

THE OLDEST FOSSILS FROM PARAGUAY: CLOUDINA - CORUMBELLA ASSEMBLAGE IN THE ITAPUCUMI GROUP, EDIACARAN

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ABSTRACT

Molds, fragments, and complete specimens of *Cloudina lucianoi*, as well as fragments of *Corumbella werneri*, stratiform stromatolites and thrombolites were found in carbonate rocks of the Itapucumi Group, in Paraguay. The assemblage described here corresponds to the oldest fossil record found in this country and figures as one of the most complete Ediacaran metazoan occurrences in South America. The association is comparable to other latest Neoproterozoic occurrences worldwide, and comprises an important discovery for elucidating the diversity and distribution of shelled organisms in the late Ediacaran.

Keywords: Ediacaran, Metazoan, Paraguay

RESUMO

Rochas carbonáticas do Grupo Itapucumi, Paraguai Oriental, contêm fósseis de moldes, fragmentos e espécimes completos de *Cloudina lucianoi*, fragmentos do organismo *Corumbella werneri*, estromatólitos estratiformes e trombólitos. A assembleia aqui descrita corresponde ao mais antigo registro fóssil encontrado neste país e figura como uma das mais completas ocorrências de metazoários ediacaranos na América do Sul. Esta associação pode ser comparada com outras ocorrências neoproterozoicas ao redor do mundo e constitui importante descoberta para a compreensão da diversidade e distribuição dos organismos esqueléticos do final do Ediacarano.

Palavras-chave: Ediacarano, Metazoários, Paraguai

INTRODUÇÃO

The end of the Neoproterozoic Era is marked by important climatic, tectonic and evolutionary events (Hoffman *et al.*, 1998;

Hoffman & Schrag, 2002). The appearance of soft-bodied metazoans and the advent of the earliest skeletal organisms significantly changed the ecological dynamics of Ediacaran environments. Within this context, *Cloudina* is considered the most important guide fossil of Ediacaran time as it delimits an interval biozone between 548 and 542 Ma at the very top of the Proterozoic record (Grotzinger *et al.*, 1995; Amthor *et al.*, 2003). In the Itapucumi Group, Paraguay, *Cloudina* was first described in float samples by Boggiani & Gaucher (2004). The discovery of new outcrops containing this and other fossils, such as *Corumbella*, allowed correlation of these occurrences with similar assemblages from Namibia, Brazil, Oman, Canada and China (Germs, 1972; Zaine & Fairchild, 1985; Conway-Morris *et al.*, 1990; Hoffman & Mountjoy, 2001). The occurrence of these archaic skeletal organisms and microbialites in Paraguay opens a new window for research on the paleobiology and paleogeography of late Neoproterozoic successions in South America.

GEOLOGICAL SETTING

The Itapucumi Group crops out in northeastern Paraguay as a marginal thrust-and-fold belt and a sedimentary cover of the Rio Apa Block (Fig. 1.1). The Rio Apa Block is delimited on the east by the Paraguay Belt, a W-vergent thrust-and-fold belt involving the Ediacaran successions of the Corumbá Group. The Itapucumi Group is about 400 m thick and comprises siliciclastic rocks of the Vallemi Formation at the base, followed by limestones and dolomites of the Camba Jhopo and Tagatiya Guazu Formations, and marls and mudstones of the Cerro Curuzu Formation at its top (Warren, 2011). Close to the Paraguay River, to the west, the Itapucumi Group is metamorphosed at the greenschist facies and intensely deformed. This Western Domain of the Itapucumi Group is characterized by shelf successions of ooid-grainstones of

the Camba Jhopo Formation, deposited as beach spits and proximal coastal facies. To the east, rocks of the Tagatiya Guazu Formation comprise inter- to supratidal facies associated with stratiform stromatolites and thrombolites containing fossils of *Cloudina* and *Corumbella* (Fig. 1.2). This sedimentary succession is made up of calcareous facies bearing massive, laminated and cross-stratified grainstones, followed by heterolithic (calcareous) mudstone/grainstone facies, mudstones, laminated microbial mats, domical thrombolites (Fig. 1.3) and subaerial desiccation breccias. This facies association suggests deposition in a peritidal evaporitic lagoonal environment upon a protected carbonate platform.

