

Evidence of Strike Slip Movement and Attenuation of Offset, Pecos Slope, Southeastern New Mexico

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The Pecos Slope of southeastern New Mexico has been explored for years for oil and natural gas fields, such that there is a large amount of subsurface data for the region. Experience in the subsurface of the Permian basin indicates that the magnitude of structural features increases with depth. This is especially true when mapping vertical uplifts such as those found on the Central Basin Platform and structures in the Tatum basin. Differential compaction, erosion, continuous uplift, additional sedimentation, and facies changes both off and on structural highs are primarily responsible for this relationship. Isopach maps of purely vertical uplift, constructed of these structures, demonstrate that sediments thin over the top and thicken on the flanks. The Pecos Slope has been involved in significant lateral, strike slip movement. The dramatic northeast trending "Buckles" are the surface expression of basement sourced, right lateral strike slip faults. Lateral displacement has been intermittent, but continuous from Precambrian time to the present. Current expression of this lateral deformation is both vertical and horizontal. Strike slip movement is generated in the basement and transmitted vertically. When basement is overlain by rigid, brittle rock, movement is transmitted directly to surface outcrops and is relatively easy to identify. When basement is overlain by plastic sediments (e.g., shale, evaporates, or other incompetent sedimentary rocks), coupling with overlying rigid beds is compromised and both horizontal and vertical displacement at the surface is attenuated. Recent mapping efforts by the New Mexico STATEMAP program have produced a series of 1:24,000 surface geologic maps for part of the Pecos Slope. In comparing subsurface data with surface bedrock expression, substantial discordance in vertical offset is observed on faults between the top of Precambrian basement and the Permian Yeso and San Andres Formations at the surface. In some places, the difference in vertical displacement is up to an order of magnitude (e.g., -4000' Precambrian offset versus -300' San Andres offset). Attenuation of vertical displacement on faults in the eastern Sacramento Mountains occurs in the much less competent Yeso Formation, which is primarily comprised of mudstone, siltstone, gypsum and lesser sandstone and dolomite.