

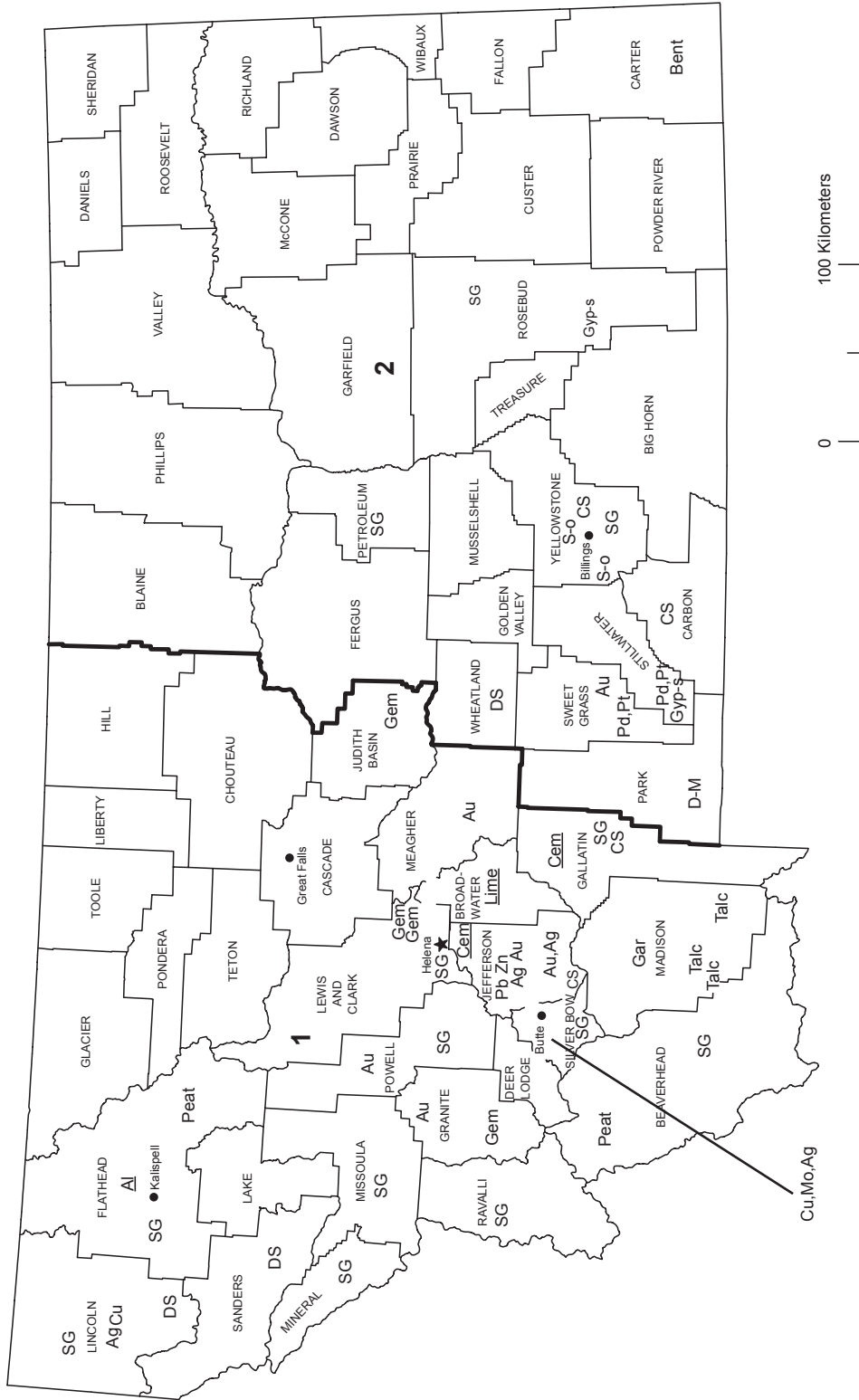
# MONTANA

## LEGEND

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

## MINERAL SYMBOLS (Major producing areas)

- |       |                              |
|-------|------------------------------|
| Ag    | Silver                       |
| Al    | Aluminum plant               |
| Au    | Gold                         |
| Bent  | Bentonite                    |
| Cem   | Cement plant                 |
| CS    | Crushed stone                |
| Cu    | Copper                       |
| D-M   | Dimension marble             |
| DS    | Dimension stone              |
| Gar   | Garnet                       |
| Gem   | Gemstones                    |
| Gyp-s | Synthetic gypsum             |
| Lime  | Lime plant                   |
| Mo    | Molybdenum                   |
| Pb    | Lead                         |
| Pd    | Palladium                    |
| Peat  | Peat                         |
| Pt    | Platinum                     |
| S-o   | Sulfur (oil)                 |
| SG    | Construction sand and gravel |
| Talc  | Talc                         |
| Zn    | Zinc                         |



# 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 2004, Montana's nonfuel raw mineral production was valued<sup>1</sup> at \$624 million, based upon annual U.S. Geological Survey (USGS) data. This was an increase of more than 26% compared with that of 2003<sup>2</sup> and followed an increase of nearly 5% from 2002 to 2003. The State rose in rank to 26th from 28th among the 50 States in nonfuel raw mineral production value and accounted for about 1.4% of the U.S. total.

Overall, metallic minerals accounted for nearly 71% of Montana's total nonfuel mineral production value in 2004. Platinum and palladium were, by value, the State's leading nonfuel minerals followed by copper, molybdenum concentrates, construction sand and gravel, and portland cement, the combined total of which accounted for nearly 80% of the State's total nonfuel mineral value.

In 2004, a significant majority of Montana's nonfuel minerals increased in value. Copper and molybdenum concentrates were up by more than \$80 million each as a result of substantial production increases and significantly higher average copper prices and significantly higher average molybdenum concentrate prices. The recent upward trend in molybdenum prices began in December 2002 and continued throughout 2003 and 2004. For example, the average annual price of molybdenic oxide rose from \$8.27 per kilogram in 2002 to \$11.75 per kilogram in 2003 to \$36.73 per kilogram in 2004 and reached \$68.89 in December 2004. Molybdenum concentrate prices remained high and continued to increase more gradually during the early months of 2005. (Prices were reported in Platts Metals Week in dollars per pound of contained molybdenum.)

