

Industrial Minerals of the United States

U.S. Talc—Baby Powder and Much More

When most people think of talc, they probably envision talcum and baby powder. Since talc is very soft and easily carved, one might also think of sculptures in soapstone (massive talc). In fact, these uses of talc are quite minor compared to its wide variety of applications in manufacturing and agriculture. High-quality (pure) talc has many physical and chemical properties favorable for its use, such as its softness, purity, fragrance retention, whiteness, luster, moisture content, oil and grease adsorption, chemical inertness, low electrical conductivity, high dielectric strength, and high thermal conductivity (Virta, 1998).

What is Talc?

Talc is a hydrous silicate mineral composed of magnesium (Mg), silicon and oxygen (SiO₂, silica), and water. Its chemical formula is Mg₃Si₄O₁₀(OH)₂. Talc is relatively pure in composition but can contain small amounts of aluminum, iron, manganese, and titanium. Talc can be white, apple green, dark green, or brown, depending on its composition.

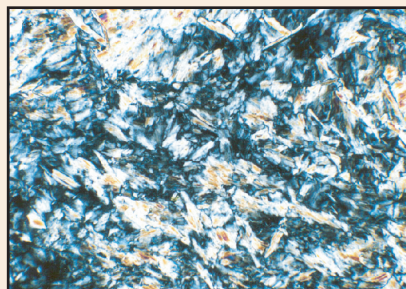
Talc is the softest mineral, having a Mohs hardness of 1, compared to diamond with a hardness of 10. It is composed of microscopic platelets, and the bonds holding the platelets together are very weak. This enables the platelets to slide by one another and results in the soft and greasy feel of talc.

Talc is also used as a term to describe a rock that contains the mineral talc. Other names for talc-rich rocks are steatite, a high-purity massive variety, and soapstone, an impure rock containing talc and other minerals.

Geology of U.S. Talc Deposits

Significant United States talc deposits occur in the Appalachians and Piedmont, from Vermont to Alabama, and in the West in Montana, California, Nevada, Washington, Idaho, and New Mexico. (See Chidester and others, 1964.) Large deposits also occur in Texas, but economic deposits are otherwise lacking between the Appalachians and the Rocky Mountains.

Talc is formed by two processes. In the first process, heated waters carrying magnesium and silica in solution react with and replace beds of dolomitic marble. Examples are the large talc deposits of southwestern Montana that formed by the replacement of marble. This talc may have formed more than 1 billion years ago. In these deposits, the marble containing the talc is metamorphic rock formed from dolomite that changed form (metamorphosed) under heat and pressure. It is not known with certainty if this metamorphism or another deep heat source was responsible for heating the waters that created the extensive talc deposits in Montana. The replacement talc deposits range from pods centimeters thick to the 29-m-thick talc body at the Treasure Chest mine near Dillon, Mont. (See Berg, 1979.)



Mosaic of talc grains magnified to 25 times actual size.

The majority of the large U.S. talc deposits are those that replaced metamorphosed dolomite. Other large deposits of this general type are in St. Lawrence County, N.Y., the Murphy Marble Belt of North Carolina, and in the Inyo and Panamint Ranges of California (Chidester and others, 1964; Piniakiewicz and others, 1994). In contrast, the Winterboro deposits in Talladega County, Ala., occur in dolomites that appear relatively unmetamorphosed. The talc deposits of the Chatsworth district of Georgia and the Allamore district of Texas formed in metamorphic rock with much more quartz than the dolomite-hosted deposits just noted.

The second process for forming talc involves the alteration of igneous rocks that contain abundant, heavy minerals called "mafic," which are enriched in magnesium and iron. A sequence of fluids reacts with the magnesium-rich mafic minerals in the host rocks, ultimately replacing the mafic minerals with talc. These talc deposits form as rinds on the mafic igneous rock bodies or nearly completely replace them; they are typically tabular or lenticular talc bodies that can reach 100 m in thickness and extend more than 300 m in length. Large deposits of this type are mined in Vermont, and smaller deposits have been mined in the eastern States, California, and Texas. (See Chidester and others, 1964; Piniakiewicz and others, 1994.) These deposits have been important sources of darker talc, commonly referred to as soapstone, owing their coloration to impurities.

