value of mineral production in Michigan totaled \$627.1 million, nearly 3 percent larger than the 1967 record high.

Most minerals had increased production over the previous year, with the exception of iron ore, lime, magnesium compounds, and petroleum.

The demand for construction materials continued to grow and value of output exceeded that of 1967 by about 5 percent.

Chemicals recovered from natural salines increased about 1 percent over the previous year's production. These two non-metallic mineral groups accounted for 57 percent of the value of State mineral production. Metallic minerals (34 percent) and mineral fuels (9 percent) accounted for the remaining value.

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

Table 1.—Mineral production in Michigan ¹

Mineral	1967		1968		
	Quantity	Value (thousands)	Quantity	Value (thousands)	
Cement:					
Portland.....	thousand 376-pound barrels..	29,645	\$94,515	31,375	\$99,158
Masonry.....	thousand 280-pound barrels..	1,995	5,296	2,006	5,527
Clays.....	thousand short tons..	2,466	2,636	2,599	2,906
Copper (recoverable content of ores, etc.).....	short tons..	58,458	44,692	74,805	62,607
Gypsum.....	thousand short tons..	1,422	5,085	1,405	5,196
Iron ore (usable).....	thousand long tons, gross weight..	14,130	162,610	12,699	148,890
Lime.....	thousand short tons..	1,787	21,582	1,630	19,870
Magnesium compounds.....	short tons..	309,446	26,388	266,406	25,087
Natural gas.....	million cubic feet..	33,589	8,296	40,480	10,160
Natural gas liquids:					
Natural gasoline.....	thousand 42-gallon barrels ² ..	1,139	3,491	1,066	3,177
LP gases.....	do.....	1,414	3,444	1,384	3,432
Peat.....	short tons..	237,107	2,292	237,513	2,919
Petroleum (crude).....	thousand 42-gallon barrels..	13,664	39,455	12,974	38,287
Salt.....	thousand short tons..	4,789	42,389	4,893	44,481
Sand and gravel.....	do.....	52,310	49,616	56,663	54,979
Silver (recoverable content of ores, etc.).....	thousand troy ounces..	302	468	473	1,014
Stone.....	thousand short tons..	36,432	39,910	37,279	41,092
Value of items that cannot be disclosed: Bromine, calcium chloride, calcium-magnesium chloride, gem stones, iodine, and potassium salts.....		XX	58,039	XX	58,293
Total.....		XX	610,204	XX	627,075
Total 1957-59 constant dollars.....		XX	552,334	XX	557,639

^p Preliminary. XX Not applicable.
¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
² Previously reported in thousand gallons.

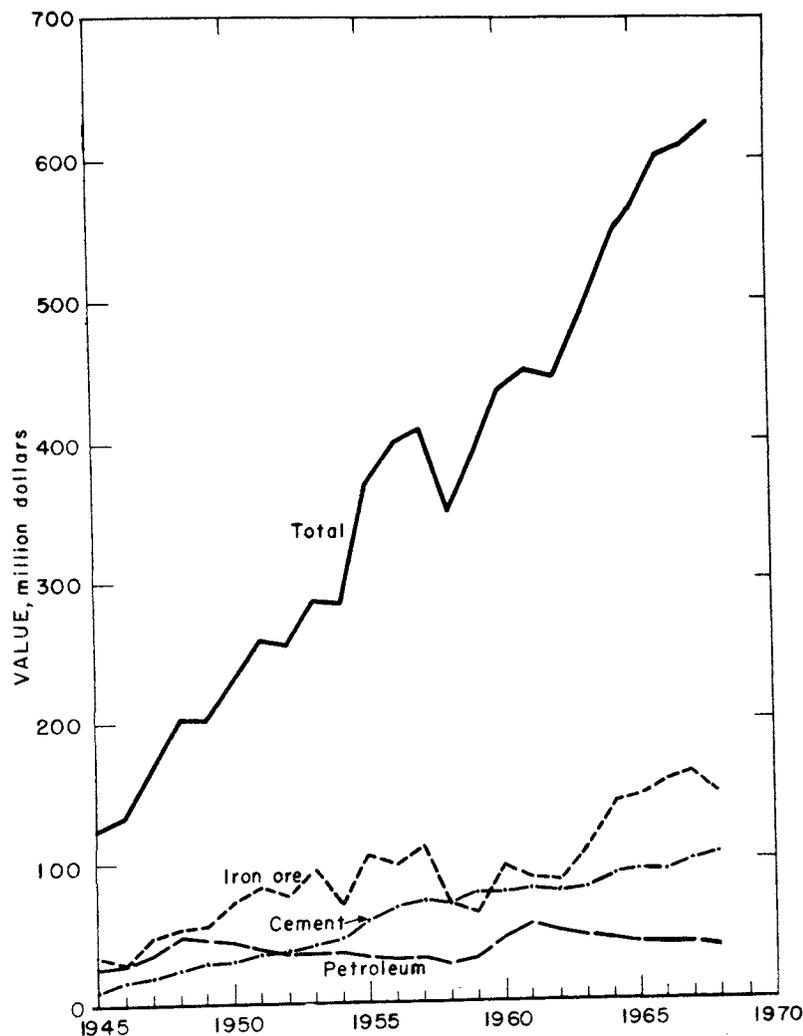


Figure 1.—Value of iron ore, petroleum, cement, and total value of all minerals produced in Michigan.

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

(Thousands)

County	1967	1968	Minerals produced in 1968 in order of value
Alcona	\$133	\$117	Sand and gravel.
Alger	57	39	Do.
Allegan	992	² 1,020	Petroleum, sand and gravel, stone, peat, natural gas.
Alpena	W	W	Cement, stone, clays, sand and gravel.
Antrim	272	431	Clays, sand and gravel.
Arenac	1,081	1,032	Petroleum, stone, sand and gravel.
Baraga	72	105	Sand and gravel.
Barry	700	572	Sand and gravel, petroleum, stone.
Bay	9,637	10,230	Cement, sand and gravel, petroleum, lime.
Benzie	---	4	Sand and gravel.
Berrien	2,554	2,450	Sand and gravel, stone.
Branch	585	W	Do.
Calhoun	7,191	² 7,092	Petroleum, sand and gravel, stone, natural gas.
Cass	311	224	Sand and gravel, stone, petroleum.
Charlevoix	906	8,928	Cement, stone, sand and gravel.
Cheboygan	69	123	Stone, sand and gravel.
Chippewa	W	W	Do.
Clare	1,795	W	Petroleum, sand and gravel, natural gas.
Clinton	315	539	Sand and gravel, clays.
Crawford	522	² 1,049	Petroleum, sand and gravel, natural gas.
Delta	260	165	Sand and gravel, stone.
Dickinson	19,749	23,819	Iron ore, sand and gravel, stone.
Eaton	603	652	Stone, sand and gravel, clays, peat.
Emmet	6,645	8,956	Cement, stone, sand and gravel.
Genesee	702	542	Sand and gravel, petroleum.
Gladwin	1,027	990	Petroleum, sand and gravel.
Gogebic	2,121	197	Sand and gravel.
Grand Traverse	W	274	Do.
Gratiot	W	W	Salines, salt, sand and gravel, petroleum, natural gas.
Hilledale	12,161	² 10,801	Petroleum, sand and gravel, stone, natural gas.
Houghton	6,493	3,015	Copper, sand and gravel, stone.
Huron	897	886	Stone, sand and gravel, lime, petroleum.
Ingham	1,318	1,177	Sand and gravel, peat.
Ionia	W	260	Sand and gravel, petroleum.
Iosco	4,401	4,836	Gypsum, sand and gravel.
Iron	14,998	11,344	Iron ore, sand and gravel.
Isabella	1,336	² 1,083	Petroleum, sand and gravel, natural gas.
Jackson	4,966	² 4,449	Petroleum, sand and gravel, stone, natural gas.
Kalamazoo	1,239	1,358	Sand and gravel, stone, peat.
Kalkaska	112	221	Petroleum, sand and gravel.
Kent	3,474	² 4,580	Sand and gravel, gypsum, petroleum, peat, natural gas.
Keweenaw	W	1,989	Copper, sand and gravel.
Lake	44	W	Petroleum, sand and gravel.
Lapeer	1,489	² 2,112	Peat, petroleum, sand and gravel, salines, natural gas.
Leelanau	56	92	Sand and gravel.
Lenawee	510	² 940	Sand and gravel, clays, petroleum, natural gas.
Livingston	2,804	² 3,819	Sand and gravel, petroleum, natural gas.
Luce	58	112	Sand and gravel.
Mackinac	W	W	Stone, sand and gravel.
Macomb	2,011	² 2,452	Sand and gravel, petroleum, natural gas.
Manistee	22,105	20,795	Salt, salines, sand and gravel.
Marquette	127,026	114,494	Iron ore, sand and gravel.
Mason	W	W	Salines, lime, sand and gravel, petroleum.
Mecosta	980	² 1,024	Petroleum, sand and gravel, peat, natural gas.
Menominee	633	705	Lime, sand and gravel.
Midland	W	W	Salines, salt, petroleum, sand and gravel.
Missaukee	1,302	² 1,476	Petroleum, sand and gravel, natural gas.
Monroe	W	W	Cement, stone, clays, peat, petroleum.
Montcalm	714	W	Petroleum, sand and gravel, natural gas.
Montmorency	---	53	Sand and gravel.
Muskegon	2,244	2,334	Salt, sand and gravel, petroleum.
Newaygo	173	419	Sand and gravel, petroleum.
Oakland	9,939	10,458	Sand and gravel, peat, petroleum.
Oceana	425	380	Sand and gravel, petroleum.
Ogemaw	1,941	² 1,756	Sand and gravel, petroleum, natural gas.
Ontonagon	36,099	59,041	Copper, silver, sand and gravel.
Osceola	1,611	² 1,896	Petroleum, sand and gravel, natural gas.
Oscoda	76	51	Sand and gravel, petroleum.
Otsego	42	W	Sand and gravel, natural gas.
Ottawa	2,586	² 2,412	Sand and gravel, petroleum, stone, natural gas.
Presque Isle	W	W	Stone, sand and gravel.
Roscommon	616	W	Petroleum, sand and gravel, natural gas.
Saginaw	434	635	Sand and gravel, clays, lime, petroleum.
St. Clair	14,679	² 16,143	Salt, cement, petroleum, clays, peat, sand and gravel, natural gas.
St. Joseph	279	W	Sand and gravel, peat, stone.
Sanilac	1,146	1,095	Peat, sand and gravel, lime.

