Significant increase in global continental weathering rates during the Toarcian Oceanic Anoxic Event

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The Toarcian Oceanic Anoxic Event (T-OAE; ~183 Ma) is associated with one of the largest carbon cycle perturbations over ~300 Ka recorded in the isotopic composition of organic carbon ($\delta^{13}C_{org}$) and carbonate carbon ($\delta^{13}C_{carb}$) of the Phanerozoic. It is thought that the eruption of the Karoo-Ferrar Large Igneous Province (~183 – 180 Ma) triggered an amplified greenhouse effect through the release of atmospheric greenhouse gases from mantle sources and intruding into organic-rich sedimentary deposits. Increasing ocean temperatures also may have destabilized reserves of biogenic methane clathrate within the seafloor, thus amplifying the warming.

In order to test whether or not enhanced silicate weathering rates may have acted as a negative feedback to increasing global temperatures by the drawdown atmospheric carbon dioxide [1] [2], we turn to the Re-Os isotopic system and reconstruct the initial $^{187}Os/^{188}Os$ composition of organic matter from an organic-rich mudrock succession that spans the T-OAE from western North America. The T-OAE interval is characterized by more radiogenic $^{187}Os/^{188}Os$ values ($^{187}Os/^{188}Os$ = ~0.6), whereas the pre- and post-T-OAE intervals are characterized by less radiogenic values ($^{187}Os/^{188}Os$ = ~0.25 and ~0.4, respectively). We interpret this osmium isotope excursion as a function of the relative contribution of continental-derived osmium to the oceans. These data show a similar trend to a record from England [3]. Therefore, we suggest that on short timescales (~10^4 – 10^5 years), silicate weathering rates may control atmospheric carbon dioxide concentrations. Furthermore, our results cast doubt into the assertion that the Re-Os record from England [3] was controlled by localized processes due to basinal restriction in Europe [4]. Our data indicate similar $^{187}Os/^{188}Os$ profiles for the T-OAE interval from two distinct locations during the Early Jurassic..

[1] Walker *et al.* (1981) *J. Geophy Res* **86**, C10. [2] Berner *et al.* (1983) *Am. J. Sci.* **283**. [3] Cohen *et al.* (2004) *Geol.* **32**, 2. [4] McArthur *et al.* (2008) *Paleoceanography* **23**, PA4217.