



2020 Minerals Yearbook

BARITE [ADVANCE RELEASE]

BARITE

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In 2020, primary U.S. barite production (sold or used by producers) decreased, but quantity and value were withheld to avoid disclosing company proprietary information. Ground barite sold or used by processors, a reasonable indication of consumption, was 1.41 million metric tons (Mt), a decrease of 40% compared with 2.35 Mt in 2019. Imports for consumption were 1.48 Mt, and exports were 0.48 Mt. World barite production was 6.84 Mt, a decrease of 24% compared with 9.02 Mt (revised) in 2019 (tables 1, 3, 5, 8).

Barite's primary use was as a weighting agent in oil- and gas-drilling fluids, so trends in sales of ground barite generally mirrored trends in the count of active oil- and gas-drilling rigs (fig. 1). This use typically accounted for more than 90% of domestic consumption and approximately 70% of global consumption (Barytes Association, The, undated). In 2020, global oil consumption was adversely affected by travel restrictions owing to the global coronavirus disease 2019 (COVID-19) pandemic and reduced demand for transportation fuels (World Bank Group, 2020, p. 19). The annual average count of international drill rigs decreased by 38% to 1,352. Declines were greatest in the United States, where the annual average count decreased by 54% to 436. Rig counts in the Middle East and in Asia and the Pacific declined the least, by 19% and 15%, respectively (Baker Hughes Co., 2021).

Barite is the mineralogical name for barium sulfate (BaSO_4). In commerce, the mineral is sometimes referred to as barytes. In this chapter, the term "primary barite" refers to the first marketable product, which includes crude barite that has undergone simple beneficiation methods, such as jigging, tabling, and washing, or more complex methods, such as flotation, heavy-media separation, or magnetic separation. Most barite ores require some upgrading to achieve minimum commercial purity or density levels.

Production

Domestic production and sales data for barite were derived from voluntary responses to a U.S. Geological Survey (USGS) canvass. Responses were received from six mining operations, but only four had reportable production. This represented 100% of domestically mined barite sold or used at company grinding mills. All of the mines were in Nevada. Data were received from 19 of the 23 grinding mills that operated during the year, representing 87% of the quantity of ground barite sold. Estimates for nonrespondents were made using prior year and other industry data.

In 2020, most of the leading companies that mined and ground barite in the United States were also major oil-service companies. Information on active U.S. mines and grinding mills can be found in table 2. Crude barite production decreased in 2020, but quantity and value data were withheld to avoid disclosing company proprietary information.

The only facilities that were active in Nevada for all of 2020 were M-I L.L.C.'s (operating as M-I SWACO) Greystone and Mountain Springs Mines and Battle Mountain Grinding plant. Although domestic mine production increased between 2016 and 2019, it never returned to levels achieved prior to an industry downturn in 2015 brought on by a decrease in oil price. Since that time, several Nevada barite operations have been idled. Halliburton Energy Services, Inc.'s Rossi Mine had been in continuous operation since 1947 until it was idled in 2015, although Halliburton continued to work on a mine expansion in 2020. National Oilwell Varco, Inc.'s Big Ledge Mine began reclamation in 2017. Progressive Contracting Inc.'s Coyote Mine was inactive in 2020. According to Mine Safety and Health Administration data, Baker Hughes Inc.'s Nevada assets were all idled in 2020—the Slaven Canyon Mine in April and the Argenta Mine and mill in September. CIMBAR Performance Minerals acquired Baker Hughes' Corpus Christi, TX, grinding plant in October (Simonelli, 2020, p. 8).

Twenty-three grinding mills operated for all or part of 2020. Most Nevada barite ore was ground at nearby company-owned grinding mills. In addition to the 4 grinding mills in Nevada, 13 grinding mills operated along the coast of the Gulf of Mexico (5 in Louisiana and 8 in Texas). These stand-alone grinding mills processed imported crude barite that was ground primarily to American Petroleum Institute (API) specifications for the oil- and gas-drilling market, although some was ground for other uses. An additional six grinding mills in California, the Midwest, and the Southeast ground barite for use as extenders, fillers, pigments, and other uses and produced API-grade barite for the oil- and gas-drilling market.

Environment

Common impurities in drilling-grade barite include chert, dolomite, quartz, siderite, and metallic oxide and sulfide compounds. These impurities are ordinarily insoluble and, as a result, standards limiting their concentrations have not been developed. In addition, the API standard does not address heavy-metal impurities, but barite derived from base-metal deposits can contain heavy metals, such as cadmium and mercury, and discharges of these often are regulated by environmental laws. For example, U.S. environmental regulations on offshore drilling allow drilling waste discharges containing barite only if the barite contains less than 3 parts per million (ppm) cadmium and less than 1 ppm mercury (Drilling Waste Management Information System, undated).

Consumption

In 2020, domestic apparent consumption of barite decreased, but data were withheld to avoid disclosing company proprietary data (table 1). Sales of ground barite (sold or used by

processors) in all regions were 1.41 Mt, a decrease of 40% compared with 2.35 Mt in 2019. Sales in Louisiana decreased by 9% to 516,000 t, those in Texas decreased by 56% to 498,000 t, and sales by mills in all other States combined decreased by 40% to 392,000 t (table 3). More than 90% of barite sales from domestic crushers and grinders were for oil- and gas-drilling markets and the rest were for other industrial end uses.

