

## **Simultaneous P-T-t estimation of ultrahigh-temperature high-pressure granulite facies metamorphism recorded in titanite**

KENTA YOSHIDA<sup>1</sup>, SOTA NIKI<sup>2</sup>, HIKARU SAWADA<sup>1</sup>,  
RYOSUKE OYANAGI<sup>1</sup>, TAKAFUMI HIRATA<sup>2</sup>, KENJI  
ASAKURA<sup>3</sup> AND TAKAO HIRAJIMA<sup>3</sup>

<sup>1</sup>Japan Agency for Marine-earth Science and Technology (JAMSTEC)

<sup>2</sup>The University of Tokyo

<sup>3</sup>Kyoto University

Presenting Author: [yoshida\\_ken@jamstec.go.jp](mailto:yoshida_ken@jamstec.go.jp)

The Sanbagawa metamorphic terrane in SW Japan records two distinct stages of metamorphism: the early stage of granulite to epidote-amphibolite facies with the age of Early Cretaceous (c. 120 Ma) and the later high-pressure metamorphism covering eclogite facies, so-called Sanbagawa metamorphism, with the age of Late Cretaceous. The early stage was recognized in coarse-grained mafic bodies in central Shikoku, whose protolith ages are Early Jurassic [1, 2].

We report the first evidence of the Early Jurassic metamorphic event preceding the above ones, based on the simultaneous pressure-temperature-time (P-T-t) estimation using titanite in a high-pressure marble collected from the Eastern Iratsu body of central Shikoku island. The studied sample records an eclogite facies stage of Late Cretaceous that was recovered by garnet petrochronology [3].

Titanite in the sample occurs in the matrix and inter-grain minerals within garnet-diopside aggregate (GDA). Matrix titanites show spindle shape while those in GDA show irregular shape. Back-scattered image observation yields most titanite are homogeneous (Ttn1) while some grains have thin dark rim (Ttn2). The formation P-T conditions of Ttn1 were well constrained by means of quartz-in-titanite Raman elastic barometer [4] and Zr-in-titanite thermometer [5], yielding 900-1100 degreeC and 1.5-1.8 GPa. LA-ICP-MS U-Pb dating was performed for titanite and zircon. Zircon and Ttn1 yielded concordant age of Early Jurassic (200-180 Ma) while Ttn2 show a clear mixing line in the Terra-Wasserburg Concordia diagram whose lower intercept age was 126 Ma. The Early Cretaceous age of Ttn2 is comparable to that of the early Sanbagawa metamorphism although P-T conditions were not constrained. On the contrary, the Early Jurassic metamorphism of UHT-HP granulite conditions, much older and higher-conditions than previously recognized, have never been reported from the Sanbagawa metamorphic terrane.

[1] Endo, Wallis, Hirata, Anczkiewicz, Platt, Thirlwall & Asahara (2009), *JMG* 31, 371-384. [2] Aoki, Aoki, Tsujimori, Sakata, & Tsuchiya (2020), *Lithos* 358-359, 105378. [3] Niki, Yoshida, Sawada, Oyanagi & Hirata (2020), *Goldschmidt Virtual 2020*, 1932. [4] Kohn (2014), *EPSL* 388, 187-196. [5] Hayden, Watson & Wark (2008), *CMP* 155, 529-540.