

U-Pb geochronology of the Oritate travertine from Unazuki area, Toyama, Japan

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Uranium-Pb dating of carbonate minerals can be widely 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. However, it is often difficult to obtain reliable estimated ages of calcite because calcite usually contains high common Pb content.

In this study, we present the geochronological results of the Oritate travertine from Unazuki area, Toyama, Japan. Typically, travertines are formed by a precipitation of carbonate minerals from hot spring. Thus, the U-Pb dating of calcite provides the timing of hydrothermal fluid activity. The Oritate travertine is called as 'Onyx Marble' by its texture. It shows layered texture with different colors from gray, white, to brown. It consists of aragonite and calcite. The chondrite normalized REE patterns of travertines show the flat and positive Eu anomalies which are different characteristics from oceanic limestones.

High initial $^{238}\text{U}/^{204}\text{Pb}$ (μ) content is requirement for precise U-Pb dating of calcite (Rasbury & Cole, 2009), 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. U/Pb ratio of the Oritate travertines range from 1.1 to 2.2. The U and Pb concentration of Oritate travertines are very low which is less than 1 $\mu\text{g/g}$. The brownish colored layers in travertines contain relatively high U concentrations. Although the chemical compositions of Oritate travertine imply the difficulty to apply U-Pb method, we examined U-Pb dating of calcite with relatively high common Pb. 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 LA-ICP-MS was optimized using continuous line ablation of a NIST SRM610. The zircon standard reference material 91500 was used as an external standard for the initial calibration of all analyses. Then, the results were calibrated with WC-1 calcite (Roberts et al., 2017). Laser ablation parameters for carbonates are a 150 μm spot for pre-ablation, 140 μm spot for ablation, ablated for 30s, at 20 Hz with fluence of 7.2 J/cm^2 . We discuss the results.

Reference

Rasbury & Cole (2009) *Reviews of Geophysics*, 47, RG3001.
Roberts et al. (2017) *G34*, 10.1002/2016GC006784

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