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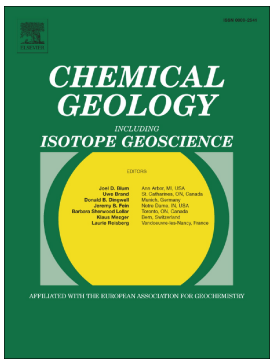

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Testing the utility of geochemical proxies for paleoproductivity in oxic sedimentary marine settings of the Gulf of Aqaba, Red Sea

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Abstract

During the early stages of sediment diagenesis most of the organic matter reoxidizes, leaving behind a residual fraction of organic carbon which does not typically reflect its original quantities. Paleo-productivity reconstructions are therefore based on changes in the chemical composition of carbonate shells or, alternatively, use the abundances of inorganic elements in the bulk sediments, that have been shown to be proxies for organic matter contents. To examine the applicability of bulk inorganic elements composition for this task, we compare recorded changes in known anthropogenic nutrient fluxes to the oligotrophic and oxygenated Gulf of Aqaba in the north Red Sea, with the sedimentary records of barium, cadmium, copper and nickel over the last decades. Among these elements, nickel and copper strongly correlate with recorded nutrient fluxes and primary productivity in the region. In the present case, nickel is a more reliable proxy since part of the copper is possibly contributed from air-borne pollution sources. The applicability of cadmium to serve as a tracer for nutrient additions could not be reliably tested because contribution of cadmium associated with phosphate ore loading in the adjacent ports may be significant. We do not observe any bulk sediment barium enrichments associated with increased nutrient fluxes. Overall, it appears from these correlations that nickel and probably also copper reliably record past changes in nutrient availability and organic matter fluxes while sedimentary barium and barite, which are commonly attributed to productivity, do not.

Highlights

1. Historical nutrient fluxes were compared with sedimentary trace metal content.
2. Nickel fluxes to the sediment strongly correlate with nutrient fluxes, suggesting it may be a solid proxy of productivity.
3. Sedimentary copper concentrations increased due to increased productivity and partially due to local pollution sources.
4. Sedimentary cadmium levels increased due to phosphate ore loading in the adjacent ports.
5. Sedimentary barium accumulation was not affected by changes in nutrient fluxes.