
Origin and Structural Development of the Pearsall Arch and its Relationship to Pearsall Field, Frio County, South Texas

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ABSTRACT

The Pearsall Arch is an east/northeast-trending, southwest-dipping structural ridge associated with the giant Pearsall (Austin Chalk) Field in southwestern Frio County. The arch forms an important part of the trapping and production mechanism of the 179 MMBOE (million barrels of oil equivalent) Pearsall (Austin Chalk) Field.

A key seismic line shows that the arch is underlain by relatively shallow Paleozoic basement (penetrated by two wells) lying southeast of a half-graben containing more than 1 sec twtt (two-way travel time) of pre-Cretaceous fill (perhaps 6600 ft [2 km]). The nature of the fill of the “North Pearsall Graben” is unknown, but it generates continuous high-energy seismic reflections that may represent alternating fine-grained and coarse-grained zones within an alluvial sequence (or alternatively igneous flows or sills).

The arch and the graben basin die off southwest of Frio County and also in the northeastern part of the county. The structures are interpreted as a horst-graben couplet formed within the strike-slip Frio River Zone in early to middle Jurassic time. Faulting does not appear to be present in younger Cretaceous units, but a continuous arch-syncline pair is formed by sediment compaction.

A well-log cross-section of post-Edwards strata across the maximum relief of the arch and the basin to the north, called the North Pearsall Syncline, shows a steady reduction in relief through time, from over 614 ft (187 m) at the Del Rio (Cenomanian) to 331 ft (101 m) at the top of Carrizo (lower Eocene). Combined with the expression of the arch in surface outcrop, these results are consistent with an origin by relative compaction north of the arch. Compactional subsidence north of the arch implies that the North Pearsall sedimentary basin is thick (at least 6000 ft [1.8 km]) and highly compactible. If the basin contains organic shale, it may include an operating petroleum system that is completely untested at present.