

Fluid Properties and Lithological Control in the Genesis of the W-Mo Porphyry Deposit Ochtiná-rochovce (Western Carpathians, Slovakia)

Peter Koděra¹, Diego Delgado Yáñez¹, František Bakos², Rastislav Vojtko¹, Juraj Majzlan³, Ondrej Nemec¹
¹Faculty of Natural Sciences, Comenius University, Bratislava, Slovakia, ²Green View, s.r.o., Bratislava, Slovakia, ³Friedrich Schiller University Jena,, Jena, Germany

The Ochtiná-Rochovce W-Mo deposit has variable host lithologies affected by hydrothermal alteration. Biotitic phyllite and mafic metavolcanites in upper parts of the deposit are the main W host, with abundant scheelite and minor wolframite. Deeper metasandstone is enriched in molybdenite. Mineralization is hosted by quartz stockworks and veins, developed during biotite-wolframite, scheelite-molybdenite-pyrite and K-feldspar-calcite stages. Fluid inclusion study showed the presence of earlier CO₂-rich and later CO₂-poor fluids. The earlier fluids associated with the W-Mo mineralization experienced heterogeneous entrapment of high-density liquid and low-density vapor. They contain 2-9 wt% NaCl eq., up to 2.6 mol% H₂S of magmatic origin, as confirmed by S isotopic composition of sulfides, and traces of N₂ likely sourced from graphitic-sericitic phyllite. Corresponding trapping PT conditions (~245-330 °C, 170-250 MPa) are consistent with those determined from contact mineral assemblages (200-300 MPa). CO₂-rich fluids were affected by continuous release of CO₂ during upflow from the parental porphyry intrusion and subsequent cooling. Late, post-mineralisation, CO₂-poor fluids have mostly similar salinities (5 to 9 wt% NaCl eq.) but much lower T_{htot} (120-180 °C) and were unaffected by fluid immiscibility. However, trapping PT conditions could be similar if applying lithostatic pressure corrections. Their mixing with external brines (up to 41 wt% NaCl eq.) was also observed. Tungsten minerals precipitated by an increase in pH aided by wall-rock reactions and loss of CO₂ from early fluids on decompression. Amphibole and plagioclase replacement by biotite in metavolcanites provided Fe, Ca, and Mg for their precipitation. Molybdenite deposition was promoted by cooling of fluids, related to decompression, combined with decreasing fO₂ and increase in pH, resulting in quartz-sericite±pyrite selvages. Progress of fluid-rock reactions and cooling invoked a further drop of acidity and fO₂, enrichment in S(-II), and liberation of Fe(II) into the fluid, generating abundant pyrite. Support by the grant APVV-22-0134 is acknowledged.