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MICHIGAN'S MINERAL INDUSTRIES
1953

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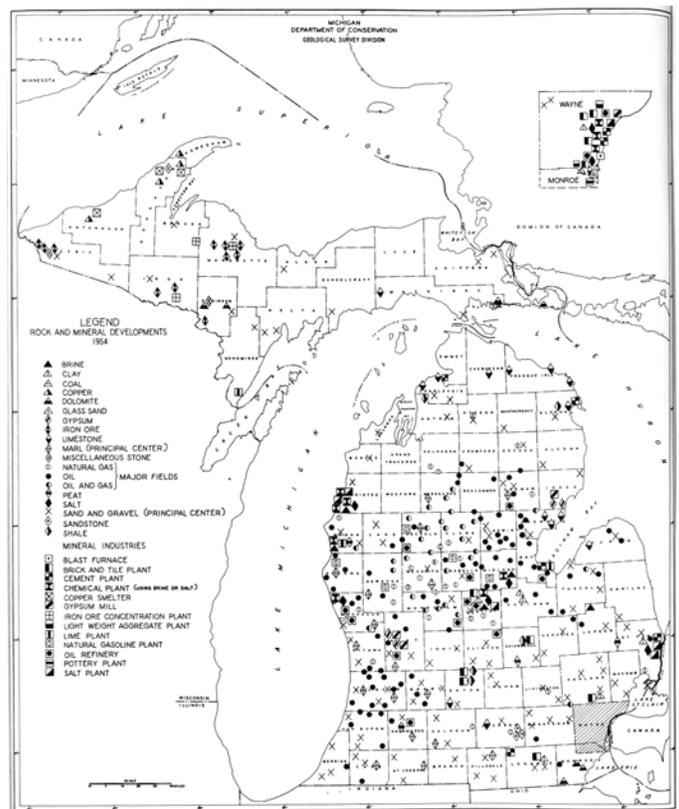
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Table I. Mineral products of Michigan, 1953 8

Table II. Mineral products of Michigan, 1952 8

[Map showing locations of rock and mineral developments and mineral industries]



RECENT DEVELOPMENTS IN MICHIGAN'S MINERAL INDUSTRIES*

The International Salt Company, now operating a mine in southern Detroit, purchased all rights to mine salt beneath the Detroit-Wayne airport, about 10 miles west of their present mine. Since the salt is 1,200 feet below the surface in the Salina formation mining will not interfere with airport operations.

The Hooker Electro-Chemical Company opened a new plant about 2 miles southwest of Montague, Muskegon County. Artificial brines formed from Salina salt are used for the production of caustic soda, hydrogen, and chlorine. It is expected that two other companies will soon be located in this new chemical-industry center. Du Pont will build a plant for the manufacture of Neoprene rubber, utilizing hydrogen and chlorine from the Hooker plant. Another basic ingredient for Neoprene, acetylene gas, will be supplied from a plant to be erected by Union Carbon and Carbide Corporation.

A new 60-89 Superior gyratory crusher was installed at the new \$15,000,000 Presque Isle quarry, 3 miles north of Bell, Presque Isle County. The new crusher--- built by Allis Chalmers Manufacturing Company---is one of the largest of its kind. It has an 8- to 9-inch setting on the open side, a 1½-inch throw, and will handle 1,800 to 2,000 tons per hour. The quarry (formerly Lake of the Woods quarry) will be operated by Kelley Island Lime and Transport Company and is a joint venture of five major steel companies. Construction of the plant which includes secondary and tertiary crushers and a screening building is nearing completion. It is expected that shipments will begin in 1955.

United States Steel Corporation, Michigan Limestone Division, opened a new quarry near Cedarville, Mackinac County. A primary crusher has been erected on the quarry floor and the crushed stone is hauled over a 6-mile rail line to Port Dolomite. Here secondary and tertiary crushers and a screen plant will process the stone into eight grades ranging from 3- to 5-inch flux stone to rice size (1/16 inch). Shipments which will begin 1955, are expected to reach 3,000,000 tons of high-grade dolomite annually.

The Nashville Gravel Pit, Nashville, Barry County, started production on a 200-acre site late in 1954. The tract has been estimated to contain 2,000,000 cubic yards of gravel.

