

Evolution of porphyry systems in central eastern Turkey

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The Erzincan-Sivas-Tunceli zone in the eastern part of the Anatolide-Touride Block contain multi-phase intrusive stocks with many porphyry systems such as Karakartal, and Çöpler Au-Cu deposits. The crystallisation of their host rocks was dated by ⁴⁰Ar/³⁹Ar as 49,86±0,4 and 44,81±0,3 Ma, respectively. K-silicate alteration at the former deposit was dated at 46,58±0,7 Ma. From Karakartal to Findıklidere and to Çöpler, the system changes from purely magmatic to magmatic-hydrothermal as shown by magnetite-pyrite-molybdenite-chalcopryrite-Au at Karakartal, pyrite-chalcopryrite-sphalerite-fahlore-galena-Au at Findıklidere, and magnetite-pyrite-molybdenite-chalcopryrite-Au-orpiment-realgar-Mn oxides at çöpler.

Quartz veins in all deposits include single phase, two-phase and multi-phase inclusions. Composed of H₂O+CO₂±CH₄ the two-phase inclusions are enriched in CaCl₂+FeCl₂+NaCl+KCl, have 15-25 wt% NaCl eq. salinity and homogenise at 200-350°C. Multi-phase inclusions, based on SEM, Raman and LA-ICP MS analyses, were determined to contain halite, sylvite, Fe-Mg-Ca chlorides, magnetite, hematite, pyrite, chalcopryrite, anhydrite, syngenite, biotite and apatite. The homogenisation of gas in these inclusions occur at 300- >875°C. Salt phases melt at intervals of 125-425°C and 400-680°C resulting in salinity values of up to 80 wt % NaCl eq. Such a complex salt brine with many solid phases indicates heterogeneous entrapment in association with different pulses of magmatic activities.

Geothermometric calculations on biotites from the K-silicate alteration zone give formation temperatures of 675-750°C, and chlorites 250-310°C, in accordance with multi-phase and two-phase fluid inclusions, respectively.

The results show that the porphyry systems were formed from salt-oversaturated brines under ultra high to high temperature conditions at moderate to low pressures, and were subsequently overprinted by repeated hydrothermal activities at lower temperatures in the Çöpler deposit, which, in turn, caused a significant increase in mineral resources.

Key words: Karakartal, Çöpler, Findıklidere, gold, K-silicate alteration, geothermometry, Raman, LA, Ar/Ar.