Development of un-irradiated and un-spiked laser fusion K-Ar dating: for single grain Potassium analysis

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Laser fusion measurements for a single grain of phenocryst or of in situ measurement of less-abundant minerals found on thin sections are established for K-Ar dating method. For such kind of samples, Ar-Ar dating is applied widely to obtain radiometric ages because the Ar-Ar method is insensitive to the site difference between K and Ar in the specimen. However, Ar-Ar dating at least raises a difficulty that nuclides produced by irradiation mask some of the original isotope ratios in rock and mineral samples. In the cases of small amount of radiogenic ^{40}Ar, large uncertainty is brought to ages useless by the masking. Herein, we report an un-irradiated and un-spiked laser fusion K-Ar dating method, with which we can analyze both Ar and K for the individual grains. This is tested in following two protocols: 1) K measurement following/after laser fusion Ar measurement applied to the retrieved single mineral grain itself; and 2) in situ laser fusion Ar measurement applying to the epoxy resin mounted grain, where its K-content measured using EPMA. Especially, in the former protocol, the model of the Hitachi Z-5010, which employs double-beam polarized Zeeman method for background correction, is used. The deuterium lump and the polarized Zeeman method realize less background in atomic absorption photometry and the new optical system and the improved graphite furnace ensure high sensitivities. This method is expected to enable acquisition of precise radiometric ages of single grain K-Ar dating.