40Ar-39Ar and Rb-Sr ages of jadeitite from the Nishisonogi metamorphic rocks, Kyushu, Japan

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The Nishisonogi metamorphic rocks are part of a Late Cretaceous subduction complex and are exposed on Nishisonogi Peninsula, Kyushu, Japan. They consist mainly of epidote-blueschist subfacies schists and small amounts of serpentinites (e.g., Nishiyama, 1989). The serpentinites typically occur as serpentinite melanges in tectonic contact with the surrounding schists. The schists yield K-Ar muscovite ages of 65-90 Ma (Hattori & Shibata, 1982) and ^{40}Ar-^{39}Ar glaucophane and phengite ages of 75-90 Ma (Faure et al., 1988).

Shigeno et al. (2005) have described tectonic blocks of jadeitite from the serpentinite melange. The mineral assemblage of the jadeitite is jadeite + paragonite + phlogopite + muscovite + clinozoisite + albite + analcime. The jadeite has many quartz inclusions in the core, which indicates higher metamorphic pressure than the schists. Albite and analcime replace jadeite, so these minerals are retrograde products. The jadeitite yields SHRIMP zircon ages of 120-160 Ma, which is considered to be the igneous protolith age (Tsutsumi et al., 2006). On the other hand, the uplift age of the jadeitite has not been constrained so far.

We carried out ^{40}Ar-^{39}Ar dating on phlogopite and muscovite of the jadeitite. In the sample, phlogopite occur as coarse-grained flakes (less than 2 mm in length). Muscovite occurs as aggregates of fine grains (more than 0.5 mm in length) in the interstices between jadeite grains, which imply that the muscovite crystallized during retrograde stage. For this reason, thin section samples (about 0.1 mm thick) were prepared for in situ ^{40}Ar-^{39}Ar analyses and were analyzed using pulse laser to obtain spot age. As a result, ^{40}Ar-^{39}Ar phlogopite ages show 63-67 Ma, and ^{40}Ar-^{39}Ar muscovite ages are 80-90 Ma.

We also carried out Rb-Sr dating of the jadeitite. After crushing the sample, the grains were sieved into 250-125 micrometer and 90-63 micrometer fractions. Phlogopite was separated from each fraction by a Frantz isodynamic separator and tapping. Non-magnetic grains were suspended in tetrabromoethene and were separated into lighter and heavier fractions. The lighter fractions of 250-125 micrometer and 90-63 micrometer consist mainly of paragonite and muscovite, respectively. From the heavier fractions, jadeite was separated by handpicking. The Rb concentration, Sr isotope composition and total Sr concentration of each fractions were determined with a TIMS. As a result, the Rb-Sr mineral isochron age of the jadeitite shows 76 Ma.

The ^{40}Ar-^{39}Ar muscovite ages (80-90 Ma) probably represent the uplift age of the jadeitite. These ages are close to the ^{40}Ar-^{39}Ar glaucophane and phengite ages (75-90 Ma) of the schists. Thus the uplift of the jadeitite is considered to be simultaneous with exhumation of the schists. The Rb-Sr mineral isochron age (76 Ma) is younger than the ^{40}Ar-^{39}Ar muscovite ages. This fact suggests that the jadeitite has been opened with respect to Sr during the uplift. The replacement of jadeite by albite and analcime may correspond to this age. Because the 40Ar-39Ar phlogopite ages (63-67 Ma) are younger than the Rb-Sr mineral isochron age, the replacement has probably occurred at more than 300 degree centigrade.

References

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