HERZENBERGITE AND Sn-BEARING TINZENITE FROM THE NYF PEGMATITE IN TŘEBÍČ PLUTON, MOLDANUBICUM, CZECH REPUBLIC

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The most common Sn-rich minerals in the granitic pegmatites include cassiterite and wodginite, scarcely also Sn-bearing ixiolite and varlamoffite. Stokesite, brannerite, kristiansenite *etc.* are very rare Sn silicates. Minerals of the stannine–kesterite group are the most frequent Sn-bearing sulphides, whereas herzenbergite, SnS, occurs in granitic pegmatites only exceptionally: the Sollefteå pegmatite field, North Central Sweden (SMEDS, 1993) and sporadically Viitaniiemi, Finland (LAHTI, 1981). Herzenbergite and associated stokesite, varlamoffite, cassiterite and tinzenite were recently found during systematical investigation of the NYF pegmatites from Třebíč pluton, Moldanubicum, Czech Republic.

Třebíč pluton forms a large (~540 km^2), probably sheet-like body of ultrapotassic (5.2–6.5 wt% K_2O) plutonic rocks of the durbachite emplaced in medium- to high-grade metamorphic rocks. The rocks are highly magnesian (3–10.4 wt% MgO), rich in Cr, Rb, Cs, U and Th. The bulk composition of TP is characterized by metaluminous signature ASI = 0.85–0.93; radiometric dating yielded age 343±6 Ma. Durbachitic rocks are interpreted as a product of mixing of an enriched mantle magma and crustal melt. Pegmatites derived from this rock belong to the NYF family. Several morphological types in different degree of fractionation were distinguished: i) irregular segregations to nests of primitive allanite subtype, ii) lenses to dykes of the more evolved euxenite subtype and iii) the most fractionated zinnwaldite–masutomilite–elbaite pegmatite at Kracovice of the Mixed family. Pegmatites form lenses or dykes with maximal thickness of 1.5 m. Concentric asymmetrical zoning comprises from the contact inwards contact zone, locally transitional to host rock, granitic zone, graphic zone, blocky K-feldspar and small quartz core. Albite replaces blocky K-feldspar and graphic zone. Quartz, K-feldspar (locally pale green amazonite), plagioclase and Mg-rich biotite are major minerals. Tourmaline is typical minor mineral, the accessory minerals include: Y, REE, Nb, Ta, Ti oxides, titanite, ilmenite, allanite-(Ce) and Sn minerals. Primary muscovite is not present.

Sn mineralization was found at locality Klučov, which belongs to euxenite subtype. It fills tiny vugs and fractures in the strongly albitized part of graphic and block zone with common tourmaline. Based on the mineral paragenesis, two different associations were distinguished: i) herzenbergite I-II–varlamoffite–stokesite–cassiterite, ii) cassiterite–tinzenite–varlamoffite.

Cassiterite I forms anhedral to corroded grains up to 20 μm; its chemical composition show increased content of Ta, Nb and Fe by the substitution $Fe^{2+}(Ta, Nb)_2 \leftrightarrow 3Sn$. Euhedral crystals of cassiterite II reach 20 to 100 μm and chemical composition corresponds to nearly pure SnO_2. Elevated Nb, Ta and Fe content in cassiterite I suggest crystallization at higher temperature relative to cassiterite II. Two generations of herzenbergite were distinguished and they differ in texture and chemical composition. Herzenbergite I forms highly altered, lathy crystals and their aggregates, up to 2 mm in size. Small amount of Fe and Cu, both up to 0,007 apfu, enter the structure. Herzenbergite I is replaced by mixture of stokesite and varlamoffite. Herzenbergite II fills space among crystals of herzenbergite I or it occurs as grains mounted on the apical part of the decomposed herzenbergite I crystal. Its chemical composition corresponds to the ideal SnS. Herzenbergite II commonly encloses oriented cigar-shaped lamellae of varlamoffite and does not show any sign of alteration. Herzenbergite I probably crystallized from hydrothermal solutions as one of the latest minerals in small vugs or its lathy crystals intergrow with quartz. Later herzenbergite II crystallized either directly from hydrothermal solutions later than herzenbergite I, or as a phase formed at the expense of herzenbergite I. In the Scandinavian localities herzenbergite replaces cassiterite (Sollefteå) or it was found as exsolution lamellae in cassiterite (Viitaniemi). Specific conditions of herzenbergite formation (fS and fO_2) and stability cause their very scarce occurrence in the pegmatites.

Tinzenite forms anhedral crystals, up to 100 μm in size. Its chemical composition varies from nearly end-member tinzenite to Ca-rich tinzenite. Elevated content of SnO_2, up to 0.86 wt. % SnO_2, was detected. It is a first occurrence of tinzenite in the pegmatites and first evidence of incorporation of Sn into natural axinites.

References

LAHTI, S. I. (1981): Bull. Geol. Surv. Finland, 314: 1–63.
SMEDS, S. A. (1993): Mineralogical Magazine, 57: 489–494.