

THE MINERAL INDUSTRY OF MICHIGAN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Michigan Department of Environmental Quality, Geological Survey Division, for collecting information on all nonfuel minerals.

In 1999, the preliminary estimated value¹ of nonfuel mineral production for Michigan was \$1.66 billion, according to the U.S. Geological Survey (USGS). This value equals that of 1997, but was a marginal decrease from that of 1998.² The State rose to seventh from eighth in rank among the 50 States in total nonfuel mineral production value, of which Michigan accounted for more than 4% of the U.S. total.

Michigan continued to be the Nation's second leading iron ore-producing State in 1999, and iron ore was by value the State's leading nonfuel mineral. Portland cement continued to be second, followed by construction sand and gravel, crushed stone, and magnesium compounds. In 1999, a more than \$30 million drop in the value of iron ore plus smaller yet significant drops in magnesium compounds, construction sand and gravel, and crushed stone totaled slightly more than increases in cement (up \$11 million), salt (up about \$8 million), potash (up about \$5 million), and bromine values, resulting in a decrease for the year. (Listings are in descending order of change.) In 1998, increases of more than \$40 million in iron ore, \$22 million in construction sand and gravel, a combined \$17 million increase in portland and masonry cements, and a more than \$7 million rise in potash led the State's increase. Overall, the increase was significantly mitigated by drops in the values of magnesium compounds, down more than \$50 million, salt and bromine, down a combined \$23 million, plus smaller decreases in industrial sand and gravel, gypsum, and lime. All other changes for both years were small and did not affect the net results.

Compared with USGS estimates of the quantities produced in the other 49 States in 1999, Michigan remained first² in magnesium compounds; second in iron ore, industrial sand and gravel, peat, and iron oxide pigments; and second of two bromine-producing States; third in construction sand and gravel and third of three States that produce potash; fourth in portland

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1999 USGS mineral production data published in this chapter are preliminary estimates as of May 2000, and are expected to change. For some mineral commodities, such as construction sand and gravel, crushed stone, and portland cement, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals/contacts/comdir.html>, by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists), or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>; facsimile copies may be obtained from MINES FaxBack.

²Values, percentage calculations, and rankings for 1998 may vary from the Minerals Yearbook, Area Reports: Domestic 1998, Volume II, owing to the revision of preliminary 1998 to final 1998 data. Data for 1999 are preliminary and are expected to change; related rankings may also be subject to change.

cement and crude gypsum; and seventh in masonry cement. The State rose to 8th from 10th in salt and was a significant producer of crushed stone, lime, and common clays. Michigan remained fifth in the Nation in the manufacture of raw steel with an estimated output of nearly 6 million metric tons (Mt), as reported by the American Iron and Steel Institute.

The following narrative information was provided by Michigan's Department of Environmental Quality, Geological Survey Division, and the State's Department of Natural Resources (DNR), Land and Mineral Services Division³. The Cleveland-Cliffs Iron Co. managed Michigan's two iron ore producers, the Tilden Mine and the Empire Mine, both in Marquette County in the Upper Peninsula. The Tilden Mine, near Ishpeming, MI, was owned by the Tilden Mining Co., which had 915 employees in 1999. Tilden is one of a very few iron ore mine operations that process both hematite and magnetite iron ores. The mine had an \$11 million program in progress to refurbish its operation in 1999, its 25th year. The company and the United Steelworkers of America agreed to a new contract in 1999, however, reduced iron industry sales resulted in a 10-week shutdown, ending in mid-October. Final 1999 production equaled 6.3 Mt (Skillings Mining Review, 2000, p. 26-27).

The Empire Mine, at Palmer, MI, owned by the Empire Iron Mining Partnership, had 1,741 employees in 1999, according to the U.S. Mine Safety and Health Administration. Most of Empire's planned iron ore pellet production was the fluxed variety. In midyear, a 6-week shutdown due to reduced industry sales was announced. Production resumed in mid-October and for the year totaled 7.2 Mt (Skillings Mining Review, 2000, p. 23-24).

