



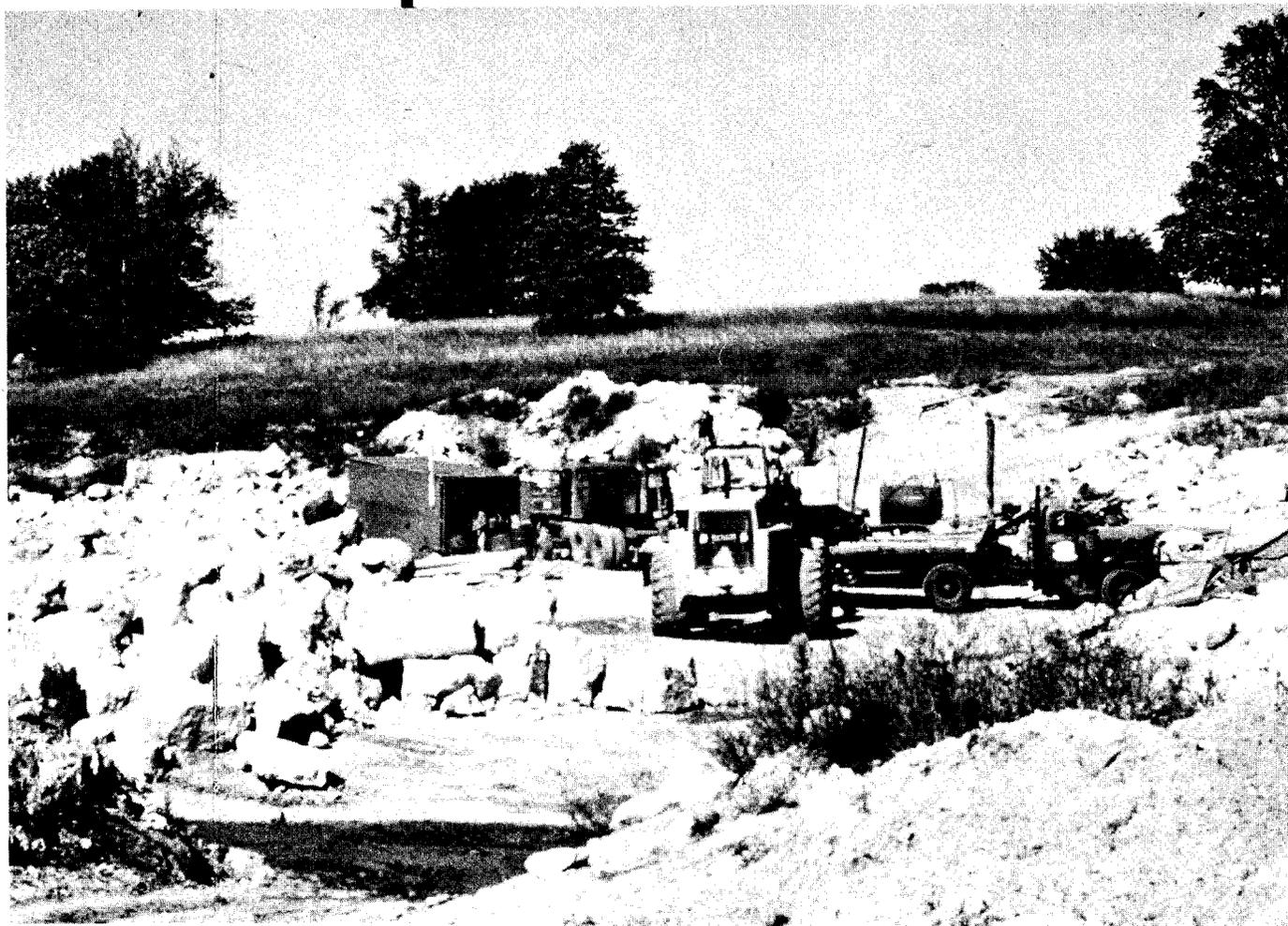
# MINERAL INDUSTRY OF MICHIGAN, 1971

1973

ANNUAL STATISTICAL SUMMARY 17

Geological Survey Division

**COVER PHOTO** — Stone quarry in the Engadine Dolostone rock strata near Trout Lake, Mackinac County. Quarries like this one, usually seen idle, are often reactivated as needs demand. The large boulders, left foreground, were shipped to Mackinac Island for lake shore erosion control.



# The Mineral Industry of Michigan

STATE OF MICHIGAN  
 WILLIAM G. MILLIKEN, *Governor*  
 DEPARTMENT OF NATURAL RESOURCES  
 A. GENE GAZLAY, *Director*  
 GEOLOGICAL SURVEY DIVISION  
 ARTHUR E. SLAUGHTER, *State Geologist and Chief*

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 JOAN L. WOLFE, Belmont, 1973-76

... 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

This chapter has been prepared under a cooperative agreement 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 Grace N. Broderick <sup>1</sup>

The mineral production of Michigan in 1971 was valued at \$640.6 million, a decrease of 4.5 percent from that of 1970. The leading commodity in terms of value continued to be iron ore, followed by cement, sand and gravel, and copper.

mineral value was contributed by production of a wide variety of nonmetallic minerals; metallic minerals accounted for 34 percent; mineral fuels made up the remainder.

About 58 percent of the total Michigan

<sup>1</sup> Physical scientist, Division of Ferrous Metals.

Table I.—Mineral production in Michigan <sup>1</sup>

Mineral	1970		1971	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland.....thousand 376-pound barrels..	29,813	\$101,019	32,489	\$104,665
Masonry.....thousand 280-pound barrels..	1,519	5,253	1,704	5,872
Clays.....thousand short tons..	2,480	2,887	2,458	3,366
Copper (recoverable content of ores, etc.).....short tons..	67,543	77,945	56,005	58,245
Gypsum.....thousand short tons..	1,312	5,061	1,433	5,585
Iron ore (usable).....thousand long tons, gross weight..	13,100	168,958	11,833	159,854
Lime.....thousand short tons..	1,538	21,355	1,444	20,549
Magnesium compounds.....short tons, MgO equivalent..	411,911	38,050	272,918	27,777
Natural gas.....million cubic feet..	38,851	10,373	25,662	6,776
Natural gas liquids:				
Natural gasoline.....thousand 42-gallon barrels..	599	1,611	553	1,513
LP gases.....do.....	1,176	2,764	975	2,623
Peat.....thousand short tons..	167	1,896	202	2,497
Petroleum (crude).....thousand 42-gallon barrels..	11,693	36,246	11,893	38,859
Salt.....thousand short tons..	4,899	49,963	4,458	49,007
Sand and gravel.....do.....	53,092	54,646	56,613	62,898
Silver (recoverable content of ores, etc.).....thousand troy ounces..	892	1,579	670	1,036
Stone.....thousand short tons..	41,687	49,501	40,705	49,240
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones, iodine, and potassium salts (1970).....	XX	41,622	XX	40,274
Total.....	XX	670,729	XX	640,636
Total 1967 constant dollars.....	XX	599,967	XX	<sup>p</sup> 556,585

<sup>p</sup> Preliminary. XX Not applicable.

