

TAPHONOMIC EFFECTS AND 'PULSE' VERSUS 'PRESS' EXTINCTION PATTERNS DURING THE PERMO/TRIASSIC INTERVAL

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Paleontologists have long debated whether the anomalous long delay between the end of the Permian mass extinction and the apparent onset of biotic recovery of marine ecosystems during the Mid-Triassic reflects the continuation of poor environmental conditions, perhaps from the eruption of the Siberian flood basalts, or an ecological response to destruction of dominant community types during the mass extinction. A comparison of mid-late Permian and Early Triassic faunas suggests a likely role for preservational bias as well. Permian faunas, particularly those with high diversity, are commonly silicified. In contrast, silicified faunas are unknown from the Early Triassic, but return in the Middle Triassic with the onset of the recovery. This 'silicification gap' is likely related to a drop in diversity of silicious sponges and radiolarians during the extinction and the subsequent re-emergence of groups with siliceous skeletons during the recovery. If many taxa are known only from silicified material, the lack of silicification may itself explain, at least in part, the apparent delayed recovery.

For example, of the 1500+ species of invertebrates documented from the magnificently preserved silicified faunas of the West Texas Permian basin, fewer than 350 have been recovered as non-silicified specimens. Girty (1908) produced the most detailed study of the unsilicified material. Among the brachiopods, by far the dominant part of the fauna, Girty recognized 128 species, versus about 980 by Cooper and Grant in their monographic treatment during the 1970's. Part of the variation reflects differences in taxonomic concepts, but the bulk of these differences lie in the exquisite preservation of the silicified material. Girty recognized 42 species and varieties of gastropods; although the assemblage remains incompletely studied, I have estimated that the total silicified fauna is about 200 species. Interestingly, for both gastropods and brachiopods the relative proportions of species appear to be comparable between the silicified and unsilicified datasets, but the silicified material provides a far richer view of the fauna and its biogeographic and environmental distribution.

Local, regional and global preservational biases may mask and distort apparent patterns, leading investigators to 'explain' patterns that are illusionary, and magnifying the Signor-Lipps effect before the extinction, and the Sppil-Rongis Effect during the recovery. In this case, preservational problems increase the difficulties in distinguishing between rapid pulse extinction events, during which no adaptive response is possible, and more prolonged, pulse extinctions which allow an evolutionary response during the course of the extinction event, influencing the nature of the recovery fauna.