Complex Archean mantle dynamics revealed by ^{142}Nd isotopes

A.N. WAINWRIGHT[1], V. DEBAILLE[1] AND J. BERGER[2]

[1]awainwri@ulb.ac.be Laboratoire G-Time, Université Libre de Bruxelles, Brussels, Belgium

[2] Géosciences Environnement Toulouse, Université Paul Sabatier, Toulouse, France

Determining the type of geodynamical regime operating during the early Earth is crucial to our understanding of the extent and timing of mantle homogenisation. Short-lived radionuclides provide an insight into the timing of homogenisation, as isotopic anomalies produced due to differentiation will become homogenised with time. How readily the mantle was homogenised provides insight into the type of geodynamical regime operating i.e. stagnant lid vs. a dynamically convecting mantle. Anomalies in short-lived isotope systems have been found at a number of localities world-wide, however their geographical extant is quite limited. As such, they may represent local anomalies rather than the prevailing global regime. Therefore, we will present ^{142}Nd data on the 2.8-3.3 Ga ultramafic-TTG suite of the West African Craton in order to help widen the geographical database.

The Amsaga area of the West African Craton is host to both silicic and mafic Archean rocks. The amphibolites yield a ^{147}Sm-^{143}Nd isochron age of 3353+-75 Ma, whilst zircon ages of the TTG suit provide ages between 2.6-2.9 Ga [1,2]. Preliminary ^{142}Nd isotope results indicate that the sample suits do not display any deviation from modern Earth, regardless of lithology. To date, on the entire African continent only the 3.55Ga Schapenburg komatiites in South Africa have a ^{142}Nd anomaly [3]. Globally, ^{142}Nd anomalies have also been observed in small regions of Greenland and Canada and one location in the USA. This highlights the relatively small area in which ^{142}Nd anomalies have been discovered, despite the diversity of Paleoarchean and older rocks. This suggests that either the Earth did not differentiate homogeneously, or was not remixed homogeneously. The latter implies that there was a complex geodynamical regime operating during the Archean.

[1] Laurent et al. (in prep). [2] El Atrassi et al. (in prep) [3] Putchel et al. (2016) Geochem. Geophys. Geosys., 17, 2168-2193.