ORE MINERALIZATION OF THE BANSKÁ ŠTIAVNICA STRATOVOLCANO, SLOVAKIA

JELEŇ, S.[1], HÁBER, M.[1], KODĚRA, P.[2] & LEXA, J.[2]
[1] Geological Institute, Slovak Academy of Sciences, Severná 5, SK-974 01 Banská Bystrica, Slovak Republic.
E-mail: jelen@savbb.sk
[2] Geological Survey of Slovak Republic, Mlynská dolina 1, SK-817 04 Bratislava, Slovak Republic.

The region of the Central Slovakian Neogene Volcanic Field, with the biggest andesitic volcano Banská Štiavnica, has served as an important source of precious and base metals for a long time. The Banská Štiavnica stratovolcano, including an extensive subvolcanic intrusive complex, large caldera and remarkable resurgent horst, hosts the following types of mineralization: 1. High-sulphidation system at Šobov, related to the subvolcanic diorite intrusion, 2. Magnetite skarn deposits and occurrences at contacts of a subvolcanic granodiorite pluton with Mesozoic carbonate rocks, 3. Stockwork/ disseminated base metal mineralisation along an irregular network of fractures in apical parts of the granodiorite pluton and in remnants of basement rocks, 4. Porphyry/skarn Cu±Mo, Au deposits and occurrences related to granodiorite/quartz-diorite porphyry dyke clusters and rock around the granodiorite pluton, 5. Caldera collapse related epithermal gold deposit in the andesitic environment just above the granodiorite pluton, 6. Hot spring type advanced argillic systems in caldera filling, 7. High sulfidation system of Varta related to an assumed granodiorite porphyry stock, 8. Vein type low sulfidation epithermal precious/base metal deposits and occurrences at faults of the resurgent horst, 9. Replacement precious /base metal mineralization of a limited extent in the Mesozoic carbonate rocks next to epithermal veins, 10. Carlin-like Au±Hg, Tl, Sb, As mineralization in Triasic dolomites at Bukovec, 11. Low temperature Au±Hg, Sb, As mineralization in rhyolite extrusive domes around the resurgent horst (LEXA, *et al.*, 1999; LEXA, 2001).

Precious and base metal, vein-type mineralization and iron skarn mineralization were the most abundant and economically most important mineralizations in this region.

Magnetite skarn deposits and occurrences are situated mostly in the western part of the horst and were the subject of medieval mining. Two types of skarns are present: the magnesian type and calcic type. Mineralization formed during three basic stages: initial, with the garnet, diopside and wollastonite assemblage (epidote and tremolite further from the contact), metasomatic, with the epidote, tremolite, andradite and magnetite assemblage and retrograde, with the zonal garnet, hematite and minor magnetite assemblage. Fluid inclusions from skarn garnets show a large variation in salinity (4–23 wt.% NaCl eq.) and T_h (220–370 °C), independent of the garnet types, reflecting variable amounts of magmatic fluids and low salinity meteoric waters. Inclusions in retrograde stage minerals showed boiling and dilution processes, further indicated by O and H stable isotope data (KODĚRA *et al.*, 1999).

Caldera collapse related epithermal Au-mineralization is located at depth of 400–500 m below the surface at the area of the Rozália mine and occurs as subhorizontal veins at the base of pre-caldera stage andesites. Au mineralization is represented by quartz, carbonates, sulphides, rhodonite, rhodochrosite, adularia and gold. It evolved during two stages, both associated with the boiling of low salinity fluids (0–3 wt.% NaCl eq.) and moderate temperatures (290–310 °C). Variable pressure conditions (114–45 bars) indicate continuous opening of the system and transition from hydrostatic + lithostatic towards hydrodynamic conditions at shallow depths. $\delta^{18}O$ and δD values suggest mixing of magmatic fluids with meteoric waters that have intermediate composition between granodiorite-related and horst-related hydrothermal systems in the ore district (KODĚRA *et al.*, 2002).

Horst-related vein type low sulfidation epithermal precious and base metal mineralization in more than 120 veins mainly occur in propylitized pyroxene andesites, diorites, quartz-diorite porphyries and granodiorites. In the ores sphalerite, galena, pyrite, chalcopyrite and hematite are widespread, accompanied by sulfides, selenides and tellurides of Ag, sulfosalts of Ag-Cu-Pb-Bi-S and Ag-Cu-Sb-As-S, native gold, silver, electrum etc. The ore-forming processes evolved during five stages and were accompanied by concomitant decrease in temperature, salinity, oxygen and sulphur activities. The minerals precipitated from low-to-moderately saline aqueous solutions (0.2–11.5 wt.% NaCl eq.) with NaCl, $CaCl_2$ and $MgCl_2$ as the major solute components. Different eutectic temperatures estimated in the upper parts of the veins indicate mixed sulphate-carbonate composition of the mineral-forming solutions. Mineralization was formed at temperatures from 380 to 50 °C, pH from 3.5 to 7.6 in depth from 0.4 to 1.6 km. The assumed age of the mineralization is 12.1–11.2 Ma (K-Ar method), resp. 12.8–11.2 Ma (Rb-Sr method) (HÁBER *et al.*, 2001).

References

HÁBER, M., JELEŇ, S., KOVALENKER, V. & ČERNYŠEV, I . (2001). Miner. Slov., 33: 215-224.
KODĚRA, P., LEXA, J., RANKIN, A. H. & FALLICK, A. E. (2002). Geol. Carpath., 53: 94-96.
KODĚRA, P., RANKIN, A. H. & FALLICK, A. E. (1999). In: Mineral deposits: processes to processing, Stanley et al. (eds). Proc. joint SGA-IAGOD conf. vol. 1, 51-54. (Balkema Press)
LEXA, J. (2001). Miner. Slov., 33: 203-214.
LEXA, J., ŠTOHL, J. & KONEČNÝ, V. (1999). Miner. Depos., 34: 639-654.