



2009 Minerals Yearbook

MICHIGAN [ADVANCE RELEASE]

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
- Lime-c Lime plant (captive)
- MgCp Magnesium compounds
- Peat Peat
- Per Perlite plant
- S-o Sulfur (oil)
- Salt Salt
- SG Construction sand and gravel
- Steel Steel plant
- TiMet Titanium metal plant
- Concentration of mineral operations

0 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 Oil, Gas, and Minerals for collecting information on all nonfuel minerals.

In 2009, Michigan's nonfuel raw mineral production¹ was valued at \$1.76 billion, based upon annual U.S. Geological Survey (USGS) data. This was about a \$260 million, or nearly 13%, decrease from the State's total nonfuel mineral production value for 2008, which had increased by \$56.5 million, or 2.9%, from 2007 to 2008. The State rose in rank to 11th from 12th among the 50 States in total nonfuel mineral production value, producing nearly 3% of the U.S. total of \$59 billion.

Iron ore remained Michigan's leading nonfuel mineral commodity by production value followed by, in descending order of production value, portland cement, construction sand and gravel, salt, crushed stone, and magnesium compounds. The combined production value of these six minerals accounted for more than 95% of the State's total nonfuel mineral production value.

In 2009, iron ore had the largest increase to production value (actual data withheld—company proprietary data). Industrial sand and gravel production value increased by \$931,000, or by 3.5%, which followed an increase in the production value of salt (actual data withheld—company proprietary data). All other mineral commodities produced in the State decreased in production value, led by portland cement, down by \$152 million, which accounted for 59% of the States total decrease in production value. Significant decreases also took place in construction sand and gravel, down by \$35 million, or by 16%, and crushed stone, down by \$21 million, or by 15%.

Dimension stone was the only nonfuel mineral commodity that increased in production quantity and the production of peat remained about the same from 2008 to 2009 (actual data withheld for both—company proprietary data). All other mineral commodities decreased in production with a considerable decrease in the production quantity of construction sand and gravel, down by nearly 11 million metric tons (Mt), or by 23%. Smaller, yet significant, decreases in production quantity also took place in crushed stone, down by almost 5.8 Mt, or by 22%; iron ore, down by 3.6 Mt, or by 29%; portland cement, down by nearly 1.4 Mt, or by 28%; and salt, down by over 30%.

In 2009, Michigan continued to lead the Nation in the production of magnesium compounds among five producing States. The State continued to rank second in the production of iron ore among 4 iron ore-producing States, third in the production of potash among 3 producing States, fourth in the production of construction sand and gravel among 50 producing States, and fifth in the production of portland cement among

¹The 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 2009 USGS mineral production data published in this chapter are those available as of September 2011. 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>.

36 producing States. Michigan rose in rank to 6th from 8th in the production of industrial sand and gravel, to 8th from 9th in the production of gypsum, to 9th from 10th in the production of masonry cement, and to 17th from 20th in the production of common clay. The State dropped in rank to 7th from 6th in the production of salt and to 14th from 13th in the production of lime.

The following narrative information was provided by the Michigan Department of Environmental Quality (MDEQ), Office of Oil, Gas, and Minerals (OOGS).² Production data and other information in the following text are those reported by the MDEQ, based upon its research, surveys, and estimates. Mineral production data may differ from production figures reported to the USGS.

Industry Overview

Michigan's production of industrial minerals was largely dependent on the construction industry. Low levels of road and home construction led to less production of industrial minerals. Iron ore continued to be mined at two large open pit mines and processed into pellets in Marquette County. One old mine in Ontonagon County continued to produce copper and related minerals for sales as specimens to museums and mineral collectors. Copper ingots continued to be shipped by rail from Canada to the electrolytic refinery in Ontonagon County. Iron and steel production remained dependent upon the State's automobile industry.

Exploration

In fiscal year 2009 (October 1, 2008, through September 30, 2009), three companies conducted exploration drilling for metallic mineral deposits in Baraga, Gogebic, and Marquette Counties. These companies drilled 103 holes for a total drilling distance of 18,400 meters (60,300 feet). The MDEQ, Office of Geological Survey regulates exploration drilling (Melanie Humphrey, Geological Technician, Michigan Department of Environmental Quality, Office of Geological Survey, U.P. District Office, written commun., October 26, 2009).

Commodity Review

Industrial Minerals

Cement.—An engineered cementitious composite, also known as bendable concrete, with self-healing capabilities was

²The text of the State mineral industry information was compiled and edited by Milton A. Gere, Jr., Geologist (retired), formerly of the Michigan Department of Natural Resources.

developed at the University of Michigan, Ann Arbor, Washtenaw County. This improved concrete may help alleviate the need for demolition and replacement of concrete after subjection to heavy stress. Exposure to moisture and carbon dioxide allows the stressed concrete to heal microscopic cracks and may make concrete last longer (Science Daily, 2009).

