Early Earth signatures recorded in the source of Large Igneous Provinces

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Resolvable ^{182}W deviations from terrestrial standards were recently reported in rocks from two Large Igneous Provinces (LIP): Baffin Island and Ontong Java Plateau [1]. The cause of these deviations is still debated. It could reflect incomplete remixing into the mantle of late accreted materials characterized by deficits in ^{182}W, and/or Hf/W fractionation in the source of the lavas during the first 50 Ma of the Earth's history. The latter implies that chemical heterogeneities present in the mantle today could date back to processes that occurred during Earth's accretion. Interestingly, the distributions of reconstructed LIP eruption sites seem to correlate with the Large Low Shear Velocity Provinces (LLSVP) imaged through seismic tomography at the base of the mantle. If the LIP sampled the LLSVP, then these mantle domains could contain primitive material that has survived remixing through convection since the first tens of Ma into the Earth's history. A recent study suggests, however, that the measured ^{182}W variations could have resulted from nuclear field shift isotope fractionations induced during sample preparation [2]. Here, we will evaluate that hypothesis and will present high precision W isotopic compositions for LIP rocks from the ~ 1976 Ma Onega Plateau, the ~100-130 Ma Kerguelen Plateau and the ~68 Ma Deccan traps. We will explore potential source regions in the deep mantle through particle tracking in geodynamically constrained convection simulations [3]. These findings might give us insights into the dynamics of the mantle from the earliest stages of the Earth's formation till present.

[1] Rizo et al., 2016. *Science*; [2] Kruijer & Kleine, *accepted*. Chemical Geology; [3] Glisovic & Forte, 2017, *Science*.