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THE APPLICATION OF KINEMATIC INDICATORS TO DETERMINE PALEO-STRESS FIELDS AND FLUID FLOW PATHS WITHIN THE MIDWAY SUNSET OIL FIELD

The technique of using well-established geometric relationships to determine the sense of shearing, paleo-stress fields, and fluid flow paths is a powerful, but infrequently used tool within the petroleum industry. Kinematic indicators as specifically applied here describe the use of fracture geometries and characteristics to determine the movement history and paleo-stress fields of faulting.

The kinematic interpretations are based on an Integrated Structural Analysis completed in conjunction with mapping the Quality Pool area of the Midway Sunset oil field. Fracture sets were categorized as shears, riedel shears, extension fractures or fold-related fractures, and then were analyzed on separate stereonet pole plots with respect to their structural features, timing, alteration, mineralogical characteristics and amount of contained petroleum. The paleo-fluid conduits were then further characterized using geochemical, petrographical and statistical techniques.

The paleo-stress fields record that the 38 fault, a dextral-normal fault discovered as a result of this study, was activated in three of four recognized deformation events. Initiated as a dextral-wrench fault in event D1, the 38 fault evolved to a normal-dominated fault in event D3. Another genetically and spatially associated fault, the 44 fault, was initiated along bedding planes during event D1 with reverse movement, and then evolved to normal-dominated shearing during event D4.

Segments of the 38 fault showing favorable inflections in strike (i.e. clockwise) and/or dip (i.e. steeper) contain the most evidence of paleo-hydrothermal fluids and petroleum. The 44 fault system also controls petroleum migration, but as a barrier rather than as a conduit.