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

**Employment.**—Preliminary data for 1971 and final data for 1970 compiled by the Federal Bureau of Mines for employment

and injuries in the mineral industries, excluding the petroleum industry, are shown in table 4.

Table 2.—Value of mineral production in Michigan, by county <sup>1</sup>

County	1970	1971	Minerals produced in 1971 in order of value
Alcona	W	\$334	Stone, sand and gravel.
Alger	\$339	69	Sand and gravel.
Allegan <sup>2</sup>	W	924	Sand and gravel, petroleum, peat, stone, natural gas.
Alpena	W	W	Cement, stone, clays, sand and gravel.
Antrim	W	W	Clays, sand and gravel.
Arenac	1,048	1,055	Petroleum, stone, sand and gravel.
Baraga	120	81	Sand and gravel.
Barry	W	W	Sand and gravel, petroleum, stone.
Bay	8,738	10,805	Cement, sand and gravel, petroleum, lime.
Benzie	3	18	Sand and gravel.
Berrien	2,960	W	Sand and gravel, stone.
Branch	355	W	Do.
Calhoun <sup>2</sup>	W	5,061	Petroleum, sand and gravel, stone, natural gas.
Cass	W	W	Sand and gravel, stone.
Charlevoix	12,389	W	Cement, stone, sand and gravel.
Cheboygan	188	W	Stone, sand and gravel.
Chippewa	4,471	3,618	Do.
Clare <sup>2</sup>	W	1,331	Petroleum, sand and gravel, natural gas.
Clinton	W	807	Sand and gravel, clays.
Crawford <sup>2</sup>	W	W	Petroleum, sand and gravel, natural gas.
Delta	270	W	Stone, sand and gravel.
Dickinson	26,983	26,210	Iron ore, stone, sand and gravel.
Eaton	1,033	729	Sand and gravel, stone, clays, peat.
Emmet	9,342	12,882	Cement, stone, sand and gravel.
Genesee	633	975	Sand and gravel, petroleum.
Gladwin	W	912	Petroleum.
Gogebic	114	W	Sand and gravel.
Grand Traverse	W	W	Sand and gravel, petroleum.
Gratiot <sup>2</sup>	W	W	Magnesium compounds, calcium-magnesium chloride, salt, bromine, sand and gravel, petroleum, natural gas.
Hillsdale <sup>2</sup>	W	W	Petroleum, sand and gravel, stone, natural gas.
Houghton	119	W	Sand and gravel, stone.
Huron	1,105	1,276	Stone, lime, sand and gravel.
Ingham	W	1,917	Petroleum, sand and gravel, peat.
Ionia	562	319	Sand and gravel.
Iosco	4,893	5,306	Gypsum, sand and gravel.
Iron	7,020	6,635	Iron ore, sand and gravel.
Isabella <sup>2</sup>	W	W	Sand and gravel, petroleum, natural gas.
Jackson <sup>2</sup>	W	2,921	Petroleum, sand and gravel, stone, natural gas.
Kalamazoo	1,809	W	Sand and gravel, stone.
Kalkaska	521	<sup>2</sup> 1,007	Petroleum, sand and gravel, natural gas.
Kent <sup>2</sup>	4,478	5,106	Sand and gravel, gypsum, petroleum, peat, natural gas.
Keweenaw	21	5	Sand and gravel.
Lake	685	630	Petroleum, sand and gravel.
Lapeer <sup>2</sup>	1,340	1,231	Peat, petroleum, sand and gravel, calcium-magnesium chloride, natural gas.
Leelanau	222	609	Stone, sand and gravel.
Lenawee <sup>2</sup>	766	1,002	Sand and gravel, clays, petroleum, natural gas.
Livingston	3,345	2,936	Sand and gravel.
Luce	33	W	Do.
Mackinac	W	W	Stone, sand and gravel.
Macomb <sup>2</sup>	2,284	2,267	Sand and gravel, petroleum, natural gas.
Manistee	27,573	26,701	Salt, magnesium compounds, bromine, sand and gravel.
Marquette	135,806	128,064	Iron ore, sand and gravel, stone.
Mason	W	26,747	Magnesium compounds, calcium-magnesium chloride, lime, bromine, sand and gravel, petroleum.
Mecosta <sup>2</sup>	W	W	Petroleum, sand and gravel, peat, natural gas.
Menominee	W	W	Lime, sand and gravel.
Midland	W	W	Bromine, salt, calcium-magnesium chloride, magnesium compounds, iodine, petroleum, sand and gravel.
Missaukee <sup>2</sup>	2,008	W	Petroleum, sand and gravel, natural gas.
Monroe	W	W	Cement, stone, clays, peat, petroleum, sand and gravel.
Montcalm	<sup>2</sup> 543	W	Petroleum, sand and gravel.
Montmorency	54	2	Sand and gravel.
Muskegon	2,260	W	Salt, sand and gravel, petroleum.
Newaygo <sup>2</sup>	493	W	Sand and gravel, petroleum, natural gas.
Oakland	W	13,543	Sand and gravel, peat, petroleum.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by county <sup>1</sup>—Continued

County	1970	1971	Minerals produced in 1971 in order of value
Oceana	\$507	\$401	Petroleum, sand and gravel.
Ogemaw <sup>2</sup>	1,736	1,628	Petroleum, sand and gravel, stone, natural gas.
Ontonagon	79,618	59,282	Copper, silver, sand and gravel.
Osceola <sup>2</sup>	2,261	W	Petroleum, sand and gravel, natural gas.
Oscoda	50	40	Sand and gravel, petroleum.
Otsego <sup>2</sup>	911	W	Petroleum, sand and gravel, natural gas.
Ottawa <sup>2</sup>	W	3,763	Sand and gravel, clays, petroleum, natural gas.
Presque Isle	W	W	Stone, sand and gravel, petroleum.
Roscommon <sup>2</sup>	W	W	Petroleum, sand and gravel, natural gas.
Saginaw	513	809	Sand and gravel, lime, clays, petroleum.
St. Clair <sup>2</sup>	19,293	18,923	Salt, petroleum, cement, clays, sand and gravel, natural gas.
St. Joseph	266	198	Sand and gravel, peat, stone.
Sanilac	1,158	1,935	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone.
Shiawassee	682	486	Sand and gravel, peat, clays, petroleum.
Tuscola	W	W	Sand and gravel, petroleum, lime.
Van Buren	174	133	Sand and gravel, petroleum.
Washtenaw	1,354	2,503	Do.
Wayne	57,189	54,028	Cement, lime, salt, sand and gravel, stone, clays, petroleum.
Wexford	121	W	Sand and gravel.
Undistributed <sup>3</sup>	238,321	202,467	
Total	<sup>4</sup> 670,729	640,636	

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

<sup>1</sup> Values for natural gas and natural gas liquids are not available on a county basis; included with "Undistributed."<sup>2</sup> Excludes value of natural gas.<sup>3</sup> 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.<sup>4</sup> Data does not add to total shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

