

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 1999, the preliminary estimated value¹ of nonfuel mineral production for Montana was \$491 million, according to the U.S. Geological Survey (USGS). This was a 3% decrease from that of 1998,² following a 1.8% increase in 1998 from that of 1997. The State decreased in rank to 30th from 28th in the Nation in nonfuel mineral production value, of which Montana accounted for about 1% of the U.S. total.

Overall, metallic minerals accounted for more than 70% of the State's total nonfuel mineral value. By value, palladium was Montana's leading nonfuel mineral, followed by copper, gold, and portland cement. In 1999, most of the State's drop in value resulted from decreases in the values of gold (down about \$10 million), molybdenum and copper (down about \$6 million each), and zinc (table 1). (All listings are in descending order of change or value.) Smaller yet significant decreases occurred in talc and platinum. Increases in palladium, construction sand and gravel, silver, and crushed stone values partially offset those decreases. All other changes were relatively small. In 1998, the increased values of palladium, up nearly \$49 million, platinum, up \$5.6 million, plus the smaller yet significant increases in construction sand and gravel, crushed stone, portland cement, and lime more than balanced decreases in gold, molybdenum, copper, zinc, and lead, resulting in a small overall gain for the year. All other changes were small and inconsequential to the net result.

Based upon USGS estimates of the quantities produced in the 50 States in 1999, Montana continued as the only U.S. producer of primary palladium and platinum. The State remained first in the production of talc; second in bentonite; third of three industrial garnet-producing States; fourth in lead; fifth in molybdenum and zinc; sixth in gold and silver; and eighth in gemstones. Montana increased in rank to fourth from fifth in the production of copper.

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.

The Montana Bureau of Mines and Geology provided the narrative information that follows.³ Montana Resources Inc., a copper-molybdenum producer, completed a new crushing circuit, allowing production to increase to 39,000 metric tons per day (t/d) of ore. The company purchased five used 150-metric-ton (t) Wabco trucks to allow for increased stripping necessary to maintain the higher ore production levels. Montana Resources also completed decommissioning of its copper leach pads. Currently, it is pumping 35,000 liters per minute of water from the abandoned Berkeley Pit to its precipitation plant for low-cost recovery of cement copper.

East of Butte, Placer Dome Inc.'s Golden Sunlight Mine completed installation of the Inco Cyanide Destruct Circuit, which will lower cyanide levels in its pond to approximately 10 parts per million. The mine has produced gold since 1981. The operation experienced two staff reductions targeting both professional and operational employees. Cash operating costs have been reported at \$131 per troy ounce of gold. Without increases in the price of gold, the mine is expected to cease operations in 2002.

South of Helena, near Jefferson City, the Apollo Gold Co. continued operations at Montana Tunnels Mine. This is a low-grade gold-silver-lead-zinc operation. Open pit reserves are expected to become depleted in early 2000. The company will mine reserves left under the haul road for an additional 2 years. Metal prices will have to improve to justify mining additional underground reserves.

The Diamond Hill Mine, a satellite gold property of the Montana Tunnels Mine, reopened in fall 1999 after a lengthy closure. During the closure, an independent 540 t/d flotation circuit was constructed at the Montana Tunnels mill for processing the ore. The ore from the Diamond Hill Mine will continue to be hauled more than 80 kilometers (km) from Townsend to the Montana Tunnels property, where it will be crushed and processed. The mine reaches to a depth of 300 meters (m) for two ore bodies and to a depth of 150 m for another two; average grade is 8.6 grams per metric ton (g/t) of gold.

