Structural architecture and evolution of the Central Utah thrust belt; implications for hydrocarbon exploration

presentation for AAPG Annual Meeting – Calgary, Alberta, Canada

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The recent discovery of the Covenant oil field along the deformation front of the Central Utah (Sevier) thrust belt has sparked renewed interest in the three-dimensional structural architecture, extensional and compressional structural geometries, and the structural evolution of the region. Along the Central Utah sector of the Idaho-Wyoming-Utah thrust belt, large-scale thrust sheets include the Canyon Range, Charleston-Nebo, Pavant, Paxton, and Gunnison-Salina thrust sheets, structural systems that were emplaced during Cretaceous through early Tertiary compressional deformation of an actively evolving foreland basin. Internal deformation within large-scale thrust sheets includes frontal and lateral duplexing and, in the vicinity of the deformation front, complex back-thrusting, tectonic-wedge formation and passive-roof duplexing, the latter assisted by ductile deformation within a thick, Jurassic-age, mixed evaporite-shale section of the Arapien Formation. The compressional deformation-front of the thin-skinned Sevier thrust belt in the Central Utah area is now recognized as being located along a Jurassic extensional fault system, and additional, pre-compressional extensional faults are believed to determine the locations of thrust-ramps and/or duplex systems along and within given thrust sheets. The east-vergent, compressional structural systems of the Central Utah thrust belt are overprinted by an Oligocene through Recent extensional tectonic event, related to adjacent Basin-and-Range development, that has broken original thrust sheets into compartmentalized extensional fault blocks. Successful hydrocarbon exploration within the Central Utah thrust belt will require focusing on original and late-stage migration pathways for oil and gas, related to Jurassic extensional faulting, Cretaceous thrust-sheet stacking, and Tertiary extensional faulting.