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The stratigraphic distribution of fossils in a tropical carbonate succession:

Ordovician Bighorn Dolomite, Wyoming, USA

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ABSTRACT

Stratigraphic architecture exerts a powerful influence on the vertical distribution of fossils and should be considered before biostratigraphic and paleobiologic interpretations to avoid interpretations of patterns that are actually stratigraphic artifacts. Previous numerical models of the stratigraphic distribution of fossils were developed for siliciclastic settings, which also work well for mixed carbonate-siliciclastic settings. These models are evaluated here using the Upper Ordovician Bighorn Dolomite, which was deposited on a tropical carbonate platform. The Bighorn Dolomite contains three third-order, unconformity-bounded depositional sequences, which correspond closely to the Steamboat Point, Leigh, and Horseshoe Mountain Members and are correlative with the C2, C3, and C5 sequences of the eastern United States. The Steamboat Point and Leigh Members record greenhouse conditions and are characterized by meter-scale parasequences with weakly defined flooding surfaces and minor internal facies changes. Absent in these units are well-defined parasequence sets with strong upward-deepening or upward-shallowing trends. In contrast, the Horseshoe Mountain Member reflects a transitional climate and consists of 10-m-thick, well-developed parasequences that clearly stack into upward-deepening (transgressive) and upward-shallowing (highstand) systems tracts. Fossil associations within the Bighorn Dolomite fall into five biofacies that reflect depositional environment and age. The brachiopod biofacies is found in deep subtidal facies, with the gastropod facies and crinoid biofacies in shallow subtidal facies. The dasyclad biofacies and coral biofacies are limited to the shallow subtidal facies of the Steamboat Point and Horseshoe Mountain sequences, respectively. In the greenhouse sequences, biofacies transitions are gradational, whereas they are abrupt and correspond to major flooding surfaces in the transitional climate sequences. Similarly, first and last occurrences are not clustered in the greenhouse-climate sequences, although they are elevated near the maximum flooding zone. First and last occurrences are clustered in the transitional-climate sequence where open marine facies border the sequence boundary, at major flooding surfaces, and where open marine facies are last expressed.