

# SYSTEMATIC REVISION AND PROVINCIAL AFFINITIES OF THE RIO DA AREIA BIVALVE FAUNA, RIO DO SUL FORMATION (ITARARÉ GROUP, LOWER PERMIAN): SOME PRELIMINARY RESULTS

Jacqueline Peixoto Neves<sup>1</sup> (nevesjp.unesp@gmail.com), Marcello Guimarães Simões<sup>1</sup> (btsimoes@ibb.unesp.br), Luiz Eduardo Anelli<sup>2</sup> (anelli@usp.br)

<sup>1</sup>Universidade Estadual Paulista, IGCE-UNESP/Rio Claro e Universidade Estadual Paulista, IBB-UNESP/Botucatu; <sup>2</sup>Universidade de São Paulo, Instituto de Geociências -São Paulo

## ABSTRACT

The Rio da Areia bivalve fauna at the top of the Rio do Sul Formation, Itararé Group, Teixeira Soares Municipality, Paraná State, is here revised. At least seven species were tentatively identified: *Volsellina* sp., *Pleurophorella* sp., *Leptodesma* (*Leptodesma*) sp., *Selenimyalina?* sp., *Myalina* (*Myalinella*) sp., *Atomodesma* (*Aphanaia*) sp., and *Aviculopecten* (or *Hillaepecten*) multiscalptus. This bivalve fauna shows general affinities with those of the Amotape Mountains, Tarma Group, Middle Pennsylvanian, Peru, and the Bonete Formation, Sauce Grande Basin, Lower Permian, eastern Argentina. However, even though these basins are very close, our results demonstrate that there are no evidences of marine connection between them. Hence, the faunas may be contemporaneous but do not have species in common. Indeed, *Eurydesma* and other conspicuous members of the Bonete Formation were not recorded in the Rio do Sul Formation yet.

**Keywords:** Bivalve, Systematic, Permian

## RESUMO

A fauna de bivalves do topo da Formação Rio do Sul, Grupo Itararé, Teixeira Soares, Paraná, é aqui revisada. Até o momento, sete espécies foram tentativamente identificadas: *Volsellina* sp., *Pleurophorella* sp., *Leptodesma* (*Leptodesma*) sp., *Selenimyalina?* sp., *Myalina* (*Myalinella*) sp., *Atomodesma* (*Aphanaia*) sp., e *Aviculopecten* (ou *Hillaepecten*) multiscalptus. A fauna mostra afinidades com as das Montanhas Amotape, Grupo Tarma, Pensilvaniano Médio, Peru, e da Formação Bonete, Bacia Sauce Grande, Permiano Inferior, leste da Argentina. Entretanto, mesmo havendo grande proximidade entre essas bacias, os resultados demonstram que não há evidências de conexão marinha entre elas. Portanto, as faunas

podem ser contemporâneas, mas não apresentam espécies em comum. De fato, *Eurydesma* e outros elementos conspícuos da Formação Bonete ainda não foram registrados na Formação Rio do Sul.

**Palavras-chave:** Bivalve, Sistemática, Permiano

## INTRODUCTION

Contrary to Argentina, where thick Lower Carboniferous up to Permian sequences yield abundant fossiliferous occurrences (González & Saraíva, 2010; Pagani & Taboada, 2010), coeval assemblages in the Brazilian portion of the huge, intracratonic Paraná Basin are rare and poorly diversified (Rocha-Campos & Rösler, 1978; Simões *et al.*, 1998). In the last decade, various papers on the marine invertebrate faunas of the Gondwana succession of Argentina were published. Thus, there were recent advances in our understandings of the paleobiogeography and biostratigraphy of those faunas with obvious biostratigraphic and paleobiogeographic implications (see Pagani and Taboada, 2010). Despite of this, the use of the Late Paleozoic marine invertebrate faunas of South America to regional scale correlations, especially among the records of the intraplate basins (i.e., Paraná, Chaco-Paraná, Sauce Grande-Colorado basins) is limited, since many of the Brazilian faunas remain undescribed and/or poorly described or illustrated. Among those faunas, the assemblages of "Rio da Areia" sandstone, "Baitaca" siltstone, and "Passinho" shale, all informal names (see Simões *et al.*, 1998), in the upper most portion of the Itararé Group are of particular interest to regional correlations. These assemblages are associated to a short transgressive-regressive episode at the end of the Late Paleozoic glaciation in the Paraná Basin (Simões *et al.*, 1998), recording the first appearance of typical Gondwanan marine



bivalves in the basin (Rocha-Campos and Rösler, 1978; Simões *et al.*, 1998).

