



# 2008 Minerals Yearbook

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## MICHIGAN

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# MICHIGAN

KEWEENAW



## LEGEND

- County boundary
- ★ Capital
- City
- 1— Crushed stone/sand and gravel district boundary

### MINERAL SYMBOLS

(Principal producing areas)

- Cem Cement plant
- Clay Common clay
- CS Crushed stone
- Cu Copper plant
- D-Sd Dimension sandstone
- Fe Iron ore
- Gyp Gypsum
- Gyp Gypsum plant
- IS Industrial sand
- K Potash
- Lime Lime plant
- MgCp Magnesium compounds
- Peat Peat
- Per Perlite plant
- S-ng Sulfur (natural gas)
- S-o Sulfur (oil)
- Salt Salt
- SG Construction sand and gravel
- Steel Steel plant
- TiMet Titanium metal plant
- Concentration of mineral operations

0 25 50 100 Kilometers

Albers equal area projection

# 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, Office of Geological Survey, for collecting information on all nonfuel minerals.

In 2008, Michigan's nonfuel raw mineral production<sup>1</sup> was valued at \$1.99 billion, based upon annual U.S. Geological Survey (USGS) data. This was a \$19.7 million, or 1%, increase from the State's total nonfuel mineral production value for 2007, which had increased by \$23.8 million, or 1.2%, from 2006 to 2007. With 2.8% of the U.S. total, the State remained ranked 12th in 2008 (11th in 2006) among the 50 States in total nonfuel mineral production value.

Michigan continued to be the Nation's second leading iron-ore-producing State in 2008, based upon quantity and value. Iron ore remained Michigan's leading nonfuel mineral commodity by value followed, in descending order of value, by portland cement, construction sand and gravel, salt, magnesium compounds, and crushed stone. The combined values of these six mineral commodities accounted for more than 94% of the State's nonfuel raw mineral production value (table 1).

In 2008, increases in the values of iron ore, salt, lime, and magnesium compounds led the increase in Michigan's total nonfuel mineral production value. The production value of iron ore increased by 11%. Iron ore consumption in China was the major factor for the growing international iron ore industry in 2008 (Jorgenson, 2009). Salt production value rose by 15%, coinciding with a 58% increase in quantity produced. The production value of lime increased by 44% with a 52% increase in quantity produced, resulting in the greatest percentage increases in both value and quantity in the State for any mineral commodity. The value of magnesium compounds rose by 7%. The production values for these four mineral commodities (iron ore, salt, lime, and magnesium compounds) were withheld to avoid disclosing company proprietary data. The most substantial decreases took place in portland cement, crushed stone, and construction sand and gravel and was owed to the slowdown in U.S. construction in 2007 and 2008. The value of Portland cement fell by \$35 million, or 7%; crushed stone was down \$28.7 million, or 22%, with a 21% decrease in quantity produced; construction sand and gravel value fell by \$22.4 million while the quantity produced fell by 22%. Smaller, yet significant, decreases also took place in masonry cement, potash, and industrial sand and gravel.

Michigan remained the Nation's leading magnesium compounds-producing State in 2008. The State rose in rank from 7th to 6th in salt production and from 15th to 13th in lime production. Michigan continued to rank third in potash

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the 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 2008 USGS mineral production data published in this chapter are those available as of July 2010. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at <http://minerals.usgs.gov/minerals>.

production, fourth in construction sand and gravel, fifth in portland cement, and eighth in industrial sand and gravel. The State dropped in rank from 3d to 7th in peat, from 8th to 9th in gypsum, and from 9th to 10th in masonry cement production. The State also dropped in rank in common clay and crushed stone.

Michigan continued to produce raw steel, production of which decreased by 10.5%, to 4.76 million metric tons (Mt), which was 21.2% less than that produced in 2006. Michigan produced 5.2% of U.S. raw steel total in 2008 and 5.4% of U.S. raw steel total in 2007 (American Iron and Steel Institute, 2008, p. 74).

