

THE MINERAL INDUSTRY OF MINNESOTA

In 2000, the estimated value¹ of nonfuel mineral production for Minnesota was \$1.57 billion, based upon preliminary U.S. Geological Survey (USGS) data. This was a 10.6% increase from that of 1999² and followed an 18.4% decrease from 1998 to 1999. The State continued to be eighth in rank among the 50 States in total nonfuel mineral production value, of which Minnesota accounted for nearly 4% of the U.S. total.

In 2000, iron ore accounted for more than 82% of the State's nonfuel mineral production value; construction sand and gravel and crushed stone accounted for 10% and 4%, respectively. In 2000, Minnesota's increase in value resulted mostly from the increased values of iron ore, up \$140 million, and construction sand and gravel, up \$18 million; the only decreases were relatively small drops in the values of dimension stone and crushed stone, in descending order of change (table 1). In 1999, the largest portion of the State's drop in value resulted from the decrease in the value of iron ore; crushed stone, construction sand and gravel, and lime, in descending order of change, also decreased in value. The value of industrial sand and gravel rose by more than \$9 million, while smaller yet significant increases also occurred in peat and dimension stone.

Compared with USGS estimates of the quantities produced in the other 49 States in 2000, Minnesota remained first in the Nation in iron ore and third in peat. Additionally, the State produced significant quantities of construction and industrial sand and gravel and dimension stone.

The following narrative information was provided by the Minnesota Department of Natural Resources' Division of Lands and Minerals (DLM).³ Minnesota continued to rank first in the Nation in iron ore production, accounting for about two-thirds of the supply to the domestic steel industry. According to the Minnesota Iron Mining Association, iron mining ranks among the State's largest industries, contributing more than \$1 billion annually to Minnesota's economy. Wages and benefits account for \$400 million; industry purchases amount to \$900 million;

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 2000 USGS mineral production data published in this chapter are preliminary estimates as of July 2001 and are expected to change. For some mineral commodities, such as construction sand and gravel and crushed stone, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing of 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 1999 may vary from the Minerals Yearbook, Area Reports: Domestic 1999, Volume II, owing to the revision of preliminary 1999 to final 1999 data. Data for 2000 are preliminary and are expected to change; related rankings may also change.

³Maryanna Harstad, Senior Planner, authored the text of State mineral industry information provided by the DLM.

capital investments are more than \$100 million, and an additional \$100 million was paid in State taxes.

Minnesota's iron mining industry began 2000 supporting 20,000 jobs in the State with about 6,000 of these workers directly employed at a mine or processing plant. Although the year 2000 began with cautious optimism and all mines and plants producing at capacity, the market for steel worsened and dramatically affected the State's taconite industry. LTV Steel Co. Inc. announced the impending closure of LTV Steel Mining Co. in Hoyt Lakes, MN. LTV Steel had employed 1,400. Both Minntac and Northshore Mining Co. announced production cutbacks for 2001, and more cutbacks were expected at other facilities.

Minnesota's aggregate industry produced three types of materials; sand and gravel mined from glacial or alluvial deposits; crushed carbonate from quarries in southeastern Minnesota where natural gravel is scarce; and high-quality crushed rock from quarries in granite, quartzite, or traprock elsewhere in the State. Aggregate was mined in 2000 in all of the State's 87 counties. In addition to the above production, some of the same quarries that produce crushed carbonate rock also produce granular carbonate (dolomite or limestone) rock, which is used for soil amendment or for cement. The Minnesota Department of Agriculture (MDA) analyzes the granular carbonate soil amendment, commonly called ag-lime, to report the neutralization potential. The MDA compilation lists year 2000 totaled sales of 770,000 metric tons (t) of ag-lime, of which 391,000 t was primary production from Minnesota quarries.

During 2000, 89 new metallic mineral leases were issued on State lands in Aitkin, Carlton, Lake, and St. Louis Counties. On October 16, 2000, 8 parties submitted 65 bids for State leases to prospect for and mine metallic minerals. The bids covered 56 mining units containing a total of 8,165 hectares. Bids were submitted on 7 mining units in Carlton County, 16 mining units in Lake County, and 33 mining units in St. Louis County. The number of bids received and the quality of companies that submitted bids demonstrated continuing interest in Minnesota's excellent mineral potential.

Exploration of the Duluth Complex for copper, nickel, and precious metals focused largely on the western contact of the intrusion. Lehmann Exploration Management Inc. managed the project at Birch Lake for the Beaver Bay Joint Venture. This joint venture included North Central Mineral Ventures, Powell Production Co., and Connor Management Inc. The Beaver Bay Joint Venture entered into an agreement with Impala Platinum Holdings Ltd. They planned to explore and evaluate the Birch Lake project for the following commodities: copper, gold, nickel, palladium, platinum, and rhodium. Eleven borings were completed in 2000 and are now being evaluated. The deposit lies between 490 and 850 meters (m) below the surface, in Bear Island State Forest, along the county line between Lake and St. Louis Counties.

