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Minor and trace elements in sphalerite from lead-zinc-ores in the Ötztal-Stubai complex

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Lead-zinc dominated, massive sulphide ores are potentially enriched in the valuable “high-tech” metals Ga, Ge, In, Sn, Sb, and Cd. However, the processes and controls on the distribution of minor and trace metal in sulphides are poorly understood. The early Palaeozoic, polyphase metamorphic Ötztal-Stubai complex (ÖSC) in the Eastern Alps hosts numerous occurrences of stratiform (SEDEX type) and vein-type (remobilised) sulphide mineralisation with sphalerite-galenite±chalcopyrite±pyrite±pyrrhotite±arsenopyrite parageneses, and mostly hosted in paragneisses [1].

Using Laser ablation QQQ-mass spectrometry (protocol and calibration: [2]), 49 samples from nine occurrences were analysed for 23 elements in sphalerite (10 spots/sample). Trace element signatures are remarkable distinct for each occurrence, suggesting overall complex, albeit within a deposit homogeneous (except *Schneeberg*), controls on Zn substitution. Mostly, Cd-Hg, Fe-Mn and Pb-Ag-Sb-Bi covary suggesting coupled Zn substitution by distinct element groups. The ore occurrences can be discriminated plotting Cd/Hg vs. Mn/Co: there is a group with low Cd/Hg and Mn/Co (*Tösens*, *Tscheyjoch*), with intermediate Cd/Hg and Mn/Co (*Knappenkar*, *Knappental*), and with high Cd/Hg and Mn/Co (*Sattelalpe*). *Schneeberg*, the largest in the region, belongs to the intermediate Mn/Co group but its broad Hg variation suggests a complex alteration zoning. Here, highest Fe and Cd concentrations are likely related to the highest metamorphic grade. More constraints on local and regional controls of trace metal distribution will be presented.

In terms of “high-tech” metal concentration, the comparison with metamorphosed SEDEX deposits in Norway and Australia [3] reveals that some occurrences in the ÖSC can compete with others: *Tösens* shows highest Ga+Ge+Co+In+Sn (mean: 750, min: 70, max: 5600 ppm) in the data set.

[1] Vavtar (1988) Arch. f. Lagerst.forsch. Geol. B.-A., **9**, 103-153. [2] Onuk, Melcher, Mertz-Kraus, Gäbler, Goldmann (2016) Geostd. and Geoanal. Res., DOI 10.1111/ggr.12154. [3] Lockington JA, Cook NJ, Ciobanu CL (2014) Mineralogy and Petrology **108**, 873-890. The research is funded by BMWF, Austria.