

Raberite, Tl₅Ag₄As₆SbS₁₅, a new Tl-sulfosalt from Lengenbach quarry, Binn Valley, Switzerland

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Lengenbach quarry in the Binn Valley, Valais, is Switzerland's most famous mineral locality and has become world-famous for its richness in rare Pb-Cu-Ag-As-Tl-bearing sulfosalt minerals mainly occurring in cavities of white dolomitic rock of Triassic age. Several new minerals have been discovered at this locality including a number of extremely rare Tl-bearing sulfosalts, among them being edenharterite, erniggliite, gabrielite, hatchite, hutchinsonite, imhofite, jentschite, rathite, sartorite, sicherite, stalderrite, wallisite, dalnegroite, and, recently, debattistiite (IMA 2011-098).

Raberite occurs as very rare crystals (up to 150 μm across) grown on hatchite/wallisite together with yellowish fibrous smithite. The mineral exhibits a subhedral to anhedral grain morphology, and does not show any inclusions of, or intergrowths with, other minerals. The mineral, as well as the other Tl minerals in Lengenbach, presumably represent products of late stage Tl- and As-bearing hydrothermal solutions during Alpine metamorphism.

Raberite is opaque with a metallic luster and shows a dark brown-red streak. In plane-polarized incident light, raberite is moderately birefractant and very weakly pleochroic from light grey to a slightly greenish grey. The mineral does not show any internal reflections. Between crossed polars, raberite is very weakly anisotropic with greyish to light-blue rotation tints.

The new mineral is triclinic, space group P-1, with $a = 8.920(1)$, $b = 9.429(1)$, $c = 20.062(3)$ Å, $\alpha = 79.66(1)$, $\beta = 88.84(1)$, $\gamma = 62.72(1)^\circ$, $V = 1471.6(4)$ Å³, $Z = 2$. The crystal structure [$R1 = 0.0827$ for 2110 reflections with $I > 2\sigma(I)$] consists of "columns" of nine-coordinated Tl-polyhedra (interrupted by the Ag₄ and M₆ positions - every 5 Tl positions there is the couple Ag₄-M₆, which is at a distance of 2.68 Å) extending along [001] and forming sheets parallel to (010). Such columns are decorated by MS₃ pyramids (M = As, Sb) and the linking between the columns is assured by Ag₃ triangles (Ag₁, Ag₂, and Ag₃ positions). The mean bond distances for the Tl-polyhedra are in the range 3.33-3.41 Å whereas the Ag-S distances are in the range 2.53-2.55 Å. Among the seven M positions, only one (i.e. M₂) is dominated by Sb over As. The mean M-S bond distances well reflect the As <-> Sb substitution occurring at these sites.

A mean of 9 electron microprobe analyses gave Tl 39.55(13), Ag 18.42(8), Cu 0.06(2), As 17.08(7), Sb 5.61(6), S 19.15(11), total 99.87 wt %, corresponding, on the basis of a total of 31 atoms, to Tl_{4.85}Ag_{4.28}Cu_{0.02}As_{5.72}Sb_{1.16}S_{14.97}.

The new mineral has been named raberite in honour of Dr. Thomas Raber (b. 1966), a well-known mineral expert on the Lengenbach minerals for more than 20 years.