Rouge Industries, Inc., a holding company for Rouge Steel Co., Dearborn, MI, had an explosion and fire on February 1, 1999, at the Rouge Complex powerhouse, jointly owned by Rouge Steel Co. and Ford Motor Co. One Ford worker was killed, several were injured in the fire, and three were unaccounted for. The explosion and fire resulted in the loss of electricity, steam, and other utilities to nearly all of the facilities at the Rouge Steel Co. Production partially resumed on February 4, using purchased slabs and coils to replace production lost. (This reduced the use of Cleveland-Cliffs Iron Co. iron ore pellets.) Rouge Industries' board of directors met in early March and predicted a return to full production by late April, and planned maintenance was moved forward. On August 19, five outside contractor employees were overcome by fumes during preparation for scheduled downtime maintenance

³The text of mineral industry information was authored by Milton A. Gere, Jr., Geologist, Minerals Lease Management Section, Land and Mineral Services Division, Department of Natural Resources and Paul Sundeen, Resource/Mine Reclamation Specialist, Geological Survey Division, Department of Environmental Quality.

at the "B" blast furnace facility. One employee died, three were hospitalized, and one was treated and released.

BHP Copper Co. North America announced that it would continue to operate its electrolytic copper refinery at White Pine, MI, while closing its other operations (mines, smelter, refinery, and rod mill) in Arizona and New Mexico. White Pine refines about 75,000 metric tons per year of anode copper to electrolytic copper cathode. The copper anodes are shipped 2,012 kilometers by rail to White Pine from the Hudson Bay Mining and Smelting Co. Ltd.'s smelter at Flin Flon, Manitoba, Canada.

The Caledonia Mine, near Mass City in Ontonagon County, is currently Michigan's only copper producing mine. Red Metal Minerals Co. operates this mine and produces a very limited quantity of copper, silver, and other mineral specimens for sale to museums and mineral collectors worldwide.

Industrial Minerals

Early in the year, Hanson, PLC, of London, signed an agreement to purchase Jannock Ltd.'s North American Brick Group, consisting of 16 brick plants in the United States and 5 in Canada. Michigan's sole brick producer, Michigan Division of U.S. Brick, at Corunna, was included in the sale.

During 1999, Georgia-Pacific Corp. closed its gypsum mine on Butterworth Road at Grand Rapids, Kent County. This was the last gypsum mine in Kent County and Michigan's last underground gypsum mine. Open pit mining of gypsum continues in Iosco County.

Sargent Sand Co.'s permit to mine industrial sand from sand dunes near Ludington, Mason County, was expected to be renewed in early 1999. A spokesperson for the Geological Survey Division, Michigan Department of Environmental Quality, said that the barrier dune mining operation near Ludington State Park on Lake Michigan was exempt from the 1989 sand dune law preventing barrier dune mining because the company had been in operation there since the 1930's. It was reported that the company was also considering selling the site for other purposes.

Oglebay Norton Co. announced plans to buy Michigan Limestone Operation's Cedarville and Rogers City limestone and dolomite quarries. The Cedarville Quarry, near Cedarville, Mackinac County, ships material out of Port Dolomite. The Rogers City Quarry is near Rogers City, Presque Isle County, and ships out of Port Calcite. Both ports are on northern Lake Huron. Years ago the quarries belonged to the former U.S. Steel Co.

In late summer, Oglebay Norton Co. announced that it sold its Global Stone Detroit Lime Co. to Carfin SA, a member of the Carmeuse Group.

Lake Superior and Ishpeming Railroad Co., Marquette, announced that the last 1998-99 iron ore pellet cargo left its Presque Isle dock, on Lake Superior, on January 9, 1999, and the last incoming coal shipment to the adjacent coal receiving facility arrived January 7, 1999. The 1999-2000 shipping season began when two ships brought coal on March 19, 1999, and one carried away iron ore pellets on March 28, 1999.

Elsewhere, the Presque Isle Corp. began 1999 limestone shipments from Stoneport, MI, on Lake Huron, on March 25, 1999. Osborne Materials Co. ended its 1998 dolomitic limestone shipping from its Drummond Island facility on the St.

Mary's River on November 25, 1998, and started its 1999 season on April 4, 1999. Oglebay Norton Co.'s Global Stone Port Inland began shipping limestone and dolomite from Port Inland, on northern Lake Michigan, on April 10.