In 2004, platinum and palladium, values were up nearly \$17 million and \$11 million, respectively. Other commodities with significant increases in value were those of silver, portland cement, construction sand and gravel, crushed stone, all up by more than \$5 million each, and zinc, up by more than \$3 million. These increased nonfuel mineral values together far outweighed the substantial decrease in gold production and value, which was down more than \$90 million; bentonite production also decreased, its value down about \$6.5 million (table 1).

In 2003, the production and value of gold significantly increased from that of 2002 with the commodity's value up more than \$60 million. Although production was down slightly, the value of platinum increased by nearly \$17 million. Smaller increases took place in zinc, lead, talc, crushed stone, and silver, ranging from \$5 million rise in zinc progressively down to a \$2 million increase in silver. These increases more than compensated for a substantial drop in the value of palladium. In addition to a more than 5% decrease in production, the precious metal's mineral production value decreased more than 40%, down nearly \$71 million from that of 2003, owing to the palladium's significantly lower average price for the year. Smaller decreases in value took place in portland cement and construction sand and gravel, down about \$3 million and \$2 million, respectively. Although the value was small in comparison to most of the State's other nonfuel minerals, the rise in the value of gemstones was significant, representing a nearly 67% increase in the commodity's value (table 1).

In 2004, Montana continued to be the only State to have primary palladium and platinum mine production. It also continued to be first in the quantity of talc produced, fourth in zinc, sixth in gemstones, and it remained a significant producer of construction sand and gravel. While the State rose in rank to fourth from fifth in copper, to fifth from sixth in molybdenum concentrates, and to fifth from seventh in the production of silver, it decreased to third from second in bentonite, to fifth from fourth in lead, and to eighth from fourth in gold.

The Montana Bureau of Mines and Geology<sup>3</sup> (MBMG) provided the narrative information that follows. Production and other data in the following text are those reported by the MBMG, based upon its own surveys and estimates. The data may differ from some production figures reported by the USGS.

