

Detachment Levels and Implications for Exploration in the Marathon Fold and Thrust Belt, west Texas

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The Marathon Fold and Thrust Belt in west Texas is an exposed salient in the Ouachita orogenic system. Tectonic shortening was primarily accommodated along a basal decollement, however, multiple detachment levels are present within the stratigraphic section. These detachments produce additional structural complexities that have hampered early exploration efforts in locating reservoir and identifying traps in the subsurface. Unraveling these complexities is an important step towards continued exploration success. We combine geologic studies based on outcrop data with results from subsurface exploration in Pinon field and propose a regionally extensive detachment surface in the late Mississippian to early Pennsylvanian Lower Tesnus formation. Specifically, we observe structural discordance between Pennsylvanian and younger strata and Mississippian and older strata, including folding and imbrication of Devonian to Ordovician rocks beneath the Lower Tesnus detachment. These observations suggest that the Lower Tesnus detachment may have initially formed as a relatively shallow decollement in the foreland that was subsequently exploited as a roof thrust in a duplex system as deformation progressed and older strata were incorporated into the toe of the orogenic wedge.