



2007 Minerals Yearbook

BARITE [ADVANCE RELEASE]

BARITE

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In 2007, primary barite production (sold or used by producers) totaled 455,000 metric tons (t) valued at \$20.6 million, and apparent consumption was 3.04 million metric tons (Mt). Imports were 2.60 Mt and exports were 15,000 t.

Barite is the mineralogical name for barium sulfate. In commerce, the mineral is sometimes referred to as barytes. As used in this report, the term primary barite refers to the first marketable product, which includes crude barite that usually has undergone simple beneficiation methods, such as jigging, tabling, washing, or more complex methods, such as flotation, heavy-media separation, and magnetic separation. Most crude barite requires some upgrading to minimum purity or density levels.

Production

Domestic production and sales data for barite were derived from voluntary responses to the U.S. Geological Survey (USGS) canvass of 33 known mines and grinding plants. The USGS received full or partial responses from 24 of the operations, representing 97% of the quantity of barite sold and used by processors. Response rates for value data were lower, and estimates had to be made for five of the respondents that only provided quantity data. Seven mines were included in the survey—four were producing, and three were idle. A new mine in Nevada, Spirit Minerals LP's Big Ledge Mine, operated briefly in December, but was not canvassed. An estimate was included for the company's grinding mill in Wyoming that processed purchased crude barite. Of the canvassed producing mines, three were in Nevada, and one was in Georgia; the idle mines were in Nevada and Tennessee. There were 24 grinding plants operating at the end of the reporting year. The Georgia mine and three of the Nevada mines had associated nearby grinding plants. Most ore in Nevada was ground onsite or shipped to grinding mills in Canada and Wyoming and sold into the petroleum drilling markets of the Western United States and southwestern Canada or to local industrial users.

Crude barite production in 2007 was 455,000 t, a decrease of 23% compared with that of 2006. The value of domestic production was \$20.6 million, a decrease of about 12%. The bulk of mine production was from Nevada with a small amount reported from Georgia. Nevada's mine production decreased by 23% in 2007, as the two largest mines shipped a significant amount of crude or run-of-mine material from stocks.

In 2007, there were 14 facilities on the coast of the Gulf of Mexico (6 in Louisiana and 8 in Texas) that produced barite to American Petroleum Institute (API) specifications (of which a minimum specific gravity of 4.20 grams per cubic centimeter is the most important). These stand-alone grinding plants primarily processed crude barite imported from China and India that was

ground to API specifications for the oil and gas drilling market. In Louisiana, there were two grinding plants in the Amelia/Morgan City area, one in Houma, one near the Lake Charles/Westlake area, one in New Iberia, and one near New Orleans. In Texas, there were two grinding plants in Brownsville, three in Corpus Christi, one in Galveston, and two in Houston, at least one of which, in addition to supplying the drilling market, also produced commercial filler-grade barite.

Grinding plants that produce commercial filler-grade barite or chemical-grade barite are located in northern Georgia or in the Mississippi River Valley. There were three mills and one mine in Georgia, and single mills in Illinois, Missouri, and Tennessee. The location of mills near the Mississippi River allowed them to receive imported barite by barge and to ship the finished product by barge, if possible, or by rail or truck to industrial users in the Midwestern United States.

In 2007, the leading companies that mined and ground barite in the United States were also major oil service companies and included Baker Hughes INTEQ (a division of Baker Hughes Incorporated), Baroid Fluid Services (the drilling fluids and industrial barite subsidiary of Halliburton Energy Services, Inc.), and M-I SWACO (a joint venture between Smith International Inc. and Schlumberger Ltd.). Baker Hughes INTEQ, Halliburton, and M-I SWACO are world renowned and operate in many countries, mining barite and providing drilling sales and services. These three companies operated barite mines with associated beneficiation mills and grinding plants in Nevada and also operated grinding plants in Louisiana and Texas. Excalibur Minerals Inc. (a division of Newpark Resources, Inc. of Houston) was a major barite importer and grinder in Louisiana and Texas for the oil and gas drilling market. The company also operated a grinding plant in Tennessee mostly serving nondrilling markets. There were other, smaller companies near the Gulf of Mexico that received imported barite by ship through ports in Louisiana and Texas. Ambar Drilling Fluids LP in Houma, LA, ground imported barite for its service unit. U.S. Clay LP of Birmingham, AL, ground bentonite for its own use in Brownsville, TX, and crude barite for other suppliers (on a toll basis). The other grinding plant in Brownsville is owned by Milwhite, Inc.

