



2018 Minerals Yearbook

BARITE [ADVANCE RELEASE]

BARITE

By Michele E. McRae

Domestic survey data and tables were prepared by Kristi J. Simmons, statistical assistant.

In 2018, primary U.S. barite production (sold or used by producers) was 366,000 metric tons (t) valued at an estimated \$40.3 million, and apparent consumption was 2.76 million metric tons (Mt) (table 1). Imports for consumption were 2.46 Mt (tables 1, 6), and exports were 67,300 t (table 5). World barite production was estimated to be 9.18 Mt (tables 1, 8).

The United States was the world's leading barite consumer. In 2018, domestic oil and natural gas drilling, the principal use of barite, continued to increase after historically low activity in 2016. The U.S. annual average count of active rigs increased by 18% to 1,032 (Baker Hughes, a GE company, LLC, 2019). Domestic apparent consumption of barite increased by 3% to 2.76 Mt (table 1), and sales of ground barite increased by 19% to 2.41 Mt.

Barite is the mineralogical name for barium sulfate (BaSO_4). In commerce, the mineral is sometimes referred to as barytes. In this report, the term primary barite refers to the first marketable product, which includes crude barite that underwent 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 minimum commercial purity or density levels. The primary use of barite is as a weighting agent in drilling fluids.

Legislation and Government Actions

In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals, including barite (U.S. Department of the Interior, 2018). This list was developed to serve as an initial focus, pursuant to Executive Order 13817, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." As defined by the Executive order, a critical mineral is defined as (1) a non-fuel mineral or mineral material essential to the economic and national security of the United States, (2) the supply chain of which is vulnerable to disruption, and (3) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security (Trump, 2017).

Under section 301(b) of the Trade Act of 1974, as amended, the Office of the United States Trade Representative (USTR) determined that acts, policies, and practices of China related to technology transfer, intellectual property, and innovation were discriminatory or unreasonable, and those actions burdened or restricted United States commerce (83 FR 14906). An initial list of 818 tariff lines became subject to an additional import duty of 25% in July 2018. In response to this action, China imposed additional import duties for certain items originating in the United States. In August, the USTR imposed an additional 25% import duty on a second list of 279 tariff lines. China responded in kind and added more products of United States origin to its

list of higher import duties. A third list of 5,745 full and partial tariff lines, including nonfuel mineral ores and concentrates and forms, became subject to an additional 10% import duty in late September. The duty rate for this third list was initially scheduled to increase to 25% on January 1, 2019, but that action was delayed.

Most mineral commodities were subject to the section 301 actions; however, a few commodities were removed from proposed lists, including barite. In response to the proposed tariff, the USTR received numerous comments from individuals, members of Congress, oil services and drilling fluids companies, and trade organizations, such as the American Petroleum Institute (API), the Independent Petroleum Association of America, the National Foreign Trade Council, and the Texas Oil & Gas Association, outlining the importance of barite in the oil and gas industry and the adverse effects that a barite tariff may have on the larger domestic energy sector. Key points included in comments and testimony described barite's function as a weighting agent in oil- and gas-drilling fluids, barite's advantageous properties that prevent its large-scale substitution with other materials, the lack of barite available in the global market that meets API specifications in sufficient quantity to meet United States demand, and the reasons why the majority of domestic barite imports originate in China. General consensus among the respondents indicated that a tariff on barite may result in reduced competitiveness of domestic oil and gas producers in the global market and increased fuel prices for domestic consumers. Because barite is a major ingredient in almost all drilling fluids, which constitute approximately 12% to 20% of the cost of drilling a well, the proposed tariff was projected to increase the cost of domestic oil and gas production (Office of the U.S. Trade Representative 2018a, b).

Production

Domestic production and sales data for barite were derived from voluntary responses to the U.S. Geological Survey (USGS) canvass. Responses were received from seven mining operations, but only five had reportable production. This represented 100% of domestic barite sold or used at company grinding mills. Of the operating mines, four were in Nevada and one was in Georgia. Data were received from 20 of the 22 grinding mills that operated during the year, representing 93% of the quantity of ground barite sold. Estimates for nonrespondents were made using prior-year data and other industry data.