In 2004, the Montana mining industry responded positively to an atmosphere of rising commodity prices, including some commodities that had not seen significant price increases since the 1940s. Interest focused on copper, gold, iron, molybdenum, and silver, with a cautious look at tungsten.

Operating mines struggled to secure equipment and tires. Because of the extended duration of the last metals price slump, many operations had deferred replacing their trucks and loaders for nearly a decade. Companies placing orders found that some delivery dates were projected 1 to 2 years and even longer for very large pieces of equipment. Late in the year, some companies indicated that tires were difficult to secure, and there were no plans by the tire companies to increase production. However, many companies had a lower employee turnover rate. Companies resuming or starting production received more than sufficient employee applications, and many applicants had previous mine experience.

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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 2004 USGS mineral production data published in this chapter are those available as of December 2005. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

<sup>2</sup>Values, percentage calculations, and rankings for 2003 may differ from the Minerals Yearbook, Area Reports: Domestic 2003, Volume II, owing to the revision of preliminary 2003 to final 2003 data. Data and rankings for 2004 are considered to be final and are not likely to change significantly.

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

A shortfall loomed in technical services personnel. Economic and mining geologists were difficult to find, and there were few new graduates and fewer students. Most of the mining-related engineering disciplines were not producing an adequate number of graduates to meet current industry needs let alone the anticipated retirements in the next few years.

## Exploration

Exploration is typically an outgrowth of the profit or need for reserves by a mining company. In the past 10 years, the companies have struggled to stay alive so investments in exploration have been minimal. During the first few years of an upturned market cycle, profits are typically reinvested in the mining operations. This is usually in the form of new or rebuilt production equipment or replacement of critical personnel followed by less critical needs. After those needs are met, the companies often invest a portion of their profits into exploration. In Montana, exploration is currently being fueled by venture capital speculation on stock and by commodity prices. Major companies have shown little, if any, activity in the State.

New companies comprised of seasoned industry professionals have started reassembling property packages based on historical exploration programs, such as molybdenum programs of the 1970s, the gold programs of the late 1980s and early 1990s, and even the iron and tungsten programs of the 1950s. Many portfolios include diversified commodities and mining methods. Interest in placer gold has also been steadily increasing but mostly for small-scale operations. Overall, exploration in Montana exhibited a modest increase in activity during the previous years. With little exception, activities were focused on property acquisition by purchase or claim staking.

In the northwest corner of the State, Idaho General Mines Inc. worked on its Molly Star property near Thompson Falls. Their focus was on a Lupine-type target and encompassed molybdenum and copper deposits in the area.

Near the Troy deposit (Spar Lake), Genesis Inc. (subsidiary of Revett Silver Co.) drilled to expand the reserve base of the strata-bound copper-silver deposit that they were mining in 2004. The company reported positive results and indicated more drilling in the future.

North of Butte, O.T. Mining Corporation started an extensive diamond-drilling program on the Ruby mine property and the surrounding area, based on results of a Mobile Metal Ions<sup>4</sup> geochemical soil survey and an extensive "Titan 24" ground geophysical survey (O.T. Mining Corp., 2004<sup>5</sup>).

The survey focused on a deep copper-porphyry target below the volcanic rocks covering the Boulder batholith. Results of Hole NA04-6 showed 179 meters (m) of nonmineralized volcanic cover overlying intercepts of copper mineralization in batholith rocks. A number of short (less than 1.5 m) intercepts ranged in grade from 0.2% to 0.34% copper. The winter drilling program was stopped at 584 m to allow an endangered lynx to go undisturbed during the winter months. The hole will be deepened in the spring. The 2005 drilling budget for O.T. Mining is estimated to be about 5,500 m.

East of Boulder, Elkhorn Goldfields, Inc. continued diamond drilling with two rigs to define the gold deposits discovered by Goldfields and Santa Fe. They have completed blocking out reserves on the north end of their property package and have completed a prefeasibility analysis on the economics. They anticipate production will commence this year at a level not exceeding 450 metric tons per day (t/d).

