TENNANTITE-TETRAHEDRITES FROM MADAN Pb-Zn HYDROTHERMAL DEPOSITS (BULGARIA): CRYSTAL MORPHOLOGY AND MINERAL TEXTURES

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The sulphosalt minerals usually occur as massive, coarse aggregates or small (< 1 mm) anhedral grains and inclusions. Tennantite-tetrahedrite polyhedral crystals are rarely reported in literature (KOSTOV & KOSTOV, 1999). Representative samples from the Petrovitsa and Gradishte base metal deposits, Madan ore region, Central Rhodopes, Bulgaria are studied. Tennantite-tetrahedrites from Madan deposits are formed in the late phases of the main quartz-sulphide stage with galena, sphalerite, pyrite and chalcopyrite, showing complex chemical compositions (VASSILEVA *et al.,* 2012). In the studied materials sulphosalts are presented as remarkable size crystals with polyhedral morphologies.

The tennantite-tetrahedrite in the Gradishte samples are observed as idiomorphic crystals and postdate the aggregates of large chalcopyrite, pyrite and quartz. In polished sections the inclusions of chalcopyrite are crosscut by the sulphosalts, showing their later formation. Under SEM it was observed that crystals are developed by negative and small positive tetrahedra. The {110} acting mostly as a modifying form. Tennantite-tetrahedrite overgrows (112) chalcopyrite faces with parallel mutual orientation, due to the similar basic structural motifs (BONEV, 1973). Characteristic penetration twins on {111} are observed (Fig. 1).

Macroscopically, the tetrahedrite from Petrovitsa occurs as well-shaped crystals, where two characteristic morphologies are observed: (i) Tennantite-tetrahedrite crystals, composing peculiar crust, completely overgrow and resemble the shape of the main sulphides. These perimorhoses are composed by subparallel crystals, which are from 0.5–1 to 3–4 mm in size, with tetrahedral habit and bounded by the faces of *o*{111}, *d*{110}, *a*{100} and small *n*{211}. In cross section, the central parts of the crusts contain aggregates of chalcopyrite-galena-sphalerite-tetrahedrite association, together with carbonates and minor quartz. The galena and chalcopyrite crystals situated under these mineral crusts are affected probably by natural dissolution, which process has not left macroscopic marks on the tetrahedrite crystals. In polished sections galena occur as characteristic vertex formations growing with chalcopyrite and sphalerite. Tetrahedrite corrodes slightly sphalerite and galena or penetrates chalcopyrite. The textural relationships among the three minerals change considerably in different places of an aggregate, suggesting complex intergrowth mechanism of formation and metasomatic replacement. (ii) Single crystals, up to 1 mm, observed preferably on cubo-octahedral galena crystals (2–3 mm). Tetrahedrite overgrows galena cubo-octahedra following the scheme galena (100) [100] // tetrahedrite (001) [110], represented the one of the cases of epitaxy, described by MINCHEVA-STEFANOVA (1960). According to the textural characteristics and spatial position these tetrahedrites are formed shortly after the polyhedral crusts.

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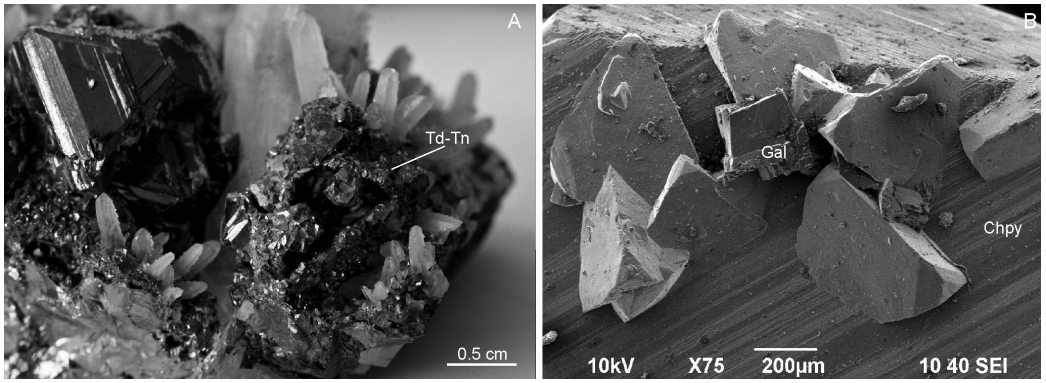

Fig. 1. *A) Tetrahedrite crust resampling sphalerite morphology, Petrovitsa; B) SEM image of Gradishte sulphosalts on chalcopyrite (Chpy).*