Chemical proxies of biological production in the Equatorial Pacific Ocean: Targeting paleoceanographic changes of the past 12 Ma

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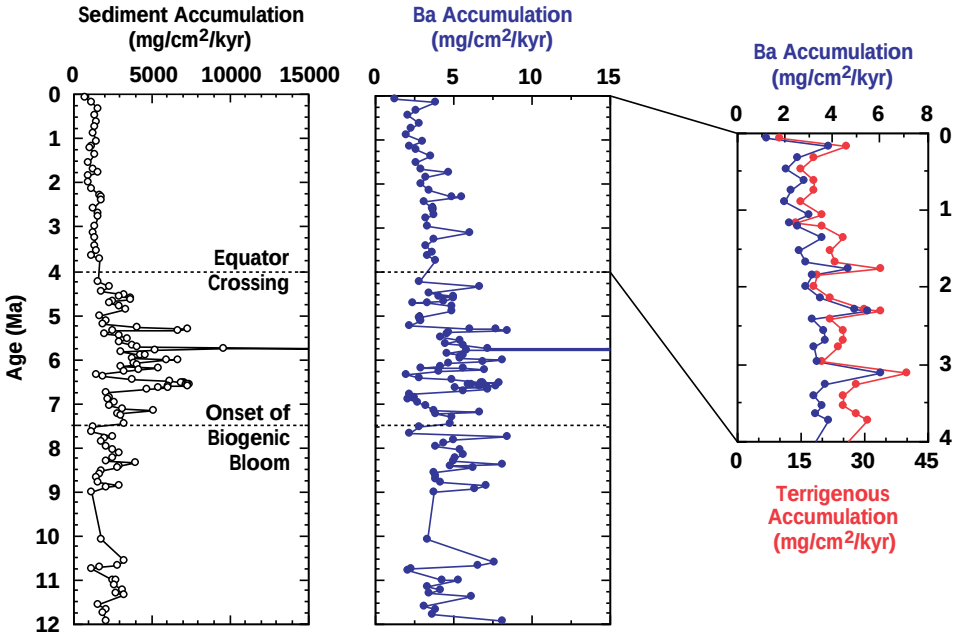
Quantifying the long-term transport of biogenically-produced calcium carbonate, opal, and organic matter to the seafloor is critically important to understanding the "biologic pump" that exports carbon from surface to deep water. Due to the diagenetically reactive nature of these biogenic constituents, however, much effort is devoted towards developing chemical proxies of their accumulation. One of the most promising proxies is Ba, itself a proxy of barite ($BaSO_4$), formation of which in modern environments has been shown to be intimately related to settling biogenic matter. The precise mechanisms of Ba incorporation into marine sediment remain unclear, however; the competing pathways of biogenic, terrigenous, and hydrothermal sources in particular need to be further unraveled.

To examine these pathways, we have studied chemical deposition over the past ~12 Ma at Site 850. Formed along the East Pacific Rise at 1-2°S and now located at 1.3°N, during its northwesterly tectonic migration the site crossed the Equator ~4 Ma and has experienced large variations in hydrothermal input and terrigenous accumulation. Our results demonstrate that in addition to the biogenic control on Ba accumulation, associations with terrigenous matter and Fe-oxides are important, and through some intervals indeed are dominant. The link between Ba accumulation and export production may be obscured by changes in sedimentary particle composition, and the non-barite elemental Ba inventory complicates using Ba as a proxy for barite. Thus, additional research targeting this Ba inventory is needed to develop a quantitative understanding of past variations in export production.



Downcore variation in bulk sediment accumulation, Ba accumulation, and, for the last 4 Ma, terrigenous accumulation at ODP Site 850 in the equatorial Pacific Ocean. Considering the entire sequence, Ba accumulation broadly follows the bulk sediment accumulation (r^2 ~0.5), and both show high values and similar distribution through the biogenic bloom from 7.5 Ma to 4.0 Ma. However, from 0-4 Ma, which includes deposition in the northern hemisphere where windblown terrigenous inputs are important, the accumulation of Ba and of terrigenous matter are most closely correlated (r^2 ~0.9).