WOLLASTONITE

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Wollastonite, a calcium metasilicate (CaSiO₃), has a theoretical composition of 48.3% calcium oxide and 51.7% silicon dioxide but may contain trace to minor amounts of aluminum, iron, magnesium, manganese, potassium, and sodium. It occurs as prismatic crystals that break into massive-to-acicular fragments. It is usually white, but also may be gray, brown, or red depending on its composition.

Wollastonite forms when impure limestones are metamorphosed (subjected to heat and pressure) or silica-bearing fluids are introduced into calcareous sediments during metamorphic processes. In both cases, calcite reacts with silica to produce wollastonite and carbon dioxide. Wollastonite also can crystallize directly from a magma that has an unusually high carbon content, but this is a more rare occurrence.

Deposits of wollastonite have been found in Arizona, California, Idaho, Nevada, New Mexico, New York, and Utah. These deposits also may contain calcite, diopside, garnet, idocrase, and quartz as minor components.

Wollastonite is used primarily in ceramics, friction products (brakes and clutches), metallurgy, paint, and plastics. Some of the properties that make it so useful are its high brightness and whiteness, low moisture and oil absorption, low volatile content, and the acicular nature of some wollastonite.

Production

Wollastonite has been mined commercially in California and New York. The California deposits, which are in Inyo, Kern, and Riverside Counties, were mined between 1930 and 1970. These operations were limited in size, producing only a few thousand metric tons per year for ceramics, decorative stone, paint, and mineral wool production.

Wollastonite deposits in New York have been mined for more than 50 years. Two companies currently are mining wollastonite: NYCO Minerals Inc., a subsidiary of Fording Inc., operates a mine in Essex County, and R.T. Vanderbilt Co. Inc. operates a mine in Lewis County. The NYCO Minerals deposit contains wollastonite, garnet, and diopside. Parts of the deposit are composed of up to 60% wollastonite. The ore is processed at the Willsboro plant where the garnet is removed by using high-intensity magnetic separators. NYCO also chemically modifies the surfaces of some of its wollastonite products to improve their performance. The R.T. Vanderbilt deposit in Lewis County consists primarily of wollastonite, minor amounts of calcite and prehnite, and trace amounts of diopside. The ore is processed at its Balmat plant where it is milled and air classified.

Domestic wollastonite production decreased from that of 1999. Much of the decrease occurred because NYCO Minerals began supplying powder-grade wollastonite to some of its North American customers from its operation in Sonora, Mexico, instead of its New York operation. This change permitted the company’s New York operation to effectively increase its capacity for its higher value products and made better use of the company’s ore reserves. Additionally, NYCO Minerals added a stirred-media grinding mill and new magnetic separators to its Willsboro plant and began pilot studies for pelletizing wollastonite fines (Fording Inc., 2000, p. 26-28). Although data collected by the U.S. Geological Survey are withheld to avoid revealing proprietary information, U.S. production was estimated to be on the order of 130,000 metric tons per year (t/yr) (Rieger, 2000).

Consumption

The use of wollastonite in the United States declined slightly from that of 1999. Sales probably were slightly lower for ceramic, metallurgy, and paint applications. Plastics markets, in 2000, production was estimated to be about 130,000 tons. Between 1960 and 1990, production and sales of wollastonite increased steadily as ceramic and paint markets expanded. Wollastonite sales also received a boost when the debate over the health risks posed by asbestos intensified during the 1970s and early 1980s. It was during this time that asbestos substitute markets, for which wollastonite was well suited, opened up. By 1990, production was estimated to be about 110,000 tons. In 2000, plastics comprised an estimated 37% of wollastonite sales, followed by ceramics (28%), metallurgical applications (10%), paint (10%), friction products (9%), and other applications (6%). Some other applications for wollastonite were abrasive wheel bond, adhesives, joint compounds, refractories, rubber filler, and welding rods. Wollastonite has been used as an asbestos substitute in such products as floor tiles, friction products, insulating board and panels, paint, plastics, and roofing products.

Wollastonite in the 20th Century

Domestic mining of wollastonite has had a rather short history compared to many other mineral commodities. There was essentially no commercial mining of wollastonite in 1900. Small scale mining did not begin until the 1930s, and annual production was only on the order of a few thousand tons. Weathered wollastonite that looks like petrified wood was a popular product for landscaping. Wollastonite also was sold to the ceramics, mineral wool, and paint industries in small quantities. This level of production continued through the 1950s with all domestic production occurring in California. In the 1950s, a large wollastonite deposit was developed in New York, and large-scale production of wollastonite began in the United States. The high demand for housing following World War II resulted in the expansion of construction-related markets and provided a ready outlet for the increased production capacities. By 1960, U.S. wollastonite production and sales were about 35,000 metric tons; ceramics and paints were the major markets.

