

# BARITE

By James P. Searls

Barite, a name which was derived from the Greek word “barus,” meaning heavy, is the mineralogical name for barium sulfate. 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 (Thrush, 1968). Few mines in the United States produce a spar grade barite.

As used in this report, the term “primary barite” refers to the first marketable product. This product includes crude barite (run of mine) and the products of simple beneficiation methods, such as washing, jigging, heavy media separation, tabling, flotation, and magnetic separation. Most primary barite requires some upgrading to minimum purity or density, then grinding to a 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. Barite used for drilling can be blue, black, brown, or gray depending on the ore body; must be finely ground, dense, soft, and chemically inert; must have a specific gravity of 4.2 or greater; must be free of soluble salts; and must be reduced in particle size such that 90% to 95% of the material must pass through a 325-mesh screen. A small percentage of iron oxide is allowable. In offshore drilling the U.S. Environmental Protection Agency limits the content of mercury to 1 milligram per kilogram of barite, and the content of cadmium to 3 milligrams per kilogram of barite (U.S. Environmental Protection Agency, 1997). This has probably become a de facto specification for the API barite producers because they need to keep their distribution channels simple.

## Production

Domestic sales data for barite were derived from a voluntary survey of U.S. operations by the U.S. Geological Survey (USGS). Actual mine production data were sometimes not reported because some mines sporadically produce to raw ore stocks, then beneficiate and sell from those stocks for several years and report these withdrawals from stocks as production; others produce normally and report their year’s production. Of the 31 operations to which a survey was sent, 29 responded, 19 by returning the forms, representing 60% of the primary barite sold or used by producers. Another 10 sites were reported with approximations by telephone conversations with site managers. Two surveyed sites were closed. Of the 31 operations surveyed, 8 were mines, 5 of which had associated beneficiating mills, 2 of which did not produce for the year but had associated mills, and 1 mine only sold run-of-mine ore (on a contract basis). The other 15 operations included 14 crushing and grinding operations, not connected to mines and 1 distribution center. The quantity of primary barite sold or used by producers rose by about 5% from

that of 1996, while weighted average prices rose about 1%. Some barite was ground at the mine sites in Nevada to supply the Western States, the Western Canadian provinces, and Alaska API markets. Grinding to API specifications was not usually performed at the mine site because railroad tariffs were higher for finished barite than for crude barite.

There are 14 barite crushing or grinding operations reporting—by survey or by telephone—to the USGS which are not geographically associated with mines. These operations are near the consumers of barite in Illinois, Louisiana, and Texas and receive imported, and some domestic, barite for processing. Harcros Pigments’ East St. Louis grinding plant was sold to Elementis Pigments Inc. Milwhite Inc.’s Houston, TX, plant, previously considered to be a grinding plant, was reported to be a distribution terminal. Several crushers and grinders opened in south Texas in response to a local shortage of API barite, apparently to supply *Petróleos Mexicanos*.

The quantity of crushed and ground barite reported as sold by mills rose about 17% from that of 1996 to 2.18 million tons and the weighted average price rose a modest, approximate 5% from that of 1996 to about \$79.35 per ton. Apparent consumption rose by about 35% to 2.92 million tons.

## Consumption

Domestic producers supplied a broad range of barite quality, excluding only the United States Pharmacopoeia barite. Crushing and grinding companies reported only a division of sales between petroleum-well weighting barite and “industrial” barite.

About 95% of the barite sold in the United States was used as a weighting agent in oil- and gas-well drilling fluids, now mostly in the Gulf of Mexico region and much smaller amounts used in the Pacific Coast areas. Drilling fluids, which are usually barite and bentonite combined with other chemicals in a water, chemical or oil base, are used to clean the bottom of a hole by removing cuttings and transporting them to the surface, to cool the bit and drill string, to control formation pressures and to seal porous well formations. Domestic API barite consumption was driven by oil and gas drilling activity, particularly in those wells that were deeper than about 2,135 meters (7,000 feet) where the petroleum-reservoir pressure increases at a greater rate than simple hydraulic pressure. When drilling through fluidized zones, the added weight of the barite creates an added hydrostatic pressure that holds back formation pressure and prevents an influx of gases and fluids from the formation into the hole. Effectively, barite, to the oil industry, owing to its specific gravity of at least 4.2, is an environmentally beneficial mineral that, when in a slurry form, exerts a hydrostatic pressure down the drill hole, counterbalancing any upwardly vented petroleum reservoir pressure. Uncounterbalanced petroleum reservoir pressure would

force the crude oil and gas to gush (spray) out of the well. Gushers of crude petroleum were, and still are, extremely dangerous fire hazards to well drilling personnel, wasteful of crude petroleum, and sources of visual and chemical pollution to the surface area surrounding the well.