During 1999, metallic mineral exploration consisted of very limited fieldwork in search of nonferrous and precious metals on Federal, State, and private lands. These exploration efforts were expected to continue in 2000.

Two companies were reported to have drilled 17 exploration holes, totaling some 2,200 meters in four counties in 1999. Drilling was expected to continue periodically during 2000 on both State and private lands.

The mine cap of the abandoned Ludington C Shaft, Chapin Mine, City of Iron Mountain, subsided in July 1999. The building immediately adjacent to the hole is the local mine history association's museum, and many homes and children are located nearby. A Governor's emergency order allowed State funds to be transferred to Dickinson County to repair this unsafe condition. An engineering consulting firm was hired to recommend repairs that are expected to be completed in late 2000.

The National Science Teachers Association held its 1999 regional convention in Detroit in October. The Minerals Education Coalition, a group of employees from many mineral companies, associations, and agencies staffed a booth and gave free mineral resource materials to hundreds of teachers. Rock and mineral kits, video tapes, and printed literature covering many commodities and the need for minerals were distributed as educational and teaching aides for the science teachers to use in their classrooms.

The A.E. Seaman Mineral Museum, Michigan Technological University, Houghton, MI, announced plans to raise money to move the Mineralogical Museum of Michigan to the site of the Quincy Mine at nearby Hancock, MI. It would be housed in a new building that would include parts of two restored historic mine buildings adjacent to the Quincy Mine Hoist Museum.

The Marquette Range Iron Mining Heritage Theme Park Inc. held a lighting ceremony for the Cliff's Shaft Mine's "B" Shaft on March 5, 1999. Also celebrated was progress in converting the idle Cleveland-Cliffs Iron Co.'s mine site into a historic park, an idea spearheaded by the President of the Marquette Range. Later in the year, volunteers began repairing the old mine "dry house" to become an office and display area for initial displays by the Ishpeming Rock and Mineral Club and the Ishpeming Historical Society. Plans for a Wall of Remembrance with the names of workers from the various mines on the Marquette Iron Range were also announced.

Government Programs

Three direct metallic mineral leases were issued in 1999 for State-owned minerals in the western part of the Upper Peninsula. Late in 1999, a company submitted three direct lease applications. Processing of the lease requests will continue in 2000. During 1999, income from the metallic minerals lease activities on State lands was \$26,967.

During 1999, total income from nonmetallic mineral lease activities on State lands exceeded \$433,799. Four 1999 and earlier lease nominations for nonmetallic mineral leases were processed or issued in 1999.

A late 1997 nomination for a limestone-dolomite lease for production from the Hendricks Quarry in Mackinac County was processed, and a competitive bid lease sale was held in late 1999. The lease document is scheduled for release in early 2000 to the Payne and Dolan Co.

A salt lease was also requested in 1997. Processing and issuing of the direct lease was finalized in early 1999. The Detroit Salt Co. leased the State acreage adjacent to its reactivated salt mine operation in Detroit, Wayne County.

A 1998 sand and gravel lease nomination, from DNR staff, was processed and finalized in 1999. This 7-year lease was for production from the Nine-Mile Pit in Roscommon County, using the new construction sand, gravel, cobble, boulder and clay lease to replace the older annual permit process. A competitive two-part lease sale was held. The winning royalty bid for this unusually desirable pit was \$2.82 per metric ton of material removed. There is a \$30,000 minimum annual royalty. Production started in April 1999, and through September the removal of 117,092 metric tons of material was reported with \$330,421 paid in royalties.

A 1999 nomination for a nonmetallic mineral exploration lease covered about 2,700 hectares in Dickinson and Iron Counties. The nomination included the exploration for and possible development and production of several potentially present nonmetallic minerals and commodities. A field review was to be completed in 2000 with a competitive lease sale anticipated for later in the year.

The report, "Dimension Stone Feasibility Study—Development Potential in Michigan's Upper Peninsula," was completed in mid-1999 by H. James Bourque and Associates, Sault Ste. Marie, MI. The Michigan Economic Development Corp. provided funding. Ninety-six rock outcrop locations listed in an early 1970's report by Michigan Technological University and other sources were field reviewed for quarry stone characteristics. A number of sites were test drilled, and 11 locations were selected as having dimension stone quarry

potential. A news release about the study and related talks tying it with potential job development made favorable news in a number of local newspapers. Stone producers interested in these potential production sites can find the report on the web site of the Michigan Department of Environmental Quality, Geological Survey Division (www.deq.state.mi.us/gsd/dsfs).

