Elastic geothermobarometry on multiple inclusions in a single host

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The characterization of the pressure and temperature (P-T) histories of subducted rocks is of key importance to unravel geological processes at all scales. Accurate PT provide constraints on tectonic and geochemical processes affecting subduction dynamics and help interpreting the geophysical images of present-day converging plates. Conventional element-exchange geothermobarometers are challenged in ultra-high-pressure metamorphic terranes as the subduction temperatures may exceed their closure temperature and minerals may undergo re-equilibration along their path. Elastic geobarometry applied to host-inclusion systems is a complementary method to determine P and T conditions of metamorphism that does not rely upon chemical equilibrium. Recent development of elastic geobarometry (Angel et al. 2019; Campomenosi et al. 2018; Murri et al. 2018) allows us to retrieve entrapment pressures for host-inclusion pairs from the residual strains acting on the inclusion but the entrapment pressure along an isomeke can only be determined if the entrapment temperature is known.

In this study we performed micro-Raman measurements on quartz and zircon inclusions trapped in garnets from a garnet-kyanite gneiss and a quartz-garnet vein from the Fjørtoft UHP terrane, Norway. From the micro-Raman data, using the program stRAinMAN (Angel et al. 2019), we calculated the strains at room conditions (Murri et al., 2018) and thus the entrapment conditions. The intersection between the two sets of isomeke calculated on multiple quartz and zircon inclusions demonstrates that measuring different inclusion phases trapped inside a single host allows unique P-T conditions for the host rock to be determined.

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Campomenosi et al. (2018) American Mineralogist, 103(12), 2032-2035.

Murri et al. (2018) American Mineralogist, 103(11), 1869-1872.