See footnotes at end of table.

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

County	1967	1968	Minerals produced in 1968 in order of value
Schoolcraft.....	W	W	Stone, sand and gravel.
Shiawassee.....	\$632	\$769	Sand and gravel, peat, clays, petroleum.
Tuscola.....	1,996	2,690	Sand and gravel, petroleum, lime, peat.
Van Buren.....	375	349	Sand and gravel, petroleum.
Washtenaw.....	1,974	² 2,353	Sand and gravel, petroleum, natural gas.
Wayne.....	55,288	² 54,472	Cement, lime, salt, sand and gravel, salines, stone, clays, petroleum, natural gas.
Wexford.....	84	² 122	Sand and gravel, natural gas.
Undistributed ³	208,162	206,081	
Total ⁴	610,204	627,075	

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 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.
⁴ Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

	1967	1968	Change (percent)
E mployment and labor force, annual average: ¹			
Total labor force..... thousands..	3,382.5	3,420.9	+1.1
Agricultural employment..... do.....	67.5	63.8	-5.5
Nonagricultural employment ² do.....	3,141.3	3,179.8	+1.2
Manufacturing..... do.....	1,104.6	1,121.9	+1.6
Motor vehicles and equipment..... do.....	352.7	372.8	+5.7
Construction..... do.....	116.7	97.8	-16.2
Mining..... do.....	12.6	13.0	+3.2
Primary metal products..... do.....	93.0	94.2	+1.3
Stone, clay, and glass products..... do.....	18.9	17.4	-7.9
All other..... do.....	1,907.4	1,947.1	+2.1
Total manufacturing payrolls..... millions..	\$9,564.2	\$10,740.6	+12.3
Personal income:			
Total..... do.....	\$29,151	^P \$32,105	+10.1
Per capita..... do.....	\$3,387	^P \$3,674	+8.5
Construction activity:			
Building permits: ³			
Valuation of authorized residential construction..... millions..	\$859	\$896	+4.4
Number of private and public residential units authorized.....	59,677	59,143	-0.9
Contract construction work performed:			
Total..... millions..	\$2,276	\$2,350	+3.3
Nonresidential building..... do.....	\$947	\$913	-3.6
Residential building..... do.....	\$990	\$1,030	+4.0
Nonbuilding..... do.....	\$339	\$408	+20.4
State highway department contracts awarded..... do.....	\$112.3	\$136.3	+21.4
Portland cement shipments to and within Michigan..... thousand 376-pound barrels..	16,386	16,158	-1.4
Retail sales..... millions..	\$14,173	\$15,542	+9.7
Farm marketing receipts..... do.....	\$855.3	^P \$866.8	+1.3
Mineral production..... do.....	\$610.2	\$627.1	+2.8
Raw steel production..... thousand tons..	9,248	9,221	-0.3
Utility production and consumption:			
Production of electric energy by electric utilities..... million kilowatt-hours..	47,632.9	^P 52,094.1	+9.4
Natural gas consumption..... million cubic feet..	689,446	703,782	+2.1
International trade: ⁴			
Value of exports through Michigan..... millions..	\$2,933.6	\$3,484.9	+18.8
Value of imports through Michigan..... do.....	\$2,556.5	\$3,236.8	+26.6

^P Preliminary. ^R Revised.
¹ Adjusted to March 1968 benchmark levels.
² Includes nonagricultural wage and salary, self-employed, unpaid family workers, and domestic workers in private households.
³ Based on a Nationwide survey of 13,000 permit issuing places.
⁴ Includes Detroit Customs District.
 Sources: Michigan Employment Security Division in cooperation with the United States Department of Labor, Survey of Current Business, Construction Reports, Statistical Abstract of the United States, State of Michigan Department of Highways, Sales Management, Farm Income Situation, American Iron & Steel Institute, Federal Power Commission, and U.S. Department of Commerce.

Table 4.—Worktime 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	Nonfatal	Frequency	Severity
1967:								
Peat.....	157	184	29	261	-----	2	7.67	31
Metal.....	5,549	282	1,565	12,503	11	481	39.35	6,806
Nonmetal.....	1,669	283	472	3,777	2	54	14.83	3,524
Sand and gravel.....	2,474	212	526	4,619	-----	93	20.14	705
Stone.....	3,391	295	1,000	8,025	-----	62	7.73	373
Total ¹	13,240	271	3,591	29,184	13	692	24.16	3,586
1968:^P								
Peat.....	167	187	31	293	-----	1	400	32.36
Metal.....	5,180	296	1,549	12,393	1	84	21.41	640
Nonmetal.....	1,790	274	491	3,924	-----	104	21.72	963
Sand and gravel.....	2,570	215	554	4,789	-----	75	9.47	1,134
Stone.....	3,410	288	983	7,918	-----			
Total ¹	13,120	274	3,608	29,316	1	663	22.65	1,331

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

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland cement shipments continued the upward trend which began in 1960, with a 6-percent increase over 1967 shipments. Masonry cement output showed a slight increase over that of the previous year. Portland cement was produced at nine plants in seven counties (Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne); masonry cement was produced at six of these plants. Annual finished portland cement capacity totaled more than 39 million barrels. Yearend stocks of portland cement at mills were 4 million barrels compared with 3.8 million barrels in 1967. 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 46 percent of the portland cement was shipped to consumers within the State. Out-of-State distribution went mostly to Ohio, Wisconsin, Illinois, Indiana, Minnesota, and New York. About 62 percent of the shipments were purchased by ready-mixed concrete companies with the remainder going principally to concrete product manufacturers (16 percent), highway contractors (12 percent), and building material dealers (7 percent). About 1.8 million barrels of cement, mostly portland, were shipped into Michigan. The bulk of the shipments originated in Ohio (82 percent), with Pennsylvania and Indiana contributing most of the remainder.

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

Year	Active plants	Production	Shipped from mills		Stocks at mills Dec. 31
			Quantity	Value	
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	3,813
1968.....	9	31,195	31,375	99,158	4,043

^R Revised.

Raw materials used in portland cement manufacture included 7.8 million tons of limestone, nearly 2.4 million tons of clay or shale, as well as quantities of gypsum, sand, iron ore, slag, mill scale, air-entraining compounds, and grinding aids. More than three-quarter billion kilowatt-hours of electrical energy was used. The wet process was used at eight plants and the dry process at one.

Clays.—Miscellaneous clay and shale were mined in 10 counties from 14 pits. Total output was 5 percent larger than in 1967. Increases in production of material for manufacturing pottery and stoneware, heavy clay products, and cement offset decreases in output for lightweight aggregates. About seven-eighths of the State production was used in cement manufacture, and the remainder mostly for lightweight aggregates and heavy clay products (building brick, sewerpipe, and drain tile). The largest production was reported from operations in Alpena, Antrim, Monroe, Saginaw, St. Clair, and Wayne Counties.