The first commercial application of the "beneficiation" of gravel in Michigan involved the installation of a heavy media separation unit to up-grade materials at a plant near Northville, Wayne County. This plant is unique in that it has been adapted for operation with portable crushing, screening, and washing units. The process removes objectionable chert and shale to meet Michigan State Highway Department and Wayne County material specifications.

The first copper was poured at the new White Pine mine, Ontonagon County, in January 1955. Construction of the mine plant and underground development, which began in 1952, is now essentially completed and it is expected that operations will reach capacity about mid year.

A contract has been awarded by the Cleveland Cliffs Iron Company for construction of a pelletizing plant at Eagle Mills, between Negaunee and Marquette, Marquette County. The plant will be used to pelletize the high grade iron ore concentrates to be produced at the Republic mine and will have an initial capacity of about 550,000 tons per year.

Late in 1954 Penn-Dixie Cement Corporation purchased the Petoskey Portland Cement Company plant at Petoskey, Emmet County. A \$1,000,000 modernization and expansion program was immediately announced which would include installation of new crushing equipment and cooler and quarry improvements. The plant will now operate under the Penn-Dixie name.

Peerless Cement Corporation announced that a new \$7,000,000 cement plant with an annual capacity of 1,000,000 barrels would be erected in the Detroit area. The plant is being built on a 14-acre site and is expected to be completed in late 1956 or early 1957. Distribution of cement will be largely in Detroit and near vicinity.

*Sources: Pit and Quarry, Rock Products, Mining Journal and other trade journals; industrialists; and field work.

SUMMARY OF MINERAL INDUSTRIES 1953

The mineral industries of Michigan in 1953 for the seventh consecutive year, broke all former state records for value of mineral products. The value of \$287,693,135 was a six per cent increase over the former record value of \$267,089,923 set in 1952. New all-time highs were reported for the stone, clay and shale, sand and gravel, and cement industries.

Fuels (petroleum, natural gas, and natural gasoline) decreased in both production and value. The continuous yearly decline of these commodities is largely due to failure to find new fields of importance and the depletion of present oil and gas fields. Production of metallic minerals (iron ore and copper) was up due to recovery of production losses resulting from labor strikes in 1952. Total value of non-metallic minerals (includes all other minerals produced in the state) increased 5 per cent or \$7,132,637 over 1952.

In volume of total United States' production, Michigan ranked first in gypsum, salt, and calcium magnesium chloride, second in iron ore, and magnesium compounds and bromine; and fourth in peat.

The principle mineral developments and industries in Michigan are shown on the frontispiece map. Production

and value of minerals and mineral products for 1953 and 1952 are shown in Table I and II. The total value of Michigan minerals for 1953 is as follows:

	Value	Per cent
Metallic minerals (iron and copper)	\$105,235,715	36.6
Fuels (petroleum, natural gas, natural gasoline)	37,332,526	13.0
Non-metallic minerals and mineral products (all others)	145,124,894	50.4
Total	\$287,693,135	100.0

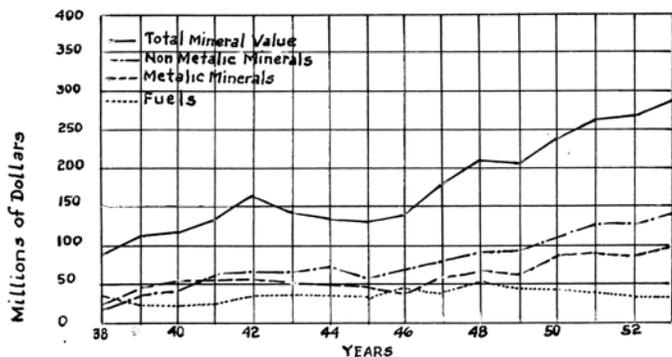


Figure 1. Graph showing relative value of mineral production in Michigan since 1938.

Metallic Minerals

IRON ORE: Shipments of ore from northern Michigan iron ranges totaled 13,380,756 tons for the 1953 season--an increase of 1,582,506 tons over 1952. This increase was largely due to the increased steel output by the mills and their need to replenish winter stock piles reduced during the 1952 strikes. Shipments were from the ports at Marquette, Escanaba, and Ashland, Wisconsin to mills in Detroit and in Indiana, Illinois, Ohio, New York and Pennsylvania.

