STRUCTURAL GEOLOGY AND TECTONIC HISTORY OF THE EAST-CENTRAL PARRAS BASIN, COAHUILA, MEXICO

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ABSTRACT

Detailed field mapping and imagery analysis (Landsat, SIR-A radar, black & white air photos) facilitate a structural and tectonic interpretation of the Parras Basin. The Parras Basin is the erosional remnant of a Maastrichtian-Paleocene foreland basin. The Difunta Group, over 4000 m (13,000 ft) of eastward-prograding fluvio-deltaic and westward-transgressing marine deposits (McBride et al., 1974), accumulated in the elongate east-west trending Parras Basin during the early development of the Sierra Madre Oriental fold-thrust belt.

The deformation sequence in the Parras Basin initiated with NNE directed thrusting and folding, accompanied by layer parallel shortening that produced a weak solution cleavage. N75°W trending folds, south of the Coahuila Platform, were progressively deformed resulting in a 30° counterclockwise rotation around the southeast "corner" of the Coahuila Platform. This resulted in the formation of N75°E trending, symmetric to asymmetric, NNW verging, gently westward plunging anticlines and doubly-plunging synclines, with thinning in the steep north limbs, and the formation of thrust faults with NNW directed transport. The early-formed solution cleavage passively rotated with the limbs of the folds and a more common, weak to moderate, axial surface parallel, solution cleavage formed in the hinge zones. Mesoscopic folds, planar calcite slickenfibers, syntectonic antitaxial calcite and quartz vein fibers, and striae document a dominant NNW transport direction and a poorly-developed, secondary WNW transport direction. A well defined 20-km (12-mi) wide zone of N20°-40°W striking, high angle normal faults and lesser strike-slip faults cut all previously developed structures.

Parras Basin rocks and structures reflect Laramide orogenic activity and the development of the Sierra Madre Oriental in northeast Mexico. Early thrusting, in the Sierra Madre Oriental transverse segment, of the thick Mesozoic carbonate sequence, and flexure of the foreland generated an asymmetric, longitudinal depression parallel to the advancing sheet. Erosion of an active magmatic arc along the western margin of Mexico and the rising hinterland supplied the fine-grained terrigenous material for the Difunta Group. Successive delta depocenters preserved in the central portion of the Parras Basin migrated to the north, with the thickest accumulations of the Difunta Group preserved closest to the Sierra Madre Oriental structural front. Continued northward migration of the Sierra Madre Oriental structural front along a basal decollement, culminated with local overthrusting and the incorporation of the Parras Basin rocks in the fold-thrust belt. Evolution of the Monterrey salient, a convex northward, arcuate fold trend in the Sierra Madre Oriental transverse segment, probably resulted in left-lateral transverse faulting between the present margin of the Parras Basin and the western limit of the Monterrey salient. The trace of the fault is suggested by the Saltillo-Ramos Arizpe lineament. The present transverse and salient geometry of the Sierra Madre Oriental-Parras Basin fold-thrust belt reflects the influence of irregular basement structures related to the late Paleozoic closing of the Gulf of Mexico and the early Mesozoic opening of the Gulf of Mexico. Exploration targets may exist to the south-southwest below the thick carbonate thrust sheets of the Sierra Madre Oriental fold-thrust belt in the coarser-grained deltaic deposits of the Difunta Group. The lack of primary porosity in the thoroughly calcite cemented, fine-grained sandstones would require secondary porosity to be developed to make them an attractive target.

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