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

Gypsum.—Gypsum output and value were substantially the same as in 1967, although unit price of the crude material was slightly higher. Crude gypsum was produced in Kent County from underground mines and processed at plants in Grand Rapids 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 gypsums for building material plants at National City, Detroit, and in Ohio and Wisconsin. Gypsum materials were shipped by lake transport from deepwater ports at National City and Alabaster.

Lime.—Decreased demand for lime by major users in manufacturing steel and chemicals was responsible for a decline in output of nearly 9 percent. Smaller quantities of lime were used in sugar refining, paper manufacture, water purification, and sewage treatment. Lime plants were operated in eight counties, but 81 percent of the production came from Wayne County to meet requirements of steel mills and chemi-

cal plants in the Detroit area. About 52 percent of the output was used by producers and the remainder sold. About 9 percent was shipped to consumers outside the State, mostly in Ohio and Wisconsin. About 267,000 tons of lime (four-fifths of it quicklime) were shipped into Michigan, with three-quarters of it coming from Ohio. Allied Chemical Corp. closed its Detroit lime plant in June and transferred the equipment to other operations. Data for lime regenerated at papermills and water purification plants 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. Value of output was slightly below the 1967 level. The Manistee plant of Standard Lime & Refractories Co. is being modernized and expanded to include a new periclase plant, pollution control equipment, and facilities for producing high-purity magnesia.

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

Salt.—Salt was recovered from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties and produced from an underground mine in Detroit. Production was 2 percent greater than in 1967, with much of the increase resulting from an increased demand for salt for road use. Michigan salt was distributed throughout the country with the largest shipments going to Wisconsin, Illinois, Indiana, Ohio, and Minnesota.

Sand and Gravel.—Michigan sand and gravel production increased 8 percent and was valued at nearly \$55 million, a record high. Michigan continued to hold second place (after California) in sand and gravel output. Sand and gravel for paving use increased 7 percent, for building use and fill 6 percent, and for industrial uses (molding, glass, engine, blast, abrasives, etc.) more than 24 percent. All counties except Monroe reported sand and gravel production. In 14 counties output exceeded 1 million tons and 38 percent of the State

total was produced in the five-county Detroit Metropolitan Area. About 93 percent of the total sand and gravel output was processed. Over 91 percent of the total commercial production was transported by truck, 6 percent by rail, and 3 percent by water. Production was reported from 401 commercial and 136 Government-and-contractor operations.

Stone.—Stone was quarried in 27 counties. Nearly all of the State stone output was limestone and dolomite, principally from large quarries in Alpena, Chippewa, Mackinac, Monroe, and Presque Isle Counties. Three-quarters 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 and dolomite increased moderately (2 percent) with larger requirements reported for aggregate and roadstone, cement, flux stone, and lime. Lesser shipments for agricultural and chemical uses were reported. Beginning with 1968, a more detailed breakdown of aggregate and roadstone is presented in table 9.

Small amounts of dimension limestone and sandstone were produced for building purposes. Dimension limestone was quarried and processed in Eaton, Huron, and Presque Isle Counties.

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	1967		1968	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building.....	6,508	\$5,990	7,475	\$6,481
Paving.....	5,565	4,550	6,704	5,585
Fill.....	3,401	1,601	3,956	1,743
Molding.....	3,231	6,198	4,129	7,637
Other ¹	810	2,111	914	2,177
Total.....	19,515	20,450	23,178	23,623
Gravel:				
Building.....	6,585	9,198	6,425	9,727
Paving.....	16,604	14,514	18,666	16,915
Fill.....	419	300	393	293
Other ²	120	184	188	304
Total.....	23,728	24,196	25,672	27,239
Total sand and gravel.....	43,243	44,646	48,850	50,862
Government-and-contractor operations:				
Sand:				
Building.....	90	49	.....	.....
Paving.....	2,291	1,121	1,839	845
Fill.....	919	373	747	310
Other.....	102	44	151	58
Total.....	3,402	1,587	2,737	1,213
Gravel:				
Building.....	.....	.....	21	11
Paving.....	5,301	3,225	4,753	2,759
Fill.....	364	158	301	134
Other.....	.....	.....	1	(³)
Total.....	5,665	3,383	5,076	2,904
Total sand and gravel.....	9,067	4,970	7,813	4,111
All operations:				
Sand.....	22,917	22,037	25,915	24,836
Gravel.....	29,393	27,579	30,748	30,143
Total.....	52,310	49,616	56,663	54,979

¹ Includes foundry (1967), chemical and railroad ballast (1968), abrasives, blast, enamel, engine, glass, pottery, porcelain, tile, and other construction and industrial uses.

² Includes railroad ballast and other construction uses.

³ Less than 1/2 unit.

⁴ Data may not add to total shown because of independent rounding.

Table 7.—Production of sand and gravel by counties

(Thousand short tons and thousand dollars)

County	1967		1968		County	1967		1968	
	Quantity	Value	Quantity	Value		Quantity	Value	Quantity	Value
Alcona.....	274	\$133	230	\$117	Leelanau.....	105	\$56	148	\$92
Alger.....	93	57	68	39	Lenawee.....	579	478	1,122	915
Allegan.....	401	278	751	462	Livingston.....	2,810	2,802	3,593	3,816
Alpena.....	187	W	135	120	Luce.....	35	38	221	112
Antrim.....	92	W	92	W	Mackinac.....	W	W	205	98
Arenac.....	W	W	49	39	Macomb.....	2,524	2,004	2,838	2,423
Baraga.....	152	72	214	105	Manistee.....	W	W	W	W
Barry.....	639	663	537	531	Marquette.....	877	741	363	W
Bay.....	-----	-----	W	W	Mason.....	975	W	W	W
Benzie.....	-----	-----	12	4	Mecosta.....	186	W	324	W
Berrien.....	2,595	2,550	1,982	2,445	Menominee.....	417	W	407	W
Branch.....	589	W	455	W	Midland.....	W	242	327	W
Calhoun.....	978	485	760	W	Missaukee.....	17	11	5	3
Cass.....	326	285	245	203	Monroe.....	-----	-----	-----	-----
Charlevoix.....	190	W	114	W	Montcalm.....	411	215	328	W
Cheboygan.....	17	21	86	W	Montmorency.....	-----	-----	81	53
Chippewa.....	W	W	285	209	Muskegon.....	477	W	487	W
Clare.....	203	W	186	W	Newaygo.....	184	113	701	354
Clinton.....	354	W	601	W	Oakland.....	9,707	9,889	10,365	10,395
Crawford.....	88	53	30	19	Oceana.....	329	210	320	210
Delta.....	334	W	264	W	Ogemaw.....	1,288	1,080	1,099	937
Dickinson.....	293	218	143	W	Ontonagon.....	230	W	234	144
Eaton.....	416	W	402	313	Osceola.....	218	143	221	176
Emmet.....	364	W	81	W	Oscoda.....	136	71	91	46
Genesee.....	897	696	572	517	Otsego.....	66	42	11	W
Gladwin.....	24	10	29	17	Ottawa.....	2,462	2,275	2,479	2,184
Gogebic.....	151	W	276	197	Presque Isle.....	521	W	565	W
Grand Traverse.....	172	W	548	274	Roscommon.....	212	127	W	W
Gratiot.....	279	W	326	297	Saginaw.....	W	W	W	W
Hillsdale.....	399	476	W	W	St. Clair.....	W	W	141	75
Houghton.....	W	W	269	223	St. Joseph.....	336	269	538	W
Huron.....	133	101	157	126	Sanilac.....	395	W	342	W
Ingham.....	1,372	1,316	1,378	1,175	Schoolcraft.....	151	W	29	19
Ionia.....	435	W	425	260	Shiawassee.....	745	512	699	W
Iosco.....	77	31	672	W	Tuscola.....	1,475	1,714	2,350	W
Iron.....	94	W	226	W	Van Buren.....	414	345	416	318
Isabella.....	665	612	502	401	Washtenaw.....	1,912	1,908	1,942	2,306
Jackson.....	306	268	318	308	Wayne.....	2,511	4,349	2,686	4,477
Kalamazoo.....	1,120	1,182	1,110	1,304	Wexford.....	97	84	158	122
Kalkaska.....	W	W	17	9	Undistributed ¹	2,210	7,694	3,008	12,296
Kent.....	2,224	2,483	2,913	3,496					
Keweenaw.....	66	34	40	18					
Lake.....	34	30	W	W					
Lapeer.....	265	155	324	180					
					Total.....	52,310	49,616	56,663	54,979

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
¹ Includes production for which no county breakdown is available, and data indicated by symbol W.

