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QUATERNARY GEOLOGY AND GLACIAL HISTORY OF BYLOT ISLAND, NORTHWEST TERRITORIES

R.A. Klassen

1993

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Cover Description

Glaciers on Bylot Island flow far outwards from their gathering grounds within the Byam Martin Mountains, transporting crystalline rocks across coastal lowlands. During periods of continental glaciation, ice sheets flowed onto the island across both the northern and southern coasts, and transported debris toward the mountains, in opposition to modern flow directions. The record of glaciation by native mountain glaciers and by foreign ice sheets is based on the composition and provenance of glacial debris. The photograph illustrates the debris-laden margin of one Bylot glacier facing Baffin Island to the south, which is visible on the skyline.

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Preface

Bylot Island lies in the eastern Canadian Arctic beside the entrance to the Northwest Passage at the northern head of Baffin Bay. The area represents not only a key part of the ecologically rich Lancaster Sound Region, which has been proposed as a national park, but also of a future Arctic transportation corridor. To provide the geological information necessary for effective land use planning and development, the Geological Survey of Canada has undertaken this study of surficial materials and glacial history of Bylot Island and adjacent Baffin Island. The work represents part of an overall effort by the Geological Survey to conduct a systematic mapping of the Canadian landmass.

Not only does the mountainous glaciated landscape of Bylot Island provide what is surely one of the most spectacular settings for geological fieldwork, but the Quaternary record of Bylot Island is both long and complex. Quaternary geology is the product of glaciation by both the Laurentide Ice Sheet and local mountain glaciers, as well as of marine and glacial marine deposition around its margins. The surficial deposits provide an important basis for understanding the glacial and nonglacial history of northern regions, and they are of wider interest to members of local communities and tourists alike who are concerned with the Arctic.

Elkanah A. Babcock
Assistant Deputy Minister
Geological Survey of Canada

Préface

L'île Bylot est située dans l'est de l'Arctique canadien, près de l'entrée du passage du Nord-Ouest, dans le nord de la baie de Baffin. Elle représente non seulement une partie importante de la région écologiquement riche du détroit de Lancaster qui a été proposée comme emplacement d'un parc national, mais également un futur corridor de transport dans l'Arctique. C'est donc pour recueillir les données géologiques nécessaires à une planification et une mise en valeur efficaces des terres que la Commission géologique du Canada a entrepris la présente étude des matériaux en surface et de l'histoire glaciaire de l'île Bylot et de l'île de Baffin voisine. Ces travaux font partie d'un projet de cartographie systématique de la masse continentale du Canada prévu par la Commission géologique.

Le paysage montagneux et englacé de l'île Bylot constitue sans aucun doute un lieu très spectaculaire pour la réalisation de travaux géologiques sur le terrain, mais la stratigraphie quaternaire de l'île Bylot est longue et complexe à établir. La géologie quaternaire est le produit de la glaciation par l'inlandsis laurentidien et par des glaciers de montagnes locaux ainsi que du dépôt de sédiments marins et glaciomarins sur son pourtour. Les matériaux en surface contribuent de façon essentielle à la compréhension de l'histoire glaciaire et non glaciaire des régions septentrionales sans compter que les habitants des agglomérations locales et les touristes attirés par l'Arctique s'y intéressent davantage.

Elkanah A. Babcock
Sous-ministre adjoint
Commission géologique du Canada

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Abstract

The Quaternary geology of Bylot Island records glaciation by regional ice sheets and by local mountain glaciers, and marine and glaciomarine sedimentation around its margins. The geological evidence for the last major "foreign" glaciation, Eclipse glaciation, is widespread in surficial deposits and landforms and is used as a basis for recognition of other glacial events and for establishing their relative ages.

Four distinct foreign glaciations are recognized. The oldest and most extensive, named Baffin glaciation, occurred prior to a period of interglacial weathering, named Salmon River interglaciation, and ice could have moved northward across the topographic divide of Bylot Island. During the later Eclipse glaciation, ice was less extensive, although it fully occupied the channels around the island and attained elevations of 270 to 370 m a.s.l. from 10 to 20 km inland on the south coast,and 500 to 600 m a.s.l. against the northern coastal mountains. Eclipse glaciation occurred prior to 43 000 radiocarbon years ago and is older than marine shells having amino acid ratios (D-alloisoleucine to L-isoleucine) of 0.20 to 0.25. Evidence of the younger Button glaciation is restricted to coastal areas of Bylot Island below 140 m a.s.l., and foreign ice was restricted to the marine channels and was likely floating. Button drift is bounded stratigraphically by shells having amino acid ratios of about 0.15 and 0.10. Cape Hatt glaciation is of Late Wisconsinan or early Holocene age during which time ice extended across Baffin Island to the northern mouth of Milne Inlet.

Three periods of native glaciation are known. The oldest, named Bylot glaciation, was most extensive and covered most of the island prior to Baffin glaciation. Late during Eclipse glaciation, native glaciers that had been "dammed" on the island by foreign ice underwent major expansion as part of Aktineq glacial phase as they re-established normal outward directions of flow. Modern glaciers appear to be either stationary at, or retreating from, Neoglacial maximum positions attained within the last 100 years that represent their greatest extent since Eclipse glaciation.

Five periods of change in relative sea level are recognized, the oldest of which predates Salmon River interglaciation and is represented in sections by marine sediments containing in situ shells with amino acid ratios of 0.55 to 0.60. Younger marine sediments of pre-Eclipse age occur in two stratigraphic sections and contain shells having amino acid ratios of about 0.4 to 0.35. Surficial marine sediments of pre-Holocene age are related to periods of higher relative sea level subsequent to Eclipse glaciation and to Button glaciation. They contain shells having amino acid ratios of about 0.2 and 0.1, respectively. Eclipse marine sediments may extend to 90 m a.s.l. near Canada Point. On northern Bylot Island, Button marine sediments extend to 35 m a.s.l. Holocene emergence is 100 m at the southern end of Milne Inlet, 80 m at Cape Hatt, 50 to 60 m near Pond Inlet townsite, and 35 to 45 m on southern Bylot Island. No raised Holocene marine sediments are known on northern Bylot Island and there the modern coast appears to be submerging.

Résumé

La géologie quaternaire de l'île Bylot témoigne de l'effet de la glaciation par des calottes glaciaires régionales et par des glaciers de montagnes locaux ainsi que de la sédimentation marine et glaciomarine sur son pourtour. Des indices géologiques de la dernière glaciation importante "allochtone", la glaciation d'Eclipse, que l'on trouve en abondance dans les dépôts de surface et les formes de relief, servent de base à la détermination d'autres événements glaciaires et à leur datation relative.

Quatre glaciations allochtones distinctes ont été identifiées. La plus ancienne et la plus étendue, appelée glaciation de Baffin a précédé une période d'altération interglaciaire, appelée interglaciation de Salmon River, et un glacier a pu, en se déplaçant vers le nord, traverser la division topographique de l'île Bylot. Au cours de la glaciation la plus récente, soit la glaciation d'Eclipse, la glace était moins étendue, même si elle a complètement occupé les chenaux autour de l'île et atteint des hauteurs de 210 à 370 m au-dessus du niveau de la mer, à une distance de 10 à 20 km vers l'intérieur de la côte sud, et de 500 à 600 m au-dessus du niveau de la mer contre les monts côtiers septentrionaux. La glaciation d'Eclipse remonte à 43 000 ans, d'après une datation au carbone radioactif, et elle est plus ancienne que les coquillages marins dont les rapports des acides aminés (D-alloisoleucine à L-isoleucine) varient de 0,20 à 0,25. On ne retrouve des

indices de la glaciation plus récente de Button que dans les zones littorales de l'île Bylot au-dessous de 140 m au-dessus du niveau de la mer, et la présence de glaciers allochtones s'est limitée aux chenaux marins où ils devaient vraisemblablement flotter. Le drift de Button est limité stratigraphiquement par des coquillages dont les rapports des acides aminés sont d'environ 0,15 et 0,10. La glaciation de Cape Hatt date du Wisconsinien tardif ou du début de l'Holocène, époque au cours de laquelle la glace a traversé l'île de Baffin jusqu'à l'embouchure nord de l'inlet Milne.