South of Melrose, one individual continued compilation of data and testing on the Browns Lake garnet-tungsten skarn. Through mapping and drill data, a reserve of 2.3 million metric tons (Mt) of 0.6% tungsten trioxide ( $WO_3$ ) has been identified. The zone was described as 6 to 9 m thick, 600 m long, and 120 to 150 m wide. Additional beds containing lower grade resources may bring the overall thickness to 20 to 24 m, even though grade is projected to be reduced to 0.3%  $WO_3$ . In addition, testing has demonstrated that the garnet waste from this operation is excellent as an abrasive for water-jet cutting of aluminum and mild steel. The existing tailings ponds from the earlier mining operations are estimated to contain approximately 1.8 Mt of sized and preground garnet. This same individual is developing markets and planning to start development of his business this year.

South of Columbus and Big Timber, Beartooth Platinum Corporation explored for platinum-group metals with four diamond-drill holes in the Iron Mountain and Picket Pin areas of the Stillwater Complex. The program was started late in the season and showed favorable results. An extensive drilling program is planned for 2005.

Near Virginia City (south of Butte), Ruby Valley Garnet, LLC. purchased the Ruby Garnet operation from the Montana-Oregon Investment Group. A higher grade deposit was also purchased. The company worked through the fall, testing the deposit and equipment and expected to be in production in 2005. Current reserves are adequate for 3 to 4 years of operations, but resources are projected to support 20 to 30 years of mining. Annual production is anticipated to be 9,000 metric tons (t). The company will focus on wholesale production of garnets for abrasive blasting medium, water filters, and water-jet cutting.

## Commodity Review

### *Industrial Minerals*

**Cement.**—Near Three Forks, Holcim (US) Inc. continued to work on its permit to replace 15% of conventional fuel needs by burning waste tires. Also, an anticipated \$1.2 million capital improvement program during the next 2 years was scheduled for the plant to reduce flue dust emissions and process dust. Local cement markets were very strong and supplies were tight. The company

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<sup>4</sup>Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

<sup>5</sup>References that include a section mark (§) are found in the Internet References Cited section.

indicated that its local market was one of the most rapidly growing in the Nation. Plant production has been sold out for the next 2 years. The company was the “exporter of the year” for the State of Montana. The operation has been recommended for ISO ratings of 14.001 and 9.001, which are for high environmental and performance standards.

**Gemstones.**—Near Lewistown, Yogo Creek Mining has temporarily closed for the winter. Its inclined shaft is completed to 130 m (vertical), and they have encountered gangue that is too hard to allow for release of the sapphires by simple washing. Future operations are dependent on discovery of additional reserves. If additional reserves cannot be developed, closure may take place within the next year. Customer demand has risen so that the mine and process facilities cannot produce at a sufficient rate to meet it.

**Talc.**—East of Dillon, Barretts Minerals, Inc. increased production from the Regal and Treasure talc mines. The company planned to increase its fleet size as well as its workforce. It added a new storage silo at the mill and planned to upgrade processing equipment. In early 2005, Barretts expected to complete a stripping and stabilization program in the Treasure Pit that was initiated by a pit wall failure in 2004. The company also planned to move the county road around the Regal Pit in the near future to increase safety for the public as the ore body is developed.

South of Ennis, Luzenac America Inc. experienced similar market strength in its talc sales, even though they operated in somewhat different markets. They also looked at some upgrades in equipment and at a modest increase in labor. Work in the South 40 Pit has developed 50 years’ reserves of high-quality talc.

## **Metals**

**Copper, Molybdenum, and Silver.**—In the northwest corner of Montana (Lincoln County), Genesis Inc. (a wholly owned subsidiary of Revett Silver Co. in Spokane, WA) resumed production at the Troy Mine (Stromnes, 2005§). Revett Minerals holds approximately 67% of the outstanding shares of Revett Silver. The Troy Mine produced 5,900 t/d of ore, averaging 54 grams per metric ton silver and 0.65% copper and planned to employ 150 people. The Troy Mine hired about 65 people by December 2004 from a pool of more than 650 applications. Purchases included a number of new trucks and drills, although delivery was delayed. Many of the Troy Mines’ older trucks were modified with new engines to meet the Environmental Protection Agency’s emission standards. Full employment and production started at the end of 2004. Funding was secured in part by a royalty agreement with Royal Gold Inc. on future production of the Troy and Rock Creek Mines. In 1999, Revett Silver acquired 100% of the Troy and Rock Creek Mines and several exploration properties in the area. If tests are promising, production from the Rock Creek Mine will start up in 2008 or 2009 (Revett Minerals, Inc., 2006§).