Thus, the host rock and process of formation determine the qualities of talc, which in turn affect the industrial applications of a particular deposit. The grain size and shape, color, and purity of talc influence its uses.

Processing Talc

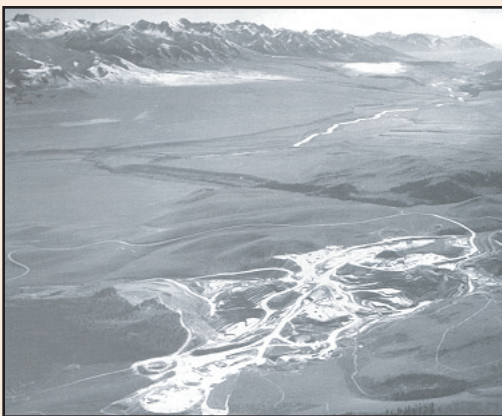
Conventional open pit mining techniques are used to produce almost all the talc mined in the U.S. Typically, the ore is drilled, blasted, and partially crushed at the mine. Selective mining and (or) hand or machine sorting may be used to produce high-grade ore feed for the mill. At the mill, the ore is further crushed and finely ground. In some instances, flotation processes are used to remove mineral impurities. Most companies produce dozens of talc products that differ primarily in particle size, particle size distribution, brightness, mineral composition, and bulk density.

Talc's Many Uses

U.S. talc is used in the production of ceramics (the main domestic use), paint, paper (for improving several paper qualities and in recycling processes), plastics (as a functional filler, providing rigidity to the plastic), roofing, rubber, cosmetics, flooring, caulking, and agricultural applications. As examples, talc is used in the ceramic substrate of catalytic converters, and is found in wire and cable insulation, auto body putty, asphalt shingles, caulks, sealants, joint compounds, foam packaging, animal feed, pharmaceuticals, chewing gum, candy, gaskets, hoses, belts, flooring (providing softness and flexibility), insecticide carriers, and of course, baby and body powders. Thus, talc is a part of everyday life.

The U.S. Talc Industry

The U.S. is second only to People's Republic of China in annual talc production, with U.S. mines producing around 1 million metric tons of crude talc ore per year during the 1990's (Virta, 1998). Production of talc is an approximately \$100 million per year industry in the U.S.



1995 aerial view of the Yellowstone mine near Ennis, Mont., the largest talc producer in the U.S. Photograph courtesy of Luzenac America, Inc.

Talc, soapstone, and steatite were excavated from 13 mines in six States in 1999. Only one of these talc mines was an underground operation; the other 12 were surface mines. Montana led the U.S. in 1999 talc production, followed by Texas, Vermont, New York, Oregon, and California.

Montana has been the leading talc-producing State in the U.S. for more than 20 years, supplying more than one-third of the U.S. production in recent years. All production has come from large deposits of high-purity talc in the southwestern part of the State. The largest producer in Montana, and the U.S., is the Yellowstone mine, an extensive open pit operation near Ennis, Mont. During the late 1990's, the Yellowstone mine produced about 300,000 short tons (270,000 metric tons) of crude talc ore per year (Montana Bureau of Mines and Geology annual reports).

Domestic development and exploration for talc are expected to stay relatively steady in the foreseeable future because:

- demand for domestic talc is expected to continue based on recent market trends (Virta, 1998);
- large mines are active and an infrastructure for talc processing is in place;
- no significant acid mine drainage is associated with talc mining. However, the presence of long, thin amphibole minerals within some talc deposits has received much public scrutiny as a health issue.

References Cited

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