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A method to synthesize large fluid inclusions in quartz at controlled times and under unfavorable growth conditions

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Abstract

A new synthesis technique allows large fluid inclusions to be produced at conditions under which one normally would obtain only small inclusions, with the additional advantage that the timing of fluid entrapment can be controlled. In the first step, primary fluid inclusions are grown at *P-T* conditions under which it is relatively easy to produce large inclusions. In the second step, which can be performed either during the same experiment or during a separate experiment after a desired time of pre-equilibration, some of the primary inclusions produced during the first step are re-opened by in-situ fracturing, causing partial replacement of the inclusion content. The sample is then left at high pressure and temperature until the cracks leading to the re-opened inclusions are healed. To test the method and quantify the efficiency of fluid replacement in the re-opened inclusions, we produced primary inclusions at 700 °C/200 MPa and re-opened them during a second experiment in the presence of a compositionally different fluid at 500 °C/70 MPa. Laser-ablation ICP-MS (LA-ICP-MS) analyses of eight primary and 11 refilled inclusions demonstrate that in the latter more than 97% of the original fluid was replaced by new fluid. Thus, the refilled inclusions are representative of the surrounding fluid at the time of in situ fracturing.

Keywords: Synthetic fluid inclusions, experimental technique, LA-ICP-MS, H_2O-salt