Stanniferous W-(Sn) skarn mineralisation near to Felbertal tungsten mine, Tauern Window, Eastern Alps

Johann G. Raith[1], Alexander Ordosch[1], Steffen Schmidt[2], Karsten Aupers[2]

[1] *Montanuniversität Leoben, Chair of Resource Mineralogy, Leoben, Austria; e-mails: johann.raith@unileoben.ac.at, alexander.ordosch@icloud.com*
[2] *Wolfram Bergbau und Hütten AG, Bergla, St. Martin i.S., Austria; e-mails: s.schmidt@wolfram.at, k.aupers@wolfram.at*

The scheelite exploration target Messelingscharte (Eastern Tyrol, Austria) is located about 8 km SSE of the world-class Felbertal tungsten deposit. The W-(Sn) mineralisation occurs in Early Palaeozoic amphibolites (Basal Amphibolite unit; Basisamphibolit) close to the contact with the overlying Basal Schist (Basisschiefer) in the central Tauern Window of the Eastern Alps. Variscan orthogneisses of different age and source are exposed nearby; *i.e.* Felbertal augengneiss, 338.5±1.3 Ma, εHf_t –6.8 to –5.3; Granatspitz gneiss, 314±18 Ma; εHf_t –3.1 to +2.5 (Kozlik *et al*., 2016b).

Geological mapping and regional geochemical sampling including re-evaluation of work undertaken during the 1970s identified three types of scheelite mineralisation: (1) Sn-bearing clinozoisite-scheelite skarn; (2) Deformed scheelite-quartz veins; (3) Scheelite in mylonitic quartz-amphibolite layers. The most important mineralisation type is the Sn-bearing clinozoisite-scheelite skarn of pre-Alpine (Variscan?) age. It occurs as metre-sized irregular pods within amphibolites and amphibole schists. The skarn-like rock is composed of major clinozoisite, quartz, and plagioclase with minor/accessory scheelite, titanite and chlorite. Analyses of random pick sample reveal high concentrations of the granitophile elements W (up to 7.7 mass% WO_3), Sn (up to 1250 ppm SnO_2), Be (up to 41 ppm) and base metals (Cu, Pb, Zn; $\sum \leq 2500$ ppm) in the skarn rock. Compared to the amphibolite host rocks Ca and LIL elements are enriched whereas less mobile Mg, HFS elements (Ti, Nb, Zr, Hf). The flat REE patterns show LREE depletion, a marked positive Eu anomaly and flat to increasing HREE.

The unique feature of the investigated W-(Sn) skarn is the association of scheelite with Sn-bearing silicates. Stanniferous clinozoisite and stanniferous titanite were identified as the main Sn carriers (clinozoisite ≤3.00 mass% SnO_2; titanite ≤6.48 mass% SnO_2). Substitution of tin is controlled by the following substitution: $2(Al,Fe)^{3+} = (Sn,Ti)^{4+} + (Fe,Mg,Mn)^{2+}$. Clinozoisite as well as titanite were affected by metamorphic re-crystallisation; *i.e.*, they are of pre-metamorphic origin. Three scheelite types are distinguished based on micro-textures, zoning, Mo-content and UV fluorescence. They show intriguing similarities to scheelites of Felbertal deposit where pre-Alpine Mo-bearing scheelite of magmatic hydrothermal origin was apparently overprinted by two stages of metamorphism (Kozlik *et al*. 2016a).

The W-(Sn) skarn formed by interaction of water-rich fluids of likely magmatic-hydrothermal origin with metabasite host rocks. The clinozoisite-dominated calc-silicate rocks are interpreted as a metamorphosed distal W-(Sn) skarn, a mineralisation type that has not been reported from the Eastern Alps before but is known as a rare skarn type *e.g.*, from some Cornish Sn skarns (van Marcke de Lummen, 1986).

REFERENCES

Kozlik, M., Gerdes, A., Raith, J.G. 2016a. Strontium isotope systematics of scheelite and apatite from the Felbertal tungsten deposit, Austria – results of in-situ LA-MC-ICP-MS analysis. *Mineralogy and Petrology* 110, 11–27.

Kozlik, M., Raith, J.G., Gerdes, A. 2016b. U–Pb, Lu–Hf and trace element characteristics of zircon from the Felbertal scheelite deposit (Austria): New constraints on timing and source of W mineralization. *Chemical Geology* 421, 112–126.

van Marcke de Lummen, G. 1986. Tin-bearing epidote from skarn in the Land's End aureole, Cornwall, England. *Canadian Mineralogist* 24, 411–415.