After being ground to API specifications, the barite is transferred directly to containers on barges docked in canals, lakes, and rivers near the plants for bulk deliveries to offshore drilling platforms. These near-shoreline barite staging locations also are convenient to the clusters of onshore areas with significant petroleum production in the Petroleum Administration for Defense (PAD) District 3. The PAD districts were World War II divisions of the oil-producing areas of the United States; these designations continue to be used.

Spirit Minerals (Wells, NV) leased 40.5 hectares (1,000 acres) in Elko County, NV, and began development of its Big Ledge open pit mine in December, but shut down after 3 weeks with plans to restart operations in March 2009. While removing overburden to expose additional barite reserves, the company planned to mill 75,000 t of stockpiled barite ore mined in the 1980s by Old Soldier Minerals Co. At current reserve levels, the Big Ledge Mine was expected to produce for 3 to 5 years, but the property may hold additional reserves. In 2007, Spirit Minerals operated a grinding mill at Evanston, WY, processing crude barite purchased from an existing Nevada producer. Plans were for output from Big Ledge to be shipped to the Evanston mill for grinding, although the company may install a grinding plant nearer the mine to eliminate transportation problems and reduce costs (Sents, 2008).

Kent Exploration Inc. (Vancouver, Canada) began evaluating the company's Flagstaff property near Northport, WA. The property contains an open pit barite deposit that has been stripped of overburden and benched ready for mining. As a result of drilling done in 1981 and 1982, it was estimated the deposit contained about 1.2 Mt of barite meeting API specifications. The size estimate of the barite deposit is taken from historic reports, and Kent Exploration has not performed sufficient work to confirm the estimate. Samples totaling 300 kilograms were taken from four separate locations on the property and submitted for initial testing for the most cost effective method of beneficiating the barite to meet API specifications. Prior mining activities in the late 1970s and early 1980s produced an estimated 100,000 t of barite (Kent Exploration Inc., 2007).

Consumption

In 2007, apparent consumption was essentially unchanged at 3.04 Mt compared with that in 2006 (table 1). Ground barite sales decreased slightly to 2.98 Mt in 2007 from 3.04 Mt in 2006. In 2007, sales by grinding plants in Louisiana decreased by nearly 4% to 1.30 Mt. Grinding plant sales in Texas increased slightly to 1.02 Mt, while sales by plants in all other States decreased slightly to 649,000 t (table 2). About 2.8 Mt, or 96%, of barite sales from domestic crushers and grinders was for petroleum well-drilling markets, and the remaining 4% was for industrial end uses (table 3).

The largest application for barite is as a weighting agent in natural gas and oil field drilling muds. The density of barite helps in down-hole flow and bit lubrication. An additional benefit of barite is that it does not interfere with magnetic measurements taken in the borehole, either during logging-while-drilling or in separate drill hole logging.

Barite used for drilling petroleum wells can be black, blue, brown, buff, or gray depending on the ore body. Most barite needs to be ground to a small uniform size before it is used as a weighting agent in petroleum well-drilling mud based on specifications set by the API or the former Oil Companies' Materials Association (OCMA).

The barite is finely ground so that at least 97% of the material, by weight, can pass through a 200-mesh (Tyler) [75-micrometer (μm)] screen, and no more than 30%, by weight, can be

less than 6 μm , effective diameter, which is measured using sedimentation techniques. The ground barite also must be dense enough so that its specific gravity is 4.2 or greater, soft enough to not damage the bearings of a tricone drill bit, chemically inert, and containing no more than 250 milligrams per kilogram (mg/kg) of soluble alkaline salts (American Petroleum Institute, 1993, p. 6-11). A small percentage of iron oxide is allowable.