Polymet Mining Co. put in 65 borings in 2000 at its NorthMet site, 16 kilometers (km) south of Babbitt. It evaluated hydrometallurgical processing techniques for copper, nickel,

palladium, and platinum, and demonstrated the potential of the deposit.

Wallbridge Mining Co. Ltd. drilled one core hole in December 2000; analyses ran 52 m of 0.86% copper, 0.3% nickel, 11 grams per metric ton (g/t) gold, 0.41 g/t palladium, and 0.18 g/t platinum. Wallbridge was exploring the down-plunge extension of the Maturi deposit, which could add significantly to the 52 million metric tons, the current estimate for the Maturi. Maturi is one of eight deposits along a 35-km-long belt that passes through the inactive Dunka iron mine east of Babbitt. Minerals Processing Corp. drilled one hole in Carlton County for SEDEX zinc.

The 2000 Minnesota Legislature appropriated \$30 million to the Minnesota Minerals 21st Century Fund. The fund was created in 1999 to make loans or equity investments in mineral processing facilities including, but not limited to, taconite processing, direct reduction of iron ore, and steel production. The Fund requires the Commissioner of Trade and Economic Development to develop a strategy for making loans and equity investments that assist the Minnesota mineral industry in becoming globally competitive.

In 1998, a 12-member Aggregate Resources Task Force was appointed by the Minnesota Legislature. The task force presented 14 recommendations to the legislature in the form of a final report on February 1, 2000, after a series of hearings, field trips, public meetings, and considerable deliberations during a period of 15 months. If implemented, the recommendations will provide a broad framework for the management of aggregate resources throughout the State, helping to ensure the continued availability of these resources for future use at reasonable costs while maintaining existing environmental safeguards related to mining. The six key areas of the recommendations provide the following:

- Technical assistance and resources to assist local governments in managing aggregate resources under their jurisdictions and providing for consistency among jurisdictions;
- Means to identify and protect aggregate resources for future use;
- Compensation for local governments that host mining operations, including provisions for increasing reclamation of mined properties;
- Recommendations for expanded use of recycled materials;
- Recommendations supporting continued use of multimodal transportation for delivering construction aggregates from their point of origin to the marketplace; and

- Education of government officials and the public, highlighting the detrimental consequences should conservation of aggregate resources be ignored.

The Minerals Coordinating Committee, a State-legislated Government-industry organization, provided a vital role encouraging research for all minerals sectors, assisting in the coordination of research for statewide mineral programs, and providing recommendations to allocate funding for specific research projects. A number of research activities to stimulate the diversified development of Minnesota's mineral resources were funded for fiscal years 2000-2001. These projects, which are now completed or nearing completion, address research needs in the following areas: assistance for existing aggregate and taconite minerals industries, evaluation of known but undeveloped resources, geological mapping and delineation of potential mineral resources, and support for land-use and environmental issues.

The fourth annual Minnesota Minerals Education Workshop was held in August 2000 at St. Cloud State University. The 3-day workshop, a collaborative effort of State and Federal agencies, professional associations, educational institutions, and the mining industry, won a Certificate of Commendation at the 2000 Partnership Minnesota Cooperative Public Service Award competition. The workshop included speakers, hands-on classroom activities, and field trips to geologic formations and mining operations. Eighty-five teachers from throughout the State took part in field trips to various quarries, processing facilities, and reclamation sites. Participants also attended classroom sessions and presentations led by educators, geologists, industry professionals, and researchers. Classroom activities, mineral identification kits, samples of Minnesota rocks and minerals, and supporting resource materials were provided to all who attended. Feedback from teachers attending these workshops was overwhelmingly positive.

The following information is available on the DNR website at URL www.dnr.state.mn.us/minerals/: aggregate resource maps for six counties; the seven-county Minneapolis-St. Paul metropolitan area aggregate resource map and a related report on projected availability of aggregate resources; the final report to the legislature of the Aggregate Resources Task Force from February 1, 2000; and the Division's monthly Open-File Bulletin, reports and data related to Minnesota's mineral resources that are made available to the public at the beginning of the month following their completion.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1998		1999		2000 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	5	NA	6	NA	6
Iron ore, usable	47,200	1,470,000	45,900	1,150,000	46,200	1,290,000
Peat	30	1,630	W	W	43	5,190
Sand and gravel, construction	39,400	154,000	37,300	142,000	40,800	160,000
Stone:						
Crushed 3/	13,600	71,500	13,400	65,700	13,000	65,300
Dimension metric tons	48,100	18,800	42,700	20,700	34,000	18,100
Combined values of clays (common), lime, sand and gravel (industrial), stone (crushed sandstone), and value indicated by symbol W	XX	23,000	XX	35,200	XX	30,100
Total	XX	1,740,000	XX	1,420,000	XX	1,570,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Total." 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 stone; kind and value included with "Combined values."

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

Kind	1998				1999			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	30	7,180	\$37,300	\$5.19	49	7,050	\$28,600	\$4.05
Granite	4	W	W	W	4	W	W	W
Dolomite	4	3,560	17,400	4.88	7	3,300	20,500	6.19
Sandstone	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Quartzite	2	W	W	W	2	W	W	W
Total or average	XX	13,600	71,500	5.26	XX	13,400	65,700	4.90

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

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

2/ Excluded from total to avoid disclosing company proprietary data.

