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Optimizing methodologies for Lu-Hf and U-Pb analysis of zircons by MC-ICP-MS using ultrafast laser ablation technology.

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Measuring two chronometers, Hf and U-Pb for a single location on a sample zircon by laser ablation multicollector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) is a commonly used analytical technique in geoscience. These complimentary isotope systems differ significantly in the degree of uncertainty (1% for U-Pb, 0.01% for Hf) required for reliable interpretation. This difference is echoed in the amount of material required for analysis: LA-MC-ICP-MS of Hf in zircons typically requires much more material than the U-Pb equivalent. This extra material is partially delivered by enlarging the spot size for Hf analysis relative to U-Pb, which can be problematic for interpretation in complex zoned materials.

Developments to improve sensitivity in LA-MC-ICP-MS has led to reductions in the spot size required for precision Hf analysis to 25 μm [1], approaching values used for U-Pb (≥20 μm). Rapid response, high efficiency laser ablation systems, designed for bioimaging applications [2,3], have recently been shown to double LA-MC-ICP-MS sensitivity [4]. Here we report on using one such ablation system, the ESI Lasers™ Bloodhound™ combined with the Thermo Scientific™ Neptune XT™ MC-ICP-MS in order to maximize efficiency for zircon analysis. By doing so we proportionally reduced the volume of material necessary for complimentary Hf and U-Pb isotopic analysis: demonstrated by ablation of a series of reference and zoned sample zircons. Furthermore a comparison was made between the sequential analysis of Hf and U-Pb by our optimzed methodology and simultaneous measurement of Hf and U-Pb by laser ablation split stream (LASS) analysis.

[1] Bauer (2018) *Chem. Geo.*, **476**, 85-99. [2] van Malderen (2016) *J. Anal. At. Spectrom.,***31**, 423-439. [3] Douglas (2015) *Anal. Chem.*, **87**, 11285–11294. [4] Craig (2018) *Anal. Chem.*, **90**, 11564–11571.