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
1964.....	150	\$150	5,383	\$68,711	8,306	\$62,030	13,839	\$130,891
1965.....	-----	-----	5,286	76,989	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
1968.....	-----	-----	2,680	51,271	1,500	15,000	4,180	66,271

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

(Thousand short tons and thousand dollars)

Kind and use	1967		1968	
	Quantity	Value	Quantity	Value
Basalt: Surface treatment aggregates.....	1	27	1	\$35
Granite: Exposed aggregate.....	3	62	2	60
Limestone and dolomite:				
Concrete aggregate and roadstone:				
Concrete aggregate.....	NA	NA	3,490	4,035
Bituminous aggregate.....	NA	NA	1,023	1,352
Macadam aggregates.....	NA	NA	214	307
Dense graded road base stone.....	NA	NA	936	1,151
Surface treatment aggregates.....	NA	NA	334	485
Total aggregate and roadstone ²	5,952	7,313	5,997	7,329
Agricultural limestone.....	757	1,093	689	872
Cement.....	9,080	7,570	9,370	7,954
Flux.....	11,270	13,638	11,376	14,327
Lime.....	6,224	6,615	6,792	7,102
Railroad ballast.....	308	380	281	370
Other ³	2,673	3,025	2,612	2,873
Total ²	36,265	39,633	37,116	40,827
Marl: Agricultural purposes.....	132	103	134	106
Grand total ²	36,426	39,832	37,275	41,026

NA Not available.

¹ Considered "Concrete aggregate and roadstone" for 1967.² Data may not add to totals shown because of independent rounding.³ Includes stone used for dead-burned dolomite (1968); asphalt filler and other fillers or extenders; chemical uses; mine dusting; poultry grit and mineral food; railroad ballast; riprap and jetty stone; stone sand; terrazzo and exposed aggregate; and other uses.

Sandstone was produced in Jackson County and used as rubble. 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.

United States Steel Corp. announced a rehabilitation and modernization program for its Calcite plant in Rogers City. The plan includes installation of new tunnels for reclaiming stone from new or expanded storage piles, new conveyor belt lines to supplement or replace existing ones, traveling stackers to stock limestone, a new primary as well as a new final screening station, a new tertiary stone crusher, and a complex of screens to size and rescreen crushed limestone. The modernization will enable the plant to produce larger quantities of small stone sizes for steelmaking and allow for closer tolerances on stone sizes shipped to customers in the chemical and cement industries.

Bethlehem Steel Corp. acquired the Drummond Dolomite, Inc., dolomite quarry, on Drummond Island in Lake Huron. Bethlehem Steel Corp. was also reported to have acquired large acreage in

the Point Patterson area of Mackinac and Schoolcraft Counties for development of limestone deposits for its steel mill.

Sulfur.—Byproduct sulfur was recovered from crude petroleum at oil refineries in Alma, Detroit, and Trenton. Shipments were at about the same level as in 1967.

Vermiculite.—Crude vermiculite, mined in Southern and Western States, was exfoliated at a plant in Dearborn and used for loose fill insulation, building plaster aggregate, concrete aggregate, agricultural, and other uses.

METALS

Copper.—Production of copper, in terms of recoverable metal content, was 28 percent greater than in 1967, despite a labor strike that began at Calumet & Hecla Corp. operations on August 21 and continued through the remainder of 1968. The average weighted price for copper increased from 38.2 to 41.8 cents per pound.

The copper smelter operated by the Quincy Mining Co. resumed operations as a custom smelter of scrap copper after a changeover of the reverberatory furnace from coal to gas fuel.

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The White Pine Mine No. 3 shaft was completed and equipped during the year. The 1,600-foot shaft is 5 miles from the present portal and will give access to ore reserves distant from present facilities. An 18-foot boring machine is engaged in connecting this shaft with the main workings.

The merger of Calumet & Hecla into Universal Oil Products Co. was completed on April 30. Underground diamond drilling on the company's Hills Creek deposit was suspended by the labor strike, although deep drilling from the surface continued. One hole was completed during 1968, and two additional holes were in progress at yearend.

Iron Ore.—Iron-ore shipments in 1968 were 10 percent lower than in 1967, although shipments of pellets continued to increase. Pellets comprised about 77 percent of the total shipments, compared with 73 percent in 1967. Average weighted mine value for Michigan usable iron ore in 1968 was \$11.72 per ton compared with \$11.51 in 1967.

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)
1964	9	3	6,718	2,174	69,040	\$45,014
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
1968	4	-----	8,027	-----	74,805	62,607

Table 11.—Crude iron ore data, in 1968, by counties and ranges

County and range	Stocks Jan. 1	Production		Shipments		Stocks Dec. 31
		Underground	Open pit	Direct to consumers	To concentrators	
County:						
Dickinson	-----	-----	4,845	-----	4,845	-----
Iron	1,001	1,780	-----	1,599	-----	1,183
Marquette	r 554	2,863	19,729	754	21,805	587
Total ¹	r 1,554	4,644	24,574	2,353	26,650	1,770
Range:						
Marquette	r 554	2,863	19,729	754	21,805	587
Menominee	1,001	1,780	4,845	1,599	4,845	1,183
Total ¹	r 1,554	4,644	24,574	2,353	26,650	1,770

r Revised.

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

About 84 percent of the crude ore mined came from open-pit mines, and the remainder from six underground mines. Average iron content of usable ore produced was 60.56 percent natural, compared with 60.25 percent in 1967.

Michigan iron ore was shipped to producers of pig iron and steel, except for a small quantity used in manufacturing iron oxide pigments. About 99 percent of the ore was shipped by rail to ore docks in Escanaba and Marquette and then by ship to lower Lake ports. The remainder was shipped by rail to consuming districts.

The lake shipping season for Michigan iron ore opened at Escanaba on March 31 and closed at the same port on December 19. Chicago & North Western Railway Co. announced plans to construct a large \$16 million iron-ore transfer and storage terminal at Escanaba designed to unload trains and store pellets on a year-round basis and to load out iron ore pellets and natural iron ore during the shipping season. The terminal is scheduled for operation at the start of the 1969 shipping season.

Table 12.—Usable iron ore ¹ produced (direct-shipping and all forms of concentrate), by ranges

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total		Iron content (percent)
				Gross weight Ore ²	Iron content	
1854-1963	322,909	265,963	247,484	836,355	NA	NA
1964	7,898	4,551	1,227	13,676	7,923	57.93
1965	8,973	4,595	753	14,322	8,343	58.25
1966	9,589	4,620	113	14,322	8,432	58.87
1967	10,231	3,750	49	14,030	8,453	60.25
1968	10,086	3,684	-----	13,770	8,339	60.56
Total ²	369,687	³ 287,162	³ 249,626	906,475	NA	NA

NA Not available.

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 Distribution by range partly estimated before 1906.

Table 13.—Iron ore ¹ shipped from mines

Year	Direct-shipping ore ²	Concentrates		Total ³	Total usable ore ³	Proportion of concentrates to total usable ore (percent)
		Agglomerates	Other			
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	8,690	1,415	10,106	14,377	70.28
1967	3,011	10,336	783	11,119	14,130	78.69
1968	2,353	9,786	560	10,346	12,699	81.47

¹ Exclusive of iron 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.

The Institute of Mineral Research at Michigan Technological University announced plans for a feasibility investigation of commercial production from low-grade iron carbonate formations in Iron County. An estimated billion-ton reserve near Alpha contains twice as many units of iron as the entire Menominee range has produced from oxide ores since mining started. The deposit extends in a 5-mile belt having an average width of 1,000 feet, and is amenable to open-pit mining.

According to the Michigan Department of Natural Resources,² the average cost per ton for underground mines was \$9.26 in 1968 compared with \$9.02 in 1967. Labor costs increased to \$2.59 per ton, while taxes (excluding Federal income tax) increased to \$0.33 per ton. Deferred costs per ton were \$0.49, and other costs were

as follows: General overhead, \$1.32; royalty, \$0.40; and marketing, \$0.055.

Pig Iron and Steel.—Pig iron and steel were manufactured in the Detroit area by the Ford Motor Co. at Dearborn; National Steel Corp. at Ecorse; and McLouth Steel Corp. at Trenton. Pig iron shipments and value were 2 percent smaller than in 1967. Basic, foundry, and low phosphorus grades were produced.

About 2.1 million tons of iron and manganese 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

² Geological Survey Division, Michigan Department of Natural Resources. General Statistics Covering Cost and Production of Michigan Iron Mines. 1969, 5 pp.

million tons, about the same output as in 1967.

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 1968 was 57 percent larger than in 1967, when a prolonged labor strike at the White Pine operation curtailed production. Because of the sharply increased price of silver, value of the 1968 production was more than double that of 1967.

MINERAL FUELS

Natural Gas and Natural Gas Products.

—Natural gas was produced in 25 counties from both oil and gas wells. More than 90 percent of the production came from five counties, with St. Clair County supplying nearly half (48 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 gasfields at a plant in Washtenaw County.