	1970	1971 <sup>p</sup>	Change, percent	
<b>Employment and labor force, annual average:</b>				
Total labor force	thousands	3,618.7	3,618.2	-0.2
Unemployment	do	253.7	295.4	+16.4
<b>Employment:</b>				
Manufacturing	do	1,072.7	1,049.3	-2.2
Contract construction	do	108.9	106.2	-2.5
Mining	do	12.3	11.7	-4.9
Transportation and public utilities	do	149.6	149.2	-0.3
Wholesale and retail trade	do	594.5	596.2	+0.3
Finance, insurance, and real estate	do	118.6	120.0	+1.2
Services	do	422.4	425.9	+0.8
Government	do	506.0	516.1	+2.0
<b>Personal income:</b>				
Total	millions	\$36,124	\$38,821	+7.5
Per capita	do	\$4,058	\$4,317	+6.4
<b>Construction activity:</b>				
Valuation of nonresidential construction	millions	\$478.1	\$508.5	+6.4
Number of private and public residential units authorized	do	51,059	74,229	+45.4
State highway department: Contracts awarded	millions	\$187.1	NA	NA
Portland cement shipments to and within Michigan	thousand 376-pound barrels	14,663	17,815	+21.5
Farm marketing receipts	millions	\$900.2	NA	NA
Mineral production value	do	\$670.7	\$640.6	-4.5

<sup>p</sup> Preliminary. <sup>r</sup> Revised. NA Not available.

Sources: Survey of Current Business, Construction Review, Employment and Earnings, Farm Income Situation, U.S. Bureau of Mines, Area Trends in Employment and Unemployment.

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
1970:								
Peat.....	173	195	43	311	--	5	16.10	230
Metal.....	4,640	303	1,406	11,251	3	314	28.18	2,565
Nonmetal.....	1,719	296	508	4,147	2	87	21.46	3,409
Sand and gravel.....	2,651	215	571	4,835	1	117	24.41	1,988
Stone.....	2,976	294	876	7,122	--	57	8.00	251
Total <sup>1</sup> .....	12,159	279	3,396	27,665	6	580	21.18	1,969
1971: <sup>p</sup>								
Metal.....	4,015	311	1,247	9,976	--	251	25.16	1,517
Nonmetal <sup>2</sup> .....	910	247	224	1,855	--	52	28.04	561
Sand and gravel.....	2,470	225	555	4,786	1	125	26.33	3,178
Stone.....	3,090	275	850	7,001	1	82	11.86	1,238
Total <sup>1</sup> .....	10,485	274	2,877	23,617	2	510	21.68	1,696

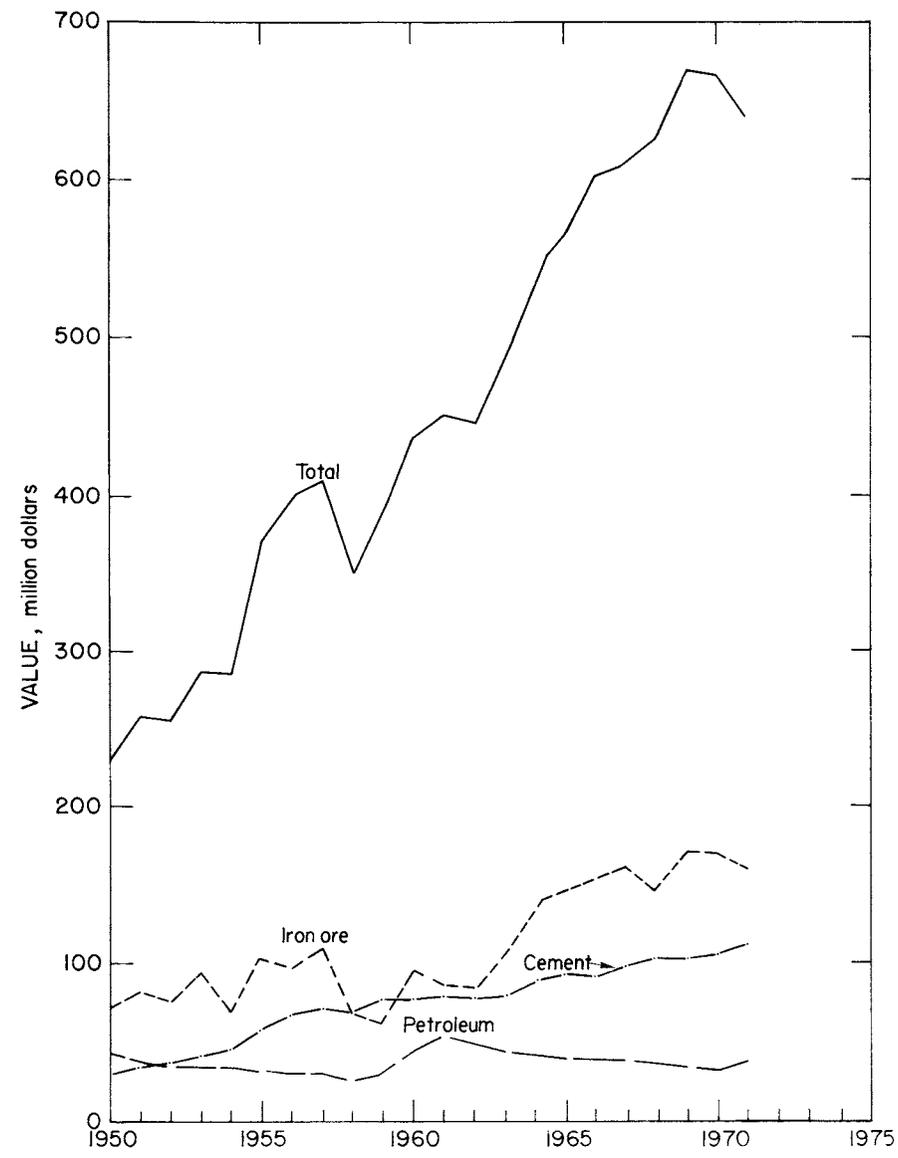
<sup>p</sup> Preliminary.<sup>1</sup> Data may not add to totals shown because of independent rounding.<sup>2</sup> Beginning in 1971, data concerning peat operations are included in the nonmetals industry.

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

## REVIEW BY MINERAL COMMODITIES

## NONMETALS

**Bromine.**—Two areas were productive of bromine from well brines in Michigan: Manistee and Mason Counties, which border Lake Michigan on the western edge of the State, and Midland and Gratiot Counties in central Michigan. Companies producing bromine were The Dow Chemical Co. at its Ludington and Midland plants, Morton Chemical Co. at its Manistee plant, and the Michigan Chemical Corp. at its St. Louis and East Lake plants. The latter plant discontinued operations at midyear. Bromine output decreased both in quantity and value in 1971. Nationally, Michigan continued to rank second to Arkansas in bromine production.

**Calcium-Magnesium Chloride.**—The Dow Chemical Co., Michigan Chemical Corp., and Wilkinson Chemical Corp. produced calcium-magnesium chloride from brine, in Gratiot, Lapeer, Mason, and Midland Counties. Output decreased 2 percent. Wyandotte Chemicals Corp. discontinued production of calcium chloride at Wyandotte in December 1970. The Dow Chemical Co. plans to increase capacity of its Ludington calcium chloride plant by about 25 percent in 1972. Process changes and other modifications will cost more than \$1 million.

