Major and trace element settling and burial fluxes in the Gulf of Aqaba, northern Red Sea

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The composition of particles sinking through oceanic water columns changes with depth, reflecting the combined effect of their initial composition, dissolution and scavenging, precipitation of authigenic minerals, and composition of surrounding seawater.

We present a record of major and trace element fluxes in settling particles from the oligotrophic Gulf of Aqaba (GOA), northern Red Sea. The observations are based on a sediment trap array deployed along a 610 m deep water column that has been collecting marine particles at a coupled daily- and monthly- resolution since 2014. The elemental composition of sediment trap samples is characterized and compared with the geochemical composition of local atmospheric dust and bottom sediments, to (a) deconvolve the sources and sinks in the water column as well as the impacts of biological uptake and regeneration, and (b) characterize the temporal variations in vertical trace element flux patterns and evaluate the remineralizations rates across the annual cycle.

Elemental fluxes show two dominant seasonal patterns. The first is controlled by the annual stratification and mixing of the water column that drives winter and spring primary production, reflected by the enrichment of Cd, Ba, Zn, Cr, Sr, Ca, U, and Pb in surface particles. These elements are then gradually leached into seawater with depth. By contrast, abrupt winter sediment resuspension events are reflected by a strong enrichment of Al, Mg, Ti, Nb, Th and rare earth elements in the deep particle flux.

The seasonal differences in elemental vertical attenutation rates are quantified and discussed in the context of biogenic and lithogenic mineral fluxes, as well as organic C and N fluxes, and further compared with core-top elemental burial rates.

We further discuss the perturbations of major and trace element fluxes in response to daily-timescale events such as dust storms, bottom resuspension and rare flash floods.