Trois périodes de glaciation autochtones ont été identifiées. La plus ancienne, appelée glaciation de Bylot, a été la plus étendue et a recouvert la grande partie de l'île avant la glaciation de Baffin. Durant la fin de la glaciation d'Eclipse, des glaciers autochtones qui avaient été "bloqués" sur l'île par des glaciers allochtones ont connu une expansion importante pendant la phase glaciaire d'Aktineq du fait que leur écoulement normal vers l'extérieur a repris. Les glaciers modernes semblent être soit stationnaires ou en recul par rapport aux positions maximales néoglaciaires atteintes au cours des 100 dernières années, ce qui représente leur plus grande extension depuis la glaciation d'Eclipse.

Cinq périodes de changement du niveau marin relatif ont été identifiées, la plus ancienne précède l'interglaciaire de Salmon River et est représentée en coupe par des sédiments marins contenant des coquillages in situ dont le rapport des acides aminés varie de 0,55 à 0,60. Des sédiments marins plus récents, soit remontant à une période antérieure à la glaciation d'Eclipse, se trouvent dans deux coupes stratigraphiques et contiennent des coquillages dont les rapports des acides aminés varient de 0,4 à 0,35 environ. Les sédiments marins superficiels d'âge pré-holocène sont liés à deux périodes de niveau marin relatif plus élevé postérieures à la glaciation d'Eclipse et à la glaciation de Button, et contiennent des coquillages dont les rapports des acides aminés sont d'environ 0,2 et 0,1, respectivement. Les sédiments marins d'Eclipse peuvent atteindre 90 m au-dessus du niveau marin, près de la pointe Canada. Dans le nord de l'île Bylot, les sédiments marins de Button atteignent 35 m au-dessus du niveau de la mer. L'émergence holocène atteint 100 m à l'extrémité sud de l'inlet Milne, 80 m à Cape Hatt, 50 à 60 m près de la localité de Pond Inlet, et 35 à 45 m dans le sud de l'île Bylot. Aucun sédiment marin soulevé d'âge holocène n'a été relevé dans le nord de l'île Bylot où la côte actuelle semble être en voie de submersion.

SUMMARY

Bylot Island lies at the northern end of Baffin Island, adjacent to Lancaster Sound, within an area bounded by latitudes 72° and 74° N and longitudes 75° and 82° W. The island is about 180 km in length and 100 km in width. Its central mountains are composed of igneous and high-grade metamorphic rocks, with peaks averaging about 1400 m a.s.l. Numerous modern glaciers originate among the mountains and flow outward as large, lobate tongues onto flanking lowlands underlain by relatively flat-lying sedimentary rock of Proterozoic and of Cretaceous-Tertiary ages.

The Quaternary history of Bylot Island records several distinct periods of glaciation by regional ("foreign") ice sheets and by local ("native") mountain glaciers, and of marine and glacial marine sedimentation around its margins. Lithological contrasts in bedrock of the region allow composition and provenance of glacial debris to be used as a powerful tool for unravelling glacial history, as well as for study of processes of erosion and transport within modern glaciers. The channels around the island are deep (500 to 1000 m) and connect directly with Baffin Bay, and the presence of foreign debris above the limits of marine submergence is considered to be compelling evidence of major glacial events associated with regional ice sheets. It can be used to distinguish between the deposits of foreign and native glaciers.

SOMMAIRE

L'île Bylot s'étend au nord de l'île de Baffin, près du détroit de Lancaster, entre les latitudes 72° et 74°N et les longitudes 60° et 82°O. L'île mesure environ 180 km de longueur et 100 km de largeur. Ses montagnes centrales sont composées de roches ignées et de roches à haut degré de métamorphisme dont les sommets se situent en moyenne à environ 1400 m au-dessus du niveau de la mer. De nombreux glaciers modernes prennent naissance dans les montagnes et s'écoulent sous forme de grandes langues lobées vers les basses terres latérales reposant sur des roches sédimentaires relativement plates datant du Protérozoïque et du Crétacé-Tertiaire.

Au cours du Quaternaire, l'île Bylot a connu plusieurs périodes de glaciation par des calottes glaciaires régionales ("allochtones") et par des glaciers de montagnes locaux ("autochtones"), et des périodes de sédimentation marine et glaciomarine sur son pourtour. Les différences lithologiques du socle de la région permettent d'utiliser la composition et la provenance des débris glaciaires pour reconstituer l'histoire glaciaire et étudier les processus d'érosion et de transport qui se produisent au sein des glaciers modernes. Les chenaux autour de l'île sont profonds (de 500 à 1000 m) et sont directement reliés à la baie de Baffin, et la présence de débris allochtones au-dessus des limites de submergence marine est considérée comme une preuve évidente d'épisodes glaciaires importants liés à ces calottes glaciaies régionnales. Elle sert aussi à distinguer sans équivoque les sédiments glaciaires d'origine allochtone et autochtone.

Constraints on interpretation

Throughout the region, Quaternary sediments are thin and discontinuous, and foreign ice sheets appear not to have been particularly erosive, indicating that they were cold-based. Stratigraphic sections are almost entirely restricted to coastal areas and are commonly composed of marine sediments and of massive mud and sandy mud containing large clasts as well as marine shells and shell fragments. The clasts include a significant component of foreign debris and the poorly sorted muddy sediments are thus interpreted as glacial marine drift associated with regional glacial events.

Sub-division of stratigraphic sections, and distinction among drift units, is based on beds of buried organic detritus, on beds of marine sediments containing articulated shells, and on zones of weathering (soils), all of which are believed to separate deposits associated with different glacial events. The principal basis for correlation of units among sections rests on amino acid analysis of shells and on the assumption that only one interglacial period (conditions less glacial than present) is represented. Amino acid analyses are based on the naturally hydrolyzed or "free" protein fraction and are reported here as the ratios of D-alloisoleucine to L-isoleucine. Glacial landforms, such as moraine ridges, and geomorphological relations among landforms are used to distinguish among glacial events and to estimate the maximum extent of ice during different glacial events.

To establish provenance of glacial debris and the major pathways of glacial transport, bedrock in northern Baffin Island is subdivided into four broad lithological suites; 1) crystalline rock, 2) amygdaloidal volcanic rock, 3) nonfossiliferous sedimentary rock (Proterozoic and Paleozoic), and 4) fossiliferous sedimentary rock (Paleozoic). In areas of crystalline terrain on Bylot Island, erratics of sedimentary rock are recognized easily, even at extremely low concentrations. Such erratics, which include fossiliferous carbonates, are widespread around the outer margins of the island and form a significant and highly visible component (to 80 wt.%) of the drift.

A system of lateral moraines adjacent to Lancaster Sound and to Pond Inlet marks the upper limit of foreign ice against the coastal mountains and is used to define the maximum extent of ice during the last major foreign glaciation–Eclipse–of Bylot Island. The moraine system–Eclipse Moraine–is spectacular in its geomorphological setting and geological clarity; it is composed largely of far-travelled limestone debris that originated on northern Baffin Island. It is because Eclipse glacial deposits and landforms are well defined that they can be used as a basis for estimating the relative ages and extent of ice during other glacial events.

Éléments limitatifs de l'interprétation

Dans toute la région, les sédiments du Quaternaire sont minces et discontinus, et les inlandsis allochtones ne semble pas avoir eu une action érosive particulièrement forte, signe qu'il s'agissait d'inlandsis à base froide. Les coupes stratigraphiques sont presque entièrement limitées aux régions côtières, et se composent généralement de sédiments marins et de boues massives et boues sableuses contenant de grands fragments de roche, de même que des coquilles et fragments de coquilles marines. Les fragments rocheux contiennent une proportion importante de débris allochtones, et on interprète les sédiments boueux faiblement granoclassés présents dans les profils comme étant un drift glaciomarin associé aux épisodes glaciaires régionaux.

