Multiple eruptions of the Ontong Java Plateau as a trigger of the Cretaceous Oceanic Anoxic Event-1a

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Massive volcanisms associated with the emplacement of large igneous provinces is thought to have had a significant impact on global climate. The Ontong Java Plateau (OJP) is one of the largest expressions of the large igneous provinces which was formed during the Cretaceous, particularly Early Aptian. Although the OJP formation has been proposed as a trigger of Oceanic Anoxic Event (OAE)-1a in the Early Aptian [1, 2], the existence of a linkage between the two events remains a topic of controversy. In this study, we show that multiple eruption events occurred upon the OJP during the Early Aptian, as revealed from analyses of the Pb and Os isotopic records of pelagic sediments from the western Tethys, the deep basin of the central Pacific, and the OJP itself. The sedimentary Os isotopic record shows two negative excursions across the OAE-1a, suggesting repeated inputs of unradiogenic Os from the OJP [2]. Pb isotopic ratios show a shift toward those of OJP rocks before the OAE-1a, corresponding to the first Os isotopic excursion. This finding indicates that a subaerial or explosive subaqueous eruption occurred prior to OAE-1a, supplying unradiogenic Pb and Os over a wide area of ocean. In contrast, the second Os isotopic excursion, synchronous with OAE-1a, is not associated with a Pb isotopic shift, suggesting the non-explosive eruption of the bulk of the basalt within the OJP, releasing a huge amount of Os to the ocean but not Pb. The earlier eruption was associated with a shift in the species composition of marine nannoplankton, which suggests change in water column structure [3]. The second could have triggered oceanic acidification [3], carbon isotopic negative excursion and OAE-1a [1, 2].

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Controls on the strontium flux of the Fly River, Papua New Guinea

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The combined effects of extremely high rainfall (up to 10 m/yr), warm temperatures, and readily erodable and weatherable rocks in Papua New Guinea results in extrodinarily efficient production of weathering derived solutes. The majority of this solute flux reflects recyling of an uplifted Jurrasic-Miocene continental margin sequence. We studied the Fly River as part of NSF'S MARGINS Source-to-Sink intiative, to better understand chemical weathering processes in the basin. Although the Fly alone is not particularly significant in terms of global weathering budgets, it and it's sister rivers (Kikori, Purari) represent a weathering regime that differs from many previously studied systems. Of major world rivers, those draining the island of New Guinea have the highest area-normalized alkalinity, silica and strontium fluxes (Gaillardet *et al*., 1999).

The Fly River system integrates a series of small mountainous rivers to become a major world river that traverses a broad lowland floodplain. Maximum alkalinities (up to 3400 μeq/L) come from upland streams draining carbonates. Maximum Si concentrations (up to 314 μmol/L) are found in upland tributaries draining clastic sediments below the high peaks. In our January, 2007 sampling campaign, fluxes of both alkalinity and silica increase significantly (factor 2-3) in the mainstem Fly as it crosses the lowland floodplain, perhaps indicating that lowland floodplain weathering reactions contribute significantly to the river's dissolved load.

Bedrock $^{87}Sr/^{86}Sr$ ratios in the basin range from 0.703 (Cenozoic volcanics) to 0.708–0.709 (Miocene limestone) to 0.715 (Jurassic mudstone). Fly and Strickland (major tributary) waters have uniform $^{87}Sr/^{86}Sr$ ratios of 0.70833–0.70839 (±0.00002). Highland tributaries (0.70808–0.70862) have similar $^{87}Sr/^{86}Sr$ ratios to the main stem of the Fly River, while lowland tributaries (0.70720–0.70814) have significantly lower ratios. These observations suggest that virtually the entire Sr load, and up to 90% of the river's alkalinity, comes from dissolution of Miocene limestone. Therefore, despite the efficiency of weathering here, much of the river's solute load may be insignificant in terms of long-term CO_2 sequestration. The Fly has among the least radiogenic $^{87}Sr/^{86}Sr$ ratios of major world rivers, slighly lower than modern seawater. The Sr flux from the Fly and similar rivers acts as a buffer on the global ocean's $^{87}Sr/^{86}Sr$, counteracting the more radiogenic flux from most rivers.