Drilling fluids, also known as muds, perform a number of functions in well drilling including controlling formation pressure, cooling and lubricating the drill bit, maintaining wellbore stability, removing formation cuttings, and transmitting hydraulic energy to the bit. Drilling fluids typically are made up of liquid and solid phases (Williamson, 2013). The primary role of barite in drilling fluids was as a solid state weighting agent. Barite is a component of almost all drilling fluids and accounts for approximately 10% of the composition of lightweight, oil-based muds and up to more than 40% (by weight) of heavyweight, oil-based muds (Bosch, 2016, p. 10). As a well is drilled, the drill bit passes through various formations, each with different characteristics. To maintain formation pressure, deeper wells require more heavily weighted muds, and therefore, a higher percentage of barite or an alternative higher specific gravity (SG) weighting agent in the mud mix. Barite is ground to a small, uniform size, based on specifications set by the API, before use as a weighting agent in drilling mud.

The most essential characteristic of barite used in drilling fluid is its SG. Until 2010, the API specifications called for weighting agents with a minimum SG of 4.20. Because of concerns about dwindling reserves of 4.20-SG barite, the API issued a new edition of “API Specification 13A, Specification for Drilling Fluids Materials,” which added specifications for 4.10-SG weighting agents (effective August 1, 2010). Except for SG, specifications for 4.10-SG weighting agents are the same as those for 4.20-SG. These specifications require weighting agents to be ground finely enough that at least 97% of the material (by weight) passes through a 200-mesh (Tyler) [75-micrometer (μm)] screen and no more than 30% (by weight) can be less than 6 μm in effective diameter. The diameter is measured using sedimentation techniques. Lastly, weighting agents may contain a maximum of no more than 250 ppm of water-soluble alkaline earth metals, such as calcium (American Petroleum Institute, 2010, p. 13–23, 83–96).

Since the adoption of the 4.10-SG specifications, 4.10-SG and sub-4.10-SG barite have gained widespread acceptance in the U.S. drilling industry. Increasingly considered “premium” material, 4.20-SG barite is combined with lower SG barite to create blends tailored for specific applications (Newcater, 2015). Within the barite industry, the term “grade” increasingly refers to barite of differing SGs, as opposed to indicating purity, as is the case with many other mineral commodities. Although higher SG barite typically contains a higher percentage of barite, the presence of certain impurities also can raise the SG of lower purity material.

Since the adoption of the 4.10-SG specifications, two other trends in non-API-conforming barite have emerged—the use of sub-4.10-SG barite and the use of barite with a finer particle size. Because neither the USGS barite canvass nor the Harmonized Tariff Schedule of the United States (HTS), used

to categorize trade data, differentiate between barite products of differing SGs, little information is available about the relative proportion of the differing SGs of barite used. However, The Barytes Association (2019, p. 8) estimated that in recent years 60% of barite sales in the United States were 4.10 SG, 30% did not meet the API specifications for SG, and 10% were 4.20 SG.

Although the 4.10-SG specifications initially were proposed as a way to extend domestic barite resources, a subsequent study challenged that assertion because the use of lower SG weighting materials affects fluid performance in a way that ultimately may require the use of more drilling fluid. This effect is less problematic for lower density fluids but is exacerbated as fluid density increases. As fluid circulates through the drilling system, it becomes contaminated with cuttings from the formation, contributing low-gravity solids, which reduce fluid efficacy and decrease longevity. Because lower SG barite usually contains more impurities (typically quartz and other materials with a lower SG than barite), the impurities contribute to total low-gravity solids and inhibit the fluid’s ability to incorporate drill solids (Scott and Robinson, 2010; Miller, 2017, p. 10, 11). These were likely some of the reasons that the API was reportedly not considering additional specifications for weighting materials with a SG of less than 4.10 (O’Driscoll, 2019).

Some barite processors have concluded that the financial benefit of using lower cost and quality barite is more than offset by increased processing costs. Because lower quality barite typically contains higher levels of more abrasive impurities such as iron oxides and quartz, it contributes to increased wear on equipment and reduces productivity (Carrasale, 2021).

Finer particle sized weighting materials are known to improve safety and maintain well control by reducing sag, preventing formation damage, and reducing equivalent circulating density, particularly in high-pressure, high-temperature, and deep-water wells. Consequently, numerous suppliers have begun offering barite in a variety of finer particle sizes than called for by the API specifications. In 2020, the API drilling fluids committee continued to research the specifications of finer sized weighting agent materials in use with the goal of establishing nomenclature, specifications, and testing methods for nonstandard weighting agent particle sizes (Barytes Association, The, 2019, p. 12).

The color of barite used for drilling petroleum varies and can be black, blue, brown, buff, or gray. In addition to a high SG, other advantageous properties of barite include low abrasiveness, low oil absorption, chemical and physical inertness, nontoxicity, low solubility, and a relatively low cost when compared to alternatives. 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 subsequent drill-hole logging. Because of these properties, barite has been the leading choice for use as a weighting agent in oil and gas drilling and available substitutes have not significantly displaced barite in this application.

Industrial end uses, such as barium chemicals, filler in paint and plastics, and powder coatings, require that barite be ground to a small, uniform size. The required size depends on the application, but for paint- and plastic-grade material, grain size was approximately 2 to 3 μm . Barite-containing materials

were used for sound reduction in engine compartments in automobiles, boats, and trucks. Barite also was used in the base coat of automobile finishes for smoothness and corrosion resistance and continued to be used in friction products for automobiles and trucks.

