Intensification of Antarctic chemical silicate weathering during the EOT revealed by Mg and Li isotopes

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Future warming beyond 2˚C could lead to the crossing of a threshold beyond which positive feedbacks within the Earth System would create a "Hothouse Earth" [1]. Understanding the interplay of feedback mechanisms is therefore of utmost importance to predicting future climate change. On Myr timescales, the hydrolysis of silicate minerals and subsequent precipitation of carbonate minerals in the ocean acts as a negative feedback within the carbon-cycle [2]. On shorter, more relevant, timescales, the subglacial weathering of fine-grained material produced during the expansion of glaciers may influence atm. CO_2 and temperature [3].

The Eocene-Oligocene Transition (EOT; ca. 34 Ma) marks the sudden appearance of ice sheets on Antarctica which caused a large surge in erosion [4], of which the associated silicate weathering response is not well understood. Here, we present magnesium and lithium isotope data for the authigenic and detrital phases of marine sediments from ODP Site 738 on the Kerguelen Plateau. During the EOT, detrital Mg and Li isotopes fractionate significantly as chemical weathering intensity increases due to the preferential retention of ^{26}Mg and ^{7}Li in weathering residues [5, 6]. Authigenic $\delta^{26}Mg$ and $\delta^{7}Li$ values are negatively correlated, reflecting a switch to more congruent weathering across the EOT [6, 7].

The $\delta^{26}Mg$ and $\delta^{7}Li$ records from Site 738 display similar variation to previous lead and neodymium isotope records, and are well correlated to oxygen isotopes, suggesting continental ice sheet expansion over Antarctica led to increased silicate weathering intensity, possibly associated with further atm. CO_2 drawdown and cooling.

[1] Steffen *et al.* (2018) *PNAS* **115**, 8252-8259. [2] Berner (2006) *GCA* **70**, 5653-5664. [3] Kump & Alley (1994) 46-60. [4] Basak & Martin (2013) *Nature Geo*. **6**, 121-124. [5] Teng *et al.* (2010) *EPSL* **300**, 63-71. [6] Tipper *et al.* (2012) *EPSL* **333-334**, 35-45. [7] Dellinger et al. (2015) *GCA* **164**, 71-93.