La subdivision des coupes stratigraphiques ainsi que leur différentiation au sein des unités de drift sont basées sur l'existence de couches de débris organiques enfouis, de couches de sédiments marins contenant des coquilles articulées, et de zones d'altération (sols); toutes ces couches seraient des dépôts distincts associés à divers épisodes glaciaires. La corrélation des unités présentes dans les profils stratigraphiques est principalement basée sur les résultats provenant de l'analyse des acides aminés des coquilles, et sur l'hypothèse selon laquelle une seule période interglaciaire (conditions glaciaires moins prononcées qu'actuellement) serait représentée. Les analyses des acides aminés sont établies en fonction de la fraction de protéines hydrolysées naturellement ou "libres", et figurent dans le présent article sous forme de rapports de l'alloisoleucine-D à l'isoleucine-L. La topographie glaciaire, par exemple les crêtes morainiques, et les relations géomorphologiques entre les formes de relief, servent à distinguer les uns des autres les épisodes glaciaires, et à estimer l'étendue maximale des glaces au cours de différents épisodes glaciaires.

Dans le but d'établir la provenance des débris glaciaires et d'identifier les principales voies empruntées par le transport glaciaire, le socle rocheux a été subdivisé dans le nord de l'île de Baffin en quatre grandes séries lithologiques; 1) roche cristalline, 2) roche volcanique amygdaloïde, 3) roche sédimentaire non fossilifère (du Protérozoïque), et 4) roche sédimentaire fossilifère (Paléozoïque). Dans les régions de terrain cristallin situées dans l'île Bylot, les blocs erratiques constitués de roches sédimentaire sont facilement identifiés, même lorsqu'ils sont en concentrations extrêmement faibles. Ces blocs erratiques, qui comprennent des roches carbonatées fossilifères, abondent à la périphérie de l'île et constituent une proportion importante et bien visible (à 80 % en poids) du drift.

À proximité du détroit de Lancaster et de l'inlet Pond, un réseau de moraines latérales marque la limite supérieure des glaciers allochtones sur les flancs de la chaîne côtière, et permet d'établir la limite d'extension maximale des glaces durant la dernière grande glaciation allochtone, soit la glaciation d'Eclipse, dans l'île Bylot. Le réseau de moraines, moraine d'Eclipse, est spectaculaire du point de vue de son cadre géomorphologique et de son caractère géologique d'une grande clarté; il se compose largement de débris calcaires transportés sur de grandes distances, issus du nord de l'île de Baffin. C'est justement en raison du fait que les dépôts glaciaires et la topographie d'Eclipse sont bien définis, qu'ils servent à estimer l'âge relatif et la limite d'extension des glaces durant les autres épisodes glaciaires.

Nonglacial events

Within several stratigraphic sections, buried beds of organic detritus and weathering (soil development) were found that are the product of nonglacial conditions. At two sites the organic debris contained fossils indicating that paleoclimatic conditions were warmer than present. In combination with evidence of advanced soil development, the fossils are used to define a period of interglacial conditions named Salmon River interglaciation. Amino acid ratios of in situ marine shells in sediments hosting the interglacial deposits are 0.55 to 0.60. Elsewhere, limited stratigraphic evidence indicates a second nonglacial period between Eclipse and Button glaciations.

Events associated with foreign ice sheets

Baffin glaciation represents one or more ancient foreign events that predate both Eclipse glaciation and a period of interglacial weathering. Evidence of Baffin glaciation is based on the occurrence of rare foreign erratics inland of Eclipse Moraine and at greater elevation, and on foreign drift of pre-Eclipse age in stratigraphic sections. The high-level occurrence of erratics indicates that a regional ice sheet inundated much of Bylot Island during Baffin glaciation and could have crossed the topographic divide.

During Eclipse glaciation, foreign glaciers fully occupied the channels around Bylot Island and flowed into the head of Baffin Bay. The ice attained elevations of 270 to 370 m a.s.l. from 10 to 20 km inland on the southern lowlands, and of 500 to 600 m against coastal mountains adjacent to Lancaster Sound. Where Eclipse glacial limits lie inland of modern glaciers there was undoubtedly interaction between foreign and native ice. The transport of foreign erratics inland of modern glaciers, and to greater elevations indicates that foreign ice caused a reversal of normal ice flow within some valleys. Where foreign ice did not extend inland of modern glaciers there is no evidence of interaction between foreign and native ice, indicating that native glaciers did not advance during Eclipse glaciation. On northern Bylot Island Eclipse Moraine bears no evidence of having been glaciated, even where it lies directly in front of native ice. There, modern glaciers appear to represent the maximum extent achieved since Eclipse glaciation.

Amino acid ratios of detrital shells within Eclipse drift range between 0.15 and 0.91; most are about 0.25 to 0.30. Radiocarbon analysis indicates that Eclipse glaciation occurred more than 43 000 years ago and is of pre-Late Wisconsinan age.

Épisodes non glaciaires

On a découvert, au sein de plusieurs profils stratigraphiques, des couches enfouies de débris organiques et des niveaux d'altèration (sols en formation) qui sont le produit de conditions non glaciaires. En deux endroits, les débris organiques contenaient des fossiles dont l'existence témoigne du fait que les conditions paléoclimatiques à l'époque étaient plus douces qu'au moment actuel. Les indices d'une pédogénèse avancée et la présence de ces fossiles servent tous deux à définir une période de conditions interglaciaires appelée interglaciaire de Salmon River. Dans des coquilles marines trouvées in situ dans des sédiments contenant les dépôts interglaciaires, les rapports des acides aminés se situent entre 0,55 et 0,60. Ailleurs, les indices stratigraphiques limités indiquent la manifestation d'une deuxième période non glaciaire, survenue entre les glaciations d'Eclipse et de Button.

Épisodes associés aux inlandsis allochtones

La glaciation de Baffin représente un ou plusieurs épisodes de glaciations allochtones qui précèdent à la fois la glaciation d'Eclipse et une période d'altération interglaciaire. Les indices de la glaciation de Baffin sont fondés sur la présence de quelques rares blocs erratiques allochtones à l'intérieur des terres par rapport à la moraine d'Eclipse et à des altitudes plus élevées, et sur la présence d'un drift allochtone remontant à une période antérieure à la glaciation d'Eclipse dans les coupes stratigraphiques. La présence de blocs erratiques en altitude indique qu'un inlandsis régional a submergé une grande partie de l'île Bylot durant la glaciation de Baffin et a peut-être traversé la ligne de partage topographique.

Durant la glaciation d'Eclipse, des glaciers allochtones ont entièrement occupé les chenaux environnant l'île Bylot et se sont écoulés dans le fond de la baie de Baffin . Entre 10 et 20 km à l'intérieur des terres, dans les basses terres au sud, les glaces atteignaient une altitude de 270 à 370 m au-dessus du niveau de la mer, et à proximité du détroit de Lancaster, sur les flancs de la chaîne côtière, une altitude de 500 à 600 m. Là où les limites glaciaires d'Eclipse se situent en deça des glaciers contemporains, il s'est sans doute produit une interaction des glaciers allochtones et des glaciers autochtones; le transport de blocs erratiques allochtones à l'intérieur des terres par rapport à ces marges, et à des altitudes plus élevées, indique que les glaciers allochtones ont provoqué une inversion de l'écoulement normal des glaces dans certaines vallées. Là où les glaces allochtones ne se prolongaient pas vers l'intérieur des terres par rapport à la position des glaciers actuels, on a trouvé aucun indice d'interaction entre les glaces allochtones et autochtones, signe que les glaciers autochtones n'ont pas avancé durant la glaciation d'Eclipse. Rien n'indique que la moraine d'Eclipse ait été recouverte par les glaces dans le nord de l' Bylot, même lorsqu'elle se trouve directement en face des glaces autochtones. Il semblerait que les glaciers actuels correspondent à la limite d'extension maximale atteinte par les glaces depuis la glaciation d'Eclipse.

Dans les débris de coquilles trouvés dans le drift d'Eclipse, les rapports des acides aminés se situent entre 0,15 et 0,91; la plupart du temps, ils se situent entre 0,25 et 0,30 environ. Les datations au carbone radioactif indiquent que la glaciation d'Eclipse a eu lieu il y a plus de 43 000 ans, et qu'elle précède le Wisconsinien supérieur.

Button glaciation refers to one or more glacial events subsequent to Eclipse glaciation and prior to the last foreign event - Cape Hatt glaciation. It is distinguished from Eclipse glaciation by the the evidence of amino acid ratios of 0.15 to 0.10 in detrital shell fragments within drift and by limited evidence that Eclipse and Button drifts are stratigraphically separated by beds bearing organic detritus. In the absence of clearly defined ice marginal positions, the extent of ice during Button glaciation is speculative and appears to have been restricted to the outer margins of the island below 140 m a.s.l.

