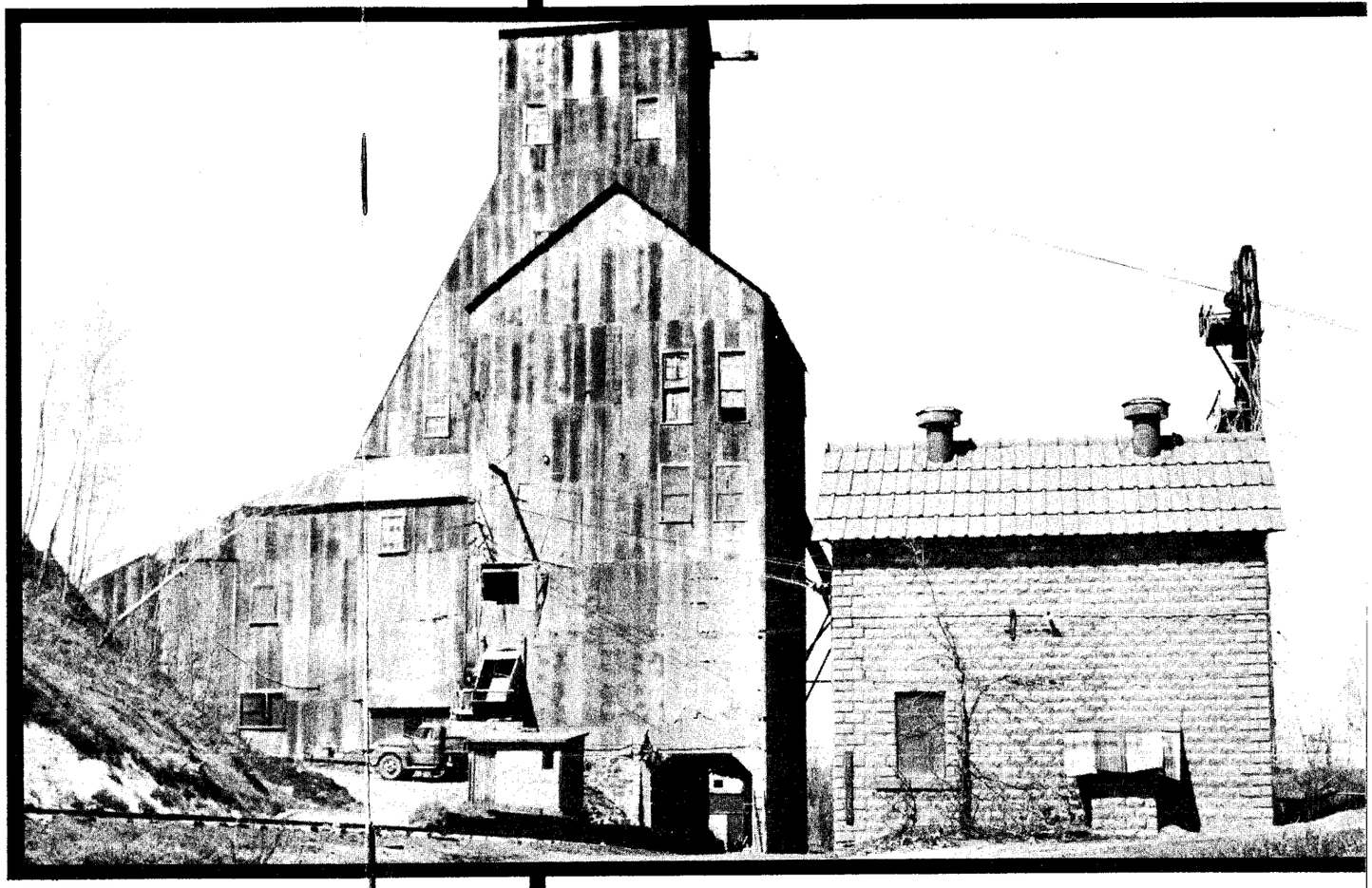
Cover photo shows shaft building of the Champion Copper Mine at Painesdale. Last shipload of copper ore was raised to the surface September 11, 1967 and marked the end of 67 years of copper operations in Houghton County by the Copper Range Company. The mine is the source of water supply for Houghton,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

MINERAL INDUSTRY OF MICHIGAN, 1967



1969

ANNUAL STATISTICAL SUMMARY 9

Geological Survey

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

—Compiled Laws Mich. 1948 s.319.202

Geological Survey

ANNUAL STATISTICAL SUMMARY 9

Mineral Industry of Michigan 1967

By

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Bureau of Mines, Minneapolis, Minnesota

Prepared in cooperation with

Bureau of Mines

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FOREWORD

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

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

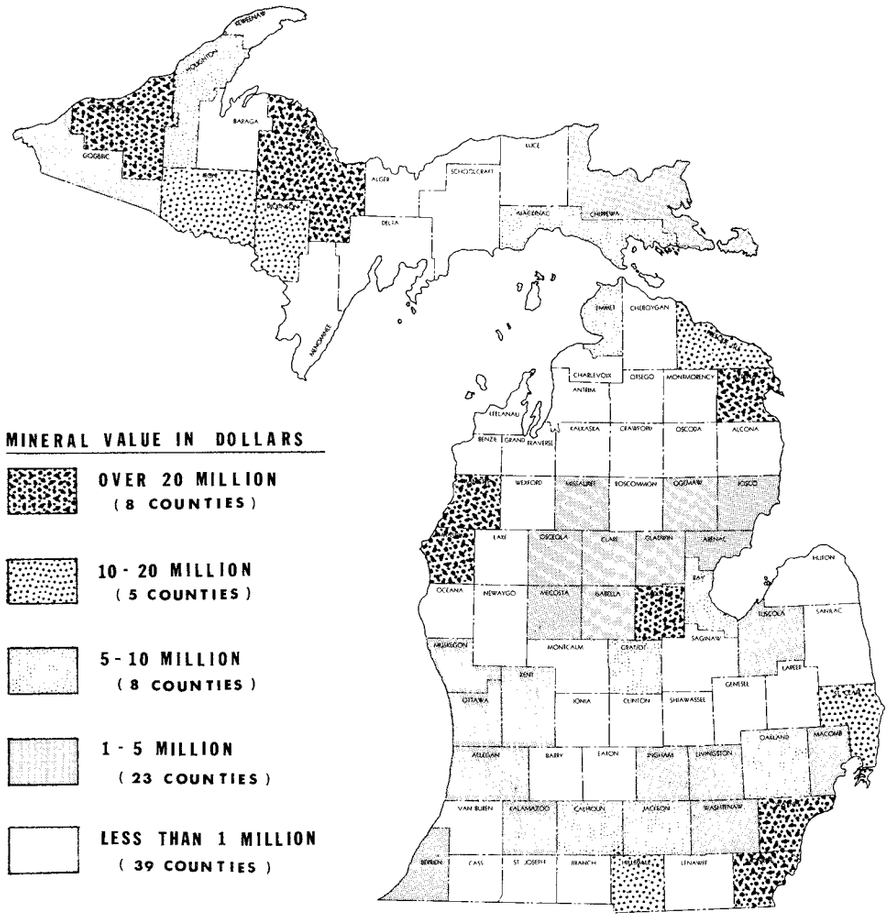
The Michigan Geological Survey expresses appreciation to all the mineral and mineral products producers for the production information they generously submitted. Without their cooperation in complying to the questionnaires sent them this report would not be possible.

