Yellow Pine Antimony—Largest Domestic Supply of a Critical Resource

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Abstract

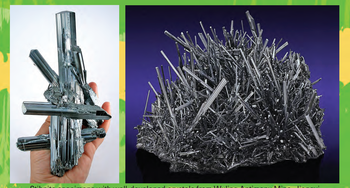
The United States defense, energy, and manufacturing industries are dependent on foreign antimony sources and could be affected if the global antimony supply declined. Although antimony substitutes are available, they are less effective and more expensive. Thus domestic antimony supplies are key. The Stibnite mining district (including the historic Yellow Pine deposit in central Idaho) contains an estimated 41,000 metric tons of antimony, making it the largest domestic antimony supply.

Many fundamental questions about the ore system that formed the ore deposits within the Yellow Pine\Stibnite mining district remain unanswered, but if addressed could provide unprecedented insight into fluid source, alteration patterns, ore-controlling fault geometry, key rock units ages, regional stratigraphic context, as well as relationship to the adjacent caldera complex.

Satellite image showing location of the historic Yellow Pine open pit mine within Idaho.

Mineral Resources Program Context

This project addresses one of the five MRP science priorities for FY15—Characterization and Identification of Critical Mineral Resources. Likewise this project answers the call of the DOI Strategic plan for mineral resources that are imported from other countries.

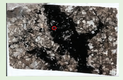


Stibnite specimens with well-developed crystals from Wuling Antimony Mine, Jiangxi Province, China. Photography courtesy of Robert Lavinsky (http://www.irocks.com).

Fluid Inclusions and Alteration

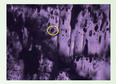
Stibnite Fluid Inclusions

Photomicrograph of a thin section showing a stibnite-quartz vein from the Yellow Pine pit that was analyzed for fluid inclusions.



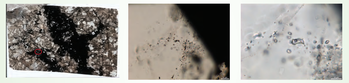
(1) Fluid inclusions in stibnite are dominantly what appears to be single phase inclusions or empty cavities.

(2) A single two-phase inclusion in stibnite that is active at room temperature. This inclusion does not qualify as an FIA (fluid inclusion assemblage), so it is unmeasurable. Nonetheless, this was a likely a low temperature inclusion.



Quartz Fluid Inclusions

Fluid inclusions in quartz in stibnite vein: A fluid inclusion assemblage (FIA) of 8 inclusions has an ice melt temperature of -4.7 °C and homogenization (to liquid) temperature to 201-217 °C. The ice melt corresponds to a salinity of 7.4 NaCl wt% equiv. The temperature of homogenization provides a minimum temperature of formation and is not in conflict with the temperature indicated by the difference in the sulfur isotope signature between pyrite and stibnite (Delta 34S of 4.5 per mil = 232°C).



FIA#	inclusions	T_h	$T_{melt (I)}$	Wt%
L4-YP-7 FIA1	8	201-217	-4.7	7.4

Next Objectives:
Additional H, O ,C, and S analyses of paragentically controlled samples and dated samples will help distinguish Eocene from Cretaceous signatures. Radiogenic isotope analysis will help determine the souce of He, Pb, Sr, Nd, and Os in Eocene dikes, ore related minerals, and fluid inclusions.

Alteration Assemblage Mapping

Au-Sn
Gold
Sn Au Sb
Sn Au
Meadow Creek Stage
Clear Creek Stage
Quartz-Sericite-Pyrite
Sericite
Silicification
Sn Phase
Mineralization
Sb As Phase
Mineralization
Sb-Au Phase
Mineralization
Sb-W Phase
Mineralization
Calc-Silicate
Quartz-Sericite-Pyrite
Quartz-Sericite
Argillic
Au & Sn
Au
Sb
Sb-Au
Sb-W
Sb
Sb-Au
Sb-W
Sb
Sb-W
Sb
Sb-W
Sb