

BARITE

By James P. Searls

Barite is the mineralogical name for barium sulfate and was derived from the Greek word "barus," meaning heavy. In commerce, the mineral is sometimes referred to as "heavy spar" or "barytes." Spar means almost any transparent or translucent, readily cleavable, crystalline mineral having a vitreous luster.¹ Few mines in the United States produce a "spar" grade barite.

The term "primary barite," as used in this report, refers to the first marketable product. This product includes crude barite, and the products of simple beneficiation methods such as washing, jigging, heavy media separation, tabling, flotation, and magnetic separation. Most primary barite requires grinding to small, uniform size before it is used as a weighting agent in petroleum well drilling mud [American Petroleum Institute (API) or Oil Companies' Materials Association (OCMA)] specification barite or as an addition to industrial products. This grinding usually was not performed at the mine site because railroad tariffs were higher for finished barite than for crude barite. There was some grinding of barite at the mine sites in Nevada to supply Western States, Western Canadian Provinces, and Alaska. Barite for petroleum well drilling, a weighting agent in the drilling mud, can be any color but must be only finely ground, dense, soft, and chemically inert. Barite for this purpose must have a specific gravity of 4.2 or greater, be free of soluble salts, and 90% to 95% of the material must pass through a 325-mesh screen. A small percentage of iron oxide is allowable. About 91% of the barite sold in the United States in 1995 was used as a weighting agent in oil- and gas-well-drilling fluids, mostly in the Gulf of Mexico region, with much smaller amounts used in the Pacific coast areas. Petroleum well drilling barite can be blue, black, brown, or gray depending on the ore body.

One domestic barite producer has named its white technical grade barite as "baryte" to distinguish it from the petroleum well drilling grade. The technical grade end uses are for filler and extender grades, colorants, weighting agents, and feedstock into barium chemicals. The industrial end uses of barite included paint; rubber; plastics; photographic print paper; batteries; brake and clutch pads for automobile and trucks; gastrointestinal x-rays; barium chemicals for the glass, ceramic products, brick and cement block industries; and barium ferrites and titanates. Industrial weighting agents encompass such things as barite in truck rubber mud flaps to prevent the flap from being lifted by the air flow around the truck, and barite in rubber rug backing to keep the rug relatively stationary.

Legislation and Government Programs

The Environmental Protection Agency (EPA) deleted barium sulfate from the category "barium compounds" on the list of toxic chemicals for which reporting was required under the section 313 of the Emergency Planning and Community

Right-to-Know Act of 1986 (EPCRA). This action was based on EPA's conclusion that barium sulfate met the deletion criteria of EPCRA section 313(d)(3). By promulgating this rule, EPA was relieving facilities of their obligation to report releases of barium sulfate that occurred during the 1993 reporting year, and releases that will occur in the future.²

Production

Domestic sales data for barite were developed by the U.S. Geological Survey (USGS) from a voluntary survey of U.S. operations. Of the 34 operations to which a survey was sent, 32 reported, representing about 99% of the primary barite sold or used by producers. Of the 34 operations surveyed, there were 14 mines and 20 mills. Of the 14 mines surveyed in 1995, Baroid's Lakes Mine was closed, while Mountain Mineral's Elk Creek Mine and Milpark's Miller Mine were idle, leaving 11 mines operating. Of the 20 milling plants surveyed, Standard Magnesia's Fallon Mill was closed and dismantled, Circle A's mill was idle, and 18 mills (beneficiating plants and crushers and grinders) were operating. The quantity of primary barite sold or used by producers declined by about 7% from that of 1994.

Consumption

Demand for petroleum-well-weighting barite has been relatively steady over 1994 and 1995 owing to deep gas well drilling off the coast of Louisiana and Texas. Production and quality problems developed in late 1993 in both China and India, and continued through 1994 and 1995, which resulted in reduced exports for those two countries to the Gulf Coast. Domestic producers were able to fill the deficiency caused by these foreign producers' problems with domestically produced barite. One domestic API grade supplier deemed the drilling mud grade barite market to have been in reasonable balance at the price range. Domestic industrial grade suppliers have been reluctant to comment on the market balance. For 1995, the domestic producers supplied a broad range of barite quality, excluding only the U.S. Pharmacopoeia barite.

