

# THE MINERAL INDUSTRY OF MONTANA

**This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Montana Bureau of Mines and Geology for collecting information on all nonfuel minerals.**

In 2000, the estimated value<sup>1</sup> of nonfuel mineral production for Montana was \$574 million, based upon preliminary U.S. Geological Survey (USGS) data. This was a 15.5% increase from that of 1999<sup>2</sup> and followed a 1.2% decrease in 1999 from that of 1998. The State rose to 26th from 28th in rank among the 50 States in nonfuel mineral production value, of which Montana accounted for nearly 1.5% of the U.S. total.

Overall, metallic minerals accounted for more than 72% of the State's total nonfuel mineral value. By value, palladium was Montana's leading nonfuel mineral, followed by gold, portland cement, construction sand and gravel, and copper. In 2000, a \$76 million increase in the value of palladium, plus increases in gold, construction sand and gravel (up \$5.3 million), and portland cement, led Montana's increase in nonfuel mineral production value (in descending order of change). Smaller yet significant increases also occurred in silver and platinum (table 1). The largest decreases in value were those of copper (down more than \$10 million), zinc (down about \$6 million), molybdenum, and lead. Crushed stone and talc also had small decreases in value. All other nonfuel minerals had incremental changes or were unchanged.

In 1999, nearly equal increases in the values of construction sand and gravel of \$15.8 million and palladium, up \$15.4 million, were further supported by significantly smaller gains in the values of dimension stone, bentonite, lead, silver, and iron ore. But these gains were more than offset by mineral commodities that decreased in value, resulting in the State's overall decrease for the year. The most significant decreases were those of copper (down more than \$15 million), gold, molybdenum (down more than \$8 million), platinum, zinc, crushed stone, and lime (table 1). Relatively smaller decreases also occurred in cement (masonry and portland), talc, gemstones, and common clay.

<sup>1</sup>The 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, 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 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.

<sup>2</sup>Values, 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.

Based upon USGS estimates of the quantities produced in the 50 States in 2000, Montana continued as the only State to have mine production of primary palladium and platinum. The State remained first in the production of talc; second in bentonite; fourth in copper and lead; fifth in zinc and molybdenum; and sixth in silver. Montana increased in rank to fifth from sixth in the production of gold and was virtually tied with Kentucky for ninth in gemstone production.

The Montana Bureau of Mines and Geology provided the narrative information that follows.<sup>3</sup> The year 2000 was one of the worst for most of Montana's mineral industry. Prices for many mineral commodities continued to be low while energy prices caused operating costs to be significantly higher. Diesel costs doubled. Companies not on regulated power paid demand rates of more than \$4,000 per megawatt-hour (the average was \$200 per megawatt-hour). A year before prices averaged \$35 per megawatt-hour. Natural gas prices rose as much as eightfold. In addition to higher energy costs, the cost of grinding media, used in milling operations, increased by 25%. The net result was that marginal properties and some formerly profitable mines became cash sinks and were forced to close. Conversely, just a few years back when other mineral commodities were enjoying good prices, palladium prices were in the range of only \$78 per troy ounce; this year, Stillwater Mining Co. considered itself very fortunate when the palladium price peaked at more than \$1,000 per troy ounce.

Some individual operations also endured heat and insufferable smoke from the regional forest fires. Montana Tunnels Mine staff (near Boulder) stopped the fire at their tailings dam. Most small operators didn't even get started—there was no water for placers, and exploration project activities were restricted because of the fire danger.

In Butte, Montana Resources Inc. closed its copper-molybdenum Continental Pit in August. Although its operation had been profitable at lower copper prices, the loss of its power contract and resulting high prices on the spot market eliminated any potential for profit. In anticipation of securing a power contract and reopening by yearend, the company raised capital and stripped waste during the fall. However, an affordable contract for a reasonable timeframe was not secured, and the mine was closed.

Near Townsend, Apollo Gold Co. produced gold from its Diamond Hill Mine. Operations were suspended at yearend as drilled reserves were exhausted. The property still appeared to be underexplored.