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

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

Lansing, Michigan
January, 1969

MICHIGAN MINERAL VALUE 1967



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 Conservation, for collecting information on all minerals except fuels.

By Donald F. Klyce [1]

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

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

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

Table 1.—Mineral production in Michigan [1]

Mineral		1966 Quantity	1966 Value (thousands)	1967 Quantity	1967 Value (thousands)
Cement:					
Portland	thousand 376-pound barrels	28,171	$87,413	29,645	$94,515
Masonry	thousand 280-pound barrels	2,032	5,221	1,995	5,296
Clays	thousand short tons	2,450	2,620	2,466	2,636
Copper (recoverable content of ores, etc)	short tons	73,449	53,133	58,458	44,692
Gypsum	thousand short tons	1,522	5,489	1,422	5,085
Iron ore (usable)	thousand long tons, gross weight	14,377	157,377	14,130	162,610
Lime	thousand short tons	1,701	20,016	1,787	21,582
Magnesium compounds	short tons	342,482	28,105	309,446	26,388
Natural gas	million cubic feet	r 34,120	8,598	33,589	8,296
Natural gas liquids:					
Natural gasoline	thousand gallons	15,703	1,099	47,817	3,491
LP gases	do	79,719	4,385	59,390	3,444
Peat	short tons	235,842	2,175	237,107	2,292
Petroleum (crude)	thousand 42-gallon barrels	14,273	40,913	13,664	39,455
Salt	thousand short tons	4,465	38,611	4,789	42,389
Sand and gravel	do	55,123	49,521	52,310	49,616
Silver (recoverable content of ores, etc.)	thousand troy ounces	483	625	302	468
Stone	thousand short tons	37,864	40,380	36,432	39,910
Value of items that cannot be disclosed: Bromine, calcium chloride, calcium-magnesium chloride, gem stones, iodine, and potassium salts		XX	56,446	XX	58,039
Total		XX	602,127	XX	610,204
Total 1957–59 constant dollars		XX	556,249	XX	p 555,433

p Preliminary. r Revised. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

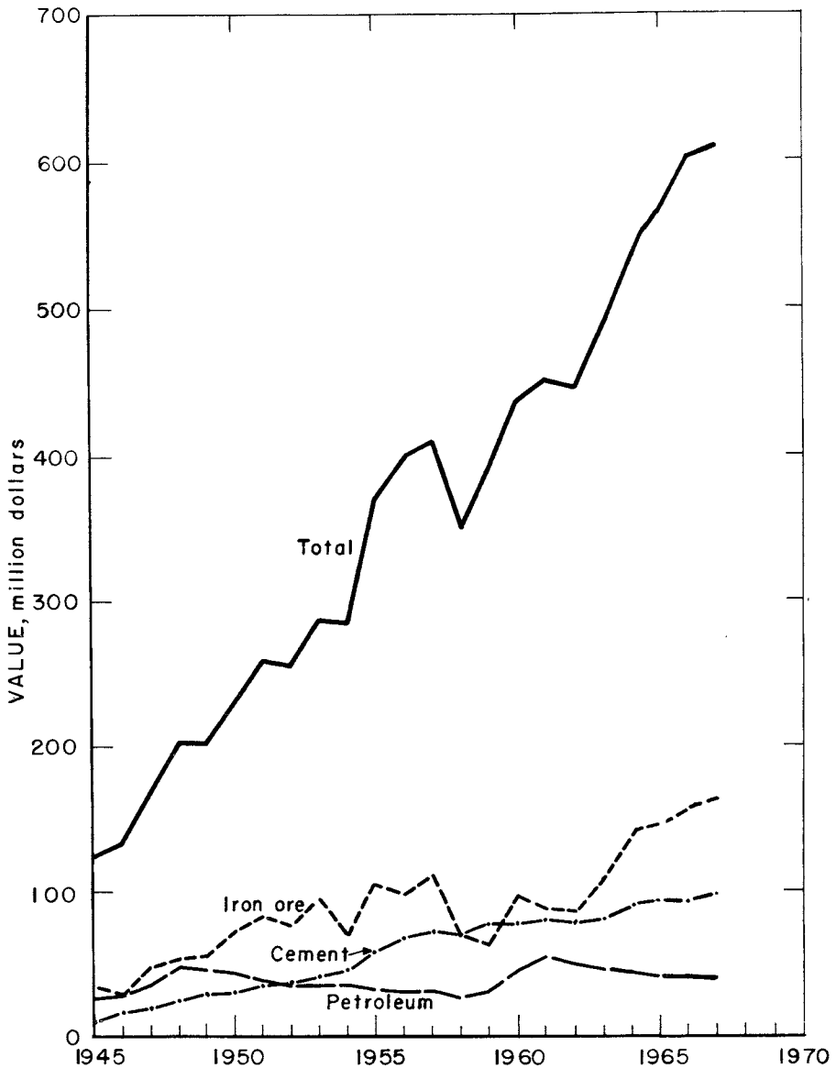


Figure 1.—Value of iron ore, petroleum, cement, and total value of all minerals produced in Michigan.

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

The act covers mines extracting minerals in solid form, and includes milling, crushing, screening, washing, flotation, pelletizing, smelting, and other preparatory operations needed to render the minerals marketable. It also covers exploration and development of mineral properties.

