SHALLOWING-UPWARD CARBONATE CYCLES IN THE BELINGWE GREENSTONE BELT, ZIMBABWE: A RECORD OF ARCHEAN SEA-LEVEL OSCILLATIONS

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ABSTRACT: Shallowing-upward carbonate cycles in the ~ 2650 Ma Cheshire Formation, Belingwe greenstone belt (Zimbabwe), closely resemble their Proterozoic and Phanerozoic counterparts. The cycles form part of a karstified carbonate-ramp sequence that is overlain by, and grades basinward into, siliciclastic turbidites. A single section of 74 cycles (1.5 m average thickness) was studied in detail. Two basic cycle types are recognized, both with an asymmetric facies stacking pattern. One cycle type contains open marine, subtidal shale at the base. Shale is intercalated with storm-generated sandstone and grainstone beds that become more common and thicken upward, indicating progressive shallowing. Wave-rippled ooid--intraclast grainstone beds and bedsets overlie shale or form the base of the second cycle type. Grainstone formed at or above fair-weather wave base as shoreface sand sheets in an agitated, shallow subtidal setting. Microbial laminites constitute the top of both cycle types and are interpreted as peritidal deposits. In the upper part of the studied section, microbial boundstones with aragonite pseudomorphs are intercalated with, or overlie, laminites and formed in a supratidal environment. The vertical facies distribution within a cycle is indicative of rapid submergence followed by gradual shallowing of relative sea level. High-frequency eustatic sea-level changes are favored over an autocyclic mechanism and tectonically induced allocyclicity as the controlling mechanism for the cyclicity. Hierarchies of stratigraphic cyclicity occur on different scales and may be a result of the combined effects of several orders of sea-level oscillations. Cycle recurrence ratios correspond well to the Milankovitch frequencies calculated for the late Archean, suggesting that orbital climatic forcing may have been in operation in Archean times.