

Upper Paleozoic Geology of the Northwest Margin of the Sverdrup Basin, Arctic Canada: Insights using stratigraphy and detrital zircon geochronology into the Paleogeographic and Tectonic evolution

*Bradley J. Galloway, Benoit Beauchamp, Keith Dewing, William Matthews
University of Calgary, Geological Survey of Canada*

Summary

The upper Paleozoic succession along the northwest margin of the Sverdrup Basin is little studied and poorly understood, yet has potential to uncover the paleogeographic and tectonic evolution of the Arctic regions including Crockerland. In this study, upper Paleozoic drill cutting samples were collected in five exploration wells on Brock, Mackenzie King and Ellef Ringnes islands. Seven unconformity-bounded sequences were identified and correlated in two cross-sections. Physical relationships interpreted from seismic on Ellef Ringnes Island indicate a major syn-sedimentary fault offsets the upper Paleozoic succession. The fault is a down-to-the-north half-graben of assumed Serpukhovian age. Gzhelian reactivation, associated with the Melvillian Disturbance, created a depression that extended far northward and was bordered to the south by an associated structural high. Minor reactivations occurred until the Early–Middle Permian boundary.

During the Kungurian, sand derived from Crockerland prograded southward onto the northwest margin; clastic influx continued into the Roadian. After a lull during the Wordian, progradation resumed in the Capitanian. Detrital zircons recovered from Kungurian and Roadian samples on both Brock and Ellef Ringnes islands display Devonian clastic wedge (DCW) signatures, the sediment eroded from the Ellesmerian Orogen. Our study suggests a carbonate

blanket deposited during the Bashkirian–Artinskian on Crockerland sheltered DCW material from erosion. This implies Crockerland was a subsiding, carbonate bank throughout the Pennsylvanian–Early Permian. A base level fall in the Kungurian, accompanying a regional uplift and transition to a more humid climate, breached these carbonates to allow erosion and transportation of DCW material. Mobilization of the DCW is also observed along the southern margin of the basin, but started earlier (Artinskian) and peaked later (Wordian). One detrital zircon of Permian age was found in this study, suggesting zircons of that age recovered on northern Axel Heiberg Island are locally derived and possibly plutonic.