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

Table 2.—Value of mineral production in Michigan, by counties [1]

(Thousand dollars)

County	1966	1967	Minerals produced in 1967 in order of value
Alcona	$203	$133	Sand and gravel.
Alger	28	57	Do.
Allegan	1,184	[2] 992	Petroleum, sand and gravel, peat, stone, natural gas.
Alpena	W	W	Cement, stone, clays, sand and gravel.
Antrim	336	272	Clays, sand and gravel.
Arenac	1,155	1,081	Petroleum, stone, sand and gravel.
Baraga	W	72	Sand and gravel.
Barry	713	700	Sand and gravel, petroleum, stone.
Bay	10,355	9,637	Cement, petroleum, lime.
Benzie	57	------	
Berrien	2,065	2,554	Sand and gravel, stone.
Branch	1,089	585	Do.
Calhoun	7,144	[2] 7,191	Petroleum, sand and gravel, stone, natural gas.
Cass	235	311	Sand and gravel, stone, petroleum.
Charlevoix	W	906	Cement, sand and gravel, stone, clays.
Cheboygan	127	69	Stone, sand and gravel.
Chippewa	4,382	W	Do.
Clare	1,761	[2] 1,795	Petroleum, sand and gravel, natural gas.
Clinton	399	315	Sand and gravel, clays.
Crawford	331	[2] 522	Petroleum, sand and gravel, natural gas.
Delta	354	260	Sand and gravel, stone.
Dickinson	19,631	19,749	Iron ore, sand and gravel, stone.
Eaton	547	603	Stone, sand and gravel, clays, peat.
Emmet	6,104	6,645	Cement, stone, sand and gravel.
Genesee	755	702	Sand and gravel, petroleum.
Gladwin	W	1,027	Petroleum, sand and gravel.
Gogebic	3,021	2,121	Iron ore, sand and gravel.
Grand Traverse	96	W	Sand and gravel.
Gratiot	W	W	Salines, salt, sand and gravel, petroleum, natural gas.
Hillsdale	13,657	[2] 12,161	Petroleum, sand and gravel, stone, natural gas.
Houghton	[3] 9,390	6,493	Copper, sand and gravel, stone.
Huron	1,256	897	Stone, sand and gravel, lime, petroleum.
Ingham	1,260	1,318	Sand and gravel, peat.
Ionia	354	W	Sand and gravel.
Iosco	4,720	4,401	Gypsum, sand and gravel.
Iron	20,102	14,998	Iron ore, sand and gravel.
Isabella	1,399	[2] 1,336	Petroleum, sand and gravel, natural gas.
Jackson	5,165	[2] 4,966	Petroleum, sand and gravel, stone, natural gas.
Kalamazoo	1,092	1,239	Sand and gravel, stone, peat.
Kalkaska	74	112	Petroleum, sand and gravel.
Kent	3,124	[2] 3,474	Sand and gravel, gypsum, petroleum, peat, natural gas.
Keweenaw	(4)	W	Copper, sand and gravel.
Lake	50	44	Sand and gravel, petroleum.
Lapeer	1,611	[2] 1,489	Peat, petroleum, sand and gravel, salines, natural gas.
Leelanau	113	56	Sand and gravel.
Lenawee	635	[2] 510	Sand and gravel, petroleum, clays, natural gas.
Livingston	3,561	[2] 2,804	Sand and gravel, petroleum, natural gas.
Luce	25	38	Sand and gravel.
Mackinac	W	W	Stone, sand and gravel.
Macomb	2,306	[2] 2,011	Sand and gravel, petroleum, natural gas.
Manistee	20,426	22,105	Salt, salines, sand and gravel.
Marquette	115,647	127,026	Iron ore, sand and gravel.
Mason	W	W	Salines, lime, sand and gravel, petroleum.
Mecosta	432	[2] 980	Petroleum, sand and gravel, peat, natural gas.
Menominee	890	633	Lime, sand and gravel.
Midland	W	W	Salines, salt, petroleum, sand and gravel.
Missaukee	1,296	[2] 1,302	Petroleum, sand and gravel, natural gas.
Monroe	W	W	Cement, stone, clays, peat, petroleum.
Montcalm	950	[2] 714	Petroleum, sand and gravel, natural gas.
Montmorency	19	------	
Muskegon	2,272	2,244	Salt, sand and gravel, petroleum.
Newaygo	232	173	Sand and gravel, petroleum.
Oakland	8,595	9,939	Sand and gravel, peat, petroleum.
Oceana	523	425	Petroleum, sand and gravel.
Ogemaw	1,201	[2] 1,941	Sand and gravel, petroleum, natural gas.
Ontonagon	44,733	36,099	Copper, silver, sand and gravel.
Osceola	1,601	[2] 1,611	Petroleum, sand and gravel, natural gas.
Oscoda	125	76	Sand and gravel, petroleum.
Otsego	30	[2] 42	Sand and gravel, natural gas.
Ottawa	2,720	[2] 2,586	Sand and gravel, petroleum, stone, natural gas.
Presque Isle	W	W	Stone, sand and gravel.
Roscommon	698	[2] 616	Petroleum, sand and gravel, natural gas.
Saginaw	479	434	Clays, lime, petroleum, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by counties [1]—Continued

(Thousand dollars)

County	1966	1967	Minerals produced in 1967 in order of value
St. Clair	$16,498	[2] $14,679	Salt, cement, petroleum, peat, clays, sand and gravel, natural gas.
St. Joseph	262	279	Sand and gravel, peat, stone.
Sanilac	912	1,146	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone, sand and gravel.
Shiawassee	672	632	Sand and gravel, clays, peat, petroleum.
Tuscola	2,152	1,996	Sand and gravel, petroleum, lime, peat.
Van Buren	314	375	Sand and gravel, petroleum.
Washtenaw	1,279	[2] 1,974	Sand and gravel, petroleum, natural gas.
Wayne	50,556	[2] 55,288	Cement, lime, salt, sand and gravel, salines, stone, clays, petroleum, natural gas.
Wexford	147	[2] 84	Sand and gravel, natural gas.
Undistributed [5]	194,502	208,162	
Total [6]	602,127	610,204	

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

Table 3.—Indicators of Michigan business activity

		1966	1967	Percent change
Personal income:				
Total	millions	$27,685	[p] $29,125	+5.2
Per capita		$3,269	[p] $3,393	+3.8
Construction activity:				
Building permits:				
Valuation of authorized residential and nonresidential private construction	millions	$1,089.6	$1,248.3	+14.6
Number of private and public residential building permits issued		40,000	46,342	+15.9
Contract construction work performed:				
Total	millions	$2,098	$2,215	+5.6
Nonresidential building	do.	$930	$947	+1.8
Residential building	do.	$835	$929	+11.3
Nonbuilding	do.	$333	$339	+1.8
State highway department:				
Contracts awarded	do.	$131.7	$112.3	−14.7
Contract work performed	do.	$149.3	$125.0	−16.3
Portland cement shipments to and within Michigan	thousand 376-pound barrels	16,900.1	16,386.4	−3.0
Cash receipts from farm marketings	millions	$886.4	$882.1	−.5
Mineral production	do.	$602.1	$610.2	+1.3
Raw steel production	thousand tons	10,004.0	9,247.9	−7.6
Manufacturing payrolls	millions	$4,682.1	$4,590.6	−2.0
Annual average labor force and employment: [1]				
Total labor force	thousands	3,305.6	3,382.5	+2.3
Agricultural employment	do.	71.7	67.5	−5.9
Nonagricultural employment [2]	do.	3,111.9	3,141.3	+.9
Manufacturing	do.	1,139.5	1,104.6	−3.1
Motor vehicles and equipment	do.	374.9	352.7	−5.9
Construction	do.	111.7	116.7	+4.5
Mining	do.	13.5	12.6	−6.7
Primary metal products	do.	99.7	93.0	−6.7
Stone, clay, and glass products	do.	21.2	18.9	−10.9
Transportation	do.	76.9	75.1	−2.3