Demand for API barite rose strongly in 1997 owing to deep oil- and gas-well drilling off the coasts of Louisiana, Mexico, and Texas and to a decline in barite production in Mexico. There has also been a technological shift within the last 4 years in the well drilling industry, combined with the maturation of the “3-D” seismic imaging and analysis, that made drilling more efficient and lowered the cost of petroleum wells (Oil & Gas Journal, 1997b). This shift led to a resurgence of drilling for gas in the United States, primarily in the adjacent Gulf Coast. Additionally, the major international U.S. oil and gas producers and sellers have turned their attention back to the Gulf Coast because of the slow development of the giant international opportunities.

The light sweet crude oil week-average futures price has fallen from \$25.64 per barrel at yearend 1996 to \$17.57 per barrel at the yearend 1997 (Oil & Gas Journal, 1998a). At midyear 1997, the price for light sweet crude oil was \$19.96 per barrel, down about 22% from yearend 1996 and down about 6% from the midyear 1996 price of \$21.29 per barrel (Oil & Gas Journal, 1997a). The natural gas week-average futures price fell 22% from \$2.86 per million British thermal units at the beginning of 1997 to \$2.24 per million British thermal units at yearend (Oil & Gas Journal, 1998b).

“The global [North American plus international] rig count was up 15.1% in fiscal 1997. The rig count in North America was up 24.7%, 20.0% in the United States, and 38.9% in Canada. The international rig count rose 2.7% primarily due to offshore activity, which was up 7.1%. Most major producing regions had more rigs in use, both offshore and onshore.” (Dresser Industries Inc., 1998).

The number of gas-directed rigs in the United States, as reported by the Baker-Hughes rotary rig count, was 480 at beginning of year 1997, 583 at midyear 1997, and 633 at yearend 1997. The number of oil-directed rigs in the United States, as reported by the Baker-Hughes rotary rig count, was 363 at the beginning of the year 1997, 380 at midyear 1997, and 366 at yearend 1997 (Oil & Gas Journal, 1997a, 1998a). It is clear that gas is more profitable at this time in the United States. The Baker-Hughes “Total U.S.” rotary rig count at the end of the year increased by about 19% to 1,003 rigs at yearend 1997 from 845 rigs at yearend 1996 (Oil & Gas Journal, 1998a).

“In 1997, the number of total worldwide hydrocarbon processing construction projects averaged well over 3,000, the highest level since 1982, and reflected the building of new process facilities and expanding and retrofitting existing ones to satisfy consumer and industrial demand. Rising project activity outside the United States more than offset a slight decline domestically.” (Dresser Industries, Inc., 1998).

This would all appear to indicate that the cost of discovery is declining so that declining prices of finished product do not discourage exploration. With the large regions coming on in Venezuela, Canada, the North Sea, and the Caspian Sea area for oil, and in the Middle East and Asia-Pacific for condensate, it must mean that the decisionmakers consider oil and gas to be

reliable and long-term solutions at long-term prices that the consumers will choose for several years (Hermes, 1998). Barite is but a small portion of the exploration and development costs and will be carried along in this surge of confidence in petroleum markets. This explains the stable-to-increasing world drilling and refinery expansion activity while the Asia-Pacific region falters economically, and with the likelihood of Iraq entering the world market with an possible price downturn.

