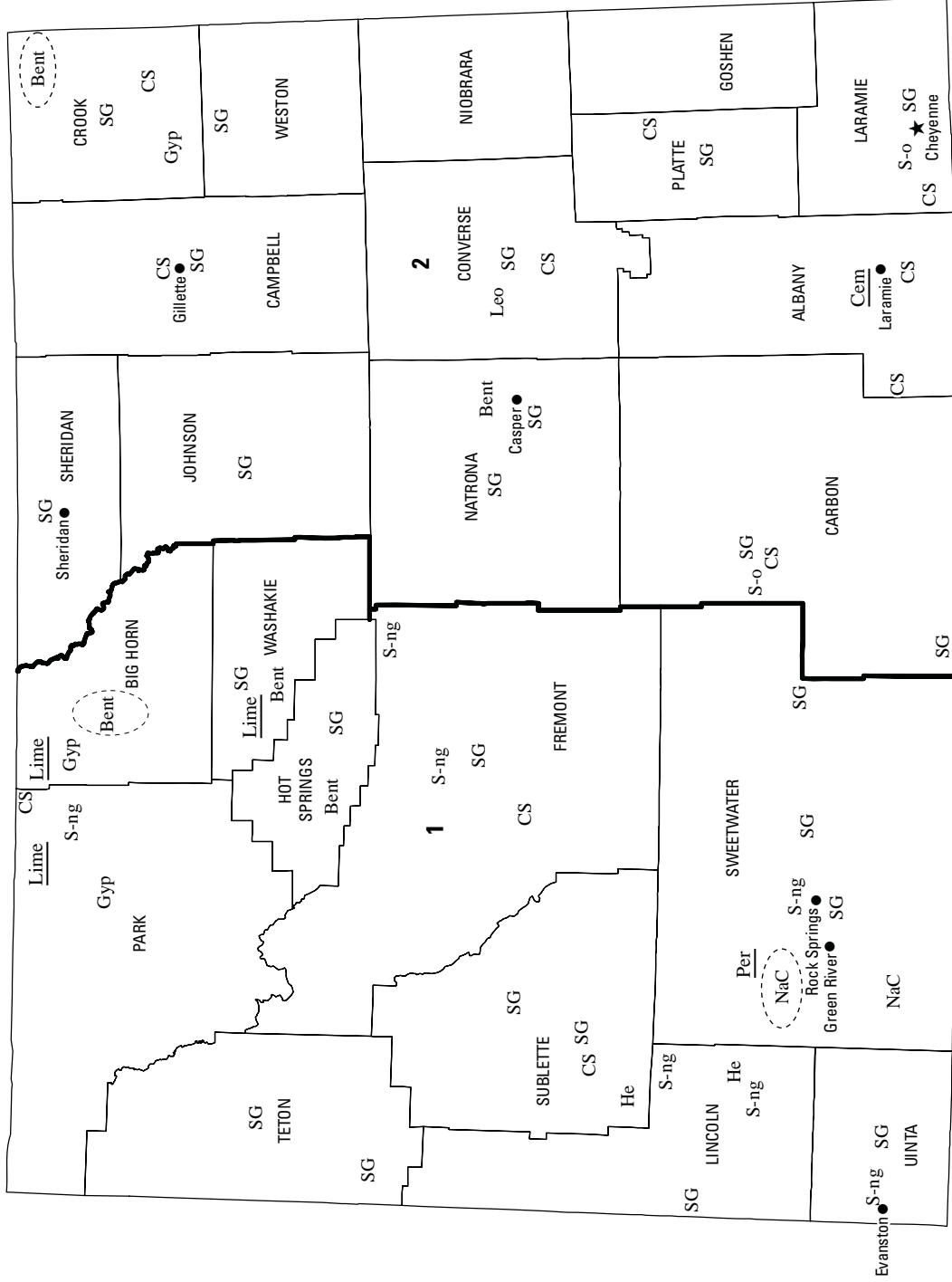




2006 Minerals Yearbook

WYOMING

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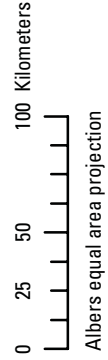


LEGEND

- County boundary
- ★ Capital
- City
- Crushed stone/sand and gravel district boundary

MINERAL SYMBOLS (Major producing areas)

