Lu-Hf Dating of Lunar Gabbro NWA 6950 – a young manifestation of KREEP

MAXWELL M. THIEMENS[1*], PETER SRUNG[1], CARSTEN MÜNKER[1]

[1] Institut für Geologie und Mineralogie Zülpicher Str. 49b D-50674 Köln

[*]m.thiemens@uni-koeln.de

Insights to the history and evolution of the Moon are limited to the few samples retrieved via the Apollo missions and meteorites that have landed on Earth. Amongst these, the Northwest Africa (NWA) 773 family of meteorites which further includes NWA 6950, 2977, 2700, 2727, and 3333 provides a unique insight into lunar volcanism. These meteorites comprise rare lunar gabbros and bear geochemical signatures akin to KREEP but are distinctly less trace element enriched at extremely low Ti contents [1]. NWA 6950 is a magnesian gabbro bearing veins of shock-induced melt. We analyzed mineral separates from NWA 6950, and used these to generate a Lu-Hf isochron.

We determined an age of 3.103 ± 0.039 Ga, older than most of the ages previously reported for the NWA 773 family but in agreement with the baddeleyite ^{207}Pb-^{206}Pb age of 3.108 ± 0.020 Ga for NWA 6950 [1]. We infer the Lu-Hf age to represent the pristine crystallization age of this KREEPy gabbro. The initial εHf of NWA 6950 (-12.46 ± 0.64) can now greatly expand a perfectly defined array in the εHf vs. age space of older KREEP-rich breccias [2] and KREEP-basalts [3] to much younger ages. In contrast, Mg-suite samples (some of the earliest magmatic lunar rocks) plot above this array. Mg-suite samples thus appear to represent a different mantle source than KREEP-dominated rocks. The source of these KREEPy rocks gave rise to magmatism for well over 1 Gyr, and may have formed within the first 50 Myrs of the solar system. This is consistent with recent Hf-W evidence [4].

[1] Shaulis *et al.* (2017) GCA 213, 435-456, [2] Sprung *et al*. (2013) EPSL 380, 77-87, [3] Gaffney and Borg (2014) GCA 140, 227-240, [4] Thiemens *et al*., Goldschmidt 2017 abstract 2017005507