No subdivisions of industrial end uses of barite are reported because each is less than about 20,000 tons per year and only three producers reported in that category. The technical grade end uses are for filler and extender grades, colorants, weighting agents, and feedstock into barium chemicals (Brobst, 1994). The construction industry uses marble-sized lumps of barite as a portion of the aggregate in concrete to weight down petroleum pipelines passing through marshes or under rivers. The same sizes will also block radiation in concrete nuclear reactor buildings. The industrial end uses of barite included barium chemicals for the glass, ceramics, bricks, and cement block industries; barium ferrites and titanates; batteries; getters for computer monitors, TV tubes, and vacuum systems for semiconductor processing; brake and clutch pads for automobiles and trucks; the contrast media for gastrointestinal x-rays; paint; rubber; plastics; and photographic print paper. One domestic barite producer has named its white technical grade barite “baryte” to distinguish it from the barite used in petroleum well-drilling. A very small amount was used in research on superconducting materials. Barite used as industrial-grade weighting agents encompass such products as barite in rubber mud flaps for trucks to prevent the flap from being lifted by the air flow around the truck and in rubber rug backing to keep the rug more stationary.

## Prices

The 1997 nominal average weighted sales price for primary barite was \$22.40 per ton in 1997, an increase of 1% from the 1996 price. Nominal average prices for the crushed and ground barite rose from \$75.44 per ton in 1996 to \$79.36 per ton in 1997, an increase of more than 5%. International prices for the middle of the year (Industrial Minerals, 1997) were as follows: API, lump, c.i.f. (cost, insurance, and freight) [U.S.] Gulf Coast, Chinese, \$48 to \$52 per ton; Indian, \$52 to \$55 per ton; Moroccan, \$52 to \$54 per ton; unground, OCMA/API, bulk, specific gravity 4.2, f.o.b. (free on board) Morocco, \$40 to \$42 per ton; ground, bagged, specific gravity 4.22, f.o.b.; Morocco, \$75 to \$80 per ton; ground OCMA/API, big bags (1.5 tons) f.o.b.; South Turkey, \$64 to \$66 per ton; ground OCMA, bulk, delivered Aberdeen [United Kingdom], \$62.47 to \$72.18 [£45-£52, (International Monetary Fund, June 30, 1997, currency units per Special Drawing Rights in June 1997, accessed July 8, 1998, at URL <http://www.imf.org/external/np/tre/sdr/1997/1997rate.htm>) per ton, delivered Great Yarmouth [United Kingdom], \$72.18 to \$83.29 (£52-£60) per ton; micronised, off white minimum 99% less than 20 micrometers delivered United Kingdom, \$194.34 to \$208.22 (£140-£150) per ton; and ground, white, paint-grade, 96% to 98% BaSO<sub>4</sub>, 350 mesh, 1-5 tons delivered United Kingdom, \$270.69 to \$305.39 (£195-£220) per ton.

## World Review

**China.**—The Chinese provinces of Guizhou, Hunan, and Guangxi are likely to be the largest barite suppliers to the United States and other countries for the near future. The small mine operations have had difficulties providing quality ores because the mining is by short-term leases from local governments. This is extremely conducive to mining for short-term goals rather than the longest lifetime for the ore body (Keegan, 1997).

## Outlook

The worldwide demand for barite will probably continue to grow as petroleum products continue to be the energy sources of choice. One company notes that the strong demand, as indicated by the number of total worldwide hydrocarbon processing construction projects as averaging well over 3,000, the highest level since 1982, and reflected the building of new process facilities and expanding and retrofitting existing ones to satisfy consumer and industrial demand. Of course, this demand will be dependent upon steady economic growth, with reduced negative effects from whatever might happen in the Pacific Basin from the growth and business practices of the last 10 years.

For the United States, the chances of an increase in offshore drilling activity seems slight, owing to a lack of more drilling equipment. The used deepwater drill rigs are currently unavailable in the Gulf of Mexico and all new drilling equipment will have to be built. Land-based drill rigs may be a little more available. The drill rigs are believed to have gone to the Latin America, the Middle East, and the North Sea. Africa and the Pacific Basin petroleum exploration activity will be unchanged. It is not clear whether offshore equipment will be bid away from the North American region or the Asian Basin. Should Asian banks and economic activity suffer further setbacks, petroleum exploration, and even sales of finished petroleum product, may decline in that region.

It is not clear how far or for how long the futures price for gas or oil will fall in the next 2 years in the United States.

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## SOURCES OF INFORMATION

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<sup>1</sup>Prior to January 1996, published by the U.S. Bureau of Mines.

