

## **Carbonate Cycles and Their Controlling Mechanism During Furongian Greenhouse Time: An Example from the Big Horse Member of the Orr Formation in Western Utah**

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Carbonate depositional cycles and sequences have been proposed to be formed by glacioeustatic sea-level changes. This mechanism would be questionable during times of high atmospheric CO<sub>2</sub> and negligible continental ice sheets such as the super greenhouse time in the Furongian (late Cambrian), during which limited glacioeustatic sea-level changes would be expected. A detailed sedimentological study of the Furongian Orr Formation in western Utah indicates that meter-scale cycles display large lateral and temporal variability in a small area (< 1 km<sup>2</sup>). The Big Horse Member of the Orr Formation mainly consists of shale, siltstone, cryptic microbialites, thrombolites, and cross-laminated oolitic grainstone/packstone that were deposited from shallow subtidal to supertidal environments. Meter-scale cycles are expressed by shallowing-upward trends with subtidal shale/siltstone at the base and supratidal microbialites with desiccation cracks, dissolution cavities, and karstic breccias at the top. Among the seven closely-spaced sections with traceable marker beds, the cycle numbers vary, and the cycle thickness change from 2 m to 20s m, moreover the cryptic microbialites can reach until 30s m of vertical stack. Individual cycles are found to change within a few hundreds of meters to non-cyclic interval or, in some cases, several cycles merge into a single cycle within short distances (< 1 km). However, two stratigraphic discontinuities marked by intensive subaerial exposure were traceable among sections. These features suggest that meter-scale cycles of the Big Horse Member were mainly formed by autocyclic process through interactions between local carbonate production rates and tectonic subsidence. Forced regression during times of high carbonate production formed the laterally persistent discontinuities, but their duration may have varied, with significant lag time recorded in some sections.