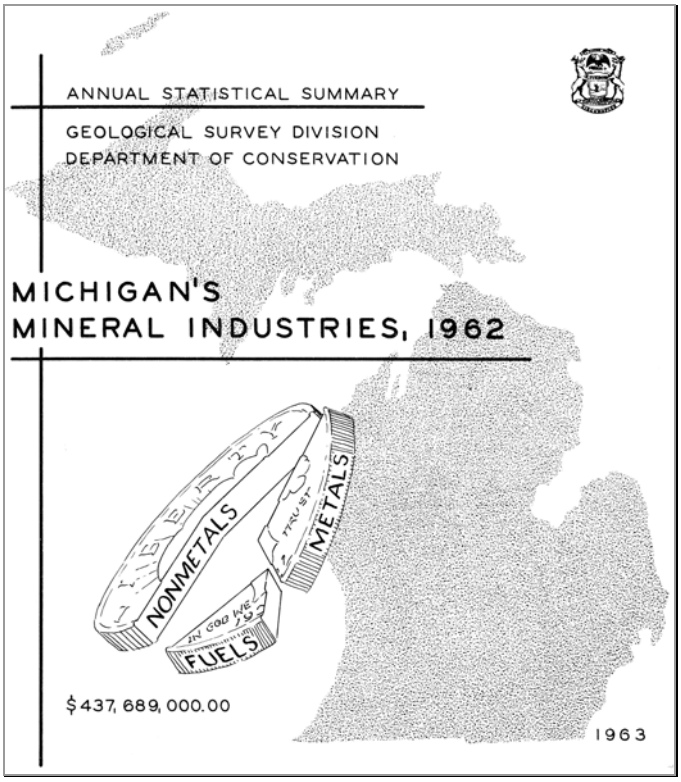

MICHIGAN'S MINERAL INDUSTRIES, 1962

* * * * * * *

The STATE GEOLOGICAL SURVEY was one of the very first offices established when Michigan attained statehood in 1837. The First Legislature charged it "...to make an accurate and complete geological survey of this state, which shall be accompanied with proper maps and diagrams, and furnish a full and scientific description of its rocks, soils and minerals...and geologic productions" — work pursued to this very day.

In 1921 the several state agencies exercising independent jurisdiction over natural resources were combined into a single organization. Thus, the Geological Survey, headed by its chief administrative officer, the State Geologist, became one of the divisions of the Department of Conservation.

Assisting the Supervisor of Wells (Director of Conservation) in enforcing regulatory practices prescribed by Michigan's oil and gas conservation laws comprises the greater part of the Division's work. Some assistance is also given the State Public Utilities Commission which regulates the transmission and use of natural gas.

The Survey constitutes a bureau of continuing information and service in the field of earth science. This function is manifested through publications, maps, reference files, and personal consultation — efforts that aid materially in delineating potential areas of economic mineral deposits, and in achieving understanding of the state's geologic history.

Iron and copper mining properties are appraised annually for general property tax purposes. From time to time, appraisals of other mineral properties are made for the State Tax Commission. Evaluations of mineral venture securities being promoted in the state are prepared upon the request of the State Securities Commission.

Mineral statistics are compiled, in cooperation with the U. S. Bureau of Mines, and published annually along with information on the progress and development of the industry. Also, cooperative assistance is provided in the development of public water supplies and in conducting surface and ground water studies.

The Survey's main offices are on the 4th floor of the Mason Building, one block west of the Capitol. A branch office, serving the Upper Peninsula, is maintained at Escanaba. In addition, district offices for oil and gas regulatory work, are maintained in Lansing, Mt. Pleasant, Plainwell, and Cadillac.

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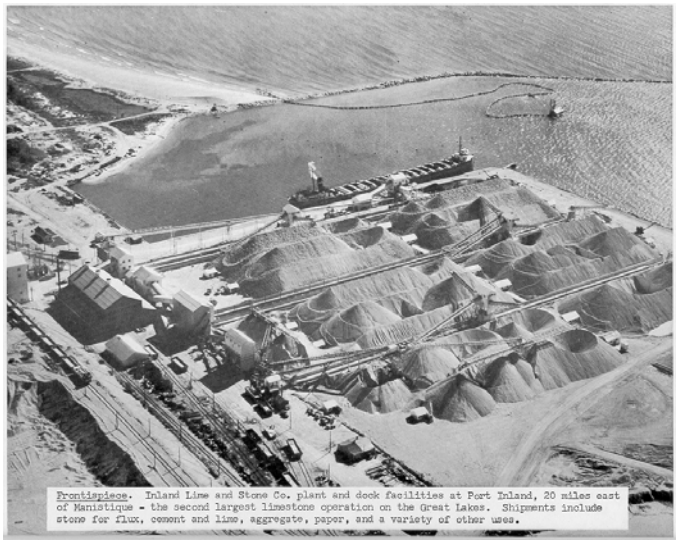
Frontispiece. Inland Lime and Stone Co. plant and dock facilities at Port Inland, 20 miles east of Manistique - the second largest limestone operation on the Great Lakes. Shipments include stone for flux, cement and lime, aggregate, paper, and a variety of other uses.

[PHOTO: INLAND LIME AND STONE CO. PLANT AND DOCK FACILITIES AT PORT INLAND.]

STATE OF MICHIGAN

DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY DIVISION

ANNUAL STATISTICAL SUMMARY

MICHIGAN'S MINERAL INDUSTRIES, 1962

BY H. O. SORENSEN AND E. T. CARLSON

LANSING
1963

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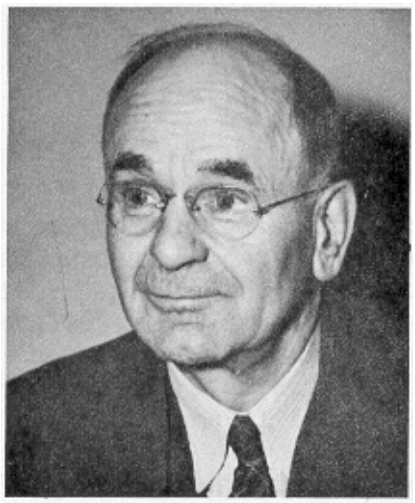
IN MEMORY



RICHARD A SMITH
Born Nov. 12, 1876. Died June 11, 1963

9th STATE GEOLOGIST OF MICHIGAN
1919 - 1946

This report is affectionately dedicated to Dr. Smith who ably guided the Geological Survey through its years of greatest expansion.

Michigan is proud of his record of hard work and achievement in geological exploration and the development of our mineral resources. Not only did he produce a wealth of needed technical reports, but he also accomplished much in making scientific knowledge understandable to many who would otherwise have never appreciated the value and fascination of geology.

His gentlemanly willingness to listen to the problems of even the humblest caller, and a desire to help wherever and whenever possible, earned “R. A.” a wide and esteemed reputation of dedicated service to all.

CONTENTS

ILLUSTRATIONS

FOREWORD

This report on the mineral industries of Michigan is a compilation of mineral production data for the year 1962. It consists of six sections: preliminary estimates of Michigan’s mineral production for 1963, news items and developments in 1963, a summary of each of the mineral industries, a break-down of mineral production by counties, a directory of mineral producers, and a picture presentation of mineral operations.

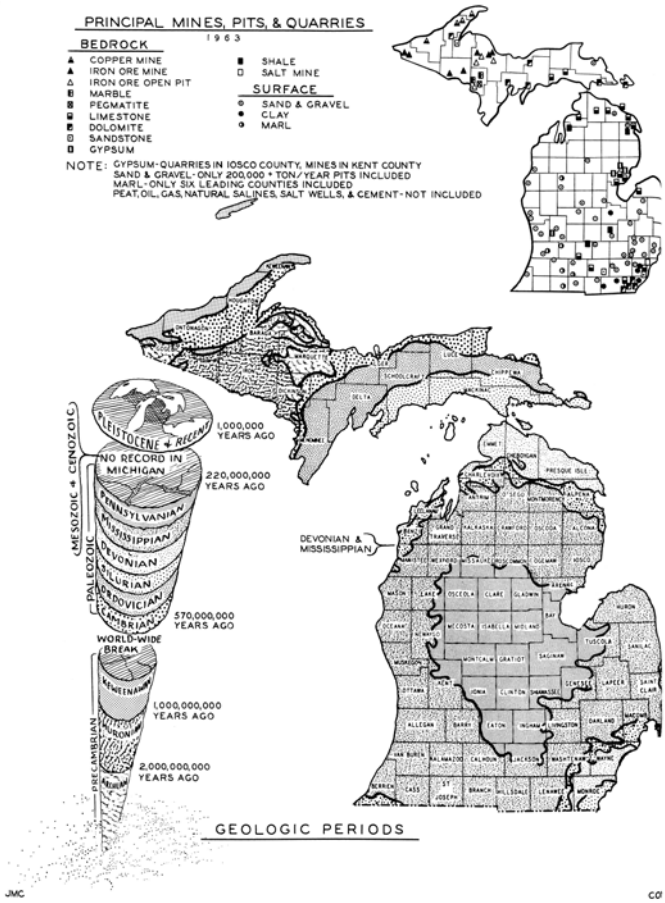
Items on 1963 developments in the various mineral fields were drawn heavily from various trade journals, magazines and publications including: "Michigan Natural Resource Council Technical Committee Reports," "Pit and Quarry," "Rock Products," "Mining World," "Steel," and "World Oil."