Genesis will operate as a contractor for ASARCO Incorporated (which formerly owned the Troy and Rock Creek Mines) until enough cashflow is generated to allow them to develop a cash bond for reclamation. It also planned to start development of the production incline for the Rock Creek Mine next summer. Troy has 2- to 5-year reserves (7.9 Mt), and Rock Creek has production potential for 30-plus years. Continuing litigation by environmental groups is expected because of the belief among some that Asarco buried barrels of waste material near the Troy Mine.

East of Noxon and the Rock Creek property, Mines Management, Inc. was expected to reapply for permits for the Montanore Mine that was previously permitted by Noranda. This major copper-silver property was expected to be repermited within a year or perhaps a bit longer.

At Butte, Montana Resources took delivery of six Caterpillar 240-metric-ton (t) ore trucks in the last half of 2004. This acquisition greatly increased production and lowered costs. Two Ingersoll (IR-270SP) drills were also on order and delivery dates are unknown. Many of the older trucks have been updated with new engines to allow continued use. A new Bucyrus International BE-495HD shovel has been ordered and is expected to be onsite in the third or fourth quarter of 2005. This shovel will load the larger-capacity trucks more effectively.

Montana Resources, which restarted the Continental Pit in November 2003, benefited from much higher commodity prices. Production for 2004 was estimated to be 29,000 t of copper, 2,700 t of molybdenum, and 18,000 kilograms of silver. A substantial production bonus was divided between the company’s 350 employees.

**Gold.**—Northeast of Avon, an individual continued small-scale gold placer production on Ophir Creek. He increased production when he replaced his cable backhoe with a Timberjack tool modified to be an all-terrain excavator.

Near Nevada City, an individual continued mining gold from the lower Browns Gulch placer (Bubany placer). In many areas, values were reported to be as high as \$131 per cubic meter, with fine and coarse gold being recovered. Mining was difficult because the gravels were covered with up to 12 m of clay and silt from earlier placer operations. The lower portion of the drainage has been reclaimed. Work will continue in the coming spring in the upper segment of the property where the gulch narrows.

East of Butte, Placer Gold Inc. started processing gold ore at its Golden Sunlight Mine 6 months earlier than originally planned. A previously unknown ore body, estimated to contain 726,000 t, was discovered while stripping for the stage 5B pit expansion. The current mine life is 4 years, but the company is initiating an extensive exploration program to look for potential ore bodies remaining on the property. The company planned to hire 15 new employees.

North of Townsend, an individual produced placer gold from the high benches in Confederate Gulch. Operations in the main gulch above Diamond City have been delayed while the person awaited a 404 Permit from the Corps of Engineers to allow him to disturb a dry streambed. Tests during the summer demonstrated that after mining and reclamation, surface flows in the dry streambed will probably be restored and that downstream water users will not be harmed during operations.

**Lead and Zinc.**—Near Boulder, Apollo Gold Corp. nearly completed an extensive stripping program at its Montana Tunnels Mine (gold, silver, lead, and zinc). The combination of a pushback and a major wall failure on the west side created need for an extensive stripping program that was recently completed. The remaining mine life was expected to be approximately 4 years. Many of its trucks have accumulated extensive hours, and the company planned to rebuild many of the trucks in the face of a short mine life and

extended delivery date for new equipment. The company also applied for a permit to expand the pit to the north. The expansion was expected to extend the mine life to 2011. If approved, the company planned to initiate a stripping program in about 2 years.

**Platinum-Group Metals.**—In the Big Timber area, Stillwater Mining Company embarked on an extensive development program to bring the East Boulder Mine ore production to a level of 1,800 t/d by 2007. Current ore production averages 1,200 t/d. This program was in progress when the contractors were laid off in 2001. Part of the program included an aggressive equipment purchase and rebuild program but implementation was somewhat impeded by delays in equipment delivery. Development was expected to approach 9,000 m in 2005. Moran Mining & Tunnelling Ltd. drove a 550-m ventilation raise with an Alimak Raise Climber, which allowed improved ventilation. With tailing ponds enlarged to the Stage II permit capacity, the company expected to produce about 900,000 t of waste rock in 2005.

