

# THE MINERAL INDUSTRY OF WYOMING

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

In 1998, the preliminary estimated value<sup>1</sup> of nonfuel mineral production for Wyoming was \$1.06 billion, according to the U.S. Geological Survey (USGS). This was about a 5% decrease from that of 1997,<sup>2</sup> and followed a 3.7% increase from 1996 to 1997. The State ranked 13th (12th in 1997) among the 50 States in total nonfuel mineral production value, of which Wyoming accounted for more than 2.5% of the U.S. total.

Wyoming's leading nonfuel mineral, by value, was soda ash, followed by bentonite, grade-A helium, and portland cement. In 1998, decreases in the values of soda ash and bentonite (descending order of change) accounted for nearly all of the State's drop in value (table 1). Crushed stone, construction sand and gravel, grade-A helium, and portland cement showed small to moderate gains; all other mineral commodities slightly increased or remained unchanged. In 1997, substantial increases in the values of bentonite and grade-A helium accounted for most of Wyoming's increase in value. Only lime and to a lesser extent soda ash and construction sand and gravel showed any significant decreases for the year.

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1998, Wyoming remained first<sup>2</sup> in soda ash and bentonite (descending order of value), second in grade-A helium, and fifth in zeolites. Soda ash (sodium carbonate) is an inorganic chemical extensively used in the manufacture of glass, paper, soap and detergents, textiles, and as sodium bicarbonate in food products. The United States is the world's largest producer of soda ash. Wyoming, one of only two producing States, is home to the world's largest known natural deposit of trona. Trona is the principal ore from which soda ash is refined. California produces a significantly smaller quantity of natural soda ash. Wyoming has not had significant metal production since iron ore mining ceased in April 1984.

<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 Wyoming State Geological Survey (WSGS) provided the following narrative information.<sup>3</sup> The WSGS reported that 1998 was a very active year for the State's minerals industry and the WSGS in regard to industrial minerals, especially diamonds and other precious stones, and in the exploration for gold.

## Industrial Minerals

Based on WSGS surveys and estimates, bentonite production continued at record levels in 1998. Expanding markets for most uses of bentonite contributed to this increase, especially the growing market for kitty litter.

Trona production was down in 1998 from the record production of 1997. This decline was due mainly to smaller orders for soda ash from the far East, owing to that region's economic difficulties. A few companies that expected smaller production during the next several years postponed expansion plans.

In early 1998, interest arose with regard to the construction of a glass plant in Wyoming for the production of brown glass beer bottles. Anheuser-Busch, Inc., Budweiser Division, which operates a brewery in Wellington, CO, about 48 kilometers south of Cheyenne, WY, announced that it was seeking an increased beer bottle supply and was accepting bids for bottles. At midyear at least two major container glass manufacturers bid for the bottle contract. Wyoming was to be the preferred location for new bottle production. However, by yearend, Budweiser announced that it was extending its existing contract with Ball-Foster Glass in Oklahoma for a year while it evaluated the whole situation to include the test marketing of plastic bottles by another beer producer.

The production of chemical grade limestone in Wyoming continued to increase in 1998. Basins Electric, Inc., which operates the Laramie River coal-fired powerplant just north of Wheatland, changed its source of limestone used for emissions control from Divide Construction's Bass Quarry to Colorado Lien's Hartville Quarry. In the Hartville Quarry, 32 kilometers closer to the powerplant than the Bass Quarry, the source material is the Mississippian-Devonian Guernsey Limestone, the same unit quarried at the Bass Quarry. Exploration for additional chemical grade and aggregate quality limestone resources continued, especially near the limestone and aggregate poor Powder River Basin and the western Green River Basin.

Railroad ballast is an important construction material produced in the State at Meridian Aggregate Co.'s Granite Cañon Quarry west of Cheyenne and by Guernsey Stone at

<sup>3</sup>Ray E. Harris, Industrial Minerals and Uranium Geologist, and W. Dan Hausel, Senior Economic Geologist (Metals), both of the Wyoming State Geological Survey, coauthored the text of mineral industry information submitted by that agency.

