

BAFFIN BAY

Age	Cretaceous (Albian?) to Tertiary
Depth to Target Zones	Unknown
Maximum Basin Thickness.. ...	14 km (8 km average)
Discoveries	None
Basin Type	Passive margin, rifted subbasins
Depositional Setting	Fluvio-deltaic to marine
Reservoirs	?Cretaceous and Paleogene sandstones
Regional Structure	Extensional faulting, half-grabens
Seals	Marine shales
Source Rocks	Lower Cretaceous (gas prone) Upper Cretaceous, Paleocene marine shales (gas with some oil potential but barely mature)
Depth to Oil Window	3300-3800 m
Seismic Coverage	Sparse reconnaissance seismic
Area under Licence	None

Baffin Bay contains local depocentres with thick Mesozoic sedimentary sequences that have good potential for gas and oil. There is evidence of active oil seeps and petroleum source rocks. Cretaceous to Lower Tertiary formations are anticipated to have good reservoir characteristics. The basin is undrilled.

Geological Setting

Baffin Bay is the northwestern extension and terminus of the North Atlantic-Labrador Sea rift system. The progressive northward stepping of sea floor spreading in the North Atlantic resulted in graben development in the incipient Baffin Bay area in the Early Cretaceous. Oceanic crust began to form in Baffin Bay in the Paleocene but sea-floor spreading appears to have ceased in the Oligocene. Baffin Bay is bounded to the north by Nares Strait, a probable transform fault, and to the south by the Ungava transform underlying Davis Strait. Sedimentary strata are thickest along the narrow east Baffin shelf and the opposing and much broader west Greenland shelf. A major depocentre is present at the northern end of the Baffin shelf opposite the mouth of Lancaster Sound.

Sedimentation has been characterized by the influx of coarse elastic material across the rifted and rapidly foundering margin of Baffin Island. The sediments were derived from the surrounding highlands of the Baffin coast and by clastics brought from the lower Paleozoic hinterland of the Canadian Arctic Islands by major rift controlled drainage systems.

Exploration History

No wells have been drilled in Baffin Bay, with the exception of ODP site 645. In 1976-77, five wells were drilled in Davis Strait, at the southern entrance to Baffin Bay. These dry and abandoned wells are in Danish waters on the west Greenland Shelf. The Geological Survey of Greenland suggests that they failed to test prospective pre-Tertiary sequences indicated by seismic.

Seismic exploration of the northeastern Baffin shelf has been limited. The few reconnaissance programs shot are insufficient to delineate drilling prospects.

Stratigraphy (Fig. 66)

The Mesozoic sediments of Baffin Bay are probably underlain by Proterozoic rocks comparable to those now exposed on Baffin Island. Ordovician to Silurian rocks may be preserved in the offshore, but there is no seismic evidence to suggest that this is the case.

