Preservation of labile organic matter over sediments of the Amazon shelf: the case of polar lipids

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Land-water interface zones occupy around 8% of the surface of the planet and they strongly influence the transport and storage of organic matter (OM) into the marine realm. Of these, estuaries and deltas situated in the wet tropics are the most important in terms of inputs. The Amazon River has the highest water discharge, corresponding to 15–20% of all fresh-water inputs to the ocean, and the third highest sediment delivery. Even though only about 25% of the fluvial particulate OM delivered by the Amazon is buried on the continental shelf, terrestrial organic carbon seems to predominate for over more than 400 km from the mouth to the northwest (Showers and Angle, 1986). The bulk of this fluvial OM is associated with highly degraded soil particles. In order to investigate allochthonic and autochthonic OM accumulating in this major depository system, the spatial occurrences and distributions of sterols and *n*-alkanols were determined. These compounds were chosen because of (1) their labile nature, and (2) their production by both marine and continental biosynthetic processes. For this study, 15 surficial sediments were collected during the AmasSeds project (A Multidisciplinary Amazon Shelf SEDiment Study), in November 1991, from the mouth of the Amazon at the Equator to around 4°N latitude (Fig. 1).

Results and discussion

In order to determine the distribution of polar lipids over the shelf, four different zones were distinguished: the river mouth zone (RMZ), the foreset-bottomset zone (FBZ), the open shelf zone (OSZ) and the northern zone (NZ) (Fig. 1).

In all zones polar lipid concentrations were extremely low (Fig. 2), possibly due to the co-oxidation of terrestrial matter and reactive autochthonic material, triggered by frequent changes in redox conditions and strong tidal currents (DeMaster *et al.*, 1983; Aller *et al.*, 1996). The RMZ was characterized by low concentrations (Fig. 2). These decreased further in the FBZ where the deepest water column is associated with strong advective currents bypassing the tip of a seaward shoal. The combination of higher marine primary productivity and fluid mud deposition would account for the bulk of polar lipid sedimentation in the outer OSZ. The lipid concentrations decreased again in the NZ. Overall, the main polar lipids accumulating on the shelf were of terrestrial origin. These included even carbon numbered high molecular weight alkanols (>C_{24}) and C_{29} sterols. However, the higher sedimentation rates towards the outer edge of the modern mud deposit encompassed a greater proportion of authigenic compounds.

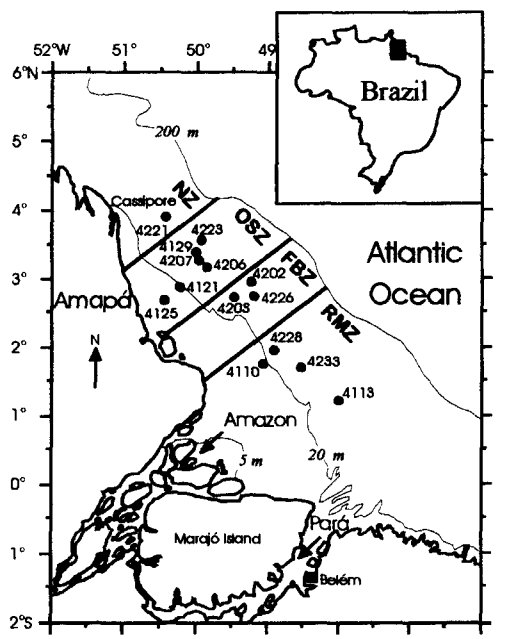

FIG. 1. Sampling locations along the river mouth zone (RMZ), foreset-bottomset zone (FBZ), open shelf zone (OSZ) and northern zone (NZ) of the Amazon shelf.

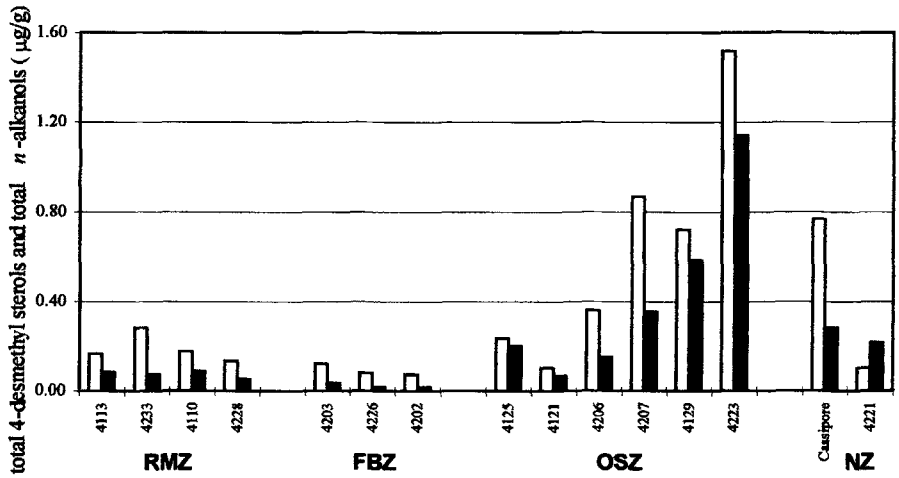

FIG. 2. Distribution of total 4-desmethyl sterols (□) and *n*-alkanols (■) in µg/g in sediments from different zones of the Amazon Shelf (RMZ, FBZ, OSZ and NZ; for abbreviations see Fig. 1).

Conclusions

Even though the Amazon River is a main source of nutrients and terrestrial matter to the world ocean, sedimentary polar lipids were found in low concentrations on the adjacent continental shelf. This is probably due to the rapid remineralization processes occurring in this highly energetic coastal area. Preservation of both terrestrial and marine compounds is therefore low, which implies that the labile fraction delivered by tropical rivers, such as the Amazon, might be less important than previously expected.

References

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