

Raman geothermobarometry and its geoscientific applications

Professor Masaki ENAMI (榎並正樹 教授)

Institute for Space-Earth Environmental Research, Nagoya University, Japan

日本名古屋大學宇宙地球環境研究所基盤研究部門

Substantive applications of Raman spectrometry to geoscience fields began in the early 1980s, and after it became possible to use a Raman spectrometer with an optical microscope, this method offered several advantages for microscopic analysis. Raman spectrometry is now an indispensable tool in the geoscience fields, especially in mineralogy and petrology.

Since 2005, my research collaborators and I have attempted to apply Raman spectrometry to the study of metamorphic rocks. I will summarize the outcome of these 10 years of research. The presentation includes the following:

1. We proposed a quartz-Raman geobarometry method employing the residual pressure retained by quartz inclusions completely sealed in a garnet porphyroblast (Enami et al., 2007, *Am. Mineral.*, 92, 1303-1315), along with a method to inversely calculate the metamorphic pressure when a quartz grain was included in the garnet host based on the residual pressure (Kouketsu et al., 2014a, *Am. Mineral.* 99, 433-442).
2. Carbonaceous material-Raman geothermometry is a useful tool for estimating the equilibrium temperature conditions of medium- to high-grade metamorphic rocks (e.g., Yui et al., 1996, *JMG*, 14, 115-124; Beyssac et al., 2002, *JMG*, 20, 858-871). We proposed a new geothermometer that can be applied to low-grade metamorphic rocks of $T = 150\text{--}400\text{ }^{\circ}\text{C}$ (Kouketsu et al., 2014b, *Island Arc*, 23, 33-50).
3. The Sanbagawa metamorphic belt in SW Japan represents the deepest part of an accretionary complex metamorphosed by the Cretaceous subduction of the Izanagi oceanic plate underneath the eastern Eurasian continental plate. The Sanbagawa metamorphic rocks were recrystallized under lower greenschist facies to quartz-eclogite facies conditions.
 - * Quartz-Raman geobarometry was applied to search for evidence of eclogite facies metamorphism from metapelites recrystallized at the subsequent epidote-amphibolite facies stage (Kouketsu et al., 2014c, *Island Arc*, 23, 263-280; Taguchi and Enami, 2014, *JMPS*, 109, 1-12; Taguchi and Enami, 2014, *JMPS*, 109, 169-176).
 - * Carbonaceous material-Raman geothermometry was employed to determine the thermal structure of low- to medium-grade regions of the Sanbagawa belt.