Quantitative analysis of binary mineral mixtures using micro-Raman spectroscopy: An opaline silica nodule of volcanic origin

Naoki Noguchi[1]; Keiji Shinoda[1]

[1] Geosciences, Osaka City Univ.

We have developed a method for the quantitative analysis of binary mixtures of minerals using a common micro Raman spectrometer, with a backscattering optical configuration and a rotating sample stage. Based on averaged Raman spectra of a mineral mixture, the calibration curves for four mixtures of calcium carbonate and silica minerals; calcite and quartz, quartz and cristobalite, coesite and quartz, and aragonite and calcite, were constructed. The calibration curves express the correlation between weight fraction and the relative intensities of Raman bands intrinsic to the binary mixture. This technique could be used to map the phase distributions in one or two dimensions across an analytical sample surface and quantitative analyses of samples containing inclusions with dimensions on the order of a few microns.

As an example of the quantitative analysis using micro Raman spectroscopy, distribution of quartz and cristobalite in a silica nodule in volcanic rock from Akaze, Ishikawa prefecture was investigated. It was confirmed by X-ray diffraction, optical observation, Raman mapping analysis that microquartz and opal-C are horizontally layered in the silica nodule. Line profile of Raman spectra crossing the two regions revealed a sequential change of the weight ratio of quartz to cristobalite (opal-C).The profile of quartz/cristobalite ratio may be reflected on nucleation rate of cristobalite in a hydrothermal silica-rich water which has been circulating in the rocks.