Construction of surface plants, shaft sinkings and underground development progressed at three new mines--the Tracy, Marquette County; the Cannon, Iron County; and the Peterson, Gogebic County. All three new shafts will be used for hoisting ore in 1955, but capacity production will not be established before 1956. Rehabilitation of the Old Carpenter shaft, south of Crystal Falls, Iron County, was completed and underground development began. This shaft will "be used to mine the iron ore on the adjacent Lawrence property.

Stripping of surface overburden at the Fortune Lake mine, west of Crystal Falls, Iron County, was continued in 1953. During the last part of the year a small amount of ore was shipped from this open pit. Stripping at the Loomis, a small open pit mine in Wakefield, Gogebic County, was completed and all ore mined during 1953. In the Iron River district, the Davidson mine was abandoned due to exhaustion of mineable ore. A neighboring mine, the James, was also nearing exhaustion and abandonment was expected in early 1954.

Development of Michigan's large reserves of low-grade iron ore continued. At Humboldt, Marquette County, the Lord Motor Company and The Cleveland Cliffs Iron

Company in a joint venture opened the Humboldt mine and continued construction of the beneficiation plant. The low-grade ore (jasper and specular hematite) will be mined by open pit methods, hauled to the plant where it will be crushed to 65 mesh and the iron ore concentrated by froth flotation. Production of concentrate will begin in early 1954. Work was started on a similar beneficiation plant at Republics Marquette County, by Cleveland Cliffs in 1953. This plant, somewhat larger than that at Humboldt, is scheduled for production in late 1955.

The Ohio Beneficiation plant, west of Michigamme, in Baraga County, operated during the shipping season. Production of iron ore concentrate at this plant began in 1952 by Cleveland Cliffs Iron Company. Late in 1953 the North Range Mining Company announced that it planned to concentrate low-grade ore at the Book mine near Alpha, Iron County. A heavy media plant will be used to beneficiate ore mined underground.

Iron Ore Shipments by Ranges, 1953.

Range	Number of mines		Iron ore shipped (Long tons)		
	Underground	Open pit	Direct shipping	Siliceous	Total
Marquette	11	4	5,222,773	348,729	\$ 5,571,502
Menominee	14	3	4,577,180	43,727	4,620,902
Gogebic	6	1	3,188,352	--	3,188,352
Total	31	8	12,988,305	392,451	\$13,380,756

Shipments and Value of Iron Ore, 1948-1953

Year	Shipments (Long tons)	Value
1948	12,768,167	\$59,394,187
1949	10,737,137	57,722,248
1950	12,926,756	73,214,839
1951	13,673,873	78,120,718
1952	11,798,250	83,942,523
1953	13,380,756	91,402,764

COPPER: The major development in Michigan's copper industry during 1953 was the materialization of the White Pine Copper Company's venture in Ontonagon County. A complete new townsite, as well as mill, smelter, and other plant facilities were under construction and underground development of the ore body started. The White Pine mine is unique insofar as Michigan is concerned in that the ore is in the Nonsuch shale and is mainly copper sulfide (chalcocite) with minor amounts of native copper. Presently operating copper mines in Houghton and Keweenaw counties obtain native copper from the Keweenawan lava flows and interbedded rhyolite conglomerates. Production from the White Pine mine is expected early in 1955 at a rate of 75,000,000 pounds of copper per year.

The Calumet and Hecla Inc, Lake Lindon reclamation plant was not operated in 1953. The company, continued dewatering operations and rehabilitation of the Osceola mine. Production is expected early in 1955.

Copper Production, 1953

County	Number of		Copper production (Pounds)		
	Mines	Reclamations	Mines	Reclamation	Total
Houghton	3	2	*13,655,942	7,106,641	20,762,583
Keweenaw	6	0	27,237,107	...	27,237,107
Total	9	2	40,893,049	7,106,641	47,999,690

*Includes a small output from Ontonagon County.

Year	Quantity (Pounds)	Value
1948	53,434,042	\$12,242,216
1949	38,498,167	7,380,099
1950	51,788,017	10,997,185
1951	49,297,864	12,077,976
1952	43,939,304	10,820,054
1953	47,999,690	13,832,951

Year	Quantity (Gallons)	Value
1948	4,402,062	\$419,000
1949	4,268,880	330,518
1950	5,218,794	349,660
1951	6,871,119	687,112
1952	5,330,139	533,014
1953	4,414,351	441,438

Fuels

PETROLEUM: At the end of 1953 there were 4,089 producing wells in 38 counties. Approximately 38 per cent of the total output was from Arenac, Isabella and Oceana counties—each contributing more than one million barrels.

