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164-8: PERSISTENCE, INCUMBENCY AND REORGANIZATION OF THE KAROO BASIN TERRESTRIAL ECOSYSTEM DURING THE PERMIAN-TRIASSIC TRANSITION

Tuesday, 6 November 2018
10:00 AM - 10:15 AM
Indiana Convention Center - Room 143-144

The geological persistence of biotic assemblages and their reorganization or destruction by mass extinctions are key features of long-term macroevolutionary and macroecological patterns in the fossil record. The loss of persistent assemblages affect biotic history disproportionately, leaving permanent imprints on global biodiversity. Here we hypothesize that the geological persistence of paleocommunities and incumbencies of taxa are maintained by patterns of biotic interactions that favor the ecological persistence and stable coexistence of interacting species: equally complex communities produced by alternative macroevolutionary histories, and hence bearing different functional structures, support less stable species coexistence, and are therefore less persistent. However, alternative communities with the same functional structure as a persistent paleocommunity, but variable clade richnesses, tend to be as or more stable than observed paleocommunities, thus demonstrating that geological persistence is not the result of constrained patterns, or ecological locking.

We tested the hypothesis using numerical modeling of food webs for seven tetrapod-dominated paleocommunities spanning the Permian-Triassic boundary in the Karoo Basin of South Africa, showing that incumbency before the Permian-Triassic mass extinction was maintained by a dynamically stable, community-level system of biotic interactions, thereby supporting the hypothesis. The system's structure was lost through successive extinction pulses, and replaced initially by a rich but geologically ephemeral Early Triassic fauna, which itself was replaced by a novel Middle Triassic community with renewed incumbency. The loss of persistence and incumbency, therefore, did not result simply from the extinction of species; instead the largest declines were accompanied by the addition of new species in the earliest aftermath of the event. We further hypothesize that ecological reorganization and evolutionary innovation in the wake of mass extinctions play key roles in the destruction of highly stable, pre-existing systems of biotic interaction. In the case of the Karoo Basin paleocommunities, we estimate that a return to stable interactions, and thus incumbency, was achieved in no less than 4 Ma.

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