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Os isotope and PGE evidence for a link between OJP Volcanism and OAE1a event

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Oceanic anoxic events (OAE's) represent global marine deposition of organic carbon-rich sediments attributed by many workers to the emplacement of Large Igneous Provinces [e.g., 1-3]. In particular, the 121-125 Ma eruption of Ontong Java Plateau (OJP) has been linked to OAE1a due to their temporal coincidence [4,5]. Two end-member models, plume vs. bolide impact, are proposed to explain the OJP emplacement: the mantle plume model and the bolide impact model [6]. The Os isotope signature alone is not an unequivocal evidence to discriminate between the two models. Additional evidence to test the models can be derived from the platinum group element (PGE) abundances in sedimentary rocks deposited before and during the OJP emplacement. Sections from the Umbre-Marche Basin (central Italy) containing organic-rich sediments [3], including the $\sim$2-m-thick Selli Level in the type locality in Gorgo a Cerbara, represent an almost complete sequence covering the period before, during, and after the main pulse of OJP volcanism. These sections were sampled and analyzed for Re and Os abundances and Os isotope composition and for platinum group elements (PGEs) to verify, respectively, the connections between eruption of the OJP and Aptian oceanographic and ecological conditions and whether a bolide impact, vs. plume impact, was responsible for the OJP emplacement.

The results showed negative excursions of Os isotope values coincident with the occurrence of the organic-rich sedimentary horizons [7]. These results indicate input of large volumes of unradiogenic Os from the mantle or cosmic sources. However, the PGE data from the same area do not show variation in compositions that can be expected for bolide impact input. There is no Ir anomaly nor a positive correlation between enrichment of PGE and drop to unradiogenic Os isotopic compositions at the base of the organic-rich interval representing OAE1a. These results suggest that the OAE1a event represented by the Selli Level horizon at Gorgo a Cerbara was triggered by a significant amount of mantle input into the marine environment and not by a bolide impact. Highly variable Os/Ir ratios that are uncorrelated with initial 187Os/188Os are very difficult to reconcile with the impact hypothesis. Our Os isotope and PGE data favor a mantle plume origin for the OJP and that the main phase of plateau volcanism triggered the OAE1a event.

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