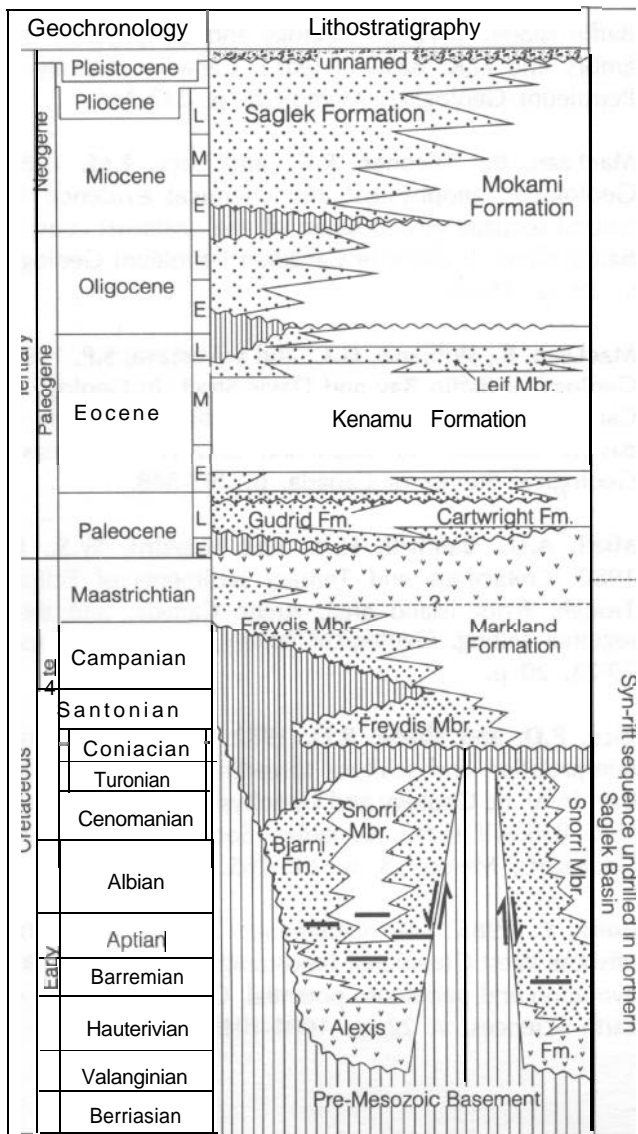


Figure 66. Generalized stratigraphy of the Baffin Bay shelf area.

The oldest Mesozoic sediments in the Baffin Bay region are Aptian to Lower Albian sandstones of the Quqaliut Formation, described by Burden and Languille (1990), north of Cape Dyer in the southern approaches to Baffin Bay. These strata are unconformably overlain by Paleocene braided stream deposits (Cape Searle Formation). The latter contains volcanic and volcanoclastic clasts formed during a violent tectonic episode, possibly the onset of sea-floor spreading in Baffin Bay. Cretaceous to Tertiary sediments also outcrop on Bylot Island and adjacent to Pond Inlet on northeastern Baffin Island. Strata of the Hassel Formation (Albian-Cenomanian), the Kanguk Formation (Campanian-Maastrichtian), and the Eureka Sound Formation (Paleocene-Eocene) are likely to be

represented as thickened successions in the offshore. The Hassel, Bjarni and Quqaliut formations are much the same age and represent early rift-fill. The Cape Searle, Eureka Sound and Cartwright formations are also contemporaneous, but differ markedly in their depositional setting.

The Hassel Formation on Bylot Island is predominantly fluvial, consisting of thick, coarse-grained sandstones and thin coals. The nonmarine fluvial Quqaliut Formation was deposited in a similar depositional setting with intermittent volcanic effusions. The lower member of the younger Kanguk Formation (> 1000 m) was deposited at a time of global marine highstand in the Late Cretaceous and represents a regionally extensive shale unit. The upper Kanguk is sandy and represents subsequent regression. The Eureka Sound Formation is 1600 m thick on Bylot Island and consists of three members of marine mudstone and sandstone and one thick member of fluvial sandstone. Lacustrine to marginal marine sediments of Paleogene age have been noted from two other localities along the east coast of Baffin Island.

Reservoirs

The Hassel Formation, upper Kanguk and Eureka Sound sandstones are potential reservoir rocks. All have good porosity and permeability in outcrop samples (in the Bylot Basin). Where age equivalents have been penetrated in the subsurface on the southeastern Baffin and Labrador shelves, favourable reservoir characteristics have been preserved.

Structure, Traps and Seal

Down-to-basin faulting characterizes the northeastern Baffin shelf. In the deeper parts of the basin, rotated fault blocks are apparent. The lower member of the Kanguk Formation is a regional top seal and drapes Cretaceous structures.

Source Rocks

Upper Cretaceous marine strata are widespread in the basin (the Kanguk and Narssamiut formations of the West Greenland shelf, although these shales are generally lean in organic matter). Samples of Campanian shale from Home Bay are rich in amorphous kerogens and these shales have potential as an oil-prone source rock. Paleocene marine shales have slightly higher organic content with potential for both oil and gas. Albian shales of the Hassel and Bjarni

formations contain terrestrially derived kerogens and are possible gas source rocks.

Subsea oil seeps in Scott and Buchan troughs (halfway along the coast of Baffin Island) are indicated by the surfacing of oil globules at several locations, as noted by several researchers (e.g., MacLean et al., 1981). The oil appears to issue from fissures close to the contact between the Tertiary or Cretaceous strata and Precambrian basement, although a more recent sampling expedition failed to recover samples of crude oil.

Potential

Most of the northeastern Baffin shelf is relatively narrow but thickens and broadens opposite the mouth of Lancaster Sound. This area is likely to contain extensive potential reservoir facies, more deeply buried (hence mature) source rocks, and large fault-bounded traps. Potential exists for both oil and gas.

Key Reading and References

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