South of Billings, the Stillwater Mining Co. (SMC) continued to expand mining and milling operations and to further develop reserves in the J-M platinum/palladium reef of the Stillwater Complex. Near the east end of the reef, 8 km west of Nye, the company experienced production shortfalls due to a lack of development footage, and was mining only about 1,100 t/d of ore. Production targets of 2,700 t/d do not appear attainable until the first quarter of 2001. SMC contracted with Tyson Construction Co. during midsummer to help speed up development. The company also experienced high rates of turn over in labor and had difficulty hiring experienced miners. At the Nye site, SMC completed construction of new equipment

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

repair bays and a warehouse, while expanding office space and other facilities. Capacity of the mill was expanded to 2,700 t/d, and an underground maintenance shop was constructed in the Stillwater Mine. A new pond at the Hertzler Ranch has been built but not yet lined. Slurry line construction was scheduled to start in 2000. On the west end of the reef, near Big Timber, SMC had two tunnel-boring machines advancing toward the mineralized reef from the East Boulder portal. Completion of those bores is expected within the second or third quarter of 2000. Delays were experienced during the year for a variety of reasons, the most predominant problems being unanticipated grouting and poor ground conditions. Construction was underway for most of the East Boulder surface facilities, but only the drying and warehouse facilities were functional. At Columbus, the company completed its new smelter building and expanded its base metal refinery to permit recovery of copper and nickel from the leach circuit. Commissioning of the facilities is expected to coincide with the startup of the East Boulder Mine and full production of the operations at Nye.

Near Malta, the Zortman-Landusky Mine, formerly owned by Pegasus Gold, Inc., remains under maintenance while State and Federal regulatory agencies negotiate over a final reclamation plan. Many believe that the bond for reclamation will be consumed by maintenance costs before a consensus between the agencies can be reached.

Cominco American Resources Inc. decided in October 1999 to close its garnet operation at Alder. The property had been for sale for some time. The garnet operation was sold to Montana-Oregon Investment Group LLC effective December 31, 1999, and the name was changed to the Ruby Garnet Mine. Garnet shipments were suspended during December 1999, and the mine resumed production again in January 2000.

Near Three Forks, Luzenac America Inc. invested more than \$3 million in equipment and facilities to enable its two talc

processing plants to process imported ore. Upon completion, two plants in other States were closed and operations were consolidated in Montana where five new jobs were created.

Exploration activities in 1999 were at a record low with only 10 projects in the State funded. In contrast, 140 projects were funded during 1991. Estimated total exploration expenditures in 1999 were less than \$100,000, whereas the industry spent \$23.6 million in 1989. At the beginning of the decade, most projects depended on corporate funds. At the end, the financing was largely "out-of-pocket" by a few entrepreneurs and small local companies.

Kennecott Corp. drilled a strata-bound copper-silver target near Thompson Falls, in Sanders County, while Phelps Dodge Corp. drilled a porphyry copper target south of Dillon. Both projects were dropped.

Yukon Mining explored flat-lying, gold-copper-sulfide bodies near Utica. Caboose Mining drilled two holes near Radersburg on narrow gold veins. Don Deem tested high elevation placer benches near Melrose. The gravel assayed 1% lead and zinc and yielded coarse gold. Ingenuity Exploration drilled geophysical targets east of Melrose on the Hecla properties. Historic production in the district was from lead-silver ore bodies that assayed in excess of 34,000 g/t silver.

West of White Sulphur Springs, Nevada Pacific Gold Ltd. completed a four-hole, 900-m drill program in a buried ultramafic intrusive. Results indicated platinum-palladium mineralization (0.21 g/t) in a magnetite host. West of Norris, Nevada Colca Gold Inc. trenched and drilled the Revenue property. Although the results were favorable, the company was unable to secure venture capital. A similar situation occurred east of Boulder where Treminco Resources, Ltd. failed to secure funding on a proven reserve (Santa Fe Pacific Gold-Newmont Mining Corp.'s Elkhorn property, also known as the East Butte Mine).

