MIDDLE PENNSYLVANIAN STRIKE-SLIP FAULTING ON THE EASTERN EDGE OF THE LLANO UPLIFT, CENTRAL TEXAS

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ABSTRACT

Pre-Strawn rocks of the Llano Uplift, Central Texas, are cut by a pervasive system of NE-trending faults whose movement more-or-less coincides with the culmination of Ouachita orogeny in the area. Map patterns indicate that major faults are near-vertical, which can be explained best by strike-slip faulting. Right-lateral displacements probably dominate near Marble Falls, Texas.

The complex fault slice centered on Marble Falls, near the eastern edge of the Paleozoic outcrop, is more than 30 km long but only 2–8 km wide. Structure within this block exhibits a syncline and an anticline having axes at about N60W that is, dips are NE in the southwestern part of the block, SW for 5 or 6 km NE of Marble Falls, and thence NE toward the unconformable Cretaceous cover. The eastern bounding fault at Mormon Mills has an apparent vertical displacement of 500 meters or so (Marble Falls Limestone and Smithwick Shale against Tanyard Dolomite). The western boundary fault has an apparent vertical displacement of more than 1 km at Marble Falls (Smithwick Shale and Marble Falls Limestone against Town Mountain Granite) but to the N splinters into several left-stepping blocks. Some splinter faults die out northward within a few hundred meters to zero displacement, and the western bounding fault of the dominant splinter block some 10 km N of Marble Falls has only 100–200 meters apparent vertical displacement (Tanyard Dolomite against San Saba Dolomite). Much of the differential displacement clearly was accommodated by folding of strata within the fault block, although cross-faults are abundant.

Outcrop and quarry exposures E of U. S. 281, near Sudduth Siding, show that the Threadgill Member of the Tanyard Formation and the overlying Staendebach Dolomite, near the crest of the broad antiform, are shattered by fractures in sets that trend N20W, N80E, N40-50E, and N30-40W. The N20W and N80E sets are most prominent on 1940 and current aerial photographs; these sets bound the Brownlee Ranch Dolomite Quarry (Dow Chemical USA) on the west and north. Randomly-oriented blocks of chert-bearing Staendebach Dolomite were dropped into breccia zones along NE-SW and E-W fracture sets within Threadgill Dolomite. No younger material was structurally incorporated into the breccia.

Where fractures are well-exposed in solid rock between breccia zones, little vertical displacement could be discerned across most individual fractures, but nearly-horizontal to shallowly-dipping slickensides and mullions are common. Some fractures of the N20W, N40-50W, and N40-50E sets display "flower structures" within the quarry on a scale that cuts dolomite into vertically-bounded blocks. In pasture outcrops these features can be mistaken easily for vertically-dipping beds 5 cm to 1 m thick. We believe that the N20W/N80E and the N40-50E/N40-50W fracture sets are pairs that formed at different times under different stress conditions, but could not determine unequivocal temporal relationships. Saddle dolomite druse in single to multiple layers coats fracture faces of all sets and no vertical or steeply-dipping stylolites were found, although horizontal stylolites are abundant.

The gross morphology of the Ouachita belt indicates first-order westward movement of the orogen in Central Texas. We suggest that as the orogen impacted the generally NW-SE trend of the Central Texas craton, extensive strike-slip faults sliced the craton into blocks, producing gentle folds within blocks during the process. Blocks also were extensively fractured internally, probably during more than one horizontally-compressive stress event. Along the eastern exposed margin of the Central Texas craton, horizontal compression ceased before fractures could be closed and modified by pressure-solution into vertical stylolites.

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