

A Petroleum Events Chart for Cretaceous Strata in Eagle Plain: An Under-explored Foreland Succession in Northern Yukon, Canada

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Eagle Plain consists of 5,800 m of Cambrian to Cretaceous clastic and carbonate strata containing existing reserves of oil and gas. Although 33 wells have been drilled and ~10,000 km of seismic have been shot, the basin remains under-explored, particularly the Cretaceous succession. The following petroleum events chart summarizes the major rock units of the Cretaceous strata and shows the chronology of the four essential elements (source rock, reservoir, seal and overburden rock) and two processes (trap formation and generation-migration-accumulation) of the Cretaceous petroleum system.

Cretaceous strata are ~2000 m thick and unconformably overlie mainly Paleozoic rocks. It includes the Lower Cretaceous Mount Goodenough, Sharp Mountain and Whitestone River formations, which is overlain unconformably by the Upper Cretaceous Eagle Plain Group, subdivided into the Parkin, Fishing Branch, Burnthill Creek, and Cody Creek formations. Cretaceous strata were deposited mainly as a marine foreland succession.

Potential source rocks include the Whitestone River and Burnthill formations, the upper part of the Parkin Formation and locally the Cody Creek Formation. The Fishing Branch Formation is a known gas reservoir, and potential reservoirs are the Sharp Mountain Formation, the lower part of the Parkin Formation and locally the Cody Creek Formation. The Whitestone River and Burnthill Creek formations are potential regional seals. Overburden rock is limited to Quaternary cover.

Laramide-age anticlines, synclines and thrust faults occur throughout Eagle Plain and represent the best traps in Cretaceous strata. Potential stratigraphic traps include pinchouts throughout the Cretaceous succession. Lower Cretaceous source rocks in northwestern Eagle Plain entered the oil window during the late Cretaceous to Tertiary, whereas most of the Cretaceous strata in Eagle Plain were not buried sufficiently to enter the oil window. However, Paleozoic strata entered the oil window in late Carboniferous to Tertiary, suggesting that oil stains in Cretaceous strata migrated from deeper sources. Hence, the critical moment best depicting that point in time for the generation-migration-accumulation of primarily natural gas is very late Cretaceous.