Guernsey. The Burlington Northern Railroad was in the process of double-tracking its main lines to the coal fields, and the Dakota, Minnesota, and Eastern Railroad was planning the construction of a new line into the coal mining area. Both of these projects will require rock for base, subbase, and ballast. Several companies had of late been testing sources for these materials near the areas of construction.

Raven Quarries, which produces a black granite, Wyoming Raven, and a pink swirled granite, Fantastico, added another pink granite, called Mirage, to its product line. Mirage is quarried adjacent to the Wyoming Raven Quarry. Raven Quarries closed its Wyoming fabricating plant in 1998. It now ships all of its quarried blocks to Western Granite in Tijuana, Mexico, for processing. At yearend, one Italian company was obtaining permits to quarry dimension limestone near Horse Creek in Laramie County, and at least three other companies had acquired quarriable stone deposits. Exploration and expansion continued for dimension stone resources in the State.

U.S. Zeolites, which mined 1,360 metric tons of the zeolite clinoptilolite southeast of Bitter Creek, in Sweetwater County in 1997, was sold to Addwest Minerals International Ltd., of Denver, CO. In 1998, Addwest hauled some stockpiled ore from the mine to a facility in Utah for refining and shipping to markets. About 900 tons of clinoptilolite ore are stockpiled at the mine site.

During 1998, the Wyoming State Legislature increased the WSGS's diamond research budget to allow for geochemical analyses of kimberlitic indicator minerals, geologic mapping, diamond testing, and remote sensing in the search for potential diamondiferous host rocks. The WSGS began reconnaissance in the Bighorn Basin in northwestern part of the State and in the Laramie Mountains and Hartville uplift in eastern Wyoming. Initial reconnaissance in the Bighorn Basin recovered some rounded, pink, red (with slight purple coloration), and yellow-orange garnets. One garnet yielded an index of refraction of less than 1.760, characteristic of pyrope, although the presence of pyrope was not yet confirmed by geochemical analyses.

Sampling and mapping continued in the Iron Mountain district in the Laramie Mountains, 56 kilometers northwest of Cheyenne. Several previously unknown kimberlites were mapped by the WSGS during the 1997 and 1998 field seasons. Based on the recent mapping, four major kimberlite dike/blow complexes occur in the district—the largest has a strike length of 4 kilometers with scattered blows ranging from 10 meters to 300 meters across. Additionally, a kimberlite sill was discovered in the district; other evidence suggested other kimberlites may be found. This optimism was based on kimberlitic indicator mineral anomalies upstream from any known kimberlite, the presence of topographic lows along kimberlite trends, and the presence of extensive Tertiary conglomerates containing kimberlitic microilmenite megacrysts that cut across the known kimberlite trends, possibly concealing undiscovered kimberlites.

Geochemical analyses of kimberlitic indicator minerals from Iron Mountain suggest some intrusives originated within the diamond stability field. Both calcic (G9) and subcalcic (G10) chrome-pyropes have been recovered and a small number of eclogitic garnets also yielded favorable chemistries. The WSGS planned the testing of samples for diamonds in the

near future. During 1998, a new report on diamonds was released by the WSGS entitled, *Diamonds and Mantle Source Rocks in the Wyoming Craton, With a Discussion of Other US Occurrences* (Hausel, 1998).

The WSGS continued to accumulate information on other gemstones, semiprecious stones, ornamental stones, and lapidary materials. In addition to diamond, minerals of interest included (roughly in order of interest) jade, ruby, sapphire, aquamarine, garnet, chrome diopside and enstatite, cordierite, agate, jasper, and gold. Field investigations of lamproite in the Leucite Hills of southwestern part of the State, led to the discovery of peridot (gem-quality olivine). The olivine was found in anthills adjacent to one of the lamproites. Several thousand carats of industrial olivine with considerable transparent olive-green peridot were recovered from two anthills. Gem-quality cordierite was discovered by the WSGS in eastern Wyoming. These occur as transparent, sapphire-blue, crystal in gneiss, west of Wheatland. The cordierite occurs along with sillimanite, corundum, and kyanite.