The Michigan Geological Survey expresses appreciation to all the mineral and mineral product producers for the production information they have submitted. Without their cooperation in complying to questionnaires sent

them in the first month of 1963 and returning them to this office this report would not have been possible.

Lansing 26, Michigan
January, 1963

Harry O. Sorensen, Geologist
and head
Emery T. Carlson, Geologist
Economic Geology Section
Geological Survey Division
Department of Conservation



[GENERALIZED GEOLOGICAL PRESENTATION OF MICHIGAN WITH MAP SHOWING PRINCIPAL MINES, PITS AND QUARRIES.]

THE MINERAL INDUSTRY OF MICHIGAN IN 1963* (Preliminary)

Mineral production in Michigan in 1963 was valued at $478 million, according to the Bureau of Mines, United States Department of the Interior. Value of output exceeded the 1962 figure by $31 million. Production of all major mineral commodities increased over 1962 with the exception of petroleum. Iron ore remained first in value, followed by cement, copper, and petroleum.

Nonmetallic minerals accounted for 57 percent of the value of mineral production; metallic minerals, 31 percent; and mineral fuels, 12 percent. In 1962 the percentage distribution was nonmetals, 57 percent; metals, 29 percent; and fuels, the remainder.

Production of copper in terms of recoverable metal was 1 percent larger than in 1962. The preliminary average weighted price for copper in 1963 was 30.8 cents per pound, the same as in 1962. Copper producers operated throughout the year without interruption. Copper Range Co. began reclamation of stamp sands from the old Atlantic Mill, at Portage Lake. The sands were transported to the Freda Mill for processing. White Pine Copper Co. suspended development work on the Southwest orebody to permit continued technical studies required for mine design.

Iron ore shipments were estimated at 10.5 million long tons, compared to 9.4 million in 1962. Value of shipments increased about $12.6 million over the previous year. Most of the gain was due to increased shipments of pellets and concentrates produced from jaspilite ore. Shipments of this material accounted for about one-third of the total iron ore shipments in 1963, compared to 28 percent in 1962.

The Hanna Mining Co. began producing pellets at its new Groveland agglomerating facility in March. The plant has an annual capacity of 1.25 million tons of pellets. Cleveland-Cliffs Iron Co. began producing pellets at its new Empire project, four miles south of Negaunee. Initial annual capacity of the Empire plant is 1.2 million tons of pellets, with expected ultimate capacity of 3 million tons. Cleveland-Cliffs also began construction of an addition to the Republic concentrator that will expand the plant's annual capacity by 400,000 tons. Upon completion, early in 1964, total annual capacity of the Republic concentrator will be 2.8 million tons of concentrate. Of this amount, 2 million tons will be agglomerated at the Republic mine site and the remainder at the Eagle Mills pelletizing plant. Plans were announced in December for a $15 million pelletizing plant at Cleveland-Cliffs, Mather underground mine. The project was expected to increase the miners annual production from 700,000 tons to 2.4 million tons by 1966. Inland Steel Co. ceased mining operations at the Greenwood underground mine near Ishpeming on April 30. Manganiferous ore was shipped from stockpile at the Cannon mine. No shipments were reported in the previous year. The Lake shipping season for Michigan iron ores opened at Escanaba on April 19 and closed at the same port on December 16. Estimated average mine value for Michigan usable iron ore in 1963 was $9.35 per ton, compared with $9.08 in 1962. The gain was attributed chiefly to the higher percentage of jaspilite concentrate shipped. Vessel freight rates to lower Lake ports were reduced 10 cents per ton in August. This reduction did not change the mine value as the freight saving was passed on to the buyer.

*Prepared December 20, 1963, by Donald F. Klyce, Industry Economist, under the supervision of Wesley A. Grosh, Acting Area Director, Area III Mineral Resource Office, Minneapolis, Minnesota.

Silver was recovered from copper ore mined at the White Pine mine. High silver-bearing concentrate from a silver-recovery circuit in the White Pine mill were

smelted separately for delivery to electrolytic refineries where the silver was recovered.

Portland cement shipments increased 12 percent in quantity and 6 percent in value. Sales of masonry cement increased 9 percent in quantity and 3 percent in value. Clay production rose 8 percent, principally because of increased consumption for cement manufacture. Production of crude gypsum increased 3 percent in quantity and 2 percent in total value. Total production of quicklime and hydrated lime increased 15 percent -in quantity and value. Total value of chemicals derived from brines (bromine, calcium-chloride, iodine, magnesium, compounds, and potash) increased. Salt production increased 2 percent in quantity and 1 percent in value. Sand and gravel output increased 1 percent in quantity and value. Total production of stone increased 4 percent in quantity and 5 percent in value. Increased consumption of crushed limestone by the cement and steel industries was the chief reason for the gain. Decreases in production of basalt, clacareous marl, and sandstone were recorded.

Petroleum output dropped over 1 million barrels, a 6-percent decrease, compared with 1962. Total production of natural gas liquids decreased slightly. Natural gas output increased 6 percent in quantity and 7 percent in value. Peat production increased 7 percent in quantity and 9 percent in value.

[TABLE: MINERAL PRODUCTION IN MICHIGAN, 1963 (Estimates).]

NEWS ITEMS AND DEVELOPMENTS IN 1963

IRON ORE

Michigan's iron mines were appraised for 1963 tax purposes at $55.3 million, nearly $13 million less than last year. This figure reflects a five-year downward trend in demand for iron ores and continuing decline in underground reserves.

The Cleveland-Cliffs Iron Company suspended operations at its Cliffs Shaft and Mather mines during January due to dwindling demand for the ore and foreign competition. Both mines are in Ishpeming and Negaunee. The company's Republic and Humboldt pellet plants, however, operated throughout the year at above rated capacity, setting new monthly records. Construction work at the Empire mine, which will be the third pellet property operated by Cleveland-Cliffs, continued and was completed at the year's end. The mine is owned by Empire Iron Mining Company, in a joint venture by Inland Steel Company, McLouth Steel Corporation, International Harvester Company, and The Cleveland-Cliffs Iron Company. Construction was begun in the spring of 1962.

Intensive research and pilot plant studies on the feasibility of concentrating and agglomerating its underground domestic ores that cannot compete with pellets and higher grade foreign ores were conducted by The Cleveland-Cliffs Iron Company. In December plans were announced for the construction of the nation's first pellet plant to agglomerate underground iron ore. The $15 million project will be a joint venture by The Cleveland-Cliffs Iron Company, McLouth Steel Corporation, and Bethlehem Steel Corporation. It is expected that the plant will be in operation by March, 1965, producing at the rate of 1,200,000 tons of high grade pellets annually. Output of the Mather Mine in Negaunee and Ishpeming will be boosted from its present 700,000 tons annually to more than 2,400,000 tons by 1966 to supply ore for the pelletizing plant.

Inland Steel Company closed its Greenwood Iron mine near Ishpeming in April after efforts to discover additional ore had failed. The mine, opened in 1930, had produced more than 2.3 million tons of ore during its life of 32 years.

Expansion of the Hanna Mining Company's iron ore concentrator and the construction of a pelletizing plant at its Groveland mine near Randville, Dickinson County, were completed and production of pellets begun. The expansion of the concentrator was designed to increase production of concentrates from 700,000 tons to 1,600,000 tons, and pelletizer was designed for a capacity of 1,250,000 tons of pellet output per year.

The Institute of Mineral Research of the Michigan Technological University was given a $70,763 contract with the U. S. Agency for International Development for the purpose of finding a way to beneficiate low-grade ores for use in making pig iron and steel. The work was to be done for one of the foreign countries served by the agency and is being performed with the understanding that technological developments will not be used to compete with domestic iron ore production.

COPPER

Michigan's copper mines were appraised for 1963 tax purposes at $14.5 million, an increase of $336,000 over 1962. The White Pine Mine, the only mine in Ontonagon County, again had the top valuation, $10,585,000. Copper mines in Houghton and Keweenaw counties were appraised at $3,221,000 and $740,000, respectively.

Copper Range Company began reclamation of stamp sands in April from the old Atlantic mill site on the shore of Portage Lake west of Houghton. The sands were transported over the Copper Range Railroad to the company's mill at Freda for milling and recovery of copper. Modern day techniques make possible the recovery of copper lost in the tailings from the earlier mill.

