Structural Style of the Ardmore Basin

Bryan Sralla[1] (1) Hewitt Mineral Corporation, Ardmore, OK

The complex structural geology of the Ardmore Basin is considered by many workers to have formed because of large-scale sinistral strike-slip motion. A detailed re-interpretation of the data instead suggests that basement-involved contraction may be a better model. The newer hypothesis is based on a series of transverse, structurally balanced and palinspastically restored cross sections constructed across several of the significant geologic features in the basin. The cross sections were created and kinematically validated utilizing LithoTect structural modeling software and incorporate subsurface control provided by greater than forty-thousand oil and gas wells. The process of restoring the cross sections to a pre-deformed state suggests that flexural slip was the predominant folding mechanism. In addition, strain calculations ranging from 20-26% indicate deformation in a uniform NE-SW oriented horizontal stress field, inconsistent with wrench tectonics. At the largest scale, the structural style more closely resembles classic foreland basement-involved “compressive block uplifts” observed in the Laramide Rocky Mountains of North America. Like the Rocky Mountains, many of the mountain front areas across the Ardmore Basin have a significant component of “basement-overhang” that are documented by well penetrations and seismic. At the smaller scale, folds display a concentric to complex fold style with numerous volumetric crowd features and detachment surfaces. High-angle faults with either a vertical, reverse, normal, oblique-slip or strike-slip sense of motion are also noted in the basin, and may have resulted from re-activation of pre-existing zones of weakness in the basement during the Pennsylvanian.