

HIGH-TECH METALS IN SPHALERITE AND CHALCOPYRITE FROM LEAD-ZINC-COPPER ORE IN THE ÖTZTAL-STUBAI COMPLEX

Angerer, T.¹, Onuk, P.², Nadoll, P.³, Tropper, P.¹, & Vavtar, F.¹

¹Mineralogical-Petrographical Institute, Innsbruck University, 6020 Innsbruck, Austria.

²Department of Applied Geological Sciences and Geophysics, Montanuni, 8700 Leoben, Austria.

³GeoZentrum Nordbayern, FAU Erlangen-Nürnberg, Schlossgarten 5a, 91054 Erlangen, Germany.

thomas.angerer@uibk.ac.at

Despite the strong interest in rare “high-tech” metals Ga, Ge, In, Sn, Sb in hydrothermal sulphide deposits, there is a dearth of studies on metamorphosed ore types (LOCKINGTON et al., 2014). The dominant host for rare metals in sulphide ore is sphalerite, but also chalcopyrite is a significant host to some “high-tech” metals, especially in metamorphic ore. We present 423 sphalerite and 110 chalcopyrite laser ablation ICP-MS spot analyses acquired from Pb-Zn and Cu-Fe-(Pb-Zn) ore samples (VAVTAR, 1988) from throughout the metamorphic Ötztal-Stubai complex (OSC). The aim is to understand controls and enrichment processes of trace metals in those ores. Financial support is kindly provided by BmWFW.

In order of their average abundance in sphalerite, Fe, Cd, Co, Mn, Hg, Ga, In, and Cr are primarily in structural solid solution. Primarily hosted in tiny inclusions are Cu (chalcopyrite), Pb (galena, sulfosalts), Sn (stannite, sulfosalts, cassiterite?), as well as Sb, Ag, Ge, As, Ni, and Bi (sulfosalts such as tetrahedrite). Fe can be present in small pyrrhotite-pyrite inclusions. Ge, Mn, Ni, Cr, and V seems to be incorporated also into silicates or carbonates.

In case of chalcopyrite, Zn, Sn, Pb, Se, Ag, and In can be enriched (>100ppm), both as inclusion-hosted and in solid solution.

Despite very heterogeneous data across the OSC region, there are distinct elemental patterns allowing a robust discrimination of most ore occurrences. Especially Hg concentrations in sphalerite show remarkably low standard deviations within ore occurrences. With respect to sphalerite, all Tösens district ore (except Hochjoch) defines a low-Mn/high-Hg group. Most Nauders district ore (Knappental, Knappenkar, Tscheyjoch) define (with Tösens Hochjoch) a medium-Mn/medium-Hg group. Nauders/Sattelalpe is exceptionally high in Mn and low in Co. Schneeberg shows variable Hg, while Mn/Co is stable, suggesting that Hg chemistry is zoned across this complex deposit. For chalcopyrite, the initial dataset does not allow a robust discrimination.

While sphalerite is a significant host for Ga, Ge, Co, Sn, and In, chalcopyrite seems to host only Sn and In. Sb and Ag are mostly carried by various sulfosalts. Following rare metal “sweet spots” are determined: Hochjoch and Tscheyjoch for Ga, Tösens/Unterbergler Gang and Tscheyjoch for Ge, Knappenkar (sphalerite) and Glücksgrat (chalcopyrite) for In, Tösens/Oberbergler Gang (chalcopyrite), Hochjoch and Sudelskof (sphalerite) for Sn, Tösens and Tscheyjoch for Co (all sphalerite), Sudelskopf for Sb (as sulfosalt inclusion in sphalerite).

LOCKINGTON, J.A., COOK, N.J., CIOBANU, C.L., (2014): *Mineralogy and Petrology*, 108, 873-890.

VAVTAR, F., (1988): *Arch. f. Lagerst.forsch. Geol. B.-A.*, 9, 103-153.