Calumet & Hecla, Inc., continued its program of utilizing all possible sources of copper rock as mill feed. Waste

rock with low copper content was taken from the Ahmeek rock pile to supplement mine production Calumet & Hecla, Inc., early in the year, completed extension of a ventilation cross-cut from the Allouez No. 3 shaft into the newly discovered orebody in the Kingston conglomerate lode. The company then proceeded by drifting along the lode to obtain samples for metallurgical testing and to determine the lateral limits of the body. Drilling to determine the vertical continuity and rake of the body was continued.

PORTLAND CEMENT

Announcement early in the year was made that the Marquette Cement Company of Chicago, Illinois, had acquired 3900 acres of limestone and shale, bearing land a few miles north of Alpena in Alpena and Presque Isle counties. The property includes the Rockport facility with quarry and harbor once operated by the Kelley Island Lime and Transport Company. Marquette Cement has offices in downtown Chicago and two cement plants on Lake Michigan, one at Oglesby, Illinois, and the other at Milwaukee, Wisconsin.

Construction of a vertical mine shaft in the floor of Huron Portland Cement Company Alpena limestone quarry for the extraction of shale has been reported as part of a future expansion plan by the company. The expansion plans also include the installation of a 12,000 barrel-per-day finish grinding mill at Alpena.

Penn-Dixie Cement Corporation announced that modernization of their Petoskey plant will be completed by early 1965. A large kiln and grinding, coal handling and auxiliary equipment will be installed.

STONE

Late in the year it was reported that the North Range Mining Company will form a corporation for the purpose of operating the Mitro-Nite Company quarry and production facilities at Felch, Dickinson County. The new corporation will be known as Felch Quarry Company. North Range is currently rebuilding Mitro-Nite's crushing and screening plant and installing new equipment. High-grade extender pigment will lie produced by the corporation for the protective coating industry.

GYPSUM

National Gypsum Company announced the renaming of its Tawas City dock for Prescott in memory of the late Senator Charles T. Prescott of Michigan's 28th senatorial district. The renaming of the dock was in response to a resolution adopted by the Michigan Senate and House, according to the announcement.

LIGHTWEIGHT AGGREGATE

A sintering and grading plant costing more than $1 million was nearing completion by mid-year on the riverfront of Detroit for the Waylite Company, a Chicago based producer. The plant will use fly ash obtained from industrial plants in the Detroit area. This will be processed by Waylite into lightweight aggregate for the concrete industry. Expected production capacity for the plant is reported to be from 1,000 to 1,500 tons per day.

SAND AND GRAVEL

The assets and facilities of the Melvin Herselschwerdt Gravel Company, Chelsea, were purchased by George and Ralph Adams, principal officers of the Adams Concrete Products Company, Inc., of Ypsilanti. The firm, which was renamed the Short Hills Gravel Company, will offer washed stone and sand for concrete, mason and sand, 60-40 washed gravel, washed septic tank stone, and fill or bank run.

Stan Kote of Jackson, Michigan, started production in May of a plastic coated specialty gravel. The material, first to be produced in the eastern United States, is intended for use as a roofing rock and for landscaping. The patented process is being used under license from an Arizona firm, which developed it principally to manufacture multi-colored landscaping rock - a popular product in arid climates.

Within the foundry sand industry the increased use of chemical binders by foundries has resulted in more extensive preparation and control by sand producers. To meet specifications the sand must be processed dry and cool (below 100° F) and as a result most sand producers have installed coolers within the last year.

PETROLEUM

Of considerable interest to the oil and gas industry is the drilling of a deep well in Ogemaw County. Drilling began in December and the well is expected to be bottomed at a depth of 12,000 feet, in Lower Cambrian rocks. This new deep test, a joint venture of three major oil companies, should contribute much needed information relating to the oil and gas bearing potentials of the state's deeper geologic formations.

LEGISLATION:

Legislation Which Became Law

Act. No. 42. Oil and gas interests. Rights, dormant, terminate, procedure.

Act. No. 66. Metallic iron mining. State Geologist to annually report true cash value to State Tax Commission; Tax Commission to assess such properties: containing 20% or more of iron ore in conformity with other properties in district; difference to be eliminated in 3 equal adjustments.

Act. No. 68. Underground iron mines. Impose specific tax upon agglomerated or beneficiated ore.

Legislation Which Was Introduced but Failed

House Bill 49. Taxation. Mineral rights assessed separately where separate from surface.

House Bill 120. Mine inspection. Safety board, remedies for dangerous conditions.

House Bill 143. Appropriations. Conservation Department, $25,000 for mineral exploration in Gogebic County.

House Bill 495. Mineral rights. Separate ownership, require registration and fee.

House Bill 572. State lands. Sand, gravel, mineral rights of non-metallic nature, 100-year private ownership strip.

House Bill 757. Oil, gas, and minerals on state lands. Require minimum royalty of 50% of value. Amend Act. 17, P.A. 1921 (C.L. 299.1-299.6) by adding sec. 5.

Senate Bill 1359. Gas pipelines. Extend public service commission jurisdiction when using highways and other public places.

Interim Study Committee

House Concurrent Resolution 68. A committee to study mineral rights.

TOPOGRAPHIC MAPPING: (U. S. Geological Survey*)

Standard Series, 15-Minute Quadrangles

New Issues: Boyne City, Boyne Falls, Chambers Island.

Standard Series, 7½-Minute Quadrangles

New Issues: Albordton, Avoca, Banfield, Bedford, Bellevue, Brockway, Brown City, Burr Oak, California, Capac, Ceresco, Clayton, Clear Lake, Colon, Delton, Hillsdale, Jasper, Jeddé, Lakeport, Meadow Lake, Nottawa, Pigeon Point, Pioneer, Roseburg, Ruby, Sturgis, Yale.

Reprints: Augusta, Battle Creek.

*For complete listing and index map of published topographic quadrangles, write to the Geological Survey Division, Department of Conservations Lansing 269 Michigan.

GEOLOGIC PUBLICATIONS, MAPS AND ARTICLES:

"Open-pit iron mining, milling, and costs, Groveland Mine, The Hanna Mining Company, Dickinson County, Michigan," by Leonard H. Heising. U. S. Bureau of Mines, Information Circular 8181 (1963). free

"Sandstone as dimension stone," by Oliver Bowles and William R. Barton. U. S. Bureau of Mines, Information Circular 8182 (1963).

"How to locate reefs in Michigan via gravity work," by R. A. Geyer, Worlds Oil, v. 156, no. 5, pp. 101-104 (April 1963).

"Information on Michigan Silurian oil and gas pools," by G. D. Ells, Geological Survey Division, Michigan Department of Conservation (1963) $.50

"Summary of operations, oil and gas fields, 1962," by L. W. Price, et al. Geological Survey Division, Michigan Department of Conservation (1963) free

"Developments in Michigan in 1962," (oil and gas) by R. E. Ives and G. D. Ells, Bulletin, American Association of Petroleum Geologists, vol. 47, no. 6, pp. 995-1006 (June 1963).

"Symposium on salt," by the Northern Ohio Geological Society, Cleveland, Ohio (1963). 661 pp. $12.00

"Guidebook for mineral collectors in the Keweenaw Copper Country," by Kiril Spiroff, Michigan College of Mining and Technology, Houghton (1963) $.50

"Index to Michigan geologic maps, 1842-1962," by E. A. Kirkby, Geological Survey Division, Michigan Department of Conservation, 62 pp. (in press)

"Aeromagnetic map of central Gogebic County, Michigan, and vicinity," by P. W. Philbin and J« Le Vargo, U. S. Geological Survey. A map released for OPEN FILE (1963). Copy available for examination in the office of Geological Survey Division, Michigan Department of Conservation, Lansing 26, Michigan.

"A look at state's iron mining industry," by W. Been, Michigan Manufacturer and Financial Record, v. III, no. 5, p. 22 (May 1963).

"Ground-water contamination and legal controls in Michigan," U. S. Geological Survey Water-Supply paper 1691 (1963) 79 pp.

"Ground-water resources of the Alma area, Michigan," U. S. Geological Survey Water-Supply Paper 1619-E (1963) 66 pp. $.50

The following U. S. Geological Survey Geophysical Investigations Maps (GP) for Michigan quadrangles, authored by J. R. Balsley and others, became available in 1963, at a cost of 50 cents a copy. These maps are overlays for the U. S. Geological Survey geologic maps cited below.

