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Evolution of Magmatic Fluids at the Banska Stiavnica Precious and Base Metal Deposit, Slovakia - Evidence from Melt and Fluid Inclusions

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Abstract

The Banska Stiavnica Au-Ag base metals epithermal deposit is hosted within a Neogene-age volcanic caldera in central Slovakia. The caldera comprises a central granodiorite stock that has been capped by comagmatic andesite and rhyolite extrusions. The intrusive felsic rocks possess a close spatial and temporal relationship with the mineralization and associated hydrothermal alteration. To investigate the possible genetic link between magmatic and hydrothermal activity, paragenetically constrained melt and fluid inclusions in magmatic quartz and vein minerals were studied, using microthermometric techniques. Primary melt inclusions in magmatic quartz from the granodiorite vary in composition from essentially silicate H_2O- and Cl-rich melt with low-salinity fluid (8.3-9.6 wt % NaCl equiv) to high-density hypersaline brines (~80 wt % NaCl equiv). Salinities of secondary fluid inclusions in magmatic quartz systematically decrease along the NaCl saturation curve toward lower temperatures and salinities equivalent to those determined for primary fluid inclusions in sphalerite and vein minerals (quartz, barite, fluorite) within the deposit (<400°C, <12 wt % NaCl equiv). This systematic evolution in measured and calculated characteristics (temperature, pressure, salinity, and density) of the studied fluid inclusions indicates that exsolved magmatic brines and aqueous chloride solutions were the primitive precursors to the hydrothermal ore-forming fluids that produced epithermal mineralization upon mixing with meteoric waters in the near-surface environment.