[p] Preliminary.
[1] Adjusted to March 1967 benchmark levels.
[2] Includes nonagricultural, self-employed, and unpaid family workers, and domestic workers in private households.

Sources: Survey of Current Business, Construction Review, Statistical Abstract of the United States, State of Michigan Department of Highways, Farm Income Situation, American Iron & Steel Institute, and Michigan Employment Security Division in cooperation with the United States Department of Labor.

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

Year and industry	Average men working daily	Days Active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries: Fatal	Number of injuries: Non-fatal	Injury rates per million man-hours: Frequency	Injury rates per million man-hours: Severity
1966:								
Peat	162	192	31	281	----	2	7.11	747
Metal	5,938	296	1,756	14,039	8	481	34.83	5,033
Nonmetal	1,697	274	466	3,727	----	34	9.12	864
Sand and gravel	2,470	232	572	4,872	2	85	17.86	3,542
Stone	3,427	295	1,010	8,115	1	87	10.84	1,454
Total	13,694	280	3,836	31,033	11	689	22.56	3,346
1967: [p]								
Peat	157	184	29	261	----	2	7.67	31
Metal	5,660	276	1,565	12,503	11	481	39.35	6,806
Nonmetal	1,670	283	472	3,777	2	54	14.83	3,524
Sand and gravel	2,475	212	526	4,619	----	93	20.14	705
Stone	3,390	295	1,000	8,025	----	62	7.73	373
Total [1]	13,350	269	3,591	29,184	13	692	24.16	3,586

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

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement reached a record high, more than 5 percent above 1966 shipments, while the output of masonry cement was slightly lower. Portland cement was produced at nine plants in seven counties, (Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne); masonry cement was produced at five of these plants. Total annual finished portland cement capacity increased to 39 million barrels. Yearend stocks of portland cement at mills were 3.8 million barrels, compared with 3.2 million barrels in 1966. More than 96 percent of the portland cement shipped was of types I and II (general use and moderate heat); the remainder was of type III (high-early-strength) and portland-pozzolan. About 47 percent of the cement was shipped to consumers within the State. Out-of-State distribution went mostly to Ohio, Illinois, Wisconsin, Indiana, Western New York, and Minnesota. Nearly 61 percent of the shipments were purchased by ready-mixed concrete companies with the remainder going principally to concrete product manufacturers (14 percent), highway contractors (13 percent), and building material dealers (8 percent). About 2.6 million barrels of cement, mostly portland, were shipped into Michigan. The bulk of the shipments originated in Ohio and Pennsylvania.

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

(Thousand 376-pound barrels and thousand dollars)

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

[r] Revised.

Raw materials used in portland-cement manufacture included 6.9 million tons of limestone, and 2.2 million tons of clay or shale, as well as quantities of gypsum, iron

ore, sand, slag, mill scale, air-entraining compounds, and grinding aids. About 690 million kilowatt-hours of electrical energy was used. The wet process was used at eight plants and the dry process at one.

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

In November, Martin Marietta Corp. announced it has discontinued development of a new cement plant at Milan, in southeastern Michigan. A severe water leakage in the quarry at the new site was instrumental in the decision to halt the project. Instead, it was announced, the company's plant at Essexville, near Bay City, will be modernized and expanded. The plant capacity at Essexville will be increased by 10 percent. One of the two kilns already delivered to Milan will be moved to Essexville to replace four older, smaller kilns. The second kiln and related equipment will be shipped to a new company plant under development in Colorado. Grinding mills will be moved from Milan to Essexville, a new raw mill will replace five mills, and a new finish mill will replace eight mills now in operation.

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

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

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

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

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

Lime.—Increased demand for lime in basic oxygen converters and open-hearth furnaces in steel plants, as well as in chemical manufacture, caused a 5-percent increase in State lime production. In addition to these major consumers, smaller quantities of lime were used in sugar refining, paper manufacture, water purification, and sewage treatment. Lime plants were operated in eight counties, but four-fifths of the State output was concentrated in Wayne County to meet requirements of steel mills and chemical plants in the Detroit area. About 55 percent of the production was used by the producers, and the remainder sold. Only 8 percent of the total production was shipped to consumers outside the State. About 262,000 tons of lime (more than three-quarters of it quicklime) were shipped into Michigan. Shipments originating in Ohio comprised most of the imports. Data for lime regenerated at papermills, water purification plants, and acetylene processors are excluded from total State production.

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

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

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

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

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

(Thousand short tons and thousand dollars)

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

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

Table 7.—Production of sand and gravel in 1967, by counties [1]

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alcona	274	$133	Leelanau	105	$56
Alger	93	57	Lenawee	579	478
Allegan	401	278	Livingston	2,810	2,802
Alpena	187	W	Luce	35	38
Antrim	92	W	Mackinac	W	W
Arenac	W	W	Macomb	2,524	2,004
Baraga	152	72	Manistee	W	W
Barry	639	663	Marquette	877	741
Berrien	2,595	2,550	Mason	975	W
Branch	589	W	Mecosta	186	W
Calhoun	978	485	Menominee	417	W
Cass	326	285	Midland	W	242
Charlevoix	190	W	Missaukee	17	11
Cheboygan	17	21	Montcalm	411	215
Chippewa	W	W	Muskegon	477	W
Clare	203	W	Newaygo	184	113
Clinton	354	W	Oakland	9,707	9,889
Crawford	88	53	Oceana	329	210
Delta	334	W	Ogemaw	1,288	1,080
Dickinson	293	218	Ontonagon	230	W
Eaton	416	W	Oscelola	218	143
Emmet	364	W	Oscoda	136	71
Genesee	897	696	Otsego	66	42
Gladwin	24	10	Ottawa	2,462	2,275
Gogebic	151	W	Presque Isle	521	W
Grand Traverse	172	W	Roscommon	212	127
Gratiot	279	W	Saginaw	W	W
Hillsdale	399	476	St. Clair	W	W
Houghton	W	W	St. Joseph	336	269
Huron	133	101	Sanilac	395	W
Ingham	1,372	1,316	Schoolcraft	151	W
Ionia	435	W	Shiawassee	745	512
Iosco	77	31	Tuscola	1,475	1,714
Iron	94	W	Van Buren	414	345
Isabella	665	612	Washtenaw	1,912	1,903
Jackson	306	268	Wayne	2,511	4,349
Kalamazoo	1,120	1,182	Wexford	97	84
Kalkaska	W	W	Undistributed [2]	2,210	7,694
Kent	2,224	2,483			
Keweenaw	66	34	Total	52,310	49,616
Lake	34	30			
Lapeer	265	155			

