MINERAL MICROINCLUSIONS HOSTED IN SULFIDES OF MAIN NEOGENE PORPHYRY COPPER AND EPITHERMAL ORE DEPOSITS OF THE SOUTH APUSENI MOUNTAINS, ROMANIA

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The Neogene porphyry copper and epithermal ore deposits of the South Apuseni Mountains are related to calc-alkaline intermediate volcano-plutonic complex structures closely connected with extensional deep-seated faults. These structures contain a large variety of ore deposit types, but with a strong specialization for Cu-Au that would involve a unique source (ROSU *et al.*, 2000).

The sulfides of main porphyry copper and epithermal ore deposits of this region contain a lot of mineral microinclusions. In order to establish the role of these solid microinclusions in the magmatic-hydrothermal fluid evolution the aim of our study is to determine, using SEM/EDAX analyses, their chemical composition.

The SEM/EDAX analyses were performed in open cavities by splitting of pyrite and sphalerite crystals from different ore deposit types: porphyry copper, base metal/gold breccia pipe and low/high-sulfidation epithermal deposits. The chemical composition of the mineral microinclusions was determined using a PHILIPS electron microscope (METAV-Bucharest Laboratory) and a REMMA 202 electron microprobe (IGR Laboratory) both equipped with EDAX analyzer. The operating conditions were an accelerating voltage of 30 kV and a counting time of 50 s.

Thus, based on about 170 SEM/EDAX analyses, the following mineral microinclusions have been determined:

- chlorides: halite, sylvite, $CaCl_2$
- complex chlorides: (Na,K)Cl; (K,Fe)Cl; (K,Fe,Cu)Cl; (K,Fe,Zn)Cl; (K,Fe,Au)Cl; (K, Zn, Au)Cl
- sulfides: chalcopyrite, bornite, molybdenite, sphalerite, galena, pyrite, pyrrhotite, marcasite
- oxides: hematite, rutile, zircon, spinel, quartz
- sulfates: anhydrite, gypsum
- phosphates: apatite, chlorapatite±Th±Cu
- carbonates: calcite, dolomite, siderite, ankerite
- phyllosilicates: illite, sericite
- silicates: Al, Ca silicates
- silicate glass

All mentioned data lead us to some conclusions, as follows:

1. Mineral microinclusions mainly appear as daughter phases trapped within fluid inclusion cavities during fluid evolution from magmatic to hydrothermal stage.

2. Chloride and silicate glass microinclusions from porphyry systems studied fill up to 50–90 vol% of fluid inclusion cavities, especially that of potassic zone, suggesting that they could be considered as really salt melt and silicate melt inclusions as in paragenetic quartz (PINTEA, 1997).

3. The ubiquity of the chloride and sulfide microinclusions hosted in pyrite and sphalerite of all porphyry copper and epithermal ore deposits studied reveals the role played by Cl and S as complexing ligand components during the magmatic-hydrothermal fluid evolution. This one could involve a metal fractionation between the coexisting fluids (HEINRICH *et al.*, 1999). According to DRUMMOND & OHMOTO (1985) Cl mainly fractionates into the saline liquid (see the chloride microinclusions), whereas S usually fractionates into the vapour phase (see the sulfide microinclusions). Therefore the liquid-partitioning elements probably include in our case Na, K, Fe, Zn, (P, Th?) and also low contents of Cu and Au, especially as complex chlorides in porphyry copper and epithermal ore deposits. As regards the vapour-partitioning elements these could include, to a certain extent, Au, Cu (Valea Morii, Voia and Rosia Poieni porphyry copper deposits) and Au, As, Sb, Cu (Baia de Aries gold breccia pipe deposit).

4. Anhydrite microinclusions suggest that magmatic-hydrothermal fluids operated under oxidizing conditions, also supported by magnetite presence.

References

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