



Critical Mineral: Antimony

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Overview

Antimony (Sb) is a chemical element that is included on the United States Geological Survey's 2022 Final List of Critical Minerals. Sb is a lustrous gray semi-metal that is rather soft in pure form. Sb oxide compounds are effective fire retardants. Lead (Pb) acid batteries have Sb added to improve charging. Sb is alloyed with Pb (typically <2 wt.% Sb) to increase hardness in bullets. It can also be alloyed with other metals such as tin (Sn) for electrical solder or antifriction alloys. Sb sulfide compounds are commonly used in primers for munitions. Other applications include electronics, lasers, and optics.



Figure 1. A 2-gram specimen of refined metallic Sb. Photo by Hi-Res Images of Chemical Elements (CC-BY-3.0).

Supply

China, Tajikistan, Turkey, and Burma were the top Sb producers in 2023: 40 kt (thousand metric tonnes), 21 kt, 6 kt, and 4.6 kt, respectively. China also holds the highest reserves: 640 kt. Other countries with high reserves are Russia (350 kt), Bolivia (310 kt), and Kyrgyzstan (260 kt). In September 2024, China placed export restrictions on Sb ore and related refined products in order to keep more value-added manufacturing that uses such materials within its borders.

The U.S. has no current Sb mine production and just 60 kt of reserves. Most domestic Sb is located in Alaska, Idaho, Montana, and Nevada. There is a major government-supported Sb and gold (Au) mine under development in Idaho with a resource of 18,477 kt of ore at 0.48% Sb (89 kt Sb). There is a Sb refinery in western Montana that currently processes foreign ore into Sb products.



Figure 2. The Pb cores of most bullets are hardened with Sb. An example is the modern NATO 5.56-mm round. Sb sulfide is also in the primer compounds for many such munitions. Photo by TKN (CC-BY-2.5).

Prices averaged \$5.60/lb. (\$12,346/t) for metallic Sb in 2023. Recent prices are \$11.38/lb., in part due to China's export restrictions. Ore grades vary from 0.3 wt.% Sb where it is a byproduct of Au mining, to almost 18 wt.% in high-grade quartz–stibnite veins.

Mineralogy

Sb is mined most commonly as stibnite (Sb_2S_3), a sulfide mineral. It can rarely occur in a reduced native (metallic) form. Many complex sulfosalts minerals such as boulangerite, cylindrite, jamesonite, pyrrargyrite, and tetra-



Figure 3. A specimen of stibnite from the Stibnite Hill Mine, Sanders County, Montana. Specimen is approximately 6 in long. Specimen is from the Montana Technological University Mineral Museum. Photo by Adrian Van Rythoven

