



# *Paleontologia em Destaque*

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*Vida no tempo profundo  
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## PERMIAN BIVALVES OF THE SERRA ALTA FORMATION, BRAZIL: ORDINARY SUSPENSION FEEDERS OR SEEP ORGANISMS?

SUZANA A. MATOS<sup>1,2</sup>, LUCAS V. WARREN<sup>3</sup>, FRANZ T. FÜRSICH<sup>4</sup>, LUCIANO ALESSANDRETTI<sup>2</sup>, MARIO L. ASSINE<sup>3</sup>, CLAUDIO RICCOMINI<sup>5</sup> & MARCELLO G. SIMÕES<sup>1</sup>

*sumatos.s@gmail.com, warren@rc.unesp.br, franz.fuersich@fau.de, luciano.geors@gmail.com, assine@rc.unesp.br, riccomin@usp.br, profmgsimoes@gmail.com*

This is the first record of a Permian seep deposit and an associated, morphologically bizarre, bivalve-dominated fauna from the Passa Dois Group, Paraná Basin, Brazil. Discoidal, cm-long, carbonate concretions found in shales of the outer-shelf facies of the Serra Alta Formation preserve a low-diversity but high-abundant, large-sized bivalve fauna with unusual morphologies. These bivalves (*Anhemia froesi*, *Maackia contorta*, *Tambaquyra camargoi*) are about ten times larger than tiny ones (e.g., *Rioclaroa levefrei*) found scattered in laterally equivalent mudstones of the same unit. Intercalated between two concretion-bearing horizons, a cm-thick, sheet-like, disrupted, "brecciated", partially silicified carbonate layer with microbially-induced lamination is also recorded. The carbonate layer shows vertical structures formed by injections of mud mixed with white limestone clasts and microbial linings. Immediately above this, silicified mudstones preserve small domal structures (= mounds) with a slightly depressed center. Monospecific concentrations of closed articulated shells of *Tambaquyra camargoi* occur at the base of these domes. Carbon-isotope ( $\delta^{13}\text{C}$ ) values from the shells, "brecciated" carbonates, and fossil-rich concretions are all depleted (negative values  $\sim -6.1$  to  $-7.6\text{‰}$ ). Combined taphonomic, sedimentological, petrographic, geochemical and paleontological data suggest that the disrupted, "brecciated" carbonate and associated fauna and domes may have formed by an exudation system. This interval of the Serra Alta Formation is  $\sim 8.7$  meters above the contact with the underlying, oil-rich Irati Formation. This unit has very high total organic carbon (up to 23%) values and high sulphur contents, supporting the interpretation of the lithological and

paleontological features as result of seepage of organic compounds at the seafloor. Where the gases and hydrocarbons escaped, the seabed was colonized by, at least facultatively, chemosymbiotic bivalves. These species belong to a highly endemic group of pachydomids that were shallow infaunal bivalves (SIB). This suggests an extreme adaptive radiation and repopulation of anoxic-dysoxic bottoms of the Paraná Basin by SIB species after the deposition of the Irati Formation. Permian fossil seep systems and faunas are poorly known. Together with the Late Carboniferous hydrocarbon-seep carbonates from the glaciomarine Dwyka Group, southern Namibia, our bivalves are one of the oldest documented members of Gondwana seep faunas. [FAPESP 96/09708-9, 12/12508-6; CNPq 302903/12-3, 401039/2014-5].

Sessão:  
Biotas e ecossistemas do Paleozoico

<sup>1</sup>Instituto de Biociências, Departamento de Zoologia, Universidade Estadual Paulista, Distrito de Rubião Junior, Botucatu, SP, 18.618-970, Postal Code 510 Brasil; <sup>2</sup>Instituto de Geociências, Universidade de São Paulo, SP, 05508-080, Brasil; <sup>3</sup>Instituto de Geociências e Ciências Exatas, Departamento de Geologia Aplicada, Universidade Estadual Paulista, Campus de Rio Claro, Rio Claro, SP, 13506-900 Postal Code 178, Brasil; <sup>4</sup>FG Paläoumwelt, GeoZentrum Nordbayern der Friedrich-August-Universität Erlangen-Nürnberg, Loewenichstrasse, D-91054, Erlangen, Germany; <sup>5</sup>Instituto de Energia e Ambiente e Instituto de Geociências, Universidade de São Paulo, SP, Brasil.