NEOPROTEROZOIC FOSSILS OF THE PARAGUAI BELT, BRAZIL

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The fossil record has contributed significantly to increased biostratigraphic resolution in Neoproterozoic successions and offers important insights on the history of life in the Precambrian (Knoll, 1996). However, in Brazil, studies with this focus are still scarce (Fairchild *et al.*, 1996, 2000; Simonetti & Fairchild, 2000; Hidalgo *et al.*, 2001). Recently obtained paleontological data from carbonate successions along the southeastern border of the Amazon Craton furnish an initial biostratigraphic framework as well as complementary elements for understanding the Neoproterozoic paleogeographic and paleoenvironmental evolution of this region.

Brazilian Neoproterozoic sediments are well preserved in the Paraguai Belt, especially in the Corumbá Group (MS), as well as in the Araras Group near Cáceres and Mirassol d'Oeste (MT), Brazil. Examination of 282 slides of palynological residues from dark colored siltstones, shales, marls, and limestones of the Tamengo Formation and from dark colored siltstones and shales of the overlying Guaicurus Formation of the Corumbá Group in the southern Paraguai Belt revealed identifiable microfossils only in the Tamengo Formation: i) *Bavlinella faveolata*, previously described by Zaine (1991); ii) *Eoentophysalis croxfordii;* iii) *Siphonophycus* sp.*;* iv) *Helicothricoides waltheri;* and v) *Leiosphaeridia crassa*. Analysis of 52 slides of palynological residues from dolostones, limestones, and cherts of the Araras Group from the northern Paraguai Belt identified: i) *Bavlinella faveolata;* ii) *Soldadophycus bossii;* iii) *Leiosphaeridia* sp.*;* iv) *Siphonophycus* spp.*;* v) *Symplassophaeridium* sp.; and vi) possible microremains of complex eukaryotes. Although microfossils were not observed in the Guaicurus Formation at the top of the Corumbá Group, several biostratigraphically significant fossils of small multicellular organisms are present: i) the problable algae *Eoholynia mosquensis;* and ii) *Enteromorphites siniansis*, as well as enigmatic, possible remains of metazoans.

Several lines of geological and paleontological evidence suggest that the Corumbá and Araras groups are correlatable: i) the occurrence of cap dolomites at the base of both groups, generally overlying regional Varanger-age glacial deposits (Boggiani, 1997; Nogueira *et al.*, this volume); ii) similar evolution of carbonate depositional environments, predominantly deep platform (Boggiani, 1997; Nogueira *et al.*, this volume); and iii) the common presence of microfossils, such as *Bavlinella faveolata*, a post-Varanger microfossil. This evidence suggests penecontemporaneous deposition of the Corumbá and Araras groups and supports the hypothesis of the physical continuity of northern and southern Neoproterozoic Paraguai Belt segments. Gaucher *et al.* (1996), based on their stratigraphic and paleontological analysis of the Neoproterozoic Arroyo del Soldado Group, would extend this belt all the way to Uruguay. The identification of the biota of the Neoproterozoic carbonate successions of the Paraguai Belt contributes to our understanding of Earth's pre-Phanerozoic evolution of the southeastern part of the Amazon Craton and initiates a new phase in the investigation of Precambrian microfossils in South America.

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SEQUENCE STRATIGRAPHY AS A TOOL FOR VERTEBRATE TAPHONOMY - AN EXAMPLE FROM A LATE CRETACEOUS DINOSAUR TAPHOCOENOSIS FROM SÃO LUIS BASIN, NORTHERN BRAZIL

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The advent of sequence stratigraphy - the geoscience that divides the infill of a sedimentary basin into genetic packages generated by discrete base level variations - revitalized and modified the traditional way in describing and interpreting the sedimentary record of a basin. As the processes and events that produce fossil accumulations are essentially the same as those that control the formation of the enclosing sedimentary deposit, the taphonomic analysis has to be closely related to stratigraphic analysis. Only by fully understanding the stratigraphic framework and the processes that acted during its genesis one can practice paleontology in an adequate and secure manner. This has been applied to the taphonomic analysis of a nationally renowned dinosaur occurrence in Northern Brazil, called the *Lage do Coringa* outcrop on Cajual Island in São Marcos Bay, close to the town of Alcântara (Fig. 1). The outcrop belongs to the Upper Cretaceous succession of the São Luis Basin (Alcântara Formation), and is made of conglomerate of both litho and bioclasts.

The up to 10 cm large lithoclasts are made of quartz, metamorphic and igneous rocks, with a sandy matrix, while the bioclasts consist of subrounded to rounded vertebrate fragments, some reaching 20 cm in length. Thin-section analysis has revealed fine-grained bioclasts and even "bone flour" mixed within the lithic matrix. The fossils are sauropod and teropod dinosaurs, but some aquatic organisms (*e.g.*, shark) are also represented in the taphocoenosis. The fossil-bearing conglomerates form up to 10 cm thick levels within a succession of cross-bedded sandstone, which has been interpreted as fluvial in the past, due to the trough and planar cross bedding of the sandy lithofacies and due to the terrestrial characteristics of its fossils. However, careful examination of the outcrops (Fig. 2) and the lithofacies succession within the area of the Lage do Coringa has led to an alternative interpretation.

In the studied interval two main facies associations were recognized: (1) stratified sandstone, showing parallel, tangential and swaley cross bedding, interpreted as tidal sand bars of a flood tidal delta complex; and (2) a rhythmic sandstone/mudstone facies recording subtidal bayfill.

The fossiliferous conglomerate levels occur at the base of the sandstone. There are at least three of these levels in the studied interval, one being the Laje do Coringa outcrop. The other two occur at a cliff section located nearby.

Due to the type of lithofacies and to the macroform progradation (towards south-southwest), the studied interval is interpreted as a retrogradational flood tidal delta within a lagoonal estuary complex (Fig. 3). The vertebrate taphocoenosis was preserved during a transgression and must be alocthonous. There are several evidences for intense transport and reworking of the vertebrate fossils: (1) mixture of lifeforms from different habitats; (2) different degrees of breakage, including cm-sized bone fragments to intensely triturated bone elements ("bone flour"); (3) abrasion even on large-sized elements, evidenced by rounded surfaces on the dinosaur bones; and (4) hydraulic selection of bone elements (there are no skulls nor mandibles, the less transportable elements of a vertebrate skeleton). This line of evidence indicates that the terrestrial fossils are the result of intense transport, coming from far away to the site where they were finally buried and fossilized. This indicates that there must have been, in the study area, several significant base-level falls, when the deposits with dinosaur bones became above base level and were eroded and transported towards the lowstand shoreline (Figs. 4A and 4B). During the subsequent transgression, these deposits were reworked by waves and tidal currents (Fig. 4C) and therefore transformed into a chaotic fossil-bearing conglomerate, which is preserved at the base of the southwestwards migrating flood tidal deltas. Insofar, the fossiliferous conglomerates are marking the onset of the transgressive pulses and are conceptually erosive transgressive surfaces.