Coupled nucleosynthetic Zr and Hf isotope inventory in chondrites

B.-M. Elfers [1,2*], N. Messling[1,2], P. Sprung[1,2], F. Wombacher[1,2], M. Pfeifer[1,2] and C. Münker[1,2]

[1]Institut für Geologie und Mineralogie, Universität zu Köln, 50674 Köln, Germany,

[2]Steinmann-Institut, Universität Bonn, 53115 Bonn, Germany, *(correspondence: elfersb@uni-koeln.de)

The stepwise dissolution of primitive chondritic meteorites allows to investigate component-specific nucleosynthetic anomalies that are otherwise hidden on the bulk rock scale. Here, we present combined Zr and Hf isotope data for acid leachates and residues as well as bulk rock samples for several primitive chondrites, including precise data for the minor p-process isotope ^{174}Hf.

Zirconium and Hf were separated from the same sample splits using a combination of cation, anion, and LN Spec resins. Measurements were performed using the Neptune MC-ICP-MS at Cologne-Bonn and amplifiers with $10^{12}\Omega$ resistors for the integration of small ion beams. Our data reveal significant, correlated Zr and Hf isotope variations in leachates and residues, consistent with results of [1] and [2]. In contrast to Hf, significant ^{96}Zr anomalies are found on the bulk rock scale consistent with results of [3].

Due to the inclusion of ^{174}Hf, our data reveal that the observed Zr-Hf isotope anomalies at the leachate scale are entirely caused by variable contributions from s-process carrier phases in leach and residue fractions. Further, the s-process Hf and Zr carrier are most likely identical. Correlated Hf and Zr isotope anomalies in leachates and the lack of anomalies for Hf on the bulk rock scale indicate that anomalous Zr isotope signatures of bulk rocks most likely stem from (1) r-process enriched Zr phase(s) practically devoid of r-process Hf or (2) an unknown s-process carrier with extremely high Zr/Hf that was not resolved during leaching.

Contradictory to [3], our data is consistent with s-process Zr carriers being only derived from low mass AGB stars, while additional s-process contributions from intermediate mass AGB stars are not required.

[1] Qin L. et al. (2011) *GCA, 75*, 7806-7828. [2] Schönbächler et al. (2005) *GCA, 69*, 5113-5122. [3] Akram et al. (2015) *GCA, 165,* 484-500.