

High-Resolution Sequence Stratigraphy of the Mississippian of the Appalachian and Illinois Basins

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Logging of outcrop sections and shallow cores from the Appalachian and Illinois Basins has generated a high-resolution sequence stratigraphy that we are taking into the subsurface of the Appalachian Basin using well cuttings and gamma-ray logs calibrated to outcrops. The Mississippian carbonates developed on and in front of the Borden siliciclastic deltaic/marine shelf. The Osagean–Meramecian Ft. Payne–Salem units built out from the abandoned delta as six to eight prograding, clinoformal depositional sequences of siliceous carbonate slope and ramp margin banks, and low-stand lobate sands. Chesterian Ste. Genevieve units are oolitic carbonates with numerous disconformities whereas post-Ste. Genevieve Chesterian units mainly are interlayered carbonate and siliciclastic units with some karstic disconformities and paleosols. These are capped by prograding dominantly siliciclastic units (Pennington and equivalent units). Between nine and eleven fourth-order Chesterian sequences can be traced between the Illinois and Appalachian Basins. Ste. Genevieve to Paoli sequences generally are carbonate-dominated except in the western Illinois Basin where they contain major clastic units. Carbonate-dominated units contain relatively regional parasequences composed of ooid grainstone tidal-ridge facies, capped by extensive lagoonal mudstones and updip by disconformities. Younger Chesterian sequences are mixed carbonate-clastic sequences with incision on sequence boundaries. These contain parasequences with a basal sandstone valley fill and tidal sand-ridge units, overlain by skeletal limestone and shale-dominated siliciclastics. The sequences seem to be bundled into third-order composite sequences bounded by major erosional disconformities. The upsection changes in sequence stratigraphy may reflect buildup of Gondwana ice sheets and increased amplitude glacio-eustasy.