Crushers and grinders reported only a division of sales between petroleum-well-weighting barite and "industrial" barite. The consumption of industrial barite has not been well reported to the USGS. No subdivisions of industrial end uses were reported because they were less than approximately 20,000 metric tons per year.

Domestic API barite consumption was driven by oil and gas drilling activity, particularly those wells deeper than about 2,100 meters (7,000 feet) because of increasing petroleum reservoir pressures. Barite is an environmentally beneficial mineral which, owing to its density of 4.2, exerts pressure down the drill

hole counterbalancing the upwardly vented petroleum reservoir pressure. Uncounterbalanced pressure allows the crude oil and gas to spray (gush) out of the well. Gushers of crude petroleum were extreme fire hazards, wasteful of crude petroleum, and visual and chemical pollution to the surface area surrounding the well.

Traditionally, the demand for barite has been explained by the prices of the petroleum products and the numbers of drill rigs used in the United States during the reported year. There has been a technological shift in the well-drilling industry reducing the demand for barite by making well drilling more efficient. For yearend 1995, the week-average futures price for light sweet crude oil rose by 12.3% to \$19.17 per barrel³ compared with \$17.07 per barrel at yearend 1994. For the first half of 1995, the price for light sweet crude oil rose to \$17.74 per barrel⁴ and then rose 8% for the second half of 1995. The rising prices may have encouraged some new activity in oil drilling in that short a period. The natural gas futures price started the year at about \$1.59 per million British Thermal Units (Btu)⁵. That price remained through the first half of the year⁶, then rose to \$2.85 per million Btu, about a 79% increase, by yearend.⁷ The number of gas-directed rigs, as reported by the Baker-Hughes rotary rig count, was essentially constant, 428 rigs at the beginning and 420 rigs at yearend,⁸ but was at 362 rigs at midyear.⁹ The "Total U.S." Baker-Hughes rotary rig count¹⁰ declined by about 6% from 791 rigs at the end of 1994 to 745 rigs at the end of 1995.

The explanation of this decline in drilling rigs along with good barite consumption is new technologies.¹¹ Owing to 3D and 4D seismic technology, fewer wells are required to establish and develop reserves. Other technologies, such as horizontal and directional drilling, have reduced the number of wells needed to access a reservoir effectively. Measurement-while-drilling, logging-while-drilling, increased drill bit effectiveness and durability, new well completion techniques, and new well stimulation services have all combined to increase flow rates, reduce well drilling and maintenance costs, and reduce the number of wells while keeping product flowing profitably at present prices.

Prices

The nominal average weighted price for sales of all barite by U.S. producers declined from a revised \$32.80 per ton in 1994 to \$31.90 in 1995, or about 3%. Nominal average prices for the crushed and ground barite rose from \$69.65 per ton in 1990 to \$84.48 per ton in 1992 and declined to \$68.20 per ton in 1995. International prices for midyear, as reported by Industrial Minerals,¹² were as follows: unground, OCMA/API bulk, specific gravity 4.2, free on board (FOB) Morocco, \$37 to \$40 per ton; ground, bagged, specific gravity 4.22, FOB Morocco, \$75 to \$80 per ton; ground OCMA/API big bags (1.5 tons) FOB, South Turkey, \$55 to \$58 per ton; ground OCMA bulk, delivered Aberdeen, \$71.73 to \$82.89 (£45 to £52)¹³ per ton; delivered Great Yarmouth, \$82.89 to \$89.27 (£52 to £56) per ton; micronised, off white minimum 99% less than 20 microns delivered United Kingdom (UK) \$223.16 to \$239.10 (£140 to

£150) per ton; and ground, white paint grade 96% to 98% BaSo₄, 350 mesh, 1-5 tons delivered UK, \$311 to \$351 (£195 to £220) per ton.

Outlook

Barite sales are not likely to increase greatly above 1995 levels in the United States and could decline. Much of the exploratory and development drilling, 90% of the U.S. demand, has moved away from the United States owing to the potential for large discoveries of oil and gas in Asia and the former Soviet Union, and the environmental concerns in the United States. The market for exported barite was small because barite was found around the world and was not shipped great distances, except by water, because of its relatively low unit value.

