# The significance and the problems of the K-Ar age of mica clay minerals in fault gouge.

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The K-Ar age of mica clay minerals in fault gouge represents the age of hydrothermal alteration associated with fault movement. However, various difficulties of its interpretation were pointed out. We report the K-Ar ages of mica clay minerals in fault gouge and its crystallographic features, and discuss their significance and problems, collected from the Ulsan fault (Korea), the Atotsugawa fault system, Tnakura Tectonic Line (Japan) and the Main Central Thrust Zone (Himalaya). The results suggest that the mica clay minerals in faults indicate various formative processes, therefore, it is important to demonstrate the detailed crystallographic features of mica clay minerals in fault gouge.

To reveal the timing of fault activity, various dating method has been applied for fault materials. The K-Ar age of mica clay minerals in fault gouges represents the age of hydrothermal alteration accompanied with fault movement. However, various difficulties on its interpretation were pointed out. In this presentation, we report the K-Ar ages of mica clay minerals in fault gouge, and discuss their significance and problems, collected from the Ulsan fault, Korea, the Atotsugawa fault system, the Tnakura Tectonic Line, Japan, and the Main Central Thrust (MCT) Zone, Himalaya.

In samples separated by means of elutriation in deionized water, comminuted preexisting muscovite crystals of the country rocks can be mixed with authigenic mica clay minerals. If the country rock was granitic rocks or metamorphic rocks, the crystallinity of comminuted muscovite grain is higher than authigenic mica clay minerals. Authigenic mica clay minerals tends to concentrate in finer fraction. Therefore, the sample was separated into following four fractions, 5-2, 2-1, 1-0.35 and 0.35-0.05 micrometer. The crystallinity (Kübler index : I.C.) of mica clay minerals were measured in each fractions, and discuss the correlation relationship between the K-Ar age and the crystallinity.

In the Ulsan fault, the collected fault gouge are derived from Cretaceous granite. Because of high content of smectite, it is impossible to measure the crystallinity of mica clay minerals, however, the polytype of this mica clay minerals is 1M, therefore, this mica clay minerals is authigenic and was formed by hydrothermal alteration accompanied with fault activity, indicating the K-Ar ages of 38-46 Ma.

In the Atotsugawa fault system, two fault gouge samples were derived from the Hida gneiss bearing Jurassic cooling age and Jurassic-Lower Cretaceous sedimentary rocks in the Tetori Group. These I.C. vary in each fractions, indicating that mica clay minerals from different origin mix in these fault gouges. As the fraction are finer, the K-Ar ages of fault gouge from the gneiss vary from 75 to 60 Ma. Similar trend is also given for fault gouge from the Tetori Goup excepting for the finest fraction. It is possible that the finest fraction from sedimentary rock origin shows mixed ages of diagenesis and hydrothermal alteration.

Fault gouges from the Tanakura Tectonic Line is derived from Cretaceous granodiorite in the Abukuma belt. Their I.C. are < 0.3 without variation in each fractions. The polytype of these mica clay minerals is only 2M1 at all fractions. The K-Ar ages 40-50 Ma. In wall rocks, sericite (I.C. = 0.25) was formed along fractures. Therefore, these mica clay minerals are probably generated by hydrothermal alteration in both granite and fault gouge.

Fault gouge from the MCT zone is derived from pelitic schist. The I.C. is high (I.C. < 0.2) in each fractions. It indicates the possibility that this mica clay minerals are comminuted muscovite from the country rock. The K-Ar age of this mica clay minerals is ca. 3 Ma, though the 5-10 Ma were dated by Ar-Ar method for muscovite in the country rock. This younger age suggests that an Ar diffusion took place in the mica clay minerals of the fault gouge.

When the sample has much smectites, the K-Ar age would be younger than its real age for excess potassium ion in expanding layers in smectite. By the replacement of the potassium ion with ammonium ion, the K-Ar age 2-5 % older than the samples without replacement.