Stillwater also experimented with conventional cut-and-fill mining methods and used slushers to see if recovery could be increased and dilution reduced in order to cut costs. The mechanized methods were fast, have greater ventilation needs, and the 50-degree dip of the ore body results in higher dilution rates. The 2-m muckers required a 2.4-m mining width, resulting in severe dilution of the typical 1.2-m to 2-m mineralized zones.

Stillwater Mining negotiated a 3-year contract with the labor union at the Stillwater Mine near Nye. They drove a ramp off the bottom of the shaft but will have to deepen the shaft eventually. They are enlarging its haulage equipment to 27-t trucks on the ramps. They added a cobalt-recovery circuit at the base-metal refinery and increased capacity to recycle a higher percentage of automotive catalytic converters. Platinum and palladium prices were up, and the mines were profitable at 2004 prices.

Southeast of Big Timber in the Deer Creek drainage, North Star Mining, Inc. completed 260 m of development on an underground quartz-sulfide-hosted precious-metal mine. Their gravity and flotation mill (113 t/d) was functional, but the company temporarily closed the mill until it can resolve recovery losses. The company also experienced problems securing a contract with a smelter that can deal with the chromite in the concentrates and recover rhodium and iridium. The company planned to resume development in 2005 and production when a favorable smelting agreement is reached.

### **Legislation and Government Programs**

Early in the year, Canyon Resources Corp. funded an initiative campaign to legalize open pit, heap-leach gold mines. The initiative (I-147) qualified for the November general election ballot, but was defeated.

The Montana Department of Environmental Quality (DEQ) and the Bureau of Land Management released their supplemental environmental impact statement on the Golden Sunlight Mine Pit Reclamation (Montana Department of Environmental Quality and U.S. Bureau of Land Management, 2004§). The document recommended against the backfill of the pit based on potential damage to the environment. It remains to be seen how this recommendation will affect the lawsuit against the DEQ by environmental groups during the permitting of the major mine expansion in 1998.

The MBMG studied mining, minerals, ground water, and geology. Geologic mapping continued with Federal matching funding from the STATEMAP program, a component of the USGS National Cooperative Geologic Mapping Program (NCGMP). Under the STATEMAP program, 4 quadrangles (1:100,000) were released in digital form, which completed most of the 94 quadrangles. A total of 51 open-file reports, which ranged from geologic maps to the origin of sapphires; 1 pamphlet; 2 reports of investigation; 1 miscellaneous contribution; and 2 special publications were produced during the biennial funding period. These documents may be ordered through the MBMG Web site at URL <http://www.mbmgt.mtech.edu/>.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2002		2003		2004	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, bentonite	181	14,900	181	14,900	102	8,400
Gemstones	NA	424	NA	707	NA	653
Palladium <sup>3</sup> kilograms	14,800	162,000	14,000	91,400	13,700	102,000
Platinum <sup>3</sup> do.	4,390	76,500	4,170	93,100	4,040	110,000
Sand and gravel, construction	16,700	76,000	15,200	74,200	14,400	80,000
Stone:						
Crushed	2,370	10,000	3,060	12,200	4,090	17,500
Dimension	12	2,620	14	2,590	14	2,550
Combined values of cement [masonry (2002-03), portland], clays (common), copper (2003-04), garnet [industrial (2002)], gold, lead, lime, molybdenum concentrates (2003-04), peat, silver, talc (crude), zinc	XX	129,000	XX	205,000	XX	303,000
Total	XX	471,000	XX	494,000	XX	624,000

NA Not available. 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.

<sup>3</sup>Recoverable content of ores, etc.