The following narrative information was provided by the Michigan Department of Environmental Quality (MDEQ), Office of the Geological Survey (MOGS) Michigan Geological Survey, and the Michigan Department of Natural Resources (MDNR), Forest Management Division.<sup>2</sup> Production data and other information in the following text are those reported by the MOGS and the MDNR, based upon those agencies' research, surveys, and estimates. Mineral production data may differ from production figures reported to the USGS.

## Overview

Michigan's nonmetallic mineral industry activity was affected by the U.S. economic recession in 2007, and activities were comparatively restrained in 2008. Low levels of roadbuilding and construction contributed to a slowdown in the aggregates, cement, and gypsum industries, as well as some others. Metallic mineral mining consisted of the production of iron ore and pellets from two large open pit mines in Marquette County. One old copper mine in Ontonagon County produced limited quantities of copper minerals for sale as specimens to hobby mineral collectors and museums. Steel production at several facilities was mostly dependent upon Michigan's automobile industry. Copper ingots shipped from Canada continued to be refined at the electrolytic refinery in Ontonagon County.

## Commodity Review

### *Metallic Minerals*

**Iron Ore.**—Cliffs Natural Resources Inc., formerly Cleveland-Cliffs Inc., operated two open pit iron ore mines (the Empire Mine and the Tilden Mine) in Marquette County on the Marquette Iron Range as the Cleveland-Cliffs Michigan Operations. Most of the iron ore was produced in the form of

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<sup>2</sup>The text of the State mineral industry information was compiled and edited by Milton A. Gere, Jr., Geologist and Supervisor, Metallic and Nonmetallic Mineral and Underground Gas Storage Leasing Unit, Mineral and Land Management Section, Forest Management Division, Michigan Department of Natural Resources.

fluxed iron ore pellets (Cliffs Natural Resources, Inc., 2008a). The Tilden Mine was the only iron ore processing plant in the world that processed both hematite and magnetite ores. Cliffs announced it invested \$30 million in 2007 in new mining equipment and expected to invest \$26 million in 2008 in new equipment and tailings basin construction.

Cliffs' board of directors approved capital projects at the Empire and Tilden Mines that would include \$290 million of incremental capital investment (Cleveland-Cliffs, Inc, 2008b). The investments were expected to allow the Empire Mine, previously expected to exhaust its ore reserves by 2011, to produce at the rate of 3 Mt of iron ore per year (Mt/yr) through 2017 and to increase the Tilden Mine's production capacity by 2 Mt/yr to 10.2 Mt/yr. Tilden's current production rate of 8.1 Mt/yr was expected to last for 30 years. Increased production at the Empire and Tilden Mines could allow Cleveland-Cliffs to fulfill its contracts as well as provide additional pellets to be sold on the spot market. Cliffs' subsidiary, Renewafuel, LLC, announced plans to build a biomass fuel production facility in Marquette, MI. The plant was expected to produce 140,000 t of high-energy, low-emission biofuel cubes from wood byproducts, corn stalks, grasses, energy crops, and other materials. Some of the fuel was proposed to replace some of the coal used in Cliffs' nearby iron ore pellet kilns and a local power plant. Operation of the facility was expected to begin in early 2009 (Cleveland-Cliffs, Inc, 2008c).

The United Steelworkers Union announced a tentative 4-year agreement with Cliffs at four mines, including the Empire and Tilden Mines. The Union reported this was the first time it successfully removed the cap on retirees' health care (Kosich, 2008). Cleveland-Cliffs, Inc merged with Alpha Natural Resources, Inc. to form Cliffs Natural Resources, Inc. (Cleveland-Cliffs Inc, 2008a). In November, Cliffs Natural Resources, Inc. reported anticipated production curtailments and, in compliance with the U.S. Department of Labor's Worker Adjustment and Retraining Notification Act, the company notified the United Steelworkers Union in four operating locations of potential production curtailments and employee reductions. Cliffs Natural Resources' partnership mines, including the Empire and Tilden Mines, were subject to approval of the reduction by the company's mining partners. Combined, the Empire and Tilden Mines had an annual production capacity of more than 13 Mt of pellets (Cliffs Natural Resources Inc., 2008b). By yearend, Cliffs Natural Resources announced production cuts at its six North American iron mines and one coal mine owing to market uncertainties and a global decline in steel demand. The company reported that, in 2009, it had contractual obligations for about 24.4 Mt of ore, or 75%, of its 2008 expected sales volume (Cliffs Natural Resources Inc., 2008c).