Quadrangle	No.	County	Geologic Map
Phoenix	GP-313	Keweenaw	GQ-34
Delaware	GP-315	Keweenaw	GQ-51
Lake Medora	GP-316	Keweenaw	GQ-52
Fort Wilkins	GP-317	Keweenaw	GQ-74
Ahmeek	GP-318	Keweenaw & Houghton	GQ-27
Mohawk	GP-319	Keweenaw & Houghton	GQ-54
Bruneau Creek	GP-320	Keweenaw	GQ-35
Hancock	GP-321	Houghton	MF-46
Laurium	GP-322	Houghton	MF-47
South Range	GP-323	Houghton	MF-48
Chassell	GP-324	Houghton	MF-43

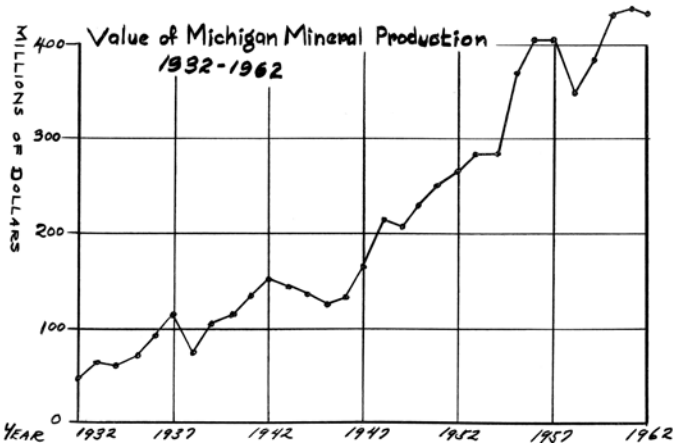
MICHIGAN MINERAL PRODUCTION 1962 GENERAL REVIEW

Mineral production in Michigan in 1962 was valued at $437,689,079. This was a decrease of 1% from 1961. Nonmetallic value decreased 1%, metallic value decreased 1%, and fuel value decreased 3%. Iron ore was first in value, followed by cement, natural salines, and petroleum.

The following table gives the value of Michigan mineral production 1962.

	Value	Per Cent	Rank U.S.*	Per Cent U.S.Total*
Nonmetallics	252,854,062	57.8	4	6.63
Metallics	124,431,465	28.4	4	6.54
Fuels	60,403,552	13.8	23	0.48
TOTAL	437,689,079	100.0	12	2.44

*Based on 1961 data.



METALLIC MINERALS*

The value of metallic minerals was 1 percent lower than in 1961. The decrease was due to a 3.4 million dollar drop in the value of iron ore. Production of copper increased 1.5 million tons.

METALLIC PRODUCTION

Product	Unit	Quantity	Value
Iron Ore	Long Tons	9,443,201	80,005,080
Copper	Lbs.	143,760,678	43,990,767
Silver	Oz.	401,491	435,618
Total			124,431,465

*Metallic statistics compiled by Michigan Geological Survey

IRON ORE

Iron ore shipments totaled 9,443,201 long tons, compared to 9,390,197 in 1961. Value of shipments decreased about 3.4 million. Growing preferences for higher quality iron ores for blast-furnace feed had a considerable effect on iron-ore mining in Michigan. Shift in demand from direct-shipping ores to higher quality concentrates resulted in the closing of two underground mines during the year. Concentrates produced from jaspilite accounted for over a quarter of iron-ore shipments in 1962. The lake shipping season for Michigan ores opened at Escanaba on April 17 and closed at Marquette on December 4.

IRON ORE SHIPMENTS BY RANGES, 1962

Range	Number of Mines		Iron Ore Shipments (Long Tons)		
	Underground	Open Pit	Direct Shipments	Siliceous	Total
Marquette	8	3	4,386,195	114,252	4,500,447
Menominee	6	1	3,462,371	-	3,462,371
Gogebic	3	-	1,480,383	-	1,480,383
TOTAL	17	4	9,328,949	114,252	9,443,201

TABLE I
MINERAL PRODUCTION OF MICHIGAN, 1962 (1)

PRODUCT	UNIT	QUANTITY	VALUE	RANK IN U.S. (2)
Iron Ore	Long Tons	9,443,201	$ 80,005,080	2
Cement	Bbls.	24,198,903	77,601,954	4
Natural Salines (3)			51,290,583	1
Petroleum	Bbls.	17,114,303	49,311,243	16
Copper	Lbs.	143,760,678	43,990,767	6
Sand and Gravel	Tons	47,562,781	42,029,146	2
Salt	Tons	4,273,667	33,342,591	4
Stone (4)	Tons	17,904,474	20,422,503	7
Lime	Tons	1,189,005	15,793,427	2
Clay Products			7,033,870	
Natural Gas	M. cu. ft.	27,766,129	6,652,958	17
Gypsum	Tons	1,278,065	4,791,311	2
Clay and Shale (5)	Tons	2,017,616		9
Peat	Tons	257,693	2,276,702	1
Natural Gas Liquids	Gallons	43,252,973	2,162,649	16
Silver	Oz.	401,491	435,618	7
Marl	Tons	145,854	88,476	3
Miscellaneous (6)			460,201	
TOTAL			$437,689,079	

(1) Metallic and fuel statistics compiled by Michigan Geological Survey. Nonmetallic statistics compiled in cooperation with the United States Bureau of Mines.
(2) Based on quantity - 1961 data.
(3) Includes bromine, magnesium compounds, calcium-magnesium chloride, potash, and iodine.
(4) Does not include 10,383,683 short tons of limestone valued at $8,533,760 used in the manufacture of cement and lime.
(5) Used in the manufacture of cement and clay products.
(6) Includes sulfur, mineral pigments, gem stones, and clay.

Cleveland-Cliffs Iron Co. completed the second 800,000 ton per year concentration unit at the Republic open-pit mine and a third was under construction. Construction of the Empire taconite plant which will have an ultimate capacity of 3,000,000 tons of pellets a year began in May near Palmer.

Hanna Mining Co. completed expansion of its Groveland operation which increased its concentration plant capacity from 700,000 to 1,500,000 tons per year.

IRON ORE SHIPMENTS BY RANGES

1958-1962 (Long Tons)

Year	Marquette	Menominee	Gogebic	Total	
				Quantity	Value
1958	3,722,139	3,095,239	1,393,528	8,210,906	70,704,419
1959	3,529,949	2,477,980	1,250,786	7,258,715	62,117,507
1960	4,944,715	4,121,165	1,889,986	10,955,866	97,072,686
1961	4,142,440	3,885,902	1,361,855	9,390,197	83,375,984
1962	4,500,447	3,462,371	1,480,383	9,443,201	80,005,080

TABLE II
MINERAL PRODUCTION OF MICHIGAN, 1961 (1)

PRODUCT	UNIT	QUANTITY	VALUE	RANK IN U.S. (2)
Iron Ore	Long Tons	9,390,197	$83,375,984	2
Cement	Bbls.	23,462,554	79,638,973	4
Petroleum	Bbls.	18,900,947	55,247,081	17
Sand and gravel	Short Tons	54,603,338	47,790,111	2
Natural Salines (3)			44,343,198	1
Copper	Lbs.	142,268,588	42,579,566	6
Salt	Short Tons	3,885,130	31,283,571	3
Stone (4)	Short Tons	18,815,855	21,991,980	6
Lime	Short Tons	1,169,036	15,526,791	3
Clay Products			6,927,050	
Natural Gas	M. cu. ft.	25,044,786	5,209,662	17
Gypsum	Short Tons	1,294,619	5,095,210	2
Peat	Short Tons	209,266	2,002,310	1
Clay and Shale (5)	Short Tons	2,005,361		9
Natural Gas Liquids	Gallons	29,601,462	1,687,283	17
Marl	Short Tons	157,351	99,578	3
Miscellaneous (6)			464,930	
TOTAL			$443,263,278	

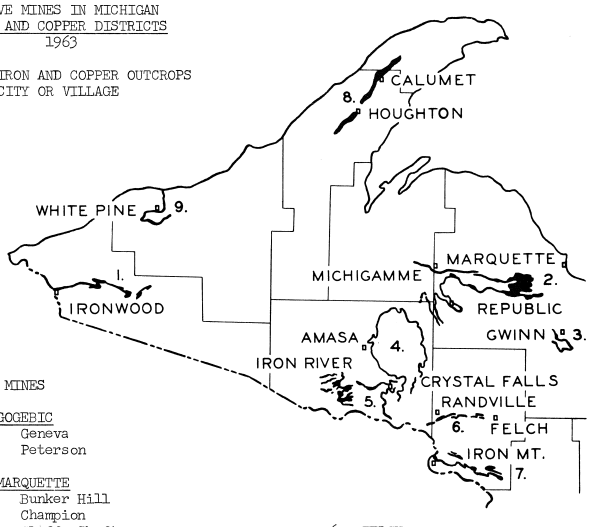
(1) Metallic and fuel statistics compiled by Michigan Geological Survey. Non-metallic statistics compiled in cooperation with the United States Bureau of Mines.
(2) Based on quantity - 1960 data.
(3) Includes bromine, magnesium compounds, calcium-magnesium chloride, potash, and iodine.
(4) Does not include 9,762,230 short tons of limestone valued at $8,032,098 used in the manufacture of cement and lime.
(5) Used in the manufacture of cement and clay products.
(6) Includes sulfur, mineral pigments, gem stones, and clay.