## AIMS AND SCOPE

Although known since the pioneer work of Lange (1944), the bivalves assemblages mentioned above were poorly studied and a high number of undescribed/unidentified species exist in the literature. In reality, since Rocha-Campos (1969) most of data available appears only in taxonomic check-lists (i.e., Rocha-Campos and Rösler, 1978). Therefore, the aim of the present contribution is threefold: first, to describe the fauna of "Rio da Areia" sandstone of the Rio do Sul Formation; second, to add new palaeobiogeographic and biostratigraphic information to Late Paleozoic bivalves of western Gondwana, and third, to encourage colleagues working in the Itararé Group in different areas of Paraná Basin, to collect further material or search for new occurrences.

## GEOLOGICAL SETTING AND MATERIAL AND METHODS

The fossil material amassed in two Brazilian public scientific collections, namely (a) Institute of Geosciences/USP, São Paulo, SP, and (b) Institute of Biosciences, São Paulo State University-IBB/UNESP, Botucatu, SP, is herein analyzed. Additionally, new fossils were collected by the authors during the 2010 (IBB-UNESP/IGC-USP) exploring expedition into Teixeira Soares region, Paraná State. The main locality explored was the Rio da Areia fossil site (50°23'24"W, 25°27'49"S), 14 km SE from Teixeira Soares, and just along the Rio da Areia stream margins (Fig. 1). This is the same locality where the geologist F.W. Lange found the marine fauna, in 1944. The fauna is recorded in a 2 meters thick sandy interval at the top of the Rio do Sul Formation. The fossil-bearing sandstone beds are transitionally succeeded by siltstones and shales, indicating a transgressive event. Most of the shells are represented by internal and external moulds and then latex casts, plus plasticine moulds were prepared for all shells.

## RESULTS

Table 1, below, summarizes the results gathered by our taxonomic study and provides an overview of the taxonomic names applied to the bivalves by distinct authors. At least seven species were recorded, three of them [*Volsellina* sp., *Pleurophorella* sp., *Leptodesma* (*Leptodesma*) sp.] may be new. The other species are *Selenimyalina*? sp., *Myalina* (*Myalinella*) sp., *Atomodesma* (*Aphanaia*) sp., and *Aviculopecten* (or *Hillaepecten*) *multiscalptus*. The fauna is dominated by epifaunal, sessile, suspension feeding Pterioda bivalves, with subordinated infaunal, shallow burrower anomalodesmatans.

## CONCLUSION

Rocha-Campos (1969) and Rocha-Campos and Rösler (1978) compared the Rio da Areia fauna with those of the Bonete Formation of eastern Argentina. Although these faunas may be contemporaneous, none species in common are shared. In other words, despite the close proximity of both basins the presence of conspicuous members of the Bonete Formation (e.g., *Eurydesma* and others) was not recorded in the Permian succession of the Paraná Basin yet (see also González and Saravia, 2010).