**Nickel and Copper.**—Kennecott Eagle Minerals Co. completed purchasing the old Humboldt Mill. The company planned to clean up and rehabilitate the old mill to crush 1,400 to 1,800 t of tons per day (t/d) of ore at the facility. The \$80 million project was expected to utilize 100 construction contractors to rehabilitate the mill and to generate 50 full-time jobs to operate the mill once rehabilitated. Ore will be trucked to the mill from the company's mines for crushing, milling, and

concentration. No smelting will be done on site. The company expected there were additional exploration sites on the Upper Peninsula and the mill could provide long-term potential for any future mines. The mill would reduce costs by increasing the concentration of ore, thereby reducing the overall quantity of ore to be shipped offsite for further refinement (Pepin, 2008b).

In December 2007, the MDEQ issued an air-use mining permit and groundwater-discharge permits to Kennecott's Eagle Project (nickel) Mine near Marquette (McCann, 2007). The Eagle Project continued to face opposition in 2008 as Kennecott sought additional permits, including a surface-use lease that was granted by the MDEQ in February (Pepin, 2008a). A 15-member advisory panel, consisting of company, county, township, and interest group officials, has been meeting quarterly since 2004 to consider the Eagle Project.

Aquila Resources, Inc. announced the results of its drill program of 44,000 meters (m) in 203 new drill holes. The massive sulfide deposit near Stephenson, in Menominee County, is a polymetallic lens containing primarily copper and zinc with local gold and silver mineralization. Highlights of the final 13 drill holes showed: (1) 3.5 m of 9.4 grams per metric ton (g/t) gold and 79.8 g/t silver; (2) 1.8 m of 2.1 g/t gold, 1,309 g/t silver, and 1.3% copper; and (3) 1.1 m of 1.4% copper and 479 g/t silver (Aquila Resources Inc., 2008).

### *Industrial Minerals*

**Cement.**—Holcim US Inc. announced plans to close its wet plant at Dundee, MI, in 2009 (Holcim US Inc., 2008). Holcim has operated the cement plant in Dundee since 1960.

**Sand and Gravel, Construction.**—Aggregate Industries US Inc., a wholly owned subsidiary of Holcim Ltd., awaited a decision of the Michigan Court of Appeals and could face more litigation concerning efforts to mine a 67-hectare (ha) property in Oshtemo Township, Kalamazoo County. The township board of trustees voted to reject the company's request to amend an ordinance to allow gravel trucks to drive on a township street. The board suggested the company pay to extend another street to the highway where travel was needed (Dunphy, 2008a).

Aggregate Resources, Inc. was granted a permit by the Texas Township, Kalamazoo County Planning Commission to expand gravel mining if the company addressed environmental concerns and met permit conditions. This could allow expansion of operations in the adjacent Prairie Ronde Township by receiving gravel via conveyor from the Texas Township pit. There was a 6-month discussion and debate about environmental concerns and protection of a rare butterfly species in the area (Dunphy, 2008b).

DeWitt Township (Clinton County) planners recommended blocking a rezoning request from Carl Schlegel, Inc. to allow opening a sand mining pit on an 8-ha site. The denial recommendation went to the township board and awaited a decision of rezoning approval. The new pit was opposed by residents concerned about road traffic.

