

Outcrop and Seismic Analysis of Natural Fractures, Faults and Structure at Teapot Dome, Wyoming

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A systematic study of natural fractures in outcrop at Teapot Dome documented three throughgoing fracture sets. The oldest fracture set is oblique to the hinge of the anticlinal fold. A second set of fractures consists of bed-normal extension fractures striking subparallel to the fold hinge. A third set consists of bed-normal extension fractures striking normal to the fold hinge. In many areas this fracture set is spatially related and subparallel to NE-striking, normal dip-slip and normal oblique-slip faults that maintain a roughly perpendicular orientation to the fold hinge. Fractures, deformation bands and faults that have a normal sense of displacement are also observed

Recent and ongoing analyses of new 3-D seismic data show normal faults in the upper stratigraphic units and thrust faults in lower Paleozoic units. Slight differences in fault orientation (up to 10 degrees) from near-surface to near-basement indicate that the orientation as well as the magnitude of induced stresses varied with depth during formation of the anticline. Therefore a complex interplay of Laramide stresses with pre-existing basement structures are responsible for uplift of Teapot Dome. Fracture-abutting relationships and the spatial relationship of fractures, deformation bands, and faults relative to the fold also indicate the deformation process was a dynamic interactive system, wherein progressive folding was driven by displacement on the basement-involved thrust fault. Fractures and normal faulting perpendicular and parallel to the fold hinge accommodated extension in two directions associated with the three-dimensional draping of beds above the thrust.