**Cement.**—Portland cement shipments increased 9 percent, and value of shipments increased 3.6 percent over those of 1970. Masonry cement shipments increased 12 percent. Portland cement was produced at nine plants in seven counties (Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne); masonry cement was shipped from four of these plants. Average mill value of portland cement was \$3.22 per barrel; average mill value of masonry cement was \$3.44 per barrel. Yearend

stocks of portland cement at mills were 3.3 million barrels, compared with 4.0 million barrels in 1970. Ninety-five percent of the portland cement shipped was types I and II (general use and moderate heat); the remainder was type III (high-early strength), type V (high-sulfate resistance), and expansive. Portland and masonry cement consumed in the State totaled 17,815,000 376-pound barrels and 1,271,000 280-pound barrels, respectively. Portland cement was consumed for ready-mix concrete (64 percent), concrete products (13 percent), building materials (6 percent), contractors (12 percent), and other uses.

Michigan is the fourth largest cement-producing State in the country, outranked only by California, Pennsylvania, and Texas. The leading producers in Michigan were National Gypsum Co., Huron Cement Div.; Peerless Cement Co., Div. of American Cement Corp.; and Dundee Cement Co.

In December Peerless Cement Co.'s new \$45 million cement plant in Detroit became operational. The plant, which opened in May, has an annual capacity of 4.0 million barrels. In 1971 Huron Cement Div. was improving the dust collecting system at its plant at Alpena, and Dundee Cement Co. was installing two electrostatic precipitators at its plant in Dundee.

St. Lawrence Cement Co. acquired the cement production facilities of BASF Wyandotte Corp. in the Detroit area. Operations were conducted by Wyandotte Cement Inc., a subsidiary of St. Lawrence Cement Co., and clinker was furnished from the company's plant at Mississauga, a suburb of Toronto, Canada. Wyandotte was replacing the 94-pound bag with a new 80-pound bag.

Table 5.—Portland cement salient statistics  
(Thousand 376-pound barrels and thousand dollars)

	1970	1971
Number of active plants.....	19	29
Rated clinker capacity, Dec. 31.....	29,539	33,024
Production.....	129,655	31,995
Shipments from mills:		
Quantity.....	29,813	32,489
Value.....	\$101,019	\$104,665
Stocks at mills, Dec. 31.....	3,959	3,297

<sup>1</sup> One plant ceased kiln and grinding operations; another plant ceased kiln operations, but continued as a grinding plant on imported clinker.

<sup>2</sup> A new (kiln and grinding) plant started operating in May 1971.

**Clays.**—Miscellaneous clays and shale were mined at 15 pits in 11 counties. Output of clay and shale was about 1 percent less than in 1970. Seventy-eight percent of the clay or shale was used in cement manufacture in 1971, compared with 82 percent used for this purpose in 1970. The remainder was used for lightweight aggregate and heavy clay products. The largest production was reported from Alpena, Monroe, Wayne, Antrim, Ottawa, St. Clair, and Saginaw Counties.

**Gem Stones.**—Agate, native copper specimens, Petoskey stone, selenite, brown calcite, pyrite, and chert were among the small quantities of semiprecious stones and minerals collected in the State in 1971. Estimated value of material found in 1971 increased over the 1970 estimate, but gem stones continued to contribute only a very minor amount of the State's total mineral value.

**Gypsum.**—Gypsum output and value in 1971 were 1,433 thousand short tons and \$5.6 million, respectively. The State continued to be the leading gypsum-producer. 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 gypsum for building material plants at National City, Detroit, and in other States. Gypsum materials were shipped by lake transport from deepwater ports at National City and Alabaster.

**Iodine.**—The Dow Chemical Co., the sole domestic producer, continued to recover crude iodine from natural well brines at Midland. Production decreased 4.9 percent from that of 1970; value increased by 48.5 percent.

**Lime.**—Seven companies produced lime at 10 plants in eight counties. Leading counties were Wayne, Mason, and Menominee. Leading companies were BASF Wyandotte Corp., Marblehead Lime Co., and Detroit Lime Co. Output decreased 6 percent and was 19 percent below the 1967 record. The lime was used for steel furnaces, alkalis, water purification, and other uses. The lime was consumed in Michigan, Ohio, Wisconsin, Indiana, and Canada.

**Magnesium Compounds.**—Output of magnesium compounds, recovered from natural well brines, declined nearly 34 percent in quantity and 27 percent in value in 1971. The State, nonetheless, continued to lead the Nation in production of refractory magnesia.

The Midland plant of Kaiser Aluminum & Chemical Corp., which produced magnesium oxide from magnesium hydroxide supplied by The Dow Chemical Co., was inactive in 1971. Morton Chemical Co. is completing an expansion of production facilities for magnesium carbonate and magnesium oxide at Manistee. Harbison-Walker Refractories Co. continued to produce refractory magnesia from purchased magnesium hydroxide.

**Perlite.**—Crude perlite, mined in Western States, was expanded at plants in Iosco and Wayne Counties. The material was used for roof insulation and plaster aggregate.

**Salt.**—Salt was produced from an underground mine in Wayne County, and from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties. Output was 9 percent less than in 1970 and value 1.9 percent less. Michigan continued to rank fifth among the States in production of salt, outranked only by Louisiana, Texas, Ohio, and New York.

**Sand and Gravel.**—Michigan continued to be a leading source of sand and gravel production, the second highest in the Nation (after California). Tonnage increased 6.6 percent and was valued at \$62.9 million, an increase of more than 15 percent over 1970. The amount of sand and gravel sold or used by producers in 1971 for building, molding, and paving increased, and that sold or used for fill material declined. Nearly every county in Michigan reported sand and gravel production. In each of nine counties, output exceeded 1 million tons. These counties provided almost 51 percent of the State production. Five of these counties make up metropolitan Detroit and produced nearly 21 million tons. About 92 percent of the sand and gravel was moved by truck, and the remainder was shipped by rail or water. Production was reported from 330 commercial and 58 Government-and-contractor operations.

Table 6.—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	1970		1971	
	Quantity	Value	Quantity	Value
<b>Commercial operations:</b>				
<b>Sand:</b>				
Building.....	6,971	\$6,181	8,568	\$7,952
Engine.....	W	W	39	104
Fill.....	3,655	1,783	3,184	1,619
Molding.....	3,188	5,994	3,435	7,063
Paving.....	4,884	4,720	6,773	6,610
Other uses <sup>1</sup> .....	2,131	3,765	1,406	3,608
Total <sup>2</sup> .....	20,829	22,444	23,405	26,954
<b>Gravel:</b>				
Building.....	6,201	10,006	6,359	10,596
Fill.....	383	229	463	263
Paving.....	17,116	16,245	19,103	19,098
Railroad ballast.....	138	186	19	35
Miscellaneous.....	213	136	1,206	1,476
Other uses.....	354	522	799	624
Total <sup>2</sup> .....	24,405	27,324	27,950	32,092
<b>Government-and-contractor operations:</b>				
<b>Sand:</b>				
Building.....	—	—	34	3
Fill.....	677	291	1,091	303
Paving.....	2,055	1,163	886	461
Other uses.....	132	77	183	79
Total <sup>2</sup> .....	2,865	1,531	2,195	846
<b>Gravel:</b>				
Building.....	38	24	163	145
Fill.....	446	201	248	92
Paving.....	4,474	3,103	2,650	2,768
Other uses.....	34	19	1	( <sup>3</sup> )
Total <sup>2</sup> .....	4,992	3,346	3,062	3,005
Total sand and gravel <sup>2</sup> .....	53,092	54,646	56,613	62,898

W Withheld to avoid disclosing individual company confidential data; included with other uses.  
<sup>1</sup> Includes abrasives, railroad ballast, blast, enamel, foundry (1971), glass, grinding and polishing, pottery, and other sands.  
<sup>2</sup> Data may not add to totals shown because of independent rounding.  
<sup>3</sup> Less than ½ unit.

