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Taphonomy of a thick Terebratula bioherm from the Pliocene of southeastern Spain

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Brachiopods were extremely abundant during the Paleozoic era but underwent a dramatic loss of biodiversity at the Permo-Triassic boundary. The comparison of brachiopod and bivalve diversity through geological time shows that the latter were the most successful counterpart at best recovering from mass extinction events. Nonetheless, there are cases where Post-Paleozoic brachiopods stand out as the dominant marine benthos in particular environments, forming paucispecific brachiopod-dominated bioherms.
This note describes an example of shallow-water brachiopod bioherm dominated by the terebratulid Terebratula calabra. The shell bed is found in mixed siliciclastic-temperate carbonate deposits of late Early Pliocene age nearby Águilas (southeastern Spain). This unique brachiopod concentration may be helpful to understand the particular success of large-sized brachiopods like Terebratula in Cenozoic environments typically dominated by bivalves.
The bioherm attains 1.5 meters in thickness and crops out along a band up to 140 meters wide. The lithology consists of bioturbated fine-grained sands containing poorly sorted bioclasts, mostly fragments of Terebratula. This shell bed also records a diverse fauna, including five brachiopod genera, pectinids (4 genera), oysters (3 genera), in addition to rare gastropods, echinoids, bryozoans, etc. The density and sorting of bioclasts is laterally variable, and the biofabrics range from loosely dispersed to densely-packed, including examples of concave-up vertical stacking and nesting of shells. Most of the fragments of Terebratula preserve the posterior part of the shell only. These fragments generally display corrasion (rounded fractured margins, rounded to completely missing symphytium), bioerosion (prevailing the ichnogenera Entobia, Gnathichnus and Podichnus) and encrustation (mainly by bryozoans, Ancistrocrania, and Pododesmus). The good preservation of Pododesmus contrasts with that of most fragments of Terebratula, although many of these shells were drilled by gastropods. Co-occurrence of altered fragments and articulated shells of Terebratula suggests that shells of this brachiopod underwent different taphonomic pathways, implying that different generations of Terebratula were able to thrive in this habitat over a period of time long enough to produce the range of taphonomic signatures encountered. Taphonomic traits point to a within-habitat time-averaged fossil assemblage, namely: 1) sediment starvation (on account of a dense bioturbation and abrasion, bioerosion, encrustation, and fragmentation of shells accumulated in clusters). 2) fossils with distinctly different taphonomic signatures corresponding to the biostratinomic phase. 3) lithologically homogeneous matrix. 4) a functional agreement between fauna and matrix. The occurrence of fixossesile organisms such as Pododesmus, Ancistrocrania and the abundance of Podichnus (which suggests that Terebratula attached to dead and alive conspecific shells) and other bioerosive traces, point out a shift from a soft/firmground to a shelly-ground propitious for the colonization by diverse epilithic animals. These features are consistent with autigenic and allogenic taphonomic feedback. Allogenic mode is suggested by reworking and winnowing by storm currents. The influence of storms is also recorded by unaltered, hollow shells of Terebratula (rapid burial), the stacked biofabrics, and the infilling of pod-like pits by shell fragments.