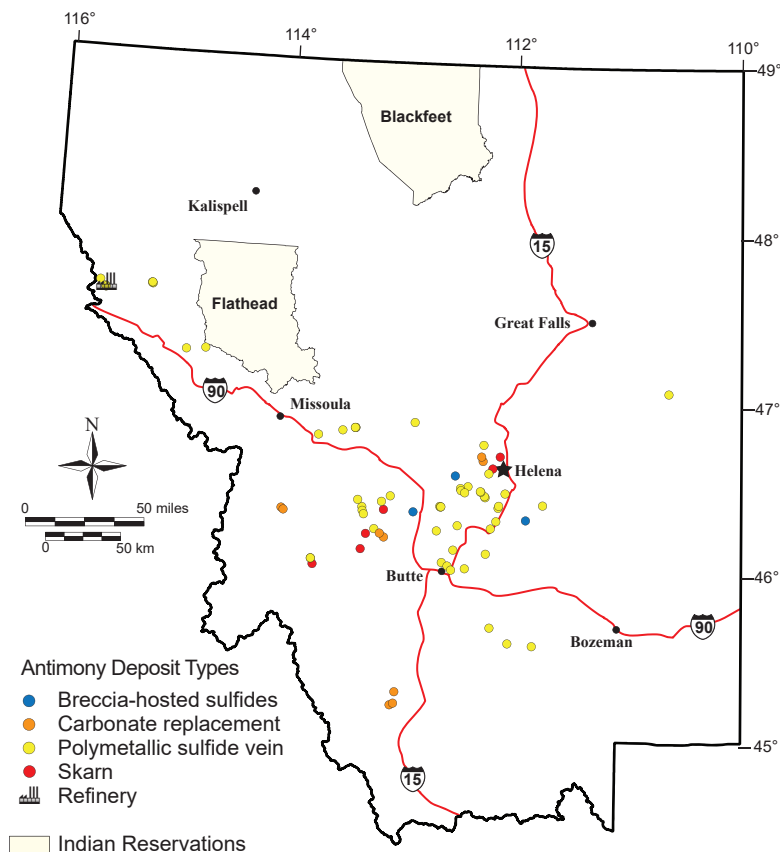


Figure 4. A map of Montana displaying known Sb occurrences by deposit type. Also shown is the smelter in Sanders County.

hedrite contain Sb along with metals such as silver (Ag), copper (Cu), Pb, iron (Fe), and Sn.

Aside from the aforementioned Sn, other critical minerals that may occur with Sb are zinc (Zn), germanium (Ge), gallium (Ga), indium (In), tellurium (Te), arsenic (As), and bismuth (Bi). Fluorite and barite can also occur in Sb-bearing veins.

As Sb is most common as a sulfide mineral, it occurs in related deposit types: breccia-hosted sulfide, carbonate replacement, polymetallic sulfide vein, and skarn.

Deposits in Montana

Occurrences of Sb mineralization in Montana are restricted to the western half of the State. Historic Sb mining was prevalent around Thompson Falls (Sanders County). Sb mining in this region ended in the early 1980s, but a smelter remains there and continues to produce Sb products from imported ore.

The Sb deposits in Sanders County are all polymetallic sulfide type. Other deposits of this type occur in Jefferson, Missoula, Granite, Powell, Deer Lodge, Lewis and Clark, Mineral, Silver Bow, Madison, Broadwater, and Judith Basin Counties.

Less common Sb deposit types are breccia-hosted sulfides (Powell and Jefferson Counties), skarn (Granite, Lewis and Clark, and Deer Lodge Counties), and carbonate replacement (Beaverhead, Ravalli, Lewis and Clark, and Deer Lodge Counties).

Outlook in Montana

Unflooded historic workings around Butte are currently being reevaluated for Sb and other critical minerals (Zn, In, Ge, etc.).

U.S. Antimony Corp. continues to operate the Sb smelter in Thompson Falls. Its annual production capacity is 5 million lbs. of Sb metal, or 15 million lbs. of Sb oxide.

Researchers at the MBMG are sampling legacy mine sites across the State in order to assess their economic potential for critical minerals. Government efforts to document the critical mineral content of mine waste, especially older (legacy) waste, is a recent initiative. The appeal of this initiative is fourfold: (1) secure domestic supply chains for critical minerals, (2) lower mining impacts on the landscape as the material is already fragmented and at the surface, (3) increase employment for legacy mining communities, and (4) rehabilitate legacy mine sites that cause pollution.



Figure 5. Twinned tetrahedrite crystals from the Black Pine Mine, Granite County, Montana. Specimen is 1.5 cm x 1.4 cm. Photo by Rob Lavinsky, iRocks.com. CC-BY-SA-3.0.

About the MBMG

Established in 1919, the Montana Bureau of Mines and Geology (MBMG) continues to fulfill its mandate to collect and publish information on Montana's geology to promote orderly and responsible development of the energy, groundwater, and mineral resources of the State. A non-regulatory state agency, the MBMG provides extensive advisory, technical, and informational services on the State's geologic, mineral, energy, and water resources. The MBMG is increasingly involved in studies of the environmental impacts to land and water caused either by past practices in hard-rock mining or by current activities in agriculture and industry. The Montana Bureau of Mines and Geology is the principal source of Earth science information for the citizens of Montana. More information is available at mbmg.mtech.edu.