

Do fluid inclusions preserve their initial composition? Experimental studies of H₂O diffusion through quartz

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The main focus of our diffusion studies lies on experimental works on synthetic and natural fluid inclusions (FI) in well selected quartz crystals. A major point of our investigations is to perform re-equilibration experiments with synthetic FI which are composed of water-related species, such as H₂O, D₂O and H₂¹⁸O, at known P-T conditions and specific molar volumes of the liquid phase. Due to the possibility of post-entrapment compositional and density changes of FI, the analyses of fluid properties have to be performed with particular attention. To comply with this requirement we work on molecules with different properties, e.g. different melting points of H₂O and D₂O (melting points: 0 °C H₂O vs. +3.8 °C D₂O) to achieve better quantitative insights on the diffusion rates. Re-equilibration experiments are carried out at high experimental temperatures and pressures (max. 700 °C and 1 GPa). We design our recent experimental work to test the behaviour of aqueous FI in quartz under conditions of different pressure and different water fugacity. We expect a movement of the water-related species within the quartz lattice. Re-equilibration processes are not yet fully understood, therefore further investigations are required to characterize all aspects of post-entrapment changes in FI. Additionally we are able to determine changes in the shape of the synthesised inclusions (morphological changes) interrelated with the location (depth) of the inclusions within the quartz crystal. First results lead to the assumption that the size, the shape (Fig. 1) and the location directly correlate. This unambiguously correlates with the measured changes in the fluid-phases composition of the primary synthesised FI.

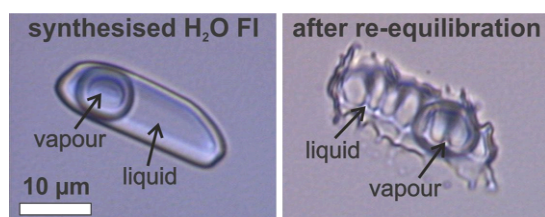


Figure 1: Photomicrograph of a FI in quartz after 19 days of re-equilibration. Pressure: 337 MPa; Temperature: 600 °C (left), 400 °C (right).

Host rocks of Santa Eulalia Plutonic Complex (Southern Portugal): A preliminary study

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The Santa Eulália Plutonic Complex (SEPC) is a calcalkaline granitic body that occupies an area of 400 km² and is located in the Variscan Iberian sector. SEPC is considered as late-Variscan because it cross-cuts the regional variscan structures, namely a major NW-SE shear zone in the contact between the two axial geotectonic zones of the Iberian Variscan belt. The host rocks of the plutonic complex are composed by metamorphic formations from Upper Proterozoic to Lower Paleozoic. In the NE-sector of the shear zone a metasedimentary Ediacaran unit (Série Negra) outcrops, composed by metasedimentary siliciclastic rocks, including some black cherts. In the SW-sector of the shear zone, a low-grade metasedimentary and metavolcanic unit involving quartz-pelitic, carbonated and volcanic rocks, correspond to the Early Cambrian sequence.

In the western sector of SEPC, several metasedimentary enclaves are present mainly with pelitic and carbonated composition. These enclaves show internal structure and lithological diversity consistent with the external metasedimentary units and, due to the thermal effect, have intense metamorphic recrystallization. One of the enclaves near the NW border of SEPC, marble, calc-silicated rocks and acid porphyritic rocks were studied, including petrography, mineral and whole-rock chemistry. The calc-silicated and the porphyritic rocks show similar Eu-nomaly, Eu/Eu* respectively 0.86 and 0.88. However, the fractionation of LREE and HREE is quite different: in porphyritic rocks (La/Sm)_n = 6.59, (Gd/Yb)_n = 2.13, (La/Yb)_n = 28.9 and ΣREE = 233.51, while in calc-silicated rocks (La/Sm)_n = 1.66, (Gd/Yb)_n = 1.38, (La/Yb)_n = 3.04 and ΣREE = 181.63. The marble has a higher negative Eu-anomaly, with Eu/Eu* = 0.57 and (La/Sm)_n = 3.15, (Gd/Yb)_n = 1.62, (La/Yb)_n = 7.87 and ΣREE = 17.31. These preliminary geochemical data indicate that all these lithologies derived from a continental crustal source.

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