Peat.—Michigan again led the Nation in peat production with 38 percent of the total. Peat was produced in 14 counties,

with 47 percent of the State output from Lapeer County; Oakland, St. Clair, Sanilac, and Shiawassee Counties accounted for much of the remainder. Peat was marketed principally as a soil conditioner, and nearly 78 percent of the output was sold in packaged form. None was sold for fuel. About 92 percent of the peat mined was reed-sedge, and the remainder was moss and humus.

Petroleum.—Petroleum was produced in 45 counties, with the largest output reported from Calhoun, Hillsdale, and Jackson Counties (fields in the Albion-Pulaski-Scipio trend). According to the Geological Survey Division, Michigan Department of Natural Resources, 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. Activity also increased in the western part of the State. Statewide, the discovery-to-dry hole ratio for new field wildcat wells was 1:12 compared with 1:20 in 1967. About 36 percent of the exploratory wells bottomed out in Devonian age rocks, 20 percent in Ordovician age rocks, and 33 percent in Silurian age rocks. The remainder reached total depth in rocks younger than Devonian in age. One Precambrian or basement test was drilled during 1968 in Koehler Township of Presque Isle County. Thirteen new fields were discovered in 1968 and one new pool discovery was reported. Ten refineries had an operating capacity of 163,400 barrels per day.

Table 14.—Crude petroleum production, by counties

(Thousand 42-gallon barrels and thousand dollars)

County	1967		1968		County	1967		1968	
	Quantity ¹	Value ²	Quantity ¹	Value ²		Quantity ¹	Value ²	Quantity ¹	Value ²
Allegan.....	242	\$700	185	\$546	Mecosta.....	293	\$847	275	\$811
Arenac.....	273	789	251	740	Midland.....	218	629	206	607
Barry.....	11	32	12	35	Missaukee.....	447	1,291	499	1,473
Bay.....	322	929	309	911	Monroe.....	6	17	4	11
Calhoun.....	2,314	6,682	2,246	6,628	Montcalm.....	173	499	144	425
Cass.....	3	9	1	3	Muskegon.....	71	204	67	197
Clare.....	587	1,695	561	1,657	Newaygo.....	21	60	22	65
Crawford.....	162	469	349	1,030	Oakland.....	1	2	1	2
Genesee.....	2	6	8	25	Oceana.....	74	215	58	170
Gladwin.....	352	1,017	330	973	Ogemaw.....	298	861	278	819
Gratiot.....	24	68	17	51	Osceola.....	509	1,468	583	1,720
Hillsdale.....	4,046	11,683	3,511	10,362	Oscoda.....	2	5	2	5
Huron.....	3	8	2	5	Ottawa.....	107	310	77	227
Ionia.....	-----	-----	(³)	(³)	Roscommon.....	169	489	163	480
Isabella.....	251	724	231	682	Saginaw.....	23	65	23	68
Jackson.....	1,603	4,628	1,387	4,094	St. Clair.....	642	1,852	710	2,094
Kalkaska.....	34	98	72	212	Shiawassee.....	4	11	10	30
Kent.....	88	253	76	224	Tuscola.....	74	215	71	209
Lake.....	5	14	49	144	Van Buren.....	11	30	11	31
Lapeer.....	64	186	70	208	Washtenaw.....	25	71	16	47
Lenawee.....	6	18	(³)	1	Wayne.....	15	44	9	27
Livingston.....	1	2	1	3					
Macomb.....	2	7	10	29	Total ⁴ ..	13,664	39,455	12,974	38,287
Mason.....	88	254	70	206					

¹ Source: Geological Survey Division, Michigan Department of Natural Resources, General Statistics Covering Cost and Production of Michigan Iron Mines, 1969, 5 pp.

² County values calculated by using State average value per barrel; \$2.89 for 1967 and \$2.95 for 1968.

³ Less than ½ unit.

⁴ Data may not add to totals shown because of independent rounding.

Table 15.—Oil and gas wells drilled in 1968

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage ¹
Alcona						1	1	722
Allegan			2			2	4	6,439
Antrim						2	2	10,262
Arenac						1	1	3,220
Barry						1	1	1,814
Bay	1					2	3	7,573
Calhoun	11	1	21			1	34	153,495
Clare				1			1	4,048
Crawford	4					1	5	21,922
Eaton						1	1	5,000
Genesee	4		1				5	9,268
Grand Traverse						3	3	17,409
Gratiot						3	3	7,648
Hillsdale	5		8			9	22	90,320
Ionia						2	2	8,744
Iosco						1	1	3,285
Isabella	3		3			5	11	42,891
Jackson	1		7			4	12	50,426
Kalkaska						1	1	6,950
Kent			2			1	3	11,305
Lake	10		3			4	17	41,734
Lapeer	4						4	11,698
Lenawee			1		1		2	1,355
Livingston				1		1	2	10,118
Macomb	1	3	6		1	25	36	113,432
Manistee						2	2	7,997
Mason			1	1		12	14	29,214
Mecosta	1		1	1		2	5	17,710
Midland						1	1	3,520
Missaukee	1		4				5	20,984
Montcalm			2			1	3	9,455
Muskegon	3		4				8	15,271
Newaygo			2	2		6	10	26,897
Oakland		1					1	4,415
Oceana			1			4	5	10,669
Ogemaw	1		1				2	7,606
Osceola	3		5	1	1	7	17	53,485
Ottawa						3	3	5,702
Presque Isle						3	3	12,599
Roscommon						1	1	1,460
St. Clair	5	3	24	3		36	71	208,191
Shiawassee	4						4	6,590
Van Buren			1			3	4	5,970
Washtenaw			1			1	2	9,133
Total	62	8	101	10	3	154	338	1,097,916

¹ Includes only wells drilled and completed for oil and gas.Table 16.—Principal producers¹

Commodity and company	Address	Type of activity	County
Cement:			
Aetna Portland Cement Co., Martin Marietta Corp.	Box 8 Bay City, Mich. 48706	Portland and masonry, wet process.	Bay.
Dundee Cement Co.	Box 317 Dundee, Mich. 48131	.....do.....	Monroe.
Huron Cement Co., Division of National Gypsum Co.	1325 Ford Bldg. 615 Griswold St. Detroit, Mich. 48226	Portland and masonry, dry process.	Alpena.
Medusa Portland Cement Co.	Box 5668 Cleveland, Ohio 44101	Portland and masonry, wet process.	Charlevoix.
Peerless Cement Co., Divi- sion of American Cement Corp.	900 Detroit Trade Center Detroit, Mich. 48226	.....do.....	.....do.....
Port Huron Plant	.....do.....	Portland, wet process	St. Clair.
Brennan Ave. Plant	.....do.....	Portland and masonry, wet process.	Wayne. Do.
Jefferson Ave. Plant	.....do.....	.....do.....	.....do.....
Penn-Dixie Cement Corp.	Box 152 Nazareth, Pa. 18064	.....do.....	Emmet.
Wyandotte Chemicals Corp.	1609 Biddle Ave. Wyandotte, Mich. 48192	.....do.....	Wayne.
Clays and shale:			
Aetna Portland Cement Co., Martin Marietta Corp.	Box 8 Bay City, Mich. 48706	Pit.....	Saginaw.
Dundee Cement Co.	Box 317 Dundee, Mich. 48131	.....do.....	Monroe.
Huron Cement Co., Division of National Gypsum Co.	1325 Ford Bldg. 615 Griswold St. Detroit, Mich. 48226	.....do.....	Alpena.
Light Weight Aggregate Corp.	12720 Farmington Road Livonia, Mich. 48150	Pit and plant.....	Wayne.
Medusa Portland Cement Co.	Box 5668 Cleveland, Ohio 44101	Pit.....	Antrim.
Peerless Cement Co., Divi- sion American Cement Corp.	900 Detroit Trade Center Detroit, Mich. 48226	Pits.....	St. Clair, Wayne.
Penn-Dixie Cement Corp.	Box 152 Nazareth, Pa. 18064	Pit.....	Antrim.
Coke:			
Industrial Chemicals Divi- sion Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	Coke ovens.....	Wayne.
Ford Motor Co.	The American Road Dearborn, Mich. 48121	.....do.....	Do.
National Steel Corp. (Great Lakes Steel Divi- sion).	2800 Grant Bldg. Pittsburgh, Pa. 15219	.....do.....	Do.
Copper:			
Calumet & Hecla Corp.	Calumet Ave. Calumet, Mich. 49913	Mine.....	Houghton.
Centennial No. 6 Mine	.....do.....	.....do.....	Do.
Osceola No. 13 Mine	.....do.....	.....do.....	Keweenaw.
Kingston Mine	.....do.....	.....do.....	Do.
Ahmeek Mill	.....do.....	Mill.....	Do.
White Pine Copper Co. White Pine.	Box 427 White Pine, Mich. 49971	Mine and mill.....	Ontonagon.
Gypsum:			
Georgia-Pacific Corp., Gypsum Division.	Box 311 Portland, Oreg. 97207	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 Road 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	Stockpile shipments.....	Marquette.
Cliffs Shaft	.....do.....	.....do.....	.....do.....