In 2018, most of the leading companies that mined and ground barite in the United States were also major oil-service companies. Information on the mines and mills can be found in table 2. Crude barite production was estimated to be 366,000 t in 2018, a 10% increase compared with 334,000 t in 2017. The bulk of mine production was from Nevada, and a small quantity

was from Georgia. The estimated value of domestic production was \$40.3 million (table 1).

Until operations were suspended in 2015, Halliburton Energy Services' Rossi Mine had been in continuous operation since 1947. Under existing permits and authorizations, mining operations at the facility's three open pits were scheduled to end in 2018. However, the company was planning a mine expansion which was expected to extend the life of the mine by 8 years. Halliburton's plans for the project included expansion of the existing operational area, three existing pits, and waste rock facilities as well as development of an additional pit and waste rock facilities. Supporting infrastructure would be expanded or improved, and surface exploration would continue throughout the project area. Without approval for the expansion, reclamation activities would commence as outlined under the existing plan of operations (U.S. Department of the Interior, Bureau of Land Management, 2018, p. 1-1, 2-58). In September, the Bureau of Land Management (BLM) released the draft environmental assessment on the proposed expansion for public comment. (Elko Daily Free Press, 2018). As of yearend 2018, BLM had not announced a final decision on the project.

In February, Constantine Metal Resources Ltd. announced that it intended to initiate testing to determine whether it could produce a marketable barite concentrate from its Palmer project in southeast Alaska. Exploration and testing at the Palmer deposit, jointly owned by Dowa Metals and Mining Co. Ltd., was initially focused on base and precious metals including copper, gold, silver, and zinc in a volcanogenic massive sulfide deposit. Barite is present in the deposit in the form of sulfide-rich lenses. The company projected that because barite accounted for approximately 22% to 25% of reported resources, recovery of barite would significantly decrease the amount of waste rock as well as add value in the form of an additional marketable product, specifically drilling-grade barite meeting API specifications. Subsequent testing yielded a 95.3% barite concentrate with a specific gravity of 4.44 and a 91.1% BaSO₄ recovery rate. Based on those results, the company commissioned a market study to assess North American barite prices and analyze transportation options and costs and announced that barite would be included in all financial reporting, including an updated mineral resource assessment (Constantine Metal Resources Ltd., 2018a, b).

In 2018, twenty-two grinding mills operated for all or part of the year. There were 4 grinding mills in Nevada that processed barite ore from the Nevada mines. 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 mills processed imported crude barite that was primarily ground for use in the oil- and gas-drilling market, although some was ground for other uses. An additional five grinding mills in California, the Midwest, and the Southeast ground barite for use as extenders, fillers, pigments, and other uses and also produced barite for the oil- and gas-drilling market.

Environment

Common impurities in drilling-grade barite include quartz, chert, dolomite, 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 are sometimes 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 2018, domestic apparent consumption of barite increased by 3% to 2.76 Mt (table 1). Sales of ground barite in all regions increased by 19% to 2.41 Mt from 2.03 Mt in 2017. Sales in Louisiana increased by 2% to 530,000 t, those in Texas increased by 34% to 1.18 Mt, and sales by mills in all other States combined increased by 11% to 707,000 t (table 3). About 2.24 Mt, or 93%, of barite sales from domestic crushers and grinders was for the oil- and gas-drilling market, and the remaining 7% was for other industrial end uses (table 4). This was in contrast to global barite consumption of approximately 77% in oil- and gas-drilling, 12% in filler-grade, and 11% in chemical-grade uses (Barytes Association, The, 2019). Domestic sales of drilling-grade barite increased by 20%, and sales of domestic and imported barite for other industrial uses increased by 8% to 177,000 t (table 4).

Barite's role in the well-drilling industry is primarily as a weighting agent in drilling muds to suppress high formation pressures and to prevent blowouts. Barite is a component of almost all drilling fluids and can account for approximately 10% of the composition of low-weighted, oil-based muds and up to more than 40% (by weight) of high-weighted, oil-based muds (Bosch, 2016). As a well is drilled, the drill bit passes through various formations, each with different characteristics. Deeper wells require a higher percentage of barite in the mud mix. Most barite must be 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 mud is its specific gravity (SG). Until 2010, the API specification called for weighting agents with a minimum SG of 4.2. Because of concerns about dwindling reserves of 4.2-SG barite, the API issued a new edition of API Specification 13A, Specification for Drilling Fluids Materials, which added specifications for 4.1-SG weighting agents (effective August 1, 2010). Except for SG, other specifications for 4.1-SG weighting agents are the same as for the 4.2-SG specification. 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 4.1-SG specification, 4.1- and sub-4.1-SG barite have gained widespread acceptance in the