Table 7.—Sand and gravel sold or used by producers, by county  
(Thousand short tons and thousand dollars)

County	1970			1971		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alcona.....	2	W	W	2	272	\$135
Alger.....	2	68	\$39	1	85	69
Allegan.....	8	933	601	7	755	497
Alpena.....	3	102	W	3	W	W
Antrim.....	1	78	62	1	84	73
Barraga.....	2	W	120	2	168	81
Benzie.....	8	1,034	991	7	582	707
Berrien.....	1	8	3	1	18	18
Branch.....	8	1,647	2,957	7	1,438	2,558
Calhoun.....	2	219	354	2	W	W
Cass.....	7	390	262	5	W	W
Charlevoix.....	7	823	521	6	349	319
Clare.....	6	132	68	6	66	50
Clinton.....	2	W	W	3	82	44
Delta.....	15	801	675	8	764	783
Dickinson.....	4	299	W	3	W	W
Dickson.....	4	123	151	2	W	W
Eaton.....	8	919	702	10	652	512
Emmet.....	4	131	77	2	74	55
Genesee.....	17	534	548	9	816	753
Gogebic.....	3	120	114	3	W	W

See footnotes at end of table.

Table 7.—Sand and gravel sold or used by producers, by county—Continued  
(Thousand short tons and thousand dollars)

County	1970			1971		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Grand Traverse.....	1	270	W	2	W	W
Gratiot.....	4	428	373	6	293	262
Hillsdale.....	7	507	591	4	107	56
Houghton.....	3	153	94	2	W	W
Huron.....	6	319	W	4	W	W
Ingham.....	10	1,285	1,087	8	774	778
Ionia.....	8	679	562	3	338	319
Iron.....	3	232	246	3	W	W
Kalamazoo.....	10	W	W	11	1,003	1,459
Kalkaska.....	1	21	11	1	22	20
Kent.....	24	2,723	3,439	19	2,525	3,968
Keweenaw.....	1	40	21	1	16	5
Lake.....	1	49	28	1	40	22
Lapeer.....	6	547	384	4	328	187
Lenawee.....	6	670	756	11	810	996
Livingston.....	9	2,827	3,343	6	2,576	2,936
Luce.....	3	52	33	2	W	W
Mackinac.....	4	212	104	5	W	W
Macomb.....	9	2,525	2,268	10	2,147	2,254
Marquette.....	12	325	283	9	545	577
Mecosta.....	4	279	281	2	161	126
Menominee.....	3	397	230	3	95	90
Missaukee.....	2	234	276	2	W	W
Montcalm.....	4	435	193	3	W	W
Montmorency.....	2	93	54	1	49	2
Muskegon.....	5	476	W	4	461	1,095
Newaygo.....	9	754	439	4	W	W
Oakland.....	29	9,895	10,597	24	11,274	13,494
Oceana.....	5	412	300	2	271	159
Ogemaw.....	6	808	809	5	W	W
Ontonagon.....	2	155	94	1	84	1
Osceola.....	2	695	688	1	W	W
Oscoda.....	1	102	46	1	63	33
Otsego.....	2	43	29	2	W	W
Ottawa.....	12	2,519	2,769	16	2,875	3,188
Presque Isle.....	4	W	527	3	W	W
Saginaw.....	3	255	179	2	W	W
Sanilac.....	10	681	329	5	W	W
Schoolcraft.....	3	259	178	—	—	—
Shiawassee.....	11	440	405	5	289	239
Tuscola.....	13	936	1,178	8	712	953
Van Buren.....	5	194	156	3	155	122
Washtenaw.....	12	1,360	1,342	9	2,188	2,487
Wayne.....	8	2,352	3,953	8	2,769	4,600
Wexford.....	5	158	121	1	W	W
Various.....	—	—	—	25	8,934	7,544
Undistributed <sup>1</sup> .....	49	6,881	7,607	46	8,502	8,272
Total <sup>2</sup> .....	453	53,092	54,646	388	56,613	62,898

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."  
<sup>1</sup> Includes Arenac, Bay, Cheboygan, Chippewa, Crawford, Gladwin (1970), Iosco, Isabella, Jackson, Lelanau, Manistee, Mason, Midland, Monroe, Roscommon, St. Clair, and St. Joseph Counties.  
<sup>2</sup> Data may not add to totals shown because of independent rounding.

**Stone.**—Michigan, with a production of 40.7 million tons, ranked eighth in the Nation's output of stone. Production (principally crushed limestone and dolomite) decreased more than 2 percent from that of 1970. Over 92 percent of the production was reported from seven counties: Alpena, Chippewa, Emmet, Mackinac, Monroe, Presque Isle, and Wayne. Much of the material (66 percent) was shipped by boat from company-owned ports on Lakes Huron and Michigan to steel mills, cement and lime plants, and other consumers.

Changes in steelmaking practices (in-

creased use of pellets in the blast furnace and increased use of basic oxygen furnaces) have changed demand for flux stone. Steel mills are specifying smaller product sizes; crushing and screening plants are being revised to produce a different product mix. More crushing is required to produce the top size, which is now smaller, without producing fines in excess of market demands. As shown in table 9, crushed and broken stone sold or used by producers for use as flux decreased from 12,973 thousand short tons in 1970 to 10,740 thousand short tons in 1971.