See footnote at end of table.

Table 16.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Iron ore—Continued			
Cleveland-Cliffs Iron Co.—Continued	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Eagle Mills pellet plant.....	.....	Pelletizes ore from the Republic mine.	Marquette.
Empire.....	.....	Open-pit mine, concentrator and agglomerator.	Do.
Humboldt.....	.....	do.	Do.
Mather.....	.....	Underground mine. Ore treated at the Ore Improvement Plant and Pioneer Pellet Plant.	Do.
Ore improvement plant.....	.....	Processed Mather ore.	Do.
Pioneer pellet plant.....	.....	Pelletizes ore from the Mather mine.	Do.
Republic.....	.....	Open-pit mine, concentrator, and agglomerator. Part of the concentrates pelletized at the Eagle Mills plant.	Do.
Tilden.....	.....	Stockpile shipments.....	Do.
The Hanna Mining Co.: Groveland.....	100 Erieview Plaza Cleveland, Ohio 44114	Open-pit mine, concentrator, and agglomerator.	Dickinson.
Homer.....	.....	Underground mine.....	Iron.
Wauseca.....	.....	do.	Do.
Inland Steel Co.: Bristol.....	30 West Monroe St. Chicago, Ill. 60603	do.	Do.
Sherwood.....	.....	do.	Do.
Jones & Laughlin Steel Corp.: Tracy.....	Michigan Ore Division Negaunee, Mich. 49866	do.	Marquette.
Iron and steel:			
Ford Motor Co.....	The American Road 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 Division).	2800 Grant Bldg. Pittsburgh, Pa. 15219	do.	Do.
Lime:			
Detroit Lime Co.....	8800 Dix Ave. Detroit, Mich. 48209	Quicklime, shaft and rotary kilns.	Wayne.
The Dow Chemical Co.....	Midland, Mich. 48640.....	Quicklime, three rotary kilns, one continuous hydrator.	Mason.
Marblehead Lime Co.....	300 West Washington St. Chicago, Ill. 60606	Quicklime, two rotary kilns.	Wayne.
Wyandotte Chemicals Corp..	1609 Biddle Ave. Wyandotte, Mich. 48192	Quicklime, nine shaft kilns.	Do.
Peat:			
Anderson Peat Co.....	2562 Graham Rd. Imlay City, Mich. 48444	Bog, processing plant..	Lapeer.
Fletcher & Rickard.....	54001 Grand River Rd. New Hudson, Mich. 48165	do.	Oakland.
J. M. Huber Corp.....	(Peat Department) Thornall St. Edison, N.J. 08817	Bogs, processing plants.	Lapeer, Sanilac.
Michigan Peat.....	1 Decker Sq.—Suite 325 Bala-Cynwyd, Pa. 19004	do.	Lapeer, St. Clair, Sanilac.
Scenic Lakes, Inc.....	Box 566 East Lansing, Pa. 48823	Bog, processing plant..	Shiawassee.
Petroleum refineries:			
Bay Refining Division, The Dow Chemical Co.	4868 Wilder Road 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.
Leonard Refineries, Inc.: Alma Division.....	East Superior St. Alma, Mich. 48801	Gratiot.

See footnote at end of table.

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Table 16.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Petroleum refineries—Continued			
Leonard Refineries Inc.—Continued			
Roosevelt Oil & Refining Division.	Box 271 Pickard Ave. & A.A.R.R. Mt. Pleasant, Mich. 48858	.....	Isabella.
Marathon Oil Co.....	1300 South Fort St. Detroit, Mich. 48217	.....	Wayne.
Naph-Sol Refining Co.....	1222 M-20, Box 630 Muskegon, Mich. 49443	.....	Muskegon.
Osceola Refining Co.....	Box 178 Reed City, Mich. 49677	.....	Ogemaw.
Petroleum Specialties, Inc....	Box 448 Trenton, Mich. 48183	.....	Wayne.
Socony Mobil Oil Co., Inc....	Box 477 Trenton, Mich. 48183	.....	Do.
Expanded perlite:			
Bestwall Gypsum Division	Commonwealth Bldg. Portland, Oreg. 97207	Processing plant.....	Kent.
Georgia-Pacific Corp.	325 Delaware Ave. Buffalo, N.Y. 14202	do.	Isoco.
National Gypsum Co.....	101 South Wacker Dr. Chicago, Ill. 60606	do.	Wayne.
Salt and salines:			
American Salt Co.....	3142 Broadway Kansas City, Mo. 64111	Processing plant: Salt..	Midland.
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 compounds, and magnesium compounds.	Mason.
Midland plant.....	.....	Brine wells and processing plant: Bromine, calcium compounds, iodine, magnesium compounds, potash, and salt.	Midland.
Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	Processing plant: Magnesium compounds.	Mason.
Hooker Chemical Corp.....	Box 295 Montague, Mich. 49437	Processing plant: Salt..	Muskegon.
International Salt Co., Inc....	Clarks Summit, Pa. 18411..	Underground salt mine.	Wayne.
Kaiser Aluminum & Chemical Corp.	900 17th St., NW. Washington, D.C. 20006	Processing plant: Magnesium compounds.	Midland.
Manistee Salt Works Division	P.O. Drawer 449 St. Louis, Mo. 63166	Processing plant: Salt..	Manistee.
Hardy Salt Co.	351 East Ohio St. Chicago, Ill. 60611	.....	Do.
Michigan Chemical Corp.:			
Manistee plant.....	.....	Processing plant: Bromine.	Do.
St. Louis plant.....	.....	Brine wells and processing plant: Bromine, calcium compounds, magnesium compounds, and salt.	Gratiot.
Morton Chemical Co., Division Morton International, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	Brine wells and processing plant: Bromine, calcium compounds, and magnesium compounds.	Manistee.
Morton Salt Co., Division Morton International, Inc.: Manistee plant.....	.....	Brine wells and processing plant: Salt.	Do.
St. Clair plant.....	.....	do.	St. Clair.
Pennsalt Chemicals Corp.....	8 Penn Center Philadelphia, Pa. 19102	Brine wells and processing plant: Salt.	Wayne.
Standard Lime & Refractories Co., Martin Marietta Corp.	2000 First National Bank Bldg. Baltimore, Md. 21203	Brine wells and processing plant: Magnesium compounds.	Manistee.
Wilkinson Chemical Corp....	Mayville, Mich. 48744.....	Brine wells and processing plant: Calcium compounds.	Lapeer.
Wyandotte Chemicals Corp..	1609 Biddle Ave. Wyandotte, Mich. 48192	Brine wells and processing plant: Calcium compounds and salt.	Wayne.

See footnote at end of table.

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Table 16.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
American Aggregates Corp.	Garst Ave. at Ave. B Greenville, Ohio 45331	Pits; stationary plants.	Kalamazoo, Livingston, Macomb, Oakland.
Arrowhead Silica Corp. Manley Bros. Division J. V. Burkett	128 South 15th St. Chesterton, Ind. 46304 St. Joseph, Mich. 49085	Pit; stationary plant. Pits; portable plants.	Berrien.
Cole Brothers, Cole Brothers Contractors, Inc.	Route 3, Box 346 Battle Creek, Mich. 49017	do.	Berrien, Calhoun, Kent, Lenawee, Newaygo, Van Buren.
Construction Aggregates Corp. R. E. Glancy, Inc.	120 South LaSalle St. Chicago, Ill. 60603 1655 South Bay Dr. Tawas City, Mich. 48763	Pit; stationary plants. Pit; portable plant.	Ottawa.
Grand Rapids Gravel Co.	2100 Chicago Dr., SW. Grand Rapids, Mich. 49509	Pits; stationary plants.	Kent.
Great Lakes Foundry Sand Co. Holloway Sand & Gravel Co., Inc.	1217 Francis Palms Bldg. Detroit, Mich. 48201 29250 Wixom Road, Box 247 Wixom, Mich. 48096	Pit; stationary plant. Pits; portable plants.	Tuscola.
Holly Sand & Gravel Plant J. P. Burroughs & Son, Inc. Koenig Fuel & Supply Co.	16240 Tindall Road Davisburg, Mich. 48019 1486 Gratiot Ave. Detroit, Mich. 48207	Pit; stationary plant. do.	Oakland. Do.
Lyon Sand & Gravel Co. Division E. C. Levy Co. Manley Sand Division Martin Marietta Corp. Mickelson Corp.	9300 Dix Dearborn, Mich. 48120 Rockton, Ill. 61072 435 Granger Road Oxford, Mich. 48051	do. do. do. Pit; dredges; portable plant.	Do. Do. Berrien. Oakland.
Molesworth Contracting Co.	321 Park Ave. Yale, Mich. 48097	Pits; portable plants.	Genesee, 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., Texas Industries, Inc. The Nugent Sand Co., Inc.	Box H New Hudson, Mich. 48165 2875 Lincoln St. Muskegon, Mich. 49441	Pits; stationary plants. Pit; stationary plant.	Oakland. Muskegon.
Ottawa Silica Co. Michigan Division. Pickitt & Schreur, Inc.	Box 577 Ottawa, Ill. 61350 Box 149 Allegan, Mich. 49010	do. Pits; portable plants.	Wayne. Allegan, Branch, Calhoun, Charlevoix, Clinton, Kalamazoo, Kent, Ottawa, St. Joseph.
Sand Products Corp.	2489 First National Bank Bldg. Detroit, Mich. 48226	Pit; stationary plant.	Manistee.
Sargent Sand Co.	2840 Bay Rd. Saginaw, Mich. 48604	Pits; stationary plants.	Bay, Mason, Saginaw, Tuscola.
I. W. Schworm & Son, Inc.	Box 162 Traverse City, Mich. 49684	Pit; stationary plant.	Grand Traverse.
Whittaker & Gooding Co.	5800 Cherry Hill Rd. Ypsilanti, Mich. 48197	do.	Washtenaw.
John G. Yerington	Route 3, Box 34 Benton Harbor, Mich. 49022	Pits; portable plants.	Allegan, Barry, Berrien, Cass, Eaton, Kalamazoo, St. Joseph, Van Buren.