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

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

Stone.—Limestone was quarried in 17 counties by 24 commercial producers and four county highway departments. Limestone, which accounted for nearly all of the State stone output, came from large quarries in Alpena, Chippewa, Mackinac, Monroe, and Presque Isle Counties. Nearly 77 percent of the material was moved by water from company-operated ports on Lakes Huron and Michigan to cement and lime plants, steel mills, and other consumers.

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

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

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

Year	Basalt		Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1963	---	---	4,938	$60,371	8,937	$62,348	13,875	$122,719
1964	150	$150	5,383	68,711	8,306	62,030	13,839	130,891
1965	---	---	5,286	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

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

(Thousand short tons and thousand dollars)

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

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

for road use. Marl was produced in 11 counties and sold for agricultural use.

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

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

METALS

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

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

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

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

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

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (thousand short tons)	Tailing (thousand short tons)	Short tons	Value (thousands)
1963	10	3	7,211	2,226	75,262	$46,361
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

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

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

Two companies, Bear Creek Mining Co. and Copper Range Co., had geological teams searching for ore and performing analytical work at different sites of the Indiana copper tract in Ontonagon County.

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

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

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

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

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

(Thousand long tons)

County and range	Stocks Jan. 1	Production		Shipments		Stocks Dec. 31
		Underground	Open pit	Direct to consumers	To concentrators	
County:						
Dickinson	------	------	3,686	------	3,686	------
Gogebic	190	[1] 49	------	239	------	------
Iron	850	2,216	------	2,065	------	1,001
Marquette	692	2,917	19,770	707	22,006	665
Total [2]	1,731	5,182	23,456	3,011	25,692	1,666
Range:						
Gogebic	190	[1] 49	------	239	------	------
Marquette	692	2,917	19,770	707	22,006	665
Menominee	850	2,216	3,686	2,065	3,686	1,001
Total [2]	1,731	5,182	23,456	3,011	25,692	1,666

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

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

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total [2]
1854–1962	317,203	262,234	246,582	826,019
1963	5,706	3,729	902	10,336
1964	7,898	4,551	1,227	13,676
1965	8,973	4,595	753	14,322
1966	9,589	4,620	113	14,322
1967	10,231	3,750	[3] 49	14,030
Total [2]	359,601	[4] 283,478	[4] 249,626	892,705

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

Table 13.—Usable iron ore shipped from mines, by ranges [1]

(Thousand long tons)

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

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

Table 14.—Production of usable iron ore

(Thousand long tons)

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

Table 15.—Iron ore [1] shipped from mines

(Thousand long tons)

Year	Direct-shipping ore [2]	Concentrates			Total usable ore [3]	Proportion of concentrates to total usable ore (percent)
		Agglomerates	Other	Total [3]		
1963	4,852	4,364	1,574	5,938	10,789	55.03
1964	5,753	6,573	1,546	8,118	13,871	58.53
1965	4,969	7,554	1,004	8,558	13,527	63.26
1966	4,272	8,690	1,415	10,106	14,377	70.28
1967	3,011	10,336	783	11,119	14,130	78.69

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

According to the Michigan Department of Conservation [2], the average cost per ton for underground mines was $9.07 in 1967, compared with $9.15 in 1966. Labor costs decreased to $2.45 per ton, while taxes (excluding Federal income tax) decreased to $0.32 per ton. Deferred costs per ton were $0.47, and other costs were as follows: General overhead, $1.28; royalty, $0.42; and marketing, $0.05.

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

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

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

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

MINERAL FUELS

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

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

Peat.—Michigan led the Nation in peat production with 38 percent of the total. Peat was produced in 14 counties, with nearly one-half of the State output from

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

Lapeer County; Oakland, St. Clair, and Sanilac Counties accounted for much of the remainder. Peat was marketed principally as a soil conditioner, and nearly three-quarters of the output was sold in packaged form. None was sold for fuel. About 80 percent of the peat mined was reed-sedge, and the remainder was moss and humus.

Petroleum.—Petroleum was produced in 44 counties, with the largest output reported from fields in the Albion-Pulaski-Scipio trend in Calhoun, Hillsdale, and Jackson Counties. According to the Geological Survey Division, Michigan Department of Conservation, the most active regions of new field exploration and field development drilling were in Macomb and St. Clair Counties and the area along the Albion-Pulaski-Scipio oilfield trend. Statewide, the discovery-to-dry hole ratio for new field wildcat wells was 1:20 compared with 1:17 in 1966. About 22 percent of the exploratory wells bottomed out in Traverse Group Limestones (Devonian), 10 percent for the Dundee Limestone (Devonian), 7 percent in the Reed City zone of Devonian age, 35 percent in Silurian age rocks of the Clinton and Niagaran Groups, and about 17 percent in Ordovician age (or older) rocks of the Black River and Trenton Groups. The remainder reached total depth in rocks younger than Devonian in age. No Precambrian or basement tests were drilled during the year. Nine new fields were discovered in 1967 and one new pool discovery was reported. Ten refineries had an operating capacity of 168,000 barrels per day.