COPPER

Production of copper was 1 percent larger than in 1961. The value was 3 percent higher because the average price used for calculating the value of copper was 30.6 cents per pound in 1962 and 29.9 cents in 1961. Copper producers operated throughout the year with only minor interruption with the exception of the Quincy Mining Co., which was closed down from May 31 to September 3 because of the collapse of a surge bin at their reclamation plant.

ACTIVE MINES IN MICHIGAN
IRON AND COPPER DISTRICTS
1963

IRON AND COPPER OUTCROPS
CITY OR VILLAGE



IRON MINES

1. GOGEBIC
   Geneva
   Peterson

2. MARQUETTE
   Bunker Hill
   Champion
   Cliffs Shaft
   * Empire
   Greenwood
   * Humboldt
   Maas
   Mather
   * Republic
   ° Tilden
   Tracy

3. GWINN (not active)

4. AMASA OVAL (not active)

5. IRON RIVER - CRYSTAL FALLS
   Bristol
   Hiawatha
   Homer
   Sherwood
   Wauseca

6. FELCH
   * Groveland

7. EAST MENOMINEE (not active)

COPPER MINES AND
RECLAMATION PLANTS

8. NATIVE COPPER
   Allouez No. 3
   Calumet and Hecla Reclamation
   Centennial
   Champion
   Osceola
   Peninsula
   Quincy Mining Co. Reclamation
   Seneca No. 2

9. COPPER SULFIDE
   White Pine

* Low grade iron ore development (open pit)
° Siliceous iron ore (open pit)

[MAP: ACTIVE MINES IN MICHIGAN IRON AND COPPER DISTRICTS, 1963.]

COPPER PRODUCTION BY COUNTIES, 1962

County	Mines	Recla-mations	Copper Production (Pounds)		
			Mines	Reclamation	Total
Houghton	4	3	17,707,243	6,364,917	24,072,160
Keweenaw	3	-	13,075,067	-	13,075,067
Ontonagon	1	-	106,613,451	-	106,613,451
TOTAL	8	3	137,395,761	6,364,917	143,760,678

Development of the White Pine Copper Company's southwest orebody continued. The exploration shaft was completed and large-scale testing of development ore begun. Late in the year Calumet and Hecla, Inc. reported the discovery of an orebody in the Kingston conglomerate with indications of a grade of ore higher than any mined in the Michigan copper district in recent years.

COPPER PRODUCTION, 1958-1962

Year	Native Copper	Sands Reclamation	Sulphide Ore	Total	
				Quantity	Value
1958	35,301,708	5,100,407	81,656,908	122,059,023	31,414,330
1959	34,167,881	9,266,420	69,647,232	113,081,533	35,245,252
1960	31,577,880	8,740,414	75,120,243	115,438,537	37,025,756
1961	31,141,849	7,370,561	103,756,178	142,268,588	42,579,566
1962	30,782,310	6,364,917	106,613,451	143,760,678	43,990,767

SILVER

During 1962 part of the refined copper, having a high silver content, was electrolytically refined resulting in a silver recovery of 401,491 ounces, which based on an average yearly price of $1.085 per ounce was valued at $435,618.

FUELS*

The value of mineral fuels produced was 3 percent lower than in 1961. The decline was due to lower output of petroleum, down 1.8 million barrels from 1961. Producers of other mineral fuels (natural gas, natural gas products, and peat) reported larger outputs than in 1961.

FUEL PRODUCTION

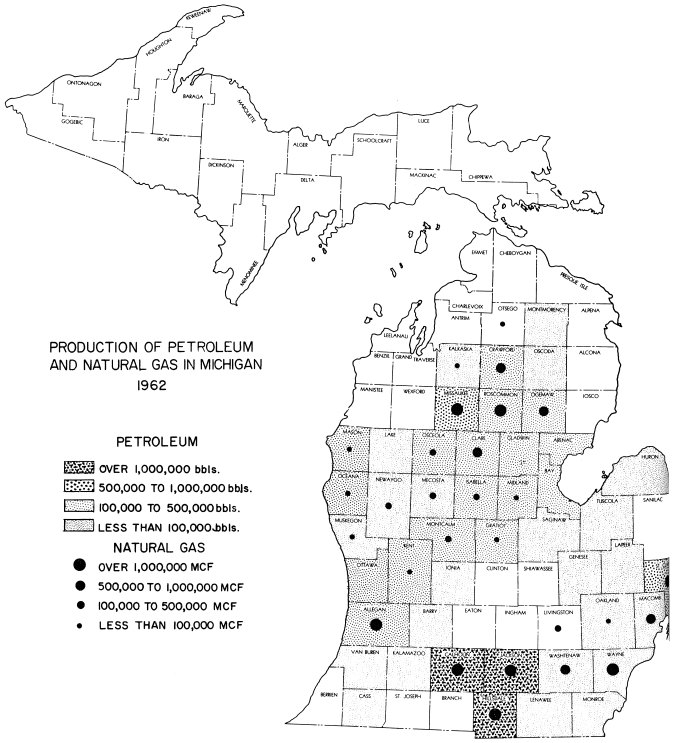
Product	Unit	Quantity	Value
Petroleum	Barrels	17,114,303	49,311,243
Natural gas	M. cu. ft.	27,766,129	6,652,958
Peat	Tons	257,693	2,276,702
Natural gas liquids	Gals.	43,252,973	2,162,649
TOTAL			60,403,552

*Fuel statistics compiled by Michigan Geological Survey

PETROLEUM

Petroleum production was 9 percent less than 1961. During the year 17,114,303 barrels valued at $49,311,243 were produced. This was the first decline in petroleum production since 1958 when the development of southern Michigan oilfields reversed a downward trend. At the end of 1962, 4,603 producing wells were in 45 counties. Approximately 58 percent of the total output was from Hillsdale, Calhoun, and Jackson counties.

During the year 685 wells were completed (184 oil producers, 62 gas producers, 475 dry holes). Of these completions 294 were wildcat (8 oil producers, 8 gas producers, and 278 dry holes). The remaining 391 completions were field wells (140 oil producers, 54 gas producers, and 197 dry holes). Fourteen refineries, in nine counties, processed crude oil in Michigan during 1961. The combined nominal daily capacity of all Michigan refineries is approximately 189,939 barrels.



[MAP: PRODUCTION OF PETROLEUM AND NATURAL GAS, 1962.]

PETROLEUM PRODUCTION AND ACCUMULATED OIL BY FORMATION, 1962

Formation	Production		Accumulated	
	Bbls.	Percent	Bbls.	Percent
Marshall	1,215	.01	67,738	.01
Berea	16,186	.09	2,189,000	.46
Traverse	1,335,105	7.80	90,435,321	18.93
Dundee	3,200,061	18.70	313,009,874	65.53
Detroit River	1,456,054	8.51	35,850,755	7.50
Salina-Niag.	1,110,937	6.49	3,018,076	.63
Trenton	9,994,745	58.40	33,129,367	6.94
TOTAL	17,114,303	100.00	477,700,131	100.00

PETROLEUM AND NATURAL GAS PRODUCTION, 1958-1962

Year	Petroleum		Natural Gas	
	Barrels	Value	M. Cu. Ft.	Value
1958	9,308,018	27,213,388	10,964,377	2,071,720
1959	10,438,608	30,518,107	15,626,227	3,045,976
1960	15,899,206	46,105,421	19,240,168	3,839,709
1961	18,900,947	55,247,081	25,044,786	5,209,662
1962	17,114,303	49,311,243	27,766,129	6,652,958

NATURAL GAS

Natural gas production increased 11 percent to a total of 27,766,129 M. cu. ft., the largest production in history. Of this amount over 17 billion cubic feet was oil well gas. Eighty two percent of the natural gas produced in 1962 was from the Salina-Niagaran and Trenton-Black River formations. St. Clair County with 33 percent of the state1s total was the leading producer followed by Calhoun, Hillsdale, and Jackson counties, all of which produced over 2,000,000 M. cu. ft.

GAS PRODUCTION AND ACCUMULATED GAS PRODUCTION BY FORMATIONS - 1962

Formations	Production		Accumulated	
	M. Cu. Ft.	Percent	M. Cu. Ft.	Percent
Drift			8,020	.002
Stray-Marshall	451,113	1.62	211,278,963	51.22
Berea	6,620	.05	9,806,431	2.38
Antrim	23,768	.08	251,406	.06
Traverse	206,613	.74	7,963,983	1.93
Dundee-Reed City	117,606	.42	48,761,057	11.82
Detroit River	4,148,707	14.94	32,513,308	7.88
Salina-Niagaran	11,926,493	42.95	70,809,662	17.16
Trenton-Black River	10,885,208	39.20	31,145,990	7.55
TOTAL	27,766,128	100.00	412,538,820	100.00

NATURAL GAS LIQUIDS - 1962

Michigan in 1962 produced from oil well gas a total of 43,252,973 gallons of natural gas liquids valued at $2,162,649. Hillsdale County, with 74 percent of the state total, ranked first among the eight producing counties.

