

NEW DATA ABOUT THE MINERALS OF THE COPPER ORE DEPOSIT AT BĂLAN (EAST CARPATHIANS) AND OF LIMESTONE XENOLITHS FROM BASALT AT RACOȘU DE JOS (PERȘANI MTS.), ROMANIA

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Rare secondary sulphates, carbonate-cyanotrichite, slavíkite, fibroferrite from the open pit of the Bălan copper ore deposit

The Bălan copper ore deposit is hosted in the epimetamorphic Tulgheș series. Primary sulphides are dominant pyrite and chalcopyrite, accompanied by sphalerite, galena, tetrahedrite and arsenopyrite. There is an extensive oxidation zone in near-surface position. Common secondary minerals include goethite, malachite, azurite, native copper; cuprite and covellite are rare (POPESCU, 1974; DAVID, 1983).

Our investigations were carried out on some secondary mineral parageneses formed in different levels of the Ferenc Ferdinánd open pit. All the minerals mentioned were identified by optical, XRD, SEM/EDS and ICP-MS methods. These minerals can be divided into two main groups according to the dominant cation, *i.e.* copper-bearing minerals (formed mainly from chalcopyrite) and iron-bearing ones (formed from pyrite). The main copper-bearing secondary minerals are chalcantite, malachite, azurite and brochantite. As a rarity we identified carbonate-cyanotrichite, forming pale blue sprays, up to 1 mm size, in close association with colourless to blue glass-like allophane encrustation. The main iron- (and/or magnesium-) bearing secondary sulphates are halotrichite, pickeringite, fibroferrite and slavíkite. Halotrichite and pickeringite are found as white to pale yellowish, fine fibrous, hair-like efflorescences, sometimes as globular aggregates. Fibroferrite forms white to pale grey encrustations, which consist of a dense intergrowth of fine fibres. Slavíkite appears as yellowish green to pale green porous crusts, consisting of, hexagonal tabular crystals, 10–20 μm in size. Carbonate-cyanotrichite, slavíkite and fibroferrite are the first occurrence reported from Romania.

Levyne-Ca and ettringite in limestone xenoliths from basalt at Racoșu de Jos

According to radiometric age determinations the basalt area at Racoșu de Jos is one of the youngest in Europe. The locality is famous for upper mantle-derived xenoliths consisting mainly of olivine and pyroxene (DOWNES *et al.*, 1995). Quartz xenoliths and contact metamorphic minerals that has been formed at the contact of the xenoliths and the enclosing basalt were also described from here (MĂLDĂRESCU *et al.*, 1982).

In the last years we found rare limestone-derived xenoliths, in which the dominating minerals were Ca silicates. We

examined these xenoliths by optical, XRD, SEM/EDS and EPMA techniques. They contain high temperature silicate minerals of contact metamorphic origin, mainly gehlenite, diopside and augite. Garnets (andradite–grossular), magnetite, ilmenite, chlorapatite, titanite, and some sulphides appear in smaller amounts.

In the cavities and fissures of the limestone xenoliths a low temperature paragenesis of hydrothermal origin occurs. This association contains mainly hydrous Ca silicates, among them zeolites, such as levyne and chabazite. Levyne forms white, hexagonal, tabular crystals up to 0.5 mm in size. According to EPMA results it is levyne-Ca. The other interesting late-stage mineral is ettringite. It occurs in white needles, some μm across and up to 0.5 mm in length, with hexagonal cross-section or forms fibrous aggregates, in close association with levyne-Ca. Ettringite crystals can be hexagonal prismatic to bladed. Ettringite was identified by XRD and SEM/EDS examinations. The three strongest XRD lines are [*d* (Å) (*I_{rel}*)]: 9.72 (100), 5.61 (76), 3.87 (31). EDS analyses sometimes show chemical compositions close to thaumasite suggesting an ettringite–thaumasite solid solution in these crystals. A few white, globular aggregates up to 0.5 mm, composed of okenite, accompany earlier mentioned minerals. The last precipitations are calcite and smectite. Levyne-Ca and ettringite are the first occurrence reported from Romania.

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