Table 16.—Oil and gas wells drilled in 1967

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage [1]
Alcona	---	---	---	---	---	1	1	2,318
Allegan	3	---	1	---	---	8	12	25,897
Arenac	---	---	---	---	---	2	2	6,015
Bay	---	---	---	---	---	2	2	6,258
Branch	---	---	---	---	---	3	3	12,130
Calhoun	13	1	30	---	---	4	48	210,851
Clare	---	---	1	---	---	---	1	3,942
Crawford	---	---	---	---	---	1	1	4,592
Genesee	1	---	---	---	---	---	1	1,646
Gladwin	---	---	---	---	---	1	1	3,539
Gratiot	---	---	---	---	---	2	2	6,743
Hillsdale	5	---	6	---	---	9	20	81,283
Ionia	---	---	---	---	---	2	2	12,403
Isabella	---	---	1	1	---	---	2	8,160
Jackson	1	1	6	---	---	3	11	33,614
Kent	---	---	---	---	---	6	6	22,954
Lake	---	---	3	1	---	5	9	24,940
Lapeer	2	---	2	---	---	---	4	13,561
Lenawee	---	7	3	---	---	3	13	19,615
Livingston	---	---	---	1	---	1	2	10,118
Macomb	1	---	6	---	---	17	24	73,142
Mason	1	---	7	---	---	7	15	21,025
Mecosta	11	---	3	---	---	6	20	66,015
Midland	---	---	1	---	---	2	3	10,531
Missaukee	3	---	2	1	---	---	6	23,220
Monroe	---	---	---	---	---	1	1	2,146
Montcalm	2	---	4	---	---	6	12	35,464
Muskegon	4	---	8	---	---	4	16	29,294
Newaygo	1	---	2	---	---	7	10	36,047
Oakland	1	---	---	---	---	2	3	13,226
Oceana	---	---	1	---	---	9	10	19,011
Ogemaw	4	---	2	---	---	1	7	26,592
Osceola	2	---	5	1	---	4	12	34,457
Otsego	---	10	1	---	---	---	11	16,459
Ottawa	---	---	---	---	---	4	4	9,055
Roscommon	---	---	---	---	---	1	1	4,572
Saginaw	---	---	---	---	---	1	1	4,240
Shiawassee	2	---	---	1	---	1	4	6,314
St. Clair	3	18	22	1	2	40	86	254,302
Tuscola	1	---	1	---	---	---	2	5,232
Van Buren	---	---	---	---	---	1	1	1,205
Washtenaw	---	---	---	---	---	1	1	3,934
Total	61	37	118	7	2	168	393	1,206,062

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

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

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Cement:			
Aetna Portland Cement Co., Division of Martin Marietta Corp.	Bay City	Bay	Portland and masonry, wet process.
Dundee Cement Co.	Dundee	Monroe	Do.
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	Portland and masonry, dry process.
Medusa Portland Cement Co.	Charlevoix	Charlevoix	Portland and masonry, wet process.
Peerless Cement Co., Division of American Cement Corp.:			
Port Huron plant	Port Huron	St. Clair	Portland, wet process.
Brennan Avenue plant	Detroit	Wayne	Do.
Jefferson Avenue plant	do.	do.	Portland and masonry, wet process.
Penn-Dixie Cement Corp.	Petoskey	Emmet	Do.
Wyandotte Chemicals Corp.	Wyandotte	Wayne	Do.
Clays and shale: [2]			
Aetna Portland Cement Co., Division of Martin Marietta Corp.	Saginaw	Saginaw	Cement.
Dundee Cement Co.	Dundee	Monroe	Do.
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	Do.
Light Weight Aggregate Corp.	Livonia	Wayne	Lightweight aggregate.
Peerless Cement Co., Division of American Cement Corp.	Smiths Creek	St. Clair	Cement.
Do.	Allen Park	Wayne	Do.
Penn-Dixie Cement Corp.	Petoskey	Antrim	Do.
Coke:			
Allied Chemical Corp.	Detroit	Wayne	
Ford Motor Co.	River Rouge	do.	
National Steel Corp., Great Lakes Steel Division	Ecorse	do.	
Copper:			
Calumet & Hecla, Inc.:			On strike August 23–September 11.
Centennial Nos. 2, 3, and 6	Calumet	Houghton	
Osceola No. 13	Osceola	do.	
Tamarack Reclamation	Hubbell	do.	Operation closed in December.
Ahmeek mill	Ahmeek	Keweenaw	
Allouez No. 3 and Kingston	do.	do.	
Ahmeek No. 3 and No. 4	do.	do.	"Poor rock" only.
Seneca No. 2	Mohawk	do.	Do.
Copper Range Co.:			
Atlantic Tailings	Freda	Houghton	Operation closed in November.
Champion	Painesdale	do.	Operation closed in September.
Freda mill	Freda	do.	Operation closed in November.
Quincy Mining Co.:			
Reclamation plant	Mason	do.	Operation closed in May.
White Pine Copper Co:			
White Pine	White Pine	Ontonagon	Mine and mill. On strike August 21 throughout balance of year.

See footnotes at end of table.

