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Environmental effects of Ontong Java Plateau formation: Implications for chronology, paleoproductivity and anoxia

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The Ontong Java Plateau (OJP) formed ~122 Ma causing a variety of biological, geochemical and climatic responses. High-resolution, multidisciplinary studies of pelagic successions indicate that marine ecosystems were drastically influenced by the thermal and compositional effects of OJP formation as well as by major increases in pCO_2 and fertility.

The early Aptian Oceanic Anoxic Event (OAE)1a correlates with onset of the mid-Cretaceous greenhouse, a time of exceptional warmth with massive burial of organic matter (Selli Level), carbon and strontium isotope anomalies, and major biotic changes. OJP formation is proposed to have introduced excess CO_2 in the ocean/atmosphere system, turning the climate into a super-greenhouse state, accelerating continental weathering and increasing nutrient content in oceanic surface waters via river run-off. However, only coastal eutrophication can be triggered by river input, whereas global productivity can be stimulated by hydrothermal megaplumes, introducing in the oceans high concentrations of dissolved and particulate metals that are biolimiting (and toxic) and, consequently, can trigger large blooms (and deaths) of primary producers.

Calcareous phytoplankton reacted to the new conditions of higher pCO_2 and fertility by drastically reducing calcification. The early Aptian "nannoconid crisis" (ca. 90 % reduction) suggests a 3–6 times increase in CO_2 during emplacement of the OJP and a major nutrification episode.

Abundance spikes of major and trace elements detected within magnetic chron CM0 and the Selli Level correlate with the nannoconid decline and crisis, and the onset of a sharp negative then steadily positive excursion in $\delta^{13}C$. We speculate that before and during OAE1a, higher trophic levels were induced and maintained by hydrothermal inputs of biolimiting metals during OJP construction, that also affected the ocean stratification by warming deep waters, causing more efficient nutrient cycling and de-stabilization of gas hydrates.

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A possible connection between mass extinction and volcanism in the late Early Cambrian

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A continental flood basalt province (CFBP) that crops out in a 1,000,000 km^2 large area in northern Australia has recently been discovered [1]. The basalts in this vast province, named the Kalkarindji CFBP by Glass et al. (this volume), are overlain by Ordian (lowermost Middle Cambrian or uppermost Lower Cambrian) strata, indicating that the eruptions occurred close to the Early–Middle Cambrian boundary, and the late Early Cambrian mass extinction. This age, c. 510 Ma, has recently been confirmed by $^{40}Ar/^{39}Ar$ dating [1]. Not only is this the oldest Phanerozoic LIP discovered, but it may also be the oldest link between LIP and mass extinction.

The late Early Cambrian extinction is believed to have been a double extinction event, one event at c. 515 Ma and a later one at c. 510 [2]. Of the then existing genera, c. 50% became extinct during the late Early Cambrian, which is comparable to the "big five" mass extinctions. The main effect was found amongst reef-building organisms and trilobites. Could the Kalkarindji CFBP have been the culprit? This Cambrian connection provides yet another link between flood basalts and mass extinction, possibly extending the excellent temporal correlation between flood basalts and mass extinctions presented by [3] even deeper in time.

Further information about the Early Cambrian extinction is needed in order to firmly establish if it involves one, two or maybe three events. The chemostratigraphy of biostratigraphically constrained late Early Cambrian sections yield insight into the environmental effects of the Kalkarindji eruptions. We present new Sr, C and O isotopic data from SW Europe [4], Siberia and Australia, which will be compared to published data. A proposed project concerning a further study of this new link between volcanism and mass extinction will also be presented.

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