## Government and Nongovernment Leasing Activities

Keweenaw Land Association, Ltd. leased the mineral rights of its Western Syncline area to Orvana Resources US Corp., a wholly owned subsidiary of Orvana Minerals Corp. of Toronto, Ontario, Canada (Keweenaw Land Association, Ltd., 2008). The location was about 32 kilometers (km) northeast of Ironwood, MI, in northern Gogebic County. Orvana referred to the area as its Copperwood Project. During fiscal year (FY) 2008, DNR held 200 metallic mineral leases with 18,308 ha under lease. Four leases, comprising 200 ha, were issued in FY 2008, and 29 leases, comprising 3,294 ha, were released that year. One nomination for a lease of 38.9 ha was received in 2008. The total income for the metallic mineral leases during FY 2008 was \$269,573. Two companies submitted three exploration plans for activities on State metallic mineral leases for review and approval during the year. On State and private lands, four companies drilled 218 exploration drill holes for a total depth of 68,957 m in five counties. The State held 48 nonmetallic mineral leases covering 1,492 ha in effect during FY 2008. Five nominations for sand and gravel leases were received—two from county road commissions, one from the U.S. Department of Agriculture, U.S. Forest Service, and two from private companies. In addition, one nomination for salt leases and two nominations for potash leases were received from private industry. The two potash sealed-bid nominations covered 33,994 ha. The total income from nonmetallic mineral activities on State lands in FY 2008 was \$644,683. This figure included \$636,781 from leasing activities and \$7,500 from permitting activities. Most of the income from leasing State-owned metallic and nonmetallic lands went to the fund from which the lands were acquired; thus, about 90% went to the Natural Resources Trust Fund (NRTF). Local governments and the State can apply to the NRTF for grants to purchase and develop recreation areas for the public.

## Awards and Mine Reclamation

Lafarge's Presque Isle Quarry (Presque Isle, MI) received a three-star Stars of Excellence Award from the National Stone, Sand and Gravel Association. The company won 10 other awards at the association's March award ceremony (National Stone, Sand and Gravel Association, 2008). Donations from the Meijer Foundation and others and land purchased by the county in Millennium Park, Grand Rapids, will allow for a \$9 million,

3-year project to develop a system of walking and biking trails between and around a series of interconnected ponds formed by former gravel pits (Dunphy, 2008c).

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TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Mineral	2006		2007		2008	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	176	22,700 <sup>e</sup>	149	20,200 <sup>e</sup>	99	12,000 <sup>e</sup>
Portland	5,440	536,000 <sup>e</sup>	5,490	537,000 <sup>e</sup>	4,930	502,000 <sup>e</sup>
Clays, common	405	1,010	533	2,250 <sup>r</sup>	365	1,730
Gemstones, natural	NA	2	NA	2	NA	2
Gypsum, crude	932	8,220	809	8,030	656	7,270
Iron ore, usable shipped	12,300	W	12,200	W	12,400	W
Peat	32	W	W	W	W	W
Sand and gravel:						
Construction	50,500	215,000	56,900 <sup>r</sup>	230,000 <sup>r</sup>	44,300	208,000
Industrial	1,460	30,400	1,360	30,000	1,500	26,800
Stone:						
Crushed	34,200	150,000	26,800 <sup>r</sup>	130,000 <sup>r</sup>	21,100	101,000
Dimension	W	W	W	W	11	891
Combined values of bromine (2006), lime, magnesium compounds, potash, salt, and values indicated by symbol W						
	XX	981,000	XX	1,010,000	XX	1,130,000
Total	XX	1,940,000	XX	1,970,000	XX	1,990,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data. Withheld values included in "Combined values" data. XX Not applicable.

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

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

TABLE 2  
MICHIGAN: CRUSHED STONE SOLD OR USED, BY TYPE<sup>1</sup>

Type	2007			2008		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone	24	19,000 <sup>r</sup>	\$85,400 <sup>r</sup>	21	18,100	\$83,200
Dolomite	5	7,120	40,800	4	2,450	14,800
Miscellaneous stone	4	680	3,730	16	506	3,170
Total	XX	26,800 <sup>r</sup>	130,000 <sup>r</sup>	XX	21,100	101,000

<sup>r</sup>Revised. XX Not applicable.

