Seismic Assessment of Wrench-Style Deformation Affecting the Red River Formation in Harding County, South Dakota and Bowman County, North Dakota

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Previous regional studies of the Williston Basin have examined basin-wide wrench style tectonics and paleostructure. This study develops similar models on a field scale to aid identification of areas in or near existing fields for developmental drilling or secondary recovery operations. Geophysical studies integrated with geological and engineering evaluations provide interpretation of reservoir heterogeneities due to faulting, fracturing and facies changes on a scale useful for field development.

Faults and shear lineaments produce structures and segmentation of Ordovician Red River reservoirs in the southern Williston Basin. Production histories and pressure data indicate significant lateral discontinuities and non-radial drainage. These reservoir barriers can prevent efficient oil recovery from intervals which appear relatively homogeneous from log data. An understanding of these lineament and wrench-style deformation patterns can lead to better identification of undrained reserves and drilling opportunities for additional oil recovery.

Reworking of old seismic data with new tools and perspectives has confirmed the lineament orientation on a field scale to provide a local model of wrench style deformation in the study area. Low fold (400-800%), structurally ambiguous seismic data obtained during the 1970's were reprocessed to provide better definition of field structures and fault trends. Use of reflection statics and radon stack provided significant noise reduction and clearer fault definition. These seismic data were interpreted in conjunction with log data and sedimentation patterns to identify major fault patterns. The integration of seismic interval time data and formation thicknesses from well logs provided further understanding of depositional thinning, fault breaks, and porosity developments on a field scale.