

Single-shot laser ablation ICP-MS U-Pb dating of invisible outer-rim of zircon

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In U-Pb dating, cathodoluminescence (CL) imaging is an important tool for revealing the internal structure of zircon. It is important to distinguish between the outer (overgrowth) rim and an inner (inherited) core, in particular for zircons from granitic and metamorphic rocks. For spot analysis, the rim and core need to be thicker than the minimum spot diameter. This presents a limitation of conventional U-Pb dating techniques. A newly-developed multiple collector (MC) ICP-MS is capable to provide U-Pb ages with 1- μ m depth resolution by a very short laser ablation (LA) of 1 second (Hattori et al., 2017). Furthermore, the combination of multiple Daly detectors with the above LA-MC-ICP-MS system improves the in situ U-Pb geochronology for small sample size (Obayashi et al., 2017).

U-Pb dating using the above techniques was performed on the natural external surfaces of zircon crystals. Because the laser pit depth from a single shot is approximately 0.2 μ m, depth profiles with five ages can be obtained over a thickness of 1 μ m. Results are presented for zircons from mylonitic granite and metamorphic rocks in the Mount Everest region. The U-Pb age profiles of most of the zircons allow to distinguish a \sim 0.5 μ m outer rim of 15 Ma and an inner rim of 19 Ma. The outer rims are not distinguishable in CL images of an internal cross section of the crystal. The single-shot LA technique is a major improvement for dating the metamorphic rims of zircon.

Hattori et al. (2017) JAAS 32, 88-95.

Obayashi et al. (2017) JAAS 32, 686-691.

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