

## Fracture Distribution and Character in Exposed Cretaceous Rocks Near the Umiat Anticline, North Slope of Alaska

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Umiat oil field in the southeast part of the National Petroleum Reserve - Alaska is one of the earliest discovered oil fields on the North Slope of Alaska. The anticline that hosts the field formed in Cretaceous foreland basin deposits during continued contraction of the Brooks Range during early Tertiary time. Shallow reservoir depths and sub-freezing reservoir temperatures have precluded development to date, but recent advances in drilling technology now make this large accumulation attractive. This study documents the orientation, distribution and character of fractures in exposed age-equivalent rocks in the vicinity of Umiat anticline in order to better understand how fractures at Umiat field may contribute to reservoir permeability. This is particularly important at Umiat field because the development scenario calls for several horizontal wells in order to access the shallow reservoir.

Fractures were surveyed at four sites in anticlines similar to Umiat anticline. Two fracture sets were delineated at each site based on relative fracture timing, fracture length and height, the presence or absence of mineral fill, and orientation with respect to bedding strike. The east-trending Big Bend anticline is located ~30 km SSE of Umiat anticline. A site in its south limb near the base of the Nanushuk Formation displays a well-defined conjugate set of NE and SW-striking shear fractures that is bisected by the trend of the fold axis. The NW-striking set is consistent with right-lateral faults present in the area. A site in the north limb of Big Bend anticline also displays apparent conjugate shear fractures, but they vary much more in their orientation. This may reflect complex local folding associated with branching of the main anticline hinge. The Fossil Creek site is located in the south limb of the Fossil Creek anticline ~24 km SSW of Umiat anticline. This site also displays apparent NE and NW conjugate shear fractures that are bisected by a south dipping bed direction. The site at Colville incision is in the upper Nanushuk in the north limb of an anticline ~22 km SW of Umiat anticline. It displays a very different pattern of two orthogonal sets of NS and EW striking extension fractures that are oriented normal and parallel to the host fold axis. This site is only 8 km from the Fossil Creek site, but is separated from it by an inferred left-lateral fault along the Colville River.

Both the shear and the extension fracture sets are interpreted to be fold-related, but represent different local stress regimes within the fold. Extension fractures similar to those identified at Colville incision may occur in the upper part of the Umiat anticline; shear fractures similar to those at Big Bend anticline and Fossil Creek may occur lower in the Umiat anticline, where confining stress is greater.