Structural Geology of the Spiro Sandstone Reservoirs along the Frontal Ouachitas-Arkoma Basin Transition Zone, Southeastern Oklahoma

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Three major gas fields of the Frontal Ouachitas-Arkoma Basin transition zone between Hartshorne and Wister Lake area are Hartshorne, Wilburton and Red Oak, producing mostly from the structural traps associated with the Lower Pennsylvanian Spiro sandstone reservoir. Since the mid-1990s, we have constructed over 20 balanced structural cross-sections along the transition zone. The cross-sections are based on the wire line logs of 100's of wells, available 2-D reflection seismic profiles, and surface geologic maps.

The Wilburton Triangle zone (Cemen et al., 2000) is present between the Arkoma Basin and frontal Ouachitas fold-thrust belt in the Wilburton gas field area. The triangle zone is floored by the Lower Atokan Detachment (LAD) and flanked by the Choctaw fault to the south and the Carbon fault to the north. Below the triangle zone is a well-developed duplex structure, which was formed by hinterland dipping imbricate thrust faults splaying from a floor thrust and joining to the LAD in the Atoka Formation. The LAD continues northward and displaces the Red Oak sandstone before reaching a shallower depth and forming the Carbon fault as a north dipping backthrust below the San Bois syncline. To the east of the Wilburton field, the Carbon fault makes a lateral ramp to the east and becomes a blind backthrust. The Carbon fault loses its separation eastward in the subsurface and dies out in the Wister Lake area.

Almost all of the successful gas wells producing from the Spiro sandstone reservoir in the footwall of the Choctaw Detachment are drilled into the structurally higher parts of horses within the duplex structure where thrust faults may be serving as seals. This suggests that the Spiro reservoir was charged before the Pennsylvanian thrusting in the transition zone.