EDIACARAN FOSSILS

Fossils of the Itapucumi Group include abundant fragments and nearly complete specimens of *Cloudina lucianoi* and short segments of *Corumbella wernerii*. The succession of nested, eccentrically emplaced, ring-like wall segments observed in some specimens is typical of the genus *Cloudina* Germs 1972. *Cloudina* shells may occur in thin accumulations (Fig. 1.4) in troughs between low-amplitude, wave-generated ripples, and surrounding thrombolitic domes. *Cloudina* also occurs in very fine grainstone as fragments and as prostrate, relatively complete individuals (Fig. 1.5), together with in-place basal portions of shells between thrombolitic domes. *Corumbella* is recorded as parautochthonous fragments and disarticulated segments along with fragments of *Cloudina* shells, a preservational pattern recorded by previous authors (Zaine 1991), but very rare, in the Tamengo Formation, Corumbá Group, Brazil. The specimens of *Corumbella* in the Itapucumi Group occur as flattened fragments of tubes, consisting of articulated, probably organic annular elements (Fig. 1.6). *Cloudina* and *Corumbella* fossils were preserved in place or very nearly so in obrution deposits when unconfined suspended lime mud and fine calcareous sand flowed into protected areas as overwash fans. The differences observed in abundance and biostratigraphic signatures in the fossil assemblages of the Itapucumi Group reflect differences in both habitat preference - protected carbonate settings for *Cloudina* and shaley settings for *Corumbella wernerii*, and in the taphonomic response of the

relatively rigid shells of *Cloudina* and the more flexible ones in *Corumbella*.

CONCLUSION

The discovery of *Cloudina* and *Corumbella* fragments in the Itapucumi Group corroborates findings of similar associations around the world and expands significantly our knowledge on the depositional setting and composition of Ediacaran-age shelly metazoan assemblages. The discovery also expands the geographic range of *Corumbella* outside its type-area of Corumbá, Brazil. Moreover, it bears important paleogeographic implications for carbonate platforms in the very early history of western Gondwana. Thus, the Itapucumi Group represents a potential landmark deposit in the paleontology of the latest Neoproterozoic of South America.

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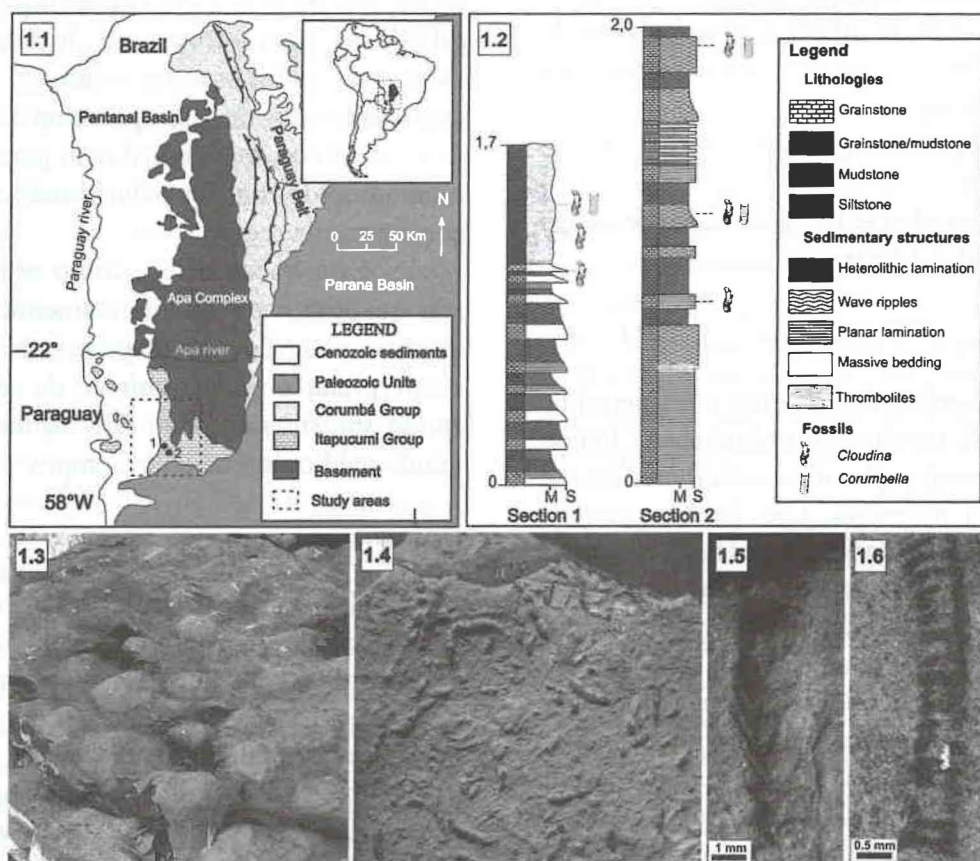


Figure 1. Location, stratigraphy and fossils from the Ediacaran-age Itapucumi Group, northeastern Paraguay. 1.1, Location map. 1.2, Stratigraphic sections. 1.3, Shell concentration of *Cloudinalucianoi*. 1.4, *Domical thrombolites*. 1.5, Close-up view of *Cloudina lucianoi* showing cone-in-cone arrangement. 1.6, Fragment of *Corumbella wernerii*.