

K-Ar ages of barroisite-bearing metabasite from the Kebara Formation at the southern margin of the Sanbagawa belt in Kii Peninsula

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The metamorphic zoning in the regional metamorphic belt can be defined as an area where a particular mineral or suite of minerals is predominant or characteristic(s) reflecting the original rock compositions, the pressure and temperature of formation, and the duration of the metamorphism (e.g., Jackson and Bates, 1997). If we found rocks with some different natures against a certain metamorphic zone, geologists generally try to consider its reason and it becomes a long-term controversy in some case, e.g., knocker like occurrence of blueschist and/or eclogite in direct contact with greywacke or serpentinite in the Franciscan complex (e.g., Colman and Lanphere, 1971). This is interpreted as a sedimentary mélangé (e.g., Wakabayashi, 2015) or a tectonic mélangé (e.g., Ukar, 2012). In the Sanbagawa belt, and eclogite facies rocks exposed in epidote-amphibolite facies schist in the Besshi area, central Shikoku, are interpreted as tectonic blocks (e.g., Kunugiza et al., 1986), a regional nappe (e.g., Wallis and Aoya, 2000) or the relict from later stage Barrovian type overprinting (e.g., Ota et al., 2004).

Kato and Hirajima (2017) found barroisite (Brs)-bearing metabasites from the Kebara Formation, a unit exposed between the Sanbagawa and Chichibu belts in Kii Peninsula. The peak metamorphic *P-T* conditions of the Kebara Formation are equivalent to pumpellyite-actinolite (PA) facies or pumpellyite-blueschist (PBS) sub-facies (<340 °C) inferred from the common occurrence of pumpellyite in metabasites (Kurimoto, 1986a) and carbonaceous material by Raman spectroscopy thermometry for metapelite (Yoshida et al., 2016). However, Kato and Hirajima (2017) claimed that the Brs-bearing metabasites were formed at higher metamorphic conditions (>450 °C and 0.4 GPa) than the surrounding rocks and then suffered by the PA or PBS facies overprinting along with the main constituents of the Kebara Formation. Kato and Hirajima (2017), finally, concluded that Brs-bearing metabasites formed at an early stage of the subduction, and subsequently exhumed and juxtaposed with newly subducted materials, which are the protolith of the main lithotype of the Kebara Formation.

In this study, we report the newly obtained 120.7 ± 3.7 Ma amphibole K-Ar age from a Brs-bearing metabasite (KB89U), and 85.2 ± 1.9 Ma white mica K-Ar age from an epidote-blueschist (KB89G) collected at the same outcrop in the Kebara Formation. Mineral separates and K-Ar analyses were carried out by Hiruzen-Chishitsu Co. Ltd. The amphibole separates of KB89U are 60-100 micron size and contain K of 0.283 wt% in average. Amphibole grains in KB89U occur as porphyroblast, up to 2 mm in long dimension, and show a zoning structure of barroisite core and magnesioriebeckite/winchite rim. K₂O content of barroisite rim ranges from 0.3 to 0.4 wt% but that of the rim is almost free. Consequently, the obtained K-Ar age could reflect the Ar closure temperature in barroisite, i.e., ca. 500°C (McDougall and Harrison, 1999). The white-mica separates of the epidote-blueschist (KB89G) are 2-1 micron size and contain K of 4.383 wt% in average. Amphibole in this sample is mainly glaucophane associated with epidote and hematite, although most of Na-amphiboles developed at the rim of barroisite are magnesioriebeckite.

K-Ar white-mica ages for pelitic schist and metabasite samples, and ⁴⁰Ar/³⁹Ar whole-rock ages for pelitic schist samples, reported in the Kebara Formation are 103-89 Ma (Isozaki et al., 1992; Kurimoto, 1993, 1995, 2013; De Jong et al., 2000). 120.7 Ma of the Brs-bearing metabasite is significantly older than but

85.2 Ma of the epidote-blueschist is synchronous to the previous data. Therefore, the barroisite-bearing rock was formed by the early stage of the Sanbagawa metamorphism like as the Western Iraitsu body reported by Endo et al. (2009). The investigation of the mixing process, i.e., older and higher grade rocks to PA facies matrix, remains as the future problem.

Keywords: Kebara Formation, K-Ar age, barroisite, melange