

***In situ* U-Th disequilibrium dating of Quaternary zircon samples utilising multiple-spot femtosecond laser ablation-ICP-triple quadrupole mass spectrometry**

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²³⁸U-²³⁰Th disequilibrium dating methods especially on Quaternary U-bearing minerals (e.g. zircon) can provide key chronological information concerning timescales of multiplied magmatic processes [1]. To derive detailed information for magmatic processes, statistical treatments based on large-scale chronological data acquired from each mineral grain are effective [2], and hence, fast and *in situ* analytical techniques for ²³⁸U-²³⁰Th dating are highly desired.

In previous studies, *in situ* ²³⁸U-²³⁰Th dating methods are conducted with secondary ionisation mass spectrometry and laser ablation-ICP-mass spectrometry [2, 3]. With these techniques, for reduction of various mass spectrometric interferences on ²³⁰Th, data acquisition must be made with a high mass resolution [4]. However, the use of the higher mass resolution causes reduction of the ion transmission within the mass spectrometers, resulting in the longer time for signal integrations.

To overcome this, we have developed a new analytical technique using an ICP-triple quadrupole-mass spectrometer coupled with a multiple-spot femtosecond laser ablation sampling technique (msfsLA-ICP-QQQ-MS) for *in situ* ²³⁸U-²³⁰Th dating. With a kinetic energy discrimination (KED) technique, the mass spectrometric interferences on ²³⁰Th can be remarkably reduced while the loss of the ion transmission through the KED was only 30%. Moreover, owing to the msfsLA system [5], sample introduction can be conducted within a few second, resulting in the shorter analysis time and the better signal-to-noise ratios of the analytes. To evaluate the analytical accuracy of the present technique, the ²³⁰Th/²³⁸U values for four standard zircons (91500, GJ-1, OD-3, and Plešovice) were measured, and the resulting ²³⁰Th/²³⁸U data for 91500, GJ-1, and Plešovice zircons agreed with the value of the secular equilibrium. Subsequently, the developed technique was applied for Quaternary zircon samples in Japan and the resulting ages were consistent with previous chronological constraints. Based on this study, in conclusion, msfsLA-ICP-QQQ-MS can become a powerful analytical tool for rapid *in situ* ²³⁸U-²³⁰Th dating.

References

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