South of Helena, Apollo Gold's Montana Tunnels Mine continued its profitable operation for another year. The company completed mining the pit reserves last year and began salvage mining of ore remaining under the haul road. This ore

<sup>3</sup>Robin B. McCulloch, Associate Research Mining Engineer, authored the text of mineral industry information submitted by the Montana Bureau of Mines and Geology.

is expected to be exhausted early in 2002. At that time, the company plans to go underground for the remaining reserves.

East of Butte, Placer Dome Inc.'s Golden Sunlight Mine had its best year ever. Ore grades averaged 3.4 grams per metric (g/t) ton gold with no stripping costs. Total gold production was more than twice the normal production at 6,590 kilograms at a cash cost of \$103 per troy ounce. The company poured its two-millionth ounce (62 metric tons) of gold in late February to early March of 2001. Testing of the waste dumps indicated that natural segregation during dumping had raised the grade of the upper portion of many of the waste dumps to that of mill feed. Continued production looked probable if a power contract after June 2001 could be procured. Otherwise, closure remained a likely option. The company accomplished significant amounts of reclamation during 1999. Most, if not all, of the southern and western dumps were graded, soiled, and seeded in 2000.

Near Big Timber, Northstar Mining started construction on a 45-metric-ton-per-day mill that is planned to process ore from the mine in the Deer Creek drainage of the Gold Hill Mining District. The company discovered that the ore body encompassed a number of quartz-gold veins having indicated values ranging from 17 to 750 g/t gold along widths of 1 to 2 meters (m). The company planned to access the property through a decline and anticipated minimal surface disturbance. It also planned for the development dumps to be consumed during the life of the mine as backfill in the ramp and fill mining method.

In 2000, the highlight of the mining industry in Montana was the Stillwater Mining Co. In Nye, production at the Stillwater mine increased steadily toward 2,700 metric tons per day. Although production was not sustainable at this rate, the contract and in-house development crews worked toward that goal. The company indicated that an aggressive development program would continue through 2001. About 621,000 metric tons of ore were mined in 2000. The paste backfill system below the 1,500-m level was expanded, and development connecting the east and west sides under the Stillwater River was completed. A significant increase in production was seen in the fourth quarter with production averaging 1,900 metric tons per day.

New management reinstated the miner-training program, expanded the human resources department, and enhanced its safety program. A significantly reduced turnover rate in employees resulted. Stillwater also realized an improvement in its overall safety record. The company worked to recruit experienced miners with little success in 2000. The supply of experienced underground miners was very limited.

The base metal refinery was expanded for copper and nickel recovery. The smelter not only processed concentrates but also recycled a portion of the used catalytic converter supply.

Development and drilling significantly improved the company's reserves. A total of 1.36 million metric tons (Mt) of reserve was added to the base, which resulted in a 900,000-metric-ton net reserve increase to what the company carried on the books in 1999 (2.4 Mt grading 25 g/t platinum and palladium). Total proven and probable reserves for the Stillwater Mine exceed 20 Mt grading 24/g/t.

Stillwater completed the access phase on its East Boulder project located south of Big Timber and west of the Nye Mine in 2000. Both tunnel-boring machines (TBM) crossed the mineralized reef, and development was initiated toward the

mining phase. The second TBM was turned to the west to construct a footwall lateral off the main drift to facilitate future development. The first machine was moved to the surface to be refitted. Development to the east focused on infrastructures such as shops, a paste plant, and water-treatment facilities. A ramp was started to develop upper levels on the ore body to the west. Progress on the infrastructure went well; completion was scheduled for mid-2001. According to the company, probable reserves for the East Boulder project exceeded 12 Mt grading 24 g/t.

On the surface, the mill was 95% complete and had been operationally tested on waste rock. The company projected the maximum capacity of the mill at startup to be 1,800 metric tons per day.

East of Dillon, Barrett Minerals, Inc. applied for a life-of-mine permit on the Regal talc mine. Early in the process, there was some concern about the potential for asbestiform minerals. The issue was settled, and the permit was granted.