Table 8.—Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1970		1971	
	Quantity	Value	Quantity	Value
<b>Dimension:</b>				
Limestone and dolomite.....	(1)	(1)	1	\$26
Marble.....	4	\$91	--	--
Sandstone.....	3	47	--	--
Total 2.....	6	138	1	26
<b>Crushed and broken:</b>				
Limestone.....	35,390	39,768	32,229	35,077
Dolomite.....	6,124	9,356	7,275	11,267
Marl 3.....	156	221	119	111
Traprock.....	10	18	9	14
Other 4.....	--	--	1,072	2,745
Total 2.....	41,681	49,363	40,704	49,214
Grand total.....	41,687	49,501	40,705	49,240

1 Withheld to avoid disclosing individual company confidential data; included with "Sandstone" for 1970.

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

3 Combined with granite for 1970 to avoid disclosing individual company confidential data.

4 Includes granite, sandstone, quartz and miscellaneous stone.

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

(Thousand short tons and thousand dollars)

Use	1970		1971	
	Quantity	Value	Quantity	Value
Bituminous aggregate.....	W	W	736	\$921
Concrete aggregate.....	2,803	\$3,161	3,048	3,261
Dense graded road base stone.....	502	607	805	954
Surface treatment aggregate.....	W	220	342	494
Unspecified aggregate and roadstone.....	4,163	6,233	3,676	5,491
Agricultural limestone.....	564	666	495	529
Cement.....	8,467	7,638	8,637	7,250
Flux.....	12,973	17,121	10,740	14,392
Lime.....	7,775	8,593	7,345	8,117
Other soil conditioners.....	142	140	69	65
Riprap and jetty stone.....	W	W	595	696
Terrazzo.....	--	--	3	65
Other 1.....	4,290	4,985	4,212	6,980
Total 2.....	41,681	49,363	40,704	49,214

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

1 Includes stone used for chemical uses, paper manufacturing, poultry grit, macadam aggregate, railroad ballast, stone sand, sugar refining and other uses not listed; also, dead-burned dolomite (1970) and drain fields (1971).

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

**Sulfur.**—Byproduct sulfur was recovered from crude petroleum by Total Leonard, Inc. (Alma), Marathon Oil Co. (Detroit), and Mobil Oil Co., Inc. (Woodhaven). Shipments remained about the same as in 1970, but value of output declined by more than 12 percent.

**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, plaster aggregate, concrete aggregate, and for agricultural and other uses.

#### METALS

**Copper.**—Production of copper, in terms

of recoverable metal, was 17 percent less than in 1970, and its value was 25 percent lower. The White Pine Copper Co., a subsidiary of the Copper Range Co., continued to be the only producer of primary copper in Michigan. A strike at the mine, which started August 1, was terminated on September 24. The White Pine mill has a total concentrating capacity of 25,000 tons of ore per day, and adequate smelter capacity to process the output of the concentrating plant. Early in 1971, a small plant to recover copper from slag, a smelter waste product, was completed.

Table 10.—Mine production (recoverable) of silver and copper

	1969	1970	1971
Mines producing: Lode.....	1	1	1
Material sold or treated: Copper ore..... thousand short tons..	8,200	7,638	6,891
Production (recoverable):			
Quantity:			
Silver..... troy ounces..	1,009,022	891,579	670,052
Copper..... short tons..	75,226	67,543	56,005
Value:			
Silver..... thousands..	\$1,807	\$1,579	\$1,036
Copper..... do.....	71,516	77,945	58,245
Total..... do.....	73,323	79,524	59,281

**Iron Ore.**—Iron ore shipments in 1971 were 11.8 million long tons, a decrease of 9.7 percent from the 13.1 million long tons shipped in 1970. The average weighted mine value for Michigan usable iron ore shipments in 1971 was \$13.51, compared with \$12.90 in 1970. Iron ore continued to be the leading commodity in the State in terms of total mineral value.

About 90 percent of the crude ore production in 1971 came from four open pit mines: The Empire, Republic, and Tilden mines in Marquette County, and the Groveland mine in Dickinson County. The remaining production came from two underground mines: The Mather mine in

Marquette County and the Sherwood mine in Iron County. The Tracy underground mine of Jones & Laughlin Steel Corp., near Negaunee in Marquette County, ceased mining in January and completed shipments from stockpile in July. Other closed mines still shipping from stockpiles were the Cliffs Shaft mine and Humboldt mines in Marquette County, and the Homer and Wauseca mines in Iron County.

Cleveland-Cliffs Iron Co. plans to develop a hematite taconite mine and pellet plant near Ishpeming in the Upper Peninsula. The Tilden Project, as it is called, would double the company's domestic iron ore pellet output by mid-1974.

Table 11.—Usable iron ore 1 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		Iron content (percent)
				Ore	Iron content	
1854-1966.....	349,369	279,729	249,576	878,675	NA	NA
1967.....	10,231	3,750	49	14,030	8,453	60.25
1968.....	10,086	3,684	--	13,770	8,339	60.56
1969.....	10,048	3,369	--	13,417	8,183	60.99
1970.....	10,363	2,394	--	12,757	7,950	62.32
1971.....	9,495	2,424	--	11,919	7,384	61.95
Total 2.....	399,592	295,350	249,625	944,568	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 12.—Iron ore shipped from mines

(Thousand long tons)

Year	Direct-shipping ore 1	Total concentrates and agglomerates	Total usable ore	Proportion of beneficiated ore to total usable ore (percent)
1968.....	2,353	10,346	12,699	81.5
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

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

2 Data does not add to total shown because of independent rounding.

**Pig Iron and Steel.**—Pig iron and steel were manufactured in the Detroit area. Pig iron shipments and value decreased 2.5 percent but increased 6.7 percent, as compared with 1970. According to the American Iron & Steel Institute, Michigan produced 9,069 thousand short tons of steel in 1971, compared with 9,547 thousand short tons of steel in 1970.

**Silver.**—Silver was recovered from copper ore mined at the White Pine mine. Concentrates from a silver-recovery circuit in the White Pine mill were shipped to an outside smelter for silver recovery. Output of silver in 1971 was 25 percent less than in 1970, and value was 34 percent less than in 1970.

#### MINERAL FUELS

**Natural Gas and Natural Gas Products.**—Natural gas was produced in 22 counties from both gas and oil wells; about 89 percent came from six counties—Calhoun, Hillsdale, Jackson, Macomb, Otsego, and St. Clair. Marketed production of natural gas decreased nearly 34 percent from that of the previous year. Proved natural gas reserve estimates of the American Gas Association, Inc. (AGA), for 1971 list 1,016,482 million cubic feet for Michigan, a gain of 76,811 million cubic feet. Gas-liquid reserves, according to AGA, increased from 9,903 thousand barrels in 1970 to 12,584 thousand barrels, a gain of 2,681 thousand barrels.

**Peat.**—Michigan again led the Nation in peat production accounting for about one-third of the U.S. total. Production, which increased from 156,699 short tons in 1970 to 209,835 short tons in 1971, was obtained from 11 counties. Seventy-nine percent of the State total came from Lapeer and San-

ilac Counties; other peat-producing counties were Allegan, Eaton, Ingham, Kent, Mecosta, Monroe, Oakland, St. Joseph, and Shiawassee.

Sales totaled 202,189 short tons in 1971, compared with 166,950 short tons in 1970, and the average value of peat produced in Michigan increased from \$11.36 per ton in 1970 to \$12.35 per ton in 1971. Ninety-three percent of the total output was used for general soil improvement; the remainder was used as an ingredient for potting soils, for mushroom beds, and packing flowers, etc. Slightly over 80 percent of the peat sold was in packaged form. Reed-sedge peat accounted for 77 percent of the total sales; humus peat, 15 percent; and moss peat, 8 percent.

**Petroleum.**—Petroleum was produced in 46 counties, and more than half of this production came from five counties—Calhoun, Jackson, Hillsdale, Otsego, and St. Clair. Production of 11,893 thousand barrels represented a gain of 1.7 percent over the 1970 figure. Reserves of crude oil, according to the American Petroleum Institute, were 58,765,000 barrels on December 31, 1971, an increase of 13,150,000 barrels over that of the previous year.

