Phengite K-Ar ages of schists from the Shimanto belt, central Shikoku, Japan: the timing of the Shimanto metamorphism

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The Japanese continental arc, which comprises some organic belts and some collided island arc, have grown oceanward by about 400 km in 450 Ma, by long-term subduction of the Pacific seafloor along the eastern margin of the Asia continent (the Pacific-type orogeny). Hence, Japan is one of the type localities of the Pacific-type orogeny in the world. Especially, geochronological studies examining the timing of a peak metamorphism and a cooling history of the metamorphic rocks are very important in understanding the dynamics of the Pacific-type orogeny.

The K-Ar method is frequently employed as a tool for the determination of cooling rates of metamorphic rocks (e.g. Itaya and Takasugi, 1988). Because the closure temperature of K-bearing minerals such as muscovite, biotite, and hornblende was well determined experimentally and geologically studies (e.g. Dodson and McClelland-Brown, 1985).

In the Oboke area, central Shikoku, schists are widely distributed and were considered as typical rocks of the Sanbagawa metamorphic belt. However, the geotectonic and geochronological observation of this area is very similar to those of the Cretaceous Shimanto accretionary complex. Thus, the ascription of this area is very controversial (e.g. Isozaki and Maruyama, 1991; Kiminami et al., 1999). Aoki et al. (2006) separated zircons within granitic clasts in conglomerates and psammitic schists from this area and carried out U-Pb analyses using a laser ablation-inductively coupled plasma-mass spectrometer (LA-ICP-MS). As a result, their ages revealed that the schists in the Oboke area belong not to the Sanbagawa metamorphic belt but to the Northern Shimanto belt. Hence, we study the peak metamorphic age and the cooling rates of the schists to understand dynamics of the deeper facies of the Cretaceous Shimanto accretionary complex.

The metamorphic age of the Oboke area was considered as ca. 65 Ma based on K-Ar ages of phengitic micas from pelitic and psammitic schists (Itaya and Takasugi, 1988). However, Itaya and Fukui (1994) showed that some schists contain inherited white micas and have an extremely older K-Ar ages in comparison with the schist without a inherited white mica. Therefore, there is a possibility that the K-Ar phengite age of this area was estimated older.

In this study, we carefully checked the lack of inherited micas within some schists in the Shimanto metamorphic rocks of the Oboke area with EPMA and separated primary phengites to carry out the K-Ar dating. This report presents metamorphic age and tectonic evolution of the Northern Shimanto belt based on the phengite K-Ar ages.