

Trace element composition and U-Pb age of travertine from Balochistan, Pakistan: possible reference material for U-Pb geochronology of calcite.

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U-Pb dating of calcite can be widely apply to understand the timing of vein-type mineralization, fault, and other geological formations if those contain calcite, which are difficult to be dated by other methods. Reference materials for U-Pb dating of calcite, such as WC-1 (254.4 ± 6.4 Ma, Roberts et al., 2017) and ASH-15D (3.001 ± 0.012 Ma, Mason et al., 2013; Vaks et al., 2013), are available from several laboratories.

In this study, we present the geochemical characteristic of travertine from Chagai, Balochistan, Pakistan and the suitability of travertine for use as a U-Pb dating reference material. The Plio-Pleistocene Koh-e-Sultan volcanic rocks occur in the Chagai volcanic arc in the western part of Pakistan. These are represented by andesite to dacite lava flow and volcanoclastics including agglomerate, tuff, lapilli tuff, volcanic conglomerate and volcanic breccia (Siddiqui et al., 2009). The travertine occurs in the Koh-e-Sultan volcanic province, and is commonly known as onyx marble. Travertine shows layered structure with different color from white, green to brown. Green and brown parts consist of calcite. White color consists of calcite and aragonite. In general, travertine is formed by a precipitation of carbonate minerals from hot spring. Sr isotopic compositions of the travertines are same as those of dacites of the Koh-e-Sultan.

High initial $^{238}\text{U}/^{204}\text{Pb}$ (μ) content is requirement for precise U-Pb dating (Rasbury & Cole, 2009), because calcite generally contains significant amount of common Pb. U/Pb ratio of the travertines range from 0.8 to 773. Uranium contents of the travertines range from 0.7 to 38 $\mu\text{g/g}$. The green colored travertines contain relatively high U concentrations. We analyzed travertines with relatively high U/Pb ratio and U contents for U-Pb dating. U-Pb dating was attempted with the solution ICP-MS as well as the LA-ICP-MS utilize a New Wave Research 193UC excimer laser ablation system, coupled to a Nu Instruments Nu Plasma II multi-collector ICP-MS or Agilent 7700 quadru-pole ICP-MS. The result shows age of c.a. 1.5 Ma. The travertine with high Pb/U ratio and U content can be a suitable reference material for the dating of Quaternary age.

[Reference]

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