INTRODUCTION

Muthmannite, AuAgTe₂, a rare gold-silver telluride was discovered in a sample from the historical mineralogical collection of the Naturhistorisches Museum of Vienna. The sample is from the gold-telluride deposit of Sacarîmb, Metaliferi Mountains, western Romania. Muthmannite occurs as anhedral grains up to 200 μm associated with large sylvanite crystals and does not show any inclusions or intergrowths of other minerals. The associated minerals are sylvanite, calaverite, and petzite, whereas the gangue mineral is quartz. Muthmannite is pale bronze in color and shows a gray-black streak. No cleavage was observed, the fracture is uneven, and the Vickers hardness (VHN₁₅) is 186 kg/mm².

Muthmannite is grayish white in reflected light, with very low birefringence and pleochroism. When observed near sylvanite it is darker and shows a gray color with a slightly bluish tint. Reflectance percentages for Rₘᵢᵣₜ and Rₘₐₓ were found to be 40.1, 40.8 (471.1 nm), 38.3, 38.6 (548.3 nm), 37.9, 38.3 (586.6 nm), and 37.7, 38.1 (652.3 nm), respectively. Muthmannite is monoclinic, space group P2₁/m, with the following unit-cell parameters: a = 5.124(2), b = 4.419(1), and c = 7.437(2) Å, β = 89.96(1)°, V = 168.4(4) Å³, and Z = 2. Electron microprobe analyses gave the chemical formula Au₀.₉₇Ag₀.₉₉Te₂₀₃. The calculated density (from the ideal formula) is 11.04 g/cm³. The crystal structure was solved and refined to R = 5.52%. It is based on the NiAs-type structure, with a distorted hexagonal closest-packed array of Te₂⁻ atoms with Au³⁺ and Ag⁺ occupying all the octahedral sites. The crystal-chemical relationships with other gold-silver tellurides are outlined.

OCCURRENCE

The Sacarîmb gold-telluride deposit is located in the southeastern part of the Metaliferi Mountains, western Romania. Although now close to exhaustion, it is one of the most famous Neogene epithermal deposits in the world. As reported by Simon et al. (1994), the telluride-bearing veins are located in a volcanic body consisting of hornblende- and pyroxene-bearing quartz-andesites of Neogene age. Geological and metallogenic data concerning the Sacarîmb deposit are summarized by Udubasa et al. (1992).

As described in the former section, the sample containing muthmannite was not found in situ but comes from the historical mineralogical collection of the Naturhistorisches Museum of Vienna, where it was labeled “sylvanite, Nagyag” (catalogue number L2138). The sample consists of sylvanite with associated muthmannite, calaverite, petzite, and quartz. Muthmannite occurs as anhedral grains up to 200 μm associated with large sylvanite crystals (Fig. 1), and it does not show inclusions or intergrowths of other minerals.

ABSTRACT

Muthmannite, AuAgTe₂, a rare gold-silver telluride was discovered in a sample from the historical mineralogical collection of the Naturhistorisches Museum of Vienna. The sample is from the gold-telluride deposit of Sacarîmb, Metaliferi Mountains, western Romania. Muthmannite occurs as anhedral grains up to 200 μm associated with large sylvanite crystals and does not show any inclusions or intergrowths of other minerals. The associated minerals are sylvanite, calaverite, and petzite, whereas the gangue mineral is quartz. Muthmannite is pale bronze in color and shows a gray-black streak. No cleavage was observed, the fracture is uneven, and the Vickers hardness (VHN₁₅) is 186 kg/mm².

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INTRODUCTION

Muthmannite, AuAgTe₂, was identified as mineral species by Zambonini (1911) during a study of gold-silver tellurides from the Sacarîmb (formerly Nagyag) deposit, western Romania, and was named in honor of Friedrich W. Muthmann (1861–1913), a German chemist and crystallographer. On the basis of the chemical composition Zambonini (1911) proposed the formula (Au,Ag)Te with Au:Ag = 1:1. More recently, Spiridonov and Chvileva (1985) described the second occurrence of muthmannite from Baia-de-Arieș (formerly Aranyosbánya), Romania, giving the following chemical formulae (for two grains): Au₀.₉₇Ag₀.₉₂Cu₀.₀₃Fe₀.₀₁Hg₀.₀₁Te₂₀₆ and Au₀.₉₅Ag₀.₉₇Cu₀.₀₂Fe₀.₀₁Hg₀.₀₁Te₂₀₄. These authors reported that the mineral replaces calaverite along the margin of the grains forming pseudomorphs after small calaverite grains. Powder X-ray study data in Spiridonov and Chvileva (1985) show strong similarities between muthmannite and calaverite, the only differences being the presence of three additional lines in the muthmannite powder pattern [i.e., d (Å): 4.17, 2.79, and 2.57]. However, owing to the scarcity of suitable crystals for a full structural study and to the presence of complex intergrowths with calaverite, Spiridonov and Chvileva (1985) were unable to determine the crystal structure of muthmannite.

In the course of a research project on tellurium-bearing minerals in the museum’s historical mineralogical collections (Bindi and Cipriani 2003a, 2003b, 2003c; Bindi et al. 2004; Cipriani and Bindi 2003) we discovered another muthmannite sample from the type locality. In this paper we report on the crystal structure of muthmannite together with physical and chemical data for the mineral.

ABSTRACT

Muthmannite, AuAgTe₂, a rare gold-silver telluride was discovered in a sample from the historical mineralogical collection of the Naturhistorisches Museum of Vienna. The sample is from the gold-telluride deposit of Sacarîmb, Metaliferi Mountains, western Romania. Muthmannite occurs as anhedral grains up to 200 μm associated with large sylvanite crystals and does not show any inclusions or intergrowths of other minerals. The associated minerals are sylvanite, calaverite, and petzite, whereas the gangue mineral is quartz. Muthmannite is pale bronze in color and shows a gray-black streak. No cleavage was observed, the fracture is uneven, and the Vickers hardness (VHN₁₅) is 186 kg/mm².

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