Cape Hatt glaciation is an event of Late Wisconsinan or early Holocene age during which ice flowing northwards across Baffin Island extended to the mouth of Milne Inlet, at least to Cape Hatt.

Events associated with local glaciers and ice caps

Three distinct periods of native glaciation can be recognized: 1) Bylot glaciation, a pre-Eclipse event of great magnitude ; 2) Aktineq glacial phase, a deglacial phase of Eclipse glaciation and, 3) Neoglaciation. The maximum extent of ice during post-Eclipse time is marked by Neoglacial and modern moraines. During Bylot glaciation, mountain glaciers inundated either most or all of Bylot Island, based on the widespread occurrence of native crystalline erratics across the outer lowlands and on mountain peaks that are now not glaciated. Bylot glaciation could include several distinct glacial events of pre-Eclipse age, although at present only one is recognized. Preservation of interglacial deposits in front of some large, modern glaciers indicates that Bylot glaciation may predate Salmon River interglaciation and that it is older than shells having amino acid ratios of 0.60 to 0.80.

Where foreign ice extended inland of large, modern glaciers during Eclipse glaciation, landforms defining a major advance of native ice contain a significant component of foreign drift, which indicates that the advance occurred subsequent to the period of foreign ice cover. In view of the contiguous nature of snow accumulation in the Byam Martin Mountains, it is difficult to explain why some native glaciers underwent major expansion subsequent to Eclipse glaciation whereas others did not. It is proposed that during Eclipse deglaciation native glaciers that had been "dammed" on the island by foreign ice had an abnormally high ice volume for their areal extent and, in re-establishing normal flow directions outwards from the island, they "surged" to positions far in advance of their modern termini, staying there until their excess volume ablated. The "advance" was not the result of increased annual snow accumulation within the highlands and it is associated only with those native glaciers that were dammed by foreign ice.

La glaciation de Button désigne un ou plusieurs épisodes glaciaires ultérieurs à la glaciation d'Eclipse et antérieurs au dernier épisode de glaciation allochtone soit la glaciation de Cape Hatt. On la distingue de la glaciation d'Eclipse partir des rapports des acides aminés compris entre 0,15 et 0,10 dans les débris de coquilles recueillis dans du drift, et à partir de quelques détails montrant que les drifts d'Eclipse et de Button sont stratigraphiquement divisés par des couches contenant des débris organiques. En l'absence d'indications précises de la situation des marges glaciaires, il est difficile de définir la limite d'extension des glaces au cours de la déglaciation de Button, mais il semble qu'elles ne se soient pas étendues au-delà des marges périphériques de l'île, à moins de 140 m au-dessus du niveau de la mer.

La glaciation de Cape Hatt est un épisode datant du Wisconsinien supérieur ou de l'Holocène inférieur, au cours duquel les glaces s'écoulant vers le nord de part en part de l'île de Baffin se sont étendues jusqu'à l'entrée de l'inlet Milne, et au moins jusqu'au cap Hatt.

Épisodes associés aux glaciers et calottes glaciaires locaux

Trois épisodes distincts de glaciation autochtone sont identifiables: 1) la glaciation de Bylot, un épisode de grande importance antérieur à la glaciation d'Eclipse; 2) ; la phase glaciaire d'Aktineq, une phase de déglaciation au cours de la glaciation d'Eclipse; et 3) le Néoglaciaire. La limite d'extension maximale des glaces après la glaciation d'Eclipse est indiquée par les moraines néoglaciaires et actuelles. Durant la glaciation de Bylot, les glaciers de montagne ont submergé l'île Bylot en grande partie ou en totalité, comme l'indique la présence à grande échelle de blocs erratiques cristallins de nature autochtone à travers les basses terres extérieures et sur les sommets montagneux qui ne sont plus recouverts par les glaces. La glaciation de Bylot pourrait inclure plusieurs épisodes glaciaires distincts remontant à une période antérieure à la glaciation d'Eclipse, même si actuellement un seul épisode est reconnu. La conservation de dépôts interglaciaires à l'avant de quelques grands glaciers actuels indique que la glaciation de Bylot précède peut-être l'interglaciaire de Salmon River et qu'elle est plus ancienne que des coquilles caractérisées par des rapports des acides aminés compris entre 0,60 et 0,80.

Là où les glaces allochtones s'étendaient à l'intérieur des terres par rapport aux grands glaciers actuels, durant la glaciation d'Eclipse, les formes de relief définissant une grande avancée postérieure à la glaciation d'Eclipse des glaces autochtones, contiennent une proportion importante de drift allochtone, ce qui indique que l'avancée a eu lieu après la période où les glaces allochtones recouvraient le territoire. Étant donné le caractère contigu de l'accumulation nivale dans les monts Byam Martin, il est difficile d'expliquer pourquoi certains glaciers autochtones ont subi une importante expansion après la glaciation d'Eclipse, et d'autres non. L'hypothèse suivante est proposée, selon laquelle pendant la déglaciation d'Eclipse, des glaciers autochtones avaient été "bloqués" dans l'île par des glaces allochtones et contenaient un volume de glace anormalement élevé par rapport à leur étendue; retrouvant leur voie normale d'écoulement en direction du pourtour de l'île, ils avaient subi une "crue" bien au-delà de leur front actuel, et y avaient persisté jusqu'à ce que leur volume excédentaire eût disparu. Comme "l'avancée" n'était pas le résultat d'un accroissement de l'accumulation nivale annuelle à l'intérieur des hautes terres, elle n'était associée qu'aux glaciers autochtones qui avaient été bloqués par des glaces allochtones.

Most modern glaciers on Bylot Island appear to be either stationary at, or retreating from, their Neoglacial maximum positions, which they attained certainly within the past 400 to 500 years, and probably within the past century.

Sea level history

Five periods of change in relative sea level are recognized, the two oldest of which are based only on stratigraphic and amino acid evidence. Although raised marine sediments are likely the direct result of glacial isostatic depression following crustal loading by glacier ice, geological evidence of prolonged periods of faulting within the North Baffin Rift Zone as well as estimates of significant Tertiary submergence in the Eastern Arctic suggest there could be some nonglacial tectonic displacement.

The oldest marine sediments in stratigraphic section lie beneath deposits of Salmon River interglaciation and contain in situ marine shells that have amino acid ratios of 0.55 to 0.60. Evidence of a later period of higher relative sea level occurs in sections where in situ marine shells have amino acid ratios of 0.35 to 0.40. The oldest marine deposits represented by surficial sediments and landforms extend to about 90 m a.s.l. on southern Bylot Island and bear no evidence of having been glaciated. They contain in situ shells that have amino acid ratios of 0.20 to 0.25 and are considered to be of post-Eclipse age. Younger marine sediments are known in coastal sections to elevations of 30 to 40 m a.s.l. on the southern and northern coasts and contain in situ shells that have amino acid ratios of 0.10 to 0.15. They are considered to have been deposited subsequent to Button glaciation. Raised marine sediments of Holocene age are recognized on northern Baffin Island and on southern Bylot Island; they are not known on northern Bylot Island. Holocene emergence has been about 30 to 35 m in the areas of Button Point and Canada Point, 40 to 45 m on the southern lowlands, 50 to 60 m near the town of Pond Inlet, 80 m at Cape Hatt, and 100 m at the southern end of Milne Inlet. The "drowned" appearance of estuaries on the northern Bylot coast indicates that it may now be submerging, and the absence of Holocene marine sediments there indicates that it may not have been an emergent coast during Holocene time.

La plupart des glaciers modernes de l'île Bylot seblent être soit stationnaires, soit en recul par rapport à leur position néoglaciaire maximale, qu'ils ont certainement atteinte au cours des 400 à 500 dernières années, et probablement au cours du siècle dernier.

