Iron isotopes and komatiites: Implications for mantle oxygen fugacity

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Due to the high degrees of partial melting involved in komatiite genesis, komatiites provide a unique insight into the mantle. We report iron isotope data for 3 exceptionally preserved komatiite localities ranging from 2.7Ga to 90Ma, which enable a study of mantle fO_2 and melting processes over this time period. Data is presented both for whole-rocks and mineral separates. Whole-rock $\delta^{57}Fe$ values range from -0.23 to 0.34‰. Olivine samples are consistently lighter than corresponding whole-rocks ($\delta^{57}Fe$ = -0.47 to -0.11‰). Pyroxene samples range from $\delta^{57}Fe$ = -0.16 to 0.41‰.

Consistent with previous findings [1] iron isotope data for all localities correlate with proxies of partial melting. The highest degree partial melts show the lightest iron isotope compositions ($\delta^{57/54}Fe$ = -0.23‰). This trend is also observed for olivine separates from the same samples. Consequently no simple relationship exists between the iron isotope composition of komatiites and the bulk silicate earth (BSE) value.

Furthermore we show that whole-rock iron isotope data correlate with V/Sc and propose that this effect is not due to crystal fractionation, but rather due to oxygen fugacity. The relatively incompatible behaviour of vanadium compared to scandium demonstrates that the komatiite source is relatively oxidising. As a result we are able to show that the variations in iron isotopes measured were created by partial melting in relatively oxidising conditions. It is further shown that there is no marked difference between 90Ma and 2.7-2.4Ga komatiites suggesting little or no change in mantle fO_2 from the late Archean to the present day.

[1] Williams *et al*. (2005) *EPSL*. **235**, 435-452.

A depth transect of four 25 kyr $^{231}Pa/^{230}Th$ records from the Argentine Basin: Assessing southern component flow rates

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We present $^{231}Pa/^{230}Th$ data from a suite of cores along a depth transect in the Argentine Basin, to reconstruct water mass distribution and circulation histories of southern component water masses for the last 25 kyr .

Opal and particle flux data from these cores show little correlation with $^{231}Pa/^{230}Th$ values meaning that changes in $^{231}Pa/^{230}Th$ cannot be explained by a local composition or particle flux effect and are instead likely to be reflecting changes in circulation.

A core bathed by AAIW throughout the last 25 kyrs (GeoB 2107, 1048 m), has relatively high $^{231}Pa/^{230}Th$ values (0.075) during the Holocene and distincly lower values (0.055) at the LGM suggesting faster AAIW transport during the last glacial. At greater depths, $^{231}Pa/^{230}Th$ and $\delta^{13}C$ data in core GeoB 2109 (2504 m) indicate a change in both circulation and water mass distribution on glacial-interglacial timescales, with moderate flow of AABW at the LGM being replaced by more vigorous flow of NADW during the Holocene.

On millenial timescals, $^{231}Pa/^{230}Th$ values in deep cores GeoB 2109 and GeoB 2112 (4010 m) indicate enhanced production of AABW during northern hemisphere stadials, when $^{231}Pa/^{230}Th$ records are of opposite signal between hemispheres, supporting a possible bipolar seesaw relationship in deep water formation between hemispheres. These data indicate that the $^{231}Pa/^{230}Th$ proxy can be used to reconstruct past flow rates of multiple water masses in the Argentine Basin and provide evidence that southern source water masses play a dynamic counterpart to NADW formation on abrupt as well as glacial-interglacial timescales.