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# Nd and Hf isotopes from Maud Rise as tracers of glacial erosion and terrestrial input into the Southern Ocean during the Eocene-Oligocene-Transition

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The effects of ice-sheet erosion on Antarctica during the Eocene-Oligocene-Transition (EOT) can be examined using deep-sea marine sediments. In particular, radiogenic isotopes, that are sensitive to changes in sedimentary source rocks, have been particularly useful for determining when erosion by ice sheets occurred relative to major global climate events known from the benthic foraminiferal $\delta^{18}$O record. In this study, we combine two radiogenic isotope systems, hafnium and neodymium, to determine if there were differences in the timing of when ice sheets began actively weathering the continental crust on Antarctica versus the timing of provenance changes. We measured trace metal concentrations, Hf isotopes, and Nd isotopes from the detrital lithogenous fraction of deep-sea marine sediments recovered in a sediment core from upper Maud Rise, offshore of Dronning Maud Land (DML).

The $\delta^{18}$O record in this drill core, analyzed by Bohaty et al., 2012, shows two steps toward higher values, the larger second step indicating the main phase of ice sheet growth. Our data reveals distinct $\varepsilon$Hf and $\varepsilon$Nd shifts, simultaneous with the two $\delta^{18}$O steps at ca. 34.1 Ma and at ca. 33.7 Ma. During the first $\delta^{18}$O step detrital $\varepsilon$Hf values decrease significantly (by about 7 $\varepsilon$Hf), with only a small change in detrital $\varepsilon$Nd values (1-2 $\varepsilon$Nd). These changes are strongly indicative of an increase in mechanical weathering on DML during the first step of the EOT. The $\varepsilon$Hf shift may have been influenced by changes in the mineralogy or grain-size of the samples. The $\varepsilon$Hf values remain relatively low throughout the record, arguing for continuous glacial weathering, which is expected from the orbitally forced advancing and retreating of an ice sheet. At the second $\delta^{18}$O step the $\varepsilon$Nd record shows a shift from -11 to -16, which is consistent with an increase in sediments sourced from the Lambert Graben/Prydz Bay sector of Antarctica during the main phase of ice-sheet development.