

RECENT EXPLORATION IN THE CENTRAL SNOWCREST RANGE, MONTANA

by

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The Snowcrest Range contains the frontal thrust blocks of the Late Cretaceous, basement-involved Blacktail-Snowcrest uplift. The thrust blocks consist of upright and overturned Phanerozoic rocks, cored by Archean basement. The frontal thrust faults, the Snowcrest-Greenhorn thrust system, are part of a long-lived, northeast-trending, zone of crustal weakness which has undergone multiple reactivation. This zone of weakness, the Snowcrest-Greenhorn lineament, influenced depositional patterns of late Paleozoic rocks and probably has a Precambrian ancestry. A significantly thicker section of upper Paleozoic rocks was deposited northwest of the lineament within a sedimentary basin called the Snowcrest trough. Where these formations thicken into the trough, reservoir and hydrocarbon-source facies are well developed. Source-rock facies are found in the Mississippian Big Snowy Group (Snowcrest Range Group of Wardlaw and Pecora, 1985) and the Permian Phosphoria Formation. Reservoir facies are found in the Pennsylvanian Quadrant and Permian Shedhorn sandstones. During Late Cretaceous uplift the Snowcrest trough became positive, and trough facies were thrust obliquely eastward against the thinner shelf facies to the east along a thrust zone within the Snowcrest-Greenhorn thrust system.

Good hydrocarbon shows and porosity were encountered in the Marathon 1-20 Cornell Camp well above this thrust zone which subtends the Snowcrest Range block. The thickest and most continuous porosity intervals such as the Quadrant and Shedhorn sandstones had fair to poor shows and appeared to be flushed with fresh water derived from the surface. However, tighter rocks and porosity zones which are protected by permeability barriers had excellent live oil shows. A porous dolograinsstone in the Triassic Thaynes Formation yielded oil to the drilling mud. Log calculations indicate a large volume of oil is in place in the Snowcrest Range block. The primary objective of the well was a Quadrant and Phosphoria reservoir-source package on a geophysically defined dome beneath the thrust zone which subtends the Snowcrest Range block. These formations had only a residual oil show and little porosity. Organic geochemical analysis indicates that the Phosphoria in this footwall block was the source of the oil in the overlying Snowcrest Range block. Also, burial-history modeling indicates that oil generation and migration were closely associated with Cretaceous thrusting and synorogenic sediment burial.