NATURAL GAS LIQUIDS PRODUCTION

Year	Quantity (Gallons)	Value
1958	3,511,671	351,167
1959	2,761,551	154,648
1960	12,217,120	684,159
1961	29,601,462	1,687,283
1962	43,252,973	2,162,649

PEAT

Peat production was about 23 percent higher in quantity and 14 percent higher in value than in 1961. Michigan continued to be the leading producer, the peat was sold principally as a soil conditioner. None was sold as a fuel.

PRODUCTION OF PEAT, 1958-1962

Year	Quantity (Short Tons)	Value	Percent of U.S.	Rank in U. S.
1958	107,342	1,683,980	32.7	1
1959	191,661	2,356,656	45.7	1
1960	214,402	2,755,245	45.5	1
1961	209,266	2,002,310	40.0	1
1962	257,693	2,276,702	45.5	1

NONMETALLIC MINERALS

The value of nonmetallic minerals decreased 1%. Substantial increases in value were recorded for natural salines and salt but were offset by decreases in sand and gravel, cement, and stone. Nonmetallic minerals accounted for 58 percent of the state total value.

CEMENT

Cement shipments increased 3 percent in quantity, but the value of shipments dropped 2.5 percent, principally because of a 20-cent drop per barrel in the average mill value of portland cement. Cement was produced by nine plants in Alpena, Bay, Emmet, Lenawee, Monroe, St. Clair, and Wayne counties.

NONMETALLIC PRODUCTION

Product	Unit	Quantity	Value
Cement	Barrels	24,198,903	77,601,954
Natural salines	-	-	51,290,583
Sand and gravel	Tons	47,562,781	42,029,146
Salt	Tons	4,273,667	33,342,591
Stone	Tons	17,904,474	20,422,503
Lime	Tons	1,189,005	15,793,427
Clay products	-	-	7,033,870
Gypsum	Tons	1,278,065	4,791,311
Clay and shale	Tons	2,017,616	-
Marl	Tons	145,854	88,476
Miscellaneous	-	-	460,201
TOTAL			252,854,062

RAW MATERIAL USED IN THE MANUFACTURE OF PORTLAND CEMENT

1962

Raw Material	Short Tons
Limestone	5,111,627
Clay and shale	1,557,256
Gypsum	169,204
Other	32,405
TOTAL	6,870,492

The largest dry-process kiln in Michigan started production June 19 at the Huron Portland Cement Company's plant at Alpena. The new kiln produces 5200 barrels of cement per day and the annual capacity of the plant is 14 million barrels. A plant expansion program is designed to increase the capacity to 22,000,000 barrels a year by 1975.

Approximately $200,000 was spent at Peerless Cement Company's Port Huron plant in a modernization program involving kilns and stack. A dry dust collector at the barge-loading site cost an additional $35,000.

In December Martin Marietta Corporation announced the purchase of the Aetna Portland Cement Company is 3 million-barrel cement plant at Bay City.

CEMENT SHIPMENTS, 1958-1962

Year	No. of Plants	Shipments (Bbls.)	Value	Rank
1958	8	20,911,990	70,542,501	4
1959	8	23,025,928	77,323,974	4
1960	9	22,361,498	77,694,087	4
1961	9	23,462,554	79,638,973	4
1962	9	24,198,903	77,601,954	4

NATURAL SALINES

The value of chemicals (bromine, calcium chloride, iodine, magnesium compounds 3 and potash) extracted from natural well brines increased 16% in 1962. The highest value was recorded for bromine, followed by magnesium compounds, calcium magnesium chloride, iodine, and potash.

VALUE OF NATURAL SALINES

Year	Value
1958	42,360,677
1959	49,286,176
1960	44,034,486
1961	44,343,198
1962	51,290,583

SAND AND GRAVEL

Sand and gravel production was down about 13 percent from 1961 because of smaller demand for road materials. Sales of sand and gravel for building construction, industrial uses and fill showed modest increases over 1961. The value of sand and gravel was $42,029,146 compared with $47,790,111 in 1961.

USES OF SAND AND GRAVEL, 1962

Uses	Quantity (Short Tons)	Value	Percent of Total
Paving and road sand	6,222,861	4,960,145	13.1
Structural sand	4,715,328	3,706,032	9.9
Molding sand	2,004,347	3,468,495	4.3
Fill sand	3,108,069	1,153,500	6.5
Other sand [1]	787,990	1,723,336	1.7
Paving and road gravel	24,630,488	20,612,913	51.8
Structural gravel	4,579,657	5,431,257	9.6
Fill gravel	938,022	453,847	1.9
Other gravel [2]	576,019	519,621	1.2
TOTAL	47,562,781	42,029,146	100.0

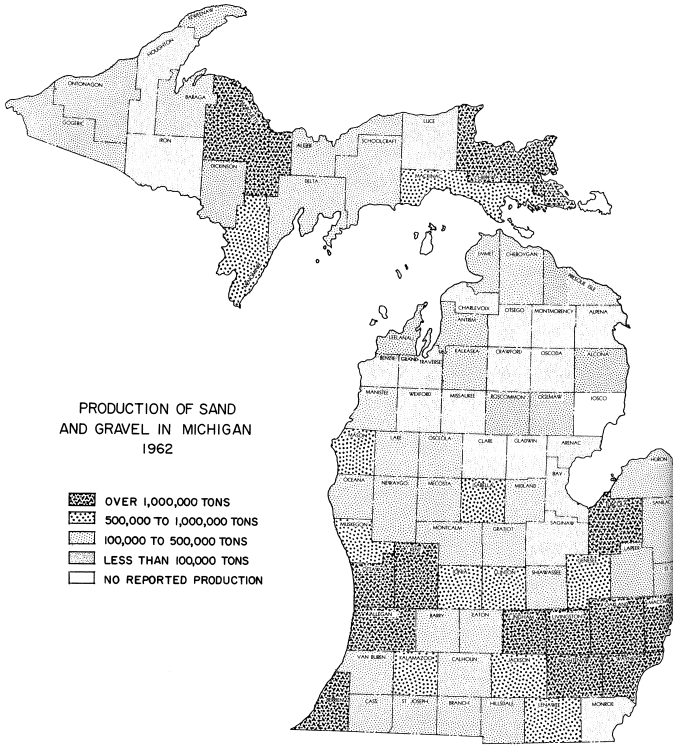
1 Includes - grinding and polishing, glass, engine, blast, and other sand.
2 Includes - railroad ballast, and miscellaneous gravel.

Production of sand and gravel was reported from 82 of Michigan's 83 counties. Approximately forty-six percent of the total production was from 10 counties; in order of rank - Oakland, Livingston, Kent, Wayne, Ottawa, Tuscola, Ingham, Washtenaw, Macomb, and Allegan. Thirteen percent of the state total was produced in Oakland County. Each of the other counties produced more than 1,000,000 tons. About 75 percent of the state's total was reported by commercial producers and the remaining 25 percent was noncommercial production by county road commissions and other governmental agencies. Sixty-five percent of the total sand and gravel output was used in road construction and 20 percent for structural purposes.

SALT

Salt was mined at Detroit, produced from natural brines at St. Louis. Gratiot County, and produced from artificial brines in Manistee, Midland, Muskegon, St. Clair, and Wayne counties.

During 1962, 4,273,667 short tons of salt valued at $33,342,591 were produced. This was an increase of 10 percent in production over 1961, principally due to a greater demand for salt in highway ice control. Wayne ranked first of the six counties producing salt — followed by Midland, St. Clair, Manistee, Muskegon, and Gratiot.



[MAP: PRODUCTION OF SAND AND GRAVEL, 1962.]

SAND AND GRAVEL PRODUCTION, 1958-1962

Year	Building Use	Paving and Road Use	Molding Sand	Others*	Total Quantity	Total Value
1958	7,960,834	27,653,570	1,792,447	2,464,351	39,871,202	34,615,648
1959	9,133,388	33,530,911	1,918,507	3,469,010	48,051,816	41,192,632
1960	8,642,775	31,610,214	1,699,124	4,958,082	46,910,195	39,304,400
1961	8,808,031	38,816,429	1,693,079	5,285,799	54,603,338	47,790,111
1962	9,294,985	30,853,349	2,004,347	5,410,100	47,562,781	42,029,146

* Includes - grinding and polishing sand, glass sand, railroad ballast, engine sand, blast sand, and fill sand and gravel.

Fifty-three percent of the salt was used by chemical plants in Wayne, Midland, and Muskegon counties. Over 2.4 million tons of salt were used in the manufacture of soda ash, chlorine, and other chemicals. Twenty-one percent of the total production was dried and evaporated salt.

International Salt Company's new thermoadhesive process was in full operation producing a grade of rock salt equal or superior to any of the southern rock salt.

