THE MINERAL INDUSTRY OF WYOMING

This chapter has been prepared under a Memorandum of Understanding between the U.S. Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wyoming for collecting information on all nonfuel minerals.

In 1996, Wyoming ranked 14th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State ranked 13th in 1995. The estimated value for 1996 was $918 million, a 5.7% decrease from that of 1995. This followed a 10.6% increase from 1994 to 1995 (based on final 1995 data). The State accounted for about 2.5% of the U.S. total nonfuel mineral production value.

Wyoming's leading nonfuel minerals, by value, are soda ash and bentonite clays. In 1996, bentonite moderately increased in value, whereas a substantial decrease in the value of soda ash accounted for the major portion of the State's overall decrease. Most of the remaining decrease resulted from drops in the values of portland cement and construction sand and gravel. Other nonfuel minerals that increased in value included Grade-A helium and lime, while a decrease occurred for crushed stone. In 1995, the State's increased value mostly resulted from a very substantial increase in soda ash and, relative to soda ash, a small increase in construction sand and gravel. Grade-A helium value showed a moderate decrease.

Compared with USGS estimates of the quantities produced in the other 49 States during 1996, Wyoming remained first in the production of soda ash and bentonite and second in Grade-A helium. Soda ash (sodium carbonate) is an inorganic chemical extensively used in the manufacture of glass, soap and detergents, paper, textiles, and as sodium bicarbonate in food products. The United States is the world's largest soda ash-producing nation. Wyoming, one of only two producing States, is home to the world's largest known natural deposit of trona, the principal ore from which soda ash is refined. California produces a significantly smaller quantity of natural soda ash. Wyoming has not had any significant metal production since iron ore mining ceased in April 1984. A small tonnage of hand-cobbed beryllium concentrate was produced in Fremont County in 1986. In recent years, however, a modest amount of precious- and base metal exploration has been taking place.

Industrial Minerals

The following narrative information was provided by the Wyoming State Geological Survey[2] (WSGS). Bentonite production continued to increase in Wyoming. In 1996, a bentonite plant near Lovell was reopened following an 8-year closure.

In Wyoming, natural soda ash is produced from the underground mining of trona ore. Trona production in Wyoming is expected to set a new record in 1996, increasing beyond the record 16.4 million metric tons[3] mined in 1995. The South Korean company that acquired a major interest in the former Rhône-Poulenc Mine and plant in 1995 announced a major expansion in 1996. The name of the soda ash producing company became OCI Chemical Corp. FMC Wyoming Corp. completed a major expansion of its soda ash refining plant, which increased the capacity of the plant by 25%. Tg Soda Ash Inc. operations announced plans to construct a new shaft to supply its existing plant with trona. The new mine shaft would be used to mine bed 17. The current mine operates in beds 19 and 20. Solvay Minerals Inc. announced a major expansion project at its soda ash plant, which will increase its capacity to the same as FMC, which has been the largest producer in the basin. Wold Trona Co. is continuing with plans for the construction of a sixth trona mine and refining plant. Wold plans to produce a product called benetron at its plant. Benetron is an acronym for beneficiated trona and can be used in applications not requiring as high a purity as that of regular soda ash. Benetron is about 96%- to 97%-pure soda ash, with regular soda ash being 99+% pure. The U.S. Bureau of Land Management held two trona lease sales in Wyoming in 1996. A total of 10 tracts were leased for a total bonus bid of $27 million. Successful bidders included General Chemical, Solvay Minerals, Church and Dwight, and Rock Springs Realty Co., a subsidiary of Union Pacific Corp. These 10 tracts contain more than 454 million tons of minable trona.

Diamond exploration in the Wyoming craton continued throughout 1996. To date, more than 100 kimberlitic intrusives have been identified in the Colorado-Wyoming kimberlite province. Approximately 35 kimberlites occur in the State Line district to the south of the craton. More than 120,000 diamonds have been recovered from kimberlites in this district to date.

