

Timing of the Oritate travertine formation by comparison between its carbonate U-Pb age and zircon U-Pb age of the overlain tuffaceous sandstone, Toyama Prefecture, Japan.

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In-situ U-Pb dating of carbonate minerals can be applied to understand the timing of vein-type mineralization, fault movements, and other geological events forming calcites, which are difficult to be dated by other methods. In this study, we present U-Pb dating of carbonate minerals in the Oritate travertine which is called as 'Onyx marble' from Unazuki area, Toyama Prefecture, Japan. Travertines are typically formed by a precipitation of carbonate minerals from hot spring. The Oritate travertine occurs near the Paleogene-Cretaceous igneous rocks. The travertines show the horizontal bedding. It is overlain by tuffaceous sandstone with conformable relationship. Thus, the travertine formed during the magmatic activity which had provided tuffaceous materials. The zircon U-Pb ages of the tuffaceous sandstone provide upper limit of the age of the travertine formation with elimination of ages of detrital components.

High initial $^{238}\text{U}/^{204}\text{Pb}$ (μ) content is requirement for precise U-Pb dating of calcite, because calcite generally contains significant amount of common Pb. It is also better to contain high U in the order of several tens of ppm for U-Pb dating. However, the U and Pb concentration of Oritate travertines are very low which is less than 1 ppm. In addition, the travertine has fractures which are filled by carbonate minerals. Although the chemical compositions of Oritate travertine imply the difficulty to apply U-Pb method, we examined U-Pb dating of calcite in travertine and carbonate minerals (calcite and ankerite) in fractures. The U-Pb dating of Oritate travertine was attempted with the LA-ICP-MS utilize a New Wave Research 193UC excimer laser ablation system, coupled to an Agilent 7700 quadru-pole ICP-MS. The results show that the Oritate travertine formed at Late Cretaceous-Paleogene. After the formation of travertine, the fractures in travertine formed at Paleogene.