- Bent Bentonite
- Cem Cement plant
- Clay Common clay
- CS Crushed stone
- Gyp Gypsum
- He Helium
- Leo Leonardite
- Lime Lime plant
- NaC Sodium carbonate
- Per Perlite plant
- SG Construction sand and gravel
- S-ng Sulfur (natural gas)
- S-o Sulfur (oil)
- Concentration of mineral operations



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 2006, Wyoming's nonfuel raw mineral production was valued¹ at \$1.59 billion, based upon annual U.S. Geological Survey (USGS) data. This was a \$290 million, or a more than 22%, increase from the State's total nonfuel mineral production value for 2005, which then was up \$250 million (up nearly 24%) from that of 2004. The State continued to rank 14th among the 50 States in total nonfuel raw mineral production value and accounted for about 2.4% of the U.S. total value. Yet, per capita, the State ranked second (first in 2004) in the Nation in the value of its mineral industry's nonfuel mineral production; with a population of 515,000, the value of production was about \$3,090 per capita.

Soda ash was Wyoming's leading nonfuel mineral, by value, followed by bentonite, Grade-A helium, construction sand and gravel, and crushed stone. Together, the five accounted for slightly more than 95% of the State's total nonfuel raw mineral production value. In 2006, nearly all the State's nonfuel mineral commodities production showed increases in value, with gemstones and zeolites value remaining the same as in 2005. The largest increases in value took place in production of bentonite clay, construction sand and gravel, crushed stone, grade-A helium, portland cement, and soda ash. A relatively small increase in soda ash production led to a more than \$160 million rise in its value. In descending order of change, the value of crushed stone rose by \$31.5 million; construction sand and gravel value rose by about \$22 million; bentonite by \$19 million; and portland cement by more than \$10 million. The unit values of each also increased, except for those of the two aggregate commodities, which were down, slightly (table 1). Although a smaller increase of less than \$5 million took place in the value of crude gypsum, its unit value rose the most of all of the State's mineral commodities; a small increase in production resulted in a near doubling of its value from 2005 to 2006. (A substantial increase also took place in the value of grade-A helium—increase in value withheld, company proprietary data.)

In 2006, Wyoming continued to be first in rank in the quantities of soda ash and bentonite clay produced, and second in Grade-A helium production. Wyoming also continued to be a producer of significant quantities of construction sand and gravel and gypsum. The United States is the world's second leading producer of soda ash, which is produced mainly from trona ore. Wyoming was one of only two soda ash-producing

States and is home to the world's largest known deposit of trona. Soda ash (sodium carbonate) is an inorganic chemical that is used extensively in the manufacture of glass, paper, soap and detergents, and textiles, and, in the form of sodium bicarbonate, in food products. California produced a significantly smaller quantity of natural soda ash.

The Wyoming State Geological Survey² (WSGS) provided the following narrative information. Production data in the text that follows are reported by the WSGS and are based on the agency's own surveys and estimates. They may differ from production figures reported to the USGS.

Exploration and Development Activities

Industrial Minerals

Diamond.—Significant increases in the price of uncut diamond in recent years, combined with the desire to locate domestic sources of diamond, attracted minor exploration interest within the State during the year. Individuals and small companies directed their exploration activities toward several locations, including the Bighorn Basin, the Cedar Mountain area, the Eagle Rock area, the Iron Mountain District, the Leucite Hills, the southern Medicine Bow Mountains, the Seminoe Mountains, the west side of the Sierra Madre mountain range, and the Wyoming-Colorado State Line District.

Gemstones.—The Cedar Rim area remained the principal focus of opal prospecting and accompanying efforts to market the State's opal resource. Prospecting for opals also extended to other locations within the State, including the Absaroka Mountains volcanic sediments, the Arikaree Formation, and related units in the Saratoga Valley and eastern Wyoming, and the Tertiary White River Formation.

Iolite, kyanite, and ruby gemstones remained the object of prospecting in the Palmer Canyon and Grizzley Creek areas of the Laramie Mountains. Prospecting was also carried out for ruby and sapphire in the Granite Mountains and the southern Wind River Mountains. General interest continued to increase for all types of gemstone resources throughout the State.

In other prospecting activity, a black tourmaline crystal, 5 centimeters (cm) long, was recovered from a pegmatite float in the Lake Owen area of the Medicine Bow Mountains. A beryl crystal, 7 cm across, was recovered from pegmatite in the Copper Mountain area of the Owl Creek Mountains, and a lavender lepidolitic quartzite float associated with conglomerate was observed in the vicinity of Beaver Rim.

