EVOLUTION OF ORE-FORMING FLUIDS AT PEZINOK-KOLÁRSKY VRCH Sb-Au DEPOSIT (WESTERN CARPATHIANS, SLOVAKIA)

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Pezinok-Kolársky vrch Sb-Au deposit belongs to the group of Sb-Au-FeS_2 ore deposits of Malé Karpaty Mts. associated with basic volcanism. The deposit is situated in about 3500 m long tectonic zone of NW-SE direction. The mineralised structure is 25-70 m thick and about 430 m long at the surface. Two types of ore mineralisations have been distinguished: 1 – metamorphosed, primarily volcano-sedimentary pyrite mineralisation, genetically related to Devonian basic submarine volcanism, and 2 – epigenetic hydrothermal Sb (Au-As) mineralisation located mostly in tectonically deformed black shales. Metallic elements could have been mobilised from the black shales by the circulation of fluids released during regional and periplutonic metamorphism caused by granitoid rock intrusion (CHOVAN *et al*., 1992).

Four stages of epigenetic mineralisation have been recognised: 1. - gold-bearing quartz-arsenopyrite-pyrite, 2. - quartz-pyrite-arsenopyrite±löllingite, tetrahedrite, chalcopyrite, 3. - quartz-carbonate-stibnite± gudmundite, pyrrhotite, pyrite, sphalerite, Pb-Sb sulphosalts, berthierite, 4. - stibnite-kermesite±antimony, valentinite, bismuth, Bi-Sb sulphosalts (CAMBEL, 1959; ANDRÁŠ, 1983).

Lead in stibnites is of upper crustal origin. The young model ages (220-230 and 110-130 Ma) are caused by the younger metamorphic processes and rejuvenation of Sb (-Au) ores. Isotope distribution shows at least two sources of sulphur. Biogenic sulphur had an important role predominantly in metamorphosed, primarily volcano-sedimentary pyrite mineralisation and in Sb hydrothermal minerals with Fe content (gudmundite, berthierite). Sulphur isotopes in gold-bearing sulphide mineralisation are differentiated: the light biogenic sulphur is incorporated into pyrite while sulphur from deep lying source into arsenopyrite. Hydrothermal fluids (mainly 3rd and 4th stage) were probably meteoric in origin but they incorporated predominantly magmatic sulphur that could have been derived from the older plutonic rocks or of juvenile origin. Distribution of carbon and oxygen isotopes in carbonates and distribution of oxygen isotopes in quartz of Sb mineralisation is inhomogeneous. The values show a relatively wide range and indicate predominantly meteoric origin of fluids (ANDRÁŠ *et al*., 1999).

The character of ore-forming fluids was specified by means of fluid inclusion study. Quartz of 1st stage contained secondary two-phase fluid inclusions. Salinity of included fluid is between 6 and 11 wt. % NaCl equiv. Nevertheless, eutectic temperature values (-45 to -55°C) suggest the presence of divalent cations such as Ca^{2+}. Inclusions homogenised to the liquid in the temperature range of 140-275°C. Calculated fluid density is around 0,88 g/cm^3. The estimated pressure is about 3 kbar. Fluids were probably endogenous-metamorphogenous in origin. Quartz coexisting with stibnite-sulphosalts mineralisation of 2nd and 3rd stage contained primary two-phase fluid inclusions. These inclusions enclosed NaCl-H_2O±$CaCl_2$ solutions with moderate to high salinity (7 – 25 wt. % NaCl equiv.) as resulted from low temperature measurements. Presence of bivalent cations (Ca^{2+}) is indicated by eutectic temperatures below -45°C. Homogenisation to liquid phase occurred between 145-200°C. According to various independent thermometers, temperature of crystallisation ranges from 350 to 390°C. Two-phase aqueous fluid inclusions from 4th stage quartz contained $CaCl_2$-NaCl-H_2O solutions with salinity of 8-25 wt. % $CaCl_2$ equiv. Inclusions homogenised to the liquid in the temperature range from 89 to 199°C. Density of included fluid varied between 0,96 and 1,16 g/cm^3. Obtained results show that of hydrothermal fluids were similar in character during whole ore-forming process. However, decrease in homogenisation temperatures indicates apparent cooling of the hydrothermal system.

The investigations Pezinok-Kolársky vrch deposit supported the increasing role of meteoric water and its intensive mixing with endogenous fluids while penetrating wall rocks during the metamorphic process.

References

ANDRÁŠ, P. (1983). Thesis. Manuscript, 159 p.
ANDRÁŠ, P., KOTULOVÁ, J., HAŠKOVÁ, A & DUBAJ, D. (1999). Uhlí-Rudy-Geologický průzkum, 11, 6: 24-30.
CAMBEL, B. (1959). Acta geol. geogr. Univ. Comen., Geogr., 3, 338 p.
CHOVAN, M., ROJKOVIČ, I., ANDRÁŠ, P. & HANAS, P. (l992). Geol. Carpath., 43/5: 275-286.