The "Michigan Abandoned Underground Mine Inventory" was completed in late 1998, and the related "Report on Mines Requiring Attention" was completed in January 1999. The reports were prepared as aids to public safety in areas of old mines. Limited distribution of the reports was made to the DNR, county mine inspectors, or related agencies in the counties containing old mines. Distribution was limited to prevent the reports from becoming guides to potentially dangerous locations for adventurous people who may enter unsafe areas and be hurt or killed.

Eleven abandoned mine sites needing attention, where the State owns the mineral rights, were selected by the DNR for repair. The sites were selected from the "Report on Mines Requiring Attention," which was published in 1999. A contract-engineering firm will provide repair specifications and secure firms to bid on the safety repair work that will be completed in late 2000. Funds were appropriated by the Legislature through the Michigan DNR.

State funds were used in Gogebic County to fence unsafe mine shafts and related areas near the abandoned Palms Mine in 1999. The shafts were included on the list of State properties requiring repair, which was published in late 2000. These unsafe old iron mines recently reverted to State ownership due to the nonpayment of property taxes by the prior owner.

Reference Cited

Skillsings Mining Review, 2000, US/Canadian iron ore production in 2000: Skillsings Mining Review, v. 89, no. 31, July 29, p. 21-36.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN 1/ 2/

(Thousand metric tons and thousand dollars)

Mineral	1997		1998		1999 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	289	23,800 e/	294	28,000 e/	302	29,000
Portland	5,700	422,000 e/	5,710	435,000 e/	5,850	445,000
Clays: Common	712	3,750	644	4,520	648	4,410
Gemstones	NA	1	NA	1	NA	1
Gypsum, crude	1,920	17,300	1,830	15,000	1,860	15,300
Lime	802	42,600	761	40,300	760	40,000
Peat	176	4,990	190	5,500	193	5,590
Sand and gravel:						
Construction	62,000	223,000	66,900	245,000	65,000	242,000
Industrial	2,680	30,000	2,390	25,700	2,300	25,000
Stone: Crushed 3/	42,000	157,000	43,700	167,000	42,300	166,000
Combined values of bromine, iron ore (usable), iron oxide pigments (crude), magnesium compounds, potash, salt, stone [crushed granite and miscellaneous (1997), crushed marl and miscellaneous (1998-99), dimension dolomite and sandstone]	XX	733,000 r/	XX	706,000	XX	685,000
Total	XX	1,660,000	XX	1,670,000	XX	1,660,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. XX Not applicable.

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

2/ Data are rounded to no more than three significant digits; may not add to totals shown.

3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
MICHIGAN: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1997				1998			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	21	33,400 r/	\$123,000 r/	\$3.67 r/	23	34,700	\$133,000	\$3.83
Dolomite	6	8,580 r/	34,300 r/	4.00 r/	6	8,970	33,500	3.74
Granite	-- r/	-- r/	-- r/	-- r/	--	--	--	--
Calcareous marl	1 r/	W	W	W	1	W	W	W
Sandstone	1	7	113	16.14	1	7	113	16.14
Traprock	--	--	--	--	1	15	48	3.20
Miscellaneous stone	1	W	W	W	1	W	W	W
Total or average	XX	42,000	157,000	3.74	XX	43,700	167,000	3.82

r/ Revised. W Withheld to avoid disclosing company proprietary data. XX Not applicable. -- Zero.