¹The 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 2006 USGS mineral production data published in this chapter are those available as of March 2008. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

²Wayne M. Sutherland, Geologist (gemstones, metals and economic geology), and Robert Gregory, Geologist (uranium, minerals, and in situ mining) of the Wyoming State Geological Survey, coauthored the text of the State mineral industry information.

Renewed interest in jade took place during the year. This was accompanied by minor prospecting in the Granite Mountains.

Metals

Production of metals during 2006 was limited to small-scale placer gold recovery and amateur prospecting. However, rapidly increasing prices of precious and base metals spurred increased interest in copper, gold, platinum, and other metals. Gold prices ended the year nearly 70% above the 2003 level, while copper prices ended the year two-and one-half times higher than the 2003 level. Prices of other metals also remained strong through 2006. Recent discoveries of major gold deposits in Canada and the Great Lakes region in terrains similar to those in Wyoming attracted several exploration companies to the State.

Prospectors targeted titaniferous magnetite in the Strong Creek area of the Laramie Mountains and titaniferous sands of the Mesa Verde Formation in the Bighorn Basin. One company interested in iron investigated the possibility of reopening the Atlantic City iron mine. Other targeted metals included chromium, copper, and nickel in the Medicine Bow Mountains, the Sierra Madre, and the Silver Crown area of the Laramie Mountains.

The Bear Lodge Mountains was the site of exploration and drilling for gold and rare-earth elements during the year. Exploratory drilling for gold also was carried out in the Rattlesnake Hills in central Wyoming, where exploration during the 1980s identified at least one significant deposit hosting an estimated 31,000 kilograms (1 million troy ounces) of gold. Several companies also focused on large paleoplacers in the South Pass area, and on gold in the historic gold districts of Atlantic City, Lewiston, and Miners Delight.

Exploration for platinum-group metals took place primarily in the Lake Owen area of the Medicine Bow Mountains in southeast Wyoming. Other investigations targeted the Sierra Madre in south-central Wyoming and platinum-hosting black shales in western Wyoming.

Commodity Review

Industrial Minerals

Bentonite.—Mine production increased by about 17% in 2006, resulting in an increase of 6.4% in refined bentonite production compared with that of 2005. Eleven mines in five counties supplied bentonite to 13 mills for processing into refined bentonite. Employment in the State's bentonite industry totaled about 800 in 2006.

Gypsum.—Production of gypsum totaled slightly more than 390,000 metric tons (t) in 2006, a decrease of about 34% compared with that of 2005. Gypsum was produced from three quarries in Big Horn, Park, and Crook Counties (in order of

decreasing total production). Eighteen people were employed in this sector in 2006. An additional quarry in Albany County that was idle during 2006 produces gypsum as needed for use as a settling retardant in cement.

Limestone.—Production of limestone continued at 13 quarries in six counties during the year. About 1.73 million metric tons (Mt) was produced in the form of crushed stone for use mainly in highway construction. A total of 596,000 t of chemical-grade limestone also was produced for use in cement manufacturing, sugar beet refining, and other industrial processes. Employment in the limestone industry totaled 114, which included those employed in the siliceous shale and chemical limestone operations.

Soda Ash and other Sodium Compounds.—In 2006, five underground mines in Sweetwater County, produced a total of 16.4 Mt of trona, a naturally occurring sodium sesquicarbonate, from which approximately 10 Mt of soda ash (anhydrous sodium carbonate) was produced. Trona production was slightly higher than in 2005, consistent with the historical growth pattern of 1% to 2% per year. The Green River Basin in southwest Wyoming is host to the largest trona deposits in the world with reserves of slightly more than 115 billion metric tons (Leigh, 1998). Soda ash is used in the manufacture of glass and chemicals, soaps, detergents, pulp and paper, and as a chemical agent in flue gas desulfurization, and water treatment (Kostick, 2008). A total of 2,259 people were employed in the trona and soda ash industries during the year.

Other Industrial Minerals.—Black Hills Bentonite LLC continued production of leonardite from its quarry near Glenrock, Converse County. Production in 2006 was 52,600 t, up 11.4% compared with that of 2005. Leonardite is a soft, earthy, coal-like material that is used as a thinner in oil drilling mud and as an ingredient in fertilizer. Black Hills employed 14 people to conduct its leonardite operations. In other industrial minerals activity, two quarries in Albany County produced a total of 159,000 t of siliceous shale, up 39.6% compared with that of 2005. This shale is used as an additive in cement. Gemstone production during the year was limited to small-scale, amateur activity.

