Laserprobe $^{40}Ar/^{39}Ar$ dating: Point analysis and step heating

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Potassium is a common element among various minerals. The $^{40}Ar/^{39}Ar$ method has a wide range of applications, but it is susceptible to a secondary event compared to other radioisotope system such as U-Pb method. This weakness can be regarded as an advantage to record a secondary event. Various minerals with different diffusion characteristics allow us to reconstruct a detailed uplift and cooling history of an area.

It is more than thirty years since the first application of a laser has been made in the $^{40}Ar/^{39}Ar$ method. Much attention has been paid on the high spatial resolution using a pulsed laser, although two different approaches (i.e., point analysis and step heating) are available. Both are useful methods to study argon diffusion processes in minerals and cooling histories.

Development of analytical technique made it possible to obtain a $^{40}Ar/^{39}Ar$ age from a sample as small as 5 microns, but they are limited to a sample with high potassium concentration. Step heating method using a continuous laser is applicable to an individual mineral of 0.1 to 1 millimeters. Difficulty in temperature control during step heating still keeps researcher from performing step heating analysis on a single grain.

The conditions to conduct both techniques with reasonable precisions are considered, and detection limit in mass spectrometry is discussed.