See footnote at end of table.

Table 16.—Principal producers¹—Continued

Commodity and company	Address	Type of activity	County
Silver: White Pine Copper Co.	Box 427 White Pine, Mich. 49971	Byproduct silver.	Ontonagon.
Smelters:			
Calumet & Hecla Corp.	Calumet Ave. Calumet, Mich. 49913	Primary copper smelter.	Houghton.
Quincy Mining Co.	Hancock, Mich. 49930	Secondary smelter.	Do.
White Pine Copper Co.	Box 427 White Pine, Mich. 49971	Primary copper smelter.	Ontonagon.
Stone:			
Basalt: Houghton County Road Commission.	Hancock, Mich. 49930	Old mine waste.	Houghton.
Granite: Crystal Rock Products, Inc.	Box 63 Crystal Falls, Mich. 49920	Quarry; stationary plant.	Dickinson.
Limestone and dolomite: Bethlehem Mines Corp. (Bethlehem Steel Corp.)	701 East 3d St. Bethlehem, Pa. 18016	Quarry; stationary plant.	Chippewa.
Dundee Cement Co.	Box 317 Dundee, Mich. 48131	do.	Monroe.
The France Stone Co.	1800 Toledo Trust Bldg. Toledo, Ohio 43604	do.	Do.
Huron Cement Co., Division of National Gypsum Co.	1325 Ford Bldg. 615 Griswold St. Detroit, Mich. 48226	do.	Alpena.
Inland Lime & Stone Co. Division of Inland Steel Co.	Gulliver, Mich. 49840	Quarries; stationary plants.	Mackinac, Schoolcraft.
Medusa Portland Cement Co.	Box 5668 Cleveland, Ohio 44101	Quarry; 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; stationary plants.	Monroe.
Penn-Dixie Cement Corp.	Box 162 Nazareth, Pa. 18064	Quarry; stationary plant.	Emmet.
Presque Isle Corp.	Box 426 Alpena, Mich. 49707	do.	Presque Isle.
United States Steel Corp. Michigan Limestone Operations.	Rogers City, Mich. 49779	Quarries; stationary plants.	Mackinac, Presque Isle.
The Wallace Stone Co., Division J. F. Burroughs & Son, Inc.	Bay Port, Mich. 48720	Quarry; stationary plant.	Huron.
Marl:			
Barnett Brothers	South Front St. Dowagiac, Mich. 49047	Pit.	Cass.
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. 49031	Pit.	Cass.
Sandstone: Ray's Stone Quarry.	303 Natasawappe St. Napoleon, Mich. 49261	Quarry; finishing plant.	Jackson.
Recovered sulfur:			
Leonard Refineries, Inc. Alma Division.	East Superior St. Alma, Mich. 48801	Byproduct sulfur recovery.	Gratiot.
Marathon Oil Co.	1300 South Fort St. Detroit, Mich. 48217	do.	Wayne.
Mobil Oil Co., Inc.	Box 477 Trenton, Mich. 48183	do.	Do.
Exfoliated vermiculite: Zonolite Division W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 01109	Processing plant.	Do.

¹ Data regarding producers of natural gas, natural gas liquids, and petroleum not available.

APPENDIX

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- I. Photographs of several mineral operations (by H. O. Sorensen)
 - II. Map of limestone resources
 - III. Bibliography of limestone resources
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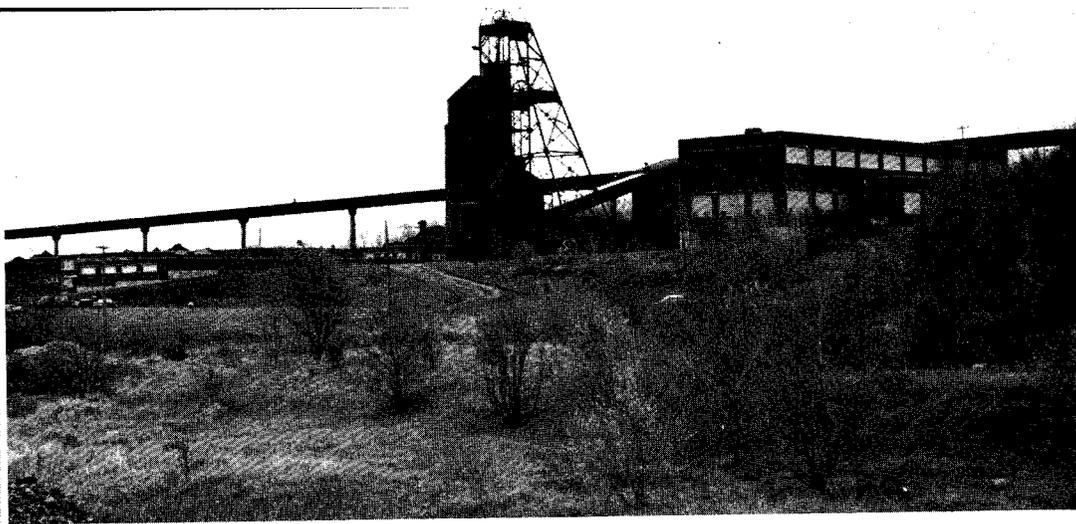


Photo 1—TRACY IRON MINE of Jones and Laughlin Steel Corp. at Negaunee. One of two underground iron mines still operating in the Marquette Iron Range. (1963)



Photo 2—HIAWATHA NO. 1 MINE. The last shipment of stockpiled iron ore from Hiawatha No. 1 and No. 2 mines on the Menominee Range was in 1967. These underground mines of the M. A. Hanna Co. at Stambaugh were closed due to diminishing demands for soft hematite. (1963)

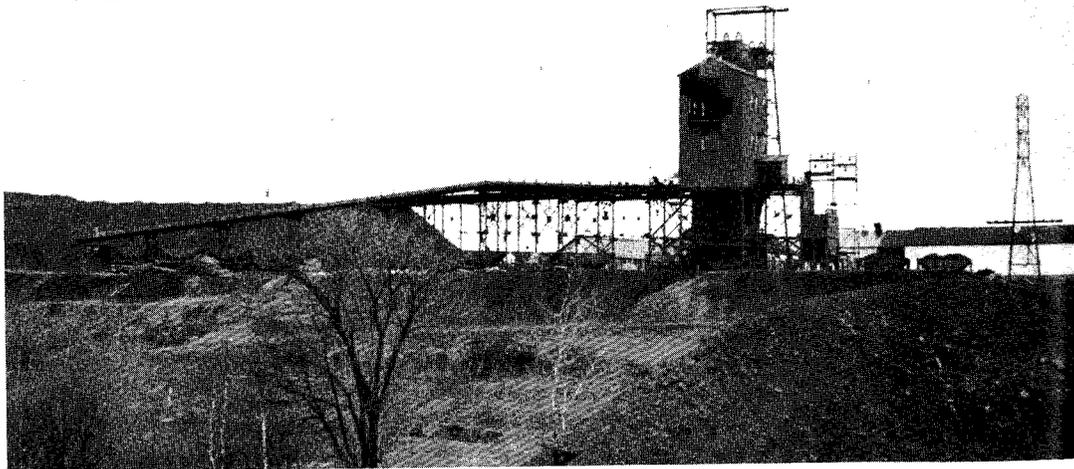


Photo 3—HIAWATHA NO. 2 MINE. The Hiawatha No. 1 and No. 2 mines produced a total of 22,160,000 long tons of direct-shipping ore over a 70-year span before closing in December, 1966. (1963)

