BIOLOGICAL PATTERNS IN SEQUENCE STRATIGRAPHY; CRETACEOUS OF THE WESTERN INTERIOR BASIN, NORTH AMERICA

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High-resolution stratigraphic analysis of Cretaceous strata in the Western Interior Basin (WIB) of North America has allowed definition of numerous disconformity-bounded, eustatically and/or tectonically driven sequences and their systems tracts at 2nd- through 4th-order scale, as well as 5th- to 7th-order climate-induced cycles. Integrated event chronostratigraphy and biostratigraphy allow detailed regional tracing and facies analysis of these sequences, leading to three-dimensional modeling of facies evolution. Whether driven by relative sealevel changes or smaller scale climate cycles, Cretaceous sequences and their bounding disconformities reflect dynamic changes in many factors which moderate biological systems (e.g. sealevel and paleobathymetric changes, changes in current velocity and in erosion/sedimentation rates and patterns, watermass temperature and chemistry, etc). Predictable biological responses (patterns) to varying environmental conditions and different systems tracts are expected in sequence stratigraphy. Once defined within well-studied systems, these patterns can then be used as an independent tool for sequence stratigraphic analysis. To date, our research has focused on the development of paleobiological criteria which aid in the recognition of sequence stratigraphic frameworks, especially in basinal facies where sequence boundaries and systems tracts may be subtly defined in the physical stratigraphy. Such criteria may include the identification of sequence boundaries and other omission surfaces by punctuated character displacement in evolutionary series, by condensation or omission of biostratigraphic zones, by mixed or time-averaged community elements and biozones, and by selective colonization by firm substrate-dependent benthic communities. Gradients within and between systems are characterized by different community composition, biofacies, taxonomic and community diversity patterns, adaptive bauplans among resident taxa, taphonomic signatures, and bioevents that allow predictive biological characterization in sequence stratigraphy. Once established and correlated, sequence stratigraphic systems among different basins provide a chronostratigaphic and environmental framework within which the regional dynamics of ancient populations and communities can be evaluated, leading to the analysis and modeling of relationships between sealevel changes and biogeographic migration patterns, and the rates and patterns of evolution and extinction.