



# 2011 Minerals Yearbook

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## WOLLASTONITE

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Wollastonite was mined by two companies in the United States in 2011. U.S. production data collected by the U.S. Geological Survey (USGS) are withheld to avoid disclosing company proprietary data, but U.S. production and sales increased by 6% as the U.S. economy continued its recovery from the 2008–09 recession. Exports of wollastonite were estimated to be less than 10,000 metric tons (t), but were thought to be greater than those of 2010. Imports of wollastonite were estimated to be less than 4,000 t in 2011, about the same as in 2010. World sales of refined wollastonite products were estimated to be in the range of 480,000 to 520,000 t in 2011 compared with 460,000 to 500,000 t in 2010.

Wollastonite, a calcium metasilicate ( $\text{CaSiO}_3$ ), has an ideal composition of 51.7% silicon dioxide and 48.3% calcium oxide but can also contain trace to minor amounts of aluminum, iron, magnesium, manganese, potassium, sodium, or strontium substituting for calcium. Wollastonite occurs in the form of prismatic crystals that break into tabular-to-acicular fragments. It is usually white but also may be gray, cream, brown, pale-green, or red depending on the impurities and grain size. Wollastonite is used primarily in automobile brakes, ceramics, metallurgical processing, paint, and plastics. Some of the properties that make it so useful are high brightness and whiteness, low moisture and oil absorption, low volatile content, and the acicular nature of some wollastonite.

## Production

In 2011, domestic wollastonite production increased by 6% from that of 2010. Data collected by the USGS were withheld to avoid disclosing proprietary information. Production in the United States increased in 2010 and 2011 as some of the markets for wollastonite began to recover from the 2008–09 recession. The slow recovery in wollastonite production was similar to the recoveries observed after each of the last two recessions in the United States. In the past, it generally took about 3 years for U.S. production to approach prerecession levels.

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 each 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 mined wollastonite in 2010. NYCO Minerals, Inc. [a subsidiary of Resource Capital Fund IV L.P. (RCF), Denver, CO] operated a mine in Essex County. R.T. Vanderbilt Co., Inc. (through its Gouverneur Mineral Division) operated a mine in Lewis County. The NYCO deposit contains diopside, garnet, and wollastonite. Parts of the deposit contain up to 60% wollastonite. The ore was processed at the Willsboro,

NY, plant, where the garnet was removed using high-intensity magnetic separators. NYCO also chemically modified the surfaces of some of its wollastonite products to improve their performance. R.T. Vanderbilt's deposit consists primarily of wollastonite with minor amounts of calcite and prehnite and trace amounts of diopside. The ore was processed at the company's St. Lawrence County plant, where it was milled and air classified. R.T. Vanderbilt also produced surface-treated products.

## Consumption

The USGS does not collect end-use data on wollastonite. Based on company press releases, general overview articles, U.S. manufacturing trends, and previously published consumption estimates, plastics and rubber applications were estimated to account for 30% to 35% of U.S. sales in 2011, followed by ceramics with 20% to 25%; metallurgical applications, 10% to 20%; paint, 10% to 15%; friction products, 10% to 15%; and miscellaneous, 10% to 15%.

Ceramic applications probably accounted for 30% to 40% of wollastonite sales worldwide, followed by polymers (plastics and rubber) with 30% to 35% of sales, and paint with 10% to 15% of sales. The remaining sales were for construction, friction products, and metallurgical applications.

The largest increases in domestic wollastonite consumption in 2011 probably were in metallurgical, plastics and rubber, and friction products markets, based on increased industrial output of those manufacturing sectors in the United States. Commercial and residential construction, where wollastonite may be used in products such as adhesives, caulks, ceramics, paints, stucco, and roof coatings, increased only slightly in 2011 so sales of wollastonite into those markets were likely not appreciably different from those of 2010. In 2011, the trend in market sales of wollastonite in Europe probably was similar to that in the United States although with smaller increases because of the lingering effects of the global economic recession. In Asia and South America, where the global recession had less of an impact, growth was likely more uniform across all markets.

In ceramics, wollastonite decreases shrinkage and gas evolution during firing, increases green and fired strength, maintains brightness during firing, permits fast firing, and reduces crazing, cracking, and glaze defects. In metallurgical applications, wollastonite serves as a flux for welding, a source for calcium oxide, a slag conditioner, and protection for the surface of molten metal during the continuous casting of steel. As an additive in paint, it improves the durability of the paint film, acts as a pH buffer, improves its resistance to weathering, reduces gloss, reduces pigment consumption, and acts as a flattening and suspending agent. In plastics, wollastonite 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 improves flexural and tensile strength (Roskill Information Services Ltd., 1996, p. 58–59, 78–81, 104–107, 119, 123–128).

