Sedimentologic, Stratigraphic and Diagenetic Analysis of Mi-crobialite-Bearing Lacustrine Rift Sequence within the Lower Cretaceous Yucca Formation, Indio Mountains, West Texas

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ABSTRACT

The upper member of the Lower Cretaceous Yucca Fm. in the Indio Mountains, West Texas comprises lacustrine/fluvial cycles deposited on the eastern margin of the Chihuahua Trough (rift basin) under greenhouse climate conditions similar to the South Atlantic pre-salt reservoirs (SAPSR). Thus it provides a suitable outcrop analog that can be used to generate relevant predictive models for the SAPSR. 11 cycles of interstratified lacustrine and fluvial facies associations were identified in a structural panel (2.4 km wide). Cycles average 30 m in thickness and contain the following facies succession: 1) basal burrowed fine-grained lacustrine sand/siltstone containing localized thrombolite lenses; to 2) massive fine-grained lacustrine sandstone containing abundant irregular septarian carbonate concretions and localized calcite radial fans and spherulites; to 3) lacustrine stromatolitic bindstone; to 4) lacustrine dolomudstone, capped by 5) coarser-grained fluvial/deltaic channel facies. Not all facies are present in every cycle and the cyclic nature of the lacustrine to fluvial depositional systems is attributed to wetter to dryer changes in climate.

The structural panel is disrupted by a series of small-displacement (few m) subseismic syndepositional normal faults that bound small-scale uplifts. The subtle differences in bathymetry/topography generated by the faults profoundly influenced lacustrine facies thickness and distribution. The stromatolitic bindstone and dolomudstone facies developed preferentially on syndepositional highs, whereas calcite radial fans/spherulites are only present within ~20 m of faults on down-dropped lows. We infer the faults acted as conduits for waters that degassed upon reaching the surface along fault-related seeps, causing precipitation of calcite radial fans/spherulites on the alkaline lake floor. Dolomitization and silicification were identified in all cycles and all lithofacies except for the thrombolite and calcite radial fans/spherulites and do not appear to be fault controlled, except for rare hydrothermal (?) saddle dolomite that is spatially associated with syndepositional faults.