Fifteen refineries, in 11 counties, processed more than 99 per cent of the state's crude oil. Of the total oil refined in the state, Michigan supplied nearly one-third; the remaining two-thirds was imported from out-of-state. The combined normal daily refining capacity of all Michigan plants is approximately 138,500 barrels. A review of 1953 operations for oil and gas is recorded in the "1953 Summary of Operations, Oil and Gas Fields", Michigan Geological Survey.

NATURAL GAS: Natural gas production declined 18.3 per cent to 7,089,985,000 cubic feet. Of this amount 2.96 billion cubic feet was oil-well gas. Natural gas was produced from 304 wells in 20 counties. Clare, Crawford and Livingston counties led, with 52 per cent of the state's total—each producing more than one billion cubic feet.

Oil- and Gas-Producing Formations, 1953

Formations	Oil production *(Barrels)	Gas production *(M. cu. ft.)
"Michigan Stray"	1,400	2,573,100
Marshall	...	1,097,400
Berea	30,800	149,400
Antrim	...	14,000
Traverse	3,002,000	55,500
Dundee	6,640,800	785,800
Detroit River	2,577,500	1,339,100
Saline-Niagaran	24,800	1,075,600
Trenton	7,200	...
Total	12,284,500	7,089,900

*Estimated

Petroleum and Natural Gas Production, 1948-1953

Year	Petroleum		Natural Gas	
	Quantity (Barrels)	Value	Quantity (M. cu. ft.)	Value
1948	16,871,046	\$48,348,084	21,369,587	\$3,040,403
1949	16,517,333	45,610,021	14,660,247	2,101,845
1950	15,826,148	43,157,905	12,614,024	1,967,788
1951	13,926,518	37,949,762	10,524,495	1,641,821
1952	13,251,387	36,176,306	8,677,737	1,353,727
1953	12,284,510	35,644,982	7,089,985	1,246,106

NATURAL GASOLINE: In 1953, Michigan produced from oil-well gas 4,414,371 gallons of natural gasoline and allied products. Of the seven counties producing natural gasoline Crawford ranked first with 62 per cent of the total state output.

Non-Metallic Minerals

PORTLAND CEMENT: Portland cement shipments and value increased for the ninth consecutive year. Nearly all plants operated at or near capacity during the year. Alpena County continued as the leading producer, with Wayne County ranking second. Other producing counties were Bay, Emmet, Lenawee and St. Clair.

Raw materials used in cement manufacturing included clay, shale, limestone and gypsum. Antrim shale from Alpena County and Ellsworth shale from Antrim County were used by the northern plants; all southern plants used local clays. The greater portion of the limestone was from the Traverse and Dundee formations in the northern part of the Southern Peninsula. All gypsum was purchased.

Raw Material used in the Manufacture of Portland Cement, 1953

Raw material	Short tons
Limestone	*3,878,109
Clay and shale	1,160,066
Gypsum	114,617

*Includes lime mud.

Several improvements were made by various cement manufacturers to meet increasing demands for cement throughout the Great Lakes region. A 6,000 ton, self unloading vessel--the Paul H. Townsend--was added to the fleet of the Huron Portland Cement Company plant at Alpena. Also expansion of the mill was planned to include four new kilns and raw- and finish-grinding equipment to increase the capacity of the world's largest cement plant by about 25 per cent. The addition of five new storage silos for a total of 11 by the company at its Detroit distributing plant assisted greatly in overcoming the cement shortage in the Detroit area.

During 1953 a clinker-grinding ball mill was installed by the Aetna Portland Cement Company at Bay City and a new kiln and raw mill installation planned to be in operation during 1954.

To facilitate loading of clinkers into barges for delivery, Peerless Cement Corporation installed a new clinker conveying system at their Port Huron plant. A clay mill was also added at Port Huron and nearly 200 feet of the No. 1 kiln was replaced with a new section. At their Detroit plant an electrical precipitator was installed to be in operation early in 1954.