1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1998, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	48	\$737	\$15.36
Filter stone	W	W	4.68
Other coarse aggregate	457	2,280	4.99
Coarse aggregate, graded:			
Concrete aggregate, coarse	4,520	18,100	4.00
Bituminous aggregate, coarse	809	3,800	4.70
Bituminous surface-treatment aggregate	477	3,400	7.13
Railroad ballast	29	209	7.21
Other graded coarse aggregate	W	W	4.98
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	1,580	5,850	3.72
Screening, undesignated	338	1,230	3.64
Coarse and fine aggregates:			
Graded road base or subbase	1,200	5,500	4.58
Unpaved road surfacing	W	W	6.75
Crusher run or fill or waste	W	W	2.20
Other coarse and fine aggregates	1,180	5,880	4.98
Agricultural: Agricultural limestone	99	698	7.05
Chemical and metallurgical:			
Cement manufacture	6,300	20,800	3.31
Lime manufacture	W	W	3.31
Flux stone	5,500	21,600	3.94
Special: Other fillers or extenders	231	1,280	5.52
Unspecified: 3/			
Actual	17,400	61,700	3.55
Estimated	759	2,710	3.58
Total or average	43,700	167,000	3.82

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

2/ Includes calcareous marl, dolomite, limestone, miscellaneous stone, sandstone, and traprock.

3/ Reported and estimated production without a breakdown by end use.

TABLE 4
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1998, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	489	2,870
Coarse aggregate, graded 4/	W	W	W	W	2,200	13,100
Fine aggregate (-3/8 inch) 5/	W	W	W	W	(6/)	(6/)
Coarse and fine aggregate 7/	W	W	513	2,370	1,610	8,260
Other construction materials	3,200	10,900	3,410	13,600	--	--
Agricultural 8/	4	33	(6/)	(6/)	93	645
Chemical and metallurgical 9/	(6/)	(6/)	8,840	32,300	1,030	3,390
Special 10/	--	--	231	1,280	--	--
Other miscellaneous uses	--	--	--	--	(6/)	(6/)
Unspecified: 11/						
Actual	(6/)	(6/)	(6/)	(6/)	454	22,300
Estimated	19	62	437	1,570	303	1,090
Total	10,100	34,100	22,200	80,300	11,400	52,300

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials." -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes dolomite, limestone, sandstone and traprock; excludes calcareous marl and miscellaneous stone to avoid disclosing company proprietary data.

3/ Includes macadam and riprap and jetty stone.

4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.

5/ Includes stone sand (bituminous mix or seal), stone sand (concrete), and screening (undesignated).

6/ Withheld to avoid disclosing company proprietary data; included in "Total."

7/ Includes graded road base or subbase, unpaved road surfacing, terrazzo and exposed aggregates, and crusher run (select material or fill).

8/ Includes agricultural limestone.

9/ Includes cement manufacture, chemical stone or alkali works, flux stone, and lime manufacture.

10/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, whiting or whiting substitute, and other fillers or extenders.

11/ Reported and estimated production without a breakdown by end use.

TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,
BY MAJOR USE CATEGORY 1/

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregate	7,770	\$27,500	\$3.55
Plaster and gunite sands	394	1,850	4.69
Concrete products (blocks, bricks, pipe, decorative, etc.)	142	567	3.99
Asphaltic concrete aggregates and other bituminous mixtures	5990	26,300	4.38
Road base and coverings 2/	12,000	34,900	2.91
Fill	4,890	8,590	1.76
Snow and ice control	501	1,700	3.39
Filtration	24	173	7.21
Other miscellaneous uses 3/	295	1,420	4.80
Unspecified: 4/			
Actual	15,400	67,500	4.39
Estimated	19,500	74,200	3.80
Total or average	66,900	245,000	3.66

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes road and other stabilization (cement and lime).

3/ Includes railroad ballast.

4/ Reported and estimated production without a breakdown by end use.

TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate 2/	263	1,640	1,290	4,290	6,620	23,500
Concrete products (blocks, bricks, pipe, decorative, etc.)	W	W	W	W	79	306
Asphaltic concrete aggregates and other bituminous mixtures	9	29	1,020	3,030	4,960	23,200
Road base and coverings 3/	741	2,600	2,200	6,360	9,070	26,000
Fill	W	W	W	W	4,030	7,480
Snow and ice control	77	134	123	284	301	1,280
Other miscellaneous uses 4/	--	--	196	1,200	123	392
Unspecified: 5/	2,650	9,220	2,350	8,210	29,900	124,000
Total	4,080	14,100	7,770	24,300	55,000	206,000

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (cement and lime).

4/ Includes filtration and railroad ballast.

5/ Reported and estimated production without a breakdown by end use.