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Stratigraphy, Petrology, and Depositional Environments of Upper Cretaceous and Lower Tertiary Sabbath Creek Section, Arctic National Wildlife Refuge (ANWR), Alaska

A 9,387-ft (2,816.1-m) section of Upper Cretaceous–Lower Tertiary strata is exposed along Sabbath Creek in the northern ANWR of northeastern Alaska and represents a regressive depositional sequence. The entire section is divided into four lithologic units (A-D), each characterized by distinct depositional assemblages. Unit A, at the base of the section, consists of several coarsening-upward sequences of alternating thick organic-rich siltstones and fine-grained litharenites, representing deposition in subaqueous to lower delta-plain environments. Unit B stratigraphically overlies unit A and is characterized by multiple, mutually erosive, fining-upward sequences of fine to coarse pebble litharenites typical of point-bar sequences in a meandering stream environment (lower to upper delta plain). Unit C consists of multiple, poorly developed fining-upward sequences of dominantly clast- and matrix-supported pebble conglomerate interpreted as braided stream deposits. At the top of the section, unit D is characterized by multiple fining- and a few coarsening-upward sequences of organic-rich shale with minor amounts of medium to coarse litharenite and pebble conglomerate representing meandering stream deposition.

The Sabbath Creek section is lithologically dissimilar to coeval units to the west. The Sagavanirktok Formation and Colville Group contain pyroclastic material and thick coal beds not seen in the Sabbath Creek section. Instead, this section is lithologically similar to the Moose Channel formation—a regressive, fluvial, deltaic sequence exposed in the MacKenzie delta area of northwestern Canada. Consequently, detailed interpretation of the Sabbath Creek section has important implications concerning the petroleum potential of the Arctic National Wildlife Refuge and offshore Beaufort Sea.

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Summary of the Geologic Mapping Program by the Division of Geological and Geophysical Surveys (DGGS) in McGrath Quadrangle, Alaska

From 1977-84, DGGS completed 1:63,360-scale geologic mapping of the McGrath quadrangle in western Alaska. Rock units in the study area range in age from lower Paleozoic to recent. The geologic history of this region has integrated stratigraphy, igneous activity, and mineral resources. From Cambro-Ordovician to Middle Devonian time, the Nixon Fork and Dillinger assemblages were deposited as coeval platform continental margin facies. Upper Devonian through Lower Jurassic shallow to deep-water sedimentary-volcanic facies of the Mystic assemblage overlie both older sequences. All three may have been offset right laterally from the Selwyn basin in northwestern Canada along the Tintina and other faults in central Alaska.

Upper Jurassic to Lower Cretaceous flysch of the Black Clastic sequence was structurally juxtaposed against the Dillinger and Mystic assemblages, probably during mid-Cretaceous compression related to terrane accretion in southern Alaska. Upper Cretaceous Kuskokwim Group flysch was deposited over Nixon Fork assemblage rocks in an extensional environment in the westernmost portion of the quadrangle.

A series of calc-alkaline intrusive and extrusive rocks ranging in age from Late Cretaceous to middle Tertiary intrude and overlie older, layered lithologies. Significant metalliferous epigenetic, stockwork, and skarn deposits are related to these igneous rocks near Farewell and McGrath. Middle Tertiary coal-bearing arenaceous sediments have been deposited in structural troughs related to the Farewell fault system. Offset solutions along the Farewell fault suggest up to 60 km of right-lateral offset since the Cretaceous. At least four Pleistocene and one late Tertiary(?) glaciations have advanced northward from the Alaska Range.

The DGGS efforts have resulted in the release of eight geologic maps and an extensive geochemistry survey of the entire quadrangle. A comprehensive summary of the geology and mineral resources of the entire quadrangle is in process. The poster session will also summarize university graduate studies of mineral deposits, igneous petrology, and stratigraphy.

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Carboniferous Conodonts, Algae, and Foraminifers from Lisburne Group, Prudhoe Bay, Alaska

Continuous cores from the ARCO/Exxon South Point State 1 and Pingut State 1 wells at Prudhoe Bay penetrated the Carboniferous Wahoo and Alapah Limestones of the Lisburne Group. The upper Alapah and the entire Wahoo were examined for conodonts, foraminifers, and algae. The Alapah and Wahoo Limestones contain abundant but low-diversity foraminifer and conodont faunas. The succession of foraminifers and conodonts is used to develop a detailed local zonation for well-to-well correlations. The larger scale aspects of the zonation permit correlation of the Alapah and Wahoo Limestones with the Carboniferous section in western Europe as well as the Mississippian and Pennsylvanian sequences of North America.

The Alapah Limestone is characterized by foraminifers of zones 16s through 19. Conodonts from the uppermost Alapah (zone 19) include *Gnathodus girtyi simplex* and *Rhachistognathus muricatus* and are assigned to the *muricatus* zone. The boundary between the Alapah and the overlying Wahoo coincides with a nondiagnostic interval between foraminifer zones 19 and 20 and with the first appearance of rare specimens of *Declinognathodus noduliferous*. The first appearance of *D. noduliferous* is coincident with the mid-Carboniferous boundary and occurs in close proximity to the Mississippian-Pennsylvanian boundary in North America. Foraminifer zones 20 and 21 are easily recognized in the Wahoo and can be integrated with four conodont zones. The conodont zones in the Wahoo are believed to be sensitive to environmental fluctuations and may be of only local biostratigraphic significance.

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Late Pleistocene Marine Transgressions of North Slope Coastal Plain

Two late Pleistocene marine transgressions of contrasting character are recorded by deposits of the Arctic coastal plain. Deposits of the oldest transgression extend from Harrison Bay west to near Barrow and contain a fauna that documents interglacial conditions. Five thermoluminescence (TL) dates on the marine deposits average 127 Ka and indicate a correlation with oxygen isotope stage 5e. Sedimentary structures characteristic of the swash zone occur at altitudes within the commonly accepted range (6 ± 4 m) for eustatic high sea level at that time, showing that this part of the coastal plain has been tectonically stable for the past 125,000 years.

Deposits of the youngest transgression are glaciomarine sediments that contain ice-rafted erratics of Canadian provenance. They compose the Flaxman member of the Gubik Formation and occur locally along the Beaufort Sea coast and inland to altitudes of about 7 m. TL dates on these sediments suggest that the Flaxman transgression occurred between 70 and 80 Ka and is correlative with deposits dated to this interval that are exposed near sea level on the North Carolina coastal plain. However, the deep-sea oxygen-isotope record is commonly interpreted to indicate that sea level was below its modern position at that time. The present altitude of the Flaxman deposits cannot be attributed to tectonism because their distribution includes the part of the coastal plain determined to be tectonically stable for the past 125 Ka. Isostatic depression and subsequent elevation are unlikely considering the correlative deposits of North Carolina. This paradox could be explained if enormous volumes of floating glacial ice were produced by the rapid breakup of a large part of the Laurentide ice sheet, and recent work indeed suggests that the Hudson Bay lowlands were ice free at this time.

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Lower Devonian Carbonate Facies and Platform Margin Development, East-Central Alaska and Yukon Territory

Pragian to Emsian (mid-late Early Devonian) sedimentation on the southwestern portion of the Yukon stable block, east-central Alaska and Yukon Territory, is represented by a package of intergradational carbonate facies, each characteristic of its relative position on or off the carbonate platform and the platform's stage of development.