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Elastic geobarometry of quartz inclusions in garnet at high temperature

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Elastic geo-thermobarometry allows the retrieval of the pressure and temperature of entrapment of an inclusion within a host (Zhang, 1998; Angel et al., 2014; Angel et al., 2015). So far, quartz-in-garnet elastic geobarometry has mainly dealt with rocks with inclusions entrapped at high pressure and low temperature conditions, such as eclogite. This is because, at high-temperature (HT) and low-to-medium-pressure conditions (T > 700 °C and P < 1.0 GPa), the rock might cross the α–β quartz transition, changing the elastic properties of quartz inclusions. Here we will show some preliminary results of HT elastic geobarometry in quartz inclusions entrapped (or re-equilibrated) within the β–quartz stability field.
The analysed samples come from three HT-LP terranes: the Athabasca granulite terrane in Canada (Dumond et al., 2015), the Jubrique Unit in the Beltic Cordilliera in Spain (Barich et al., 2014), and the Aus granulite terrane from the Namaqua metamorphic complex in Southern Namibia (Diener et al., 2013). These terrains include crustal rocks such as garnet-bearing gneisses and felsic and mafic granulites that equilibrated at low pressures and high temperatures, near or within the β-quartz stability field. Within these samples, Cesare et al. (2020) described post-entrapment shape change of quartz inclusion in garnet. The quartz inclusions have Raman spectra with peaks shifted to lower wavenumbers with respect to the unstrained reference quartz crystal. The changes in Raman peak shifts of the inclusions were converted into strains using the software StRAinMAN (Angel et al., 2019) and have positive volume strains with ε1>0 and ε3<0. The quartz EoS by Angel et al. (2017), which includes the α–β quartz transition, allowed the entrapment isomekes crossing the phase transition to be calculated and the entrapment pressures of quartz inclusions at HT to be estimated. The results of elastic geobarometry for the set of samples in question are consistent with the PT estimates by classic geothermobarometry, suggesting entrapment or re-equilibration at HT within the β–quartz stability field.
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