Évolution du niveau de la mer

Cinq périodes de variations du niveau de la mer relatif ont été identifiées, dont les plus anciennes ne sont fondées que sur les indices stratigraphiques et les indices fournis par l'analyse des rapports des acides aminés. Même si la présence de sédiments marins soulevés soit due directement à la dépression isostatique glaciaire qui a suivi la surcharge imposée à la croûte par la glace de glacier, d'une part les indices géologiques prouvant que dans la zone de rift de North Baffin la formation de failles s'est poursuivie pendant des périodes prolongées, et d'autre part les estimations relatives à une submersion importante pendant le Tertiaire dans la région est de l'Arctique, semblent indiquer qu'il ait pu se produire un certain degré de mouvement tectonique d'origine non glaciaire.

Les sédiments marins les plus anciens du profil stratigraphique se situent au-dessous de dépôts de l'interglaciaire de Salmon River, et contiennent des coquilles marines in situ, caractérisées par des rapports des acides aminés compris entre 0,60 et 0,55. La preuve de l'existence d'une période à laquelle le niveau de la mer relatif était plus élevée apparaît dans des coupes où les coquilles marines in situ se caractérisent par un rapport des acides aminés compris entre 0,35 et 0,40. Les dépôts marins les plus anciens, représentés par les sédiments de surface et les formes de relief, atteignent environ 90 m au-dessus du niveau de la mer dans le sud de l'île Bylot, et ne présentent aucun indice d'avoir été recouverts par les glaces. Ils contiennent des coquilles in situ caractérisées par des rapports des acides aminés compris entre 0,20 et 0,25, et on considère qu'il datent d'une époque postérieure à la glaciation d'Eclipse. Des sédiments marins plus récents sont connus, dans les profils côtiers, jusqu'à des altitudes comprises entre 30 et 40 m au-dessus du niveau de la mer sur les côtes sud et nord, et contiennent des coquilles in situ caractérisées par des rapports des acides aminés compris entre 0,30 et 0,15. Ils auraient été mis en place après la glaciation de Button. Des sédiments marins soulevés d'âge holocène ont été identifiés dans le nord de l'île de Baffin et dans le sud de l'île Bylot; il ne semble pas qu'ils existent dans le nord de l'île Bylot. Durant l'Holocène, l'émersion a atteint environ 30 à 25 m dans les régions de la pointe Button et de la pointe Canada, 40 à 45 m dans les basses terres au sud, 50 à 60 m près de la ville de Pond Inlet, 80 m au cap Hatt, et 100 m à l'extrémité sud de l'inlet Milne. Dans la partie nord du littoral de l'île Bylot, l'aspect "ennoyé" des estuaires indique que la côte subit peut-être actuellement une submersion, et l'absence de sédiments marins d'âge holocène à cet endroit indique qu'il n'a peut-être pas existé à l'Holocène de côte en voie d'émersion.

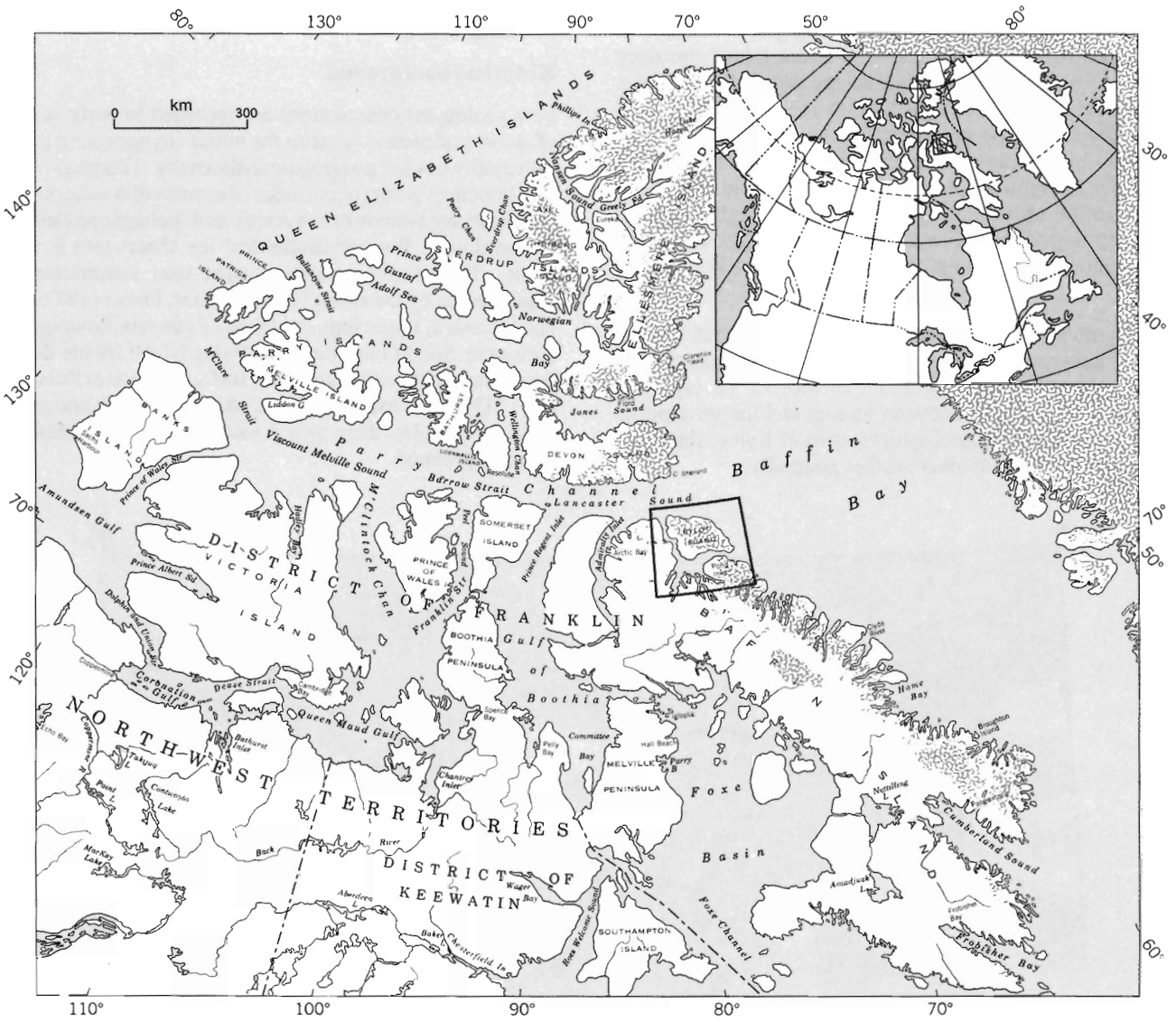

Figure 1. Location of study area in the Eastern Arctic and extent of modern glaciers (shaded areas).

INTRODUCTION

This report describes the surficial geology of Bylot Island and parts of adjacent Baffin Island and presents a history of glaciation by regional (foreign*) ice sheets and by local (native*) mountain glaciers and ice caps. The area studied occupies the central part of the Eastern Arctic, adjacent to Lancaster Sound at the head of Baffin Bay. It is bounded by latitudes 72° and 74° N and by longitudes 75° and 82° W, and includes parts of NTS map areas 38 B,C and 48 A,D (Fig. 1). Fieldwork was carried out during the summers of 1978, 1979, and 1981, and most of the work was directed toward study of Bylot Island.

Bylot Island lies near the northeastern margins of the Laurentide Ice Sheet and is now characterized by numerous, extensive mountain glaciers and ice caps (Fig. 2). The modern glaciers occur within the Davis Highlands (Bostock, 1970). The Highlands extend over 1500 km between southern Baffin Island and northern Ellesmere Island and have been proposed as the initial gathering ground of the Laurentide Ice Sheet (Andrews and Barry, 1978). The island is also located beside Lancaster Sound, which has been a major pathway for ice flowing eastwards out of arctic regions and into Baffin Bay. On several occasions Bylot Island has undergone periods of foreign and native glaciation. Foreign glaciers flowing within Lancaster and Eclipse sounds have transported debris onto the island and have created a series of spectacular moraines against the outer coastal mountains. Distinctive lithological variations in regional bedrock geology allow the composition of glacial debris to be used as a powerful tool for distinguishing between foreign and native deposits of the

*For convenience the terms "foreign" and "native" are used to distinguish between glaciers originating within the area of study (native) and those originating from centres of flow located elsewhere (foreign). Debris transported by glaciers is likewise described as native (eroded from outcrop in the area) and foreign (transported into the study area).

various glacial events and for unravelling glacial history. It is because marine channels around Bylot Island are deep (500-1000 m) that foreign debris on the island demonstrates unequivocally glacial transport by an ice sheet of regional extent and cannot be considered to be the result of local expansion by ice caps on nearby Baffin Island. Ice sheets with the potential to impinge on the island could have been centred to the north among islands of the High Arctic as well as to the south in Foxe Basin. This study, however, has found evidence of glaciation only by an ice sheet to the south.

