ASSESSING THE RELIABILITY OF ELASTIC GEOBAROMETRY METHODS

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Elastic geobarometry makes use of the contrast in elastic proprieties between host inclusion pairs to determine entrapment conditions for the inclusions. The theoretical basis has been developed extensively in the past few years, but an experimental validation and assessment of the calculated P and T of entrapment is still required. We report Raman measurements of quartz inclusions trapped in almandine garnet synthesized at eclogitic conditions in a piston cylinder apparatus, from which we determined the stress state in the inclusions by two methods. The use of the hydrostatic calibration of the 464cm^{-1} line of quartz leads to a large spread in inclusion 'pressure' values for inclusions trapped at 3 GPa, although it is more accurate for inclusions trapped at 2.5 GPa. Entrapment pressures calculated with the hydrostatic calibration can be up to 0.8 GPa in error. The use of the mode Grüneisen tensors of quartz enables the full strain state and thus the stress state of inclusions to be determined, and leads to a much smaller spread in mean stress values inferred for inclusions, and the calculated entrapment pressures differ from the known experimental values by less than 0.2 GPa. These results show that the most significant effect of the elastic anisotropy of quartz is on the Raman shifts of the inclusion, but not on the subsequent calculation of entrapment conditions.

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