TABLE 3
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1999,
BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	W
Riprap and jetty stone	251	\$2,100	\$8.37
Filter stone	W	W	W
Other coarse aggregate	15	141	9.40
Coarse aggregate, graded:			
Concrete aggregate, coarse	451	2,010	4.47
Bituminous aggregate, coarse	237	1,670	7.03
Bituminous surface-treatment aggregate	W	W	W
Railroad ballast	648	4,230	6.52
Other graded coarse aggregate	1,150	8,660	7.51
Fine aggregate (-3/8 inch):			
Stone sand, concrete	10	48	4.80
Stone sand, bituminous mix or seal	222	1,460	6.59
Screening, undesignated	W	W	W
Other fine aggregate	339	1,990	5.88
Coarse and fine aggregates:			
Graded road base or subbase	1,350	6,570	4.86
Unpaved road surfacing	357	1,430	4.01
Terrazzo and exposed aggregate	W	W	W
Crusher run or fill or waste	27	196	7.26
Other coarse and fine aggregates	1,150	6,380	5.55
Other construction materials			
Agricultural:			
Agricultural limestone	W	W	W
Poultry grit and mineral food	W	W	W
Other agricultural uses	304	1,920	6.31
Unspecified: 3/			
Reported	4,730	20,000	4.23
Estimated	2,200	6,900	3.17
Total or average	13,400	65,700	4.90

W Withheld to avoid disclosing company proprietary data; included with "Other."

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

2/ Includes dolomite, granite, limestone and quartzite; excludes sandstone to avoid disclosing company proprietary data.

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

TABLE 4
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1999, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 3		District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	45	583	24	100
Coarse aggregate, graded 4/	W	W	W	W	1,150	8,560	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W	W	W	W	W
Coarse and fine aggregate 6/	W	W	W	W	1,850	10,100	632	2,190
Agricultural 7/	W	W	W	W	237	1,470	53	193
Unspecified: 8/								
Reported	--	--	W	W	W	W	W	W
Estimated	W	W	1,100	3,300	W	W	690	2,300
Total	1,690	8,660	2,670	13,200	5,110	30,000	3,940	13,900

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/ No production reported in Districts 1 and 2.

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

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

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

6/ Includes crusher run (select material or fill), graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

7/ Includes agricultural limestone, mineral food, poultry grit, and other agricultural uses.

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

TABLE 5
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1999,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	9,510	\$45,700	\$4.80
Plaster and gunite sands	213	1,220	5.71
Concrete products (blocks, bricks, pipe, decorative, etc.)	275	2,200	7.98
Asphaltic concrete aggregates and other bituminous mixtures	4,980	20,500	4.12
Road base and coverings	8,600	27,200	3.17
Road stabilization (cement)	399	1,760	4.40
Road stabilization (lime)	189	373	1.97
Fill	2,290	4,220	1.84
Snow and ice control	339	1,070	3.15
Roofing granules	15	101	6.73
Filtration	56	242	4.32
Other miscellaneous uses 2/	559	1,810	3.24
Unspecified: 3/			
Reported	2,930	11,600	3.97
Estimated	6,900	24,000	3.48
Total or average	37,300	142,000	3.80

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

2/ Includes railroad ballast.

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

TABLE 6
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1999, 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 (including concrete sand)	349	2,110	638	3,080	3,280	11,200
Plaster and gunite sands	W	W	91	589	W	W
Concrete products (blocks, bricks, pipe, decorative, etc.)	W	W	W	W	W	W
Asphaltic concrete aggregates and other bituminous mixtures	309	1,010	234	667	2,760	9,500
Road base and coverings	785	1,680	2,030	6,250	4,030	10,400
Fill	21	33	205	505	202	373
Snow and ice control	--	--	W	W	37	179
Other miscellaneous uses 2/	9	35	413	1,400	315	945
Unspecified 3/						
Reported	313	896	621	1,400	280	1,480
Estimated	2,500	8,600	620	2,200	750	2,600
Total	4,230	14,300	4,850	16,100	11,700	36,700
Use	District 4		Districts 5 and 6		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)	562	2,620	4,680	26,700	--	--
Plaster and gunite sands	W	W	W	W	--	--
Concrete products (blocks, bricks, pipe, decorative, etc.)	W	W	W	W	--	--
Asphaltic concrete aggregates and other bituminous mixtures	726	5,640	595	2,890	358	790
Road base and coverings	981	3,420	985	6,070	372	1,490
Fill	105	367	1,760	2,940	--	--
Snow and ice control	W	W	169	634	--	--
Other miscellaneous uses 2/	89	564	208	2,060	--	--
Unspecified 3/						
Reported	(4/)	3	1,710	7,820	--	--
Estimated	1,300	4,400	1,800	5,900	--	--
Total	3,900	17,200	11,900	55,000	730	2,280

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

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

2/ Includes filtration, railroad ballast, and roofing granules.

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

4/ Less than 1/2 unit.