

The Aklavik Range as an Analogue for Basin-Margin Structures, Mackenzie Delta Region

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ABSTRACT

Two structural domains are documented by new detailed bedrock mapping in the Aklavik Range. A western low-strain domain, located between the Donna River Fault zone (DRFZ) and the Cache Creek uplift, preserves open doubly-plunging folds that are dismembered by predominantly local-scale faults. An eastern high-strain zone coincides with the Aklavik Range itself. Within this zone, structures are dominated by northwest trends. Whereas the folds in the low-strain domain have wavelengths on the order of 10 km, structures in the high strain domain typically are spaced less than one kilometre apart.

The low-strain domain is dominated by the Martin Creek anticline and syncline, gentle folds trending 010° with limbs dipping less than 30° . The anticline extends across the entire map area, whereas the syncline comprises an en echelon pair. The folds are markedly doubly plunging, producing a dome and basin geometry. Faults are common, but only three exceed 10 km in mapped length. Faults have steep dips but variable strikes and are best developed in the brittle sandstone-dominant units. They dissipate in the thick shale successions. Local structures indicate early east-west shortening, followed by later north-south shortening accompanied by east-west extension.

The Donna River Fault is a splay diverging northward from the Richardson-Trevor-Eskimo Lakes fault system. It projects beneath the Mackenzie Delta to define the eastern margin of the Tununuk High, the downplunge projection of the Cache Creek uplift. The fault, where exposed, is a subvertical, throughgoing structure striking 010° , accompanied by a zone of brecciation up to 300 m wide. The Aklavik Range is a local structural culmination comprising competent Paleozoic and Jura-Cretaceous strata east of the Donna River Fault, juxtaposed against Early Cretaceous shale and sandstone on the west. Most faults in the Aklavik Range have steep dips; however, three low-angle east-directed thrust faults are mapped. The Donna River Fault zone preserves evidence of multiple episodes of displacement since Jurassic time. Inferred Jura-Cretaceous rift-related activation has been completely overprinted by Tertiary convergent and dextral strike-slip deformation. However, multiple sets of fault striations are rarely preserved in this zone. The orientations of subsidiary structures, as well as penetrative fabrics within the DRFZ indicate dextral strike-slip; whereas the low angle thrust faults and significant uplift of the Aklavik Range indicate important convergence. Aklavik Range geometry and evolution are analogous to those of subsurface structures in the southeast Beaufort-Mackenzie basin-margin area.