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New insights into a historical mine site: the Sn-W-Li Zinnwald/Cínovec deposit, eastern Erzgebirge, central Europe

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The historically significant Sn-W-Li Zinnwald/Cínovec deposit is characterised by greisen-type mineralization hosted within the apical portion of a small granite intrusion. Similar to other granitic stocks with Sn-W mineralization in the Erzgebirge, the Zinnwald granite intruded during the post-collisional stage of the late-Variscan (Permo-Carboniferous) magmatic evolution. These small Li-F granite bodies are characterised by the prominent enrichment of incompatible elements (F, Li, Rb, Cs, Sn, Nb, Ta) and the depletion of Ba, P, Sr, Zr, Ti, and Mg [1].

The Zinnwald granite is located in the eastern part of the Erzgebirge-Fichtelgebirge anticline and consists of highly evolved, weakly peraluminous and variably altered albite-Li mica leucogranite of anorogenic-type affiliation. Laterally extensive pegmatitic veins, which are located in the apical part of the granite cupola, represent the dominant source for the historically exploited Sn-W mineralisation, whereas sheet-like, metasomatic greisen ore bodies serve as a major resource for Li due to the abundance of Li-mica (zinnwaldite). This was demonstrated recently by extensive exploration of the Li mineralisation carried out by SolarWorld Solicium GmbH (SWS) during 2011 and 2014 [2].

This contribution aims to present new insights into the architecture, mineralization and geochemistry of the Zinnwald deposit based mainly on recent and historic drill core samples and their analysis by light microscopy and scanning electron microscopy, EPMA, LA-ICP-MS and whole rock ICP-MS. The results indicate an orientation of greisen ore bodies and veins parallel to the granite contact as well as a decrease of mineralization thickness and abundance with depth. While the host granite itself is highly evolved in its composition, progressive greisenization (Fig. 1) is accompanied by a decrease of fractionation indices (e.g. K/Rb from 20 to 8) and increasing contents of incompatible elements. For instance, mean grades of the most abundant quartz-mica-topaz-greisen include 3,700 ppm Li, 70 ppm Cs and 3.1 wt.% F. Fluid-controlled metasomatic processes are inferred from microscopic textures, trace element behaviour and significant tetrad-effect in normalized REE patterns. The chemical composition of Li-mica is similar for various greisenized lithologies of the endo- and exocontact, and Li concentrations range from 1.1 to 2.2 wt.%. Greisenization, which corresponds to the formation of zinnwaldite, follows an incipient stage of quartz-replacement and is spatially related, but not genetically linked, to

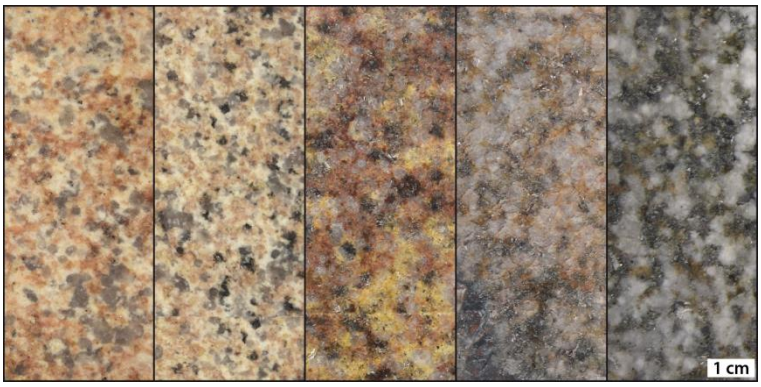

Fig. 1: Alteration sequence from unmineralized albite granite (left) towards quartz-mica-topaz-greisen (right).

disseminated Sn-W mineralization. This is demonstrated by the presence of disseminated Sn-W mineralization hosted either by greisen lithologies or by albite granite, which was only moderately affected by greisenization. This, in turn, may require a critical assessment of current metallogenetic models.

References

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