Fueled by the dramatic increase in oil and gas prices and the need to replace declining U.S. reserves, there has been a significant increase in domestic exploration (especially for natural gas). The average monthly U.S. rig count (operating drilling rigs) increased for the fifth year in a row to 1,768 rigs, an increase of 119 compared with the monthly average for 2006 and an increase of 938 compared with the average for 2002. As has been the case since the late 1990s, consumption of barite in well drilling in the United States was driven primarily by the demand for natural gas. At the end of 2007, 81.5% of drill rigs operating in the United States (onshore and offshore) were drilling for gas (Baker Hughes Incorporated, 2008).

Besides traditional gas-producing areas, such as the Gulf of Mexico and Texas, the Rocky Mountain States account for more than 20% of the total natural gas reserves in the United States. These are mostly in unconventional tight-gas or coal bed formations, and it is the exploration of such formations that is driving demand for barite in the Rocky Mountain States and the accompanying interest in developing new barite mines.

In 2007, sales of domestic and imported barite sold for industrial uses increased by about 4% to 134,000 t (table 3). Industrial end uses such as barium chemicals (the largest by volume is barium carbonate), filler in paint and plastics, and powder coatings all require the barite to be ground to a small uniform size. The size depends on the use, but for paint- and plastic-grade material, it averages about 2 to 3 μm . Barite-containing materials that are used for sound reduction in engine compartments are gaining market share among automotive manufacturers. Barite also is used in the base coat of automobile finishes for smoothness and corrosion resistance and continues to be used in friction products for automobiles and trucks.

Barite that is used as an aggregate in "heavy" cement or radiation-shielding cement is crushed and screened to sizes ranging from 4.75 millimeters (0.187 inches) to 3.75 centimeters (1.5 inches) for the coarse grade. New Riverside Ochre Company, Inc. (Cartersville, GA) is the leading supplier of barite aggregate.

Foreign Trade

Owing to a large decrease in exports of crude barite to Canadian grinding mills, barite exports during 2007 decreased by 79% to 15,000 t. About 79% of the total was exported to Canada, 8% went to Mexico, and the remaining 13% went to other countries (table 4).

Assignment of the correct harmonized tariff schedule (HTS) number by importers is sometimes problematic. As a result, import data for crude natural barite, ground barite, and other sulfates of barium have been adjusted in an attempt to classify material by type and use. These adjustments involved separating, by unit value, imports intended for use in drilling

muds (crude and ground barite) and all other uses (other sulfates of barium).

Imports of crude natural barite were essentially unchanged at 2.54 Mt; 98% of imports came from China, and India accounted for the bulk of the remaining 2%. Imports of ground barite used for drilling mud increased to 35,500 t in 2007 from 815 t in 2006. Imports for the several forms of barite reported under the HTS nomenclature “Other sulfates of barium” decreased by 29% compared with those of 2006, to 15,900 t (table 5).

There is a tariff on U.S. imports of crude barite equal to \$1.25 per metric ton, but there is no tariff on imports of ground barite. As a result, some of the major importers of crude barite have applied for and received foreign trade zone status for their grinding mills in the United States. Two such applications submitted by M-I SWACO were approved in 2007 for the company’s grinding plants in Amelia, LA, and Galveston, TX. This means that the ground barite produced by these mills will be reported as imports for consumption and not crude barite received from foreign suppliers (U.S. Department of Commerce, Import Administration, 2008).

Prices

The average sales value for primary barite from mines and their associated beneficiation plants in the United States increased to about \$45.20 per ton, an increase of 13% compared with that of 2006 (table 1). The average sales value for drilling-grade barite ground in Louisiana decreased slightly to about \$95.70 per ton, while the sales value for drilling-grade barite ground in Texas was about \$98.40 per ton. The average value for all grades ground in Texas increased to nearly \$107 per ton. The sales value of barite ground in other States increased by 9% to \$114 per ton compared with the 2006 values (table 2). Barite for barium chemicals, filler and extender, and glass increased by 20% to \$336 per ton for 2007 (table 3).

