Early mantle heterogeneities in modern mantle plumes – new insights from ^{182}W measurements

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Throughout the last decade, the short lived ^{182}Hf-^{182}W isotope-system ($t_{1/2}$= 8.9 Ma) has become a powerful tool studying and identifying vestiges of early solar system processes in Archean rocks [e.g. 1,2] as well as modern ocean island basalts (OIBs) [e.g. 3]. For Earth's mantle, both excesses or deficits in the ^{182}W composition have been interpreted to reflect sluggish inmixing of late veneer or early (Hadean) silicate fractionation processes [e.g., 2].

Here were report ^{182}W data for selected mafic volcanic rocks with supposed mantle plume origin from the Eifel Volcanic Field (EVF), La Réunion and Ascension Island, representing a variety of major mantle endmember components (EM, HIMU and FOZO). While a plume origin for La Réunion is beyond doubt, the origin of Ascension Island is still highly debated and long-lived radiogenic isotope signatures indicate a lithospheric influence in the EVF. Indeed, samples from Ascension Island and the EVF display modern mantle-like ^{182}W isotope composition ($\mu^{182}W = 0$) within error, whereas rocks from La Réunion exhibit variable ^{182}W deficits. Samples from Piton de la Fournaise volcano are strongly negative, with values as low as $\mu^{182}W = -9 \pm 4$ ppm, rocks from Piton des Neiges volcano yielded modern mantle-like ^{182}W composition. There appears to be no clear co-variation between ^{182}W compositions and noble gas systematics, as previously claimed. Our data therefore highlight that ancient mantle domains only appear to be preserved in distinct types of mantle plumes, calling for a revised classification for OIBs with respect to the presence of primordial mantle domains.

[1] Willbold et al. (2011) Nature **477**, 195-198. [2] Toboul et al. (2012) Science **355**, 1065. [3] Mundl et al. (2017) Science **356**, 66-69.