Within the district, Redaurum Ltd. began operations at its Kelsey Lake Mine in May with a mill rated at 195 tons per hour. To date, the mine has produced several

high-quality gemstone diamonds including four of the largest (6.2, 9.4, 14.2, and 28.3 carats) ever recovered in the United States. The 28.3-carat stone, a yellow gemstone the size of a thumbnail, is the fifth largest verified stone found in the United States. This mine is just across the State line in Colorado. Just over the border in Wyoming, exploration for diamonds has been taking place for a number of years because Wyoming shares some of these same and other related formations and because of the proximity of some of the Kelsey Lake Mine deposits. Aeromagnetic surveys of the district in Wyoming were planned for the first half of 1997.

Elsewhere in the district, Royal Gold announced the recovery of kimberlitic indicator minerals during a recent exploration program on Union Pacific Railroad lands. The company reported encouraging results, which suggested the presence of kimberlite and a "potential for the discovery of new diamond occurrences where kimberlites had not been previously identified." The company yielded indicator minerals in 17 of 73 stream-sediment samples.

To the north of the State Line District, other discoveries were reported as followup studies to anomalies earlier identified by the WSGS. One consultant reported finding two new kimberlites in the Sybille Canyon area north of Laramie, and a company reported the recovery of micro diamonds in sediment samples in the same region.

In November, Guardian Enterprises Ltd. announced the discovery of 10 kimberlitic diatremes and associated dikes in southwestern Wyoming. This is the first report of kimberlitic intrusives in this region; although kimberlitic indicator minerals have been known in the Cedar Mountain region for nearly two decades, and lamproites have been known to occur in the Leucite Hills to the northeast and in the Kamas, UT, region to the southwest. Guardian also reported finding three diamonds associated with the kimberlite pipes. Geochemical studies of the host rocks by the WSGS suggest possible affinity for lamproite rather than kimberlite, although the studies are continuing.

Guardian continued working in a 620-square-kilometer area in the Green River Basin. The basin includes a 2,600-square-kilometer anomaly characterized by the presence of kimberlitic indicator minerals. In a September press release, Guardian reported finding 48 alluvial diamonds from a new source other than the breccia pipes. The diamonds were reported to weigh a total of 2.3 carats and were recovered from 90 kilograms of material. Other activity in the basin was reported by Silver Sage Resources, MK Gold, Royal Gold Inc., and Primus Resources.

The production of cut and polished pieces of Wyoming Raven and Fantastico (stone) continues at Sunrise Stone's quarry and fabricating plant. Western Aggregates, of Boulder, CO, purchased decorative rock from Abbott Construction of Wheatland and from the Rawhide Ranch south of Lusk. An Italian stone producer has been exploring for decorative rock and is currently developing financing for fabricating plants for dimensional limestone and dimensional granite.

In November, Guernsey Stone, a division of Peter Kiewit Inc., purchased the property known as MS 108, about 3 kilometers north of the existing Guernsey Stone Quarry near Guernsey. Guernsey Stone quarries both construction and decorative aggregate at their quarry. MS 108 consists of multicolored dolomitic marble similar to the product from the existing quarry. The WSGS included MS 108 in its report published in 1991 entitled "Decorative Stones of Wyoming."

V. A. Resources (VA), of Casper, WY, acquired both the Plumbago Creek silica deposit in Albany County and the Cassa silica deposit in Platte County. VA constructed access roads and conducted an exploratory drilling program on the Plumbago Creek deposit in November and planned the beginning of a similar program on the Cassa deposit for December. The WSGS conducted initial exploratory drilling and mapping programs on both of these deposits in 1987 and 1988, respectively. The WSGS reports were used by VA in locating these resources and in the development of their mining plans. Additionally, adjacent to the silica sand deposit at Plumbago Creek in Albany County, VA constructed access roads and conducted exploratory drilling on a limestone resource. VA planned to begin quarrying this resource as early as late December 1996.

Mountain Cement Co.'s second kiln became operational in the spring of 1996, nearly doubling the capacity of their Laramie cement plant.