Total Leonard, Inc. began constructing a \$6 million hydrocarbon platforming unit at Alma, Mich. The plant capacity is expected to be 20,000 barrels of gasoline per day. The crude oil comes from northern Michigan and Canadian oilfields.

When new gas line connections are completed in the northern Michigan gasfields, it is expected that the northern part of the Lower Peninsula will change from a gas-importing area to an area exporting gas to the southern Michigan industrial areas.

Table 13.—Crude oil production, by county

(Thousand 42-gallon barrels and thousand dollars)

County	1970		1971	
	Quantity <sup>1</sup>	Value <sup>2</sup>	Quantity <sup>1</sup>	Value <sup>2</sup>
Allegan	130	\$404	122	\$399
Arenac	226	701	231	755
Barry	10	32	12	39
Bay	249	772	234	765
Calhoun	1,828	5,666	1,533	5,009
Clare	462	1,432	394	1,287
Crawford	496	1,537	524	1,712
Genesee	27	85	68	222
Gladwin	299	928	279	912
Grand Traverse	--	--	3	10
Gratiot	11	33	7	23
Hillsdale	2,602	8,065	2,356	7,698

See footnotes at end of table.

Table 13.—Crude oil production, by county—Continued

(Thousand 42-gallon barrels and thousand dollars)

County	1970		1971	
	Quantity <sup>1</sup>	Value <sup>2</sup>	Quantity <sup>1</sup>	Value <sup>2</sup>
Huron	1	4	(3)	1
Ingham	6	20	348	1,137
Isabella	201	622	187	611
Jackson	1,048	3,247	849	2,774
Kalkaska	165	510	302	987
Kent	63	194	58	190
Lake	212	657	186	608
Lapeer	62	192	81	265
Lenawee	(3)	1	(3)	1
Livingston	1	2	--	--
Macomb	5	16	4	13
Mason	37	115	29	95
Mecosta	172	535	101	330
Midland	184	571	185	604
Missaukee	559	1,732	545	1,781
Monroe	2	7	2	7
Montcalm	113	350	123	402
Muskegon	32	99	20	65
Newaygo	17	54	16	52
Oakland	(3)	1	1	3
Oceana	67	207	74	242
Ogemaw	299	927	346	1,130
Osceola	507	1,573	622	2,032
Oscoda	1	4	2	7
Otsego	235	883	815	2,663
Ottawa	59	184	51	167
Presque Isle	1	5	(3)	1
Roscommon	167	517	209	683
Saginaw	21	67	21	69
St. Clair	977	3,028	873	2,852
Shiawassee	9	28	7	23
Tuscola	63	196	60	196
Van Buren	6	18	5	16
Washtenaw	4	12	5	16
Wayne	5	16	4	13
Total <sup>4</sup>	11,693	36,246	11,893	38,859

<sup>1</sup> Source: State of Michigan, Department of Natural Resources.

<sup>2</sup> County values calculated by using State average value per barrel: \$3.10 for 1970 and \$3.27 for 1971.

<sup>3</sup> Less than 1/2 unit.

<sup>4</sup> Data may not add to totals shown because of independent rounding.

Table 14.—Oil and gas well drilling completions, by county

County	Proved field wells <sup>1</sup>			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Allegan	--	--	--	1	--	2	3	7,545
Alpena	--	--	--	--	--	1	1	5,260
Antrim	--	--	--	--	--	1	1	6,578
Arenac	--	--	1	--	--	2	3	9,467
Barry	--	--	--	--	--	3	3	14,057
Bay	--	--	1	--	--	2	3	9,705
Benzie	--	--	--	--	--	1	1	5,445
Branch	--	--	--	--	--	1	1	3,515
Calhoun	--	1	6	--	1	5	13	52,779
Charlevoix	--	--	--	--	--	2	2	8,954
Clare	1	--	--	--	--	--	1	4,020
Clinton	--	--	--	--	--	1	1	2,647
Crawford	--	--	--	1	--	--	1	7,300
Eaton	--	--	3	1	--	3	7	30,272
Genesee	6	1	1	--	--	1	9	23,501
Gladwin	1	--	2	1	--	2	6	23,591
Grand Traverse	--	--	1	--	2	1	4	25,363
Gratiot	--	--	--	--	--	2	2	6,315
Hillsdale	5	--	11	1	--	5	22	88,034
Ingham	16	--	8	4	1	6	35	148,703
Isabella	--	--	1	--	--	2	3	11,579
Jackson	--	--	2	--	--	8	10	46,735

See footnote at end of table.

Table 14.—Oil and gas well drilling completions, by county—Continued

County	Proved field wells <sup>1</sup>			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Kalkaska	6	--	--	8	5	4	23	159,854
Lake	1	--	--	--	--	1	2	6,912
Lapeer	5	1	--	--	--	--	6	17,018
Lenawee	--	--	1	--	--	--	4	15,471
Livingston	--	8	1	--	--	--	11	43,556
Macomb	--	--	--	--	--	--	1	3,705
Manistee	--	--	--	--	--	--	2	9,901
Mason	--	--	1	--	--	--	1	5,122
Mecosta	--	--	--	--	--	--	4	11,830
Midland	--	--	--	--	--	--	1	3,518
Monroe	--	--	--	--	--	--	1	2,575
Montcalm	1	--	7	1	--	1	10	34,719
Montmorency	--	--	--	--	--	--	1	4,833
Newaygo	--	--	--	--	--	3	3	6,376
Oakland	--	4	2	--	--	--	6	26,036
Oceana	2	--	1	2	1	5	11	24,125
Ogemaw	1	--	--	--	--	1	2	12,923
Oscoda	1	2	1	--	1	1	6	14,400
Ottawa	--	--	--	--	--	2	2	16,396
Presque Isle	6	--	5	5	--	8	24	149,967
St. Clair	--	--	--	--	--	2	2	4,373
Tuscola	--	--	--	--	--	1	1	3,153
Van Buren	--	--	--	--	--	2	2	4,599
Washtenaw	--	--	--	--	1	2	3	11,002
Wexford	--	--	--	--	--	1	1	8,306
Total	55	20	66	26	13	122	302	1,254,097

<sup>1</sup> Development wells as defined by American Petroleum Institute.  
Source: American Petroleum Institute.