Assuming that the demand for barite was driven primarily by gas well drilling, not petroleum, it seems clear that if the gas prices in the United States stay at \$1.50 to \$2.00 per million Btu for the foreseeable future, gas exploration and development may continue as long as large-sized, profitable gas discoveries are completed. This would maintain the demand for API barite at approximately the present level in constant dollars. However, the number of large undiscovered gas reserves was unpredictable but likely to be small.

¹A Dictionary of Mining, Mineral, and Related Terms, P. W. Thrush, Ed., U.S. Department of the Interior, U.S. GPO, Washington, DC, 1968, p. 1049.

²Federal Register. Barium Sulfate; Toxic Chemical Release Reporting; Community Right-to-Know, EPA-Rule and Regulations. V. 59, No. 123, June 28, 1994, pp. 33205-33208.

³The Oil & Gas Journal. V. 94, No. 2, Jan. 8, 1996, p. 3.

⁴———. V. 93, No. 27, July 3, 1995, p. 3.

⁵Reference cited in footnote 3.

⁶Reference cited in footnote 4.

⁷Reference cited in footnote 5.

⁸Page 78 of reference cited in footnote 3.

⁹Page 76 of reference cited in footnote 4.

¹⁰Reference cited in footnote 8.

¹¹The Oil and Gas Journal. V. 93, No. 39, Sept. 25, 1995, pp. 49-55.

¹²Industrial Minerals (London). No. 334, July 1995, p. 60.

¹³International Monetary Fund, International Financial Statistics, End of June, 1995, \$1.5688/Special Drawing Right (SDR), £0.98417/SDR, Feb. 1996, p. 6.

OTHER SOURCES OF INFORMATION

U.S. Geological Survey Publications

Barite. Ch. in Mineral Commodity Summaries, annual.

Brobst, Donald A., 1973, Barite, in Brobst, D. A., and Pratt, W. P., United States Mineral Resources: U.S. Geological Survey Professional Paper 820, p. 75-84.

Other Sources

Brobst, Donald A., 1994, in Industrial Minerals and Rocks, 6th Ed., Carr, D. Sr. Ed., AIME, Soc. of Min., Met., and Expl., Inc. pp. 125-134.

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Mining Journal Annual Review.

TABLE 1
SALIENT BARITE AND BARIUM CHEMICAL STATISTICS 1/ 2/

(Thousand metric tons and thousand dollars)

	1991	1992	1993	1994	1995
United States:					
Barite, primary:					
Sold or used by producers	448	326	315 3/	583	543
Value	\$21,300	\$19,600	\$19,300 3/	\$19,100 r/	\$17,300
Exports	43	12	18	14	16
Value	\$3,300	\$1,810	\$2,610	\$1,850	\$2,020
Imports for consumption 4/	887	354	804	1,070	1,040
Value	\$41,300	\$17,300	\$34,200	\$47,200	\$52,500
Consumption (apparent) 5/	1,290	668	1,100	1,640	1,570
Crushed and ground (sold or used by processors) 6/	1,270	999	1,090	1,250	1,210
Value	\$103,000	\$84,400	\$79,200	\$81,100	\$82,500
World: Production	5,170 r/	4,470 r/	4,140 r/	4,210 r/	4,410 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits.

2/ Barium chemicals data withheld to avoid disclosing company proprietary data.

3/ Data excludes run-of-mine.

4/ Includes crude and ground.

5/ Sold or used plus imports minus exports.

6/ Includes imports.

TABLE 2
U.S. PRIMARY BARITE SOLD OR USED BY PRODUCERS, BY STATE 1/

State	Number of operations	Run of mine		Beneficiated material 2/		Total	
		Quantity (thousand metric tons)	Value (thousands)	Quantity (thousand metric tons)	Value (thousands)	Quantity (thousand metric tons)	Value (thousands)
1994:							
Nevada	5	W	W	284	\$5,020	284 3/	\$5,020 3/
Other States	6	W	W	77	10,800	77 3/	10,800 3/
Total	11	222	\$3,330 r/	361	15,800	583	19,100 r/
1995:							
Nevada	5	W	W	W	W	479	7,950
Other States	6	W	W	W	W	64	9,400
Total	11	W	W	W	W	543	17,300

r/ Revised. 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 flotation concentrate.

