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Simultaneous determination of Hafnium radiogenic ($\varepsilon^{176}Hf$) and mass-dependent ($\delta^{179/177}Hf$) isotope variations in rocks and minerals using a ^{174}Hf-^{179}Hf double spike

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Isotopic studies of hafnium (Hf) to this date have exclusively focused on mass independent effects, mostly radiogenic variability due to the decay of long-lived ^{176}Lu to ^{176}Hf (e.g., 1, 2), and nucleosynthetic and/or neutron-capture anomalies in planetary materials (e.g., 3, 4). However, despite >40 years of active Hf isotope geochemistry research, mass dependent Hf isotope variations have remained completely unexplored. Given recent discoveries of resolvable mass-dependent fractionations of other high field strength elements such as Ti (e.g., 5) and Zr (e.g., 6) in high- and low-T environments, exploring mass dependent variations of Hf may provide additional insights on how this element partitions between and cycles though various terrestrial reservoirs, complementing the information that can be gleaned from radiogenic $\varepsilon^{176}Hf$ variations alone. To evaluate this potential, we developed a novel method for Hf isotopic analysis using a ^{174}Hf-^{179}Hf double spike. The method was optimized to allow simultaneous determination of mass-dependent $^{179/177}Hf$ as well as radiogenic $\varepsilon^{176}Hf$ of terrestrial rocks and minerals from a single measurement, thus alleviating the need for two independent runs of unspiked and spiked aliquots. We will present: 1) results of collaborative efforts with the U.S. National Institute of Standards and Technology (NIST) to develop new isotopic reference materials for Hf isotopic analyses; and 2) measurements of zircon crystals and bulk-rock samples from various localities, highlighting the accuracy, reproducibility, and applicability of the method.

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