THE FIRST OCCURRENCE OF BISMUTH SULPHOSALTS IN THE ŞUIOR ORE DEPOSIT, BAIA MARE DISTRICT, ROMANIA

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The Baia Mare metallogenetic district, Romania, represents the NW part of the Neogene Volcanic Chain inside the Carpathian Mountains. The polymetallic Şuior-Cremenea deposit is one of the most economically important deposits within the Baia Mare district. Ag-Bi sulphosalts are reported from Cu-rich ores within base metal mineralization situated beneath Au ores below level 750-800m in the Cremenea vein of the Şuior epithermal vein deposit. The Cremenea 'vein' is an important ore body in the Baia Mare district due to its size at upper levels; the vein extends *ca*. 800m along strike, reaching a depth of 1,200m, with a width between 2 and 40 m. Beneath the Au-Ag ores at upper levels, base metal mineralization is predominant in middle and lower parts. Telescoping is recognised in the middle part of the vein, with Au-Ag mineralization overlapping the base metal ores. The Cremenea vein lies on the northern side of a subvolcanic intrusion of porphyritic microdiorite. The upper Au-Ag-rich part consists of pyrite, wurtzite, sphalerite, arsenopyrite, chalcopyrite, tetrahedrite, galena, boulangerite and marcasite. Below 800 m, sphalerite and galena are predominant, frequently associated with chalcopyrite. Inclusions of Sb sulphosalts (tetrahedrite, proustite and pyrargyrite) appear frequently within galena. Beneath the gold zone, Cu-rich ores (pyrite – chalcopyrite ± arsenopyrite) may be present at the northern boundary of the ore body. They may also include Bi-minerals.

Electron probe microanalytical data were collected using a Cameca SX-51 instrument at the University of Adelaide, Australia and a Hitachi scanning electron microscope equipped with an Oxford Instruments wavelength-dispersive spectrometer at the Natural History Museum, University of Oslo, Norway.

The Bi sulphosalts occur within a Cu-rich ore (pyrite-chalcopyrite assemblage). The Bi sulphosalts appear as clustered elongated patches placed mostly at contacts between quartz and sulphides. They may also be located at grain boundaries in the quartz aggregates especially when pyrite is the only sulphide adjacent to the cluster. Typically, however, they are found in close association with chalcopyrite. When in chalcopyrite, they occur instead as well-shaped lamellae. With the exception of wittichenite, the Bi sulphosalts correspond to compounds that plot along the matildite-galena join in the Ag(+Cu)-Bi(+Sb)-Pb system.

Only a small number of the lamellae and blebs are fully homogenous. Microanalytical data show the presence of a homogeneous unnamed phase with empirical composition $[(Ag_{0.81}Cu_{0.12})_{0.93}Pb_{0.91}(Bi_{1.11}Sb_{0.06})_{1.17}(S_{2.98}Se_{0.02})_3]$, showing light Bi-enrichment relative to ideal $\mathbf{AgPbBiS_3}$. The compositional clusters of homogenous lamellae overlap with one another in an area of the (Ag + Cu)–(Bi + Sb)–Pb diagram between the ideal composition $PbAgBiS_3$ and half way towards the tie line corresponding to the lillianite homologue $N^L = 9$. Microanalysis profiles taken along and across the homogenous lamella confirm the compositional homogeneity.

The second group of lamellae within the samples display such lamellar intergrowths. Compositional plots for the parallel intergrowths show a spread between the phases $PbAgBiS_3$ and $PbAg_2Bi_2S_5$. Parallel lamellar intergrowths have bulk compositions approximating $\mathbf{Pb_4Ag_{5.6}Bi_{5.6}S_{15.2}}$. These compositions represent natural equivalents of phases synthesized in the PbS–$AgBiS_2$ system.

The most abundant type of lamellae, however, is that display well-developed basket-weave intergrowths of galena and matildite. Needle-shaped matildite is generally coarser than the galena. The compositional plot for patches with basket weave intergrowths expands on both sides of the ideal phase $PbAgBiS_3$ along the PbS–$AgBiS_2$ join, between $\mathbf{Pb_3Ag_2Bi_2S_7}$ and $\mathbf{Pb_4Ag_{5.6}Bi_{5.6}S_{15.2}}$. These intergrowths with a characteristic basket-weave texture are interpreted as decomposition products of $AgPbBiS_3$.

Close-to-galena compositions were measured from larger, homogeneous areas separated from the basket weave intergrowths (brighter areas in the BSE images); close-to-matildite compositions are determined for the needle-shaped lamellae in the same intergrowths (darker areas in the BSE images).

Although galena and matildite end- and decomposition-products may be formed at still lower temperatures, interpretation of observed textures and microanalytical data, in combination with published phase diagrams, indicate formation of the intermediate phases at temperatures as low as 144 °C. Similarly, we interpret minimum temperatures of initial precipitation as melts (in the range 40–70 % $AgBiS_2$) to be in the range 230–175 °C. The observed Bi excess may be a factor preventing decomposition of $AgPbBiS_3$ into galena and matildite.