U.S. drilling industry. Increasingly considered “premium” material, 4.2-SG barite is combined with lower SG barite to create blends tailored for specific applications (Newcaster, 2015). Within the barite industry, the term “grade” increasingly refers to barite of differing SG, 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 can also raise the SG of lower purity material. Because neither the USGS barite canvass nor the Harmonized Tariff Schedule of the United States, 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 estimated that in 2018, 10% of barite sales in the United States were 4.2 SG, 60% were 4.1 SG, and 30% did not meet API’s SG specifications (Barytes Association, The, 2019).

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 abrasion, 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 separate 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 barite ground to a small, uniform size. The required size depends on the application, but for paint- and plastic-grade material, grain size averages about 2 to 3 μm . Barite-containing materials were used for sound reduction in engine compartments in automobiles, boats, and trucks. Barite was also 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, 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.

Prices

Because domestic barite-mining companies sold very little primary barite, value data for primary barite were mostly estimated. The average unit value for primary barite from domestic mines and their associated beneficiation plants was estimated to have increased by 15% to \$110 per metric ton from \$96 per metric ton in 2017 (table 1).

Value data for ground barite, as reported to the USGS, do not necessarily represent open market prices. Because oil-service companies own many of the U.S. barite grinding mills, barite is often sold to customers at a reduced price or at cost because the barite is merely a small part of the overall service contract. Taking this reduced cost into account when comparing prices with those from 2017, the average unit value for barite ground in Louisiana increased by approximately \$6 to \$166 per metric ton, the average unit value for barite ground in Texas decreased by

\$25 to \$147 per metric ton, and the unit value of barite ground in other States increased by \$27 to \$232 per metric ton (table 3). The barite unit value for chemicals, glass, paint, rubber, and other filler decreased by approximately \$27 to \$379 per metric ton in 2018. The average unit value for drilling-grade barite remained unchanged at \$160 per metric ton (table 4).

According to yearend 2018 published price ranges for crude barite from major exporting countries, the price for free-on-board (f.o.b.) barite from China, API grade, 4.20 SG unground lump was \$80 to \$90 per metric ton, unchanged from that in 2017. The import price for f.o.b. barite from Chennai, India, API grade, 4.20 SG unground lump was \$85 to \$90 per metric ton, a decrease from \$90 to \$100 per metric ton. The import price for f.o.b. barite from Morocco, API grade, 4.20 SG unground lump was \$86 to \$95 per metric ton, an increase from \$70 to \$88 per metric ton at yearend 2017 (Fastmarkets IM, 2017, 2019).

Foreign Trade

In 2018, U.S. barite exports (natural and precipitated barium sulfate) were 67,300 t (table 5), a 42% decrease compared with those in 2017. Leading recipients were Canada (66%), the Marshall Islands (17%), and Mexico (9%).

Combined imports of barite (crude and ground natural barium sulfate, and precipitated barium sulfate) totaled 2.46 Mt, essentially unchanged compared with a revised 2.47 Mt in 2017 (table 1). China was the leading supplier and accounted for 49% of total barite imported, followed by India (23%), Morocco (14%), and Mexico (12%), which made up most of the remaining imports. Imports of the several forms of barite reported under the Harmonized Tariff Schedule nomenclature “Other sulfates of barium,” the chemically precipitated form of barite, were 18,500 t, a slight increase compared with those of 2017 (table 6).

The tariff on U.S. imports of crude barite was \$1.25 per metric ton, but imports of ground barite had no tariff. 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 allows 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 increased by approximately 12% to 9.18 Mt in 2018, from a revised 8.20 Mt in 2017. Production in China, the world’s leading producer, decreased by an estimated 200,000 t, which was attributed to increased regulation of China’s mining industry that led to mine closures. Most of the increase in world barite production came from India, where production was estimated to have increased by more than 800,000 t in 2018.

