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Study of genesis in Qahr-Abad fluorite deposit using fluid inclusion, southeast of Saqqez, the Kurdistan province

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Introduction

The Qahr-abad fluorite deposit is located in the area of 36°10′ 3″ N and 46°34′ 21″E within the Sanandaj-Sirjan district east of the Kurdistan province , Iran and it is located ~57 km southeast of the city of Saqqez (Kholghi Khasraghi, 1999). This deposit is developed as scatter lenses, veins, and veinlets (stockwork structure) within carbonate rocks of Elika formation and controlled by the regional NW–SE trending Zagross thrust nappe system. Fault trends in this area are perpendicular to fault trends in the Zagros zone. The fault dips are nearly vertical and mineralization has occurred in the brecciation fault zone (Talaii, 2010). The rough geological instruction of the deposit has indicated that it is similar to worldwide Epithermal deposits.

The mineralization occurs as replacement (type I)/ open-space (type II) vein fillings and bodies within Mesozoic lime stones (mostly Upper Triassic and Lower Jurassic members of the Elika Formation), where they crop out to form horst structures. The mineralization is typically associated with post Pliocene disjunctive faults, which in part appear to have served as channel ways for the fluorite forming fluids that are representative of the geological setting of the mineralized area.

Fluorite occurs in several color variations such as green, violet, blue, white or colorless, and is accompanied by quartz, barite and calcite (Moslehi, 2013).

Materials and methods

The minerals sampled for the fluid inclusion study include fluorite from mineralization stages. Samples covered all ore types. Micro thermometry analyses for 23 samples were performed after careful microscopic observation of 35 sections and 30 doubly polished sections. Micro thermometry was undertaken using a Linkam THS600 heating-freezing stage, with a measurable temperature range of between −196 and +600 °C (precision of freezing data and homogenization temperature of ±0.2 °C). Micro thermometry was undertaken in the Department of geology of the Karazmy University.

Results

Petrography and classification of inclusions:

The samples used for the inclusion study were doubly polished sections of fluorite from mineralization stages 1 to 2. A number of inclusion types were identified. These include negative crystals and elongate round, polygonal or irregular shapes with a size range from <1 µm to several tens of µm. Based on their petrographic characteristics at room temperature and phase change characteristics during the heating process, inclusions were grouped into three principal types. Here we just discuss primary and pseudo secondary fluid inclusions, mainly including three fluid inclusions as follows:

1) (vapor + liquid) or (L+V) and negative crystal fluid inclusions, each of which will provide more believable information for the mineralization hydrothermal fluid. These fluid inclusions in fluorite are, isolated, and irregular or rectangular with 10 µm to 20µm long major axes. They include two phases at room temperature, an aqueous liquid (L) and some kind of carbonic vapor phase (V), and have L/ (V +L) Fillinge ratio

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values of 90–95%. Abundant fluid inclusions are present.

2) fluorite that are generally quadrilateral in shape, have 2–20 µm long major axes, and occur as clusters or form trails. These fluid inclusions contain three phases at room temperature depending on the density of the nonaqueous gases in the fluid inclusions and have nonaqueous phase ratios of around 5%. They have major axes 2–15 µm long. They contain two phases and have L/ (V + L) volume ratio values around 0.95% .

3) Fluid inclusions in some fluorite are rare. Most of them are isolated and roughly circular. They have 2–10 µm long major axes, and contain four phases as (liquid+ vapor + daughter mineral 1+ daughter mineral 2) or (L+V+S1+S2) and have L/(V + L) volume ratios of 90–92% at room temperature. Some twin fluid inclusions
were also identified in this type and analyzed during this study.

Discussion

Thermometric investigations indicate that homogenization temperatures for primary and pseudo secondary fluid inclusions in all fluorite types range from 155 to 245°C with an average of 187°C. Gas phase changes to liquid phase in the homogenization processes. The degree of fillings in most inclusions are more than 90%. -23 to -18 °C with an average of -20.7°C. There are eutectic temperatures in the freezing method and calculated salinity is 30.8 wt% NaCl equivalents in terms of the H2O-CO2-NaCl system.

The Bernoulli Effect has occurred in this resource (Barnes, 1998). Isothermal mixing, boiling, surface fluid dilution and depressurization are four processes that have effects on the mineralization in this resource (Wilkinson, 2001). Finally we think, Qahr -abad fluorite deposit has been prepared by hydrothermal to epithermal processes and fluids have basin origin (fossil waters) (Tajoddyn, et al, 2010) and the orebody has precipitated from this fluid, when it was mixed with cold surface waters.

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