

## **Metamorphic vanadian-chromian silicate mineralization in carbon-rich amphibole schists from the Malé Karpaty Mountains, Western Carpathians, Slovakia**

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### **ABSTRACT**

Mineralization, involving vanadian-chromian silicates, has been studied in Lower Paleozoic, carbon-rich amphibole schists with pyrite and pyrrhotite near Pezinok, southwest Slovakia. A detailed electron microprobe study has revealed the presence of V,Cr-rich garnet, clinozoisite, and muscovite, associated with amphiboles (magnesiohornblende, tremolite, actinolite, and edenite), diopside, and albite. The garnet contains 5–19 wt% V<sub>2</sub>O<sub>3</sub>, 5–11 wt% Cr<sub>2</sub>O<sub>3</sub>, and 2–13 wt% Al<sub>2</sub>O<sub>3</sub> (16–64 mol% goldmanite, 19–36 mol% uvarovite, and 9–59 mol% grossular end-members). The garnet is unzoned or shows V-rich cores and Al-rich rims, or irregular coarse oscillatory zoning with V, Cr, and Al, locally involving Ca and Mn as well. The V,Cr-rich clinozoisite to mukhinite and “chromian clinozoisite” contains 2–9.5 wt% V<sub>2</sub>O<sub>3</sub> and 1.5–11 wt% Cr<sub>2</sub>O<sub>3</sub>; the muscovite contains 2.5–8 wt% V<sub>2</sub>O<sub>3</sub> and 0–7 wt% Cr<sub>2</sub>O<sub>3</sub>. The mineralization originated from primarily V-, Cr-, and C-rich mafic pyroclastic rocks, affected by volcano-exhalative processes. These rocks were weakly metamorphosed during early Hercynian regional metamorphism (M1), followed by late-Hercynian contact metamorphism (M2) with crystallization of V,Cr-rich silicates, diopside, amphiboles, phlogopite, titanite, albite, quartz, carbonate, pyrite, and pyrrhotite. The youngest Alpine(?) retrograde metamorphic event (M3) is connected with production of V,Cr-poor muscovite, clinocllore, clinozoisite, pumpellyite-(Mg), prehnite, quartz, and carbonates, under prehnite-pumpellite facies conditions.

**Keywords:** V and Cr mineralization, amphibole schists, contact metamorphism, goldmanite, uvarovite, mukhinite, Western Carpathians, Slovakia