Barite used as an aggregate in “heavy” concrete or radiation-shielding concrete was crushed and screened to sizes ranging from 4.75 millimeters (0.187 inches) to 3.75 centimeters (1.5 inches).

Transportation

Since 2014, annual U.S. net import reliance for barite has exceeded 75% (McRae, 2022). As a bulk commodity used primarily for its weight, transportation expenses are a substantial component of the final cost of barite used on a per-ton basis.

Most crude barite imports were shipped in handymax-size bulk carriers (typically 35,000- to 60,000-t deadweight tonnage). After being ground to API specifications, barite was transferred directly to containers on barges docked in canals, lakes, and rivers near the grinding mills for bulk delivery to offshore drilling platforms. These nearshore barite staging locations also were convenient to the clusters of onshore areas with significant petroleum production in the Petroleum Administration for Defense District 3, mostly along the coast of the Gulf of Mexico. Ground barite was typically shipped in containers. The proximity of drilling operations in the Permian Basin to mines in northern Mexico has contributed to increased imports by truck in recent years (Barytes Association, The, 2019, p. 6).

Prices

Because domestic barite-mining companies sold very little crude barite, value data for crude barite were largely estimated. The average unit value for crude barite from domestic mines and their associated beneficiation plants was withheld to avoid disclosing company proprietary data (table 1).

Value data for ground barite, as reported to the USGS, do not necessarily represent open market prices. Because oil-service companies owned many of the U.S. barite grinding mills, barite often was sold to customers at a reduced price or at cost because the barite was merely a small part of the overall service contract. Taking this reduced cost into account when comparing prices with those in 2019, the average unit value for barite ground in Louisiana decreased by \$40 per metric ton to \$130 per metric ton; the average unit value for barite ground in Texas increased by \$8 per metric ton to \$166 per metric ton; and the unit value of barite ground in other States increased by \$51 per metric ton to \$273 per metric ton (table 3). The unit value of sales for barite used in chemicals, glass, paint, rubber, and other filler increased by \$45 per metric ton to \$528 per ton in 2020. The average unit value for drilling-grade barite decreased by \$13 per metric ton to \$144 per metric ton.

According to yearend published price ranges for API-grade 4.20-SG unground lump barite from major exporting countries, the yearend 2020 price for barite free-on-board (f.o.b.) from China was \$95 to \$100 per metric ton compared with \$89 to \$93 per metric ton at yearend 2019. The import price for f.o.b. barite from Chennai, India, was \$89 to \$92 per metric ton

compared with \$88 to \$92 per metric ton at yearend 2019. The import price for f.o.b. barite from Morocco was \$85 to \$92 per metric ton compared with \$86 to \$92 per metric at yearend 2019 (Fastmarkets IM, 2020, 2021).

Foreign Trade

In 2020, barite exports (natural barium sulfate and other sulfates of barium, the chemically precipitated form of barite) were 47,800 t, a 24% increase compared with those in 2019. The leading recipients of barite exports from the United States were Canada (46%), Guyana (38%), and Mexico (11%) (table 5).

Combined imports of barite (crude and ground natural barium sulfate, and precipitated barium sulfate) totaled 1.48 Mt, a decrease of 41% compared with those in 2019 (tables 1, 6). The leading sources of domestic imports were China (39%), India (32%), Mexico (14%), and Morocco (10%). Imports of the several forms of barite reported under the HTS nomenclature “Other sulfates of barium,” the chemically precipitated form of barite used primarily in specialty applications, were 13,300 t, a 10% decrease compared with those in 2019 (table 6).

The normal duty rate on U.S. imports of crude barite was \$1.25 per metric ton, but imports of ground barite were free from duty. As a result, the major importers of crude barite applied for and received foreign trade zone (FTZ) status for many of their grinding mills in the United States. FTZ status allowed the ground barite produced by these mills to be reported as imports for consumption and not as crude barite received from foreign suppliers. Grinding mills in FTZs are identified in table 2.

World Review

Estimated world barite production was 6.84 Mt in 2020, a decrease of 24% compared with 9.02 Mt (revised) in 2019 (table 8).

Canada.—Voyageur Pharmaceuticals Ltd. advanced plans to produce pharmaceutical-grade barite from its Frances Creek property in British Columbia. The company’s intent was to develop a fully integrated North American supply chain for the manufacturing of barium and iodine contrast products for medical imaging. In February, Voyageur announced that barite meeting all U.S. Pharmacopeia specifications had been processed using gravity separation from the company’s Frances Creek property, but it continued to test other sorting technologies. In November, the company announced that it filed an updated National Instrument (NI) 43–101 Technical Report, which included X-ray separation data from the Frances Creek deposit, and was finalizing a preliminary economic assessment and prefeasibility study on its barium contrast products. Initial barium contrast products would use barite sourced from third parties and, by yearend 2020, the company was awaiting approval for five products that had been submitted to Health Canada (Voyageur Minerals Ltd., 2020a, b; Voyageur Pharmaceuticals Ltd., 2022, p. 6, 14).

China.—China was the world’s leading barite producer. Estimated production in 2020 was 2.8 Mt, unchanged compared with that in 2019 (table 8). Production in recent years had been adversely affected by domestic policy, particularly by

increased regulation of the mining sector, which resulted in closure of 50% to 70% of the country's mines. Overall capacity, however, was less affected because many of the larger mines still in operation were able to offset production capacity lost from the closure of smaller operations. Conversely, Chinese domestic barite consumption had been increasing, particularly for industrial uses such as filler, which led to increased prices in the domestic market. These price increases incentivized leading producers to focus on the domestic market, which led to difficulty in sourcing ore for export as traders and exporters were dependent on fewer, smaller mines (Barytes Association, The, 2019, p. 15).