Another deposit investigated by the WSGS was a corundum schist, known as the Red Dwarf ruby deposit near Jeffrey City in the Granite Mountains of central Wyoming. This schist has a strike length of 1,520 meters with widths up to 6 meters. The schist contains numerous, purplish-red, translucent and opaque, corundum crystals that range in size from microscopic to 5 centimeters across. From some specimens cut into cabochons, attractive, semiprecious gems have produced. Hundreds of gems and other mineral occurrences were described in another new WSGS publication: *Preliminary Report on Gemstones, Semi-precious Stones, Lapidary Materials, Ornamental Stones, and Other Unique Minerals and Rocks of Wyoming - A Collectors Guide* (Hausel and Sutherland, 1998).

## Metals Exploration

Gold continued to attract interest in Wyoming. In the South Pass greenstone belt near the southern edge of the Wind River Mountains in the western part of the State, Newmont Exploration Inc. dropped its interest in the Lewiston district at South Pass, while a second exploration company immediately picked up the property. Some claim-staking activity was also reported in the Dickie Springs-Oregon Buttes area to the south, on one of the largest auriferous paleoplacers in North America. In the same area, private prospectors reported having some success. One Wyoming prospector recovered some nuggets including a 230-gram (7.5-troy ounce) nugget. Another prospector from Colorado found more than 40 nuggets at South Pass with the use of a metal detector.

Elsewhere in the State, interest was shown for large-tonnage deposits of gold. One of these, the Rattlesnake Hills alkalic province in central Wyoming, includes 50 Tertiary intrusives that disrupt an Archean greenstone belt. Past drilling by American Copper and Nickel Co., Inc., Canyon Resources Corp., and Newmont Mining Corp. on one of the intrusives identified a large-tonnage, low-grade gold deposit with an estimated resource of 7,800 kilograms (250,000 troy ounces), which is open at depth and laterally. Recent reevaluation of the drilling data has suggested that this resource could possibly be increased to 31,000 kilograms (1,000,000 troy

ounces). At the Copper King property west of Cheyenne, evaluation of drill data by Mountain Lake Resources Inc. indicated a potential resource of more than 13,200 kilograms (425,000 troy ounces) of gold and 29,000 metric tons (63,000,000 pounds) of copper, with potential for expansion.

Some claim staking was reported for platinum-group metals (PGM) and in 1997 and 1998 there was interest in known iron and titanium deposits in the State. The PGM activity centered on Proterozoic-age, layered mafic complexes known as the Mullen Creek and Lake Owen complexes in the Medicine Bow Mountains, and the Puzzler Hill complex in the Sierra Madre Mountains of southeastern Wyoming. All three complexes have yielded highly anomalous mineralization. Other complexes of potential interest in the region include the Tony Ridge peridotite and the Laramie anorthosite-gabbro complex in the Laramie Range, and the Woods and Elkhorn

Mountain complexes in the Sierra Madre. In regard to Wyoming's iron and titanium deposits, sizable iron resources occur in the South Pass and Seminoe Mountains greenstone belts, the Copper Mountain region, and in the Hartville uplift. Large resources are also found complexed with titanium in titaniferous magnetite in the Laramie anorthosite.

## References Cited

- Hausel, W.D., 1998, Diamonds and mantle source rocks in the Wyoming Craton, with a discussion of other U.S. occurrences: Wyoming State Geological Survey Report of Investigations 53, 93 p.
- Hausel, W.D., and Sutherland, W.M., 1998, Preliminary report on gemstones, semiprecious stones, lapidary materials, ornamental stones, and other unique minerals and rocks of Wyoming—A collector's guide: Wyoming State Geological Survey Mineral Report, MR98-3, 170 p.

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

Mineral	1996		1997		1998 <sup>d/</sup>	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	3,030	98,400	3,340	140,000	3,330	132,000
Common	30	W	W	W	W	W
Gemstones	NA	11	NA	11	NA	11
Sand and gravel: Construction	3,420	14,700	3,090	12,300	3,850	15,800
Stone: Crushed	5,180	30,000	5,010	30,700	5,900	35,400
Zeolites metric tons	(3/)	NA	(3/)	NA	NA	NA
Combined values of cement (portland), gypsum (crude), helium (Grade-A), lime, soda ash, and values indicated by symbol W	XX	935,000	XX	938,000	XX	880,000
Total	XX	1,080,000	XX	1,120,000	XX	1,060,000

<sup>d/</sup> 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/ Withheld to avoid disclosing company proprietary data.

