

New titanite U–Pb age of so-called 'Inishi-type' calcareous rock from the Hida Belt: Constraints on timing of the carbonate–silicate rock interaction during a collision

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Titanite (CaTiSiO_5) is a widespread accessory mineral in calcareous gneiss that can contain small amount of uranium in its lattice. Because of relatively high closure temperature of Pb in titanite ($\sim 600\text{--}700^\circ\text{C}$), it has a potential for direct dating of titanite-forming metamorphic reaction using the U–Pb isotopic system. We conducted titanite LA-ICPMS U–Pb dating for so-called 'Inishi-type' calcareous rock from the Hida Belt. The calcareous rock has also known as clinopyroxene-bearing migmatite, which is characterized by the presence of coarse-grained diopside–hedenbergite series clinopyroxene and titanite. It has been thought that the 'Inishi-type' calcareous rock had formed by the interaction between marble and amphibolite that might have occurred at a period of anatexis of lower to middle crust accompanying regional deformation and felsic magma intrusion. The investigated sample is pegmatitic calcareous rock that contains the mineral assemblage plagioclase ($\text{An}_{>25}$) + orthoclase + quartz + clinopyroxene + titanite \pm calcite. The abundant occurrence of orthoclase suggests an effect of mixing of anatectic melt with a syenitic composition.

LA-ICPMS analyses of coarse-grained titanites show highly variable $^{238}\text{U}/^{206}\text{Pb}$ ratio (15.0–24.0) and $^{207}\text{Pb}/^{206}\text{Pb}$ ratio (0.172–0.419). The scattered trend defines an isochron line with a lower intercept at 225.4 ± 2 Ma. This age was also supported by U–Pb age (222 ± 3 Ma) of metamorphic zircon formed in marble. Our new titanite age is slightly younger than the inferred timing of peak metamorphism of the Hida Belt (~ 240 Ma). However, the result clearly indicates that 'Inishi-type' calcareous rock was formed by the post-collisional event, possibly anatectic event accompanying intrusion of syenitic magma into the calcareous rock. The timing of these events consistent with the age of post-collisional migmatite and syenite from the Sulu–Dabie ultrahigh-pressure metamorphic belt. Although zircon geochronology is not simple in orthogneiss-dominant polymetamorphosed metamorphic complex like the Hida Belt, titanite U–Pb dating for reaction rock formed via carbonate–silicate rock interaction would be effective to interpret timing of specific event

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