India.—India was the second-ranked producer of barite after China (table 8). The Mangampet Mine, owned by the Andhra Pradesh Mineral Development Corp. Ltd. (APMDC), was the leading barite mine in the world and accounted for approximately 90% of the barite mined in India. APMDC sold its production to exporters and domestic processing plants through a bidding and tendering process according to the following classification—A grade met or exceeded SG of 4.20 with an average of 4.25 SG per lot; B grade had a minimum SG of 4.10; and C, D, and Waste (W) grades were low-density products with no guarantee of SG, although SG typically averaged more than 3.90. Stockpiles of low-grade material had accumulated over time and, as of January 2015 (the last year that the Indian Bureau of Mines collected barite production statistics), low-grade stocks were 4.9 Mt. Numerous private companies experimented with improved beneficiation techniques and (or) blending low-grade ore with higher grade ore to produce a marketable product (Indian Bureau of Mines, 2017, p. 3-6; John Newcaster, Principal, IMPACT Minerals LLC, written commun., February 21, 2020).

Laos, Thailand, and Vietnam.—Prior to the COVID-19 pandemic, barite mine production in Laos was estimated to have increased significantly, from 75,000 t in 2017 to 486,000 t in 2019 (table 8). As a landlocked country, exports from Laos were shipped through neighboring countries such as China, Thailand, or Vietnam. In 2020, production was estimated to be 180,000 t, a decrease of 63% compared with that in 2019, which was attributed to decreased global barite consumption and difficulty exporting material to neighboring countries, particularly Vietnam, owing to pandemic-related border closures (Lao, 2021, p. 10).

Laos, Thailand, and Vietnam all have long histories of barite production. In addition, Thailand and Vietnam each had capacity to grind and process barite for the oil- and gas-drilling industry. A few drilling companies reportedly had supply agreements with mines in Laos, particularly in the Vientiane Province near Kasi. Because of these relationships and trade logistics, it was difficult to ascertain where domestic barite imports from Southeast Asian countries originated, although most are thought to have originated in Laos. In 2018 and 2019, the U.S. Census Bureau began reporting increased quantities of barite imports from Laos and Vietnam, according to The Barytes Association (2019, p. 17). In 2018, a new mine in Laos began transporting barite by truck to the Port of Cua Lo in Vietnam for export. According to the USGS barite canvass, United States grinding plants reported importing approximately 200,000 t of barite from Laos in 2019.

In 2020, the U.S. Census Bureau reported that barite imports from Laos and Vietnam were zero, but that there were 51,600 t of imports from Thailand. The imports reported from Thailand may have originated in Laos but have been exported through Thailand owing to border closures between Laos and Vietnam.

Lao-China Base Barite Co. Ltd. had three separate licenses to mine barite northwest of Kasi, Vientiane Province. According to the company, it began exporting barite from its first and largest pit, Pha Yai, in 2018. It planned to develop five additional pits, all containing barite of SG of more than 4.30 and low levels of arsenic, cadmium, and mercury. The company reported that since beginning operation in 2018, it had exported approximately 600,000 t of barite to localities including the Middle East, China, Thailand, and the United States, until suspending operations in 2020 owing to the COVID-19 pandemic. After suspending operations, the company continued to implement projects to increase capacity and range of offered products including construction of a new jig plant, two spiral washers, and two grinding plants. The company also executed an exclusive sales agreement with and advanced plans to export barite from the Port of Nghi Son in Vietnam. The company expected that implementation of Laotian railroad projects being developed as part of China's Belt and Road initiative would reduce the company's transportation costs and facilitate access to additional ports in China and Thailand by 2023 (Lao, 2021).

Mexico.—Mexico has had a long history of barite production and, in recent years, production and exports to the United States had increased. In 2010, barite imports from Mexico totaled 18,100 t, which was less than 1% of all domestic imports (Miller, 2012, p. 9.7). In 2020, imports from Mexico were 213,000 t, which accounted for 14% of domestic barite imports. The leading producing Mexican State continued to be Nuevo Leon, but production also increased in other States such as Chihuahua, Coahuila, and Sonora, which all border the United States. Although the SG of barite in deposits in these Mexican States is typically lower than that in deposits in Mexican States bordering the Gulf of Mexico, the SG of barite was still suitable for much of the onshore drilling in the Permian Basin of the United States, and these locations are in closer proximity to the Permian Basin than the U.S. barite mines in Nevada. More than 90% of Mexico's barite production was thought to be exported to the United States—primarily by truck, but also by ship and rail. Internal consumption, concentrated offshore in the Gulf of Mexico, was supplied primarily by imports and production in adjacent States (Barytes Association, The, 2019, p. 6; Ruiz, 2019, p. 12, 13, 15).

Outlook

The properties of barite, including low abrasiveness, chemical and physical inertness, nontoxicity, low oil absorption, low solubility, and high SG, as well as it being less expensive than alternatives, have made it the leading choice for use as a weighting agent in oil and gas drilling. Available substitutes are not expected to significantly displace barite for the foreseeable future. Long-term barite consumption therefore is expected to be commensurate with trends in oil and gas production and consumption.

