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RESÚMENES

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Dissolution of *Bouchardia rosea* shells: implications for taphonomic bias in rhynchonelliform brachiopod assemblages

S. C. Rodrigues¹, J. P. Neves¹, M. G. Simões¹ and M. Kowalewski²

¹Departamento de Zoologia, Universidade Estadual Paulista, Botucatu, Brasil. hsimoes@ibb.unesp.br; scoelho@ibb.unesp.br; dollyunesp@yahoo.com.br ²Department of Geosciences, Virginia Polytechnic Institute and State University, Blacksburg VA, USA 24061. michalk@vt.edu

In order to understand the effects of intrinsic shell factors (shape, area, weight, thickness) on the dissolution behavior of valves of *Bouchardia rosea* (Rhynchonelliformea), a series of experiments were conducted following Flessa and Brown (1983) and Smith *et al.* (1992). Eighty five individual valves (40 ventral and 45 dorsal), encompassing the typical range of size and morphology of *B. rosea* were selected for the experiment. Unaltered shells were cleaned, dried, and weighed to the nearest 0.01 g. Shells were grouped into classes, according to their size and weight. In addition, valve thicknesses were measured from cross-sections of each valve (ventral and dorsal). Measurements of the three major shell axes were obtained to the nearest 0.01 mm with a digital caliper. Shells were placed in separated baths of 100 ml of acetic acid solution (1 %). Examinations were made at 0.5 h intervals for the first 3 h, at 1 h intervals for the subsequent 6 h, and from then on 3 h intervals until 24 h. At each interval, specimens were removed from the acid, washed in distilled water, dried in a 40°C oven for 30 min, weighed, measured, and described. Yet, pH values were measured for each dissolution interval using a digital pHmeter. Dissolution rate (%/hr) was calculated as the average percentage weight loss in the interval between the start and the hour marked by loss of 10 % of the initial weight. At the first 0.5 h, ventral valves showed a mean pH rose of 0.89 and 0.41 at 1h interval. Dorsal valves showed a mean pH rose of 0.74 and 0.31, at 0.5 and 1.0h intervals, respectively. The pH curves, rinsed no more than 0.10 on each interval from 5 h for ventral valves, and from 2.5 h interval for the dorsal ones. The average of dissolution rate is as follow: 71.3 %/hr for ventral valves and 58.2 %/h for dorsal shells. The dissolution rates among shells of the same class area (e.g., 426.32 to 460.82 mm²) are as follow: 89.3 %/hr for ventral valves, and 39.3 %/hr for dorsal valves. Polling data for both valves of the same weight class (e.g., 0.29 to 0.31g) ventral shells show dissolution rates of 61.6 %/h, and dorsal shells of 45.1 %. Ventral and dorsal valves with the same surface area to weight ratio (e.g., 0.30) have dissolution rates of 51.4 %/hr, and 39.8 %/hr, respectively. Hence, faster dissolution rates are shown by ventral valves. Ventral shells are more convex than the dorsal ones (nearly planar shells), but this intrinsic factor alone does not explain the observed pattern. Weight and shell thickness are two important factors since the difference in the dissolution values of the shells of the same weight are smaller than the differences in the dissolution rates for shells of the same area. This difference is even more pronounced when shells of the same surface area to weight ratio are considered (see above). In fact, the dorsal valves are smaller, but thicker and comparatively heavier than the ventral shells. In other words, it is reasonable to expect that in brachiopod species with very distinct valves (shape, area, weight, and thickness) one shell will be more prone to the taphonomic biases caused by diagenetic (dissolution) processes. In our study, this is the case of the larger, thinner and lighter valve, named ventral shell. Modern accumulations containing hundreds of *Bouchardia rosea* shells with chalky textures (a chemical signature) from muddy bottoms of the Ubatuba Bay (Brazilian platform) show a pronounced deviation in favor of dorsal valves (79.6 %, n=359). Contrary to those accumulations generated under high-energy, shallow-water settings, shells from these assemblages were not transported. Hence, the ventral/dorsal deviation is not hydraulic (physical) in origin. Thus, a Paleo-lesson emerges from these Modern and laboratory examples: the ventral/dorsal deviation in brachiopod shells, an important issue in palaeoecologic analysis, can be produced by differential shell dissolution and not only by differential fragmentation and/or transportation of valves.

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Smith, A.M., Nelson, C.S., and Dansher, P.J. 1992. Dissolution behavior of bryozoan sediments: taphonomic implication for non tropical shell carbonates. *Palaeogeography, Palaeoclimatology, Palaeoecology* 93: 213-226.