Canada.—Voyageur Minerals Ltd. initiated a prefeasibility study for the production of barium contrast products used in medical imaging procedures. In 2017, Voyageur completed a drilling program at its Frances Creek property in British Columbia. Barite at the property is present in structurally controlled veins and breccias with an average content 96%

to 99% BaSO₄. In 2018, the company signed two separate agreements for development of the barium contrast product. The first was a Memorandum of Understanding with Innovation Metals Corp. (Toronto, Ontario) for proprietary processing technology needed to produce pharmaceutical-grade barite. The second established a joint venture with Chief Medical Supply Ltd. (Calgary, Alberta). Voyageur agreed to provide up to 2,000 metric tons per year of pharmaceutical-grade barite, and Chief Medical would be responsible for product formulation, manufacturing, packaging, and testing as well as securing regulatory approval from the Government of Canada (Voyageur Minerals Ltd., 2018a, b, c).

India.—India was the second-ranked producer of barite after China. The Mangampet Mine, owned by the Andhra Pradesh Mineral Development Corp. Ltd. (APMDC), is the largest barite mine in the world and accounts for approximately 90% of the barite mined in India. APMDC sells its production to exporters and domestic processing plants through a bidding and tendering process according to the following classification—A-grade meets or exceeds SG of 4.25, B-grade has a minimum SG of 4.10, and C-, D-, and Waste (W) grades are low-density product with no guarantee as to SG, although SG typically averages more than 3.90. Stockpiles of low-grade material have accumulated over time. Although the Indian Bureau of Mines (IBM) no longer publishes barite production statistics, as of January 2015 (the last year that IBM collected barite production statistics), there was 4.9 Mt in low-grade stocks. Numerous private companies have experimented with improved beneficiation techniques and (or) blended low-grade ore with higher grade ore in order to produce a marketable product (Indian Bureau of Mines, 2017, 2018; John Newcaster, Principal, IMPACT Minerals LLC, written commun., February 21, 2020). These efforts likely contributed to increased production in India in recent years.

Laos.—In response to USGS data collection in 2018, United States grinding plants reported importing approximately 100,000 t of barite from Laos, which was not reflected in official trade statistics as reported by the U.S. Census Bureau (table 6). Laos has historically been a minor barite producer and, prior to 2018, ore had been sent to Thailand for processing. Beginning in 2018, a new mine began trucking ore to the Port of Cua Lo in Vietnam for export, and the U.S. Census Bureau reported that the United States imported 14,400 t of crude and ground barite from Vietnam in 2018. These imports likely originated in Laos (Barytes Association, The, 2019).

Mexico.—Mexico has had a long history of barite production and, in recent years, production and exports to the United States have increased. In 2010, barite imports from Mexico totaled 18,100 t, which was less than 1% of all domestic imports. By 2018, imports from Mexico had increased to 292,000 t, approximately 12% of domestic barite imports. The leading producing State continued to be Nuevo Leon, but production has increased in other States such as Chihuahua, Coahuila, and Sonora, which border the United States. Although the SG of barite deposits in these States is typically lower than in States bordering the Gulf of Mexico, particularly Yucatan, many are near key drilling areas in the Permian Basin. API's adoption of the 4.1-SG standard combined with favorable logistics has

supported production growth in the country. More than 90% of Mexico's barite production was believed to be exported to the United States; the country's internal consumption, concentrated offshore in the Gulf of Mexico, was supplied primarily by imports and production from States in the Yucatan Peninsula (Barytes Association, The, 2019; Ruiz, 2019).

In 2018, CIMBAR Performance Minerals (Chatsworth, GA), a leading processor of barite in the United States with five barite grinding plants, announced that it entered into a joint venture with Minera Loma Negra S.A. de C.V., which operated a barite mine in Muzquiz, Coahuila. The company intended to increase production capacity at the Mexico operation, targeting 400,000 metric tons per year of barite by 2020 as well as expand its presence in the Permian Basin with additional trucks, trailers, and stock locations (O'Driscoll, 2019).

Outlook

In addition to high specific gravity, barite's properties, including low abrasion, low oil absorption, chemical and physical inertness, nontoxicity, low solubility, and being relatively inexpensive in comparison to 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 is therefore expected to be commensurate with increased oil and gas production.