Travel restrictions imposed in response to the COVID-19 pandemic contributed to significant decreases in total global oil consumption and production in 2020 compared with 2019. However, if restrictions start to ease in 2021, global oil consumption could increase. This could positively affect crude oil production by the United States and members of The Organization of the Petroleum Exporting Countries, as well as increased domestic production of dry natural gas and increased domestic exports of liquefied natural gas.

References Cited

American Petroleum Institute, 2010, Specification for drilling fluids materials—ANSI/API Specification 13A (18th ed.): Washington, DC, American Petroleum Institute, ANSI/API specification 13A series, 109 p.

Baker Hughes Co., 2021, Worldwide rig counts—Current & historical data: Houston, TX, Baker Hughes Co. (Accessed April 9, 2021, via <https://rigcount.bakerhughes.com/intl-rig-count>.)

Barytes Association, The, 2019, The 2019 oil and gas markets update: The Barytes Association General Assembly, 27th, Safi, Morocco, June 20, presentation, 43 p.

Barytes Association, The, [undated], What is barytes?—Introduction: Brussels, Belgium, The Barytes Association. (Accessed March 21, 2022, at <https://www.barytes.org/barytes/>.)

Bosch, Chris, 2016, Oilfield mineral consumption trends: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2016, Houston, TX, June 6, presentation, 12 p.

Carrasale, Santiago, 2021, Extending life of assets through equipment wear reduction: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2021, Houston, TX, May.

Drilling Waste Management Information System, [undated], Fact sheet—Discharge to ocean: Argonne, IL, Argonne National Laboratory.

Fastmarkets IM, 2020, Fastmarkets IM December 2019 price movements: Fastmarkets IM, January 10. (Accessed March 19, 2020, via <http://indmin.com>.)

Fastmarkets IM, 2021, Fastmarkets IM December 2020 price movements: Fastmarkets IM, January 6. (Accessed March 1, 2021, via <http://indmin.com>.)

Indian Bureau of Mines, 2017, Minor minerals—Barytes, chap. 3 of Mineral reviews: Nagpur, India, Indian Minerals Yearbook 2015, v. III, 11 p. (Accessed March 24, 2022, at [http://ibm.nic.in/writereaddata/files/08092017094858Barytes2015\(Final\).pdf](http://ibm.nic.in/writereaddata/files/08092017094858Barytes2015(Final).pdf).)

Lao, Calvin, 2021, Laos's barite development and future projects: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2021, Houston, TX, May 26, 13 p.

McRae, M.E., 2022, Barite: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 30–31.

Miller, J.J., 2017, Essential minerals for drilling fluids: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2017, Houston, TX, May, 17 p.

Miller, M.E., 2012, Barite, in Metals and minerals: U.S. Geological Survey Minerals Yearbook 2010, v. I, p. 9.1–9.8. (Accessed March 24, 2022, at <https://s3-us-west-2.amazonaws.com/prd-wret/assets/palladium/production/mineral-pubs/barite/myb1-2010-barit.pdf>.)

Newcaster, John, 2015, Application of barite in drilling fluids past & future: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2015, Houston, TX, May 28, presentation.

O'Driscoll, Mike, 2019, Oilfield minerals rock in Houston: Epsom, Surrey, United Kingdom, IMFORMED [Industrial Mineral Forums & Research Ltd.], July 10. (Accessed March 24, 2022, at <http://imformed.com/oilfield-minerals-rock-in-houston/>.)

Ruiz, Paloma, 2019, Mexican barite and oil & gas overview: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2019, Houston, TX, June 10–12, presentation, 30 p.

Scott, P.D., and Robinson, L.H., 2010, Economic considerations and impacts for using low-grade barite: 2010 American Association of Drilling Engineers Fluids Conference and Exhibition, Houston, TX, April, 7 p. (Accessed March 23, 2022, at <https://www.aade.org/application/files/8615/7261/8002/AADE-10-DF-HO-19.pdf>.)

Simonelli, Lorenzo, 2020, Baker Hughes: Bernstein Strategic Decisions Conference, presentation transcript, May 27, 24 p. (Accessed March 24, 2022, at <https://investors.bakerhughes.com/static-files/6d2d5a6a-75e4-46f7-89a7-3bd3fa4ecdda>.)

Voyageur Minerals Ltd., 2020a, Voyageur files updated NI-43-101 report on the Frances Creek project & completes SGS Canada Inc. mine site visit for advancement of PEA: Calgary, Alberta, Canada, Voyageur Minerals Ltd. news release, November 2. (Accessed March 25, 2022, via <https://voyageurpharmaceuticals.ca/company-news/>.)

Voyageur Minerals Ltd., 2020b, Voyageur Pharmaceuticals confirms Frances Creek barite meets all pharmaceutical grade specification: Calgary, Alberta, Canada, Voyageur Minerals Ltd. news release, February 3. (Accessed March 25, 2022, at <https://voyageurpharmaceuticals.ca/wp-content/uploads/2020/02/3rd-Major-milestone-reached-VM-meets-all-Pharma-Grade-Specs.pdf>.)

Voyageur Pharmaceuticals Ltd., 2022, Voyageur—From the earth to the bottle: Calgary, Alberta, Canada, Voyageur Pharmaceuticals Ltd., May, 27 p. (Accessed August 11, 2022, at <https://voyageurpharmaceuticals.ca/wp-content/uploads/2022/06/Voyageur-Deck-May-2022-1.pdf>.)