Biotic interactions between Late Holocene rhynchonelliform brachiopods and boring polychaetes from the south Brazilian bight: paleoichnological implications

S. C. Rodrigues¹, M. G. Simões¹, M. Kowalewski², M. A. V. Petti³ and E. F. Nonato⁴

¹Departamento de Zoologia, Universidade Estadual Paulista, Botucatu, Brasil. ²Department of Geosciences, Virginia Polytechnic Institute and State University, Blacksburg, USA. ³Departamento de Oceanografia Biológica, Instituto Oceanográfico, Universidade de São Paulo, São Paulo, Brasil. scoelho@ibb.unesp.br

We document a case of intense biotic interactions, mostly representing commensal and/or parasitic relations, between the rhynchonelliform brachiopod *Rauchardina rosea* and spionid worms. We combined direct *in vivo* observations of infested brachiopod specimens collected alive with quantitative data on traces left on subfossil shells from surficial Holocene death assemblages of the Ubatuba Bight (23° 26'S and 45° 02'W), northern coast of the state of São Paulo, SW Atlantic. We: (a) evaluate the identity of the bioeroder, (b) describe typical traces left by it in host shells; (c) estimate the frequency of traces, and (d) discuss possible paleontological implications of the data gathered. Bulk samples included a total of 1616 valves of *B. rosea* collected from 14 nearshore localities (depth range: 0-30 m) in the general area of Ubatuba Bight. At each sampling station, 8 liters of surficial sediments were collected using a Van Veen grab sampler (1/40 m³). The samples were wet-sieved, throughout 8 to 2 mm sieves, and air-dried. All live brachiopods were picked and stored in 70% ethanol. Both living and dead shells bear distinct type of traces: a U-shaped gallery, with straight "U" arms, quite close together, and parallel to the surface plane of the brachiopod shell. The sides of the tube are deeper than the middle, resulting in a central ridge, extending along the length of the trace. Hence, the cross sectional shape is characterized by a broad-centered "figure 8" morphology. Both gallery openings communicate only with the outer surface of the shells and do not come in contact with the internal soft parts of the host. This U-shaped trace is referable to the ichnogenus *Caulostrepsis*. In all brachiopods collected alive, worms were found inside the trace, living in association with the host. Conversely, none of the dead shells yielded living worms. Worms showed long and coiled peristomial palps stretching out of the tube, large setae on both sides of the 5th body segment and a flanged pygidium, which are diagnostic of the genus *Polydora* (Spionidae). Out of 1616 brachiopods, 292 dead shells display *Caulostrepsis* traces; an infestation frequency of 18%. Infestation rates vary by collecting site, with values reaching up to 26% (Station UBA 4, 25 m water depth), and by shell size. For shells grouped in terms of their maximum length into three categories >8 mm, 8-6 mm, and 6-2 mm, frequencies of infestation are 28%, 20% and 12%, respectively. Most of the infested valves are dorsal (n=110, 74%). This pattern does not necessarily imply a stereotyped infestation, but rather reflects the fact that dorsal valves are much more common in the samples than the ventral ones. Indeed, in the case of a sample with well-represented ventral and dorsal valves, both are commonly infested. Similar rates of infestation for dorsal and ventral valves may reflect the free-lying mode of life of *B. rosea*, as its valves are not firmly attached to the substrate. Infestations on *B. rosea* shells by *Polydora* may represent parasitism. However, given no obvious detrimental effects on brachiopod shells (e.g., lack of shell deformations) the infestations may also represent a commensal relation. Additionally, there is no evidence of endoparasitism and tubes inhabited by infestors open only to the exterior. Besides the exact ecological nature of this interaction, in all living brachiopods, the infestors were found in physical association with *Caulostrepsis* traces (inside the trace) indicating that they were responsible for these marks. Two paleontological implications are particularly noteworthy. First, *Caulostrepsis* traces occur in fossils going back to Devonian times. Several authors have suggested that this trace could be produced by worms (Spionidae). The documentation of living *Polydora* in *Caulostrepsis*-like tubes demonstrates that this trace can be due to the activity of boring polychaetes. Second, *Caulostrepsis* traces in shells of rhynchonelliform brachiopods are good examples of bioerosion acquired primarily (or perhaps exclusively) during the life of the host, rather than the result of the pronounced temporal exposure of shells around the sediment/water interface. Indeed, recent analyses of individually dated shells of *B. rosea* indicate that the infestation by endobionts decreases with the increase in the host valve age (Rodland *et al.*, 2006). The data presented here thus reinforce the idea that biotic interactions (bioerosion by *Polydora*) preserved in *B. rosea* shells may represent ecological snapshots, with high temporal resolution, that can be recognizable in the fossil record of shelly marine benthos.

Rodland, D.L., Kowalewski, M., Carroll, M. and Simões, M.G. 2006. The temporal resolution of epibiont assemblages: are they ecological snapshots or overexposures? *Journal of Geology* 114: 313-324.