

THE EFFECT OF THE α - β -QUARTZ TRANSITION BOUNDARY IN RE-EQUILIBRATION EXPERIMENTS

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Initially synthesized pure H₂O fluid inclusions in quartz are re-equilibrated under hydrothermal experimental conditions. A series of experiments within the α -quartz stability field is compared to a series which is carried out at similar P - T conditions but above the α - β transition boundary. The transition between α - and β -quartz is a major change in crystal properties, and therefore, it may influence the properties of fluids that are trapped in these crystals. Previous experiments (DOPPLER et al., 2013) have evidenced the importance of H₂O diffusion at constant pressures and relative high temperatures. This study illustrates that α - β transition of quartz is another important process of fluid inclusion re-equilibration. A series of re-equilibration experiments has been carried out by using pure D₂O at the experimental temperature of 625°C at 279.3 MPa and 322.2 MPa (α -quartz). A second series of experiments has been re-equilibrated at 675 °C (β -quartz) at the same experimental pressure as it was chosen for the α -quartz experiments. The relative amount of H₂O/D₂O in the fluid inclusions can be easily detected by measuring the melting temperatures T_m (SV→LV) due to the linear relationship between T_m (0.0°C H₂O to +3.8 °C D₂O) and concentrations. During re-equilibration initially elongated and irregular shaped fluid inclusions tend to become more ideal and equant shaped. No differences in magnitude of shape changes can be detected regarding eventual differences between re-equilibration in the α -quartz stability field compared to the β -quartz modification. After re-equilibration noticeable changes in composition and density of the initially synthesized pure H₂O fluid inclusions can be recognized. In respect to the magnitude of changes there are considerable differences between α -quartz and β -quartz. The experiments in the β -field show higher T_m (ice) values compared to the experiments that have been carried out at the appropriate pressure conditions in the α -field. Within the α -field changes in density are related to the experimental pressure. At 279.3 MPa fluid inclusions are shifting to lower T_h (LV→L) values, whereas at higher pressure they shift to higher homogenisation temperatures. Two experiments have been re-equilibrated with pure H₂O. The changes in density are inverted regarding to the α -field and the β -field. The experiments in the β -field show higher T_m (ice) values compared to the experiments that have been carried out at the appropriate pressure conditions within the α -field. Fluid inclusion changes are more dominant within the β -quartz field than within the α -quartz field at nearly equal P - T conditions. Regarding the T_h (LV→L) of two β -quartz experiments it is assumed that the difference in experimental pressure of 43 MPa does not influence the diffusion rate of the fluid species regarding the same shift in homogenization temperatures. The inverse changes in density of H₂O re-equilibration experiments are most likely related to the different quartz modifications. *We would like to thank the Austrian Research Fund (FWF) for financial support (project no. P 22446-N21).*

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