

# 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 1997, Colorado climbed in rank to 24th from 25th among the 50 States in total nonfuel mineral production value,<sup>1</sup> according to the U.S. Geological Survey (USGS). The estimated value for 1997 was \$536 million, about a 4.5% increase from that of 1996. This followed a 10% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for nearly 1.5% of the U.S. total nonfuel mineral production value.

About 69% 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. In 1997, a significant decrease in the production and value of gold was more than balanced out by the increases that occurred for zinc (up more than \$13 million), construction sand and gravel, portland cement, and crushed stone. A \$27 million decrease in the value of gold was the largest single decrease in the State's nonfuel mineral value in 1997; production was down 20%. All other nonfuel minerals increased in value except common clays, silver, lead, and peat, all of which slightly decreased. Bentonite and kaolin values remained the same.

In 1996, a \$31 million increase in the value of gold, and smaller increases in crushed stone and portland cement, were mitigated by a significant decrease in the value of molybdenum together with smaller decreases for construction sand and gravel and zinc. A 54% decrease in molybdenum was the largest single decrease in nonfuel mineral value in 1996, resulting in the State's overall drop in value. The overall drop in value occurred because of average to relatively low prices for molybdenic oxide throughout the year.

Compared with USGS estimates of the quantities produced in the other 49 States during 1997, Colorado remained second in molybdenum, fifth in grade-A helium, and sixth in zinc. The State was 8th of 13 gold-producing States, rose to 7th in gemstones (by value), and dropped from 10th to 11th in construction sand and gravel. Additionally, substantial quantities

<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 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some 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. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at <http://minerals.er.usgs.gov/minerals/contacts/comdir.html>. All Mineral Industry Surveys – mineral commodity, State, and country – also may be retrieved by way of MINES FaxBack or over the Internet at <http://minerals.er.usgs.gov/minerals/>.

of portland cement and dimension stone were produced in the State.

The following narrative information was provided by the Colorado Geological Survey<sup>2</sup> (CGS). The precious metals industry in Colorado set a modern era (post-World War II) production record in 1996 of approximately 7,650 kilograms of gold and 9,700 kilograms of silver. Production estimates for 1997 showed a decline to 6,310 kilograms of gold because of the closure of Battle Mountain Gold Co.'s San Luis Gold Mine in San Luis, Costilla County, and the partial closure of ASARCO Incorporated's Black Cloud Mine in Leadville, Lake County.

In mineral exploration activities, Pikes Peak Mining Co. had continuing success with its aggressive precious metals exploration and development program in the Cripple Creek District, Teller County. Mineral exploration drilling continued in eastern Colorado for titanium resources in the Fox Hills Sandstone. Uranium exploration drilling was conducted near the Schwartzwalder Mine north of Golden and in western Colorado.

According to Pikes Peak Mining and the CGS, the Pikes Peak's Cresson Mine began production in February 1995. The mine had total proven and probable reserves of more than 66 million metric tons at a grade of 1.03 grams of gold per ton. In early 1997, mine management forecasted 1997 production of approximately 6,130 kilograms of gold and 840 kilograms of silver. The Cresson Mine employed about 275 persons in 1996 and 1997. Operating (cash) costs at the Cresson Mine are \$197 per ounce of gold.

Base metal production in Colorado, excluding molybdenum, is minor. Asarco produced 816 tons per day of copper-lead-zinc-silver-gold ore from its Black Cloud Mine. The mine was reopened in March 1997 after a closure of about 6 months owing to a primary ball mill failure. Approximately 200 employees currently work at the mine and mill.

Cyprus Amax Mineral Co.'s Henderson Mine in Clear Creek County is the Nation's top producer of primary molybdenic oxide. In 1997, an estimated 32 million pounds of molybdenic oxide was produced at the mine and mill from about 6.35 million tons of ore, about the same as that of 1996. According to the company, the average realization per pound of molybdenic oxide in 1997 was \$5.59, which equals an estimated \$179 million production value. Given stable economic conditions, the production forecast for 1998 was projected to again be 32 million pounds. Cyprus Amax reported that the Henderson Mine and mill employs 460 to 470 people with an annual average salary of \$50,000.

The Henderson Mine has begun a modernization program called "Henderson 2000." At present, ore is hauled by an underground train system through a 15.3-kilometer tunnel under the Continental Divide to the mill site. "Henderson 2000" includes

<sup>2</sup>James A. Cappa, Chief, Minerals and Mineral Fuels, authored the text of mineral industry information provided by the Colorado Geological Survey.

replacement of the train system by a 16-kilometer underground conveyor belt system; ore crushing facilities will be moved from the surface at the mill to an underground site at the mine.

The aggregate industries did well in the Front Range metropolitan area from Colorado Springs to Fort Collins and in selected areas of western Colorado. The expected production of aggregate in 1997 was about 42.6 million metric tons, up 2.5% from the 1996 level of 41.5 million tons (*table 1*). The value of 1997 production was estimated at \$209 million. Residential, school, and commercial construction and highway improvements were expected to result in continued increases in aggregate production.

Colorado Diamond Co., a subsidiary of Redaurum Red Lakes Mines Ltd. of Toronto, continued mining at its Kelsey Lake kimberlite prospect in the State Line District of Larimer County. The Kelsey Lake Mine is North America's only commercial diamond producer. Mine development has been based on a

company reserve estimate of 16.9 million tons of ore, enough to last for 12 years of mining at the current rate. In April 1997, Redaurum acquired the Maxwell kimberlite about a mile west of the Kelsey Lake Mine. A bulk sampling program will be implemented to evaluate this prospect, probably starting in the first half of 1998.