U.S. Zeolite applied for a zoning permit to construct a pilot plant at Bitter Creek, southeast of Rock Springs in Sweetwater County. This plant will process zeolites from the Fort La Clede deposit southeast of Bitter Creek.

In 1996, the WSGS hosted the 32d Annual Forum on the Geology of Industrial Minerals. This event was held in Laramie in May, with about 200 in attendance.

Metals

The Wyoming Department of Environmental Quality recently contracted Harrison-Western to reopen the drainage adit (a horizontal passage from the surface into a mine) of the historic Ferris-Haggarty Mine in the Encampment district in the Sierra Madre of southeastern

Wyoming. The reopening of the mine is designed to identify the source of cupriferous waters draining from the mine and to attempt to stop the flow of the water into Haggarty Creek. Several years ago, an Exxon Minerals sampling program in a portion of the underground workings identified significant mineralization. Samples yielded 0.10% to 21.3% copper, 1.1 parts per million to 80 grams per metric ton silver, and 75 parts per billion to 11 grams per metric ton gold. Reserves reportedly included 842,000 metric tons of ore averaging 6.5% copper containing 3,600 kilograms of gold. Of historical note, the Ferris-Haggarty Mine was a copper producer in the early 1900's. Records indicate the mine produced more than 9,500 metric tons of copper with some gold and silver from Proterozoic Age quartzite breccia along a contact with a hanging wall felsic schist. Ore shoots were reported to average 6% to 8% copper in the historic mine and to average 6 meters in thickness with swells as thick as 20 meters. High-grade ore yielded as much as 30% to 40% copper.

Mountain Lake Resources signed a letter of intent to form a joint venture with Compass Minerals for exploration and development of the Copper King gold-copper property, 29 kilometers west of Cheyenne. According to a news release, Compass Minerals identified proven and probable reserves of 23 million tons of 0.82 grams per ton gold and 0.19% copper within a larger resource. Three other prospective anomalies were identified within a 3-kilometer radius of the property.

Cominco American Inc. and BHP Minerals were reportedly exploring for massive sulfides at various localities around the State. Other activity was reported by several companies searching for Cu-Ni-Co-precious metal mineralization as a followup to the WSGS's discovery of significant mineralization in the Puzzler Hill layered complex in the Sierra Madre of southeastern Wyoming.

Exploration and property acquisition was reported by Newmont Gold in the South Pass greenstone belt. No other information was available.

Production of uranium, a fuel mineral, increased as the current producers completed their expansion projects. Wyoming was the Nation's leading producer of yellow cake in 1995 and continued to lead the Nation in 1996. Uranium continued to be mined in Wyoming by in situ methods at Cogema Inc.'s operations at the Christensen Ranch Mine in Johnson County and Power Resources operations at the Highland and Morton Ranch properties in Converse County. Other companies with mining plans for properties in Wyoming include Kennecott Uranium, for an underground mine on Green Mountain, south of Jeffrey City in Fremont County; Rio Algom, which is developing the Smith Ranch property in Converse County for in situ production; Energy Fuels Nuclear, which is investigating the Reno Ranch property in southern Campbell County for in situ development; CAMECO, which is investigating properties in the Red Desert area of Sweetwater County and the Boot Heel area of Albany County; and Power Resources, which has applied for a permit to construct an in situ mine and recovery plant in the Gas Hills in Fremont County. Near the end of the year, CAMECO purchased Power Resources from its British owners. No changes in plans have been announced for the existing Power Resources operation. Further information on uranium in Wyoming may be obtained by contacting the WSGS.

---

[1]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 1996 USGS mineral production data published in this chapter are estimates as of February 1997. 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

[2]Ray E. Harris, Industrial Minerals and Uranium Geologist, and W. Dan Hausel, Senior Economic Geologist (Metals), both of the WSGS, coauthored the text of Wyoming mineral industry information submitted by that agency.

[3]All tons are metric unless otherwise specified.

