Constraints from the West African Craton on Archean mantle dynamics

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

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

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

Determining the extent of mantle mixing during the Hadean-Archean is an integral factor in our understanding of early geodynamic processes and degree of mantle homogenisation. If a dynamic convecting mantle was the predominant regime it would be expected that early formed isotopic anomalies would be quickly homogenised, whilst in a stagnant lid regime these anomalies might last for hundreds of millions of years [1]. Using the short-lived ^{146}Sm-^{142}Nd chronometer, any ^{142}Nd anomalies that formed only during the first 500 Ma of Earth's history is subsequently remixed with the bulk mantle. Both positive and negative ^{142}Nd anomalies have been observed in rocks ranging from 2.7-3.9 Ga [2]. However, to determine whether these were local anomalies or are representative of the entire Earth requires that Archean rocks from other localities are also investigated. As such, we will present ^{142}Nd data on the 2.8-3.3 Ga ultramafic-TTG suite of the West African Craton.

The Amsaga area of the West African Craton is host to both silicic and mafic suites. The mafic amphibolites display typical flat incompatible element patterns, indicating little fractionation or secondary metamorphic enrichment. The silicic TTGs have typical incompatible element patterns with an enrichment in the most incompatible elements, due to their more evolved nature. The amphibolites yielded a ^{147}Sm-^{143}Nd isochron age of 3353±75 Ma, with initial εNd compositions ranging between +5.0 and +6.2 and zircon dating indicates an age of 2.6-2.9 Ga for the TTGs [3,4]. A positive initial εNd for the amphibolites suggest that the magmatic protolith evolved from an already differentiated source, making these samples a prime candidate for a ^{142}Nd investigation. The ^{142}Nd isotopic composition will provide constraints on timing of mantle mixing, as the ages observed throughout the suite will enable us to track the homogenisation of the local mantle through time.

[1] Debaille *et al.* (2013) *Earth Planet. Sci. Lett.*, **373,** 83-92. [2] Rizo et al. (2012) *Nature,* **491**, 96-100. [3] Laurent *et al.* (in prep). [4] El Atrassi *et al.* (in prep)