AAPG Search and Discovery #90106©2010 AAPG Rocky Mountain Section, Durango, CO 13-16 June 2010

Structural and Tectonic Evolution of the Douglas Creek Arch and Environs, Northwestern Colorado and Northeastern Utah

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The Douglas Creek arch is a north-south-trending faulted anticline that separates the Uinta basin of north-eastern Utah from the Piceance basin of north-western Colorado. Previous work indicates that the arch initially formed during the Laramide orogeny as part of a broad, north-south-trending uplift that extended from northwestern Colorado into southern Wyoming and included the Rock Springs uplift. The axis of this structure was offset sinistrally and truncated by the late-Laramide uplift of the Uinta Mountains. This study examines available geologic, structure, Bouguer gravity, aeromagnetic, seismic, and paleomagnetic data to investigate this late-Laramide history, as well as indications of younger, post-Laramide tectonic events that have shaped the Douglas Creek arch and environs. This study also uses the existing data to evaluate the genetic relationships between Precambrian basement structures and shallower structures formed in the sedimentary cover.

Results of this investigation suggest that a major east-west-oriented structure, the Douglas Creek fault, likely has a Precambrian ancestry and was reactivated during the Phanerozoic. Structures in the study area are consistent with periodic sinistral slip, dominantly along the Douglas Creek fault, most recently during late-Laramide tectonic events. Northwest-striking fractures flanking the Douglas Creek arch and extending into the surrounding basins are likely synthetic strike-slip faults related to a subsequent period of dextral slip on the Douglas Creek fault. This deformation could be the result of the northwest translation of the Colorado Plateau and opening of the Rio Grande rift during post-Laramide Tertiary extension.

Wrench faulting has created enhanced permeability and numerous structural traps for petroleum accumulation across the Douglas Creek arch and in the surrounding basins. Wrench structures are identified by their distinct geometries, and the origins of their individual features can be discerned using supporting subsurface data. Knowledge of the genesis of the wrench system allows for better understanding of wrench structures and thus a better potential for success in the search for oil and gas.