Portland Cement Shipments, 1948-1953

Year	Shipments (Barrels)	Value	Rank in U.S.	No. of plants
1948	11,116,911	\$23,533,001	5	7
1949	12,747,791	28,823,055	5	7
1950	12,854,423	29,619,766	5	7
1951	14,112,639	35,121,324	5	7
1952	14,760,783	36,819,041	5	7
1953	15,853,096	41,860,464	-	7

STONE: Stone production hit a new all-time high in 1953, largely due to greater demands for flux stone because of the steel companies efforts to overcome losses caused by later strikes in 1952. More than a million tons of limestone or dolomite were produced from each of the following counties: Alpena, Chippewa, Mackinac and Presque Isle. Stone was also quarried in Arenac, Cheboygan, Dickinson, Eaton, Emmet, Huron, Jackson, Monroe and Wayne counties.

Other stone produced during 1953 included dimensional limestone from Eaton, Huron, Monroe and Presque Isle counties; sandstone (rough construction, rubbles and flagging stone) from Jackson County, and crushed basalt (road construction) from Houghton County.

Stone Production, 1953

	Quantity (Short tons)	Value
Limestone and dolomite		
Crushed	21,396,451	\$17,318,854
Dimensional	4,849	53,425
Sandstone		
Dimensional	1,256	7,385
Basalt		
Crushed	51,310	62,586
Total	*21,453,866	\$17,442,250

*Does not include 7.3 million tons of limestone used in the manufacture of Portland cement and lime.

Approximately 70 per cent of Michigan's total limestone and dolomite output was quarried from the Devonian, Rogers City, Dundee and Traverse limestones in Presque Isle, Alpena, Wayne and Emmet counties. The remaining 30 per cent was from the Niagaran limestones and dolomites in Mackinac and Chippewa counties; the Bayport limestone in Huron, Eaton, Jackson, and Arenac counties; and the Bass Island dolomites of Monroe County.

Uses of Crushed Limestone and Dolomite, 1953

Uses	Per cent of total	Quantity (Short tons)	Value
Flux	59.6	12,746,549	\$9,780,588
Chemical uses*	19.2	4,113,217	2,848,731
Concrete, road metal	16.7	3,579,375	3,671,514
Agricultural	3.0	650,442	601,588
Railroad ballast	.6	124,580	151,136
Others**	.8	179,375	228,297
Total	99.9	21,393,538	\$17,281,854

* Includes alkali, calcium-carbide, sugar, glass, paper.

** Includes putty filler, riprap, asphalt, roof filler, carbon, mineral feeds, stone sand and others.

Plans for establishment of a quarrying and processing plant at Cedarville in the northern Peninsula went into effect during 1953. The project, expected to produce approximately 3,000,000 tons of metallurgical quality dolomite annually, will be the United States Steel Corporation's first waterborne dolomite source on the Great Lakes. Stone will be quarried from the Engadine formation at the company's 10,000-acre site, 6 miles

northeast of Cedarville, and transported by railroad to the mill east of Cedarville. The location on McKay Bay will be called Port Dolomite.

The construction of a \$12,000,000 limestone plant north of Bell, Presque Isle County, began in 1953. The project will be financed by five steel companies and operated by Kelley Island Lime & Transport Co. The former Lake of the Woods quarry, operated by Kelley Island from 1932 to 1949, will be reopened to provide high-calcium flux stone from the Rogers City and Dundee formations. Shore fill was under way during 1953 for a mammoth stone loading pier to extend 1,200 feet into Lake Huron and a dock to extend another 1,000 feet for boat loading facilities. Tunnels were under construction for two conveyor systems to move rock from the quarry to the pier. Footing has been laid for a large machine shop between the pier and the quarry. The capacity of the plant is expected to be 8,000,000 tons of stone annually.

Production of Stone, 1948-1953

Year	Quantity (Short tons)	Value	Rank in U.S.
1948	19,710,576	\$13,906,111	3
1949	19,546,670	13,387,334	4
1950	19,095,703	15,389,684	3
1951	20,935,767	17,082,206	3
1952	18,001,080	15,590,573	4
1953	21,453,866	17,442,250	-

SAND AND GRAVEL: Another new record for sand and gravel production was set in 1953. Sand and gravel used for paving and road purposes accounted for more than three-fifths of the output or approximately 20 per cent over 1952. Structural sand and gravel production was down about 100,000 tons and molding sand was up 235,000 tons.

Production was reported from all but five counties with Oakland ranking first. Approximately 50 per cent of the state's total production was from Oakland, Livingston, Ottawa, Wayne, Washtenaw, Macomb and Kent counties-- each producing more than 1,000,000 tons. Commercial producers accounted for 24,209,362 tons of sand and gravel. The remaining 6,250,301 tons were noncommercial sand and gravel, reported by county road commissions and other governmental agencies.