Williamson, Don, 2013, Drilling fluid basics: Houston, TX, Oilfield Review 25, no. 1, Spring. (Accessed March 22, 2022, at <https://www.slb.com/-/media/files/oilfield-review/defining-drilling-fluids.ashx>.)

World Bank Group, 2020, Commodity markets outlook—Persistence of commodity shocks: Washington, DC, World Bank Group, October, 83 p. (Accessed March 21, 2022, at <https://openknowledge.worldbank.org/bitstream/handle/10986/34621/CMO-October-2020.pdf>.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Barite. Ch. in Mineral Commodity Summaries, annual.

Barite (Barium). Ch. in Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply, Professional Paper 1802, 2017.

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140, 2005.

Other

Barite. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Barium Minerals. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.

Barytes. British Geological Survey Mineral Profile, September 2005.

Economics of Barytes, The (10th ed.). Roskill Information Services Ltd., 2006.

TABLE 1
SALIENT BARITE STATISTICS¹

(Thousand metric tons and thousand dollars)

	2016	2017	2018	2019	2020
United States:					
Barite, primary:					
Crude, sold or used by processors:					
Quantity	232	334	366	414	W
Value ^c	22,000	32,100	40,300	45,700	W
Exports: ²					
Quantity	78	116	67	38	48
Value	30,100	29,700	20,100	12,800	14,900
Imports for consumption: ³					
Quantity	1,260	2,470	2,460	2,500 ^r	1,480
Value	192,000	267,000	284,000	311,000 ^r	194,000
Consumption, apparent ⁴	1,410	2,680	2,760	2,880 ^r	W
Crushed and ground, sold or used by processors: ⁵					
Quantity	1,420	2,030	2,420	2,350	1,410
Value	266,000	364,000	426,000	420,000	257,000
World, production ⁶	7,880 ^r	8,620 ^r	8,980 ^r	9,020 ^r	6,840

^cEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through October 6, 2021. Data are rounded to no more than three significant digits.

²Exports include crude, ground, and other barite exports calculated from Schedule B numbers 2511.10.1000 and 2833.27.0000.

³Imports include crude, ground, and other barite imports calculated from Harmonized Tariff Schedule of the United States codes 2511.10.1000, 2511.10.5000, and 2833.27.0000.

⁴Defined as primary barite sold or used by processors plus imports minus exports.

⁵From domestically mined and imported crude barite.

⁶Totals may include estimated data.

TABLE 2
 BARITE MINES AND GRINDING MILLS IN THE UNITED STATES IN 2020¹

State and operator (owner)	County or parish	Mine or mill	Foreign trade zone
Mines:			
Nevada:			
Baker Hughes Drilling Fluids (Baker Hughes Inc.)	Lander	Argenta	XX.
Do.	do.	Slaven Canyon	XX.
Halliburton Energy Services, Inc. (Halliburton Co.)	Elko	Rossi ²	XX.
M-I L.L.C., operating as M-I SWACO (Schlumberger Ltd.)	Lander	Greystone	XX.
Do.	do.	Mountain Springs	XX.
Progressive Contracting Inc.	Elko	Coyote ³	XX.
Grinding mills:			
California, Industrial Minerals Co.	Sacramento	Florin	XX.
Georgia, CIMBAR Performance Minerals	Murray	Chatsworth	XX.
Indiana, CIMBAR Performance Minerals	Posey	Mt. Vernon	XX.
Louisiana:			
Baker Hughes Drilling Fluids (Baker Hughes Inc.)	St. Mary	Morgan City	No. 124, Gramercy, LA.
Excalibar Minerals LLC (Newpark Resources, Inc.)	Iberia	New Iberia	Do.
Halliburton Energy Services, Inc. (Halliburton Co.)	Calcasieu	Lake Charles	No. 087, Lake Charles, LA.
Do.	Lafourche	Larose	No. 124, Gramercy, LA.
M-I L.L.C., operating as M-I SWACO (Schlumberger Ltd.)	St. Mary	Amelia	Do.
Nevada:			
Baker Hughes Drilling Fluids (Baker Hughes Inc.)	Lander	Barite Grinding Plant	XX.
Halliburton Energy Services, Inc. (Halliburton Co.)	Eureka	Dunphy ²	XX.
M-I L.L.C., operating as M-I SWACO (Schlumberger Ltd.)	Lander	Battle Mountain	XX.
National Oilwell Varco, Inc.	Elko	Osino	XX.
Ohio:			
CIMBAR Performance Minerals	Columbiana	Wellsville	XX.
Do.	Washington	Marietta	XX.
Tennessee, Excalibar Minerals LLC	Dyer	Dyersburg	XX.
Texas:			
Baker Hughes Drilling Fluids (Baker Hughes Inc.)	Nueces	Corpus Christi	No. 122, Corpus Christi, TX.
CIMBAR Performance Minerals	Harris	Houston	XX.
Excalibar Minerals LLC (Newpark Resources, Inc.)	do.	do.	XX.
Do.	Nueces	Corpus Christi	No. 122, Corpus Christi, TX.
Halliburton Energy Services, Inc. (Halliburton Co.)	do.	do.	Do.
Milwhite Inc. (Control MINAR, S.A. de C.V.)	Cameron	Brownsville	XX.
Superior Weighting Products, LLC (CES Energy Solutions Corp.)	Nueces	Corpus Christi	No. 122, Corpus Christi, TX.
TOR Minerals International	do.	do.	Do.

