Experimental study for frictional melting gabbro about resetting K-Ar age from degassed noble gas

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The isotope ratios of noble gas in particular minerals are regarded be easily modified by their ambient reservoirs when minerals have been caught higher temperature than their closure temperature, in general. Therefore, thermal history of a rock or a geologic event including fault movement could be determined quantitatively with radiometric dating method applying to a set of different minerals. However, because of the difficulty to prove the temperature of an event exceeds closure temperatures of minerals, the radiometric dating method is not able to be applied easily to the purpose in the case of faulted rocks. there is a problem to apply radiometric dating for the purpose in the case of faulted rocks.

Here we report a preliminary experiment that effectuates high temperature frictional melting experiments by a high-velocity friction apparatus in Kyoto University (now re-installed to KOCHI JAMSTEC) in order to test reset of their noble gas isotope ratio on frictional heating of fault movement. In the experiment, the temperature on the modeled fault plane is well above the closure temperature of K-Ar system, which estimated by a calculated cooling age. Due to rapid equilibrium of volatiles during frictional melting of rocks, we expect that the noble gas isotope composition/ratio should be reset to the atmospheric one by this experiment. We determined noble gas isotopes of a gabbro sample by the Laser fusion analysis apparatus to check (the isotopic composition) whether the age was initialized by frictional high temperature degassing. The initialize of noble is only observed in glass completely melted. Rejuvenating and/or growing of the K-Ar ages are only observed in narrow zone of 1-2mm wide area faced on fault plane such as altered by thermal and fractured in thin section. In a field observation, such glassy materials, indicating complete melting of rocks, are faced on the fault planes. In addition, the outgas sample, collected into small aluminum tube after the friction experiment under the condition of the nitrogen atmosphere, contains carbon dioxide, water vapor, hydrogen, helium and other noble gases released from the rock samples.