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The W–Mo polymetallic deposit in the andraditic skarn from the upper Mraconia Valley (Almăj Mountains, Romania)

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In the upper basin of Mraconia Valley (Almăj Mountains, Southern Carpathians, Romania), mineralized bodies of skarn develop at the very contact of Variscan marbles of the Neamţu Series and a porphyric granodiorite of Triassic age [1]. The skarns form metasomatic columns with sharp contacts with the surrounding marbles. The main mineral of the skarn bodies is andradite (Adr 50.99 – 94.81 mol.%, Grs 5.00 – 45.63 mol.%) that can reach, in the mineralized zones, up to 95% of the rock volume. The mineral contains minor morimotoite (0.05 – 2.90 mol.%), uvarovite (0.03 – 0.04 mol.%) and pyralspites (up to 0.13 mol.% Alm, 0.02 mol.% Prp and up to 0.42 mol.% Sps - symbols after [2]) in the solid solution. The hydrogarnet component, pointed out by both Raman and infrared spectra, is low: up to 0.280 *pfu* (OH) can be deduced for $[Si + (OH)_4] = 3$ *apfu*. Andradite is generally isotropic, but optically anomalous garnet can occur; sectorial and lamellar "twinning" is, however, scarce. The unit-cell parameters (*a*), refined on the basis of X-ray powder data, vary between 12.006(4) Å and 12.066(3) Å. The main associated skarn mineral is magnetite, with a mean chemical-structural formula $(Fe^{2+}_{1.003}Mn_{0.002})(Fe^{3+}_{1.986}Al_{0.004}Ti_{0.005})O_4$. Secondary chamosite and pistacite occur as nests or veins in the andradite mass, as products of hydrothermal alteration. Pseudomorphs of hematite after magnetite are also visible.

Scheelite is the main exponent of the superposed ore deposit, occurring as isolated crystals or clusters of crystals, generally included in the andradite mass. The individual crystals are up to 2 mm in length, and up to 1 mm thick and have a prismatic-bipiramidal, tetragonal habit. The mean chemical-structural formula (average of 135 point analyses) is: $(Ca_{1.017}Pb_{0.001}Cu_{0.001}Mn_{0.001}Fe^{2+}_{0.001})(W_{0.974}Mo_{0.019})O_4$. A recurrent zoning inside individual crystals can be observed in cathodoluminescence, and corresponds to slight variations of the scheelite/powellite ratio (the powellite component varying between 1.20 and 3.31 mol.% Pwl).

Within the skarn bodies, the dominant sulfide is pyrite, generally with slightly less abundant molybdenite and much lesser quantities of galena, sphalerite and chalcopyrite. Molybdenite $(Mo_{0.943}W_{0.001}Pb_{0.095}Bi_{0.004}Cu_{0.004}Fe_{0.007}S_2)$ occurs both on fissures affecting the granodiorite mass, near the contact, where it associates with quartz, pyrite and chalcopyrite, and as impregnations in the skarn mass. In both cases, Pb is the main element substituting for Mo. Galena occurs generally as disseminations or small veins with associated calcite and, in some cases, with sphalerite and chalcopyrite. Its mean chemical-structural formula is $Pb_{0.990}Cu_{0.006}Mn_{0.003}Sb_{0.001}S$. The mean cell parameter (average of 14 values) is 5.925(12) Å. Sphalerite (mean formula: $Zn_{0.843}Fe_{0.121}Mn_{0.004}Cd_{0.007}Cu_{0.014}Pb_{0.011}S$) generally associates with galena and chalcopyrite. The unit-cell parameters (*a*), refined on the basis of X-ray powder data, vary between 5.401(1) Å and 5.429(2) Å, as a result of chemical variability (*i.e.*, Fe-for-Zn substitution). Chalcopyrite associates with galena and sphalerite in nests or in infillings of small veins, together with calcite. The mean chemical-structural formula of this mineral is $(Cu_{0.984}Fe_{0.997}Mn_{0.001}Mo_{0.009})S_2$. Chalcocite occurs as an alteration product of chalcopyrite. The mean chemical-structural formula calculated for a representative sample is $(Cu_{1.976}Fe_{0.001}Mn_{0.001}Mo_{0.005})S$.

References

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[2] Whitney and Evans (2010) Am. Mineral., 95: 185-187.