December U.S. import prices for Chinese barite, API grade, lump, including cost, insurance, and freight, U.S. Gulf Coast were in a range of \$105 to \$125 per ton. This was an increase of \$30 to \$50 per ton compared with prices in the same period in 2006. The price increase for Indian barite was even greater; December 2007 import prices were listed at \$143 per ton compared with \$82 to \$85 per ton in December 2006. Chemical grade from China was listed in a range of \$100 to \$105 per ton (Industrial Minerals, 2007).

World Review

Canada.—In March, Acadian Mining Corporation (Halifax, Nova Scotia, Canada) acquired a 100% interest in 52 mineral claims covering 842 hectares (3.25 square miles) on Cape Breton Island, Nova Scotia, known as the Lake Ainslie barite-fluorite deposits. The deposits host a resource estimated to contain 4.25 Mt grading 34.0% barite and 17.3% fluorite based on exploratory drilling done in the early 1970s. This equates to approximately 1.3 Mt of 90% contained barite. Acadian is planning a program of infill diamond drilling and in-house engineering studies on the Upper Johnson deposit, the highest grade (50% to 55%) of the Lake Ainslie barite deposits. There is good potential for expansion of the currently identified barite

deposits as well as for discovery of additional barite on the Lake Ainslie property. Should the Lake Ainslie deposits be brought into production, the residual fluorite could be stockpiled pending studies to determine the potential of upgrading this material to acid-grade quality (Acadian Mining Corp., 2008).

Spain.—Minerales y Productos Derivados S.A. (Bilbao, Spain) was unable to produce barite meeting drilling-grade specifications, and as a result ceased mine production of barite at the end of 2007. The company could resume production in the future, if conditions change (Moores, 2008).

Outlook

Long-term demand for oil and gas is expected to continue to drive domestic exploration. Recently, natural gas production in the lower 48 States has seen strong growth. After 9 years of no net growth through 2006, an upward trend began with 3% growth between first quarter 2006 and first quarter 2007, followed by an unusually large 9% increase between first quarter 2007 and first quarter 2008. The large recent increases in supply came from across the lower 48 States. However, more than one-half of the increase in natural gas production between the first quarter of 2007 and the first quarter of 2008 came from Texas, where supplies increased by an exceptionally high 15%. Other contributing regions included Wyoming with growth of 9%, Oklahoma with 6% growth, and Louisiana with 4% growth during this same period. These increases were the result of improved technology, developed over many years, that now allows economic production of resources in deep water and large “unconventional” resources, which are difficult to produce. In recent years, higher natural gas prices have spurred more natural gas exploration and the increased drilling of more complex horizontal wells with greater productivity (U.S. Department of Energy, Energy Information Administration, 2008).

Most of the domestically mined barite is expected to continue to be consumed in the Rocky Mountain region. The sustained growth in exploration in this area is expected to not only consume the output of existing Nevada mines but also fuel the exploration for barite and the development of new barite mines to meet rising demand and replace depleted reserves.

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TABLE 1
SALIENT BARITE STATISTICS¹

(Thousand metric tons and thousand dollars)

	2003	2004	2005	2006	2007
United States:					
Barite, primary:					
Sold or used by producers:					
Quantity	468	532	489	589	455
Value	13,900	18,700	17,600	23,500	20,600
Exports:					
Quantity	44	70	93	72	15
Value	4,620	6,400	9,930	12,100 ^r	6,300
Imports for consumption: ²					
Quantity	1,650	2,000	2,690	2,550	2,600
Value	85,500	109,000	162,000	160,000	194,000
Consumption, apparent ³	2,080	2,460	3,080	3,070	3,040
Crushed and ground, sold or used by processors: ⁴					
Quantity	2,230	2,440	2,720	3,040	2,980
Value	165,000	208,000	238,000	289,000	308,000
World, production	6,730 ^r	7,680 ^r	7,760 ^r	7,900 ^r	7,670 ^e

^eEstimated. ^rRevised.

