

Shallowing-upward carbonate cycles of late Archean age in the Cheshire Formation, Belingwe greenstone belt, Zimbabwe

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Carbonate cycles are a common component of passive-margin sedimentary sequences dating back to the early Proterozoic. Shallowing-upward, metre-scale cycles have been discovered in the late Archean (c. 2.7 Ga) Cheshire Formation, Belingwe greenstone belt. The Cheshire Formation tectonically overlies mafic lavas of the possibly oceanic Zeederbergs Formation. It mainly consists of deep-water siliciclastics, but locally comprises a c. 150 m thick basal unit of cyclically intercalated limestone and shale.

The lower 100 m of the carbonate unit comprises c. 70 sedimentary cycles. Cycle thickness is 0.4-7.2 m. Cycles have asymmetrically stacked facies interpreted to reflect high-frequency, eustatic oscillations in sea level. They commonly consist of open marine, shallow subtidal shale at the base that formed during rapid submergence. Shale is intercalated with storm-generated sandstone beds that become more common and thicken upward indicating gradual shoaling. Shale commonly grades into, or is substituted by interbedded calcisiltite/siliciclastic mudstone. This is overlain by amalgamated beds of wave-rippled ooid/intraclast grainstone formed close to fair-weather wave base. Overlying or intercalated with grainstone, and forming cycle tops, are tabular to domed lithoherms of stromatolites and microbial boundstones with aragonite? pseudomorphs that developed in the upper subtidal to intertidal zone during sea level lowstand. Dolomite caps partly form cycle boundaries.

Sea level changes were probably controlled by glacio-eustasy. Lower order cyclicity as indicated by variations in cycle type and cycle thickness might indicate that Milankovitch-type orbital forcing was operating during late Archean times.