In quest of enriched reservoirs in the Hadean mantle: New ^{146,147}Sm-^{142,143}Nd data for the Pilbara Craton

M. TOUBOU[1], B. BOURDON[2], T. KLEINE[2]
AND P. PHILIPPOT[3]

[1]Department of Geology, University of Maryland, USA (*correspondence: mtouboul@umd.edu)
[2]Institute of Geochemistry and Petrology, ETH-Zurich, Switzerland (bourdon@erdw.ethz.ch)
[3]Institut für Planetologie, Westfälische Wilhelms-Universität Münster, Germany (thorsten.kleine@uni-muenster.de)
[4]Institut de Physique du Globe de Paris, France (philippot@ipgp.jussieu.fr)

Coupled ^{147,146}Sm-^{143,142}Nd systematics are a powerful tool to unravel Earth's earliest differentiation. Positive ^{142}Nd anomalies in some Eoarchean crustal provinces of southern West Greenland [1, 2, 3] and of Western Australia [3] are witnesses of an early mantle depletion prior to ~4.3 Ga. However, the signature of a complementary early-enriched crustal reservoir has been difficult to establish. Although negative ^{142}Nd anomalies were reported in pre-3750 Ma rocks from the Nuvvuagittuq supracrustal belt (North-Eastern Canada) [4], another study [5] could not reproduce these results. To further search for the presence of an early-enriched reservoir in Archean terrains, we obtained high-precision ^{142}Nd data for a suite of well-preserved coeval meta-komatiites collected from drill holes through the 3.48 Ga Dresser Formation, Warrawoona Group (Pilbara craton). These rocks have an initial ε^{143}Nd of -3.3 at ~3.5 Ga [6] and thus are promising targets when searching for negative ^{142}Nd anomalies and a putative enriched hadean crustal reservoir.

The ^{147}Sm-^{143}Nd isochron for North Pole meta-komatiites yields an age of 3.4 ± 0.1 Ga and an initial ε^{143}Nd of –4.4 ± 1.8, consistent with results obtained in a previous study [6]. In spite of the negative initial ε^{143}Nd, these samples have no resolvable ^{142}Nd anomaly within outside reproducibility of ± 5 ppm. Hence, the enriched crustal component in the mantle source of these rocks must have been isolated from the convective mantle later than 4.2 Ga ago. Consequently, these rocks do not carry a signature of a Hadean crustal component that is complementary to the early depleted reservoirs of West Greenland and Western Australia.

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Competitive sorption of Pb and anthracene to natural and synthetic Mn oxides

JANETTE TOURNEY[1], KAREN HUDSON-EDWARDS[2]
AND KAREN JOHNSON[1]

[1]School of Engineering and Computer Science, Durham University, South Road, Durham DH1 3LE, UK
[2]Department of Earth and Planetary Sciences, Birkbeck College, University of London, Malet Street, London WC1E 7HX, UK

Manganese oxides are strong oxidising agents, facilitating the breakdown of organic contaminants and enhancing humification of natural organic matter. Interactions with metals and radionuclides, including surface adsorption, sequestration and oxidation can lead to incorporation of metals into insoluble mineral phases and a consequent reduction in bioavailability of toxic contaminants. As Mn oxides are a common constituent of many soil environments, understanding their roles in such reactions is an important step towards quantifying and predicting biogeochemical cycling of trace elements, radionucleides and organic pollutants. In order to achieve this objective, competitive effects between different organic and inorganic solutes must be considered.

The aim of the present study is to characterise the competitive effects between a toxic heavy metal (Pb) and an organic contaminant (anthracene) at the surfaces of Mn oxides. It is well established that Mn oxides have a large sorptive capacity for Pb [1, 2], and previous research has shown that PAHs such as anthracene may be sorbed, and possibly oxidised, by Mn oxides [3]. However, few studies to date have investigated interactions with the Mn oxide surface in systems containing both inorganic species such as metal ions and organic contaminants.

The experiments were undertaken using synthetic Mn oxides, as well as a natural 'waste' Mn oxide-containing mineral. Use of synthetic Mn oxides facilitates study of the reaction mechanisms, whilst use of the natural Mn oxide aids extrapolation of our results to natural settings. Furthermore, the presence of humic-like organic matter in the structure of the natural Mn oxide mineral enables an assessment of the effect of natural organic matter as an additional component in the system.

[1] Matocha *et al.* (2001) *ES&T* **35**, 2967–2972. [2] Villalobos *et al.* (2005) *ES&T* **39**, 569–576. [3] Dowding (2009) PhD Thesis, Durham University.