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Terrywallaceite, $AgPb(Sb,Bi)_3S_6$, isotypic with gustavite, a new mineral from Mina Herminia, Julcani Mining District, Huancavelica, Peru

Hexiong Yang,[1,*] Robert T. Downs,[1] Stanley H. Evans,[1] and William W. Pinch[2]

[1]Department of Geosciences, University of Arizona, Tucson, Arizona 85721-0077, U.S.A.
[2]19 Stonebridge Lane, Pittsford, New York 14534-1800, U.S.A.

Abstract

A new mineral species, terrywallaceite, ideally $AgPb(Sb,Bi)_3S_6$, has been found in Mina Herminia, Julcani Mining District, Huancavelica, Peru. It is associated with tetrahedrite, gustavite, barite, and pyrite. Terrywallaceite crystals are lath-shaped, metallic-black, with striations parallel to the elongated direction (the **c** axis). The mineral is opaque with black streak and metallic luster. It is brittle and has a Mohs hardness of ~4; cleavage is good on {010} and no parting was observed. Twinning is pervasive on (100). The calculated density is 6.005 g/cm^3. Optically, terrywallaceite is grayish white in polished thin section, with weak bireflectance, weak pleochroism (white to pale gray), and weak anisotropy (gray with bluish tint to bluish black in air). An electron microprobe analysis yielded an empirical formula, based on 6 (S+As) apfu, $Ag_{1.02}Pb_{0.87}(Sb_{1.53}Bi_{1.47})_{\Sigma=3.00}(S_{5.94}As_{0.06})_{\Sigma=6.00}$.

Terrywallaceite is a member of the lillianite group and isostructural with $P2_1/c$ gustavite. Its unit-cell parameters are a = 6.9764(4), b = 19.3507(10), c = 8.3870(4) Å, β = 107.519(2)°, and V = 1079.7(1) Å^3. The structure of terrywallaceite contains six symmetrically-nonequivalent S sites and five cation sites [Ag, Pb, M1 (=0.82Bi + 0.18Sb), M2 (=0.60Bi + 0.40Sb), and M3 (=0.95Sb + 0.05Bi)]. The pronounced preference of Sb for the M3 site over M2 and M1 in terrywallaceite is consistent with the site occupancy data reported for Sb-bearing gustavite, and suggests an alternative ideal formula for terrywallaceite of $AgPb(Sb,Bi)(Bi,Sb)_2S_6$, instead of $AgPb(Sb,Bi)_3S_6$.

Keywords: Terrywallaceite, gustavite, $AgPb(Sb,Bi)_3S_6$, sulfosalt, crystal structure, X-ray diffraction