

# THE MINERAL INDUSTRY OF COLORADO

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

In 1998, the preliminary estimated value<sup>1</sup> of nonfuel mineral production for Colorado was \$604 million, according to the U.S. Geological Survey (USGS). This was about a 15% increase from that of 1997,<sup>2</sup> following a 2.1% increase from 1996 to 1997. The State climbed in rank to 23d from 26th among the 50 States in total nonfuel mineral production value, of which Colorado accounted for 1.5% of the U.S. total.

About 66% of Colorado's nonfuel mineral production value came from industrial minerals, especially construction sand and gravel, portland cement, and crushed stone, in descending order of value. Most of the State's remaining nonfuel mineral value resulted from the production of molybdenum, gold, and zinc (descending order of value). In 1998, significant increases in the values of molybdenum, construction sand and gravel, and crushed stone, in descending order of change, plus a moderate increase in portland cement far outweighed moderate and small decreases in the values of gold and zinc, respectively. Most other nonfuel minerals increased in value except silver, lead, and grade-A helium, which showed small decreases, and peat, which remained the same. In 1997, increases in the values of molybdenum, construction sand and gravel, and zinc more than balanced out decreases in gold and crushed stone, resulting in the State's overall rise in value.

Compared with USGS estimates of the quantities produced in the other 49 States during 1998, Colorado remained fifth<sup>2</sup> in lead and sixth in zinc. While the State rose to 7th from 8th in gold, to 8th from 11th in construction sand and gravel, and up to 8th in gemstones (by value), it dropped from 1st to 2d in molybdenum.

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on 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 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, 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 <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 <http://minerals.usgs.gov/minerals>; facsimile copies may be obtained from MINES FaxBack.

<sup>2</sup>Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The following narrative information was provided by the Colorado Geological Survey.<sup>3</sup> The precious metal industry in Colorado produced about 7,430 kilograms (kg) of gold and 12,800 kg of silver in 1997. Production in 1998 will improve slightly to approximately 7,710 kg of gold and an estimated 12,800 kg of silver. Recorded gold production comes from the Cresson Mine in the Cripple Creek district and the Black Cloud Mine in the Leadville district.

Pikes Peak Mining Co. and Golden Cycle Gold Corp. have formed a joint venture called Cripple Creek & Victor Gold Mining Co. It operates the Cresson Mine, which had total proven and probable reserves of 66 million metric tons at a grade of 1 gram of gold per metric ton when it began production in February 1995. Gold production for the Cresson Mine in 1998 was approximately 7,400 kg of gold and 1,500 kg of silver. The value of gold produced at the Cresson Mine based upon \$294 per ounce of gold is estimated at \$70 million.

In 1998, Cripple Creek & Victor Gold received permission from the Division of Minerals and Geology, the State mining regulatory agency, to expand the size of the existing open pit, dig two additional pits, and enlarge its existing cyanide heap leach pad. The expansion will guarantee ore reserves through 2006.

Because of an increase in the price of silver earlier this year, Sunshine Mining Co. of Boise, ID, is reevaluating its Revenue-Virginus Mine in Ouray County. The Revenue Virginus is estimated to contain about 190 tons of silver with an inferred resource of approximately the same amount.

Base metal production in Colorado, excluding molybdenum, is minor. ASARCO Incorporated produced 800 tons per day of copper-lead-zinc-silver-gold ore from its Black Cloud Mine at Leadville, Lake County. In December 1998, Asarco announced that it would be shutting down production at the Black Cloud Mine, the last producing mine in the Leadville district, ending a 140-year colorful mining history in this part of Colorado. Low commodity prices and exhaustion of reserves at the mine prompted the decision to shut down. In January 1999, over 100 highly paid mine and mill workers were laid off. Asarco continued exploration and maintenance activities at the mine with a much-reduced staff of about 20 people.

The Henderson Mine in Clear Creek County is the Nation's top producer of primary molybdenum ore. In 1998, the mine produced an estimated 16,000 tons of molybdenum concentrate from about 6 million tons of ore, down about 900 tons from that of 1997. The November 1998 price for molybdenum concentrate was \$1.55 per pound (Platt's Metal Week). Prices for molybdenum concentrate have slid 50% from the July price of \$3.10. The Henderson Mine and mill

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<sup>3</sup>James A. Cappa, Chief, Minerals and Mineral Fuels, at the Colorado Geological Survey, authored the text of mineral industry information submitted by that agency.

employ 460 to 470 people with an annual average salary of \$50,000, according to Cyprus Amax Minerals Co.

