Laser Raman microspectroscopy with fluid inclusions from the Darrehzar porphyry copper deposit, Kerman, Iran

Einali, Morteza*, Bakker, Ronald J.**, Alirezaei, Saeed* and Azimzadeh, Amir Morteza**

*Faculty of Earth Sciences, Shahid Beheshti University, Tehran, Iran
**Department of Applied Geosciences and Geophysics, University of Leoben, Leoben, Austria

The Darrehzar porphyry copper deposit is located in the southern part of the Cenozoic Urumieh- Dokhtar magmatic belt in Iran (~8 km SE of the giant Sarcheshmeh Cu-Mo-Au porphyry deposit). Mineralization in Darrehzar is associated with two Miocene porphyritic bodies of diorite and granodiorite compositions, and their enclosing Eocene volcano-sedimentary rocks.

Both intrusions and their host rocks are extensively altered by hydrothermal fluids into potassic, phyllic, propylitic and argillic assemblages. The ore reserve in Darrehzar has been estimated to be about 67 Mt at an average copper grade of 0.37 % (NICICO, 2008). The hypogene ore occurs in quartz-sulphide stockworks, as well as disseminations. This paper presents laser Raman data of fluid inclusions in quartz from the quartz-sulphide veinlets associated with potassic and phyllic alteration zones in Darrehzar. All experiments were carried out at the Leoben University (Austria) using a LABRAM Jobin-Yvon system.

Fluid inclusions and laser Raman study:

Based on the phases present at room temperature, four major types of fluid inclusions have been identified in the quartz-sulphide veinlets in the potassic alteration zone. They include vapour-rich, liquid-rich, halite-bearing, and halite-sylvite-bearing inclusions. The same types of fluid inclusions, excluding the halite-sylvite-bearing inclusions, occur in the quartz -sulphide veinlets in the phyllic alteration zone.

Several solid phases including chalcopyrite, hematite, magnetite, molybdenite, pyrite, rutile and siderite were identified by laser Raman microspectroscopy in the salt-bearing inclusions. Chalcopyrite and hematite are the dominant solid phases in the inclusions, and appear to be true daughter minerals. Hematite mainly occurs as reddish flaky crystals (Fig. 1a), and chalcopyrite mostly occurs as triangular crystals (Fig. 1b). Magnetite and pyrite were observed in the salt-bearing inclusions as relatively large irregular bodies and appear to be captured phases (Fig. 1b). Flaky molybdenite crystals were recognized only in the halite-bearing inclusions in the potassic alteration.

Siderite ($FeCO_3$) is abundant in salt-bearing and vapour-rich inclusions. This mineral mostly occurs as greenish rounded translucent crystals (Fig. 1a-c).

Chalcopyrite and hematite are the only daughter minerals identified in the vapour-rich inclusions (Fig. 1a-c). Anhydrite was identified as transparent tabular crystals (Fig. 1d), only in the vapour-rich inclusions, associated with both phyllic and potassic alterations.

Most liquid-rich inclusions devoid solid phases; some high salinity liquid-rich inclusions were found to contain chalcopyrite, hematite and siderite. The occurrence of various gases, CO_2, SO_2, N_2 and CH_4, was investigated by laser Raman in various types of the fluid inclusions. The vapour-rich inclusions were identified to have CO_2 in their bubbles. Some salt-bearing inclusions contain minor CO_2, and the liquid-rich inclusions are devoid of the gas.

Conclusions:

The identification of chalcopyrite, magnetite, molybdenite, siderite, anhydrite (Fig. 2a-d) hematite and pyrite in the fluid inclusions of Darrehzar deposit shows that ore fluid was rich in copper, molybdenum, iron, sulphur, chlorine, and CO_2. This metal-Cl-S-CO_2 rich fluid is a suitable source to generate a mineralized porphyry system.

