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Where Layer-Cake Stratigraphy Breaks Down - The Coeval Development of Highstand Deltas, Condensed Sections, and Platform Carbonates of the Virgilian Oread Cycle, SE Kansas and NE Oklahoma

The Oread cycle contains a succession of marine and nonmarine siliciclastic and carbonate rocks deposited on the epeiric Kansas shelf in Late Pennsylvanian. It has been a classic example of layer-cake stratigraphy because of its persistent component lithologies. Outcrop and subsurface facies analysis and cycle correlation using 45 sections along a 100-km outcrop and 200 logs covering 32,000 km2 indicate great lateral thickness and lithologic changes that falsify layer-cake stratigraphy. The limestones, except the transgressive Leavenworth Limestone, thicken from 10's of cm in the lagoon to ~10 m in the phylloidal algal mounds, and thin on the basin slope where they developed a middle shale. They also pinch out into or juxtapose with thick deltaic deposits to the south. The condensed Heebner Shale on the shelf is black, thin (2 m), phosphatic but changes abruptly into thick (30 m) gray prodeltaic shale to the south. The regressive marginal marine and nonmarine siliciclastic deposits become thicker and more sandstone-rich to the south. Paleotopography, controlled by regional tectonics and local differential compaction, determined the facies mosaic, whereas eustasy controlled the facies migration and higher-order cyclicity. The proximity to the Ouachita source area caused the regional southward thickening and coarsening of siliciclastic deposits and, combined with the precipitation seasonality, caused development of Heebner delta during maximum transgression. The juxtaposition of condensed Heebner Shale and Plattsmouth Limestone on the shelf with the Heebner delta was controlled by alongshore currents associated with oceanic upwelling systems.