

Paleozoic echinoderm hangovers: Waking up in the Triassic

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We thank Salamon and Gorzelak for their Comment (Salamon and Gorzelak, 2017) on our recent *Geology* paper (Thuy et al., 2017) on the discovery of Paleozoic echinoderms surviving into the Triassic, corroborating the provocative nature of the topic. Salamon and Gorzelak argue that we failed to address the issue of a possible reworking of Paleozoic echinoderm fossils into Triassic sediments. We agree that echinoderm fossils can be sturdy enough to survive re-sedimentation processes relatively unscathed with respect to surface morphology. We furthermore acknowledge that some reports on extraordinary stratigraphic range extensions should, indeed, raise skepticism. Caution is due in particular if such studies describe a single occurrence, push the temporal range of a species beyond plausible limits, and/or are based on so few specimens that an independent reproduction of the results by other researchers is practically impossible (e.g., Gorzelak et al., 2011).

In our case, in contrast, Paleozoic echinoderm fossils occurred in more than 10 localities representing a varied spectrum of Middle to Upper Triassic depositional environments, including settings with virtually no input of detrital components and/or no Upper Paleozoic marine rocks as possible sources of reworked echinoderms in the further surroundings. Some of the occurrences were previously described (e.g., Donofrio and Mostler, 1977; Kristan-Tollmann et al., 1979) and, although taxonomically misinterpreted, they were independently identified as original part of the Triassic fossil assemblage. Finally, the reported Paleozoic echinoderms from Triassic sediments all belong to three specific lineages, which, in Upper Paleozoic assemblages, represent only a small part of the echinoderm faunal spectrum. Repeated reworking of both microfossils and articulated specimens belonging to exactly those three lineages would require an almost miraculously selective re-sedimentation process.

Against this background, we securely excluded the scenario of reworking and thus omitted it from our discussion for the sake of conciseness.

Salamon and Gorzelak further support their reworking hypothesis by arguing that the state of preservation of some of the echinoderm microfossils in our paper is “not ideal”, and highlight rounding of edges

in the ossicles shown on our figures 1B and 1C as evidence for their claim. This statement left us somewhat puzzled, as rounded edges are a typical feature of test plates in many Paleozoic echinoids including the proteroceroidaroids (e.g., McCoy, 1849). This is even visible to the non-specialist eye when taking a closer look at the plate shapes in the articulated echinoid specimen shown on our figure DR3.

Furthermore, Salamon and Gorzelak raised the possibility of convergent evolution to explain the similarities between Upper Paleozoic and Triassic echinoderms. Unless the authors intend to challenge the very fundament of phylogeny, they will acknowledge that stratigraphic range extension of Paleozoic lineages is by far the most parsimonious explanation for the presence of multiserial test plating in a Triassic echinoid and ambulacral groove spines in a Triassic ophiuroid, only to highlight the most striking examples.

Finally, we consider Salamon and Gorzelak’s Comment regarding the Triassic crinoid *Encrinus* as evidence that our paper achieved its goal to raise awareness for the artificial nature of the distinction between Paleozoic and post-Paleozoic echinoderms. The case of *Encrinus* and its possible erisocrinid affinities is particularly intriguing, and we hope that our paper will spark further research in this respect.

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