Relationship of Magmatic and Ore-forming Processes in Andesitic Volcanoes – Example from the Štiavnica Stratovolcano, Slovakia

Peter Koděra[1], Jaroslav Lexa[2], Bertrand Rottier[3], Alexander Kubač[1], Oscar Laurent[4]
1. Comenius University, Faculty of Natural Sciences, Bratislava, Slovakia, 2. Earth Science Institute, Slovak Academy of Sciences, Bratislava, Slovakia, 3. Département de Géologie et Génie Géologique, Université Laval, Québec, QC, Canada, 4. Institute of Geochemistry and Petrology, ETHZ, Zürich, Switzerland

In big, long-living volcanic centres, such as Štiavnica andesitic stratovolcano in the Western Carphatians, there are present diverse styles of ore deposits with a variable metal endowment. Based on LA-ICP-MS, EMPA and microthermometry data from rocks, melt inclusions and fluid inclusions, magmas and most deposits were sourced from an upper crustal (~1 to ~3 kbar) reservoir that was active more than 3 My. Ore deposits were formed during periods of reservoir cooling when the residual melt reached fluid saturation. This melt is represented by evolved rhyolitic melt inclusions of a roughly stable composition, hosted by rock-forming minerals from different stages of magmatic activity. Fluid inclusions in most deposits (except of brines in Cu-Au skarn-porphyries) showed increased B, As, Sb concentrations indicating that the main source of fluids was a magmatic supercritical fluid contracted to liquid during ascent from the reservoir or a contracted vapor resulting from fluid heterogenization. The relatively constant composition of most studied elements, high Cs contents, and agreement with the published fluid-melt fractionation factors indicate a common long-lasting source of magmatic fluids, exsolved from the evolved interstitial melt. The fluids were continuously exsolved and accumulated but liberated during periodical tectonic events. They include migration via contraction fractures (Pb-Zn-Cu stockwork in granodiorite), ring fractures and shear zone induced by a sector collapse of the volcano (early Au-Ag-Pb-Zn-Cu veins), along with porphyry stocks and ring dikes as a precursor of a caldera collapse (Cu-Au skarn-porphyries), and faults of a resurgent horst uplift (late Ag-Au-Pb-Zn-Cu veins). Ore precipitation was triggered by mixing of magmatic and meteoric water (stockwork), boiling of decompressed fluids (early veins), cooling of contracted vapor affected by late fluid heterogenisation (skarn-pophyries) and mixing+boiling (late veins). Our results show that external factors, rather than melt and fluid compositions, primarily control the different metal endowment of the deposits.