Os isotope evidence of a causal link between eruption of the Deccan flood basalts and latest Cretaceous warming

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Analyses of South Atlantic DSDP Site 525 yield $^{187}Os/^{188}Os$ ratios that decline by 25%, from 0.55 to 0.4, over a time interval less than 500,000 years. Approximately half of this decline takes place late in magnetochron C30n. The remainder occurs early in magnetochron C29r. This decline in seawater $^{187}Os/^{188}Os$ is correlated with a previously reported excursion in the oxygen isotope composition of benthic foraminifera. This stable isotope record in conjunction with similar data from ODP and DSDP sites in the North Atlantic, Pacific and Southern Oceans indicate a transient warming event of 3-4 C in the latest Cretaceous (Barrera and Savin 1999; Li and Keller 1999; Olsson et al. 2001). Paleotemperature estimates derived from fossil plants from western North America indicate a correlated warming in the terrestrial environment of 5-6 C (Wilf et al. 2003). The duration of the event is approximately 400,000 years and it terminates about 100,000 years prior to the K-T boundary. The simplest interpretation of the Site 525 Os isotope record is that emplacement of the Deccan flood basalts is responsible for the decline in seawater $^{187}Os/^{188}Os$ ratio. A direct implication of this interpretation is that emplacement of the Deccan flood basalts played a causative role in global warming. This has been suggested previously but uncertainties associated with the age of the Deccan are too large to demonstrate timing consistent with a causal link between magmatism and the warning event. The shift in seawater $^{187}Os/^{188}Os$ appears to provide a valuable chemostratigraphic marker of flood basalt volcanism that constrains the major phase of Deccan volcanism more precisely than available radiometric dates. The significance of demonstrating a causal link between Deccan volcanism and the transient warming event is two-fold. First, it indicates that the environmental consequences of Deccan are limited in time and fully resolvable from the K-T extinction event. As one of the largest known flood basalt provinces, this suggests that the environmental consequences of flood basalt volcanism are not in general sufficient to cause mass extinction. Second, the combined duration and magnitude of the warming event documented in the marine and terrestrial realm is larger than predicted by simple climate models of the influence of CO_2 degassing on mean global temperatures.

Production and consumption of atmospheric methyl halides in Irish soil ecosystems

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Several important atmospheric processes, including ozone depletion and aerosol formation have been linked to halogen radicals in the atmosphere. A significant fraction of the halogen radicals in the troposphere and the stratosphere are due to oxidation and photo-oxidation of methyl halide gases. In turn, terrestrial ecosystems appear to be major sources of these gases. We examine three ecosystems in Ireland (peatland, agricultural pastureland, and forest) to explore the influence of various soil constituents on isotopic signatures of atmospheric methyl halides. Here we present the results from soil that has been irradiated and therefore is indicative of physical and chemical processes only. We identify whether these soils are capable of modifying isotopic signatures of overlying ambient air under multiple soil pore water saturation conditions. The effect of a range of temperatures (5-25 degrees C) is also investigated.