The Kelsey Lake Mine continued production of exceptional gem-quality diamonds. In July 1997, two stones weighing 28.2 and 16.3 carats were recovered. Other exceptional stones included a 14.2 carat white diamond recovered during bulk sample testing in 1994 and a 28.3 carat yellow diamond unearthed in 1996. Redaurum expects the mine to produce about 25,000 carats in 1997. Plant upgrades were in progress to increase production. The usual percentage of gem-quality stone production at worldwide diamond mines is about 20% to 30%. To date about 65% of the recovered diamonds at Kelsey Lake have been gem quality.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN COLORADO 1/ 2/  
(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>Clays:</b>						
Bentonite	(3/)	9	1	19	1	19
Common	288	2,040	317	2,320	283	1,860
Kaolin	6	W	6	W	6	W
Gemstones	NA	245	NA	754	NA	W
Sand and gravel: Construction	34,100	141,000	31,600	133,000	32,400	139,000
Silver 4/ metric tons	W	W	7	1,240	W	W
<b>Stone:</b>						
Crushed	9,000	58,500	9,940	64,900	10,200	70,000
Dimension metric tons	17,800	2,640	23,900	3,330	24,000	3,350
Combined value of cement, gold, gypsum (crude), helium (Grade-A), lead, lime, molybdenum, peat, sand and gravel (industrial), zinc, and values indicated by symbol W	XX	366,000	XX	308,000	XX	322,000
Total	XX	570,000	XX	513,000	XX	536,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" 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/ Less than 1/2 unit.

4/ Recoverable content of ores, etc.

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

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	8	2,600	\$15,300	\$5.88	8	2,840	\$15,200	\$5.35
Granite	9	5,040	33,500	6.65	9	5,590	39,500	7.07
Sandstone	7	696	7,150	10.27	6	W	W	W
Traprock	1	W	W	3.54	1	204	W	W
Quartzite	1	W	W	5.80	1	W	W	6.54
Volcanic cinder and scoria	1	W	W	7.34 r/	1	W	W	7.53
Miscellaneous stone	2	W	W	6.68	3	W	W	6.29
Total	XX	9,000	58,500	6.50	XX	9,940	64,900	6.54

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 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	465	\$3,070	\$6.60
Filter stone	2	9	4.50
Coarse aggregate, graded:			
Concrete aggregate, coarse	653	4,700	7.20
Bituminous aggregate, coarse	542	3,550	6.54
Bituminous surface treatment aggregate	18	67	3.72
Fine aggregate (-3/8 inch); stone sand, bituminous mix or seal 4/	598	2,030	3.39
Coarse and fine aggregates:			
Graded road base or subbase	532	2,810	5.28
Unpaved road surfacing	100	760	7.60
Terrazzo and exposed aggregate	W	W	7.41
Crusher run or fill or waste	378	722	1.91
Agricultural; poultry grit and mineral food	W	W	7.18
Chemical and metallurgical; cement manufacture	1,170	5,330	4.57
Unspecified: 5/			
Actual	3,320	27,200	8.19
Estimated	1,960	13,300	6.76
Total	9,940	64,900	6.54

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

1/ To avoid disclosing company proprietary data; "District tables were not produced for 1996."

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

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

4/ Includes stone sand (concrete).

5/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 4  
 COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,  
 BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	6,670	\$33,800	\$5.07
Plaster and guniting sands	64	427	6.67
Concrete products (blocks, bricks, pipe, decorative, etc.)	277	1,770	6.40
Asphaltic concrete aggregates and other bituminous mixtures	2,840	12,900	4.54
Road base and coverings 2/	5,920	23,200	3.93
Fill	2,880	8,330	2.89
Snow and ice control	169	1,310	7.76
Other miscellaneous uses 3/	3,670	14,500	3.94
Unspecified: 4/			
Actual	1,890	7,850	4.15
Estimated	7,240	28,500	3.93
Total or average	31,600	133,000	4.19

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

2/ Includes road and other stabilization (cement).

3/ Includes filtration and railroad ballast.

4/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 5  
 COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,  
 BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	786	5,520	758	3,780
Asphaltic concrete aggregates and road base materials 3/	3,610	14,800	2,210	7,900
Other miscellaneous uses 4/	891	3,380	(5/)	(5/)
Unspecified: 6/				
Actual	1,270	5,650	(5/)	(5/)
Estimated	675	2,070	963	3,560
Total	7,240	31,400	5,720	22,400
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	135	753	3,550	17,700
Asphaltic concrete aggregates and road base materials 3/	509	1,410	3,180	11,500
Other miscellaneous uses 4/	--	--	689	2,720
Unspecified: 6/				
Actual	--	--	188	562
Estimated	140	247	3,530	14,600
Total	785	2,410	11,100	47,000
	District 5		District 6	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,490	6,760	287	1,510
Asphaltic concrete aggregates and road base materials 3/	1,340	4,950	949	5,280
Other miscellaneous uses 4/	483	1,930	(5/)	(5/)
Unspecified: 6/				
Actual	171	745	(5/)	(5/)
Estimated	1,160	4,830	773	3,170
Total	4,650	19,200	2,090	10,100

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

2/ Includes plaster and gunite sands.

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

4/ Includes filtration and railroad ballast.

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

6/ Includes production reported without a breakdown by end use and estimates for nonrespondents.