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

(Thousand metric tons and thousand dollars)

	1993	1994	1995	1996	1997
United States:					
Barite, primary:					
Sold or used by producers	315 3/	583	543	662	692
Value	\$19,300 3/	\$19,100	\$10,400	\$14,700	\$15,500
Exports	18	14	16	31	22
Value	\$2,610	\$1,850	\$2,020	\$3,190	\$2,430
Imports for consumption 4/	804	1,070	1,040	1,540	2,250
Value	\$34,200	\$47,200	\$52,500	\$81,900	\$122,000
Consumption (apparent) 5/	1,100	1,640	1,570	2,170	2,920
Crushed and ground (sold or used by processors) 6/	1,090	1,250	1,370	1,870	2,180
Value	\$79,200	\$81,100	\$99,800	\$141,000	\$173,000
World: Production	4,570 r/	4,580 r/	5,060 r/	6,330 r/	6,930 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	Total	
		Quantity (thousand metric tons)	Value (thousands)
1996:			
Nevada	5 2/	W	W
Other States 3/	4	W	W
Total	9	662	\$14,700
1997:			
Nevada	4 2/	W	W
Other States 3/	4 2/	W	W
Total	8	692	15,500

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 one idle mine.

3/ Includes Georgia, Missouri, and Tennessee.

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

State	1996			1997		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	6 r/	1,090	\$80,500	6	1,320	\$105,000
Nevada	3	238	10,200	3	267	12,300
Texas	4 r/	454	33,900	4	524	40,300
Other 3/	6	81	16,100	6	78	16,000
Total	19	1,870	141,000	19	2,180	173,000

r/ Revised.

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

2/ Includes imports.

3/ Includes California, Georgia, Illinois, and Missouri.

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	1996		1997	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	102	\$16,600	106	\$18,400
Well drilling	1,760	124,000	2,080	155,000
Total	1,870	141,000	2,180	173,000

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	1996		1997	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Algeria	--	--	7	\$20
Argentina	35	\$6	110	14
Austria	--	--	18	4
Belgium	24	6	--	--
Canada	12,800	1,140	18,900	1,590
Chile	1,440	242	--	--
China	--	--	25	25
Colombia	33	34	73	56
Egypt	81	35	--	--
France	1	4	--	--
Germany	150	6	238	29
Hong Kong	152	132	--	--
India	--	--	1	7
Ireland	--	--	7	8
Italy	48	211	--	--
Jamaica	--	--	2	9
Japan	27	11	3	3
Korea, Republic of	22	15	--	--
Mexico	9,660	798	2,010	551
Netherlands	6	4	12	8
Oman	32	118	11	17
Panama	20	8	8	7
Peru	--	--	156	26
Singapore	--	--	10	41
Thailand	4	7	--	--
United Kingdom	1	6	3	17
Venezuela	5,960	415	--	--
Total	30,500	3,190	21,600	2,430

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	1996		1997	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
<b>Barite, crude:</b>				
Canada	12,700	\$2,620	13,800	\$2,560
China	1,130,000	59,200	1,990,000	106,000
India	244,000	9,220	154,000	7,460
Japan	341	10	60	20
Mexico	25,000	1,270	8,080	529
Morocco	39,000	1,950	16,600	809
Peru	--	--	26,500	909
Switzerland	12,100	541	--	--
United Kingdom	--	--	22	9
Total	1,470,000	74,800	2,210,000	118,000
<b>Barite, ground:</b>				
Canada	1,500	999	6,930	1,440
China	--	--	122	40
Germany	55	48	167	102
Mexico	68,800	5,970	27,000	2,430
Netherlands	111	46	93	52
United Kingdom	1	2	29	17
Total	70,400	7,060	34,300	4,080

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/

	1996		1997	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
Barium choride	1,680	\$1,260	1,340	\$863
Barium oxide, hydroxide, and peroxide	4,380	4,850	4,330	4,690
Barium nitrate	3,880	2,930	3,000	3,150
Barium carbonate, precipitated	18,900	13,100	25,900	15,900
Other barium compounds	12,400	12,700	12,400	13,400