3/ Data excludes run-of-mine.

TABLE 3
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS IN THE UNITED STATES,
BY STATE 1/ 2/

State	1994			1995		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	5	676	\$51,700	5	712	\$41,500
Nevada	4	308	7,220	3	W	W
Other States 3/	10	266	22,200	10	500	41,000
Total	19	1,250	81,100	18	1,210	82,500

W Withheld to avoid disclosing company proprietary data; included with "Other States."

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

2/ Includes imports.

3/ Includes California, Georgia, Illinois, Louisiana (1994), Missouri, Nevada (1995), New York, Texas, and Utah.

TABLE 4
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS IN THE UNITED STATES,
BY USE 1/ 2/

(Thousand metric tons and thousand dollars)

Use	1994		1995	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	130	\$18,700	105	\$17,500
Well drilling	1,120	62,400	1,110	65,000
Total	1,250	81,100	1,210	82,500

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

2/ Includes imports.

TABLE 5
U.S. EXPORTS OF NATURAL BARIUM SULFATE (BARITE), BY COUNTRY 1/

Country	1994		1995	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	19	\$3	26	\$42
Barbados	90	48	--	--
Brazil	--	--	4	7
Canada	11,700	\$1,120	14,000	1,140
Colombia	3	3	10	6
Dominican Republic	23	9	--	--
France	--	--	3	6
Greece	--	--	40	9
Israel	--	--	10	56
Italy	28	14	--	--
Japan	43	207	18	293
Jordan	7 r/	5 r/	--	--
Korea, Republic of	36	15	--	--
Mexico	1,870	408	1,430	428
Spain	--	--	20	5
Suriname	--	--	36	6
Switzerland	--	--	7	12
Taiwan	--	--	19	7
United Kingdom	19	19	--	--
Total	13,800	1,850	15,600	2,020

r/ Revised.

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

Source: Bureau of the Census.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF BARITE, BY COUNTRY 1/

Country	1994		1995	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
Crude barite:				
Canada	321	\$67	87	\$27
China	788,000	33,000	699,000	33,900
India	198,000	5,980	216,000	7,760
Mexico	2,390	217	10,700	474
Morocco	26,300	1,110	38,400	1,890
Netherlands	--	--	25	15
United Kingdom	--	--	1	8
Total	1,020,000	40,400	965,000	44,100
Ground barite:				
Canada	11,600	2,730	11,600	2,850
Denmark	7	4	--	--
Germany	189	92	231	124
Japan	106	60	65	65
Mexico	46,600	3,920	66,400	5,360
Netherlands	2	3	49	25
Total	58,500	6,810	78,400	8,430

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

2/ C.i.f. value.

Source: Bureau of the Census.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF BARIUM CHEMICALS 1/

Year	Barium choride		Barium oxide, hydroxide, and peroxide	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
1994	510	\$264	4,240	\$4,640
1995	1,110	651	4,410	4,890
Year	Barium nitrate		Barium carbonate, precipitated	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
1994	2,800	2,510	18,700	10,600
1995	3,950	3,450	20,500	13,200
Year	Other barium compounds			
	Quantity (metric tons)	Value 2/ (thousands)		
1994	13,000	11,400		
1995	13,400	13,000		

1/ Data are rounded to three significant digits.

2/ C.i.f. value.

Source: Bureau of the Census.