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

(Thousand metric tons and thousand dollars)

Mineral	1994 Quantity	1994 Value	1995 Quantity	1995 Value	1996 p/ Quantity	1996 p/ Value
Clays	2,530 3/	91,300 3/	2,970	89,900 3/	3,210	95,700 3/
Gemstones	NA	13	NA	11	NA	W
Sand and gravel (construction)	3,210	13,100	3,860	17,500	3,100	13,200
Stone (crushed)	5,040	29,700	4,670	27,500	4,500	26,800
Combined value of cement (portland), clays (common), gypsum (crude), helium (Grade-A), lime, soda ash, and value indicated by symbol W	XX	746,000	XX	838,000	XX	783,000
Total	XX	880,000	XX	973,000	XX	918,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Combined values." 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/ Excludes certain clays; kind and value included with "Combined value" data.

TABLE 2
WYOMING: 1/ CRUSHED STONE 2/ SOLD OR USED BY PRODUCERS IN 1995, BY USE 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	W	W	$9.33
Coarse aggregate, graded:			
Concrete aggregate, coarse	75	$615	8.20
Bituminous aggregate, coarse	24	201	8.38
Bituminous surface-treatment aggregate	W	W	2.50
Railroad ballast	W	W	5.38
Fine aggregate (-3/8 inch): Stone sand, concrete 4/	17	148	8.71
Coarse and fine aggregates:			
Graded road base or subbase	686	2,470	3.60
Other construction materials 5/	132	1,930	14.63
Special:			
Mine dusting or acid water treatment	9	239	26.56
Whiting or whiting substitute	3	97	32.33
Other fillers or extenders	37	1,370	37.14
Other specified uses not listed	(6/)	5	22.28
Unspecified: 7/			
Actual	3,090	16,700	5.42
Estimated	598	3,650	6.10
Total	4,670	27,500	5.88

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ To avoid disclosing company proprietary data, "District tables were not produced in 1995."
2/ Includes granite, limestone, limestone-dolomite, marble, miscellaneous stone, quartzite, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes stone sand (bituminous mix or seal).
5/ Includes roofing granules and terrazzo and exposed aggregate.
6/ Less than 1/2 unit.
7/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1994 Number of quarries	1994 Quantity (thousand metric tons)	1994 Value (thousands)	1994 Unit value r/	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value
Limestone 2/	9	1,470	$5,810	$3.96	12	1,550	$6,430	$4.15
Marble	1	93	3,250	34.90	1	90	3,110	34.51
Granite	3	3,410	19,900	5.84	3	2,960	17,200	5.81
Quartzite	1	W	W	10.92	4	W	W	11.36
Volcanic cinder and scoria	1	W	W	11.42	1	W	W	11.25
Miscellaneous stone	1	W	W	18.33	1	11	67	6.09
Total	XX	5,040	29,700	5.90	XX	4,670	27,500	5.88

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

TABLE 4
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	634	$3,300	$5.21
Asphaltic concrete aggregates and other bituminous mixtures	W	W	9.12
Road base and coverings	1,370	5,430	3.96
Fill	328	1,230	3.75
Snow and ice control	W	W	8.94
Other	376	3,390	9.02
Unspecified: 3/			
Actual	645	2,880	4.47
Estimated	503	1,300	2.58
Total or average	3,860	17,500	4.55

W Withheld to avoid disclosing company proprietary data; included with "Other."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 5
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1 Quantity	District 1 Value	District 2 Quantity	District 2 Value
Concrete aggregate and concrete products 2/	391	1,920	242	1,380
Asphaltic bituminous mixtures	W	W	W	W
Road base and coverings	805	3,160	565	2,270
Fill	113	394	216	837
Snow and ice control	W	W	W	W
Other miscellaneous uses	212	1,230	164	2,160
Unspecified: 3/				
Actual	634	2,850	10	34
Estimated	390	1,010	113	284
Total	2,540	10,600	1,310	6,960

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes production reported without a breakdown by end use and estimates for nonrespondents.