The combination of location within the central Eastern Artic, of numerous mountain glaciers that are susceptible to climatic change, and of variations in bedrock geology that permit clear distinction between foreign and native deposits makes the Quaternary geological record of Bylot Island important for arctic Quaternary studies generally.

Previous work

Historical background

Few geological observations are recorded in early accounts of arctic exploration because the initial voyages were focused principally toward geographical discovery. Haughton (1859) first documented the occurrence of erratics of southern provenance among islands of the Arctic archipelago and described the northward flow of continental ice sheets into arctic regions. Haughton's comments were later summarized and expanded on by Dawson (1887). Earlier, Fisher (1821, p. 62) had recorded, in passing, evidence of glaciers flowing out of Lancaster Sound onto northern Bylot Island by his description of far-travelled limestone in surficial debris at Possession Bay: "The fixed rocks consisted chiefly of basalt and granite, and in the valley there was a vast quantity of limestone in loose fragments".

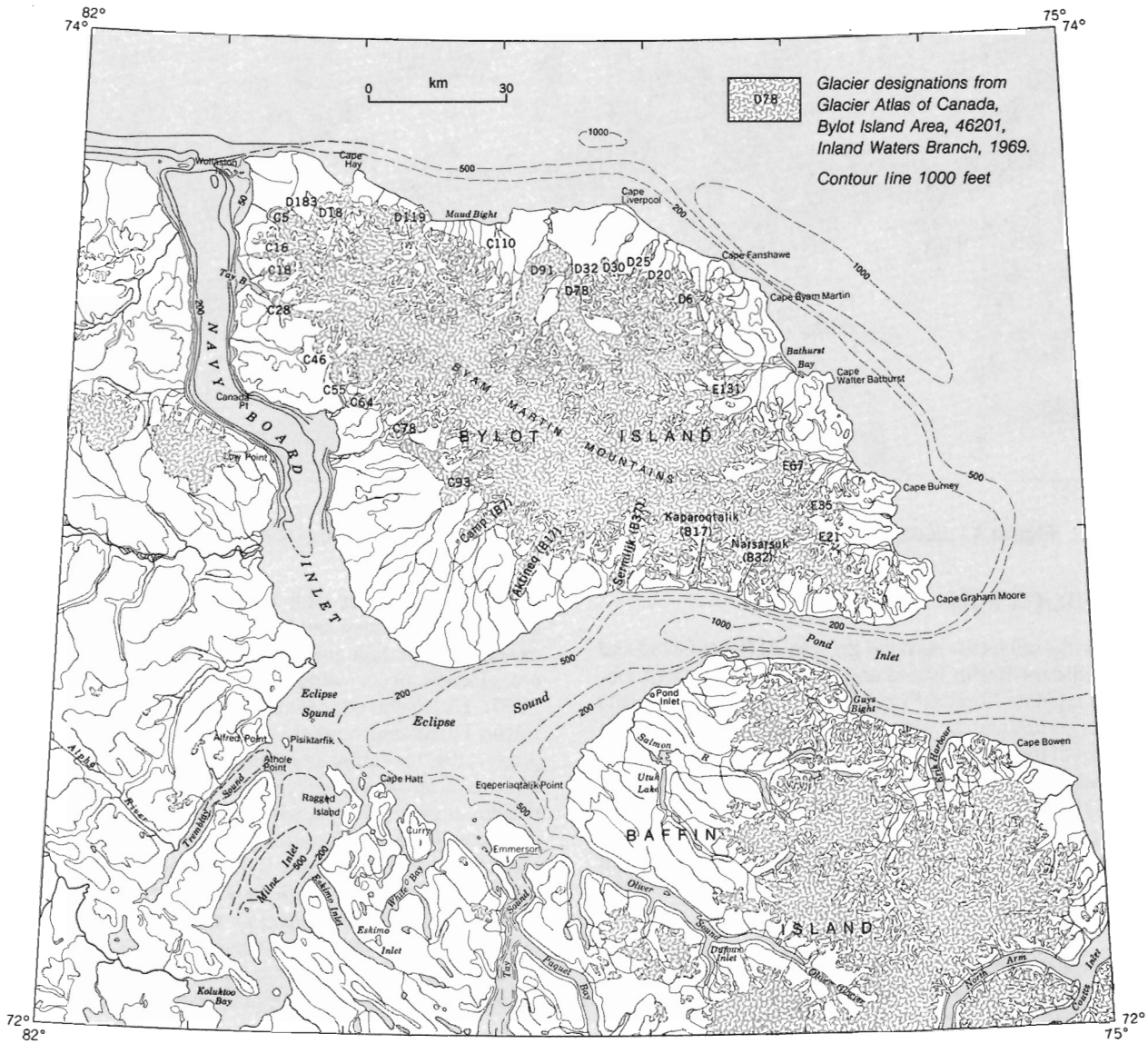

Figure 2. The study area showing place names and glaciers referred to in the text.

Tyrrell (1898) proposed that northern Baffin Island was fully glaciated by ice originating with the Keewatin Ice Sheet, centred west of Hudson Bay. Based on fieldwork carried out during the voyage of the Neptune (1903-1904), Low (1906) recognized a northward decrease in the intensity and extent of glacial erosion from which he interpreted, in contrast to Tyrrell, discontinuous arctic ice cover during the last glaciation. According to Low (1906, p. 61):

> "There is no doubt that in the glacial period the size and extent of glaciers of Baffin Islands were much greater than at present; at the same time the sharp outlines of the hills, together with the absence of that intense polishing and striation of the rocks so common in Labrador and more southern regions, point to a much thinner ice-cap during the glacial period in these northern regions than on the continental area to the south. This may be accounted for, in part, by a smaller precipitation from the narrow, ice laden seas in the north."

Coleman (1926), following Low's interpretations, portrayed a restricted continental ice sheet extending to the eastern margin of Foxe Basin and midway across central northern Baffin Island.

The Danish Fifth Thule Expedition (1921-1924) was the first scientific party to visit Bylot and northern Baffin islands (Mathiassen, 1933). The expedition reported evidence of glacier flow outwards from central northern Baffin Island and concluded that northward-flowing ice was deflected by, but did not override, Bylot Island (Freuchen and Mathiassen, 1925). The occurrence and elevation of raised marine deposits and landforms was also noted by expedition members in the areas of Pond and Milne inlets. In keeping with the work of the Danish expedition, the ice sheet margins were located by Antevs (1929) in Lancaster Sound beyond the northern and eastern coasts of Baffin Island, leaving Bylot Island unglaciated.

Modern era

In recent time, glacial history of the Eastern Arctic has been a subject of considerable controversy over the age and extent of regional ice sheets. Various historical models, and the fundamental differences among them, have been reviewed by Ives (1978), Boulton (1979), Mayewski et al. (1981), and Prest (1984). Craig and Fyles (1960) proposed initially that the area was fully glaciated during Late Wisconsinan time by the Ellesmere-Baffin Glacier Complex, which was described as ice cover contiguous with the Laurentide Ice Sheet to the southwest over Foxe Basin and with the Greenland Ice Sheet to the north. The age and extent of ice were based on raised Holocene marine sediments that were assumed to be the result of direct ice loading, on ice flow features of 'recent' appearance, and on an implicit correlation with events of the mid-continent region. This view was fully accepted by Flint (1971, Fig. 18.5, p. 478) who incorporated it in his well known textbook.

