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GEOLOGY AND PETROLEUM POTENTIAL OF CANADIAN ARCTIC ISLANDS

The Canadian Arctic Islands sedimentary basin covers an area of approximately 530,000 sq mi, with a land area of 306,000 sq mi, and contains an estimated 900,000 cu mi of sediment.

The area consists of 4 major structural provinces. (1) The bordering Precambrian shield areas have structural arches that extend into the basin. (2) The central stable region consists of several basins containing relatively flat-lying shelf carbonates of Ordovician-Silurian age that generally are 5,000 ft thick within the basin and thicken northward to a maximum of 15,000 ft. (3) Inuitian region, a mobile belt characterized by thick sedimentary deposits, was tectonically active from the Paleozoic to the Tertiary. The region is comprised of the Franklinian fold belt and the Sverdrup basin. The Franklinian fold belt is a gently folded lower Paleozoic geosyncline, approximately 1,500 mi long. It contains up to 16,000 ft of Ordovician and Silurian carbonates, evaporites, and shale; up to 6,000 ft of Lower Devonian clastic rocks, and 16,000 ft of Middle and Upper Devonian sedimentary rocks ranging from marine carbonates and clastics to nonmarine clastics. The Sverdrup basin, a NE-SW-trending basin approximately 600 by 200 mi contains up to 40,000 ft of post-Devonian to Tertiary rocks. Permo-Pennsylvanian strata are predominantly carbonate and evaporite. The Mesozoic to lower Tertiary are dominated by heavy and continuous terrigenous clastics, in general, basinal marine shale facies and marginal sandstone facies. The axis of the basin is characterized by numerous evaporite diapirs. (4) Arctic coastal plain province is along the northwest edge of the Arctic Islands, bordering the Arctic Ocean in the position of the present continental shelf. It contains late Tertiary and Pleistocene sedimentary rocks.

The Arctic Islands sedimentary basin has all the necessary geologic elements conducive to the entrapment of hydrocarbons in prolific quantities. There is a very thick, lithologically varied, stratigraphic succession representing every geologic period with adequate source beds, and abundant potential reservoir rocks. There is an abundance of diversified traps—large anticlines, reefs, evaporite domes, faulted homoclines, unconformities, and facies changes. Hydrocarbon shows, including "oil sands," seeps, stain, and bitumen are present in a large area and in a wide range of ages. The Arctic Islands is an area in which hydrocarbons shows have indicated outstanding potential for the discovery of large oil fields.

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BIOSTRATIGRAPHY OF CARBONIFEROUS OF NORTHERN ALASKA

Depositional patterns and facies are major controlling factors of Carboniferous biostratigraphy in Arctic Alaska. Marine onlap was dominant in the Early Mississippian, the most continuous deposition being in the central part of the Brooks Range. On both the northeast and west, progressively younger Mississippian beds lie on older Paleozoic terrane. Correlations with other parts of the American Arctic indicate that this northward and eastward onlap was a general pattern in the Carboniferous; Eurasian and cosmopolitan faunal elements became more prominent after mid-Mississippian time.

Oldest marine rocks are in the Shainin Lake area, central Brooks Range, where basal Mississippian nearshore clastic rocks succeed Upper Devonian nonmarine strata. By Meramec time the seas had spread across northern Alaska, except for the northernmost areas (Barrow-Sadlerochit Mountains trend). Carbonate deposition continued into the Pennsylvanian and Early Permian near the center of the eastern Brooks Range, but there was uplift in the Sadlerochit-Shublik Mountains area after mid-Pennsylvanian time.

Megafossil zonation is based mainly on ranges and occurrences of lithostrotionoid corals, brachiopods, bryozoans, echinoderms and mollusks. Early Mississippian (Kinderhook-Osage) zones are (in ascending order): *Leptagonia analoga, Cryptoblastus, "Zaphrentis" koninckі, Unispirifer tenuicostatus,* and *Brachythyris suborbicularis.* Late Mississippian (Meramec-Chester) zones are: *Naticopsis suturicompta, Lithostrotion (Siphonodendron)* aff. *L. asiaticum, Eumetria costata, Sciophyllum lambarti, Goniatites cremistria, Gigantoproductus striato-sulcatus,* and *Lithostrotion (Siphonodendron)* spp.

Pennsylvanian megafossil zonation is not as clearly defined as that for the Mississippian, but two main assemblages occur: a Morrowan bryozoan-echinoderm assemblage and an Atokan *Corwenia-Lithostrotionella* assemblage. Larger fossils other than corals are rare in the Pennsylvanian strate.

The megafossil succession is consistent with that developed for the Foraminifera by B. L. Mamet and only minor difficulties arise when correlations are attempted with other parts of the world.

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PERMIAN PALEOGEOGRAPHY OF ARCTIC

Distribution of lands and seas throughout the Arctic during the Permian resulted from earlier Paleozoic tectonic events. In the Pacific region, restricted marine connections with the Tethyan realm provided access for a limited number of warmer water animals, but the boreal faunal assemblages are generally distinct and relatively limited in number of genera.

Permian geography was dominated by 3 large land areas: Fennoscandia, central and southern Siberia (Angaraland), and Canada. Several smaller landmasses were present in China, the Seward-Chukotskiy region, northern and eastern Siberia, and north of present Alaska. Coal deposits and strata bearing land plants covered a large area in central Siberia; saline basins with redbeds developed in the Zechstein, Pechora, Perm, Canadian, and West Texas basins as the seas withdrew, generally in the later Permian.

Eugeosynclinal troughs extended along the Pacific borders and apparently were limited to those regions. Volcanism accompanied deposition of predominantly clastic sediments in many parts of the eugeosynclines.

Platform and miogeosynclinal deposits, dominated by carbonate rocks, preceded saline deposition in the basins and persisted on shallow shelves adjacent to the geosynclines.

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EXPLORATION AND PRODUCTION IN CANADIAN ARCTIC ARCHIPELAGO