SALT PRODUCTION, 1958-1962

Year	Quantity Short Tons	Value	Percent U.S. Total	Rank in U.S.
1958	4,266,688	33,018,368	19.5	1
1959	4,485,145	35,724,796	17.8	3
1960	4,087,760	33,759,466	16.0	3
1961	3,885,130	31,283,571	15.1	4
1962	4,273,667	33,342,591	-	-

STONE

Stone production was 17,904,474 short tons valued at $20,422,503 in 1962 compared to 18,815,855 short tons valued at $21,991.980 in 1961. The decline was due to

a smaller demand for roadstone and material for concrete aggregate. Approximately 90 percent of the limestone and dolomite produced in Michigan in 1961 was quarried in Presque Isle, Mackinac, and Chippewa counties. Dimensional limestone was produced in Charlevoix, Eaton, Huron, and Presque Isle counties. Sandstone for rough construction, rubble, and flagging stone was quarried in Alger, Baraga, and Jackson counties. Basalt was crushed and used for road construction in Dickinson, Houghton, and Ontonagon counties.

STONE PRODUCTION, 1962*

Commodity	Quantity (Short Tons)	Value
Limestone + dolomite		
Crushed	17,803,435	20,228,958
Dimensional	7,798	51,603
Sandstone		
Crushed	5,317	3,652
Dimensional	15,223	65,156
Basalt		
Crushed	72,701	73,134
TOTAL	17,904,474	20,422,503

* Does not include 10,383,683 short tons of limestone valued at $8,533,760 used in the manufacture of cement and lime.

USES OF CRUSHED LIMESTONE AND DOLOMITE, 1962

Uses	Percent of Total	Quantity (Short Tons)	Value
Flux	59.4	10,512,738	11,068,740
Concrete and rd. metal	20.8	3,729,510	4,609,356
Chemical*	15.6	2,791,898	3,269,787
Agricultural	2.8	507,152	849,856
Other**	1.4	262,137	431,219
TOTAL	100.0	17,803,435	20,228,958

* Includes: Alkali, calcium-carbide, sugar, and paper.
** Includes: Riprap, R.R. ballast, whiting, asphalt, dust for coal mines, mineral food, poultry grit, and ornamental concrete.

USES OF CRUSHED LIMESTONE AND DOLOMITE
1958-1962 (Short Tons)

Year	Flux	Concrete + Road Metal	Chemical*	Agriculture	Others**	Quantity	Value
1958	8,821,169	6,063,671	2,985,530	486,653	165,049	18,522,072	19,754,092
1959	10,805,705	5,311,121	3,729,465	434,116	131,526	20,411,933	22,432,225
1960	12,292,426	5,306,573	2,971,051	572,921	182,041	21,325,012	24,104,405
1961	10,565,419	4,649,369	2,839,444	520,680	166,458	18,741,370	21,749,506
1962	10,512,738	3,729,510	2,791,898	507,152	262,137	17,803,435	20,228,958

* Includes: Alkali, calcium-carbide, sugar, glass, and paper.
** Includes: Filler, asphalt, dust for coal mines, mineral foods, railroad ballast, stone sand, riprap, and others.

LIME

Production of lime increased 2 percent to 1,189,005 tons valued at $15,793,427. Lime was produced in 13 plants in 12 counties during the year. Wayne County ranked first in production. The principal markets for lime were chemical, metallurgical, paper, water treatment, and sugar plants.

CLAY AND SHALE

Clay and shale were used for the manufacture of cement, brick, tile, pottery, and lightweight aggregate. During 1962 2,017,616 short tons of clay and shale, valued at $2,278,127 were produced. Wayne County led in production and value with 28 percent of the state's total output, followed by Alpena, Monroe, and Saginaw counties. Approximately 77 percent of all raw clay and shale produced was used by the cement industry.

PRODUCTION OF LIME 1959-1962

Year	Production	Value	Rank
1959	861,808	11,747,657	4
1960	1,177,431	15,730,384	4
1961	1,169,036	15,526,791	3
1962	1,189,005	15,793,427	-

PRODUCTION OF CLAY AND SHALE AND CLAY PRODUCTS, 1958-1962

Year	Raw Clay and Shale Quantity (Short Tons)	Value	Value Clay Products
1958	1,948,444	2,191,909	6,786,247
1959	2,050,760	2,311,917	6,745,027
1960	1,989,149	2,250,950	6,587,345
1961	2,007,011	2,256,061	6,927,050
1962	2,017,616	2,278,127	7,033,870

GYPSUM

The output of crude gypsum continued to decline and the value was 6 percent less than in 1961. Gypsum was quarried in Iosco County and mined in Kent County. The raw material was processed in Gypsum mills at National City; Grand Rapids; River Rouge; East Chicago, Indiana; Waukegan, Illinois; and Loraine, Ohio. Raw gypsum was also used as a retarder in cement manufacture.

Among the significant new developments during 1962 was the total introduction of ammonium nitrate, a low cost blasting agent, into the underground mines. The Grand Rapids Gypsum Company installed and operated successfully a pneumatic system for conveying fine ground gypsum for a distance of one-quarter mile.

GYPSUM PRODUCTION, 1958-1962

Year	Quantity (Short Tons)	Value	Percent of U. S.	Rank in U. S.
1958	1,330,889	4,924,431	14	2
1959	1,721,453	6,595,256	16	1
1960	1,462,781	5,608,519	15	2
1961	1,294,619	5,095,210	14	2
1962	1,278,065	4,791,311	-	-

MARL

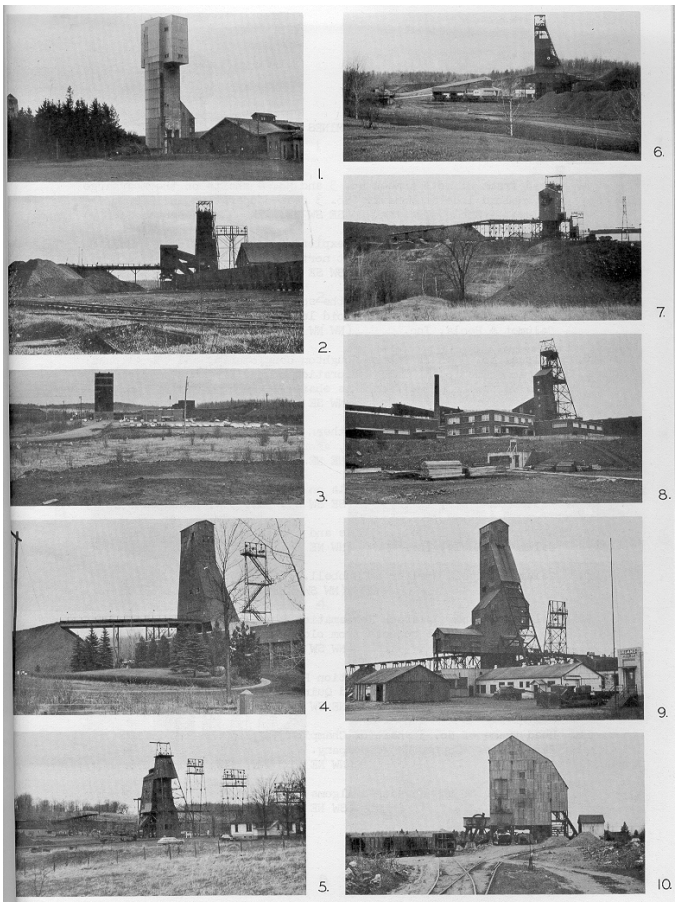
Marl production decreased to 145,854 tons valued at $88,476 in 1962. Commercial marl production was reported in 16 counties during 1962. Calhoun County ranked first, followed by Kalamazoo, Allegan, Barry, and Cass. These counties produced 77 percent of the state output. All marl was used for agricultural purposes.

MARL PRODUCTION, 1958-1962

Year	Quantity (Short Tons)	Value	Ranked in U.S.
1958	230,105	130,231	4
1959	201,387	118,240	4
1960	159,345	91,173	4
1961	157,351	99,578	3
1962	145,854	88,476	-

[PICTURE PRESENTATION OF MINERAL PRODUCERS]

IRON MINES



Photo

1. "C" Shaft of the Cliffs Shaft Iron Mine at Ishpeming. Cleveland-Cliffs Iron Company. Michigan's first Koepe hoist.