¹Data are rounded to no more than three significant digits.

²Includes crude, ground, and other barite imports.

³Sold or used plus imports minus exports.

⁴Includes imports.

TABLE 2
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS
IN THE UNITED STATES, BY STATE^{1,2}

State	2006			2007		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	6	1,360	\$132,000	6	1,300	\$125,000
Texas	8	1,010	87,300	8	1,020	109,000
Other ³	10 ^r	665	69,400	10	649	74,000
Total	24 ^r	3,040	289,000	24	2,980	308,000

^rRevised.

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

²Includes imports.

³Includes Georgia, Illinois, Missouri, Nevada, Tennessee, and Wyoming.

TABLE 3
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS
IN THE UNITED STATES, BY USE^{1,2}

(Thousand metric tons and thousand dollars)

Use	2006		2007	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	129	\$36,100	134	\$45,100
Well drilling	2,910	253,000	2,850	263,000
Total	3,040	289,000	2,980	308,000

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

²Includes imports.

TABLE 4
U.S. EXPORTS OF NATURAL BARIUM SULFATE (BARITE), BY COUNTRY¹

Country	2006		2007	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Angola	--	--	192	\$66
Belgium	--	--	41	36
Canada	68,200	\$7,120	11,900	2,380
China	18	16	49	53
Colombia	20	5	23	15
Congo	154 ^r	38 ^r	--	--
Italy	18 ^r	50 ^r	--	--
Japan	808	3,830	694	3,060
Mexico	2,090	686	1,210	387
Philippines	103	165	--	--
Singapore	91	18	45	8
Taiwan	--	--	32	21
Trinidad and Tobago	147 ^r	106 ^r	--	--
Venezuela	129	29	--	--
Other	67 ^r	40 ^r	879	276
Total	71,900 ^r	12,100 ^r	15,000	6,300

^rRevised. -- Zero.

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

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF BARITE, BY COUNTRY¹

Country	2006		2007	
	Quantity (metric tons)	Value ² (thousands)	Quantity (metric tons)	Value ² (thousands)
Crude:				
Canada	--	--	100	\$3
China	2,360,000	\$133,000	2,500,000	174,000
Germany	--	--	601	32
India	139,000	10,500	44,200	3,580
Korea, Republic of	10 ^r	3 ^r	235	6
Mexico	3,340	94	314	11
Morocco	20,200	1,060 ^r	--	--
Total	2,530,000	145,000	2,540,000	178,000
Ground:				
Canada	15	2	--	--
China	--	--	35,500	3,230
India	--	--	--	--
Japan	102	15	--	--
Mexico	698	122	--	--
Morocco	--	--	--	--
Total	815	139	35,500	3,230
Other sulfates of barium:				
Belgium	--	--	5	6
Canada	17	6	296	46
China	6,620	1,890	2,960	1,250
Finland	9	43	--	--
France	45	28	--	--
Germany	10,300	9,050	9,280	7,630
India	--	--	2	4
Italy	4,670	2,850	2,440	1,740
Japan	529	1,140	640	1,780
Korea, Republic of	42	99	--	--
Netherlands	--	--	10	15
Spain	177	153	222	206
Switzerland	16	10	--	--
United Kingdom	--	--	18	10
Total	22,400	15,300	15,900	12,700

^rRevised. -- Zero.

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

²Cost, insurance, and freight value.

Source: U.S. Census Bureau data; adjusted by the U.S. Geological Survey.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF BARIUM CHEMICALS¹

	2006		2007	
	Quantity (metric tons)	Value ² (thousands)	Quantity (metric tons)	Value ² (thousands)
Chloride	98	\$94	51	\$53
Oxide, hydroxide, peroxide	3,580	3,530	3,760	7,250
Nitrate	4,120	7,720	NA	NA
Carbonate, precipitated	4,710	4,940	3,220	2,740

NA Not available.

¹Data are rounded to no more than three significant digits.

²Cost, insurance, and freight value.

Source: U.S. Census Bureau.

