Dating a 'princess': U–Pb age determination of 'nunakawaite' (strontio-orthojoaquinite)

*Tatsuki Tsujimori¹, Tomomi Hara¹, Yuzuki Shinji¹, Tomohiro Ishizaka¹, Hiroshi Miyajima², Jun-Ichi Kimura³, Shogo Aoki⁴, Kazumasa Aoki⁴

1. Tohoku University, 2. Fossa Magna Museum, 3. JAMSTEC, 4. Okayama University of Science

'nunakawaite' (strontio-orthojoaquinite) is an orthorhombic variety of strontiojoaquinite [Sr₂Ba₂(Na,Fe)₂Ti₂]Si₄O₁₂[O₂(OH)₂-H₂O]; it is a rare joaquinite group mineral that is only found in a riebeckite-bearing albitite in the serpentinite-matrix mélange of the Itoigawa–Omi area. The mineral was originally named after 'Princess Nunakawa' (nunakawa hime) in the Japanese Shinto mythology 'Kojiki'.

'nunakawaite' is characterized by remarkably high Ba, Zr, Nb, Zn, LREEs, MREEs, and enriched in U (35.8–721 μg·g⁻¹), Pb (2.2–31 μg·g⁻¹), and Th (7.42–2365 μg·g⁻¹). LA-ICPMS analyses show highly variable U/Pb (²³⁸U/²⁰⁶Pb = 9.245–68.98) and Pb (²⁰⁷Pb/²⁰⁶Pb = 0.0758–0.756) isotope ratios, and the scattered trend define an isochron line with a lower intercept at 89.19 ±1.07 Ma. The 'nunakawaite' U–Pb age confirms that the 'nunakawaite'-hosted riebeckite-bearing albitite formed at late Cretaceous. This implies that the serpentinite-matrix mélange unit with early Paleozoic jadeitites and late Paleozoic blueschist, eclogite and amphibolite was reactivated by a significantly younger tectonic event.

In-situ Sr-Pb isotope analyses show two different isotope trends between Sr-rich accessory minerals in riebeckite-bearing albitite ('nunakawaite' and ohmilite) and those in jadeitite (itoigawaite, stronalsite, vesvianite, Sr-rich epidote). The Sr-Pb isotopes also support the idea that the riebeckite-bearing albitite formed by a fluid-induced metasomatic event different from the jadeitite-forming metasomatism at early Paleozoic. The formation of riebeckite-bearing albitite at ~90 Ma is coeval with late Cretaceous granitic intrusion of the Omi area (youngest zircon U–Pb: 90.8 ±1.1 Ma: Nagamori et al. 2018). The granitic intrusion might have acted an important role in the formation of 'nunakawaite'. In other words, reactivation of metasomatic mineralization in the Paleozoic serpentinite mélange is recorded in the Cretaceous riebeckite-bearing albitite.

Keywords: 'nunakawaite' (strontio-orthojoaquinite), U–Pb dating, metasomatism, serpentinite mélange, Itoigawa–Omi area