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New lithogeochemical and mineralogical exploration of Li-Sn greisen mineralisation in old mining adits of the Zinnwald deposit, Germany

Jörg Neßler (1), Thomas Seifert (1), Jens Gutzmer (2), Armin Müller (3), Jan Henker (3), and Kersten Kühn (4)

(1) Department of Mineralogy, TU Bergakademie Freiberg, Germany (joerg.nessler@mineral.tu-freiberg.de), (2) Helmholtz Institute Freiberg for Resource Technology, Germany, (3) SolarWorld Solicium GmbH, Freiberg, Germany, (4) G.E.O.S. Ingenieurgesellschaft mbH, Halsbrücke, Germany

The polymetallic Zinnwald-Cínovec deposit is represented by greisen-type mineralisation hosted within the apical portion of a small granite intrusion. Similar to other granitic stocks with Sn-W mineralisation in the Erzgebirge, the Zinnwald granite intruded during the post-collisional stage of the late-Variscan (Permo-Carboniferous) magmatic evolution. These intrusions are characterised by the prominent enrichment of incompatible elements (F, Li, Rb, Cs, Sn, Nb and Ta) and the depletion of P2O5.

The deposit is located in the eastern part of the Erzgebirge region, Germany and straddles the border between Germany and the Czech Republic. It is characterised by flat dipping, sheet-like greisen ore bodies (up to 40 m in thickness) and veins (up to 1 m in thickness) located in the apical part and along the quaquaversal dipping edges of the granite stock. The greisen bodies predominantly consist of quartz, Li-Rb-Cs-bearing mica (named zinnwaldite), topaz, fluorite and accessory kaolinite and cassiterite.

Historically mined for its cassiterite and wolframite ores since the 16th and 19th century, respectively, the deposit still provides access to a wide spread system of drifts and adits. Selected parts of the underground mine are now presented by the visitor's mine "Vereinigt Zwitterfeld zu Zinnwald". These local conditions are favourable for the re-examination of the exhibited greisen mineralisation.

Within the framework of the ongoing Li and Sn exploration project of the SolarWorld Solicium GmbH in the German part of the deposit, an underground sampling campaign has been conducted, incorporating a series of 88 channel samples gained at two different levels (Tiefer Bünau adit = 750 m a.s.l.; Tiefe Hilfe Gottes adit = 720 m a.s.l.). Equally spaced channels of 2 m intervals and approximate dimensions of 180 x 5 x 2.5 cm have been created on pre-selected and detailed mapped walls of two different adits within the mine. The sample material has been gained for mineralogical and geochemical investigation using optical light microscopy and ICP-MS. The herein presented work aims to provide information about the horizontal distribution of selected elements (Li, Rb, Cs, Sn, W, Sc, Nb, Ta and Zn) and to assess historic data on mineralogy and geochemistry. Furthermore, the question of a sufficient sampling distance is tried to answer with the help of statistical exclusion principles.

Investigations on the chemical composition of the greisen ore yielded homogeneous concentration of elements contained in micas (Li, Rb, Cs, Zn and Sc!) with Li concentration of about 0.3 wt. %, whereas concentrations of Sn and W (but also Nb and Ta) are more heterogenic distributed with some high-grade values connected to local mica-nests, veins and/or joint planes. Moreover, results of investigated elements from this campaign are in good agreement with the overall geochemical pattern obtained by past investigations. Compared with geochemical whole rock data from drill core samples of surrounding drill holes, the mean Li grades of channel samples are consistent for different areas within the mine.

In case of Li, the application of statistical exclusion principles can provide a good estimation of the sufficient maximum sampling distance (about 5 m).