TABLE 7
BARITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country	2003	2004	2005	2006 ^c	2007 ^c
Afghanistan ^{e, 3}	2,000	2,000	1,500	1,500	1,500
Algeria	45,649	47,945	52,813	64,787 ^{r, 4}	63,098 ⁴
Argentina	6,934	2,762	3,355 ^r	6,276 ^{r, 4}	6,300
Australia ^c	20,000	20,000	20,000	21,000	16,000
Bolivia	1,851	5,774	11,379	7,300 ^r	7,000
Bosnia and Herzegovina ^c	80 ^r	65 ^r	160	190 ^{r, 4}	200
Brazil, beneficiated	57,452	49,046 ^r	39,545 ^r	19,151 ^{r, 4}	13,300
Bulgaria ^{e, 5}	91,200	75,400	76,600 ^r	74,500 ^r	51,000
Burma	4,850	2,224	2,058	2,930 ^{r, 4}	2,500
Canada	27,369	20,601	21,000	21,000	21,000
Chile ^c	229	31	91 ⁴	375 ^{r, 4}	77 ⁴
China ^c	3,600,000	3,900,000	4,200,000	4,400,000	4,400,000
Colombia ^c	600	600	600	600	600
Ecuador	2,139	3,695 ^r	-- ^r	-- ^r	--
Egypt ^c	500	500	500	500	500
France	81,000	82,000 ^c	82,000 ^c	30,000	--
Germany, marketable Ba ₂ SO ₄	109,506	93,624	88,591 ^r	85,524 ^{r, 4}	88,265 ^{p, 4}
Guatemala	100 ^c	70 ⁴	181 ⁴	-- ^r	--
India ^c	723,000	1,100,000	1,200,000	950,000	1,000,000
Iran ³	196,169	275,607	231,184 ^r	230,000 ^r	240,000
Italy	12,214	9,698 ^r	4,722 ^r	5,000 ^r	5,000
Kazakhstan ⁶	79,000	115,000 ^r	95,000 ^r	95,000 ^r	95,000
Korea, Republic of	140	50	--	--	-- ⁴
Laos	18,070	10,470	28,500 ^r	29,000 ^r	29,000
Malaysia	--	--	--	910 ^r	500
Mexico	287,451	306,668	268,657	206,106 ⁴	185,921 ⁴
Morocco ⁵	325,000 ^r	313,000 ^r	335,000 ^r	506,000 ^r	485,000
Nigeria ^{e, 7}	5,000 ^r	6,000 ^r	6,000 ^r	6,300 ^r	6,000
Pakistan	40,745	44,207	42,087	43,000	44,000
Peru	2,906	3,606	3,700	3,700	3,700
Poland	2,900	3,183	2,357	3,000	3,000
Russia ^c	78,000	63,000	63,000	63,000	63,000
Saudi Arabia	9,000 ^c	15,000	-- ^r	-- ^r	--
Slovakia, concentrate	12,000	27,100	12,000	15,000	15,000
Spain, marketable Ba ₂ SO ₄	44,660	40,776	37,000	45,001 ^{r, 4}	40,000
Thailand	115,600	211,278	3,989 ^r	4,549 ^{r, 4}	4,500
Tunisia	3,000	1,813	--	-- ⁴	--
Turkey	119,648	134,504	157,179	200,000 ^r	150,000
United Kingdom ^c	57,000	61,000	62,000	50,000	55,000
United States ⁸	468,000	532,000	489,000	589,000 ⁴	455,000 ⁴
Vietnam	81,456	101,040	116,000	120,000	120,000
Total	6,730,000 ^r	7,680,000 ^r	7,760,000 ^r	7,900,000 ^r	7,670,000

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through June 10, 2008.

³Data are for fiscal year beginning March 21 of that stated.

⁴Reported figure.

⁵Estimated marketable production based on export data.

⁶Estimated marketable barite, however, reported figures are as follows, in metric tons: 2003—214,200; 2004—310,700; 2005-06—251,000; and 2007—not available.

⁷Considerably more barite is produced, but it is considered to be commercially unusable.

⁸Sold or used by producers.