TABLE 2  
MONTANA: CRUSHED STONE SOLD OR USED, BY KIND<sup>1</sup>

Kind	2002				2003				2004			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	5	1,400	\$6,270 <sup>r</sup>	\$4.47	7	2,430	\$9,900	\$4.07	8	2,960	\$13,600	\$4.61
Marble	--	--	--	--	--	--	--	--	2	W	W	2.97
Granite	3	W	W	3.64	3	W	W	3.75	3	W	W	3.75
Sandstone and quartzite	3	W	W	3.64	2	43	150	3.49	2	44	153	3.48
Traprock	2	W	W	4.09	1	W	W	3.86	2	W	W	3.88
Volcanic cinder and scoria	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	1	W	W	3.15	1	W	W	3.14
Miscellaneous stone	8 <sup>r</sup>	126 <sup>r</sup>	496 <sup>r</sup>	3.94 <sup>r</sup>	5	74	272	3.68	4	133	485	3.65
Total or average	XX	2,370	10,000	4.23	XX	3,060	12,200	3.99	XX	4,090	17,500	4.27

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Total or average." XX Not applicable. -- Zero.

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

TABLE 3a

MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Construction:</b>			
Concrete aggregate (+1½ inch), riprap and jetty stone	W	W	\$6.65
<b>Coarse aggregate graded:</b>			
Concrete aggregate coarse	(2)	(2)	2.81
Bituminous surface-treatment aggregate	(2)	(2)	3.75
Railroad ballast	(2)	(2)	3.86
Total or average	241	\$917	3.80
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	(2)	(2)	4.13
Unpaved road surfacing	(2)	(2)	3.73
Total or average	267	1,000	3.76
Other construction materials	20	92	4.60
<b>Agricultural:</b>			
Agricultural limestone	(2)	(2)	3.37
Poultry grit and mineral food	(2)	(2)	20.88
Total or average	17	239	14.06
<b>Chemical and metallurgical:</b>			
Cement manufacture	(2)	(2)	2.97
Lime manufacture	(2)	(2)	6.03
Sulfur oxide removal	(2)	(2)	2.47
Total or average	1,140	4,950	4.34
Special, mine dusting or acid water treatment	W	W	14.49
<b>Unspecified:<sup>3</sup></b>			
Reported	91	292	3.21
Estimated	1,300	4,600	3.64
Total or average	1,360	4,900	3.61
Grand total or average	3,060	12,200	3.99

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

<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>Withheld to avoid disclosing company proprietary data, included in "Total or average."

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



TABLE 3b  
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Construction:</b>			
Concrete aggregate (+1½ inch), riprap and jetty stone	W	W	\$9.80
Coarse aggregate graded, concrete aggregate coarse	W	W	3.67
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	(2)	(2)	4.93
Unpaved road surfacing	(2)	(2)	3.75
Crusher run or fill or waste	(2)	(2)	3.45
Other coarse and fine aggregates	127	\$418	3.29
Total or average	308	1,130	3.68
Other construction materials	1	6	6.00
Agricultural, poultry grit and mineral food	W	W	17.34
<b>Chemical and metallurgical:</b>			
Cement manufacture	(2)	(2)	2.96
Lime manufacture	(2)	(2)	9.00
Sulfur oxide removal	(2)	(2)	2.36
Total or average	1,730	8,940	5.16
Special, mine dusting or acid water treatment	W	W	39.52
<b>Unspecified:<sup>3</sup></b>			
Reported	602	1,880	3.12
Estimated	1,400	5,100	3.67
Total or average	1,980	6,930	3.50
Grand total or average	4,090	17,500	4.27

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

<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>Withheld to avoid disclosing company propriety data, included in "Total or average."

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

TABLE 4a

MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
<b>Construction:</b>				
Coarse aggregate (+1½ inch) <sup>2</sup>	W	W	W	W
Coarse aggregate, graded <sup>3</sup>	W	W	W	W
Coarse and fine aggregates <sup>4</sup>	W	W	W	W
Other construction materials	10	40	10	52
Agricultural <sup>5</sup>	W	W	W	W
Chemical and metallurgical <sup>6</sup>	W	W	W	W
Special <sup>7</sup>	W	W	W	W
<b>Unspecified:<sup>8</sup></b>				
Reported	6	22	86	269
Estimated	1,100	4,200	120	450
<b>Total</b>	<b>2,260</b>	<b>8,970</b>	<b>799</b>	<b>3,230</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>Includes riprap and jetty stone.<sup>3</sup>Includes concrete aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.<sup>4</sup>Includes graded road base or subbase and unpaved road surfacing.<sup>5</sup>Includes agricultural limestone and poultry grit and mineral food.<sup>6</sup>Includes cement and lime manufacture and sulfur oxide removal.<sup>7</sup>Includes mine dusting or acid water treatment.<sup>8</sup>Reported and estimated production without a breakdown by end use.

