TECTONIC AND EUSTATIC CONTROLS ON THE CARBONATE STRATIGRAPHY OF THE LEONARDIAN-GUADALUPIAN (PERMIAN) SECTION, NORTHWESTERN DELAWARE BASIN, NEW MEXICO AND TEXAS

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ABSTRACT

The effects of tectonics and eustasy on carbonate sedimentation have been determined using seismic, well logs, and outcrop data for the mid-Permian of the Delaware Basin. Sequence and chronostratigraphic analyses indicate the section contains a broad tectonically-controlled aggradational/progradational cycle overprinted by eustatic sea-level cycles.

Early Leonardian deposition of the Abo Formation and the third Bone Spring sand occurred during a period of rapid subsidence, producing the aggradational geometry observed on seismic and well logs. This followed a time of uplift to the northwest of the study area which caused enhanced shelf erosion during late Wolfcampian time. The aggradational style of deposition continued through the mid-Leonardian. Late Leonardian time is characterized by progradational geometry, due to a slower subsidence rate. This resulted in a 15 km progradation of the Bone Spring shelf margin in the northwestern part of the Delaware Basin. A second period of uplift to the northwest followed, leading to the deposition of the sands of the Brushy Canyon Formation (Guadalupian). This aggradational/progradational cycle is followed by a similar cycle which ends after the deposition of the Capitan Formation.

Within the carbonate-dominated Leonardian aggradational/progradational cycle, nine sea-level cycles are recognized. The lowstand systems tracts within this package are of two types. The lowstands within the aggradational part of the section consist primarily of slope fans while those associated with progradation contain large lowstand prograding wedges. Steep margins are associated with aggradation while progradation is characterized by a ramp-like geometry. Highstands are widespread on the shelf and prograde into the basin throughout this interval.

PERMIAN BASIN OIL AND GAS FIELDS: INNOVATIVE IDEAS IN EXPLORATION AND DEVELOPMENT