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however, appear to have remained strong.

Major domestic uses of wollastonite were in plastics (37%), ceramics (28%), metallurgy (10%), paint (10%), friction products (9%), and miscellaneous (6%) (Industrial Minerals, 1999). Wollastonite also was used in adhesives, joint compounds, refractories, rubber, and wallboard applications.

In ceramics, wollastonite decreases shrinkage and gas evolution during firing, increases green and fired strength, permits fast firing, and reduces crazing, cracking, and glaze defects. In metallurgical applications, wollastonite serves as a flux for welding and to protect the surface of the molten metal during the continuous casting of steel. As a filler in paint, it reinforces the paint film, acts as a pH buffer, improves its resistance to weathering, reduces pigment consumption, and acts as a flattening and suspending agent. In plastics, it improves tensile and flexural strength, reduces resin consumption, and improves thermal and dimensional stability at elevated temperatures. Surface treatments are used to improve the adhesion between the wollastonite and the polymers to which it is added. As a substitute for asbestos in floor tiles, friction products, insulating board and panels, paint, plastics, and roofing products, wollastonite is resistant to chemical attack, inert, stable at high temperatures, and a good reinforcer.

**Prices**

Prices per metric ton for domestically produced acicular wollastonite, ex-works, were $209 for 200 mesh, $258 for 325 mesh, and $284 for 400 mesh. The price per ton, ex-works, for acicular, high-aspect-ratio wollastonite was $351 and for ground (10-micrometer) wollastonite was $694. Prices per ton for wollastonite, free on board, in bulk, were $209 for 200 mesh and $253 for 325 mesh (Industrial Minerals, 2000). Quoted prices should be used only as a guideline because actual prices depend on the terms of the contract between the seller and the buyer.

**Foreign Trade**

Foreign trade data were not available from the U.S. Census Bureau for wollastonite. Imports previously were estimated to be between 2,500 metric tons (t) and 5,000 t. The revised estimate is between 10,000 t and 12,000 t, mainly because NYCO Minerals began supplying some of its North American customers from its operation in Mexico. Imports from China also were believed to have increased in 2000 compared with those of 1999. Most of the imports are thought to be lower-value wollastonite grades. Some wollastonite also was imported from Finland and India. Exports were estimated to be between 5,000 t and 8,000 t in 2000.

**World Review**

Worldwide production of wollastonite was estimated to be between 500,000 t and 550,000 t in 2000. China again was an unknown factor with regard to wollastonite production and sales. Production estimates for China typically have been in the 200,000-t/yr to 300,000-t/yr range. One source estimated exports from China to be between 100,000 t/yr and 150,000 t/yr and domestic consumption to be 100,000 t/yr, placing production in the 200,000-t/yr to 250,000-t/yr range (Roskill Information Services Ltd., 1996, p. 18). Production for Finland, India, and Mexico was estimated to be 20,000 t, 100,000 t, and 75,000 t, respectively. With the closure of the only Canadian producer, production from Canada was estimated to be at most a few hundred tons. Small tonnages probably also were produced in Chile (reported as 270 t in 1996), Namibia (reported as 347 t in 1999), North Korea, Pakistan, South Africa (reported as 200 t in 1999), and Turkey.

**Canada**—The board of directors of Orleans Resources Inc. suspended production at the Lac St.-Jean plant in July 2000. A build-up of inventory, the company’s financial situation, and lack of a partner prompted the action. The company planned to meet client needs from inventory (Orleans Resources Inc., 2000). Orleans Resources also hired the consulting firm KPMG International to locate a business partner for Orleans or conduct a sale of the company’s assets (North American Minerals News, 2000).

**Outlook**

The decline of the U.S. economy, which began in 2000, probably will continue to hamper sales in the United States, causing a stagnation or slight decline in sales and consumption. Markets most likely to be affected will be in ceramics, metallurgy, and paint. Sales for friction products also may decline slightly. Decreases such as these would be expected during an economic slowdown with associated downturns in housing starts (ceramic and paint markets), automobile sales (friction products), and steel output (metallurgical applications). The most promising market is plastics; sales should increase in the coming years. Despite economic slowdowns faced by some other countries, worldwide sales of wollastonite should increase slightly as more durable goods are required for growing populations.

**References Cited**


Orleans Resources Inc., 2000, Orleans Resources suspends production activities at its Lac St.-Jean wollastonite plant: Montreal, Orleans Resources Inc. press release, July 31, 1 p.


**GENERAL SOURCES OF INFORMATION**

**U.S. Geological Survey Publications**


**Other**


American Ceramic Society.

Ceramic Industry (monthly).

Chemical Market Reporter (weekly).

Mining Engineering (monthly).

Mining Journal (monthly).

Minerals Pricewatch (monthly).

Paint and Coatings Industry (monthly).