In November 2018, U.S. crude oil production surpassed 10 million barrels per day for the first time since 1970, which is attributed primarily to advances in oil and gas recovery from shale and other low permeability formations. The U.S. Energy Information Administration projects that crude oil production will continue to set annual records through 2027 and that natural gas plant liquids production could reach 6 million barrels per day by 2029. All these factors should contribute to continued strong domestic demand for barite (U.S. Energy Information Administration, 2018; 2019, p. 16).

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, a GE company, LLC, 2019, Worldwide rig counts—Current & historical data: Houston, TX, Baker Hughes, a GE company, LLC, May. (Accessed August 6, 2019, 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.
- Bosch, Chris, 2016, Oilfield mineral consumption trends: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum Houston 2016, Houston, TX, June 5–7, presentation, 12 p.
- Constantine Metal Resources Ltd., 2018a, Constantine initiates barite metallurgical test program at Palmer project: Vancouver, British Columbia, Canada, Constantine Metal Resources Ltd., February 27. (Accessed February 24, 2020, at <https://www.constantinemetals.com/news/2018/constantine-initiates-barite-metallurgical-test-program-at-palmer-project/>.)
- Constantine Metal Resources Ltd., 2018b, Constantine metallurgy program yields quality barite concentrate and recoveries of 93% for zinc and 89% for copper: Vancouver, British Columbia, Canada, Constantine Metal Resources Ltd., August 13. (Accessed February 24, 2020, at <https://www.globenewswire.com/news-release/2018/08/13/1550899/0/en/Constantine-Metallurgy-Program-Yields-Quality-Barite-Concentrate-and-Recoveries-of-93-for-Zinc-and-89-for-Copper.html>.)

