Sedimentology and Depositional Environments of Cyclic Microbial Bearing Strata of the Cambrian Point Peak Member of the Wilberns Fm. Exposed along the Llano River and Mill Creek, Mason County, TX*

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Abstract

With discovery of oil fields in the pre-salt of offshore Brazil, interest in lacustrine microbialites has intensified. Marine microbial carbonates contain similar features that allow them to serve as powerful analogues. Private ranches of Mason have made accessible Upper Cambrian microbial reefs along the Llano River and Mill Creek for detailed study. Sections beneath the large microbial reef complexes are mixed carbonate siliciclastic facies including glauconitic siltstone, hetrolithic facies, skeletal and oolitic packstone and grainstone, flat pebble conglomerate, microbial mounds and biostromes. The siltstone and heterolithic facies are interpreted to represent low-energy intertidal environments based on the presence lamination, ripples with reversing currents, tidal bundles and mud cracks. The skeletal and oolitic grainstone is interpreted to represent an open-marine high-energy environment based on stenohaline fauna, cross-bedding, and asymmetrical mega-ripples. Skeletal grains are filled with carbonate mud indicating initial low-energy deposition followed by reworking. Bioturbated packstone beds indicate a lower energy subtidal environment. Flat pebble conglomerates are interpreted to represent storms on the basis of channels, scoured bases and rounded clasts. The microbialites are interpreted to represent shallow subtidal to intertidal environments with stenohaline conditions based on alternating grainy and muddy sediments between mounds and stenohaline fauna. The gamma ray curve depicts cyclic fluctuations in sea level and siliciclastic influx with multiple orders of oscillation. Small microbial mounds and biostromes occur within the mixed carbonate-siliciclastic part of the section and siliciclastic sediment is trapped within microbialites indicating they formed in the presence of siliciclastic flux. The switch to large microbial reef complexes is coincident with a widespread massive skeletal-oolitic grainstone 1.6 m thick and a decrease in siliciclastics. The grainstones represent a large ramp crest grainstone body. The reefs nucleated on a hardground and transgressive flat pebble conglomerate near the middle of the grainstone. Grainstone dips toward the reefs indicating accelerated currents forming a moat. The base of the grainstone bed as well as the intertonguing reef flank beds are deformed downward by compaction. Flank beds include heterolithic, oolites, and skeletal grainstone indicating continuing shallow-marine conditions.
Sedimentology and Depositional Environments of Cyclic Microbial Bearing Strata of the Cambrian Point Peak Member of the Wilberns Fm. exposed along the Llano River and Mill Creek, Mason County, TX

Goals

1. To determine the depositional environments of the cyclic microbial bearing strata
2. To identify the microbial structures present in the strata

Background

The field area is located in the southwest flank of the Llano uplift of Central Texas.

Field site along the Llano River in Mason, TX
Field site along Mill Creek in Mason, TX

Microbial Biostrome

Oolite Grainstone

Acknowledgments

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Major Lithofacies and Depositional Environments

Conclusions

1. The silty limestone is interpreted to represent a low energy, shallow water intertidal environment. Muddy layers indicate a temporary decrease in energy, whereas cross-bedding indicates a tidal current influence.
2. Cross-bedding of the heterolithic facies indicates reversing tidal currents, while silty to muddy layers indicate sedimentary structures from low-energy, intertidal conditions.
3. Within the glauconitic siltstone, high percentages of glauconite are interpreted as having formed diagenetically, indicating a marine environment with low energy turbulence.
4. The microbialites are interpreted to represent shallow subtidal and intertidal environments. Microbial clots and biostromes indicate the fluctuating energy conditions of the intertidal zone.
5. The oolite grainstone is interpreted to represent shallow-subtidal, open-marine environments, while the epicontinental sedimentary facies is interpreted to represent an open-subtidal, epicontinental environment.
6) The microbialites are interpreted to represent shallow subtidal and intertidal environments. Microbial clots and biostromes indicate fluctuating energy conditions, whereas cross bedding and current ripples indicate sedimentary structures from low-energy, intertidal conditions.
7. The high frequency oscillation of the grain size may result from tidal fluctuations in water level while the low frequency oscillation may be due to diagenetic processes. Another major oscillation in grain size and current ripples is not observed in the oolitic grainstone.
8. Although carbonate rock typically forms in environments with low silica fluxes, the presence of siliciclastic matrix and glauconite demonstrates that the microbialites were formed in a subtidal to intertidal environment.

Paleocurrents

Microbial Mounds and Biostromes

Oolite Grainstone

Acoustic and optical data indicates that oolite grainstone is influenced by southeastern directed tidal currents, which are consistent with the southeast-oriented paleocurrents.

Gamma Ray Plots

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Conclusions

- The silty limestone is interpreted to represent a low energy, shallow water intertidal environment.
- Cross-bedding indicates reversing tidal currents, while silty to muddy layers indicate sedimentary structures from low-energy, intertidal conditions.
- Glauconitic siltstone is interpreted to represent shallow-subtidal, open-marine environments.
- Microbial mounds and biostromes indicate fluctuating energy conditions, whereas cross bedding and current ripples indicate sedimentary structures from low-energy, intertidal conditions.
- The oolite grainstone is interpreted to represent shallow subtidal and intertidal environments.