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1997		1998		1999 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1,120	NA	453	NA	398
Gold 3/ kilograms	10,200	109,000	8,200	77,900	7,600	68,400
Iron ore, usable	--	--	W	W	7	130
Lead 3/ metric tons	9,230	9,470	7,310	7,300	8,510	8,200
Palladium kilograms	8,400	49,700	10,600	98,600	10,200	105,000
Platinum do.	2,610	33,200	3,240	38,800	3,200	37,600
Sand and gravel: Construction	8,390	30,800	8,550	34,900	8,940	37,300
Stone: Crushed	2,600	10,600	3,880	15,100	4,100	16,300
Zinc 3/ metric tons	W	W	24,900	28,200	W	W
Combined values of cement, clays (bentonite, common), copper, garnet (industrial), lime, molybdenum, peat, sand and gravel [industrial, (1997)], silver, stone Dimension miscellaneous), talc and pyrophyllite, and values indicated by symbol W	XX	254,000	XX	206,000 r/	XX	218,000
Total	XX	498,000	XX	507,000 r/	XX	491,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable. -- Zero.

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	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	23	2,020	\$8,620	\$4.27	15	3,370	\$13,200	\$3.91
Sandstone and quartzite	5	W	W	W	4	W	W	3.35
Traprock	3	W	W	W	3	W	W	3.84
Miscellaneous stone	2 r/	111 r/	137 r/	1.23 r/	5	73	242	3.31
Total or average	XX	2,600	10,600	4.09	XX	3,880	15,100	3.88

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 1998,
BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	25	\$156	\$6.24
Coarse aggregate, graded:			
Bituminous aggregate, coarse	W	W	5.50
Bituminous surface-treatment aggregate	67	191	2.85
Railroad ballast	W	W	3.86
Total or average	456	1,820	3.98
Coarse and fine aggregates:			
Graded road base or subbase	W	W	3.31
Unpaved road surfacing	W	W	2.87
Other coarse and fine aggregates	11	47	4.27
Total or average	214	701	3.28
Other construction materials	30	99	3.30
Agricultural: Agricultural limestone	(3/)	(3/)	6.52
Chemical and metallurgical:			
Cement manufacture	W	W	3.31
Lime manufacture	W	W	4.55
Total or average	2,380	9,690	4.07
Special: Mine dusting or acid water treatment	(3/)	(3/)	3.58
Unspecified: 4/			
Actual	73	242	3.32
Estimated	672	2,220	3.31
Total or average	745	2,470	3.31
Grand total or average	3,880	15,100	3.88

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

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

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

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

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

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

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	25	156	--	--	--	--
Coarse aggregate, graded 3/	W	W	W	W	--	--
Coarse and fine aggregate 4/	W	W	W	W	--	--
Other construction materials	30	99	--	--	--	--
Agricultural 5/	W	W	--	--	--	--
Chemical and metallurgical 6/	2,380	9,660	--	--	--	--
Special 7/	W	W	--	--	--	--
Unspecified: 8/						
Actual	--	--	7	23	66	219
Estimated	70	230	602	1,990	--	--
Total	2,970	11,900	840	2,940	66	219

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 bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.

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

5/ Includes agricultural limestone.

6/ Includes cement manufacture and lime manufacture.

7/ Includes mine dusting or acid water treatment.

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

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

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate and concrete products	1,230	\$5,850	\$4.74
Plaster and gunite sands	2	4	2.00
Asphaltic concrete aggregates and other bituminous mixtures	1,260	8,200	6.52
Road base and coverings	2,840	10,600	3.74
Fill	468	792	1.69
Snow and ice control	307	1,170	3.80
Filtration	23	42	1.83
Other miscellaneous uses 2/	28	162	5.79
Unspecified: 3/			
Actual	431	1,660	3.86
Estimated	1,960	6,430	3.28
Total or average	8,550	34,900	4.08

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
MONTANA: 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		Unspecified districts 2/	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates 3/	889	3,530	347	2,320	--	--
Asphaltic concrete aggregates and other bituminous mixtures	1,020	6,780	237	1,420	--	--
Road base and coverings	2,100	7,690	735	2,920	--	--
Fill	405	545	63	247	--	--
Other miscellaneous uses 4/	339	1,250	19	124	--	--
Unspecified: 5/						
Actual	176	672	33	119	222	871
Estimated	1,310	4,190	652	2,240	--	--
Total	6,240	24,700	2,090	9,390	222	871

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

2/ Includes production within the State with no district reported.

3/ Includes plaster and gunite sands.

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

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