Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SGL43-P02 Room:Convention Hall Time:May 23 13:45-15:15

Development of un-irradiated and un-spiked laser fusion K-Ar dating for single grain minerals (2nd report)

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A laser fusion K-Ar dating has been developed as an in-situ micro measurement of radiometric ages applicable for less-abundant minerals found on thin sections [1, 2]. Strong induced radio-activities in Fe-rich minerals by neutron irradiation prohibits collecting sufficient amount of mineral separates, which partly limits applications of Ar-Ar method[3]. Nonetheless, once K-Ar method establish for a single grain mineral containing trace K with $<$0.1 wt%, much wider applications are anticipated, e.g. fine minerals of hydrothermal origin. Thus, we have installed a laser fusion apparatus to GVI-5400He noble gas mass spectrometer of JAMSTEC, as a part of the TAIGA-project: Grant-in-aid for Scientific Research on Innovative Areas.

Quantitative determination of K for trace concentration, approx. 0.1wt%, using EPMA sometimes faces poor accuracy and/or precision for a requirement of accurate dating. Thus we have been tested single grain K measurement under a low blank protocol using graphite furnace atomizer to ensure high sensitivities. This K measurement follows a laser fusion Ar measurement applied to the retrieved single melted mineral grain itself. An accurate K-Ar age determination requireds complete retrieval both K and radiogenic Ar. Thus, conditions laser irradiation and K quantitation have investigated using SORI-93 K-Ar standard [4].

Our preliminary results show a 15% older averaged age with more than 10% deviation for recommended age for SORI-93 (92.6+/-0.6Ma, [4]), which is still under investigation.

[1] Sato et al. (2008) Chikyukagaku, 42, 179-199.
[2] Sato et al. (2011) JpGU annual meeting 2011.
[3] Ishibashi et al. (2009) J. Geogr., 118, 1186-1204.
[4] Sudo et al. (1998) Geochemical J., 32, 49-58.

Keywords: K-Ar dating, laser fusion, single grain, SORI-93 K-Ar standard