STRUCTURAL GEOLOGY OF THE OWL CREEK MOUNTAINS AND THE NORTHERN WIND RIVER BASIN, WYOMING

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ABSTRACT

Located within the Rocky Mountain Foreland province of Wyoming, the Wind River Basin is a northwestward-deepening, rhombic-shaped structural depression bounded by basement-rooted structural uplifts. However, while the Wind River Basin is located along the gently north- to northwest-dipping "back-limbs" of the Wind River Range and Granite Mountains uplifts, the northern boundary of the basin is defined by a complex compressional to transpressional structural system along which the Owl Creek Mountains have been thrust over the Wind River Basin. Understanding hydrocarbon-trap development and potential hydrocarbon migration pathways within the northern Wind River Basin is therefore dependent on understanding the structural relationships between the Owl Creek Mountains and the Wind River Basin, and the structural evolution of the Owl Creek Thrust system.

As part of an overall structural study of the northern Wind River Basin, a detailed structural mapping program was conducted within the Owl Creek Mountains and the adjacent regions of the northwestern Wind River Basin. Surface structural data collected during the field program was then integrated with subsurface data to produce a series of balanced structural cross sections across the Owl Creek Mountains. Maps, cross sections, and subsurface data were then utilized to examine the tectonic boundary between the Owl Creek Uplift and the Wind River Basin.

Results from this research indicate significant variations in structural geometries along the Owl Creek Thrust and related structural systems between the eastern and western Owl Creek Mountains and the adjacent sectors of the Wind River Basin, with accommodation to tectonic shortening across the region having been relayed from a single, dominant fold-thrust system within the Wind River Canyon region to multiple structural systems to both the east and west. Additional structural variations identified along the Owl Creek Uplift-Thrust system include: 1) a significant decrease, from east to west, in stratigraphic offset and structural uplift across the Owl Creek Thrust system; 2) a general increase, from east to west, in the width of the area over which compressional deformation across the Owl Creek structural system has been accommodated; 3) a westward increase in the importance of northeast-vergent back-thrust systems; 4) a pronounced change in the orientation of structural elements in the vicinity of Mexican Pass; and 5) a westward decrease in the importance of post-Laramide extensional faulting along the south flank of the Owl Creek Mountains. Despite the structural variations described above, all of the structures identified and mapped within the study area are basement-rooted elements which are believed to be geometrically and genetically related, and which are believed to have developed as a result of displacement along a mid-crustal detachment surface which climbed progressively towards the erosion surface from north-northeast to south-southwest.

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