Formation of the high-sulfidation type epithermal Cu-Au-Ag deposit in the Recsk Ore Complex, NE Hungary, based on ore mineralogy and fluid inclusion study*

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The Recsk Ore Complex is an example of the porphyry-skarn-epithermal systems in the Alp-Carpathian region. The first ore discoveries of the area date back to the end of the 18th century, but the exploitation of the shallow epithermal Cu-Au ore ended in 1979. Deep-seated Cu-porphyry, Pb-Zn skarn, and metasomatic Pb-Zn ores were discovered by an intense drilling program in the 1950-80s, but the exploitation of these deposits has not been started yet.

The mineralized intrusive-volcanic complex at Recsk is a part of the Paleogene Volcanic Belt of Hungary. The studied high-sulfidation type Cu-Au-Ag deposit is located peripherally to the northern apex of the intrusions at the Lahóca Hill, except one single ore body (the Lejtakna ore body), which is located separately above the subvolcanic intrusions. Host volcanic units are characterized by dickite-kaolinite argillic alteration around brecciated vuggy silica bodies and variable intensity of silicification and pyrite formation.

The high sulfidation type epithermal Cu-Au-Ag mineralization of the Lahóca Hill consists of wide variety of ore minerals, which are clustered into three successive assemblages. These assemblages represent and characterize three determinative stages of the shallow high sulfidation type epithermal system. Mineralogy and fluid inclusion study of the first assemblage (e.g. pyrite, tennantite, tetrahedrite, galena, chalcopyrite, quartz) suggests the highest-temperature (260°C - 235°C) mineral forming fluid with the lowest salinity (0.5-2.5 NaCl equiv. wt%), lowest tellurium fugacity (Te-undersaturated system) and moderate sulfur fugacity (intermediate sulfidation state). The next assemblage represents the main ore forming stage of the epithermal system. The mineral assemblage (e.g., enargite, luzonite, famatinite, pyrite, calaverite, hessite, native gold) and the enargite-hosted fluid inclusions indicate a cooling fluid (from 245°C to 170°C) coupled with increasing salinity (from ~1.0 to 9.5 NaCl equiv. wt%), higher tellurium (Te-saturated system) and sulfur fugacity (high sulfidation state). Economically important massive enargite and luzonite bodies were formed during this stage with significant gold content. The last ore mineral assemblage (e.g., tennantite, goldfieldite, Au-Ag-tellurides, native tellurium, base metal selenides, pyrite) indicates decreasing sulfur fugacity (intermediate sulfidation state), further increase of the tellurium fugacity (Te-oversaturated system) and local occurrence of higher oxidizing conditions reflected by the rare occurrence of base metal-selenides (e.g., kawazulite, tiemanite). Precipitation of native gold also decreased and silver became the dominant metal of in the telluride assemblage.

The observed differences in mineral diversity and trace element compositions of some sulfide minerals describe the spatial evolution of the epithermal system. Spatial distribution of homogenization temperatures of quartz and enargite-hosted fluid inclusion also confirm the lateral flow of hydrothermal fluids. However, interpretation of the original fluid flow direction in the present-day setting is difficult, due to the complex tectonic history of the area.