Uses of Sand and Gravel, 1953

Uses	Quantity (Short tons)	Value	Per cent of total
Molding sand	1,965,807	\$ 1,978,565	6.5
Structural sand	3,641,863	2,589,998	12.0
Paving and road sand	3,677,639	2,610,486	12.1
Other sand*	778,916	1,020,747	2.6
Structural gravel	3,815,209	3,795,671	12.5
Paving and road gravel	15,977,046	10,759,907	52.4
Railroad ballast gravel	506,727	349,729	1.6
Other gravel	96,456	65,699	0.3
Total	30,459,663	\$23,170,802	100.0

*Includes glass sand, grinding and polishing sand, blast sand, engine sand, railroad ballast sand, and other sand.

Year	Quantity (Short tons)	Value	Rank in U.S.
1948	20,671,078	\$14,071,712	2
1949	20,475,996	13,992,903	2
1950	24,559,253	16,699,203	2
1951	24,688,264	18,324,872	2
1952	27,126,339	21,050,125	2
1953	30,459,663	23,170,802	-

SALT: Although short of the 1951 all-time high Michigan again ranked first in the nation, producing one-fourth of the total output for the United States. Of the five counties producing salt, Wayne County was first with four companies reporting a combined total of 3,913,285 tons or approximately 76 per cent of the state's total output. The producing counties were Midland, St. Clair, Manistee and Gratiot.

Approximately 70 per cent of the salt produced was used by chemical plants in Wayne and Midland counties. Soda ash manufacturing accounted for nearly 2.2 million tons, and chlorines bleaches, chlorides, and other chemicals 1.4 million tons. Dried and evaporated salt accounted for 7 per cent and was used largely for food processing, dust and ice control, livestock and other farm uses, water treatment, metallurgy, textile processing, hides and leather, and refrigeration. Salt exported to other states accounted for 20 per cent, and to Canada approximately 3 per cent of the state's total production.

Of the four brine and salt-producing formations--Marshall, Dundee, Detroit River and Salina--the Salina was by far the greatest contributor. Artificial brines, formed by dissolving rock salt from the Salina were recovered by five plants in St. Clair and Wayne counties for production of evaporated salt and for use in chemical plants. Salina rock salt was mined at Detroit by means of a shaft approximately 1,100 feet in depth. Evaporated salt was produced from natural brines from the Marshall and Dundee formations at St. Louis and from artificial brines from the Detroit River formation at Manistee. Artificial brine from the Detroit River formation was used at the chemical plant at Midland.

Uses of Salt, 1953

Uses	Quantity (Short tons)
Chemical	3,565,000
Food processing	355,000
Highway, dust and ice control	321,000
Livestock	229,000
Table and other household	142,000
Water treatment	118,000
Metallurgy	65,000
Textile, hides and leather processing	64,000
Refrigeration	56,000
Agriculture	19,000
Other	193,000
Total	5,127,000

Year	Quantity (Short tons)	Value	Rank in U.S.	Per cent of U.S. total
1948	4,387,879	\$16,265,743	1	26.7
1949	4,064,106	16,009,117	1	26.1
1950	4,446,667	19,178,765	1	26.7
1951	5,137,639	21,221,330	1	25.4
1952	4,778,347	21,446,382	1	24.4
1953	5,127,387	22,171,988	1	24.7

CLAY AND SHALE: Michigan attained a new record high for raw clay and shale production in 1953, with 11 counties producing. Wayne County lead with 36 per cent of the state's total output, followed by Alpena, Saginaw and St. Clair counties. Approximately 70 per cent of the raw clay and shale produced was consumed by the Portland cement industry. The remaining 30 per cent was used for the manufacture of clay products and a small quantity for prepared clays.

CLAY PRODUCTS: Michigan's clay products include brick, tile, pottery and light-weight aggregate. Three tile plants used Saginaw shale as raw material; all other plants utilized local clays. Surface clays furnished 80 per cent of the raw material used in clay products manufacturing, and shale 20 per cent.

Production of Clay and Shale and Clay Products, 1948-1953

Year	Raw clay and shale		Clay products
	Quantity *(Short tons)	*Value	Estimated value
1948	1,308,170	\$ 985,740	\$3,764,000
1949	1,363,440	1,013,250	3,650,000
1950	1,426,659	1,137,002	5,499,000
1951	1,531,732	1,592,137	5,112,000
1952	1,580,123	1,615,122	4,534,000
1953	1,605,804	1,646,113	6,995,181

*Sold or used; value of clay used in cement and heavy clay products not included in total value of state.