TABLE 2  
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS, 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 <sup>2/</sup>	4	1,620	\$5,330	\$3.29	5	1,500	\$6,700	\$4.47
Marble	1	91	3,230	35.44	1	104	3,280	31.53
Granite	2	W	W	6.10	2	W	W	6.30
Quartzite	4	W	W	11.59	4	W	W	11.91
Volcanic cinder and scoria	1	W	W	8.62	1	W	W	6.17
Traprock	5	W	W	3.34 <sup>r/</sup>	5	W	W	3.97
Miscellaneous stone	--	--	--	--	1	97	577	5.95
Total	XX	5,180	30,000	5.79	XX	5,010	30,700	6.13

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

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

2/ Includes "limestone-dolomite" reported with no distinction between the two.

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

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	W	W	\$9.63
Coarse aggregate, graded:			
Concrete aggregate, coarse	275	\$2,310	8.41
Bituminous surface-treatment aggregate	93	286	3.08
Railroad ballast	W	W	6.88
Fine aggregate (-3/8 inch):			
Stone sand, concrete	21	199	9.48
Stone sand, bituminous mix or seal	W	W	6.08
Coarse and fine aggregates:			
Graded road base or subbase	W	W	4.89
Terrazzo and exposed aggregate	66	1,330	20.18
Other coarse and fine aggregates	126	1,510	12.01
Other construction materials	31	87	2.81
Agricultural: Other agricultural uses	1	23	23.00
Special:			
Mine dusting or acid water treatment	8	208	26.00
Whiting or whiting substitute	2	88	44.00
Other fillers or extenders	47	1,670	35.47
Roofing granules	(3/)	1,300	W
Unspecified: 4/			
Actual	3,070	17,000	5.53
Estimated	600	2,490	4.15
Total	5,010	30,700	6.13

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

1/ Includes granite, limestone, limestone-dolomite, marble, miscellaneous stone, quartzite, traprock, and volcanic cinder and scoria.

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

3/ Less than 1/2 unit.

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

TABLE 4  
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,  
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/	--	--	W	W	--	--
Coarse aggregate, graded 3/	--	--	405	2,850	--	--
Fine aggregate (-3/8 inch) 4/	--	--	W	W	--	--
Coarse and fine aggregate 5/	W	W	576	3,970	--	--
Other construction materials 6/	--	--	W	W	--	--
Agricultural 7/	--	--	1	23	--	--
Special 8/	--	--	57	1,960	--	--
Unspecified: 9/						
Actual	--	--	2,980	16,400	97	577
Estimated	W	W	56	332	--	--
Total	653	3,450	4,260	26,700	97	577

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 riprap and jetty stone.

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

4/ Includes stone sand (concrete), stone sand (bituminous mix or seal).

5/ Includes graded road base or subbase, terrazzo and exposed aggregate, and other combined coarse and fine aggregates.

6/ Includes roofing granules.

7/ Includes other agricultural uses.

8/ Includes mine dusting or acid water treatment and other fillers or extenders, and whiting or whiting substitute.

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

TABLE 5  
WYOMING: 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 and concrete products 2/	529	\$2,750	\$5.20
Asphaltic concrete aggregates and other bituminous mixtures	294	2,140	7.28
Road base and coverings	1,050	3,600	3.44
Fill	147	498	3.39
Snow and ice control	7	35	5.00
Other miscellaneous uses	146	560	3.84
Unspecified: 3/			
Actual	655	1,860	2.84
Estimated	269	880	3.27
Total or average	3,090	12,300	3.98

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

2/ Includes plaster and gunite sands.

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

TABLE 6  
WYOMING: 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		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	280	1,730	249	1,020	--	--
Asphaltic concrete aggregates and road base materials	580	2,560	761	3,180	--	--
Fill	40	286	107	212	--	--
Other miscellaneous uses 3/	136	533	18	64	--	--
Unspecified: 4/	422	1,710	190	520	312	515
Total	1,460	6,820	1,330	5,000	312	515

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

2/ Includes plaster and gunite sands.

3/ Includes fill and snow and ice control.

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