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Palynofacies and foraminifera as hidrodynamic indicators of Araguari estuary, Amazon coast, Amapá-Brazil

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The Araguari estuary is located in northern Brazil at the Amazon mouth and subjected to macrotidal regime. The larger tide amplitude of 5m promotes the development of tidal bore waves, locally known as "pororoca". The tidal bore entering the estuary causes strong upriver currents that can reach up to 45 km inland. Because of the macrotidal regime this estuary has a different dynamic than those proposed for traditional estuary models. The distribution of particulate organic matter (POM) is useful method to characterize the environments and distribution pattern of foraminifera and thecamoebians as bioindicators of ecological, sedimentological, and physical-chemical parameters.

In April 2005, samples were collected in 16 stations along the Araguari River with 7 km spacing between them. Sample preparation was based on non-oxidative palynological procedures (Tyson, 1995). The foraminifera sample preparation was carried out according to Boltovskoy (1965). Cluster analyses by R- and Q-mode based on relative abundance and composition of POM and foraminifera and thecamoebians were employed. Fourteen types of POM and 28 species of foraminifera and thecamoebians were identified. No Devonian rocks were recorded near the Araguari River, but 4 genera and one species of Devonian acritarchs were recorded.

Four assemblages of POM were revealed by R-mode analysis:
I. fresh-water algae, pollen and spores,
II. opaque and translucent phytoclasts;
III. spores and hyphae of fungi, foraminiferal linings and dinoflagellates and;
IV. cuticle, translucent phytoclast membrane and amorphous organic matters.

In addition, four assemblages were also revealed by the foraminifera and thecamoebians:

1) only thecamoebian;
2) thecamoebian and *M. fusca*;
3) *Difflugia* spp and foraminifera species of brackish water: *H. wilberti* and *A. mexicana;*
4) foraminifera species of salt and brackish waters: *Bolivina* spp. *Q. Lamarkiana, P. hipoalina* and *S. sphaerica.*

By mode-Q five groups were revealed:

A. stations 11, 13, 15 and 16,
B. 07 and 05;
C. 06 and 12;
D. 02, 04, 08, 09 and 14 and
E. 01, 03 and 10.

The integration of the both mode suggests that the Group A (stations 11, 13, 15 and 16) has high abundance of assemblages IV and 3, the Assemblage 4 occurs only in these samples. The Group B (stations 07 and 05) shows a high abundance of assemblages II and 3. The Group C (stations 06 and 12) shows high abundance of Assemblage I and no foraminifera recorded. Group D (stations 02, 04, 08, 09 and 14) shows the same characteristics as Group C. Finally, the Group E (stations 01, 03 and 10) shows high abundance of assemblages I, II, III, 2 and 1. We conclude that Group A indicates a zone near the river mouth where there is a significant deposition of components of salt and brackish waters, suggested by the punctual presence of dinocysts and foraminifers species of salt and brackish waters. Groups B, C and D indicate a zone characterized by the discontinuous presence of foraminifers and thecamoebians, and the innermost boundary of acritarchs deposition. This revealed a mixed zone of fresh and brackish waters and the acritarchs show the influence of sediments from Amazon River. The third zone represented by Group E, is only influenced by fluvial deposition as suggested by the presence of thecamoebians, pollen and spores.