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Sequence Development on a Foreland Carbonate Ramp, Mississippian Appalachian Basin, West Virginia

Previous tectonic models suggested that the Mississippian Greenbrier carbonates were deposited during a time of tectonic quiescence. This appears to be incompatible with the considerable differential subsidence and thickening of the carbonates from a feather-edge on the distal foreland to over 900m in the proximal foreland. The thickening takes place not only across the regional hinge, but along several trends updip and downdip from the regional hinge at different times. This complex pattern resulted from movement of foreland basement fault blocks, which also produced local seismites. Differential subsidence controlled thickness and facies variations not only over the ramp-margin hinge, but also over fault blocks on the distal foreland, and thus was an important control on the accommodation created during sequence deposition. The regional hinge marks the seaward limit of caliches and eolianites on the ramp. Downdip of the regional hinge, subsidence was 5-30 cm/ky compared to low subsidence rates of 1-3 cm/ky updip on the distal foreland. Broad sags and adjacent highs, which periodically developed on the foreland, influenced the position of updip shoal water grainstones that were separated by lagoonal lime wackestone/mudstone from ramp margin grainstones. Structural trends at high angles to the orogenic belt also influenced grainstone location. The differential subsidence modified the local magnitudes of relative sea level changes, but did not override the eustatic changes that formed the basin-wide sequences, with their lowstand to transgressive siliciclastic-prone units and the carbonate-prone late transgressive and highstand units.