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How are global patterns of faunal turnover expressed at regional scales? Evidence from the Upper Mississippian (Chesterian Series), Illinois Basin, USA

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ABSTRACT

Linking biotic patterns across spatiotemporal scales provides a greater understanding of the processes that drive ecological and evolutionary change. Here, we examine how global patterns of biotic turnover are expressed in the structure of regional biotic gradients from the Illinois Basin (USA) during the late Paleozoic ice age (LPIA)—an interval noted for low global rates of taxonomic turnover. Results indicate that the pre-LPIA interval is characterized by well-defined biotic gradients; depositional environments are dominated by distinct sets of taxa, arrayed along a gradient of substrate composition, and are clearly differentiated by ordination and ANOSIM analyses. There is a marked shift in gradient structure across the onset of the LPIA; environments become weakly distinguished, are dominated by similar sets of taxa that are widespread across the ramp, and are arrayed along a nearshore-offshore gradient. Our results are consistent with findings from global-level studies, which indicate that broadly adapted taxa (eurytopes) increased in importance following the start of the LPIA. Unlike the global level, however, the regional increase in eurytopy is not linked to the extinction of narrowly adapted taxa in response to climate change. Instead, eurytopy increased as the geometry of the Illinois Basin shifted from a flat carbonate ramp, composed of shallower-water and higher-stress environments in the pre-LPIA interval, to a steeper ramp comprising deeper-water and more stable habitats in the LPIA interval. We suggest that increased eurytopy drove (1) a previously documented decrease in regional-level turnover during the late Paleozoic and (2) a perceived pattern of greater persistence in late versus early Paleozoic biotic gradients.