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Upper Cretaceous to Lower Paleogene Carbonate Growth Strata Associated with a Passive Salt Diapir, La Popa Basin, Mexico: An Outcrop Analog to Shelfal Salt Exploration

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Syndepositional near-surface rise of El Gordo diapir strongly influenced depositional patterns of Upper Cretaceous to Lower Paleogene strata as evidenced by: 1) siliciclastic strata that onlap and thin (from 1500m to 400m) toward El Gordo diapir, 2) presence of diapir proximal progressive unconformities, 3) presence of isolated lenticular carbonates adjacent to the diapir, and 4) presence of diapir-derived metaigneous clasts found in debris flow deposits within carbonate lentils. Carbonate lentils are thickest (up to 150m) near the diapir and thin rapidly away from the diapir to where they merge with encasing mudstone.

Carbonate facies comprise diapir-proximal reefal facies that trend to fore reef and calciturbidite facies down the depositional slope away from the diapir. Reefal diapir-proximal facies are underlain by carbonate and metaigneous clast debris flows. These debris flows were generated by near-surface diapiric rise that caused instability and failure of the slope. Comparison of carbonates adjacent to El Gordo diapir with other diapir-related carbonates within La Popa basin suggest that local bathymetric conditions related to the expression of salt above the sea floor was the primary influence on carbonate sedimentation patterns.

Thin section analysis indicates that the primary porosity of all carbonate facies was completely occluded by pervasive early marine cementation. Secondary porosity is primarily a series of cross-cutting fractures.

The lentils are highly fractured where upturned proximal to the diapir and the amount of fracturing decreases in younger lentils. The fractures are multiphase and completely filled by early marine cement and sediment infills indicating fracture formation directly following carbonate lentil deposition. Fracturing is related to salt tectonism and deformation of rapidly cemented competent carbonate beds.

El Gordo diapir and the associated strata of the Potrerillos Formation offer an outcrop analog to shelfal salt structures commonly visible only in seismic and well log data sets. This study exemplifies the complexity of reservoir geometry and continuity in salt tectonic settings. Reservoir facies have strong lateral gradients and lack continuity; they are highly deformed and fractured adjacent to the diapir, and are highly compartmentalized where separated by angular unconformities.