Ives and Andrews (1963) proposed that, at the last glacial maximum, regional ice sheets were restricted to major inlets of northern and eastern Baffin Island, and that large areas, including Brodeur and Borden peninsulas and Bylot Island, were covered only by local ice caps. Their proposal was a direct outgrowth of earlier work in northern Labrador (e.g. Ives, 1978). "Old" radiocarbon dates and differential weathering of glacial deposits were interpreted to indicate that the maximum extent of ice during the last glaciation was attained prior to Late Wisconsinan time (Loken, 1966; Andrews and Ives, 1972; Pheasant and Andrews, 1973). The Cockburn Moraine, mapped at the inner heads of Baffin Island inlets, has been interpreted 1) to outline the extent of the Laurentide Ice Sheet between 8000 and 9500 years ago (Falconer et al., 1965), 2) to mark a still-stand during a general retreat of more extensive ice (Craig, 1965; Hodgson and Hasleton, 1974), and 3) to mark the Late Wisconsinan glacial maximum (Miller and Dyke, 1974; Andrews, 1975).

Prest et al. (1968) and Prest (1970) tentatively drew the northeastern margin of the Laurentide Ice Sheet in Lancaster Sound, north of Bylot Island, during Late Wisconsinan time. Their portrayal of more extensive ice cover accorded with Blake (1970, 1975), who had proposed that the Laurentide Ice Sheet merged in Lancaster Sound with the Innuitian Ice Sheet, which was centred among islands of the northern archipelago. This portrayal was used by Hughes et al. (1977) and by Denton and Hughes (1981) in support of a model of extensive arctic ice cover during Late Wisconsinan time, when Lancaster Sound was occupied by a major outlet glacier "draining" the Laurentide Ice Sheet.

The surficial geology and glacial history of northeastern Baffin Island was outlined initially by Hodgson and Haselton (1974), whose extensive fieldwork forms an important background to this study. Additional field studies of central and northern Baffin Island include that of Blackadar (1970), who described glacial landforms and ice flow patterns in the area of Fury and Hecla Strait, and of Sim (1960), who described a late glacial history of Foxe Basin region.

Hodgson and Haselton (1974) documented geomorphological and compositional evidence of glaciation on Bylot and Baffin islands by both regional ice sheets and native glaciers. By radiocarbon analysis of marine shells, they provided the first direct evidence from the northern Baffin region that the maximum extent of the Laurentide Ice Sheet could have been attained prior to Late Wisconsinan time. Submarine moraines outlining the extensions of the ice sheet crossing the northeastern Baffin shelf were described by Loken and Hodgson (1971). Three distinct periods of native glaciation were recognized by Hodgson and Haselton (1974). The first, and most extensive, occurred prior to the last foreign glaciation of Lancaster Sound; the later two were successively less extensive. The youngest advance, identified as Neoglacial in age, was considered to mark the greatest extent of local ice since Late Wisconsinan time, and possibly earlier. Neoglaciation and Neoglacial moraines on Bylot Island have been described by Baird (1955), Falconer (1962), DiLabio and Shilts (1978), and Klassen (1982a, b).

Raised marine deposits and landforms show patterns of differential Holocene uplift with greatest emergence (80-100 m) at the head of fiords in northern Baffin Island, as well as evidence of recent submergence, particularly on the northern coast of Bylot Island (Falconer, 1962; Hodgson and Haselton,1974).

Some aspects of the present report and the main conclusions found therein have already been published by the author (Klassen, 1981, 1982a, b, 1985).

Details of radiocarbon dates are given in Appendix 1, and of amino acid analyses in Appendix 2. Descriptions and locations of stratigraphic sections are provided in Appendix 3. Reports of fossil arthropod and plant macrofossils are included as Appendix 4.

Acknowledgments

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Figure 3. Generalized geological map of northern Baffin Island and geological provinces of the Eastern Arctic region (inset).

Director) provided logistic support, and the assistance of F. Alt and F. Hunt was of great importance to the success of field work. PetroCanada Ltd. and H. Steltner provided logistic help in Pond Inlet. I thank the helicopter pilots and engineers for their co-operation and skills during long hours and difficult flying conditions. My capable field assistants were S. Lavender, R. Muktar, and R. Weber (1978); R. Needham, G. Iannucelli, R. Muktar, and L. Kettles (1979); and J. Hornsby (1981). D.A. Fisher and R.M. Koerner provided advice concerning glaciological reconstructions. In addition, I thank J.T. Andrews and G.H. Miller, both at INSTAAR, for amino acid analysis; W. Blake, Jr., for radiocarbon analysis; J.V. Matthews, Jr., and W. Mode, INSTAAR, for fossil identification; and S.K. Frape, University of Waterloo, for isotopic analysis. A.S. Dyke is thanked for thorough, constructive critical review.

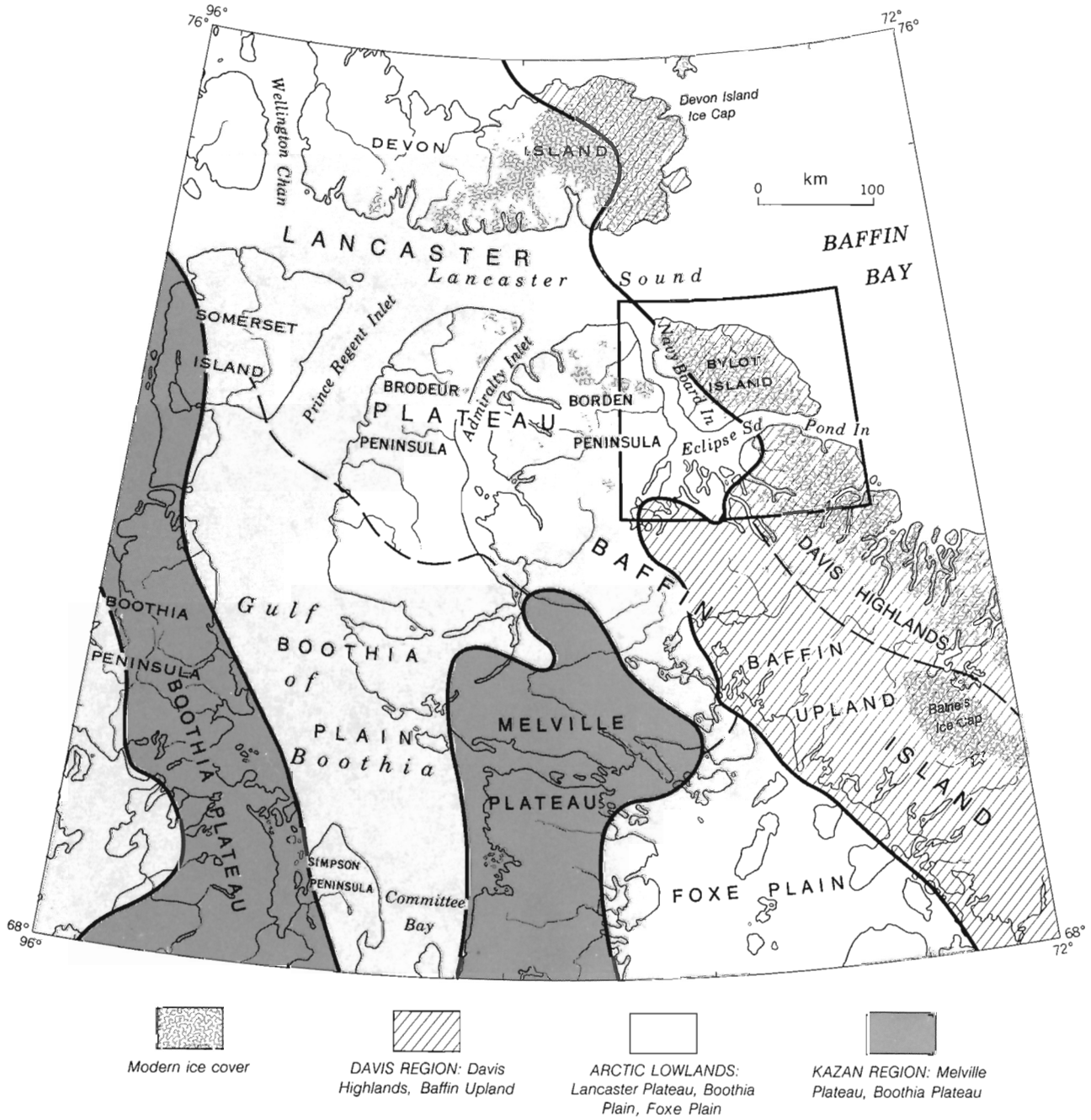


Figure 4. Physiographic regions of the Eastern Arctic.

