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# Cycle Hierarchy in Middle and Upper Pennsylvanian Strata of the Mid-Continent: A Review: Abstract

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## ABSTRACT

A hierarchy of depositional cycles is recognized in Middle and Upper Pennsylvanian strata in the upper Midcontinent, U.S. High-frequency unconformity-bounded, cyclothem-scale 4th-order (0.1-1 Ma duration) cycles averaging 50 ft (15 m) thick are regionally correlatable (physically and biostratigraphically) and mappable through outcrops, cores and well logs. These units are the "principle depositional sequences" often delineated in the subsurface by thin, often radioactive marine shales (condensed sections, maximum :looding surfaces). Lithologic composition is complex, but the general format varies predictably from shelf to basin due to changes in inferred sediment accommodation space (sea level and structure) and depositional environment (sediment supply and climate). The principle sequences contain recognizable and locally correlatable parasequences and unconformity-bounded higher frequency sequences which lead to compartmentalization important at the field scale. Preservation of these high frequency components varies with shelf position and sea-level history. Analytical techniques include chemical stratigraphy such as minor element, stable isotope, and organic composition, magnetostratigraphy and log analysis such as multivariate classification procedures.

Longer-duration sequence sets (3rd-order), approximately 330 ft (100 m) thick, contain from 5 to 7 primary depositional sequences. These sets closely correspond to formal stratigraphic groups, often representing major stratal changes including forward and backward stepping of the shelf margins. Corresponding stratal changes on the interior shelves are more subtle, but do affect the character of petroleum reservoirs.

Case studies are used to illustrate observed sequence hierarchy. Simulation and conceptual models are used to analyze possible controls. The results suggest opportunities for continued resolution of sequence stratigraphic hierarchy to aid in predicting stratigraphically controlled accumulations of petroleum remaining in the Midcontinent.

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