Compound-specific isotopic evidence of paleoenvironmental change Lake El'gygytgyn, NE Russia

K. WILKIE*, S.T. PETSCH, S. BURNS AND J. BRIGHAM-GRETTE

Dept. of Geosciences, University of Massachusetts, Amherst, MA, USA (*correspondence: kwilkie@geo.umass.edu)

Recent successful drilling operations at Lake El'gygytgyn, NE Russia have recovered sediment cores back to 3.6Ma, representing the longest time-continuous sediment record of past climate change in the terrestrial Arctic. Compound-specific isotopic analysis of sedimentary lipids from this remote basin spanning the last 120ka allows reconstruction of past hydrological conditions, thereby providing a powerful tool for reconstructing past Arctic climate changes.

The hydrogen isotopic composition of lipid biomarkers was determined from previously obtained Lake El'gygytgyn sediment cores and compared with other multi-proxy evidence of past climate change within the lake basin. Here we present δD measurements of individual sedimentary fatty acids representing aquatic and terrestrial sources (e.g. aquatic, δD_{AQ}: nC_{20}, nC_{22}; terrestrial, δD_{TER}: nC_{30}) over the past 120 ka. The δD_{AQ} record shows little variation on glacial-interglacial cycles, possibly due to perennial ice cover during full glacial conditions and/or changes in aquatic community structure and aquatic organic matter sources. The data from terrestrial components show significant variation (up to 70‰) between glacial-interglacial intervals as well as variation on millenial timescales (~200 yr resolution). The most negative δD_{TER} values occur during glacial conditions (i.e. the Last Glacial Maximum and MIS 4) while enriched values are observed during interglacial intervals (i.e. most notably during the Holocene and MIS 5e). Preliminary reconstruction of the isotopic composition of precipitation from these results allows for comparision with the δD ice core records from both Greenland and Antarctic to assess high latitude environmental change and global teleconnections. Initial comparison of these records shows high fidelity with speleothem records from Hulu and Dongge caves [1] as well as with δD_{GRIP} [2] and δD_{VOSTOK} [3] records.

[1] Wang *et al*. (2005), *Science* **308**, 854-857. [2] Masson-Delmotte *et al*. (2005), *Science* **309**, 118-121. [3] Petit *et al*. (1999), *Nature* **399**, 429-436.

The W isotopic composition of the Hadean mantle – Evidence for the late heavy bombardment

M. WILLBOLD[1], T. ELLIOTT[1] AND S. MOORBATH[2]

[1]University of Bristol, School of Earth Sciences, Wills Memorial Building, Queens Road, Bristol, BS8 1RJ, United Kingdom

[2]University of Oxford, Department of Earth Sciences, South Parks Road, Oxford, OX1 3AN, United Kingdom

The contrasting behaviour of its daughter and short-lived ($t_{1/2}$ ~9Ma) parent has made the ^{182}Hf-^{182}W system invaluable in determining the timescales of planetary core formation. However, Hf is also considerably less incompatible than W in many melting and crystallisation scenarios in purely silicate systems. Thus the ^{182}Hf-^{182}W pair has also been used with success in examining the evolution of the silicate portion of planetessimals. Recent ε^{142}Nd data demonstrate that Hadean mantle fractionation events are recorded in the isotopic signatures of samples from Isua, Greenland. Notably one interpretation of terrestrial ^{142}Nd-^{143}Nd systematics invokes the formation of an enriched, deep reservoir within the first 30Ma of Earth History. It has further been suggested that the contrast between ε^{142}Nd in the most ancient Greenland samples and present day mantle (~20ppm) is a result of partial remixing between this hidden reservoir and convecting mantle after ~3.5Ga. If so, the Greenland samples derived from mantle that pre-dates this event would be expected to show a difference in e^{182}W relative to modern mantle.

We have made high-precision (<5ppm; 2σ) ε^{182}W measurements on some Isua samples. These document significant differences between these samples and modern mantle values (~13ppm). In contrast to previous studies [1,2] our analyses are considerably more precise and we are the first to document significant differences. However, the magnitude of the difference in our ε^{182}W is smaller than predicted for a remixing scenario of early enriched reservoir with the convecting mantle that can account for the difference in ε^{142}Nd between Isua and present mantle. We thus re-emphasise the conclusions of [1], that this change in ε^{142}Nd with time does not provide good evidence for the existence of an early enriched reservoir. We further note that the addition of ~0.5% of primitive chondritic material after core formation, as suggested by the late veneer model, is sufficient to account for the lowering of ε^{182}W from values we report in the Isua samples to present-day.

[1] Iizuka, T. *et al*. (2010) *Earth and Planetary Science Letters* **291**, 189-200. [2] Moynier, F. *et al*. *Proceedings of the National Academy of Sciences* (2010) **107**, 10810-10814.