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

TABLE 3  
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2008, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Macadam	W	W
Riprap and jetty stone	163	2,500
Filter stone	W	W
Other coarse aggregate	288	2,870
Coarse aggregate, graded:		
Concrete aggregate, coarse	1,270	9,320
Bituminous aggregate, coarse	W	W
Bituminous surface-treatment aggregate	W	W
Other graded coarse aggregate	130	1,460
Fine aggregate (-¾ inch):		
Stone sand, concrete	W	W
Stone sand, bituminous mix or seal	3,300	17,500
Screening, undesignated	W	W
Other fine aggregate	(2)	2,890
Coarse and fine aggregates:		
Graded road base or subbase	4,250	26,400
Unpaved road surfacing	W	W
Crusher run or fill or waste	W	W
Other coarse and fine aggregates	34	349
Other construction materials	4	18
Agricultural:		
Limestone	5	34
Other agricultural uses	651	4,700
Chemical and metallurgical:		
Cement manufacture	W	W
Flux stone	W	W
Unspecified: <sup>3</sup>		
Reported	411	2,850
Estimated	5,400	21,000
<b>Total</b>	<b>21,100</b>	<b>101,000</b>

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

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

<sup>2</sup>Less than ½ unit.

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

TABLE 4  
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2008,  
BY USE AND DISTRICT<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	Districts 1, 2, and 3	
	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch) <sup>3</sup>	515	6,010
Coarse aggregate, graded <sup>4</sup>	1,510	11,600
Fine aggregate (-¾ inch) <sup>5</sup>	3,490	19,000
Coarse and fine aggregate <sup>6</sup>	4,530	28,300
Other construction materials	4	18
Agricultural <sup>7</sup>	656	4,740
Chemical and metallurgical <sup>8</sup>	4,600	7,260
Unspecified: <sup>9</sup>		
Reported	411	2,850
Estimated	5,400	21,000
Total	21,100	101,000

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

<sup>2</sup>Specified districts are combined to avoid disclosing company proprietary data.

<sup>3</sup>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.

<sup>4</sup>Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), and other graded coarse aggregate.

<sup>5</sup>Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregates.

<sup>6</sup>Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

<sup>7</sup>Includes limestone and other agricultural uses.

<sup>8</sup>Includes cement manufacture and flux stone.

<sup>9</sup>Reported and estimated production without a breakdown by end use.

TABLE 5  
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2008,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity	Value	Unit
	(thousand metric tons)		
Concrete aggregate (including concrete sand)	3,320	\$21,100	\$6.35
Plaster and gunite sands	77	344	4.47
Concrete products (blocks, bricks, pipe, decorative, etc.)	154	645	4.19
Asphaltic concrete aggregates and other bituminous mixtures	3,570	21,000	5.88
Road base and coverings	4,660	22,100	4.74
Road and other stabilization (cement)	159	766	4.82
Road and other stabilization (lime)	195	1,740	8.91
Fill	5,970	11,800	1.98
Snow and ice control	380	1,580	4.16
Railroad ballast	9	88	9.78
Other miscellaneous uses <sup>2</sup>	222	1,480	6.68
Unspecified: <sup>3</sup>			
Reported	7,300	39,100	5.35
Estimated	18,000	86,000	4.68
Total or average	44,300	208,000	4.68

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

<sup>2</sup>Includes filtration.

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

TABLE 6  
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2008, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products <sup>2</sup>	343	2,740	851	4,050	2,360	15,300
Asphaltic concrete aggregates and road base materials <sup>3</sup>	1,140	4,330	3,070	16,900	4,370	24,300
Fill	87	268	482	1,040	5,400	10,500
Snow and ice control	W	W	229	511	W	W
Other miscellaneous uses <sup>4</sup>	15	112	232	556	364	2,490
Unspecified: <sup>5</sup>						
Reported	72	297	98	877	6,880	36,800
Estimated	902	4,200	3,100	14,000	14,000	67,000
Total	2,560	12,000	7,820	37,900	33,700	157,000
	Unspecified districts					
Use	Quantity	Value				
Concrete aggregate and concrete products <sup>2</sup>	--	--				
Asphaltic concrete aggregates and road base materials <sup>3</sup>	--	--				
Fill	--	--				
Other miscellaneous uses <sup>4</sup>	--	--				
Unspecified: <sup>5</sup>						
Reported	246	1,110				
Estimated	--	--				
Total	246	1,110				

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

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

<sup>2</sup>Includes plaster and gunite sands.

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

<sup>4</sup>Includes filtration, railroad ballast, and snow and ice control.

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