- Drilling Waste Management Information System, [undated], Fact sheet—Discharge to ocean: Argonne, IL, Argonne National Laboratory. (Accessed April 13, 2020, at <https://web.archive.org/web/20111016032003/http://web.ead.anl.gov/dwm/techdesc/discharge/index.cfm>.)
- Elko Daily Free Press, 2018, Halliburton proposes Rossi Mine expansion: Elko [NV] Daily Free Press, September 17. (Accessed February 14, 2020, at https://elkodaily.com/mining/halliburton-proposes-rossi-mine-expansion/article_1b820e1d-f5cd-5ab7-857a-9d25ab7ffd37.html.)
- Fastmarkets IM, 2017, IM's December price movements: Fastmarkets IM, December 22. (Accessed August 3, 2018, via <http://indmin.com>.)
- Fastmarkets IM, 2019, Fastmarkets IM December price movements: Fastmarkets IM, January 14.
- Indian Bureau of Mines, 2017, Minor minerals—Barytes, chap. 3 of *Mineral reviews* (54th ed.) (final release): Nagpur, India, Indian Minerals Yearbook 2015, v. III, July, p. 3–1 to 3–11. (Accessed February 21, 2020, at [http://ibm.nic.in/writereaddata/files/08092017094858Barytes2015\(Final\).pdf](http://ibm.nic.in/writereaddata/files/08092017094858Barytes2015(Final).pdf).)
- Indian Bureau of Mines, 2018, Minor minerals—Barytes, chap. 30 of *Mineral reviews* (56th ed.) (final release): Nagpur, India, Indian Minerals Yearbook 2017, v. III, March, p. 30–1–1 to 30–1–5. (Accessed February 21, 2020, at <http://ibm.gov.in/writereaddata/files/12102018130535Barytes%202017.pdf>.)
- Newcaster, John, 2015, Application of barite in drilling fluids past & future: IMFORMED [Industrial Mineral Forums & Research Ltd.] Oilfield Minerals & Markets Forum, Houston, TX, May 28, presentation.
- O'Driscoll, Mike, 2019, CIMBAR opens new US barite plant & acquires ATH plant: Epsom, Surrey, United Kingdom, IMFORMED [Industrial Mineral Forums & Research Ltd.], April 25. (Accessed February 24, 2020, at <http://imformed.com/cimbar-opens-new-us-barite-plant-acquires-ath-plant/>.)
- Office of the U.S. Trade Representative, 2018a, Request for public comment concerning proposed modification of action pursuant to section 301—China's acts, policies, and practices related to technology transfer, intellectual property, and innovation: Office of the U.S. Trade Representative request for comments, docket USTR-2018-0026. [The 13 comments on barite summarized in this chapter were separately authored. The request for comments was initiated as a notice in the Federal Register, at 83 FR 33608]. (Accessed February 19, 2020, via <https://www.regulations.gov/docketBrowser?rpp=25&so=DESC&sb=commentDueDate&po=0&s=barite&dt=PS&D=USTR-2018-0026>.)
- Office of the U.S. Trade Representative, 2018b, USTR finalizes tariffs on \$200 billion of Chinese imports in response to China's unfair trade practices: Office of the U.S. Trade Representative press release, September 18. (Accessed February 14, 2020, at <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2018/september/ustr-finalizes-tariffs-200>.)
- 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, [unpaginated].
- Trump, D.J., 2017, A Federal strategy to ensure secure and reliable supplies of critical minerals—Executive Order 13817 of December 20, 2017: Federal Register, v. 82, no. 246, December 26, p. 60835–60837. (Accessed February 14, 2020, at <https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf>.)
- U.S. Department of the Interior, 2018, Final list of critical minerals 2018: Federal Register, v. 83, no. 97, May 18, p. 23295–23296. (Accessed February 14, 2020, at <https://www.govinfo.gov/content/pkg/FR-2018-05-18/pdf/2018-10667.pdf>.)
- U.S. Department of the Interior, Bureau of Land Management, 2018, Rossi Mine expansion project—Draft environmental impact statement 2018: Elko, NV, Tuscarora Field Office, U.S. Department of the Interior, Bureau of Land Management DOI-BLM-NV-E020-2015-0041-EIS. (Accessed February 14, 2020, via <https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=82884>.)
- U.S. Energy Information Administration, 2018, Today in energy—U.S. monthly crude oil production exceeds 10 million barrels per day, highest since 1970: U.S. Energy Information Administration, February 1. (Accessed August 2, 2019, at <https://www.eia.gov/todayinenergy/detail.php?id=34772>.)
- U.S. Energy Information Administration, 2019, Annual energy outlook 2019—With projections to 2050: U.S. Energy Information Administration, January 24, 165 p. (Accessed August 2, 2019, at <https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf>.)
- Voyageur Minerals Ltd., 2018a, Voyageur announces high grade resource. Initiates steps of creating barium contrast suspension products: Calgary, Alberta, Canada, Voyageur Minerals Ltd. news release, July 5. (Accessed February 20, 2020, at <https://www.globenewswire.com/news-release/2018/07/05/1533725/0/en/Voyageur-Announces-High-Grade-Resource-Initiates-Steps-of-Creating-Barium-Contrast-Suspension-Products.html>.)
- Voyageur Minerals Ltd., 2018b, Voyageur Minerals Ltd. and Innovation Metals Corp. sign MOU for worldwide rights to high-purity barite technology: Calgary, Alberta, Canada, Voyageur Minerals Ltd. news release, March 20. (Accessed February 20, 2020, at <https://voyageurpharmaceuticals.ca/wp-content/uploads/2018/03/Voyageur-Joint-Venture-March-20th-2018.pdf>.)
- Voyageur Minerals Ltd., 2018c, Voyageur Minerals signs joint venture with Chief Medical Supply to begin manufacturing barium contrast pharmaceutical products: Calgary, Alberta, Canada, Voyageur Minerals Ltd. news release, November 8. (Accessed February 20, 2020, at <https://www.globenewswire.com/news-release/2018/11/08/1648065/0/en/Voyageur-Minerals-Signs-Joint-Venture-with-Chief-Medical-Supply-to-Begin-Manufacturing-Barium-Contrast-Pharmaceutical-Products.html>.)

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)

	2014	2015	2016	2017	2018
United States:					
Barite, primary:					
Crude, sold or used by producers:					
Quantity	667	433	232	334	366
Value ^c	74,900	51,200	22,000	32,100	40,300
Exports: ²					
Quantity	161	147	78	116	67
Value	45,300	54,800	30,100	29,700	20,100
Imports for consumption: ³					
Quantity	2,710 ^r	1,660	1,260	2,470 ^r	2,460
Value	386,000	247,000	192,000	267,000 ^r	284,000
Consumption, apparent ⁴	3,210	1,950	1,410	2,680 ^r	2,760
Crushed and ground, sold or used by processors: ⁵					
Quantity	3,410	2,010	1,420 ^r	2,030	2,420
Value	652,000	390,000	266,000	364,000	426,000
World, production	9,670 ^r	8,380 ^r	7,710 ^r	8,200 ^r	9,180

^cEstimated. ^rRevised.

