

Bismuth

U.S. Geological Survey mineral commodity specialist James F. Carlin Jr. has compiled the following information about bismuth, a critical component in several chemical and pharmaceutical applications.

Bismuth compounds are most known for their soothing effects on the stomach, wounds and sores. These properties make the compounds an essential part of many medicinal and cosmetic preparations, which until 1930 accounted for about 90 percent of the bismuth used. The subsequent development of low-melting alloys and chemical catalysts containing bismuth, as well as its use as an additive to casting alloys, has resulted in a wider variety of industrial applications for bismuth.

Bismuth-lead and bismuth-tin alloys are known to have been used during the Middle Ages. The metal was referred to as "wismuth," and at the end of the 16th century, the early mineralogist Georgius Agricola latinized the German name to "bisemutum." Around 1597, the efficacy of bismuth nitrate in the treatment of intestinal disorders was discovered, leading to its modern-day use in stomach ailment remedies. In the 18th century, pure bismuth metal was produced, thus demonstrating bismuth to be a distinct element, with properties similar in many respects to those of lead.

Bismuth rarely occurs in sufficient concentrations to permit commercial recovery as a primary product; it is usually produced as a byproduct from the processing of ores of other metals, principally lead. Bismuth supply, therefore, is dependent on demand for these other metals.

Initially, bismuth was produced by smelting bismuth-rich ores to produce a crude metallic bismuth. The association of bismuth with base-metal ores and the fact that it accompanies lead through the smelting and refining operation permits extraction of crude bismuth when the base metals reach the refinery. The development and improvement of metallurgical processes for extraction and purification of bismuth have resulted in a commercially available bismuth metal of 99.995 percent purity.

Bismuth is sold in various forms that are determined by the particular application. Most common forms are: bars, which are often sold in 25-pound units and used for alloying applications; needles, which are 1 inch long and used for medicinal and chemical uses; and pellets, which are preferred for metallurgical additive applications.

The U.S. bismuth reserve base is estimated to be about 2 percent of the world reserve base. Bismuth is present in some lead ores mined domestically, but the bismuth-containing residues are not processed domestically. Imports in the form of refined metal and alloys account for about 95 percent of U.S. bismuth consumption. Small amounts of bismuth are recycled.

Bismuth was last produced domestically, as a byproduct of lead refining, at a Nebraska refinery that closed in 1997. The last stocks of bismuth held in the National Defense Stockpile were sold the same year. Since then, all primary bismuth consumed in the United States has been imported. The leading foreign producers of refined bismuth in 2005 in decreasing order of production were China, Mexico, Belgium, Peru and Japan.

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Sample of bismuth ore with penny for scale. Image from *Minerals in Your World*.