Title: The response of the marine Os isotope record to large igneous province emplacement and impact events: Can we untangle the effects of the Chicxulub impact and Deccan volcanism?

Abstract:

Recent high precision geochronologic work has reinvigorated claims that eruption of the Deccan Traps contributed in a significant way to the Creatceous-Paleogene (K-Pg) mass extinction (Schoene et al. Science 2015), and renewed speculation that the Chicxulub impact caused a significant increase in Deccan magma effusion rate (Renne et al. Science 2015). Abundant empirical evidence shows that the marine Os isotope ($^{187}Os/^{188}Os$) record is strongly influenced by large impact events and by the emplacement of some large igneous provinces (LIPs), specifically continental flood basalts and oceanic plateaus. Os isotope records from latest Cretaceous (Robinson et al. EPSL 2009) and the across the K-Pg boundary (Ravizza and Vonderhaar Paleoceanography 2012) do not provide evidence supporting intensified magmatic activity at, or immediately above the K-Pg boundary. This interpretation is based upon comparison of the temporal evolution of the K-Pg Os isotope excursion to those associated with other well-documented impact and LIP events. However, unpublished data from the work of Jessica Zaiss (UH MS) on early Paleogene sediments recovered from the Kerguelen Plateau (ODP Site 738) show $^{187}Os/^{188}Os$ ratios that are persistently lower (greater influence of mantle-derived Os) than contemporaneous records from other sites that are geographically farther removed from the Deccan eruptions. While it is tempting to attribute low $^{187}Os/^{188}Os$ ratios at ODP 738 to ongoing Os input to the oceans from Deccan basalts, sparse Os data from other Indian Ocean sites do not lend support to this hypothesis. Although spatial heterogeneity displayed in Paleogene Os isotope records holds potential for placing better geographic constraints on the source(s) of mantle-derived Os to the Paleogene oceans, our limited understanding of the mechanisms responsible for transferring Os from mantle-derived rocks to seawater complicate this effort.

In more general terms, simple comparison of Os isotope excursions that coincide with LIP activity (e.g. Deccan/K-Pg boundary, the Central Atlantic Magmatic Province/Triassic-Jurassic boundary, the Ontong-Java Nui/early Aptian, the Caribbean LIP/ Cenomanian-Turonian boundary and the North Atlantic Igneous Province/ Paleocene-Eocene boundary) make it clear that the Os isotope signature of LIP emplacement is highly variable, requiring multiple processes affecting Os flux to the global ocean. This variability complicates using the marine Os isotope record as a fingerprint of magmatic activity; a line of primary evidence in the sediment record used to correlate environmental changes, for example anoxia or mass extinction, with LIP emplacement.