ABSTRACT

SEDIMENTOLOGY AND STRATIGRAPHY OF THE SAN JOSE LENTIL, LA POPA BASIN, MEXICO AND ITS IMPLICATION ON CARBONATE DEVELOPMENT IN A TECTONICALLY INFLUENCED SALT BASIN

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The San Jose lentil, located in NE Mexico in the La Popa basin, nucleated on a seafloor topographic high created by the La Popa salt wall. San Jose lentil consists of 8 carbonate lentil horizons initiating in the Lower Mudstone Member of the Potrerillos Formation and terminating in the Middle Siltstone Member. Nine lithofacies arranged by lentil facies versus inter-lentil facies make up the San Jose lentil. The lentil facies are: (1) Sponge-red algal boundstone, (2) rhodolith framestone and rudstone, (3) fossiliferous packstone and grainstone, (4) meta-igneous clast fossiliferous packstone and grainstone, (5) quartz silt-meta-igneous clast

fossiliferous packstone and grainstone, (6) meta-igneous clast-quartz silt fossiliferous packstone and grainstone, and (7) quartz silt extraclastic packstone. The inter-lentil facies consist of: (1) quartz silt brachiopod-bivalve packstone and (2) calcareous shale and siltstone. Siliciclastic detritus becomes increasingly integrated into the carbonate facies from the Lower Mudstone Member-hosted lentils (San Jose lentils 1 and 2) to the Middle Siltstone Member-hosted lentils (San Jose lentils 3-8). The beds of the San Jose lentil are interpreted to be leeward deposits of a former isolated carbonate buildup. Windward San Jose deposits are interpreted to be similar to the Lower Gordo lentil and buried in the down-dropped block, on the south side of the La Popa salt weld. The lentils also define the basal portion of 8 halokinetic sequences that make-up the San Jose. The ideal halokinetic sequence at the San Jose lentils consists of a basal storm-reworked carbonate unit followed by a succession of fossiliferous grainstone units which are then capped by siliciclastic inter-lentil facies. All halokinetic sequences found at San Jose are Type-A, characterized by high angles of unconformable truncation geometries. Halokinetic sequences at San Jose are typically stacked with the exception of the amalgamated halokinetic sequences 1-3, which coalesce and are deformed together at the La Popa salt weld. San Jose lentil 3 is interpreted to exhibit thickening into the La Popa syncline putting the initiation of the Hidalgoan orogeny in the late Maastrichtian. The extrinsic controls on the Maastrichtian lentils in La Popa basin are eustasy, regional and local tectonism, and siliciclastic influx. Maastrichtian sea level was high and there was also high subsidence in La Popa basin caused by early deformation by the Hidalgoan orogeny.

Siliciclastic sedimentation was restricted to landward positions except at the end of the Cretaceous. The combination of low sea level and increased siliciclastic influx at the end of the Maastrichtian buried the lentils in the basin. The Lower Gordo and San Jose lentils are similar with respect to thickness (80-120 m), facies present and areal extent (4-5 km from the diapir). Whereas the time-equivalent El Papalote lentil 1 is thin (12 m), has less diversified facies, and only extends 1-1.5 km from the El Papalote diapir. El Gordo diapir and La Popa salt wall were in the hinges of anticlines and shortened; whereas El Papalote diapir was on the limb of the El Gordo anticline and experienced less shortening. Carbonate accumulations at San Jose and El Gordo lentils were higher and had a larger bathymetric halo because of higher salt rise rates due to Hidalgoan shortening. El Papalote lentil 1 accumulated less carbonate and a narrow halo of bathymetric relief because it nucleated on a non-shortened diapir. Carbonate accumulations in La Popa basin differ greatly compared to conventional carbonate deposits. Carbonate development in La Popa basin is non-existent in the lowstand systems tract, greatest in the transgressive systems tract, and greatly reduced to non-existent in the highstand systems tract. In contrast, other isolated platforms typically have carbonate development in all the systems tracts, with greatest development in the transgressive and highstand systems tracts.