Table 15.—Principal producers <sup>1</sup>

Commodity and company	Address	Type of activity	County
<b>Cement:</b>			
Aetna Portland Cement Co., div. of 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.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Portland and masonry dry process.	Alpena.
Medusa Portland Cement Co.	Box 5668 Cleveland, Ohio 44101	Portland, wet process.	Charlevoix.
Peerless Cement Co., div. of American Cement Corp.: Port Huron Plant.	900 The Executive Plaza Detroit, Mich. 48226	do.	St. Clair.
Brennan Ave. Plant.	do.	do.	Wayne.
Penn-Dixie Cement Corp.	Box 152 Nazareth, Pa. 18064	Portland and masonry, wet process.	Emmet.
Wyandotte Cement Inc.	3505 Biddle Ave. Wyandotte, Mich. 48192	do.	Wayne.
<b>Clays and shale:</b>			
Aetna Portland Cement Co., div. of Martin Marietta Corp.	Box 8 Bay City, Mich. 48706	Pit.	Saginaw.
Dundee Cement Co.	Box 317 Dundee, Mich. 48131	Pit.	Monroe.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Pit.	Alpena.
Light Weight Aggregate Corp.	12720 Farmington Rd. Livonia, Mich. 48150	Pit and plant.	Wayne.
Medusa Portland Cement Co.	Box 5668 Cleveland, Ohio 44101	Pit.	Antrim.
Peerless Cement Co., div. of American Cement Corp.	900 The Executive Plaza Detroit, Mich. 48226	Pits.	St. Clair, Wayne.
Penn-Dixie Cement Corp.	Box 307 Petuskey, Mich. 49770	Pit.	Emmet.

See footnote at end of table.

Table 15.—Principal producers <sup>1</sup>—Continued

Commodity and company	Address	Type of activity	County
<b>Coke:</b>			
Industrial Chemicals Div. Allied Chemical 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.
<b>Copper:</b>			
White Pine Copper Co., subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Mine and mill.	Ontonagon.
<b>Gypsum:</b>			
Georgia-Pacific Corp. Gypsum Division.	900 SW. 5th 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.
<b>Iron ore:</b>			
Cleveland-Cliffs Iron Co.:	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Empire	do.	Open pit mine, concentrator, and agglomerator.	Marquette.
Mather	do.	Underground mine. Ore treated at the Ore Improvement Plant and Pioneer Pellet Plant.	Do.
Ore improvement plant.	do.	Processes Mather ore. Pelletizes ore from the Mather mine.	Do.
Pioneer pellet plant.	do.	do.	Do.
Republic	do.	Open pit mine, concentrator, and agglomerator. Part of the concentrates pelletized at the Humboldt plant.	Do.
Tilden	do.	Open pit mine and stockpile shipments.	Do.
The Hanna Mining Co.:	100 Erieview Plaza Cleveland, Ohio 44114	Open pit mine, concentrator, and agglomerator.	Dickinson.
Inland Steel Co.:	30 West Monroe St. Chicago, Ill. 60603	Underground mine.	Iron.
<b>Iron and steel:</b>			
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.
<b>Lime:</b>			
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.	Midland, Mich. 48640	Quicklime, 3 rotary kilns, continuous hydrator.	Mason.
Marblehead Lime Co.	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.
<b>Peat:</b>			
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.

See footnote at end of table.

Table 15.—Principal producers<sup>1</sup>—Continued

Commodity and company	Address	Type of activity	County
Peat—Continued			
J. M. Huber Corp.-----	(Peat Department) P.O. Box 312 Sandusky, Mich. 48471	Bog, processing plant.	Sanilac.
Michigan Peat-----	Eight Executive Mall Valley Forge, Pa. 19481	Bogs, processing plant.	Do.
Scenic Lakes, Inc.-----	Box 926 East Lansing, Mich. 48823	Bog, processing plant.	Shiawassee.
Expanded Perlite:			
National Gypsum Co.-----	325 Delaware Ave. Buffalo, N.Y. 14202	Processing plant.	Iosco.
United States Gypsum Co.-----	101 South Wacker Dr. Chicago, Ill. 60606	do.	Wayne.
Petroleum refineries:			
Bay Refining Division, 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.
Total Leonard, Inc.: Alma Division-----	East Superior St. Alma, Mich. 48801		Gratiot.
Marathon Oil Co.-----	1300 South Fort St. Detroit, Mich. 48217		Wayne.
Mobil Oil Co., Inc.-----	Box 477 Trenton, Mich. 48183		Do.
Osceola Refining Co.-----	Box 178 Reed City, Mich. 49677		Ogemaw.
Salt and salines:			
American Salt Corp.-----	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-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 Pittsburgh, Pa. 15222	Processing plant: Magnesium compounds.	Mason.
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.-----	Clarks Summit, Pa. 18411	Underground salt mine.	Wayne.
Kaiser Aluminum & Chemical Corp.-----	900 17th St., N.W. Washington, D.C. 20006	Processing plant: Magnesium compounds.	Midland.
Michigan Chemical Corp.: East Lake Plant.-----	351 East Ohio St. Chicago, Ill. 60611	Processing plant: Bromine.	Manistee.
St. Louis Plant.-----		Brine wells and processing plant: Bromine, calcium-magnesium compounds, magnesium compounds, salt.	Gratiot.
Morton Chemical Co., div. of 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.-----		Brine wells and processing plant: Salt.	Do.

See footnote at end of table.

## ENGADINE DOLOSTONE

Large tonnages of high-purity low-silica dolostone of the Engadine Group (Silurian Niagaran Series) are present near the shores of Lake Michigan and Lake Huron in Schoolcraft, Mackinac, and Chippewa Counties of the Upper Peninsula of Michigan. Reserves of 100 to more than 300 million tons are located at Engadine, Rexton, Ozark, and Kenneth, southeast of Gould City, and northwest of Hessel in Mackinac County. Similar reserves are found south of Stalwart and on eastern Drummond Island in Chippewa County. Lesser reserves are located near Gulliver in Schoolcraft County and at Gatzville and DeTour Village in Chippewa County.

The dolostone is quarried extensively by three major corporations for use as flux stone in the manufacture of high quality steel at steel centers in the Lower Great Lakes region and by a fourth firm for fill and riprap material. Large tonnages of the dolostone are produced for concrete aggregate for highway construction as well as for magnesium lime burning. Quarry operations are located near Gulliver, Rexton, and Cedarville and on eastern Drummond Island. In addition, several small abandoned quarries were located throughout The Engadine outcrop belt in the Eastern Upper Peninsula. These were formerly worked for lime, foundation stone, and road metal.

The lower 100 feet and upper 50 feet of the Engadine Dolostone is characterized by very massive bedding. Maximum thickness of the formation is about 225 feet at a point six miles east of Cedarville where the strata dips southward under the waters of Lake Huron. The dolostone is characterized by its distinctive white or light gray color and its uniform crystallinity. Chemically, it is almost pure dolomite with silica content less than one percent in many places.

The Engadine Dolostone is stratigraphically equivalent, at least in part, to the Racine dolomite of Wisconsin and the Amabel and Guelph formations of Ontario. The hardness and weather resistant nature of the Engadine has often left it as the cap rock of a very prominent escarpment extending from the Door Peninsula in Wisconsin, across the Upper Peninsula of Michigan, traversing Cockburn and Manitoulin Islands, and forming a very conspicuous landscape feature throughout the Bruce Peninsula of Ontario.

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- Ehlers, G. M and Kesling, R. V. (1957) Silurian Rocks of the Northern Peninsula of Michigan: (p. 23).

PHOTO: Quarry at Ozark, Mackinac County. SW NE 8, T43N, R5W. Reprap production by Howes & Howes, Kalena, Michigan for pier construction on Mackinac Island. September 1967.