TABLE 8
BARITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1991	1992	1993	1994	1995 e/
Afghanistan e/ 4/	2,000	2,000	2,000	2,000	2,000
Algeria	44,361	51,159 r/	47,232 r/	20,590 r/	25,000
Argentina	23,896	10,015	11,267	11,500 e/	11,000
Australia e/	11,000	11,000	11,000	11,000	11,000
Belgium e/	35,000	30,000	30,000	30,000	30,000
Bolivia	1,277	368	-- e/	3,307	10,845
Bosnia and Herzegovina e/ 5/ 6/	XX	3,000	2,000	1,000	1,000
Brazil (beneficiated)	46,784	54,490	32,068	31,499 r/	32,000
Burma	11,339	13,589	15,628	21,969 r/	34,601 7/
Canada	50,000	37,000	59,000	55,000	57,000 7/
Chile	3,153 r/	2,514	2,035	3,670 r/	3,000
China e/	1,600,000	1,500,000	1,500,000	1,500,000	1,500,000
Colombia	9,288	9,380	4,840	7,000	21,300 7/
Croatia e/ 6/	XX	1,500	1,500	1,000	1,000
Czechoslovakia 8/	86,000 e/	31,313	XX	XX	XX
Egypt	5,943	7,840 r/	1,125 r/	419 r/	500
France	96,500 r/	98,100 r/	67,900 r/	72,100 r/	70,000
Georgia e/	XX	40,000	30,000	20,000	20,000
Germany (marketable)	147,219 r/	154,873 r/	147,614 r/	145,223 r/	150,000
Greece (crude ore) e/	1,309 7/	1,000	1,000	1,000	1,000
Guatemala	--	1,720	1,500 e/	1,000 e/	1,200
India	615,000	458,436	547,875 r/	566,393 r/	575,000
Iran 4/	191,238	181,174	226,378 r/	139,000 r/ e/	150,000
Ireland	94,300	70,600	53,000 e/	60,000 e/	60,000
Italy	88,486	74,884	52,000 e/	60,000 e/	38,000
Kazakhstan e/	XX	200,000	200,000	150,000	150,000
Kenya e/	100	100	14 r/ 7/	14 r/	10
Korea, Republic of	1,014	40	-- r/	85 r/	80
Malaysia	16,600	10,525	11,551	17,144	16,966 7/
Mexico	191,962	187,730	136,000	86,605 r/	248,367 7/
Morocco	433,325	401,000	325,200	264,526	265,000
Pakistan	28,751	32,432	26,336	20,320 r/	15,360 7/
Peru	9,250 r/	16,579	23,988 r/	53,074 r/	37,420 7/
Philippines e/	500	500	500	500	500
Poland	18,300	15,700	-- r/	25,000 r/	20,000
Portugal e/	1,000	378 7/	350	300	300
Romania e/	70,000	118,100 7/	115,000	104,700 7/	105,000
Slovakia e/	XX	XX	30,000	25,000	25,000
South Africa	4,790	3,570	2,000	1,945 r/	1,990 7/
Spain	5,200 r/	6,194 r/	6,000 e/	5,000 e/	5,000
Thailand	92,974	46,328	42,385	53,248 r/	50,000
Tunisia	22,366	30,179	30,000 e/	30,000 e/	30,000
Turkey (run-of-mine)	248,911 r/	311,335	118,367 r/	116,220 r/	158,000
U.S.S.R. e/ 9/	450,000	XX	XX	XX	XX
United Kingdom	85,505	76,723	55,000 r/	54,000 r/	85,000
United States 10/	448,000	326,000	315,000 11/	583,000 r/	543,000 7/
Yugoslavia 5/ 6/ 12/	20,000 e/	XX	XX	XX	XX
Zimbabwe	866	232	120	-- r/	--
Total	5,170,000 r/	4,470,000 r/	4,140,000 r/	4,210,000 r/	4,410,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through July 12, 1996.

3/ In addition to the countries listed, Bulgaria also produces barite, but available information is inadequate to make reliable estimates of output levels.

4/ Data are for fiscal year beginning Mar. 21 of that stated.

5/ All production in Yugoslavia for 1991 came from Bosnia and Herzegovina.

6/ Barite concentrates.

7/ Reported figure.

8/ Dissolved Dec. 31, 1992. Production in Czechoslovakia for 1991 came from the Czech Republic and Slovakia; all production for 1992 came from Slovakia.

9/ Dissolved in Dec. 1991.

10/ Sold or used by producers.

11/ Data excludes run-of-mine.

12/ Dissolved in Apr. 1992.