The Michigan House of Representatives' Education Committee authorized Michigan's community colleges to provide programs offering baccalaureate degrees in concrete technology. The Alpena Community College had previously offered an associate degree in concrete technology (Aggregate Research, 2009b).

Limestone.—A building used for maintenance at the Carmeuse Lime and Stone's (Pittsburgh, PA) limestone quarry near Rogers City in Presque Isle County was destroyed by fire in early March. No one was injured in the fire, but the building was considered a total loss. Investigators were trying to determine the cause of the fire (Aggregate Research, 2009a).

Sand and Gravel, Construction.—At a public meeting in January, the Planning Commission of Waterloo Township voted to accept Aggregate Industries Management, Inc.'s (Waltham, MA) application for a special land-use permit to allow the company to expand its pit owing to the company's noise mitigation proposals (Dunphy, 2009a). In early August, the Portage Township Board meeting was working on a solution for the excessive noise complaints that residents had with the Valley View Quarry operators. A subcommittee planned to meet with the gravel pit operators to arrive at a solution (Mining Journal, The, 2009b). Kentwood Excavating, Inc. (Grand Rapids, MI) began development of its proposed sand and gravel production site after settling a 3-year-old lawsuit with Caledonia Township in Kent County. Kentwood agreed to create a buffer zone around the site, limit hours of production, plant vegetation, pave a street to the site, and construct a bike path along the street (Dunphy, 2009b).

Metals

Copper and Nickel.—Kennecott Eagle Minerals Co. (subsidiary of Rio Tinto, plc) deferred development of the Eagle Mine, a copper and nickel mine in Marquette County, until market conditions recover. The company was expected to continue working on permitting and litigation issues. The Eagle Mine, an \$80 million project, included mining 2 hectares (ha) (6 acres) underground and was expected to yield 110,000 to 140,000 metric tons (t) (250 to 300 million pounds) of nickel and 90,000 t (200 million pounds) of copper during the mine's lifetime (Pepin, 2009a). The lawsuit contesting Kennecott's leasing of about 50 ha (120 acres) of State land for the Eagle Mine was dismissed by an Ingham County circuit judge (Fletcher, 2009).

The MDEQ made a preliminary decision to grant permits to Kennecott to reuse the old Humboldt Mill in Marquette County to process approximately 1,400 t (1,500 short tons) of ore per day from the Eagle Mine. The company expected the mill to employ 70 full-time workers. The project would require 100 to 200 local contractors to prepare the site. The company

planned to dispose of waste rock in the old Humboldt Mine pit located near the mill. The mill may be upgraded to process material from other mining projects in the region (Pepin, 2009b). A public hearing about the reuse of the mill was held in western Marquette County in December. A letter in support of Kennecott's proposal signed by the Marquette County Board was read. Written responses from the community were accepted until December 29 (Boyle, 2009a).

Kennecott joined an aggregate producer, land owners, and logging interests to form Woodland Road LLC. Woodland Road proposed a 35-kilometer (km) (22-mile) privately owned road that would connect the Eagle Mine and the Humboldt mill. The road would shorten the originally planned route on public roads by about 60 km (38 miles) and avoid population centers and traffic. The cost of building the road was expected to be \$50 million and employ 125 workers for construction and 12 workers for maintenance. The road was planned to be open to the public (Pepin, 2009c). In November, the MDEQ asked the court to reconsider the recommendation to only grant permits to Kennecott for the Eagle Mine if steps are taken to protect Eagle Rock, an area of spiritual significance for local Native American tribes. Kennecott planned to locate the entrance to Eagle Mine near the outcrop (Mining Journal, The, 2009a).

In June, HudBay Minerals Inc. (Toronto, Ontario, Canada) announced plans to close its electrolytic copper refinery in White Pine, Ontonagon County. The company closed its copper smelter in Flin Flon, Manitoba, Canada, and planned to stop sending copper anodes to White Pine for refining. The closure would eliminate 65 jobs in White Pine (HudBay Minerals Inc., 2009a).

Red Metal Minerals' Caledonia Mine in Ontonagon County remained the State's sole copper-producing mine. This small-scale operation produced copper mineral specimens for sale to museums, schools, and private mineral collectors.

Gold and Zinc.—In August, HudBay announced plans to buy a 15% stake in Aquila Resources Inc. and obtain the rights to buy a majority interest in Aquila's Back Forty project, an advanced-staged exploration project delineating a gold- and zinc-rich volcanogenic massive sulfide deposit in Menominee County. HudBay planned to send zinc concentrates from the Back Forty Project to their metallurgical complex in Flin Flon, Manitoba, Canada (HudBay Minerals Inc., 2009b).

