MORPHOLOGY AND FLUID INCLUSIONS OF QUARTZ CRYSTALS FROM THE BRAD-SĂCĂRÂMB NEOGENE EPITHERMAL AU-BASE METAL DEPOSIT, TRANSYLVANIA, ROMANIA

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Introduction and geology

The Brad-Sacaramb basin is situated in the southwestern part of the Transylvanian Metaliferi Mountains and hosts several low sulphidation type Au-base metal deposits (Fig. 1). The host rock of mineralization is mainly andesite and dacite of Neogene age and subordinately sandstone, shale and pelitic-psammitic sediments of Cretaceous to Neogene age (Ianovici et al., 1969). The Neogene volcanic rocks were affected by two stages of hydrothermal alteration. The first stage of hydrothermal alteration resulted in propylitization while the second stage is characterised by sericitization, local adularitization and argillitization.

The main gangue minerals in the veins of the studied deposits are quartz, Ca-Mn carbonates and barite. Predominant ore minerals are pyrite, galena, sphalerite, chalcopyrite, stibnite, alabandine, realgar, tetrahedrite, buornonite, boulangerite and tellurides of Au, Ag, Pb, Sb and Hg. The gold and silver-bearing minerals were formed in association with galena and sphalerite. In some places, an early stage of Au-Ag and a later stage of Pb-Zn (with little amounts of Au and Ag) mineralization can be distinguished. Sulphosalts and chalcopyrite, as well as carbonates are the latest minerals following the earlier gold-bearing stages.

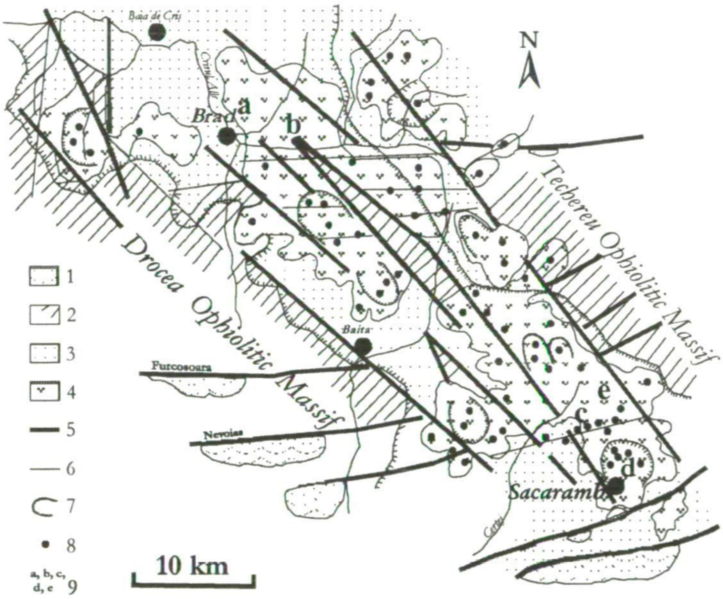

Figure 1: Geology of the Metaliferi Mountains and loc ation of studied deposits; 1 – metamorphic basement, 2 - ophiolite and sedimentary rocks of Createceous age, 3 - sediment ary rocks of Neogene age, 4 – volcanic rocks of Neogene age, 5 – Pre-Tertiary faults, 6 - Tertiary faults, 7 - volcanic caldera, 8 - volcanic centers, 9. – deposits: a -Valea Morii Veche, b - Carpen, c - Coranda, d - Sacaramb, e- Bocsa

Quartz crystal morphology

Quartz is a frequent hidrothermal mineral, which shows certain crystal forms under certain physico-chemical conditions (Molnár 1986, 1993; Hurai et al., 1987). In addition, fluid inclusions trapped during the growth of the quartz crystal can also be used for estimation of P-T-X conditions.

During this study, morphology and fluid inclusions of quartz crystals associated with the Pb-Zn (Au-Ag) stage of mineralization at the Sacaramb, Coranda, Bocsa, Valea Morii Veche and Carpen deposits were studied. Two different types of quartz were distinguished in the studied deposits. Vein quartz forms comb-textured aggregates with free crystal terminations in the center of veins. Euhedral quartz occurs in vugs and cavities in the host rock of veins. The appearing crystal forms on both types of quartz are: m prism (1.0.-1.0), positive r and negative z rhombohedra (1.0.-1.1), and rhombohedra with high indices {(h.0.-h.l). (l (2.0.-2.1.), 'l (0.2.-2.1.), (M (3.0.-3.1), 'M (0.3.-3.1.), γ (4.0.-4.1), 'γ (0.4.-4.1.), e (5.0.-5.1.), 'e (0.5.-5.1.), ξ (6.0.-6.1.), 'ξ (0.6.-6.1.), φ (7.0.-7.1.), 'φ (0.7.-7.1.), Ψ (11.0.-11.1.), 'Ψ (0.11.-11.1.))}. These rhombohedra with high indices appear as stripes forming a staggered habit.

Fluid inclusions

Quartz crystals were cut parallel with the "c" axis and doubly polished thin sections were prepared of them for fluid inclusion study. No definite growth zoning was observed in the quartz crystals. The spider web structure typical of the epithermal quartz crystals (Van den Kerkhof et al, 2001) was recognized. Liquid-rich and vapor-rich, primary aqueous fluid inclusions occur in the crystals. Thus growth of crystals took place during boiling of hydrothermal fluids. Microthermometry was carried out on the liquid-rich two-phase fluid inclusions only. First melting temperatures were observed between -18 and -

22°C, which indicate a NaCl-dominated aqueous brine. Melting of the last ice crystal occurred in the range from -4.1 to -0.3°C corresponding apparent salinities between 0.5 and 6.6 wt.% NaCl eqv. (Bodnar, 1993). Minimum homogenization temperatures to liquid phase for the vein quartz are 250 and 260 °C (Sacaramb-Bernard level and Valea Morii Veche, respectively). Fluid inclusions for vein quartz show the lowest average apparent salinity values (1.9 – 1.4 NaCl eqv. wt. %). Minimum homogenization temperatures to liquid phase for the euhedral quartz from the wall rocks are from 180 to 230°C and salinities are between 2.6 and 4.5 wt %.NaCl eqv.

Conclusion remarks

Based on the morphological results it can be stated that there is no difference between frequency of the crystal forms either in the comb-textured quartz aggregates or vein quartz. The staggered habit is the result of fluid variability during crystallization.

The textural features of the fluid inclusions suggest that both the vein quartz and the comb-textured aggregates are the results of a boiling system. Furthermore, the Tmice/Th diagram for vein quartz shows the boiling of the system whereas for the quartz in the comb textured aggregates this unequivocal boiling trend cannot be recognized.

The calculated pressure range for the average homogenization temperature (+/- 10 C) falls between 8 and 43 bar. Higher pressures (35 to 43 bars) are characteristic for the vein quartz whereas the pressures for the quartz crystals in the comb-textured aggregates fall between 8 and 24 bars. We suggest that the two quartz types were crystallized from different hydrothermal solutions.

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