TABLE 4b

MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
<b>Construction:</b>				
Coarse aggregate (+1½ inch) <sup>2</sup>	W	W	W	W
Coarse aggregate, graded <sup>3</sup>	W	W	W	W
Coarse and fine aggregates <sup>4</sup>	W	W	W	W
Other construction materials	--	--	1	6
Agricultural <sup>5</sup>	--	--	W	W
Chemical and metallurgical <sup>6</sup>	W	W	W	W
Special <sup>7</sup>	--	--	W	W
<b>Unspecified:<sup>8</sup></b>				
Reported	475	1,410	127	463
Estimated	1,400	5,100	--	--
<b>Total</b>	<b>2,840</b>	<b>12,900</b>	<b>1,240</b>	<b>4,550</b>

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

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.<sup>2</sup>Includes riprap and jetty stone.<sup>3</sup>Includes concrete aggregate (coarse).<sup>4</sup>Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.<sup>5</sup>Includes poultry grit and mineral food.<sup>6</sup>Includes cement and lime manufacture and sulfur oxide removal.<sup>7</sup>Includes mine dusting or acid water treatment.<sup>8</sup>Reported and estimated production without a breakdown by end use.

TABLE 5a  
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate and concrete products <sup>2</sup>	1,120	\$7,370	\$6.57
Asphaltic concrete aggregates and other bituminous mixtures	1,460	9,190	6.28
Road base and coverings <sup>3</sup>	3,980	17,900	4.51
Fill	624	2,930	4.70
Snow and ice control	104	489	4.72
Railroad ballast	182	824	4.53
Other miscellaneous uses	94	983	10.46
Unspecified: <sup>4</sup>			
Reported	3,550	16,300	4.59
Estimated	4,100	18,000	4.39
Total or average	15,200	74,200	4.86

<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 plaster and gunite sands.

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

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

TABLE 5b  
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	1,160	\$8,040	\$6.93
Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup>	13	57	4.50
Asphaltic concrete aggregates and other bituminous mixtures	1,010	14,100	13.98
Road base and coverings	3,110	15,400	4.96
Fill	707	3,170	4.49
Snow and ice control	61	382	6.26
Other miscellaneous uses <sup>3</sup>	428	2,210	5.16
Unspecified: <sup>4</sup>			
Reported	3,090	14,400	4.67
Estimated	4,800	22,000	4.64
Total or average	14,400	80,000	5.57

<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 plaster and gunite sands.

<sup>3</sup>Includes railroad ballast.

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

TABLE 6a  
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products <sup>2</sup>	613	4,050	509	3,320	--	--
Asphaltic concrete aggregates and other bituminous mixtures	946	6,140	185	1,130	332	1,930
Road base and coverings <sup>3</sup>	2,360	11,100	1,330	5,250	284	1,560
Fill	W	W	W	W	11	58
Railroad ballast	182	824	--	--	--	--
Other miscellaneous uses <sup>4</sup>	733	4,150	78	195	--	--
Unspecified: <sup>5</sup>						
Reported	635	3,020	1,670	7,530	1,250	5,760
Estimated	3,200	14,000	960	4,300	--	--
Total	8,640	43,200	4,730	21,700	1,870	9,310

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 snow and ice control.

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

TABLE 6b  
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products <sup>2</sup>	754	5,920	419	2,170	--	--
Asphaltic concrete aggregates and other bituminous mixtures	509	8,840	159	943	339	4,310
Road base and coverings	1,740	8,830	974	4,340	394	2,230
Fill	568	2,780	65	145	74	245
Other miscellaneous uses <sup>3</sup>	473	2,540	15	48	(4)	1
Unspecified: <sup>5</sup>						
Reported	1,240	5,800	1,840	8,620	7	13
Estimated	3,800	18,000	1,000	4,700	--	--
Total	9,040	52,200	4,510	21,000	814	6,800

-- 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 railroad ballast and snow and ice control.

<sup>4</sup>Less than ½ unit.

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