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

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Gypsum:			
Bestwall Gypsum Division, Georgia-Pacific Corp.	Grand Rapids	Kent	Mining, calcining, and fabricating.
Grand Rapids Gypsum Co.	do.	do.	Mining (underground), calcining, and fabricating.
Michigan Gypsum Co.	Whittemore	Iosco	Mining.
National Gypsum Co.	National City	do.	Calcining and fabricating.
Do.	Tawas City	do.	Mining.
United States Gypsum Co.	Alabaster	do.	Do.
Do.	Detroit	Wayne	Calcining and fabricating.
Iron ore:			
Cleveland-Cliffs Iron Co.:			
Bunker Hill and Maas	Negaunee	Marquette	Stockpile shipments only.
Cliffs shaft	Ishpeming	do.	Ore treated at the Ore Improvement Plant. Underground mine closed in December.
Eagle Mills pellet plant	Negaunee	do.	Pelletizes ore from the Republic mine.
Empire	Palmer	do.	Open-pit mine, concentrator, and agglomerator.
Humboldt	Champion	do.	Do.
Mather	Ishpeming	do.	Underground mine. Ore treated at the Ore Improvement Plant and Pioneer Pellet Plant.
Ore improvement plant	Negaunee	do.	
Pioneer pellet plant	do.	do.	Pelletizes ore from the Mather mine.
Republic	Republic	do.	Open-pit mine, concentrator, and agglomerator. Part of the concentrates pelletized at the Eagle Mills Plant.
Tilden	Ishpeming	do.	Stockpile shipments only.
The Hanna Mining Co.:			
Groveland	Iron Mountain	Dickinson	Open-pit mine, concentrator, and agglomerator.
Hiawatha	Stambaugh	Iron	Stockpile shipments only.
Homer	Mineral Hills	do.	Underground mine.
Wauseca	Iron River	do.	Do.
Inland Steel Co.:			
Bristol	Crystal Falls	do.	Do.
Sherwood	Iron River	do.	Do.
Jones & Laughlin Steel Corp.:			
Tracy	Negaunee	Marquette	Do.
North Range Mining Co.:			
Champion	Champion	do.	Underground mine closed in August.
Pickands Mather & Co.:			
Peterson	Bessemer	Gogebic	Stockpile shipments only.
Iron and steel:			
Ford Motor Co.	Dearborn	Wayne	Iron blast furnaces and open-hearth steel furnaces.
McLouth Steel Corp.	Trenton	do.	Do.
National Steel Corp., Great Lakes Steel Division	Ecorse	do.	Do.
Lime:			
Detroit Lime Co.	River Rouge	do.	Quicklime, one shaft and one rotary kiln.
The Dow Chemical Co.	Ludington	Mason	Quicklime, three rotary kilns, one continuous hydrator.
Industrial Chemicals Division., Allied Chemical Corp.	Detroit	Wayne	Quicklime, pot kiln.
Marblehead Lime Co.	River Rouge	do.	Quicklime, two rotary kilns.
Wyandotte Chemicals Corp.	Wyandotte	do.	Quicklime, nine shaft kilns.
Petroleum refineries:			
Bay Refining, Division Dow Chemical Co.	Bay City	Bay	
Crystal Refining Co.	Carson City	Montcalm	
Lakeside Refining Co.	Kalamazoo	Kalamazoo	
Leonard Refineries, Inc.:			
Leonard Division	Alma	Gratiot	
Roosevelt Division	Mt. Pleasant	Isabella	
Marathon Oil Co.	Detroit	Wayne	
Naph-Sol Refining Co.	Muskegon	Muskegon	
Osceola Refining Co.	West Branch	Ogemaw	
Petroleum Specialties, Inc.	Flat Rock	Wayne	
Socony Mobil Oil Co.	Trenton	do.	
Peat:			
Anderson Peat Co.	Imlay City	Lapeer	Reed-sedge.
Fletcher & Rickard	New Hudson	Oakland	Humus.
Green Thumb Peat Co., Inc.	Sandusky	Sanilac	Moss and reed-sedge.
J. M. Huber Corp.	Imlay City	Lapeer	Reed-sedge.
Michigan Peat	do.	do.	Reed-sedge bog extends into St. Clair County.
Do.	Capac	St. Clair	Reed-sedge, bog extends into Lapeer County.
Do.	Minden City	Sanilac	Reed-sedge.
Expanded perlite:			
Bestwall Gypsum Division, Georgia-Pacific Corp.	Grand Rapids	Kent	
National Gypsum Co.	National City	Iosco	
United States Gypsum Co.	Detroit	Wayne	
Salt and salines: [3]			
American Salt Corp.	Midland	Midland	Salt.
Diamond Crystal Salt Co.	St. Clair	St. Clair	Do.
The Dow Chemical Co.	Ludington	Mason	Bromine, calcium compounds, and magnesium compounds.
Do.	Midland	Midland	Bromine, calcium compounds, iodine, magnesium compounds, potash, and salt.
Great Lakes Chemical Corp.	Filer City	Manistee	Bromine. Plant closed in June.
Harbison-Walker Refractories Co.	Ludington	Mason	Magnesium compounds.
Hooker Chemical Corp.	Montague	Muskegon	Salt.
International Salt Co., Inc.	Detroit	Wayne	Underground salt mine.
Kaiser Aluminum & Chemical Corp.	Midland	Midland	Magnesium compounds.
Manistee Salt Works, Division Hardy Salt Co.	Manistee	Manistee	Salt.
Michigan Chemical Corp.	East Lake	do.	Bromine.
Do.	St. Louis	Gratiot	Bromine, calcium compounds, magnesium compounds, and salt.
Morton Chemical Co., Division Morton International, Inc.	Manistee	Manistee	Bromine, calcium compounds, and magnesium compounds.
Morton Salt Co., Division Morton International, Inc.	do.	do.	Salt.
Do.	Port Huron	St. Clair	Do.
Pennsalt Chemicals Corp.	Wyandotte	Wayne	Do.
Standard Lime & Refractories Co., Division of Martin Marietta Corp.	Manistee	Manistee	Magnesium compounds.
Wilkinson Chemical Corp.	Mayville	Lapeer	Calcium compounds.
Wyandotte Chemicals Corp.	Wyandotte	Wayne	Calcium compounds and salt.

See footnotes at end of table.

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

Commodity and company	Location of operation(s)		Remarks
	Nearest town	County	
Sand and gravel: [4]			
American Aggregates Corp	Kalamazoo	Kalamazoo	Stationary plant.
Do	Brighton	Livingston	Do.
Do	Romeo	Macomb	Do.
Do	Oxford	Oakland	Do.
Arrowhead Silica Corp., Manley Bros. Division	Bridgman	Berrien	Stationary plant, industrial sand.
J. V. Burkett	St. Joseph	do	
Construction Aggregates Corp	Ferrysburg	Ottawa	Do.
Grand Rapids Gravel Co	Grandville and Grand Rapids	Kent	Stationary plants.
Great Lakes Foundry Sand Co	Vassar	Tuscola	Stationary plant, industrial sand.
Holloway Sand & Gravel Co., Inc	Various locations	Calhoun	
Do		Genesee	
Do		Livingston	
Do		Oakland	
Do		Ogemaw	
Do		Washtenaw	
Holly Sand & Gravel Plant, J. P. Burroughs & Son, Inc.	Davisburg	Oakland	Stationary plant.
Manley Sand Division, Martin Marietta Corp	Bridgman	Berrien	Stationary plant, industrial sand.
Michigan Silica Division, Ottawa Silica Co	Rockwood	Wayne	Do.
Mickelson Corp	Oxford	Oakland	Stationary plant and dredge.
Natural Aggregates Corp	Brighton	Livingston	One stationary and one portable plant.
Do	Romeo	Macomb	Stationary plant.
New Hudson Sand & Gravel, Inc., Texas Industries, Inc.	New Hudson	Oakland	Do.
The Nugent Sand Co., Inc	Muskegon	Muskegon	Stationary plant, industrial sand.
Pickitt & Schreur, Inc	Various locations	Allegan	
Do		Berry	
Do		Branch	
Do		Calhoun	
Do		Kalamazoo	
Do		Kent	
Do		Ottawa	
Do		Roscommon	
Sand Products Corp	Manistee	Manistee	Stationary plant, industrial sand.
Do	Muskegon	Muskegon	Do.
Sargent Sand Co	Ludington	Mason	Do.
Do	Vassar	Tuscola	Do.
Standard Sand Co	Grand Haven	Ottawa	Do.
Do	South Haven	Van Buren	Do.
John G. Yerington	Otsego	Allegan	
Do	Dowling and Middleville	Barry	
Do	Berrien Springs, Buchanan, Eau Claire, and Watervliet	Berrien	
Do	Burlington	Calhoun	
Do	Dowagiac and Marcellus	Cass	
Do	Charlotte	Eaton	
Do	Kalamazoo	Kalamazoo	
Do	Sturgis	St. Joseph	
Do	Keeler and Lawrence	Van Buren	
Silver:			
White Pine Copper Co	White Pine	Ontonagon	
Smelters:			
Calumet & Hecla, Inc	Calumet	Houghton	Primary copper smelter.
Quincy Mining Co	Hancock	do	Do.
White Pine Copper Co	White Pine	Ontonagon	Do.
Stone:			
Limestone: [5]			
Drummond Dolomite, Inc	De Tour Village	Chippewa	
Dundee Cement Co	Dundee	Monroe	
The France Stone Co	Monroe	do	
Huron Cement Co., Division of National Gypsum Co.	Alpena	Alpena	
Inland Lime & Stone Co., Division of Inland Steel Co.	Manistique	Mackinac	
Do	do	Schoolcraft	
The Michigan Stone Co	Maybee and Ottawa Lake	Monroe	
Penn-Dixie Cement Corp	Petoskey	Emmet	
Presque Isle Corp	Alpena	Presque Isle	
United States Steel Corp	Cedarville	Mackinac	
Do	Rogers City	Presque Isle	
Recovered sulfur:			
Leonard Refineries, Inc	Alma	Gratiot	Hydrofining process.
Marathon Oil Co	Detroit	Wayne	Parsons process.
Mobil Oil Co., Inc	Trenton	do	Claus process.
Exfoliated vermiculite:			
Zonolite Division, W. R. Grace & Co	Dearborn	do	

