Genesis of Unique Carbonate Features in a Pre-Salt Reservoir Analogue Lower Cretaceous Yucca Formation Indio Mountains, West Texas

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Hydrocarbon exploration in Pre-Salt sediments of rift basins on the South Atlantic Margin of West Africa and South America has experienced a major resurgence because these settings have proven to be successful major oil plays. The Brazilian Pre-Salt reservoirs of the Santos, Campos, and Espirito Santo Basins are hosted by lacustrine/marine-influenced carbonates that comprise laterally extensive laminated microbialite facies. The Indio Mountains, located in West Texas, provide well-exposed outcrops of Lower Cretaceous marine and nonmarine rift basin strata that can be considered an analog to South Atlantic Margin Pre-Salt facies.

Of particular interest for hydrocarbon exploration are unique carbonate features that have been discovered in the Lower Cretaceous Yucca Formation at the Indio Mountains. The carbonate features include a laterally continuous bed of septarian nodules and radial carbonate fans (which form as a rind around the nodules) that are associated with fault zones. These lithologies potentially also occur in Pre-Salt lacustrine carbonate facies in rift basins off the coast of Brazil, but may have been misconstrued as microbialites. Little is known about the conditions under which these carbonate features form. Filling this gap in knowledge is fundamental for hydrocarbon exploration in Pre-Salt settings. First, misinterpretations of such carbonate features – that potentially are confined to fault zones – as geographically expansive microbialite mounds could severely undermine the prediction of the size and location of carbonate-hosted oil reservoirs. Secondly, the uniqueness of the car-

bonate features implies that they were formed under very special biogeochemical conditions. As such, they could be the key to so far untapped information about the geologic history of Pre-Salt sedimentary deposits, and their propensity to become hydrocarbon reservoirs.

The goal of this project is to reconstruct the geochemical and depositional environment in which the radial carbonate features and septarian nodules from the Lower Cretaceous Yucca Formation at the Indio Mountains formed. A combination of field observations, petrographic (i.e. thin sections), mineralogical (i.e. XRD) and geochemical analyses (element and isotopic compositions, e.g. C, O, S, Ca, Mg, Sr) will be used to assess the role of major players in the formation of the carbonates. These players include tectonic influences such as fluid migration along faults, climatic impacts such as the periodicity of fluvial input into the lacustrine environment and the consequences for its salinity and alkalinity, geochemical zonation such as stratification of water bodies and relative position of mineral formation to the sediment-water interface, and microbial activity mediating the precipitation of minerals.