

## **Carboniferous and Permian Stratigraphy and Hydrocarbon Potential of Prince Patrick Island, Sverdrup Basin**

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### **ABSTRACT**

The Carboniferous and Permian succession of the Sverdrup Basin occurs widely in the subsurface of northern Prince Patrick Island of the Canadian Arctic Archipelago, Northwest Territories. The succession is known from a series of seismic profiles and four exploratory wells (Intrepid Inlet H-49, Jameson Bay C-31, Andreasen L-32 and Satellite F-68) that were drilled during the early nineteen seventies. Upper Paleozoic strata are characterized by two broad packages. The lower package comprises Carboniferous to Lower Permian clastics and carbonates that are truncated by a number of northwest-southeast trending syn-sedimentary normal faults. The upper package is composed of Middle Permian (Guadalupian) clastics that were deposited during a regime of passive subsidence following the cessation of faulting. These strata are separated from the underlying Lower Permian and Carboniferous succession by a widespread and locally angular unconformity.

Eleven upper Paleozoic formations have been identified on Prince Patrick Island; they are: Borup Fiord (Serpukhovian(?) red sandstones, conglomerates), Canyon Fiord (Bashkirian-Sakmarian sandstones, shales, limestones), Belcher Channel (Sakmarian limestones, sandstones and shales), Nansen (Bashkirian-Sakmarian limestones), Raanes (Sakmarian mixed clastic-carbonates), Hare Fiord (Bashkirian-Sakmarian shales, siltstones, limestones), "unnamed clastic" (Artinskian sandstones, siltstones and shales), Trappers Cove (Artinskian-Kungurian shales and siltstones), Sabine Bay (Kungurian red shales, sandstones), van Hauen (Kungurian-Wordian dark shales and siltstones, limestones) and Troid Fiord (Wordian-Capitanian(?) sandstones, siltstones).

The upper Paleozoic succession of Prince Patrick Island contains eight major unconformities that can be correlated over a significant area. Five of these unconformities were encountered in Jameson Bay C-31, Intrepid Inlet H-49 and Andreasen L-32. Three additional unconformities were observed on seismic profiles only. The eight unconformities and the seven transgressive-regressive sequences between them have been traced seismically using a series of profiles. The age of these sequences are Serpukhovian(?), Bashkirian-Kasimovian, Gzhelian-Sakmarian, Sakmarian-Artinskian, Kungurian, Roadian-Wordian and Capitanian(?).

The Carboniferous and Permian geological history of Prince Patrick Island recorded a complex succession of events whereby tectonic pulses, as evidenced by brittle deformation, alternated with episodes of tectonic quiescence and

passive subsidence. Climatic conditions evolved from warm and relatively arid during the Bashkirian-Sakmarian interval to increasingly cooler during the Artinskian-Capitanian(?) interval. More humid conditions were also established during the Kungurian. A major river system fed the Prince Patrick area with large amounts of clastic material during the Artinskian-Guadalupian interval.

The current geological setting of the area suggests the presence of many unexplored oil and gas plays. A large segment of the Late Carboniferous and Permian succession lies within the oil window of thermal maturation and/or within the wet gas and condensates zone. Potential source rocks likely occur at various levels in the succession as well as variably porous clastic horizons.