Iron Ore and Iron and Steel.—Cliffs Natural Resources Inc. (Cleveland, OH) operated the State's two iron ore-producing mines, the Empire and Tilden Mines, in Marquette County. The company delayed capital projects that would have increased the output of the two mines. In 2009, the output from the Empire and Tilden Mines and associated processing facilities was 2.6 million metric tons (Mt) and 5.7 Mt of iron ore pellets, respectively. As part of an annual program, Cliffs supported a new tree planting initiative along the Iron Ore Heritage Trail by providing financial assistance for the purchase and planting of 75 conifer trees between Negaunee and Ishpeming (Cliffs Natural Resources Inc., 2009a, b). Iron ore and other Great Lakes shipping was slow in 2009 owing to low demand for steel and other commodities (Boyle, 2009b).

Government Activities and Programs

In 2009, leasing of State-owned mineral lands and mineral rights was managed by the Department of Natural Resources, Forest Management Division, Forest, Mineral and Land Management Section, in Lansing. The majority of the income generated by mineral leasing went to the Natural Resources Trust Fund that is used to acquire the mineral rights involved in leasing activities. At the end of fiscal year 2009, approximately 11,900 ha (29,300 acres) were under 136 State metallic mineral leases. No new State metallic mineral leases were issued in 2009. One nomination, almost 8,400 ha (20,700 acres), was in the field review process. There were 64 metallic mineral leases of almost 6,500 ha (15,900 acres) terminated in fiscal year 2009. The total income from metallic mineral activities on State-owned mineral lands was no more than \$270,000. One exploration plan for 840 ha (2,070 acres) was approved in fiscal year 2009 for lands previously leased. The metallic mineral exploration was confined to the Precambrian rocks in the western half of the Upper Peninsula (Thomas Hoane, Geologist, Michigan Department of Natural Resources, Forest Mineral and Fire Management, Mineral and Land Management Section, Nonmetallic Mineral Leasing Program, unpub. data, 2010).

At the end of fiscal year 2009, 50 State nonmetallic mineral leases were in place on nearly 1,500 ha (3,670 acres). One lease was nominated for sand and gravel, one for salt, and one for potash. One sand and gravel lease of 30 ha (80 acres) was terminated. One salt lease and two direct sand and gravel leases were issued 2009. Three nominated potash areas, totaling 34,000 ha (84,000 acres), were included in an August sealed bid lease sale. The fiscal year 2009 nonmetallic mineral lease income totaled almost \$760,000. The State approved 122 leases, covering 12,700 ha (31,400 acres), to be issued in fiscal year 2010 (Thomas Hoane, Geologist, Michigan Department of Natural Resources, Forest Mineral and Fire Management, Mineral and Land Management Section, Metallic Mineral Leasing Program, unpub. data, 2010).

Limited gold panning on State-owned segments of some rivers was allowed by the MDNR. The State prohibits hobby gold panning and sluicing in river segments with mussel beds, designated trout streams, natural rivers, and natural areas. The limit of gold found, recovered, and kept is 15.6 grams (0.5 troy ounces) per person per year.

In 2009, the State election Board approved the MiWater ballot initiative, which would amend part 632 of the State's Natural Resources and Environmental Protection Act. The initiative would place restrictions and additional regulations on the mining of sulfide ore. About 400,000 signatures were needed to place the initiative on the November 2010 ballot (Hauglie, 2009).

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN^{1,2}

(Thousand metric tons and thousand dollars)

Mineral	2007		2008		2009	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	149	20,200 ^e	99	12,000 ^e	80	9,800 ^e
Portland	5,490	537,000 ^e	4,930	502,000 ^e	3,550	350,000 ^e
Clays, common	533	2,250	365	1,730	318	1,310
Gemstones, natural	NA	2	NA	2	NA	2
Gypsum, crude	841 ^r	5,100 ^r	603 ^r	4,490 ^r	372	3,110
Iron ore, usable shipped	12,200	W	12,500 ^r	W	8,870	W
Sand and gravel:						
Construction	57,100 ^r	231,000 ^r	45,100 ^r	211,000 ^r	34,600	176,000
Industrial	1,360	30,000	1,500	26,800	1,330	27,700
Stone, crushed	26,800	130,000	26,100 ^r	136,000 ^r	20,400	115,000
Combined values of lime, magnesium compounds, peat, potash, salt, stone (dimension dolomite and sandstone), and values indicated by symbol W	XX	1,010,000	XX	1,130,000	XX	1,080,000
Total	XX	1,970,000	XX	2,020,000 ^r	XX	1,760,000

^eEstimated. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data. Withheld values included in "Combined values" data. XX Not applicable.