Near Alder, Green Diamond Abrasives took an option on Cominco American Resources Inc.'s Ruby Garnet mine. The option was conditional, based on verification of grade and reserves, both of which were tested and proven. The company planned to replace the current excavation equipment with a cutterhead dredge and to slurry the gravel to the plant. This procedure was expected to not only reduce costs but also noise and dust complaints from neighboring properties.

Near Lewistown, Vortex Mining, LLC had another profitable year with its vertically integrated Yogo Sapphire Mine. More than 10,000 carats were mined, and nearly all the inventory was cut, mounted, and sold. Demand continued to increase for all sapphires; however, the Yogo sapphires were still the most in demand on the market. Late in the year, the company finished its new wash plant. Small Mines Development began a 900-meter (m) decline on the property that was expected to develop ore to the 180-m level. The current shaft bottomed at the 76-meter level. In anticipation of higher production levels, the company also established a new jewelry division where stones could be cut and mounted on-site.

Mineral exploration continued in Montana at an extremely low level funded by a few venture capital dollars. No major companies were known to be involved. Even Canadian junior companies, which have been decreasing in number, had no presence in the State. Funding had been primarily from individuals or small companies.

Low commodity prices and market limitations targeted interest toward mineral commodities with investment potential such as platinum-group metals (PGM), free-milling gold, and gold placers. Although many properties were permitted, exploration was limited because of the extreme fire danger.

In Sanders County, in the northwest portion of the State near Thompson Falls, Palouse Resources permitted its Lost Girl Project. Another placer exploration project was permitted at the Master Mine near Garrison.

Near Philipsburg, the Golden Jubilee reopened and shipped two test lots to the ASARCO Incorporated smelter in East Helena. The second shipment reportedly averaged 86 grams per metric ton gold. The structure appeared to be more than 240 m long as currently exposed.

Near Virginia City, an individual permitted a number of gold exploration projects in and adjacent to historic Alder Gulch. Great Rocky Mountain Mining Corp. placed a 9-m steel caisson

in Brown's Gulch to test placer gravels. Bedrock was reportedly more than 7 m deep.

Near Melrose, an individual drilled a mineralized range-front fault. Results were rumored to be favorable. Another individual tested zinc carbonate deposits in the Hecla mining district.

West of Radersburg, Caboose Mining continued its long-term drilling program on gold resources near the Ohio-Keating Mine.

Near Lewistown, the Golden Arrow Mining Co. drove a long drift into gold deposits under Linster Peak. Britt Minerals

permitted its Homestead project. This was part of a diamond exploration program in the central Montana diatremes.

Southwest of Columbus, Idaho Consolidated Metals Corp. formed a joint venture with Boulder Gold and explored for PGM occurrences in chrome zones within the Stillwater Complex. The newly formed company also holds a sizable claim position on the Picket Pin deposit on the north side of the Complex. Field activities focused on mapping and evaluation of previously drilled core. The company planned an aggressive drilling program for the upcoming year.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1998		1999		2000 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	453	NA	294	NA	294
Gold 3/ kilograms	8,200	77,900	7,570	68,100	W	W
Lead 3/ metric tons	7,310	7,300	7,950	7,660	6,020	5,780
Palladium metal kilograms	10,600	98,600	9,800	114,000	10,000	190,000
Platinum metal do.	32,200	38,800	2,920	35,600	3,050	38,300
Sand and gravel, construction	8,550	34,900	12,000	50,700	12,900	56,000
Stone:						
Crushed	3,880	15,100	3,440	13,300	3,000	11,900
Dimension metric tons	W	W	9,500	1,440	9,500	1,440
Zinc 3/ do.	24,900	28,200	22,200	26,100	16,600	20,200
Combined values of cement [masonry (1998), portland], clays (bentonite, common), copper, garnet [industrial (1998-99)], iron ore (usable), lime, molybdenum concentrates, peat, silver, stone [dimension miscellaneous (1998)], talc, and values indicated by symbol W	XX	202,000 r/	XX	180,000	XX	250,000
Total	XX	503,000 r/	XX	497,000	XX	574,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. 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/ Recoverable content of ores, etc.