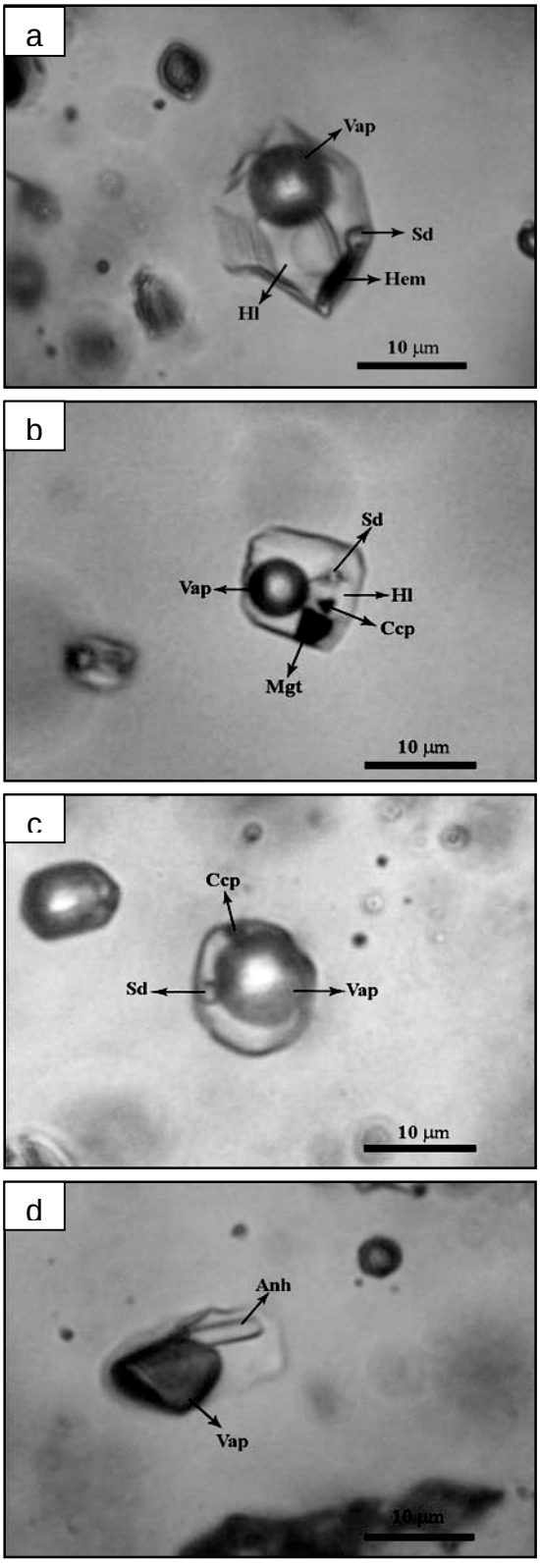

Fig. 1. Solid phases identified in the fluid inclusions from Darrehzar porphyry system (Abb. Hl: halite, Vap: vapour, Hem: hematite, Sd: siderite, Ccp: chalcopyrite, Mlb: molybdenite, Mgt: magnetite, Anh: anhydrite).

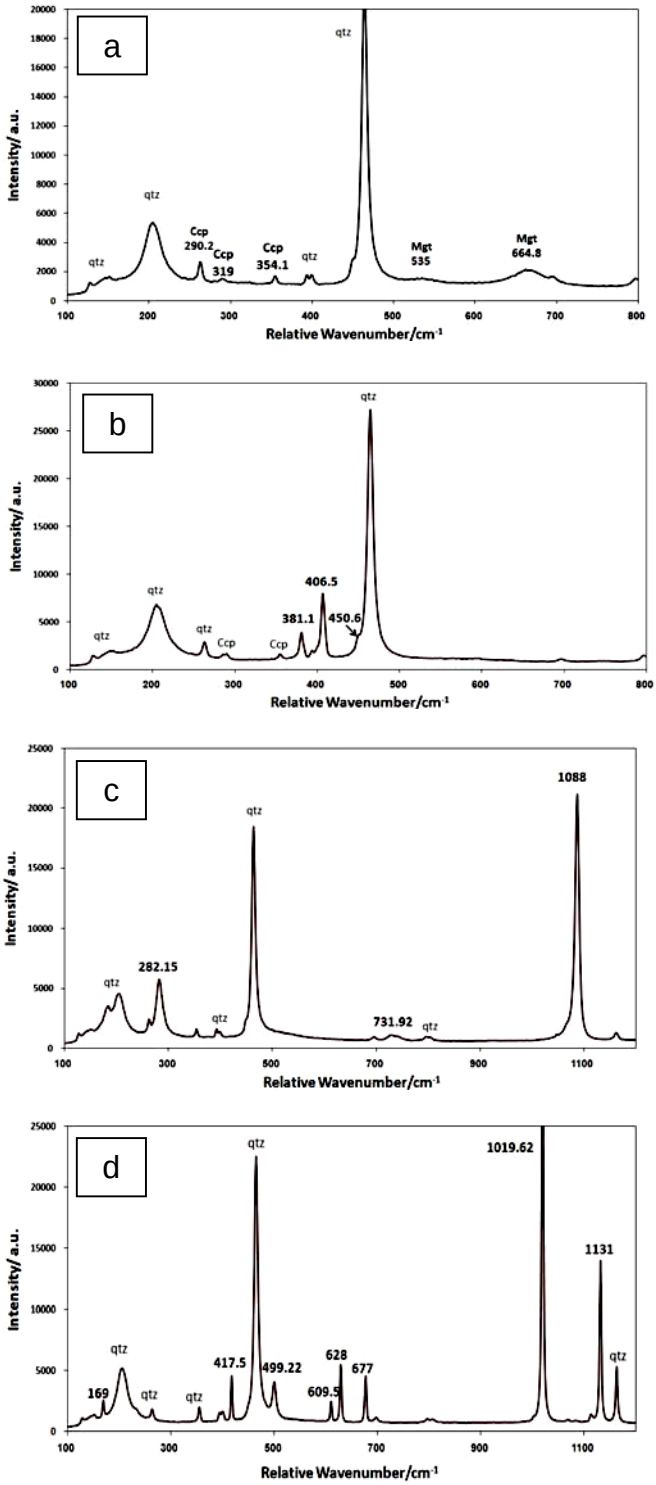

Fig. 2. Raman spectrum of a) chalcopyrite and magnetite, b) molybdenite, c)siderite, d) anhydrite in the fluid inclusions from Darrehzar porphyry copper deposit .

REFERENCE

NICICO (2008) *Darrehzar ore reserve estimates*. Internal report [In Farsi].