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

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

TABLE 2
MICHIGAN: CRUSHED STONE SOLD OR USED, BY TYPE¹

Type	2008			2009		
	Number of quarries	Quantity ^f (thousand metric tons)	Value ^f (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone ²	22 ^r	20,500	\$107,000	21	15,700	\$93,400
Dolomite	4	5,060	27,400	4	3,860	19,900
Miscellaneous stone	16	615	1,090	17	791	1,960
Total	XX	26,100 ^r	136,000 ^r	XX	20,400	115,000

^fRevised. XX Not applicable.

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

²Includes limestone-dolomite; reported with no distinction between the two.

TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 2009, BY USE¹

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Macadam	W	W
Riprap and jetty stone	83	1,440
Filter stone	W	W
Other coarse aggregate	114	1,210
Coarse aggregate, graded:		
Concrete aggregate, coarse	2,390	16,100
Bituminous aggregate, coarse	600	4,170
Bituminous surface-treatment aggregate	W	W
Other graded coarse aggregate	464	2,590
Fine aggregate (-¾ inch):		
Stone sand, concrete	W	W
Stone sand, bituminous mix or seal	W	W
Screening, undesignated	151	627
Other fine aggregate	341	6,240
Coarse and fine aggregates:		
Graded road base or subbase	1,710	11,600
Unpaved road surfacing	679	1,580
Crusher run or fill or waste	W	W
Other coarse and fine aggregates	600	4,660
Agricultural:		
Limestone	W	W
Other agricultural uses	40	180
Chemical and metallurgical:		
Cement manufacture	W	W
Flux stone	W	W
Special, other fillers or extenders	W	W
Other miscellaneous uses and specified uses not listed	W	W
Unspecified: ²		
Reported	3,140	21,500
Estimated	6,000	31,000
Total	20,400	115,000

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

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

²Reported and estimated production without a breakdown by end use.

TABLE 4
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2009,
BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate (+1½ inch) ²	W	W	W	W	192	2,650
Coarse aggregate, graded ³	W	W	W	W	W	W
Fine aggregate (-¾ inch) ⁴	W	W	W	W	W	W
Coarse and fine aggregate ⁵	W	W	W	W	W	W
Agricultural ⁶	W	W	W	W	W	W
Chemical and metallurgical ⁷	W	W	W	W	--	--
Special ⁸	--	--	W	W	--	--
Other miscellaneous uses	--	--	--	--	W	W
Unspecified: ⁹						
Reported	3	14	1,240	6,170	1,900	15,300
Estimated	3,060	15,900	2,430	11,600	506	3,430
Total	6,790	32,900	6,270	24,000	7,310	58,400

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

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

²Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.

³Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregate.

⁴Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregates.

⁵Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

⁶Includes limestone and other agricultural uses.

⁷Includes cement manufacture and flux stone.

⁸Includes other fillers or extenders.

⁹Reported and estimated production without a breakdown by end use.

TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2009,
BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	2,980	\$17,900	\$6.01
Plaster and gunite sands	66	291	4.41
Concrete products (blocks, bricks, pipe, decorative, etc.)	17	144	8.47
Asphaltic concrete aggregates and other bituminous mixtures	2,670	16,600	6.24
Road base and coverings	4,770	27,500	5.77
Road and other stabilization (cement)	84	555	6.61
Road and other stabilization (lime)	196	1,780	9.08
Fill	3,920	9,620	2.45
Snow and ice control	235	1,060	4.51
Railroad ballast	4	39	9.75
Filtration	40	264	6.60
Other miscellaneous uses	67	382	5.70
Unspecified: ²			
Reported	4,270	26,000	6.10
Estimated	15,200	73,900	4.85
Total or average	34,600	176,000	5.10

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

²Reported and estimated production without a breakdown by end use.

TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2009, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)	250	2,360	599	2,970	2,130	12,600
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	76	387	W	W	W	W
Asphaltic concrete aggregates and other bituminous mixtures	120	722	W	W	W	W
Road base and coverings	1,020	8,020	1,100	4,740	2,650	14,700
Road and other stabilization (cement and lime)	--	--	--	--	275	2,330
Fill	86	187	354	752	3,480	8,680
Other miscellaneous uses ³	31	193	138	516	1,490	9,140
Unspecified: ⁴						
Reported	36	205	27	235	3,970	24,100
Estimated	698	3,360	2,910	14,400	11,600	56,100
Total	2,310	15,400	6,290	30,900	25,700	128,000
			Unspecified districts			
			Quantity	Value		
Concrete aggregate (including concrete sand)	--	--	--	--		
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	--	--	--	--		
Asphaltic concrete aggregates and other bituminous mixtures	--	--	--	--		
Road base and coverings	--	--	--	--		
Road and other stabilization (cement and lime)	--	--	--	--		
Fill	--	--	--	--		
Other miscellaneous uses ³	--	--	--	--		
Unspecified: ⁴						
Reported	239	1,480				
Estimated	--	--				
Total	239	1,480				

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

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

²Includes plaster and gunit sands.

³Includes filtration, railroad ballast, and snow and ice control.

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