Geophysical Research Abstracts
Vol. 21, EGU2019-10106, 2019
EGU General Assembly 2019

Raman thermobarometry based on quartz and zircon inclusions in garnet host: application to Holsnøy eclogite, Bergen arc, Norway

Xin Zhong (1), Niels Andersen (2), Marcin Dabrowski (1,3), and Bjørn Jamtveit (1)

(1) Physics of Geological Processes, The Njord Centre, Department of Geosciences, University of Oslo, Norway (xinzhong0708@gmail.com), (2) Department of Chemistry, University of Oslo, Norway, (3) Computational Geology Laboratory, Polish Geological Institute - NRI, Wrocław, Poland

Mineral inclusions entrapped into a host crystal are commonly observed in nature. During tectonic or erosional processes, cooling and decompression may occur that lead to the development of residual pressure within the inclusion. This is because of the differences in thermal expansivity and compressibility between the inclusion and host. By combining laser Raman spectroscopy and experimental data relating pressure and Raman shift, it is possible to estimate the entrapment pressure-temperature (P-T) conditions using an isotropic elastic model. In this study, both quartz and zircon inclusions entrapped in garnet host have been identified in Holsnøy eclogite with laser Raman spectroscopy, and their Raman spectral shifts are measured. Using the published experimental data, the maximal residual pressures for zircon and quartz inclusions are estimated to be ca. 0.6 GPa and 0.65 GPa, respectively. The equation of state for zircon has been fitted based on published experimental measurements and used in a 1D isotropic elastic model to recover the entrapment P-T conditions. The recovered entrapment P-T conditions are ca. 1.7∼1.9 GPa and 680∼760 °C, which are generally consistent with previous estimates using phase equilibria techniques. Heating/cooling experiments are performed on a spherical, entrapped zircon inclusion using a specially designed thermostated aluminium box and cryostat. A clear trend is observed between the residual zircon inclusion pressure and the externally controlled temperature from ca. -100 to 100 °C. It is confirmed in this study that the residual zircon inclusion pressure sealed in garnet host is very sensitive to the entrapment temperature, and can be used as a Raman-thermometer. The effect of laser power has been found out to be significant. A safe laser power is determined to be ca. 10mW, which does not cause any local heating effect. The significance of thermo-elastic anisotropy of zircon inclusion on the residual stress/strain state is investigated using the classical Eshelby's solution and will be discussed in details.