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/	1993	1994	1995	1996	1997 e/
Afghanistan e/ 4/	2,000	2,000	2,000	2,000	2,000
Algeria	47,232	20,584 r/	29,838 r/	31,348 r/	32,000
Argentina	14,761	27,828 r/	28,907 r/	14,038 r/	15,000
Australia e/	11,000	11,000	11,729 r/	12,000 r/ e/	15,000
Belgium e/	30,000	30,000	30,000	30,000	30,000
Bulgaria 5/	130,000	120,000	150,000	120,000	120,000
Bolivia	-- e/	3,307	10,845	4,745 r/	5,500
Bosnia and Herzegovina e/ 6/	2,000	1,000	1,000	500	2,000
Brazil (beneficiated)	32,068	31,499	30,750	39,662 r/	39,700
Burma	15,628	21,969	34,601	20,000 r/ e/	22,000
Canada	59,000	55,000	61,000	58,000 r/	103,000 p/
Chile	2,035	3,670	3,080 r/	2,559 r/	2,600
China e/	1,500,000	1,500,000	1,800,000 r/	2,800,000 r/	3,500,000
Colombia	4,840	7,000	21,300	21,000 r/ e/	21,000
Croatia e/ 6/	1,500	-- r/	-- r/	-- r/	--
Egypt	1,125	419	500 e/	500 e/	500
France	67,200	72,100	75,450	75,000 e/	76,000
Georgia e/	40,000 r/	30,000 r/	20,000	20,000	20,000
Germany (marketable Ba <sub>2</sub> SO <sub>4</sub> )	131,163 r/	127,383 r/	122,268 r/	121,476 r/	120,000
Greece (crude ore)	988 r/	701 r/	668 r/	671 r/	700
Guatemala e/	400 r/	500 r/	500 r/	500 r/	500
India	547,875	497,971	421,867 r/	369,500 r/	400,000
Iran 4/ e/	226,378 7/	139,000	150,000	150,000	150,000
Ireland	53,000 e/	--	--	-- e/	--
Italy	52,697 r/	57,856 r/	44,000 r/ e/	80,463 r/	75,000
Kazakstan e/	200,000 r/	200,000 r/	286,000	250,000	250,000
Kenya	14	20	20 e/	20 e/	20
Korea, North	110,000	110,000	120,000	110,000	120,000
Korea, Republic of	--	85	90	80	80
Malaysia	11,551	17,144	16,966	17,458 r/	16,500
Mexico	136,000	86,605	248,367	470,028 r/	236,606 7/
Morocco	325,200	264,526	289,308 r/	288,308 r/	300,000
Nigeria	--	--	--	--	4,000
Pakistan	26,336	20,320	15,360	18,582 r/	19,000
Peru	23,988	53,074	37,420	37,500 e/	37,000
Philippines e/	-- r/	-- r/	-- r/	-- r/	--
Poland	20,400	26,600	22,400	25,000 e/	25,000
Portugal e/	350	50	50	-- r/	--
Romania	115,000 e/	104,700	18,169	12,541	12,000
Russia e/	70,000	70,000	70,000	70,000	70,000
Saudi Arabia	2,000	5,000	6,000	8,000	8,000
Slovakia e/	30,000	25,000	25,000	25,000	25,000
South Africa	2,000	1,945	1,990	7,428	7,384 7/
Spain	17,656	28,037	28,600	28,000 e/	28,000
Thailand	30,085 r/	36,356 r/	35,883	48,074 r/	54,800
Tunisia	15,289 r/	15,732 r/	10,825 r/	15,360 r/	12,841 7/
Turkey (run-of-mine)	118,367	116,220	153,719 r/	160,000 r/ e/	160,000
United Kingdom	32,623	54,000	85,000 e/	102,000	100,000
United States 8/	315,000 9/	583,000	543,000	662,000	692,000
Zimbabwe	120	--	--	-- e/	--
Total	4,570,000 r/	4,580,000 r/	5,060,000 r/	6,330,000 r/	6,930,000

e/ Estimated. p/ Preliminary. r/ Revised.

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 June 10, 1998.

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 March 21 of that stated.

5/ Based on estimated recovery factor of 70%.

6/ Barite concentrates.

7/ Reported figure.

8/ Sold or used by producers.

9/ Data excludes run-of-mine.