   (NW NW 10, 47N, 27W, Marquette County)

2. Old head frame of the Wauseca-Aronson Iron Mine, north of Iron River. M. A. Hanna Company.

   (SW NE 23, 43N, 35W, Iron County)

3. The new Homer-Wauseca shaft northeast of Iron River. M. A. Hanna Company. Michigan's second Koepe hoist.

   (NW NW 26, 43N, 35W, Iron County)

4. Sherwood Iron Mine just north of Iron River. Operated by Inland Steel Company.

   (SE NE 23, 43N, 35W, Iron County)

5. Abandoned Tobin Iron Mine near Crystal Falls. Republic Steel Company.

   (NE NW 31, 43N, 32W, Iron County)

6. Hiawatha No. 1 Iron Mine in Stambaugh. M. A. Hanna Company.

   (SW SE 35, 43N, 35W, Iron County)

7. Hiawatha No. 2 Iron Mine in Stambaugh. M. A. Hanna Company.

   (NE NE 2, 42N, 35W, Iron County)

8. Tracy Iron Mine at Negaunee. Jones & Laughlin Steel Corporation.

   (SW SW 5, 47N, 26W, Marquette County)

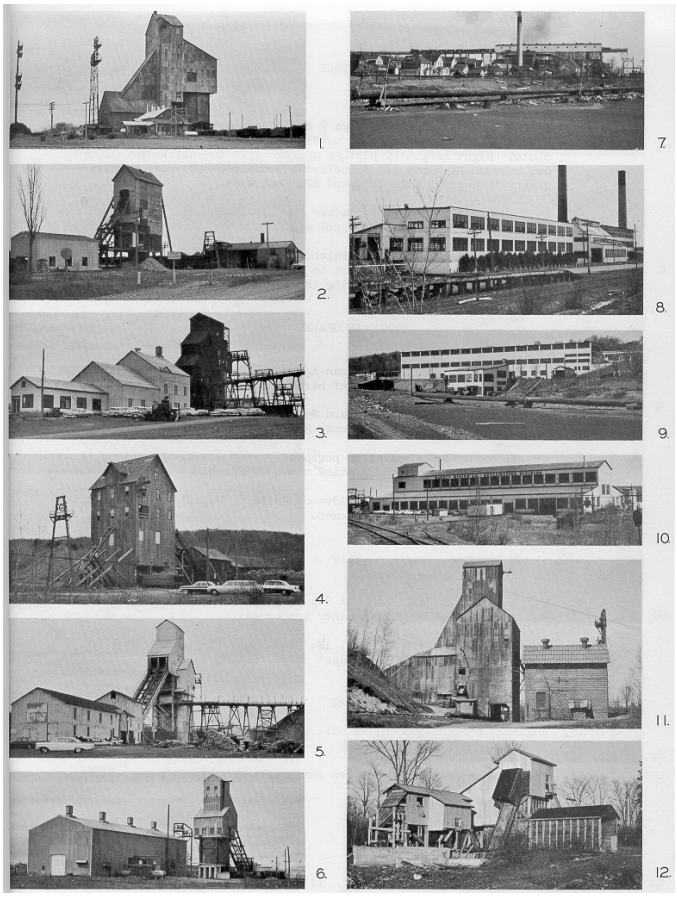
9. Abandoned Greenwood Iron Mine. Inland Steel Company. Located west of Ishpeming.

   (SW SE 14, 47N, 28W, Marquette County)

10. Champion Iron Mine at Champion North Range Mining Company.

    (SW 31, 48N, 29W, Marquette County)

COPPER MINES



Photo

1. Head frame of both Ahmeek No. 3 and No. 4 shafts on the Kearsarge amygdaloid lode at Mohawk. No. 3 ceased operation in 1959. Calumet & Hecla , Inc.

   (SE SW 28, 57N, 32W, Houghton County)

2. Centennial No. 3 shaft is an exploration on the Calumet & Hecla conglomerate lode located just north of Calumet. Calumet & Hecla, Inc.

   (SW SE 12, 56N, 33W, Houghton County)

3. Centennial No. 2 shaft is on the southern extremity of the workings on the Kearsarge amygdaloid lode just northeast of Laurium. Calumet & Hecla, Inc.

   (NW NW 18, 56N, 32E, Houghton County)

4. Allouez No. 3 shaft on the Houghton conglomerate and the Allouez conglomerate lodes. The exploration of the Kingston conglomerate is also taking place from this shaft. Calumet & Hecla, Inc.

   (NW SE 31, 57N, 32W, Keweenaw County)

5. Seneca No. 2 shaft on the northern extremity of the mined area of the Kearsarge amygdaloid lode, about one mile northeast of Mohawk. Calumet & Hecla, Inc.

   (NE NE 27, 57N, 32W, Keweenaw County)

6. Osceola Noc 13 shaft at Osceola on the Osceola amygdaloid lode. Calumet & Hecla, Inc.

   (SE SW 23, 56N, 33W, Keweenaw County)

7. Ahmeek Mill at Hubbell. Mills and treats all the ore mined by Calumet & Hecla, Inc.

   (NW NE 13, 55N, 33W, Houghton County)

8. Calumet & Hecla smelter at Hubbell.

   (NW SW 7, 55N, 32W, Houghton County)

9. Calumet & Hecla Tamarack Reclamation Plant at Hubbell. Reclaims copper from coarse rejects from old mill tailings.

   (NW SW 13, 55N, 33W, Houghton County)

10. Quincy Mining Company Reclamation Plant at Mason. Reclaims copper from coarse rejects of the old Quincy Mill.

    (NE SW 23, 55N, 33W, Houghton County)

11. Head frame of No. 3 shaft of Champion Mine on the Baltic lode at Painesdale. Copper Range Company.

    (NW NE 31, 54N, 34W, Houghton County)

12. Head frame of the abandoned Algoma Mine near Mass. Algoma Mining Company.

    (SW NE 3, 50N, 38W, Ontonagon County)

LIMESTONE

Photo

1. Inland Lime and Stone quarries 7 miles northeast of Port Inland (frontispiece) which is just outside the upper right corner of this photo. Right margin of picture approximates the north-south boundary between Mackinac and Schoolcraft counties. The new smaller quarry is about 1 mile long and 600 feet wide.

2. North face at Inland quarry after blasting. Stone is high-calcium limestone of Niagaran (Silurian) age.

3. Crushed marble operation at Felch. Formerly operated by Metro-Nite Company, but now being rebuilt to produce high-grade extender pigment for the protective coating industry.

SAND AND GRAVEL

4. New Romeo plant of the American Aggregate Corp. having a heavy-media separation unit for removal of harmful chert, shale, clay, etc.

5. Gravel plant of H. Lindberg and Sons, Inc., approximately 5 miles southwest of Marquette on County Rd. 480.

6. Macomb County Rd. Commission portable gravel plant. Operating in outwash 4 miles west and 2 miles south of Romeo.

7. & 8. Pit (7) and plant (8) of Advance Building Material, Inc., 3 miles west and one mile south of Romeo.

SALT

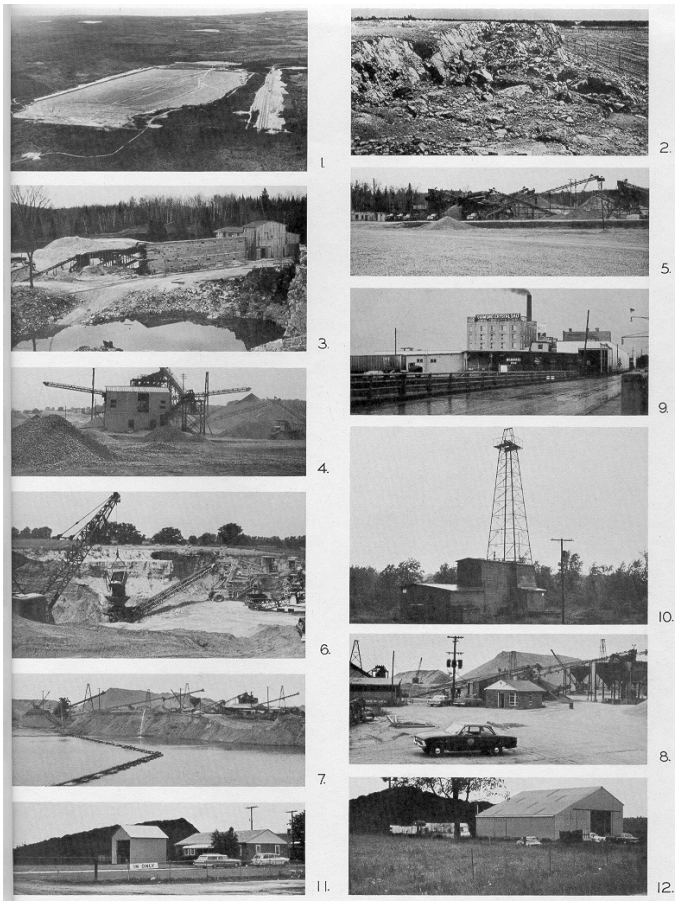
9. Diamond Crystal Salt plant at St. Clair. Produces salt by Alberger, Vacuum Pan, and circular grainer processes.

10. Diamond Crystal Salt Well No. 19, just south of Pine River about one mile southeast of main plant in St. Clair.

PEAT

11. Anderson Peat Co., 3½ miles east and 1 mile south of Imlay City. Lapeer County.

12. Hofman Peat Co., about 2 miles northeast of Imlay City.



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