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EVIDENCE FOR PENNSYLVANIAN TRANSPRESSION FROM FRACTURE ANALYSES IN THE SACRAMENTO MOUNTAINS, NEW MEXICO

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Folds and faults in the western Sacramento Mountains are unconformably overlain by undeformed or weakly-deformed Permian strata, offering an excellent opportunity to study Pennsylvanian deformation related to Ancestral Rocky Mountains tectonics. Three major Pennsylvanian-early Permian, north-south striking faults in the range chosen for detailed field study and kinematic analysis are the Fresnal, Alamo and Bug Scuffle faults. The faults studied here have been interpreted as either normal (Pray, 1961), vertical (Johnson, 1985), and, in the case of the Fresnal fault, normal with a dextral component (Cather, 2000) due to the obliquity of the fault with local fold axes.

Slickensided minor faults (n = 588) were measured on and adjacent to these major faults. Eigenvector analysis of the slickenlines gives an average slip orientation of S72°W-38°. The average slip trend is 18 degrees from perpendicularity with the average fault strike, suggesting dextral oblique motion. Slickenlines measured on N-S striking faults, both the major fault planes and on minor faults adjacent to the main faults (n = 94) are bimodal, with near vertical and near horizontal orientations. This indicates that both strike-slip and dip-slip motion occurred on the faults, perhaps in two separate events or during a partitioned transpressional event. Of sub-horizontal slickenlines on these planes right-lateral shear sense was dominant (n = 13). Analysis of a thin section cut horizontal to the Alamo Fault shows definitive R and R' Riedel shears (method of Petit, 1987) indicating right-lateral shear sense for the Alamo Fault.

Ideal σ_1 axes orientations (25° from slickenlines using the method of Compton, 1966) of all fault data indicate an average σ_1 orientation of S71ºW-23º. Ideal σ_1 axes orientations for the Fresnal and Alamo faults in the northern part of the study area demonstrate NE-oriented compression consistent with this average σ_1 orientation, while those from the Bug Scuffle fault to the south indicate NW-directed compression. An extensional component, with σ_1 vertical, is noted in plots for the Fresnal and Bug Scuffle faults. Restoration of bedding orientation does not alter obliquity of stresses to the main faults.

These fault data from major Pennsylvanian-early Permian faults preserved in the Sacramento Mountains indicate a complex transpressional event occurred in this area during the Ancestral Rocky Mountains uplift. Some overprint of Laramide and Rio Grande Rift tectonics is represented in the data. Fold axis orientations relative to fault strikes and fault kinematics support the Ye et al. (1996) hypothesis of NE-directed compression and Yang and Dorobek conclusions for right-lateral movement on major faults bounding the Central Basin Platform (1995). This hypothesis will be further tested by additional thin-section analyses and 2D and 3D restorations.

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