Do., do. Ditto. XX Not applicable.

¹Table includes data available through July 19, 2021.

²Temporarily closed.

³Inactive in 2020.

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

State	2019			2020		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	5	568	\$96,900	5	516	\$67,400
Texas	8	1,130	179,000	8	498	82,700
Other ³	10	652	145,000	10	392	107,000
Total	23	2,350	420,000	23	1,410	257,000

¹Table includes data available through July 19, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²From domestically mined and imported crude barite.

³Includes California, Georgia, Indiana, Nevada, Ohio, and Tennessee.

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	2019		2020	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and (or) extender, glass, paint, rubber	W	W	W	W
Well drilling	W	W	W	W
Total	2,350	420,000	1,410	257,000

W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through July 19, 2021. Data are rounded to no more than three significant digits.

²From domestically mined and imported crude barite.

TABLE 5
U.S. EXPORTS OF NATURAL BARIUM SULFATE (BARITE), BY COUNTRY OR LOCALITY^{1,2}

Country or locality	2019		2020	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Canada	28,400	\$6,010 ^r	22,000	\$5,980
China	113	167	177	156
Colombia	66	62	805	296
Dominican Republic	262	144	230	106
Guyana	463	181	18,200	2,630
Jamaica	133	73	--	--
Kuwait	746	538	--	--
Mexico	5,400	4,400	5,270	5,090
Thailand	202	89	264	121
Trinidad and Tobago	28	29	240	68
United Arab Emirates	2,220	655	--	--
Other ³	447 ^r	467 ^r	612	460
Total	38,500	12,800	47,800	14,900

^rRevised. -- Zero.

¹Table includes data available through June 22, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Exports calculated from Schedule B numbers 2511.10.1000 and 2833.27.0000.

³Includes countries and (or) localities with less than 100 metric tons each.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF BARITE, BY COUNTRY OR LOCALITY^{1,2}

Country or locality	2019		2020	
	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)
Crude:				
China	174,000	\$25,600	104,000	\$17,200
India	193,000 ^r	15,800 ^r	84,300	6,740
Laos	88,700	10,200	--	--
Mexico	134,000	12,400	47,500	5,660
Morocco	97,000	9,050	37,200	4,500
Pakistan	10,100	1,040	--	--
Thailand	--	--	51,600	6,770
United Kingdom	4,540	134	5,420	196
Vietnam ⁴	-- ^r	19,400 ^r	--	22,700
Other [4 countries and (or) localities]	986	57	--	--
Total	703,000^r	93,600^r	330,000	63,800
Ground:				
China	578,000 ^r	56,000 ^r	467,000	41,200
Germany	2,090 ^r	2,020 ^r	1,910	1,890
India	626,000 ^r	68,200	394,000	35,100
Laos	54,200	5,560	--	--
Liberia	7,830 ^r	1,250 ^r	--	--
Mexico	206,000	27,200	166,000	20,800
Morocco	281,000	30,100	110,000	10,800
Vietnam	30,800	3,270	--	--
Other [6 countries and (or) localities]	899	224	206	100
Total	1,790,000	194,000	1,140,000	110,000
Other sulfates of barium:				
China	4,610 ^r	3,550	4,620	3,170
Germany	4,430	12,800	3,990	10,600
Hong Kong	72	44	252	159
Italy	4,420	4,940	3,800	4,470
Japan	1,040	2,350 ^r	497	1,320
Korea, Republic of	18	21	--	--
Mexico	14	30	13	27
Spain	21	46	19	31
Switzerland	126	152	92	87
United Kingdom	63	102	38	57
Other [3 countries and (or) localities]	13	18	5	8
Total	14,800	24,100	13,300	19,900
Grand total	2,500,000^r	311,000^r	1,480,000	194,000

^rRevised. -- Zero.

¹Table includes data available through June 22, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Imports calculated from Harmonized Tariff Schedule of the United States codes 2511.10.1000, 2511.10.5000, and 2833.27.0000.

³Cost, insurance, and freight value.

⁴Referred to U.S. Census Bureau for verification.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF BARIUM CHEMICALS^{1,2}

	2019		2020	
	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)
Barium chloride	1,740	\$1,820	1,860	\$1,750
Barium oxide, hydroxide, peroxide	5,030	9,200	2,950	5,500
Barium carbonate, precipitated	1,930	3,020	1,450	2,010

¹Table includes data available through June 22, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Imports calculated from Harmonized Tariff Schedule of the United States codes 2816.40.2000, 2827.39.4500, and 2836.60.0000.

³Cost, insurance, and freight value.

Source: U.S. Census Bureau.