TABLE 2  
MONTANA: 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	12 r/	3,260 r/	\$12,900 r/	\$3.95 r/	9	2,710	\$10,600	\$3.92
Granite	3	110	311	2.83	3	238	846	3.55
Sandstone and quartzite	4	W	W	W	4	W	W	W
Traprock	3	W	W	W	3	W	W	W
Miscellaneous stone	5	73	242	3.31	6	140	473	3.38
Total or average	XX	3,880	15,100	3.88	XX	3,440	13,300	3.87

r/ Revised. 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.

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

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Construction:</b>			
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	W	W	\$4.20
Coarse aggregate, graded, railroad ballast	W	W	3.86
<b>Fine aggregate (-3/8 inch):</b>			
Stone sand, bituminous mix or seal	W	W	3.54
Screening, undesignated	W	W	3.53
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	W	W	3.42
Unpaved road surfacing	W	W	3.55
Other coarse and fine aggregates	W	W	3.30
Other construction materials	20	\$67	3.35
<b>Chemical and metallurgical:</b>			
Cement manufacture	W	W	3.97
Lime manufacture	W	W	6.01
Flux stone	W	W	3.95
Sulfur oxide removal	W	W	4.37
Special, mine dusting or acid water treatment	W	W	2.00
<b>Unspecified: 3/</b>			
Reported	140	473	3.38
Estimated	1,500	5,200	3.42
Total or average	1,660	5,700	3.44
Grand total or average	3,440	13,300	3.87

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

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

2/ Includes granite, limestone, miscellaneous stone, sandstone and quartzite, and traprock.

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

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

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>Construction:</b>						
Coarse aggregate (+1 1/2 inch) 2/	W	W	--	--	--	--
Coarse aggregate, graded 3/	W	W	--	--	--	--
Fine aggregate (-3/8 inch) 4/	W	W	--	--	--	--
Coarse and fine aggregate 5/	180	634	--	--	--	--
Other construction materials	20	67	--	--	--	--
Chemical and metallurgical 6/	1,270	5,770	--	--	--	--
Special 7/	W	W	--	--	--	--
<b>Unspecified: 8/</b>						
Reported	--	--	18	70	122	402
Estimated	70	250	1,400	4,900	--	--
<b>Total</b>	<b>1,850</b>	<b>7,880</b>	<b>1,460</b>	<b>5,010</b>	<b>122</b>	<b>402</b>

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 riprap and jetty stone.

3/ Includes railroad ballast.

4/ Includes screening (undesignated) and stone sand (bituminous mix or seal).

5/ Includes graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

6/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.

7/ Includes acid water treatment or mine dusting.

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

TABLE 5  
MONTANA: 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) 2/	1,390	\$6,990	\$5.04
Concrete products (blocks, bricks, pipe, decorative, etc.)	16	55	3.44
Asphaltic concrete aggregates and other bituminous mixtures	1,360	6,890	5.05
Road base and coverings 3/	3,890	15,300	3.94
Fill	445	1,140	2.56
Snow and ice control	285	1,060	3.71
Roofing granules	6	34	5.67
Filtration	4	56	14.00
Other miscellaneous uses 4/	14	70	5.00
<b>Unspecified: 5/</b>			
Reported	1,180	5,030	4.25
Estimated	3,400	14,000	4.12
<b>Total or average</b>	<b>12,000</b>	<b>50,700</b>	<b>4.22</b>

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

2/ Includes gunite sands and plaster.

3/ Includes road and other stabilization (lime).

4/ Includes railroad ballast.

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

TABLE 6  
MONTANA: 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		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products 2/	1,050	4,850	358	2,200	--	--
Asphaltic concrete aggregates and road base materials 3/	4,190	16,800	1,070	5,420	--	--
Fill	402	973	43	165	--	--
Roofing granules	6	34	--	--	--	--
Other miscellaneous uses 4/	287	1,090	11	41	--	--
Unspecified: 5/						
Reported	999	4,020	47	226	138	784
Estimated	1,600	6,300	1,800	7,700	--	--
Total	8,530	34,200	3,340	15,700	138	784

-- Zero.

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

2/ Includes gunite sands and plaster.

3/ Includes road and other stabilization (lime).

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

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