GYPSSUM: For the ninth consecutive year Michigan ranked first in the nation in the production of gypsum although total production was below that of the 1951 record year.

All gypsum was obtained from the Michigan formation from two quarries in Iosco County and two mines in Kent County. Iosco County ranked above Kent County in production. The manufacture of prefabricated products (lath, wallboard, and sheathing) is by far the most important use of this commodity.

Production of Gypsum, 1948-1953

Year	Quantity (Short tons)	Value	Per cent of U.S.	Rank in U.S.
1948	1,309,331	\$3,617,868	18	1
1949	1,264,511	3,470,294	19	1
1950	1,474,210	4,090,777	18	1
1951	1,566,276	4,402,725	18	1
1952	1,487,642	4,200,418	18	1
1953	1,446,973	4,091,002	18	1

PEAT: Five concerns in four counties reported peat production during 1953. Lapeer County remained first, followed by Shiawassee, Kalamazoo and Mason counties. Michigan peat is used almost exclusively for horticultural purposes. Its largest market is as a soil conditioner for lawns, golf courses, gardens, nurseries, and greenhouses. It is estimated by the United States Bureau of Mines that Michigan, Minnesota and Wisconsin contain 75 per cent of the nation's total peat reserves.

Production of Peat, 1948-1953

Year	Quantity (Short tons)	Value	Per cent of U.S.	Rank in U.S.
1948	12,425	\$154,500	...	4
1949	...	...	...	5
1950	13,625	186,000	10.4	4
1951	20,180	320,100	10.4	5
1952	36,020	430,156	16.6	2
1953	25,439	257,176	12.5	4

MARL: Commercial marl production was reported by 27 producers in 18 counties during 1953. Isabella County ranked first, followed closely by Allegan, Kalamazoo and Mecosta counties. Combined, these counties produced approximately 55 per cent of the state's output. The large decrease in value of marl for 1953 is misleading and should not be compared with values of former years. Normally the value of marl is based at or near \$1.00 per cubic yard. In 1953, however, evaluation by most producers was 50 cents per cubic yard or less. All marl was used for agricultural purposes.

Production of Marl, 1948-1953

Year	Quantity (Short tons)	Value	Rank in U.S.
1948	...	...	...
1949	1,500	\$ 1,500	...
1950	218,429	122,212	1
1951	144,731	125,212	1
1952	130,613	119,705	1
1953	183,685	72,781	...

LIME: Lime production for Michigan's three plants was about 14 per cent below that of 1952. Paper, chemical and industrial uses, water purification, and metallurgy consumed approximately 90 per cent of the total output. Smaller amounts of lime were used in sewage and trade waste treatment; in tanneries; in the manufacture of sugar, brick (sand-lime) and insecticides; petroleum refining; food and food by-products; and wood distillation. Mason County continued to rank first in production, followed by Menominee and Bay counties.

Stone quarried in northern Michigan from the high-calcium Dundee of Presque Isle County and the Burnt Bluff limestone of Mackinac County served as raw material for the lime industry.

BROMINE, CALCIUM-MAGNESIUM CHLORIDE, MAGNESIUM COMPOUNDS, POTASH: The value of the natural salines--bromine, calcium, magnesium chloride, magnesium compounds, and potash recovered from natural brines by the chemical plants decreased 2 per cent below 1952. Bromine production increased considerably to meet demands for ethylene debromide used for gasoline anti-knock compounds, whereas

production of other saline commodities decreased. Only one plant (Dow Chemical Company, Midland County) reported production of potassium salts from natural brines.

Sales of calcium-magnesium chloride were principally for stabilization of dirt roads and dust control. Another important use for calcium chloride is "freeze-proofing" coal, iron ore and other materials shipped in bulk in railroad cars or stockpiled in the open. Magnesium compounds have a variety of uses and are of particular importance in the manufacture of fertilizers, oxychloride cement, rayon and rubber. Magnesium chloride is used predominately in the production of metallic magnesium. Magnesium sulfate, carbonate, oxide and hydroxide are used extensively in pharmaceuticals.