¹Table includes data available through April 16, 2020. Data are rounded to no more than three significant digits.

²Exports include crude, ground, and other barite imports calculated from Harmonized Tariff 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.

⁴Sold or used by producers, plus imports, minus exports.

⁵From domestically mined and imported crude barite.

TABLE 2
ACTIVE BARITE MINES AND GRINDING MILLS IN THE UNITED STATES IN 2018¹

State and operator (owner)	County or Parish	Mine or mill	Foreign trade zone
Mines:			
Georgia, New Riverside Ochre Co., Inc.	Bartow	New Riverside Ochre	XX.
Nevada:			
Baker Hughes Drilling Fluids (Baker Hughes Inc.)	Lander	Argenta	XX.
Do.	do.	Slaven Canyon Mine	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 Mine	XX.
Progressive Contracting Inc.	Elko	Coyote Mine	XX.
Grinding mills:			
California, Industrial Minerals	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	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.
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.
M-I L.L.C., operating as M-I SWACO (Schlumberger Ltd.)	Galveston	Galveston	No. 036, Galveston, TX.
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.

Do., do. Ditto. XX Not applicable.

¹Table includes data available through April 16, 2020.

²In temporary closure.

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

State	2017			2018		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	5	517	\$82,900	5	530	\$88,100
Texas	8	876	151,000	8	1,180	173,000
Other ³	9	636	130,000	9	707	164,000
Total	22	2,030	364,000	22	2,420	426,000

¹Table includes data available through April 16, 2020. 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	2017		2018	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and (or) extender, glass, paint, rubber	163	\$66,400	177	\$67,200
Well drilling	1,870	297,000	2,240	359,000
Total	2,030	364,000	2,420	426,000

¹Table includes data available through April 16, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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	2017		2018	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	2,970	\$885	25	\$23
Brazil	878	531	951	621
Canada	52,000	9,340	44,200	8,400
China	377	711	144	167
Colombia	961	510	12	13
Italy	60	45	--	--
Jamaica	132	55	796	340
Korea, Republic of	806	2,540	57	126
Liberia	--	--	171	181
Malaysia	--	--	192	97
Marshall Islands	46,900	9,180	11,600	3,790
Mauritania	181	52	--	--
Mexico	7,120	4,440	6,220	5,350
Pakistan	5	15	--	--
Saudi Arabia	12	7	505	222
Suriname	2,730	919	--	--
Sweden	6	8	17	28
Thailand	226	47	187	82
Trinidad and Tobago	26	26	1,750	250
Other ³	392 ^r	415 ^r	386	369
Total	116,000	29,700	67,300	20,100

^rRevised. -- Zero.

¹Table includes data available through April 16, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Imports calculated from Harmonized Tariff Schedule B numbers 2511.10.1000 and 2833.27.0000.

³Includes 20 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	2017		2018	
	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)
Crude:				
China	343,000 ^r	\$41,300 ^r	345,000	\$47,600
India	292,000 ^r	21,100 ^r	198,000	18,200
Mexico	108,000	8,970	80,200	8,230
Morocco	208,000 ^r	14,700 ^r	140,000	14,200
Pakistan	9,830	801	--	--
Switzerland	19,900	2,090	6,360	852
United Kingdom	9	5	4,460	140
Vietnam	--	--	11,900	1,490
Other [5 countries and (or) localities]	60 ^r	53 ^r	128	50
Total	979,000^r	89,000^r	786,000	90,800
Ground:				
China	752,000	73,600	859,000	78,800
Germany	1,730	1,680	1,920	1,850
India	325,000	30,200	373,000	34,400
Japan	1,650	291	7	18
Mexico	195,000	25,800	212,000	28,300
Morocco	192,000	17,200	209,000	18,000
Vietnam	--	--	2,420	254
Other [12 countries and (or) localities]	486	205	428	198
Total	1,470,000	149,000	1,660,000	162,000
Other sulfates of barium:				
China	4,380	3,200 ^r	4,960	4,780
France	90	106	36	44
Germany	7,530	18,500	7,290	19,500
Hong Kong	61	37	204	147
Italy	4,660	4,640	4,440	4,520
Japan	1,150	2,300 ^r	1,270	2,540
Mexico	22	46	82	60
Switzerland	55	72	144	179
United Arab Emirates	40	26	--	--
United Kingdom	18	71	20	23
Other [5 countries and (or) localities]	--	--	33	50
Total	18,000	29,000^r	18,500	31,800
Grand total	2,470,000	267,000	2,460,000	284,000

^rRevised. -- Zero.