For additional information on these minerals, including recent publications, and further information on the geology of Wyoming, visit the Wyoming State Geological Survey Web site at <http://www.wsgs.uwyo.edu/>.

References Cited

- Kostick, D.S., 2008, Soda ash: U.S. Geological Survey Mineral Commodity Summaries 2008, p. 154–155.
- Leigh, R.T., 1998, Wyoming trona—An overview of the geology, in Dyni, J.R., and Jones, R.W., eds., Proceedings of the First International Soda Ash Conference, Volume II, Rock Springs, WY, June 10–12, 1997: Laramie, WY, Wyoming State Geological Survey Public Information Circular No. 40, p. 1–14.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WYOMING^{1,2}

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2004		2005		2006	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	3,510	151,000	4,160	190,000	4,360	209,000
Common	49	107	53	128	53	206
Gemstones, natural	NA	13	NA	14	NA	14
Sand and gravel, construction	10,200	40,100	11,700	52,400	17,200	74,600
Stone, crushed	6,300	35,300	6,990 ^r	39,800 ^r	12,600	71,300
Combined values of cement (portland), gypsum (crude), helium (Grade-A), lime, soda ash, zeolites	XX	819,000	XX	1,010,000	XX	1,240,000
Total	XX	1,050,000	XX	1,300,000	XX	1,590,000

^rRevised. NA Not available. XX Not applicable.

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

²Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 2
WYOMING: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2005			2006		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone ²	13 ^r	1,860 ^r	\$9,210 ^r	20	3,500	\$19,900
Granite	1	W	W	1	W	W
Quartzite	1	9	44	1	(3)	1
Marble	1	W	W	--	--	--
Traprock	-- ^r	--	--	8	W	W
Volcanic cinder and scoria	5 ^r	1,370 ^r	6,580 ^r	9	4,470	25,400
Miscellaneous stone	1	1,560	8,240	3	2,180	12,400
Total	XX	6,990 ^r	39,800 ^r	XX	12,600	71,300

^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable. -- Zero.

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

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

³Less than ½ unit.

TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE¹

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse and fine aggregates, graded road base or subbase	W	W
Chemical and metallurgical, cement manufacture	W	W
Unspecified: ²		
Reported	11,700	67,200
Estimated	920	5,200
Total	12,600	72,400
Grand total	12,600	71,300

W Withheld to avoid disclosing company proprietary data; included with "Unspecified: Reported."

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

²Reported and estimated production without a breakdown by end use.

TABLE 4
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse and fine aggregate ²	--	--	--	--	W	W
Chemical and metallurgical ³	--	--	W	W	--	--
Unspecified: ⁴						
Reported	212	1,210	9,110	51,700	2,350	13,100
Estimated	65	370	850	4,900	--	--
Total	277	1,580	9,970	56,600	2,350	13,100

W Withheld to avoid disclosing company proprietary data; included with "Unspecified: Reported." -- Zero.

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

²Includes graded road base or subbase.

³Includes cement manufacture.

⁴Reported and estimated production without a breakdown by end use.

TABLE 5
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006,
BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	470	\$4,190	\$8.91
Asphaltic concrete aggregates and other bituminous mixtures	485	4,500	9.28
Road base and coverings	3,690	15,700	4.25
Fill	191	1,490	7.80
Other miscellaneous uses	5	69	13.80
Unspecified: ²			
Reported	10,500	38,600	3.68
Estimated	1,830	10,100	5.51
Total or average	17,200	74,600	4.35

¹Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

²Reported and estimated production without a breakdown by end use.

TABLE 6
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006,
BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates (including concrete sand)	379	3,590	91	602	--	--
Asphaltic concrete aggregates and road base materials	2,190	11,300	1,570	5,670	411	3,190
Fill	138	1,200	53	289	--	--
Other miscellaneous uses	5	66	1	3	--	--
Unspecified: ²						
Reported	3,350	11,300	2,600	13,900	4,540	13,400
Estimated	597	3,290	789	4,350	443	2,440
Total or average	6,660	30,800	5,110	24,800	5,400	19,100

-- Zero.

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

²Reported and estimated production without a breakdown by end use.