Chemical companies in Midland and Gratiot counties used natural brines from the Marshall, Dundee and Sylvania formations; companies in Mason and Manistee counties used brines from the Filer sandstone of the Detroit River formation.

Production of Bromine and Calcium-Magnesium Chloride, 1948-1953

Year	Bromine			Magnesium Compounds			
	Quantity (Pounds)	Value	Per cent of U.S. total	Rank in U.S.	Quantity (Tons)	Value	Rank in U.S.
1948	17,666,243	\$5,435,940	23.2	2	34,500	\$3,577,000	3
1949	28,034,765	7,023,211	32.0	2	*	*	...
1950	*	*	...	2	59,036	4,998,342	2
1951	*	*	...	2	*	*	1
1952	*	*	...	2	*	*	2
1953	*	*	...	2	43,190	4,591,922	2

*Data concealed.

Value of Michigan's Minerals and Mineral Products 1938-1952

Year	Value	Year	Value
1938	\$ 75,897,923	1946	\$133,672,135
1939	109,867,740	1947	170,269,272
1940	117,991,285	1948	214,115,771
1941	135,492,921	1949	207,607,694
1942	152,624,946	1950	238,474,008
1943	147,113,888	1951	257,529,882
1944	140,493,319	1952	267,089,423
1945	128,046,408	1953	283,924,677

TABLE I
MINERAL PRODUCTS OF
MICHIGAN, 1953⁽¹⁾

Product	Unit	Quantity	Value	Rank in U.S. (2)
Iron ore	Long tons	13,380,756	\$91,402,764	2
Portland cement	Barrels	15,853,096	41,860,464	...
Petroleum	Barrels	12,284,510	35,644,982	...
Sand and gravel	Short tons	30,459,663	23,170,802	...
Salt	Short tons	5,127,387	22,171,988	1
Stone (3)	Short tons	21,453,866	17,442,250	...
Copper	Pounds	47,999,690	13,832,951	...
Clay products	...	...	6,995,000	...
Magnesium compounds	Short tons	43,190	4,591,922	2
Gypsum	Short tons	1,446,973	4,091,002	1
Clay and shale, raw	Short tons	1,605,804	(4)	...
Natural gas	M. cu. ft.	7,089,985	1,246,106	...
Natural gasoline	Gallons	4,414,371	441,438	...
Peat	Short tons	25,439	257,176	4
Marl	Short tons	183,685	72,781	...
Miscellaneous (5)	...	...	24,471,509	...
Total			\$287,693,135	

- (1) Statistics compiled in co-operation with the United States Bureau of Mines.
- (2) Based upon quantity.
- (3) Limestone used in the manufacture of Portland cement and lime not included.
- (4) Value of clay and shale used in clay products and cement industries not included in state total value; value of other clays included under miscellaneous.
- (5) Includes bromine, calcium chloride, calcium-magnesium chloride, clay, lime, and potassium salts.

TABLE II
MINERAL PRODUCTS OF
MICHIGAN, 1952⁽¹⁾

Product	Unit	Quantity	Value	Rank in U.S. (2)
Iron ore	Long tons	11,798,250	\$ 83,942,523	2
Portland cement	Barrels	14,760,783	36,819,041	5
Petroleum	Barrels	13,251,387	36,176,306	...
Salt	Short tons	4,778,347	21,446,382	1
Sand and gravel	Short tons	27,126,339	21,050,125	2
Stone (3)	Short tons	18,001,080	15,590,573	4
Copper	Pounds	43,939,304	10,820,054	...
Clay products	...	...	4,534,000	...
Gypsum	Short tons	1,487,642	4,200,418	1
Natural gas	M. cu. ft.	8,677,737	1,353,727	...
Clay and shale, raw	Short tons	1,580,123	(4)	...
Natural gasoline	Gallons	5,330,139	533,014	...
Peat	Short tons	36,020	430,156	2
Marl	Short tons	130,613	119,705	1
Miscellaneous (5)	...	...	30,073,203	...
Total			\$267,089,423	

- (1) Statistics compiled in cooperation with the United States Bureau of Mines.
- (2) Based upon quantity.
- (3) Limestone used in the manufacture of Portland cement and lime not included.
- (4) Value of clay and shale used in clay products and cement industries not included in state total value; value of other clays included under miscellaneous.
- (5) Includes bromine, magnesium compounds, calcium chloride, calcium-magnesium chloride, clay, coal, lime, and potassium salts.