¹Table includes data available through April 16, 2020. 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.

Source: U.S. Census Bureau.

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

	2017		2018	
	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)
Barium chloride	2,500	\$2,220	2,540	\$2,390
Barium oxide, hydroxide, peroxide	3,840	5,930	3,760	7,450
Barium carbonate, precipitated	2,510	2,760	2,540	2,970

¹Table includes data available through April 16, 2020. 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	2014	2015	2016	2017	2018
Algeria, crude	56,829	44,000	52,000	40,000 ^{r,e}	40,000 ^e
Argentina	16,265	12,917	12,389	5,977 ^r	6,000 ^e
Australia	14,676	6,017	7,139	8,958	6,534
Bolivia	26,240	46,732	16,632	17,000 ^e	55,000 ^e
Bulgaria ^c	19,000 ^r	59,000 ^r	50,000	67,000 ^r	70,000
Burma ³	23,060	2,836	3,215	2,186 ^r	1,110 ^e
Canada	35,000	42,000 ^e	20,000 ^e	50,000 ^e	40,000 ^e
China ^e	3,700,000 ^r	3,500,000 ^r	3,200,000 ^r	3,100,000 ^r	2,900,000
Egypt	3,379	7,540	7,500 ^{r,e}	7,500 ^{r,e}	7,500 ^e
Germany	87,585	45,311	49,374	34,177 ^r	34,000 ^e
Guatemala	43	544	500	43 ^r	40 ^e
India	1,182,829	670,000 ^e	1,200,000 ^e	1,560,000 ^e	2,390,000 ^e
Iran	440,741	340,318 ^r	399,750 ^r	430,000 ^{r,e}	490,000 ^e
Kazakhstan ^c	590,000	607,000	620,000	620,000	620,000
Laos ^e	45,000 ^r	90,000 ^r	80,000 ^r	75,000 ^r	90,000
Liberia	48,000 ^e	--	--	--	--
Malaysia	14,456	--	--	--	--
Mexico ^c	460,000 ^r	310,000 ^r	170,000 ^r	390,000 ^r	380,000
Morocco, crude	1,006,600	1,212,130	668,500	818,010 ^r	940,000 ^e
Nigeria	7,113	3,323	537	714 ^r	700 ^e
Pakistan	153,808	121,575	107,224	106,081	110,000 ^e
Peru	106,071	28,407	7,953	9,182	15,621
Russia	360,000 ^e	361,000	434,000	178,000 ^r	163,000
Saudi Arabia	32,000	--	--	--	--
Slovakia	21,000	20,000 ^e	25,000 ^r	25,000 ^{r,e}	25,000 ^e
Thailand	81,996 ^r	72,000 ^{r,e}	140,000 ^{r,e}	67,000 ^{r,e}	67,000 ^e
Tunisia, crude	9,800	10,000 ^e	10,000 ^e	10,000 ^e	10,000 ^e
Turkey, ground	320,754	209,097	105,573	167,647 ^r	245,000 ^e
United Kingdom	44,000	50,000	56,000	55,000 ^r	55,000 ^e
United States, crude ⁴	667,000	433,000	232,000	334,000	366,000
Vietnam ^e	95,000	76,000 ^r	30,000	26,000 ^r	48,000
Total	9,670,000 ^r	8,380,000 ^r	7,710,000 ^r	8,200,000 ^r	9,180,000

^cEstimated. ^rRevised. -- Zero.

¹Table includes data available through July 22, 2019. All data are reported unless otherwise noted. 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 production estimates.

³Production is based on fiscal year, with a starting date of April 1 of the year shown.

⁴Crude barite sold or used by producers.