TABLE 8
BARITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality ²	2016	2017	2018	2019	2020
Algeria, crude	52,000	29,159 ³	39,426 ³	40,000 ^e	40,000 ^e
Argentina	12,389	5,977	7,225	3,898 ^r	4,000 ^e
Australia	7,139	8,958	6,534	1,982	--
Bolivia	16,632	29,114	53,163	39,458 ^r	9,611
Bulgaria ^e	50,000	67,000	70,000	72,000 ^r	41,000
Burma	2,627	3,206	2,935	13,045 ^r	5,200 ^e
Canada ^e	20,000	50,000	40,000	40,000	50,000
China ^e	3,200,000	3,100,000	2,900,000	2,800,000	2,800,000
Ecuador	--	--	2,868	3,000 ^e	3,000 ^e
Egypt ^e	7,500	7,500	7,500	7,500	7,500
Germany	49,374	34,177	37,897 ^r	30,474 ^r	30,000 ^e
Guatemala	500	43	63	60 ^e	60 ^e
India	1,246,371 ⁴	2,038,915 ⁴	2,390,000 ^e	2,100,000 ^{r,e}	1,600,000 ^e
Iran	399,750 ⁵	239,132 ⁵	201,721 ^r	202,000 ^{r,e}	202,000 ^e
Kazakhstan	685,100	569,900	570,000 ^{r,e}	530,600 ^r	445,300
Laos	80,000 ^e	75,000 ^e	230,000 ^e	486,009 ^r	180,000 ^e
Liberia	--	--	--	12,000 ^e	-- ^e
Mexico	156,854	359,912	366,234	378,295 ^r	322,818
Morocco, crude	668,500	818,010	899,365	1,100,000 ^e	410,000 ^e
Nigeria	537	714	387	370 ^r	-- ^e
Pakistan	107,224	105,554	99,286 ^r	85,992 ^r	86,000 ^e
Peru	7,953	9,182	15,621	16,373	5,252
Russia	434,000	178,000	163,000	228,000 ^r	287,000
Slovakia	25,000	15,690	9,500 ^r	5,770 ^r	5,800 ^e
Thailand	223,101 ^r	147,954 ^r	67,490 ^r	33,644 ^{r,e}	34,000 ^e
Turkey, crude and ground	105,573 ⁶	310,667	335,473	298,000 ^{r,e}	180,000 ^e
United Kingdom	56,000	55,000	55,000	50,000 ^r	50,000 ^e
United States, crude ⁷	232,000	334,000	366,000	414,000	W
Vietnam ^e	30,000	26,000	41,000	31,000 ^r	43,000
Total	7,880,000 ^r	8,620,000 ^r	8,980,000 ^r	9,020,000 ^r	6,840,000

^eEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data. -- Zero.

¹Table includes data available through October 6, 2021. All data are reported unless otherwise noted; totals may include estimated data. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the countries and (or) localities listed, Afghanistan, Italy, and some other countries and (or) localities may have produced barite, but available information was inadequate to make reliable estimates of output.

³Data as reported by the Algeria Office of National Statistics only included production from state-owned entities.

⁴Production is based on fiscal year, with a starting date of April 1 of the year shown.

⁵Year beginning March 20 of that stated.

⁶Data as reported by the Turkish Statistical Institute included only ground production. Crude production was withheld.

⁷Crude barite sold or used by producers.

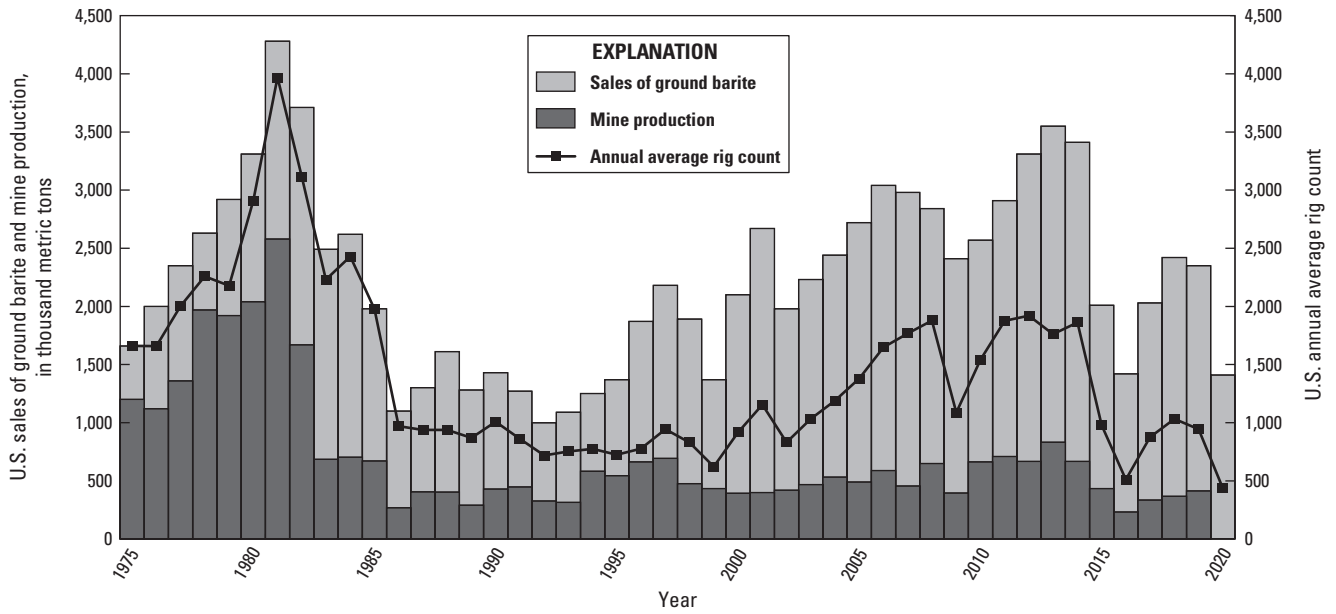


Figure 1. Historical trends in sales of ground barite, mine production of barite, and annual average rig count in the United States from 1975 through 2020. Mine production in 2020 was withheld to avoid disclosing company proprietary data. Sales of ground barite include domestically mined and imported crude barite. Sources: Baker Hughes Co. and U.S. Geological Survey.