Mn-RICH TETRAHEDRITES IN THE ROMANIAN TERRITORY

DAMIAN, Gh. & DAMIAN, F.
Department of Geology, North University of Baia Mare, 62/A Dr. Victor Babes Street, RO-4800 Baia Mare, Romania.
E-mail: damgeo@univer.ubm.ro

Tetrahedrite–tennantite is the most common sulphosalt present in the majority of hydrothermal ore deposits. Manganoan tetrahedrites appear in some hydrothermal ore deposits from South Apuseni Mts. MAKOVICKY & KARUP-MØLLER (1994) showed that Mn can be incorporated in the synthetic tetrahedrite structure. The stoichiometric formula of tetrahedrite is $Cu_{10}Me_2^{2+}(Sb,As)_4S_{13}$. Incorporation of Mn in tetrahedrites is possible by substituting cations in the structure. Mn can substitute Cu^{2+} in the structure. Manganese was indicated in all publications, but not exceeding 0.5 wt %.

BASU *et al.* (1984) described an occurrence of manganoan tetrahedrite with 1.5–1.7 Mn atoms per formula unit. These tetrahedrites are As varieties containing between 0.7 and 2.2 atoms, alongside with 0.1–0.2 Pb, 0.1–0.3 Fe, and minor amount of Zn and Hg. BURKHART-BAUMAN (1984) described at Quiruvilca (Peru) two intimately intergrown tennantites. One variety had Pb-bearing manganoan tennantite, and the other had tennantites rich in Mn with 1.48 atoms per formula unit. Another occurrence of manganoan tetrahedrite was described by DOBRE (1992) from the skarns of the Tunaberg Cu-Co deposit, Bergslagen, Central Sweden, and had 0.61 to 0.86 Mn per formula unit.

In Romanian territory the richest analyses in Mn were communicated by HIDEGH (1881) at Săcărâmb (South Apuseni Mts) with 1.23 wt % Mn. This tetrahedrite is intermediary between tetrahedrite-tennantite with 1.77 wt % Fe, and 5.55 wt % Zn. Other manganoan tetrahedrite occurrences were described at Boteş-Bucium, Arama vein by LOCZKA (1901) with 0.69 wt % Mn and KRETSCHMER (1911) with 0.26 wt % Mn.

We have identified new occurrences of manganoan tetrahedrites in the South Apuseni Mts. Two occurrences are certain at Gura Barza (Brad) and Coranda Hondol. The Gura Barza tetrahedrites contain 3.04–4.16 wt % Mn, and the Coranda-Hondol ones, between 0.74–6.31 wt % Mn. Microscopically, some varieties have been identified. At Coranda-Hondol the intergrowings between different varieties are highly evident and UDUBAŞA *et al.* (1982) signalled them. These intergrowings are more evident when they are built up of varieties with manganoan tetrahedrites and non-manganese varieties.

Formulae units for Gura Barza tetrahedrites are $Cu_{6.82-7.45}Zn_{0.98-1.65}Fe_{0.33-1.01}Mn_{0.95-1.31}Ag_{1.56-1.9}Sb_{3.89-3.93}S_{13}$ and for Coranda-Hondol are $Cu_{8.32-9.58}Zn_{1.45-1.74}Fe_{0.21-0.2721}Mn_{0.22-1.87}Ag_{0.19-0.24}Sb_{2.73-3.15}As_{0.8-1.40}S_{13}$. The tetrahedrites from Gura Barza contain Sb and especially large quantities of Ag, which include them in the argentian tetrahedrites group. These tetrahedrites contain more Me_2^{2+} than would normally result from the substitution of Cu_2^{2+} by Fe and Zn. The tetrahedrites from Coranda-Hondol contain As and Sb and a very small amount of Ag. In these tetrahedrites Cu_2^{2+} is almost totally substituted by Fe and Zn. Under these circumstances we assume that Mn substitutes Cu^+ together with Ag. BASU *et al.* (1984) claims that once the Me^{3+} content increases the Me^+ content lowers. This statement is not applied to some tetrahedrites from South Apuseni Mts. Because Fe and Zn substitute most of Me_2^{2+}, we assume that Mn together with Ag^+ substitutes Cu_{10}^+ in the formula unit. According to MAKOVICKY & KARUP-MØLLER (1994), the presence of Mn in synthetic tetrahedrites contributes to the increase of the unit cell parameter *a*. This increase is due to the much higher value of Mn^{2+} (0.67 Å) cationic radius compared to that of Fe^{2+} (0.64 Å) and Zn^{2+} (0.637 Å). The presence of Ag in tetrahedrites also determines the increase of the *a* parameter (RILEY 1974). The high amount of Mn and Ag, present in the studied tetrahedrites, can determine essential changes in the tetrahedrite structure. As the structure is very much modified, we do not exclude the possibility of having a new mineral, a tetrahedrite with manganese. Further investigation of these tetrahedrites will either confirm or reject our suppositions.

References

BASU, K., BORTNIKOV, N., & MOOKHERJEE, A. (1984). N. Jb. Miner. Abh., 141: 280-289.
BURKHART-BAUMAN (1984). N. Jb. Miner. Abh., 150: 37.
DOBRE, R. T. M. (1992). Miner. Mag., 56: 113-115.
HIDEGH, K. (1879). Tschermak's Mineral. Petrol. Mitt., 2, Ref. Z.K., 1881, 5.
KRETSCHMER, A. (1911). Zeits. Kryst., 9.
LOCZKA, J. (1901). Zeits. Kryst., 34.
MAKOVICKY, E. & KARUP-MØLLER, S. (1994). N. Jb. Miner. Abh., 167: 89-123.
RILEY, J. F. (1974). Mineral. Deposita, 9: 117-124.
UDUBAŞA, G. *et al.* (1982). D. S. Instit. geol. geofiz., Bucureşti, LXVII/2: 197–232.