The Henderson Mine is on track for the year 2000 completion of its "Henderson 2000" modernization program, which includes replacement of the underground train system by a 16-kilometer underground conveyor belt; ore crushing facilities will be moved from the surface at the mill to an underground site at the mine.

American Soda Co. of Glenwood Springs announced plans for a solution-mining venture in order to produce sodium carbonate (soda ash) and sodium bicarbonate from the bedded nahcolite deposits in the Piceance Creek Basin of northwest Colorado. The nearby White River Nahcolite solution mine produces sodium bicarbonate (baking soda) from the same nahcolite deposits.

The remaining \$8 million debt on the Yule Marble Quarry near Marble, Gunnison County, famous for its high quality

white marble used at the Tomb of the Unknown Soldier in Arlington, VA, and the Lincoln Memorial in Washington, DC, was sold to a private citizen in England. Sales have increased under the guidance of the new management.

Calais Resources of Vancouver purchased the assets of Hendricks Mining Co., which include the Cross Mine and other properties in the Caribou mining district of Boulder County. Recent drilling in the Caribou district has indicated a new gold and silver resource area.

Holman Inc. announced that it is planning a \$200 million expansion to its existing cement plant near Florence, CO. The proposed expansion will double the facility's capacity to about 1.5 million tons. Colorado's strong economy and continued growth in residential and commercial construction were the major factors in the expansion decision.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	1	19	--	--	--	--
Common	317	2,320	258	1,970	264	2,010
Kaolin	6	W	--	--	--	--
Gemstones	NA	754	NA	254	NA	770
Lime	W	W	30	1,850	41	2,350
Sand and gravel: Construction	31,600	133,000	32,100	142,000	37,700	172,000
Silver 3/ metric tons	7	1,240	W	W	W	W
Stone:						
Crushed	9,940	64,900	9,720	60,800	12,000	78,900
Dimension metric tons	23,900	3,330	10,800	3,250	12,500	3,310
Combined values of cement, gold, gypsum (crude), helium (Grade-A), lead, molybdenum, peat, sand and gravel (industrial), zinc, and values indicated by symbol W	XX	308,000	XX	313,000	XX	345,000
Total	XX	513,000	XX	524,000	XX	604,000

p/ Preliminary. 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 three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

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

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	8	2,840	\$15,200	\$5.35	6	1,790	\$11,100	\$6.22
Granite	9	5,590	39,500	7.07	6	5,710	38,000	6.66
Sandstone	7 r/	W	W	7.84	5	397	2,900	7.30
Traprock	1	W	W	3.63	1	W	W	3.72
Quartzite	1	W	W	6.75	1	W	W	6.50
Volcanic cinder and scoria	2 r/	W	W	7.08	2	W	W	7.18
Miscellaneous stone	1 r/	W	W	6.29	3	1,440	7,180	5.00
Total	XX	9,940	64,900	6.54	XX	9,720	60,800	6.26

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

1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 3  
 COLORADO: CRUSHED STONE SOLD OR USED BY PRODUCERS  
 IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Coarse aggregate (+1 1/2 inch):</b>			
Riprap and jetty stone	204	\$1,190	\$5.85
Other coarse aggregate 3/	20	130	6.50
<b>Coarse aggregate, graded:</b>			
Concrete aggregate, coarse	1,120	7,920	7.06
Bituminous aggregate, coarse	645	3,910	6.06
Other graded coarse aggregate 4/	194	1,040	5.35
<b>Fine aggregate (-3/8 inch):</b>			
Stone sand, bituminous mix or seal	733	2,190	2.99
Other fine aggregate 5/	120	645	5.38
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	782	2,850	3.65
Unpaved road surfacing	19	72	3.79
Terrazzo and exposed aggregate	42	298	7.10
Crusher run or fill or waste	625	907	1.45
Other construction materials 6/	380	2,140	5.62
<b>Agricultural:</b>			
Agricultural limestone	W	W	27.58
Poultry grit and mineral food	W	W	12.88
Chemical and metallurgical: Cement manufacture	837	4,850	5.79
<b>Special:</b>			
Mine dusting or acid water treatment	W	W	27.56
Other fillers or extenders	W	W	28.70
Other miscellaneous uses: Other specified uses not listed	W	W	22.78
<b>Unspecified: 7/</b>			
Actual	2,950	25,200	8.53
Estimated	1,030	7,170	6.95
<b>Total</b>	<b>9,720</b>	<b>60,800</b>	<b>6.26</b>

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

1/ Includes granite, limestone, miscellaneous stone, quartzite, sandstone, traprock, and volcanic cinder and scoria.