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

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PLATES

Photographs of several mineral operations
taken during 1968

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

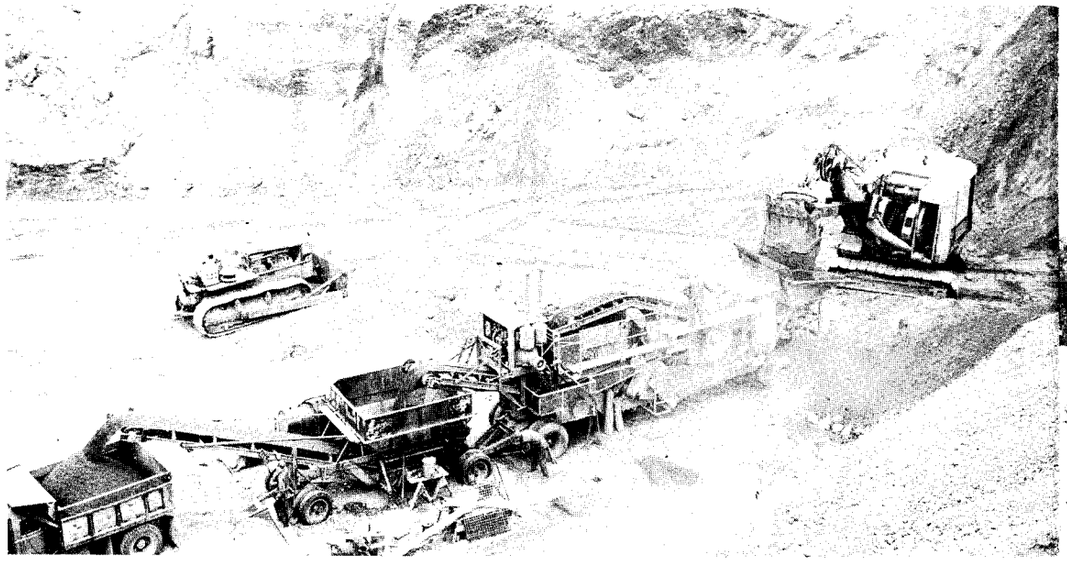

Photo 2—Portable plant of Superior Sand and Gravel Company operating in glacial outwash material just outside of city of Hancock, Houghton County.

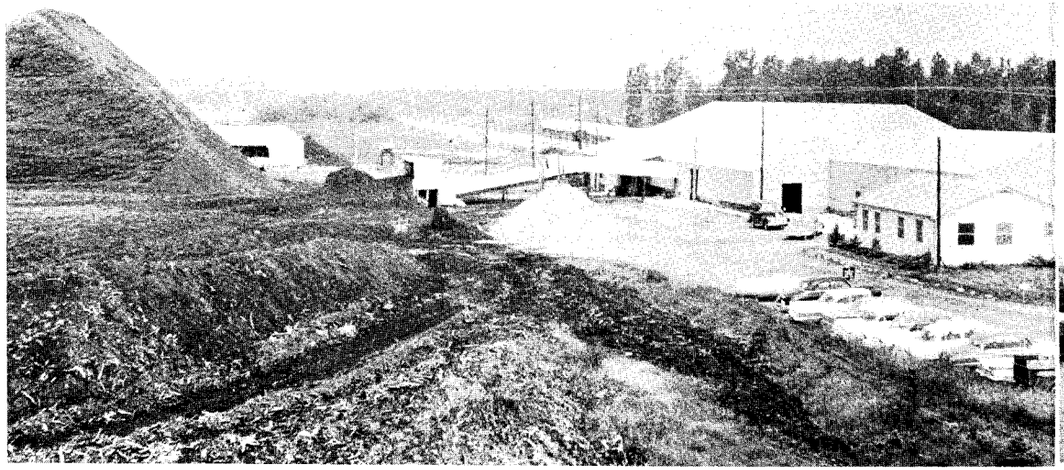

Photo 3—Peat operation of Michigan Peat Company, about 3 miles southwest of Minden, Sanilac County. After aging, this mountain of peat will be processed, packaged and marketed for garden and soil conditioning.

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

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

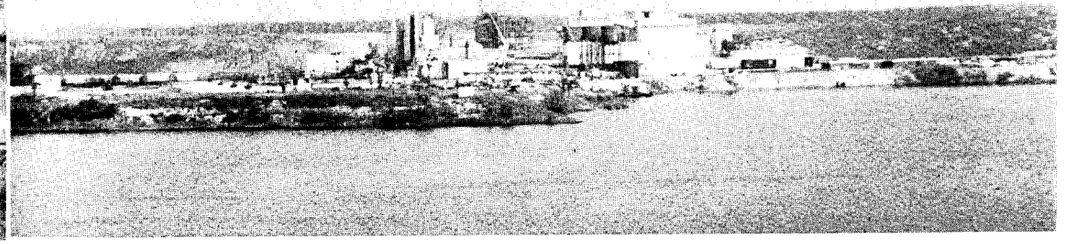

Photo 6—View of Standard Lime & Refractories Company's plant near Stronach, Manistee County. Expansion currently underway includes facilities for production of a high purity periclase and present product line to include highburn magnesia production.

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