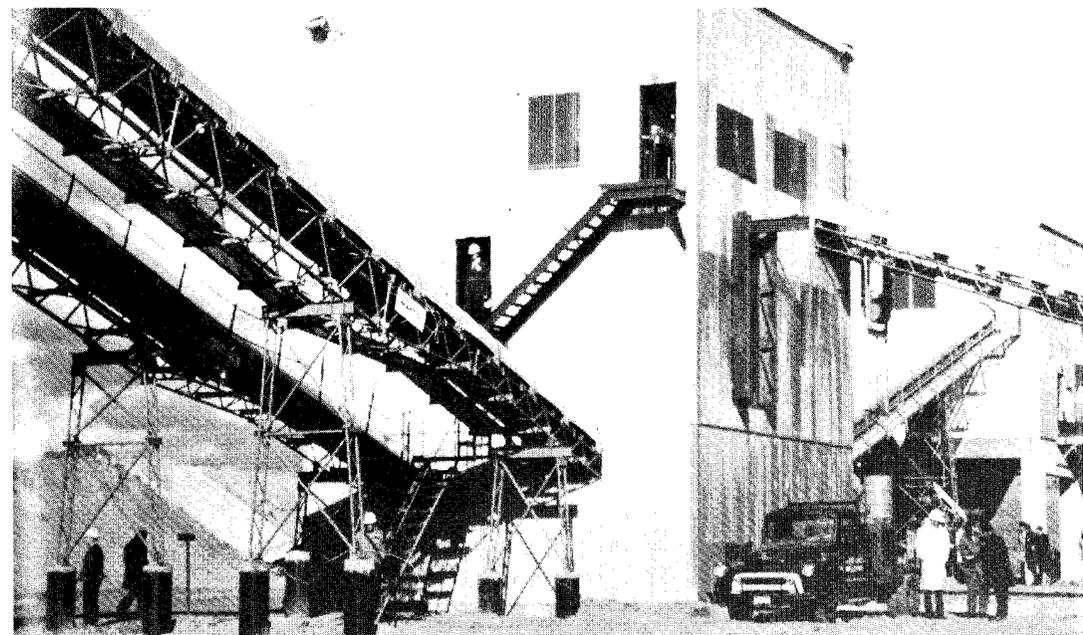


Photo 4—CONSTRUCTION AGGREGATE CORP. New highly automated, light-weight aggregate plant near Grand Haven, Ottawa County. Expanded clay, marketed as USS Lakelite, will be shipped throughout the Great Lakes area for making concrete products and structural concrete. (1969)



Photo 5—HOLLY SAND AND GRAVEL near Holly, Oakland County. Approximately 4,500 tons of classified aggregate are produced each day at this plant. (1965)

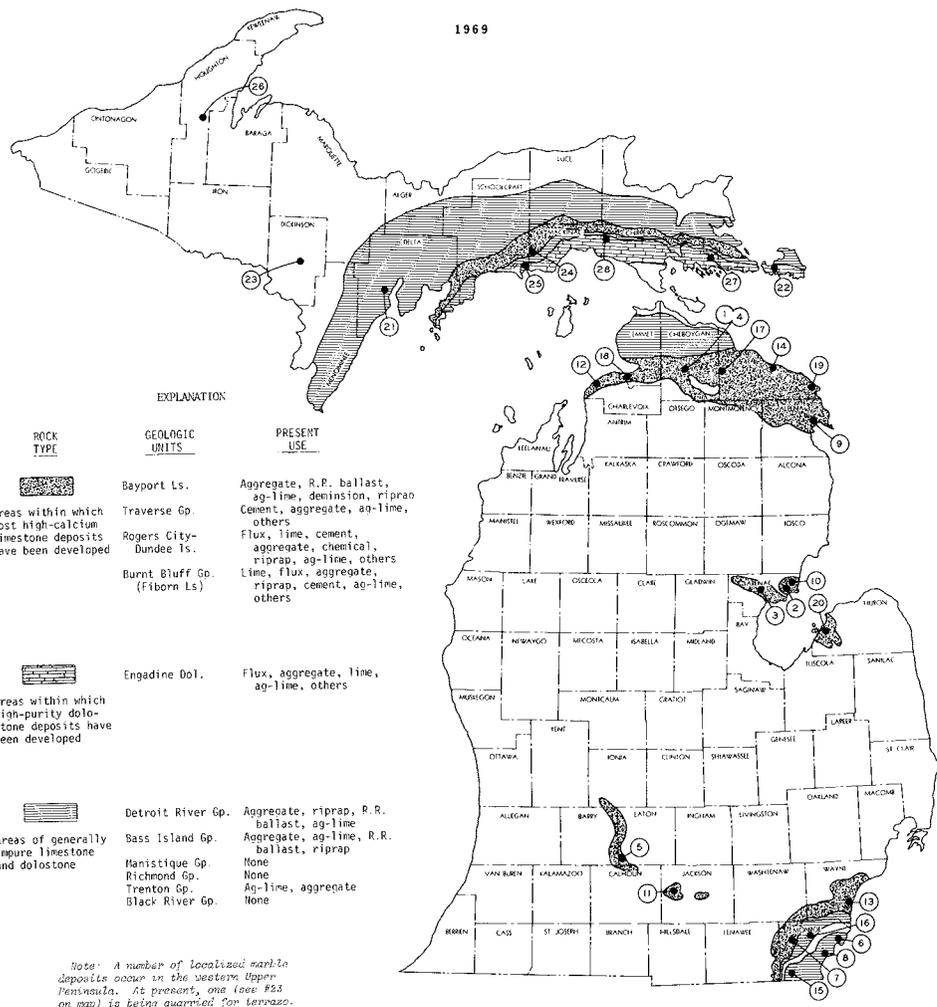


Photo 6—DETROIT EDISON CO. QUARRY. Stone produced at this new quarry at Stoney Point, Monroe County, is used for fill material at the nuclear power plant under construction. (1969)

LIMESTONE RESOURCES OF MICHIGAN

GEOLOGICAL SURVEY DIVISION

1969



NUMBER KEY

No.	Producer's Name	Geologic Unit	No.	Producer's Name	Geologic Unit
SOUTHERN PENINSULA					
1	Afton Stone & Lime Co.	Traverse Gp.	17	Onaway Stone Co.	Traverse Gp.
2	Arenac Co. Road Comm.	Bayport Ls.	18	Penn-Dixie Cement Corp.	Traverse Gp.
3	Bay Co. Road Comm.	Bayport Ls.	19	Presque Isle Corp.	Rogers City Ls.
4	Charlevoix Lime & Stone Co.	Traverse Gp.	20	Wallace Stone Co.	Bayport Ls.
5	Cheney Limestone Co.	Bayport Ls.			
6	Detroit Edison Co.	Bass Islands Gp.	NORTHERN PENINSULA		
7	Dundee Cement Co.	Dundee Ls.	21	Bichlers Gravel Co.	Trenton Gp.
8	France Stone Co.	Bass Islands Gp.	22	Bethlehem Mines Corp.	Engadine Dol.
9	Huron Portland Cement Co.	Traverse Gp.	23	Felch Quarry Co.	Pre-Cambrian (marble)
10	Iosco Co. Road Comm.	Bayport Ls.	24	Inland Lime & Stone Co. (limestone qy)	Burnt Bluff Gp. (Fiborn Ls Mb)
11	Jeffrey Limestone Co.	Bayport Ls.	25	Inland Lime & Stone Co. (dolostone qy)	Engadine Dol.
12	Miduser Portland Cement Co.	Traverse Gp.	26	Limestone Mountain Co.	Trenton Gp.
13	Mich. Foundation Quarry Co.	Detroit River Gp.	27	Mich. Limestone Operation	Engadine Dol.
14	Mich. Limestone Operation	Rogers City-Dundee Ls.	28	Sand Products Corp.	Engadine Dol.
15	Mich. Stone Co. (Ottawa Lake Qy)	Bass Islands Gp.			
16	Mich. Stone Co. (Maybee Qy)	Detroit River Gp.			

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 1952 Stratigraphy and structure of the Devonian rocks in southeastern Michigan and northwestern Ohio: G. M. Ehlers, et al, 48 pp.
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Many of the publications above are out of print, but are in many instances available for use in Michigan public and university libraries, and at the Lansing office of the Michigan Geological Survey.