### Prices

Quoted prices for domestically produced acicular wollastonite, ex-works, were \$231 to \$265 per metric ton for 200-mesh, \$242 to \$276 per ton for 325-mesh, and \$894 per ton for high-aspect-ratio wollastonite. Prices for wollastonite from China, free on board, in bulk, were \$80 to \$90 per ton for 200-mesh and \$90 to \$100 per ton for 325-mesh (Industrial Minerals, 2011). 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

Comprehensive trade data were not available for wollastonite because it is included under generic U.S. Census Bureau Harmonized Tariff Schedule (HTS) code 2530.90.8060 (mineral substances not elsewhere specified or included). Some wollastonite also may be exported under HTS code 2521.00.0000 (limestone flux; limestone and other calcareous stone). U.S. exports were estimated to have increased from those of 2010 but were still likely be less than 10,000 t. Documented exports were in the range of 2,500 to 2,600 t in 2011, an increase from 1,300 to 1,400 t in 2010. These exports were transported by ship to the Republic of Korea, Japan, China, Germany, the Netherlands, the Dominican Republic, the United Kingdom, Brazil, Colombia, Italy, India, and Belgium, in decreasing order by tonnage (United Business Media Global Trade, undated). Additional quantities probably were transported by truck or train to Canada.

U.S. imports were estimated to be less than 4,000 t in 2011, about the same as in 2010. Documented imports were 2,000 to 2,100 t, an increase from 1,900 to 2,000 t in 2010. Imports transported by ship were received from Canada, Finland, Mexico, Spain, and China, in decreasing order by tonnage (United Business Media Global Trade, undated). Wollastonite imported from Canada was probably transshipped because there were no active producers of wollastonite in Canada in 2011. Wollastonite may have been imported by rail or truck from Mexico.

### World Review

Many countries do not report wollastonite production or others report production 2 to 3 years after it takes place. Therefore, data in this section is estimated unless otherwise noted.

World production of crude wollastonite ore probably increased by 3% to 6% in 2011 compared with that of 2010. Although the effects of the 2008–09 recession continued to affect much of Europe, the U.S. economy had begun to recover, and the Asian economy remained strong. Estimated crude ore production increased and was in the range of 580,000 to

610,000 t in 2011 compared with 550,000 to 575,000 t in 2010. Sales of refined wollastonite products probably were in the range of 480,000 to 520,000 t in 2011, an increase from 460,000 to 500,000 t in 2010.

In 2011, China was the leading producer of wollastonite with an estimated 290,000 to 320,000 t of production. India was the second-ranked producer with an estimated 150,000 t of production. The United States ranked third in wollastonite production. Production in Mexico was 47,523 t (reported); in Finland, 15,000 t; in Spain, 6,000 t; and in South Africa, 2,400 t. Small quantities of wollastonite may have been produced in other countries.

**India.**—After increasing production capacity at its mine in the Sirohi District of Rajasthan in 2010, Wolkem India Ltd. planned to further increase production by 30,000 metric tons per year (t/yr) during the next 2 to 3 years. The planned expansion was in response to improved domestic markets, primarily for ceramics, friction products, and plastics, and increasing exports to Asia Pacific and Southeast Asian markets (Feytis, 2011).

**Spain.**—Aroche SL announced plans to mine wollastonite at its Huelva Province deposit near Aroche. Planned production capacity was 43,000 t/yr with sales primarily to the ceramics industry (Feytis, 2011).

### Outlook

Domestic production of wollastonite increased in 2010 and 2011 mainly as a result of increased U.S. manufacturing in several industry sectors that manufactured products containing wollastonite. These included such markets as automobiles (friction products and plastic and rubber components), consumer appliances (powder coatings), primary metal (surface conditioner in steel casting), and plastics (reinforcing component). U.S. manufacturing continued to improve through early 2012 with an 8% increase in durable goods production from March 2011 to March 2012 (Board of Governors of the Federal Reserve System, 2012, p. 8). Housing starts increased by 10.3%, and the value of commercial and residential construction put in place increased by 6% from March 2011 to March 2012 (U.S. Census Bureau, 2012a, b). This suggested that in 2012 there may be some additional recovery of sales of wollastonite to construction-related markets, such as in caulks, ceramic tile glazes and bodies, paints, roof coatings, sanitaryware, sealants, structural clay products (brick and quarry tile), stucco, and wallboard.

Coupled with the International Monetary Fund (2012, p. 2) prediction for U.S. economic growth of 2.1% in 2012 and overall global economic growth of 3.5% in 2012, production and sales of wollastonite in 2012 may approach the 6% increase observed in 2011.

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## **GENERAL SOURCES OF INFORMATION**

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