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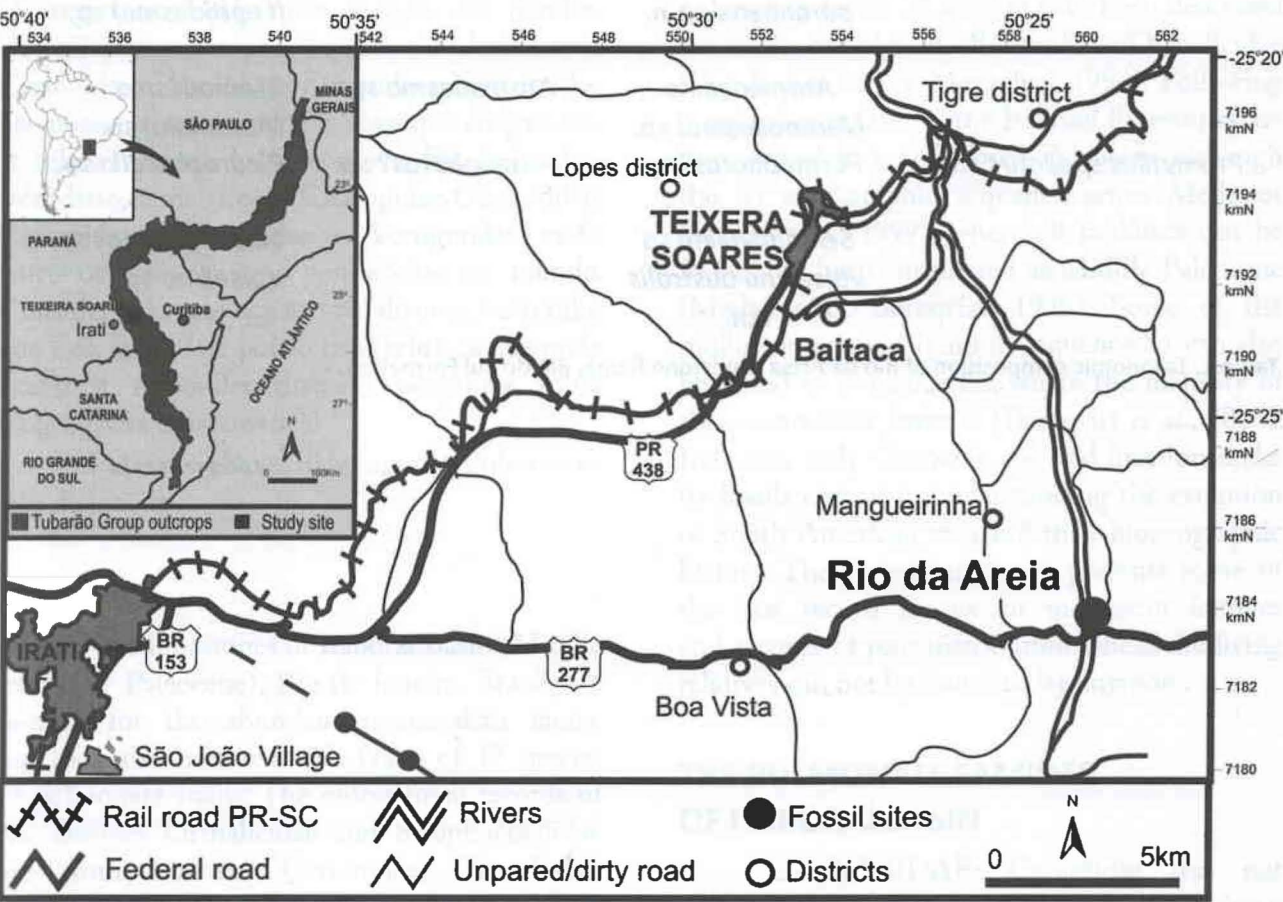


Figure 1. Location map of the study area in the Teixeira Soares Municipality, Paraná State, Brazil.

| Authors                            |                                             |                                          |                                                                     |
|------------------------------------|---------------------------------------------|------------------------------------------|---------------------------------------------------------------------|
| Beurlen (1954)                     | Rocha-Campos (1969)                         | Rocha-Campos & Rösler (1978)             | This Study                                                          |
| <i>Aviculopecten multiscalptus</i> | <i>Aviculopecten multiscalptus</i>          | <i>Aviculopecten</i> sp.                 | <i>Aviculopecten</i> (or <i>Hillaepecten</i> ) <i>multiscalptus</i> |
| <i>Prosopecten alternatus</i> n.n. |                                             |                                          |                                                                     |
| <i>P. densicostatus</i> n.n        |                                             |                                          |                                                                     |
| <i>P. elegans</i> n.n              |                                             |                                          |                                                                     |
| <i>P. radiatus</i> n.n             |                                             |                                          |                                                                     |
| <i>P. rhomboidalis</i> n.n         |                                             |                                          |                                                                     |
|                                    | <i>Myalina</i> ( <i>Myalinella</i> ) sp.    | <i>Myalina</i> ( <i>Myalinella</i> ) sp. | <i>Myalina</i> ( <i>Myalinella</i> ) sp.                            |
| <i>Myalina oblique</i> n.n.        | <i>Leiopteria paranaensis</i> n.n.          | <i>Leiopteria</i> sp.                    | <i>Leptodesma</i> ( <i>Leptodesma</i> ) sp.                         |
|                                    | <i>Atomodesma</i> ( <i>Atomodesma</i> ) sp. | <i>Atomodesma</i> sp.                    | <i>Atomodesma</i> ( <i>Aphanaia</i> ) sp.                           |
| <i>Promytilus spoliatus</i> n.n.   | <i>Permophorus?</i> sp.                     | <i>Permophorus?</i> sp.                  | <i>Pleurophorella</i> sp.                                           |
|                                    | <i>Selenimyalina</i> sp                     |                                          | <i>Selenimyalina?</i> sp.                                           |
|                                    | <i>Volcellina australis</i> n.n.            |                                          | <i>Volcellina</i> sp.                                               |

**Table 1.** Taxonomic composition of Rio da Areia sandstone fauna, Rio do Sul Formation.