2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

3/ Includes filter stone.

4/ Includes bituminous surface treatment aggregate and railroad ballast.

5/ Includes stone sand (concrete) and screening (undesignated).

6/ Includes other coarse and fine aggregates.

7/ Includes reported and estimated production without a breakdown by end use.

TABLE 4  
 COLORADO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>Construction aggregates:</b>						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	78	489
Coarse aggregate, graded 4/	--	--	--	--	W	W
Fine aggregate (-3/8 inch) 5/	W	W	(6/)	(6/)	W	W
Coarse and fine aggregate 7/	W	W	--	--	W	W
Other construction materials	24	158	--	--	3,510	15,500
Agricultural 8/	--	--	--	--	--	--
Chemical and metallurgical 9/	--	--	(6/)	(6/)	(6/)	(6/)
Special 10/	--	--	--	--	--	--
Other miscellaneous use	--	--	--	--	--	--
Unspecified: 11/						
Actual	--	--	--	--	(6/)	(6/)
Estimated	--	--	43	710	236	1,520
Total	24	159	142	1,060	6,600	41,200
Use	District 5		District 6		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>Construction aggregates:</b>						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	--	--
Coarse aggregate, graded 4/	W	W	--	--	--	--
Fine aggregate (-3/8 inch) 5/	W	W	--	--	--	--
Coarse and fine aggregate 7/	W	W	(6/)	(6/)	--	--
Other construction materials	1,180	18	--	--	--	--
Agricultural 8/	(6/)	(6/)	--	--	--	--
Chemical and metallurgical 9/	--	--	--	--	--	--
Special 10/	(6/)	(6/)	--	--	--	--
Other miscellaneous use	(6/)	(6/)	--	--	--	--
Unspecified: 11/						
Actual	(6/)	(6/)	(6/)	(6/)	50	338
Estimated	342	2,290	(6/)	(6/)	--	--
Total	2,450	15,100	459	2,950	50	338

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

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ No production for District 3.

3/ Includes riprap and jetty stone and other coarse aggregate.

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

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

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

7/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and crusher run (select material or fill).

8/ Includes agricultural limestone, poultry grit, and mineral food.

9/ Includes cement and lime manufacture.

10/ Includes mine dusting or acid water treatment and other fillers or extenders.

11/ Includes reported and estimated production without a breakdown by end use.

TABLE 5  
 COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,  
 BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,310	\$20,900	\$4.85
Plaster and gunite sands	86	917	10.66
Concrete products (blocks, bricks, pipe, decorative, etc.)	80	431	5.39
Asphaltic concrete aggregates and other bituminous mixtures	1,610	8,130	5.06
Road base and coverings 2/	4,530	17,400	3.85
Fill	1,050	2,750	2.61
Snow and ice control	46	302	6.57
Other miscellaneous uses 3/	109	550	5.05
Unspecified: 4/			
Actual	12,100	53,900	4.46
Estimated	8,150	36,900	4.53
Total or average	32,100	142,000	4.43

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.

2/ Includes road and other stabilization (cement and lime).

3/ Includes filtration and railroad ballast.

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

TABLE 6  
 COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,  
 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 and concrete products 2/	482	2,840	1,540	6,940	51	179
Asphaltic concrete aggregates and road base materials 3/	2,480	8,890	1,920	7,070	578	1,850
Other miscellaneous uses 4/	W	W	31	185	--	--
Unspecified: 5/						
Actual	W	W	2,040	8,330	135	1,040
Estimated	2,370	13,200	1,020	4,070	23	58
Total	7,920	36,000	6,550	26,600	788	3,120
Use	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,690	9,570	618	1,980	95	731
Asphaltic concrete aggregates and road base materials 3/	869	4,520	300	931	1,030	5,360
Other miscellaneous uses 4/	6	37	W	W	W	W
Unspecified: 5/						
Actual	5,320	23,700	W	W	W	W
Estimated	2,440	9,480	858	3,880	1,440	6,170
Total	10,300	47,300	3,670	16,000	2,830	13,100

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

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.

4/ Includes filtration and railroad ballast.

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