Depositional Systems and Gas Production, Atoka and Morrow Series (Pennsylvanian), Haley Field Area, Loving County Texas

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Haley Field, Loving County, Texas has produced over 300 bcf of gas from Morrowan and Atokan strata in the Delaware Basin. However, only one in four wells drilled in the field is economic. The reservoirs were deposited in deep-water settings in a basin undergoing active tectonism associated with the Marathon-Ouachita orogeny. Tectonic activ-ity largely determined patterns of sediment distribution and accumulation in the basin. Primary structural features affecting sedimentation were the Central Basin Uplift, Red Hills Arch, and Grisham Anticline. The basin fill was derived from the Pedernal Massif to the northwest and the Central Basin Uplift to the east.

Lower and middle Morrow strata represent distal deposits of basin-margin turbidite complexes. Muddy and sandy sediment formed lobate submarine ramps off the Northwestern Shelf in the northern portion of the study area. Linear slope aprons were formed in the southern portion by sediment derived from the steep, uplifted margin of the Central Basin Uplift. The rising Red Hills Arch and Grisham Anticline formed bathy-metric obstacles on the sea floor that deflected currents to the southwest. Sedimentation changed from predominantly clastic in the lower and middle Morrow to mainly carbonate in the upper Morrow and Atoka. Upper Morrow and Atoka strata consist primarily of carbonate sediment deposited as the shelf edge prograded into the basin during a relative rise in sea level. Deep-water sediments were deposited to the southeast of the prograding shelf. Sediments were deposited in both fan and ramp settings off the Central Basin Uplift. By the Late Morrowan and Atokan, the Northwestern Shelf had prograded into the basin, covering the Red Hills Arch. The Central Basin Uplift and Grisham Anticline continued to control patterns of sediment distribution to the south.

Potential hydrocarbon reservoirs exist in stacked turbidite channels, overbank splays, and fan lobes within both Morrowan and Atokan fan complexes. These reservoirs will have good seals, but are likely to be highly heterogeneous. Potential reservoirs also exist in feeder channels on the Northwestern Shelf and the Central Basin Uplift, as well as slope aprons deposited along the flank of the Central Basin Uplift. Natural gas accumulations in the Haley Field area are highly overpressured and very deep. Reservoirs along the northern end of the Central Basin Uplift are likely to be shallower but still possibly overpressured.