Biogenic baryte trapped and sedimented fluxes in the Tropical Atlantic (EUMELI Sites): controls of the baryte dissolved/particulate exchanges and their bearing on the palaeoproductivity proxy

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Objectives

An empirical relationship between baryte fluxes and export production have been proposed by François *et al.* (1995). This relationship can be used to reconstruct oceanic palaeoproductivities only if i) it is valid under different oceanic environments and ii) the sedimented-baryte signal is well preserved. The synthesis of baryte in surface water is biologically mediated whereas baryte dissolution at depth depends on thermodynamic conditions (Jeandel *et al.*, 1996). In addition, preservation of baryte in sediments depends on the redox conditions prevailing in the sediments (McManus *et al*, 1996).

In this work, we compare exported carbon flux deduced from baryte flux in trapped material with the measured exported production and with sediment data originating from the same locations. Trapped material and sediments were collected offshore Mauritania during EUMELI program (**EU**trophic, **ME**sotrophic and o**LI**gotrophic sites). Both productivity and dust input decrease drastically from the eutrophic (E-site) to the oligotrophic site (O-site). In addition, redox conditions change from the eutrophic site (anoxic sediments) to the oligotrophic site (oxic sediments).

Main results

Time series of Ba-baryte fluxes were determined at both the M-and O-sites (2500 m depth, Feb. to Oct 1991). The Particulate Organic Carbon flux to baryte flux ratio (POC/Ba) shows seasonal variations of a factor of 10 at the M-site, whereas it stays constant around a value of 100 at the O-site. Exported production of carbon calculated from the baryte flux using François's relationship ranges between 5 and 40 $gC/m^2/y$ at the M-site, that is 10 to 18% the primary production measured at the same location during 2 cruises (fall 1991 and spring 1992). At the O-site, calculated exported production ranges between 0.5 and 3 $gC/m^2/y$, that is 1 to 3% the measured primary production. These estimations of exported production yield lower values than those based on the POC flux, mostly at the M-site: validity of empirical relationships based on Ba on one hand (François *et al*, 1995) and on POC on the other hand (Sarnthein *et al*, 1988) are discussed.

Some of the estimated exported C fluxes can be compared to direct measurement (by the analysis of drifting trap samples collected at 200 m during the 2 cruises of spring and fall). Both set of values are in good agreement, which validates the François's relationship for the present-day ocean. Determination of the accumulation rate of baryte in the sediment is underway and will complete this description of baryte fluxes. Its preservation in the Tropical Atlantic sediment will be discussed in terms of biotic processes (role of the microbial diagenesis) and thermodynamic ones (saturation of the dissolved baryte). This work improves our understanding of the role of baryte as a proxy for palaeoproductivity.

References

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