Phosphorites and Carboniferous Carbonate Platform Drowning, Lisburne Group, Central Brooks Range, Alaska

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The Carboniferous Lisburne Group generally deepens from a carbonate ramp (northeast) to basin (southwest) across northern Alaska and records five third-order depositional sequences in the eastern and central Brooks Range (CBR). Sequences 1-3 (Osagean-Meramecian) indicate similar depositional histories along strike but facies stacking patterns in overlying sequences (late Meramecian- Pennsylvanian) differ sharply. In the east, sequence 4 (~250 m) records platform backstepping followed by progradation of shoal environments over the outer ramp. In the CBR, a 30-m-thick interval of organic-rich shales and phosphorites at the base of sequence 4 (total thickness ~160 m) implies a significant oceanographic change that resulted in upwelling and drowning of the central Lisburne ramp. Overlying shallowing-upward cycles never shoal much above fairweather wave base. Sequence 5 was initiated by latest Chesterian transgression. In the east, it consists of dominantly shallow-water strata (Wahoo Limestone ~250 m). In the CBR, coeval high-frequency cycles of deep-water carbonate mudstones, glauconitic packstones, and black shales (~ 40 m) indicate complete platform drowning.

The thin succession, high phosphate content, and gamma ray signature of lowermost sequence 4 (CBR) implies considerable condensation. Nutrification associated with marine upwelling likely played a role in the demise of the carbonate platform. However, the lack of additional phosphatic or siliceous intervals and the low accumulation rates for sequence 5 carbonates implies that subsidence-enhanced rates of relative sea level rise might have facilitated platform drowning. Regional geologic evidence suggests that the abrupt late Meramecian deepening, initiation of marine upwelling, and eventual platform drowning in the CBR was tectonically controlled. Additional evidence for late Meramecian-early Chesterian tectonism includes basalt flows in the eastern Brooks Range and sediment-hosted massive sulfides in the western Brooks Range. Down-dropping of the central Brooks Range area along reactivated Devonian extensional structures could parsimoniously explain the volcanism and subsidence that resulted in marine upwelling and eventual drowning of the central Lisburne ramp.