Decoding Earth's surface history by osmium isotope records of marine sediments

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We review paleoceanographic investigations based on osmium isotopic (187Os/188Os) records of marine sediments. The 187Os/188Os of seawater varies in response to inputs from three major sources; radiogenic Os from continental crust, unradiogenic Os from extraterrestrial source, and unradiogenic Os from juvenile mantle via mid-ocean ridge or intraplate volcanisms, as well as weathering of ophiolite. In the late Miocene the Mediterranean Sea experienced a salinity crisis at which thick sequences of evaporites precipitated across the deep and marginal basins. Messinian evaporitic sediments of the Mediterranean basins have 187Os/188Os values significantly lower than coeval ocean water, suggesting a limited water exchange between the Mediterranean and the North Atlantic. The source of unradiogenic Os would be derived by weathering of ultramafic rocks (ophiolite) cropping out in the Mediterranean's drainage basins.
Fingerprints of unradiogenic Os from the mantle have also been observed in the Mesozoic marine sediments, in particular middle of Cretaceous, which is characterized by high production rate of large igneous provinces (LIPs) such as Ontong Java, Caribbean and Kerguelen plateaus. Cretaceous marine sediments mark at least twice drastic decreases in 187Os/188Os values; one is at Early Aptian (~120 Ma) occurred simultaneously with Oceanic Anoxic Event (OAE) 1a, and the other is at end-Cenomanian (~94 Ma), coincided with OAE 2. The former is attributed to eruption of Ontong Java Plateau, while the latter is to that of Caribbean Plateau. These coincidences suggest that massive eruption of LIPs could trigger drastic environmental changes resulted in anoxic events.