BEDROCK GEOLOGY AND PHYSIOGRAPHY

Geology

The study area occupies parts of the Canadian Shield and the Arctic Platform geological provinces, which have been described by Thorsteinsson and Tozer (1970) (Fig. 3, inset). The Canadian Shield includes both a basement complex of Archean-Aphebian crystalline rock and an overlying succession of Proterozoic sedimentary and volcanic rocks that are little metamorphosed and relatively undeformed. The crystalline rocks, which are igneous, metavolcanic, and metasedimentary in origin, outcrop over most of northeastern Baffin, Bylot, and eastern Devon islands. Proterozoic rocks outcrop over north-central Baffin Island, parts of western and northern Bylot Island, and most of Borden Peninsula (Fig. 3).

The Arctic Platform includes terrains where the Shield is overlain by flat-lying sedimentary strata of Cambrian to Late Silurian ages. In the study area, the platform also includes clastic, poorly consolidated sedimentary rock of Cretaceous-Tertiary age that outcrops on southern Bylot and adjacent Baffin islands (Jackson and Davidson, 1975; Miall et al., 1980). The Arctic Platform extends over much of north-central Baffin Island including almost all of Brodeur Peninsula, the southern lowland of Bylot Island, and the western part of Devon Island.

The geology of Bylot and adjacent Baffin islands has been described by Jackson and co-workers (Jackson and Davidson, 1975; Jackson et al., 1975; Jackson et al., 1978). Bedrock of adjacent sea beds is known only through seismic records. The floor of eastern Lancaster Sound is thought to comprise up to 5000 m of Mesozoic- and Tertiary-age sediments that thin westwards (Daae and Rutgers, 1975, p. 101).

Figure 5. On southern Bylot Island native glaciers extend outwards as piedmont tongues from the crystalline highlands of the Byam Martin Mountains onto lowlands that are underlain by sedimentary rock of Cretaceous-Tertiary age (geological contact shown). NAPL T344R-200

Structural features

Sedimentary rocks of the Arctic Platform are preserved within down-faulted tectonic elements of the North Baffin Rift Zone. Block faulting has created a series of horst and graben structures oriented northwest that define the Rift Zone, and has occurred periodically from before the onset of Neohelikian sedimentation until the present time (Jackson et al., 1975). The shapes of islands and channels around Lancaster Sound appear to be controlled by faults of Cretaceous or Tertiary age and follow structural trends in crystalline basement and Paleozoic cover (Kerr, 1980). Although channels may have been modified by glacial erosion subsequent to their formation, faulting accounts for their main morphological features, including cliffs that form straight coastlines. Tertiary submergence of some areas in the Eastern Arctic could have been up to 900 m, relative to modern sea level (Pelletier, 1966).

Physiography

Regional setting

The area studied occupies parts of the Davis Region and Arctic Lowlands physiographic areas described by Bostock (1970) (Fig. 4). The Davis Region, which is underlain by crystalline rock, is further subdivided into the Davis Highlands, which extends more than 1500 km along the rim of the Eastern Arctic from southern Baffin Island to northern Ellesmere Island, and the Baffin Upland, which occupies central Baffin Island. Davis Highlands is a mountainous region, dissected by major valleys and fiords. Remnants of an old erosional surface form summits in general accordance at about 1700 m a.s.l. Baffin Upland also represents an ancient erosional surface sloping regionally upward from Foxe Basin and eastward toward Davis Highlands. Baffin Upland terrain has generally low relief, and rises in elevation to about 500 m a.s.l.

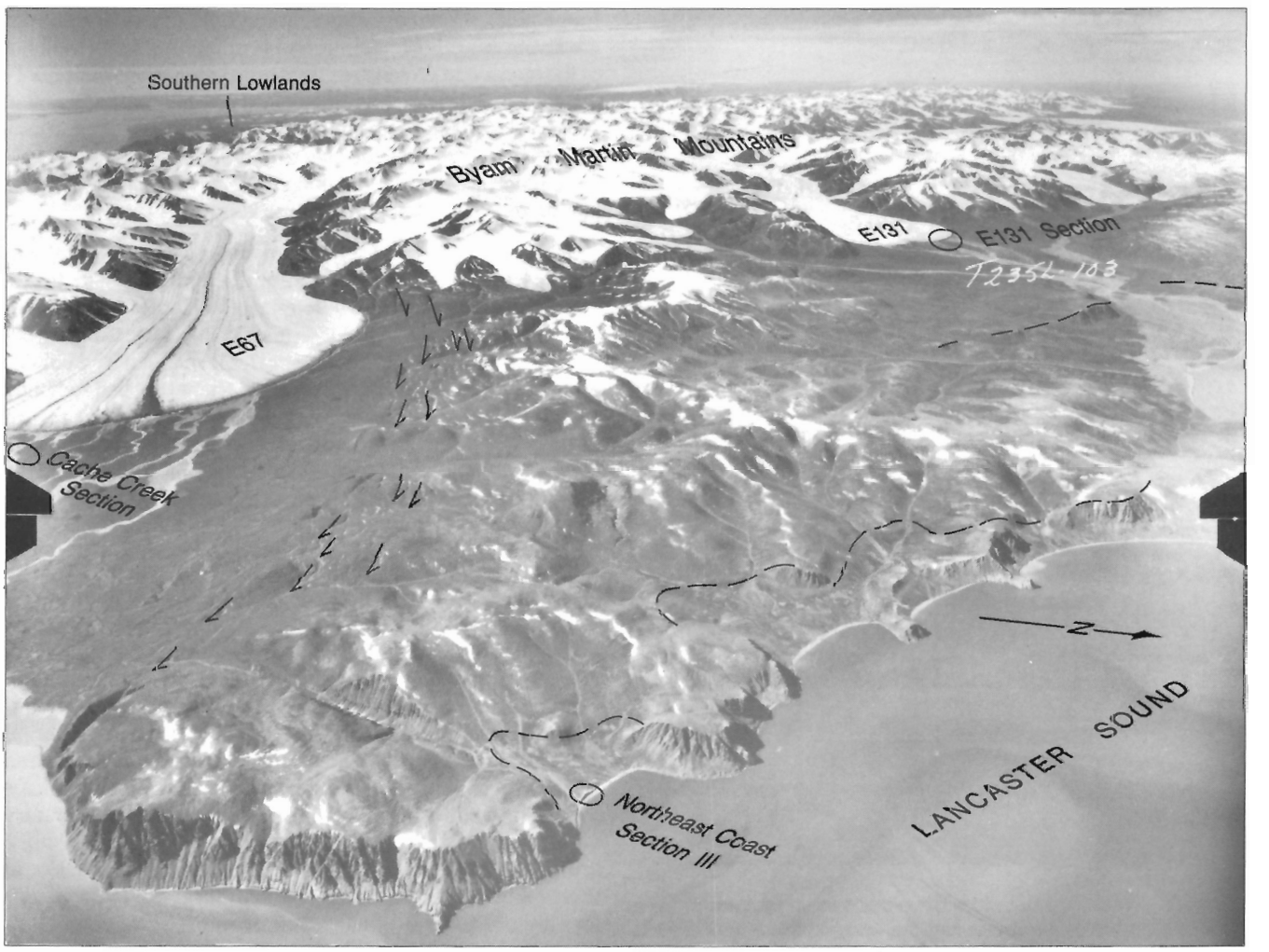


Figure 6. View of northeastern Bylot Island. The central mountains display classic landforms of mountain glaciation whereas the outer parts, at lower general elevations, appear more rounded and subdued and are associated with the ancient erosional surface of the Baffin Upland. Lateral meltwater channels incised in crystalline bedrock in front of glacier E67 outline a major advance of native glaciers associated with Bylot glaciation. NAPL T235L-103

All sedimentary bedrock, including units of Proterozoic, Paleozoic, and Cretaceous-Tertiary ages, is mapped within the Lancaster Plateau physiographic subdivision of the Arctic Lowlands (Fig. 4). On northern Baffin and northwestern Bylot islands, Proterozoic and Paleozoic sedimentary rocks form high plateaus (300-600 m a.s.l.) and rolling hills that are cut by deep valleys of either fluvial or glacial origin, or both.

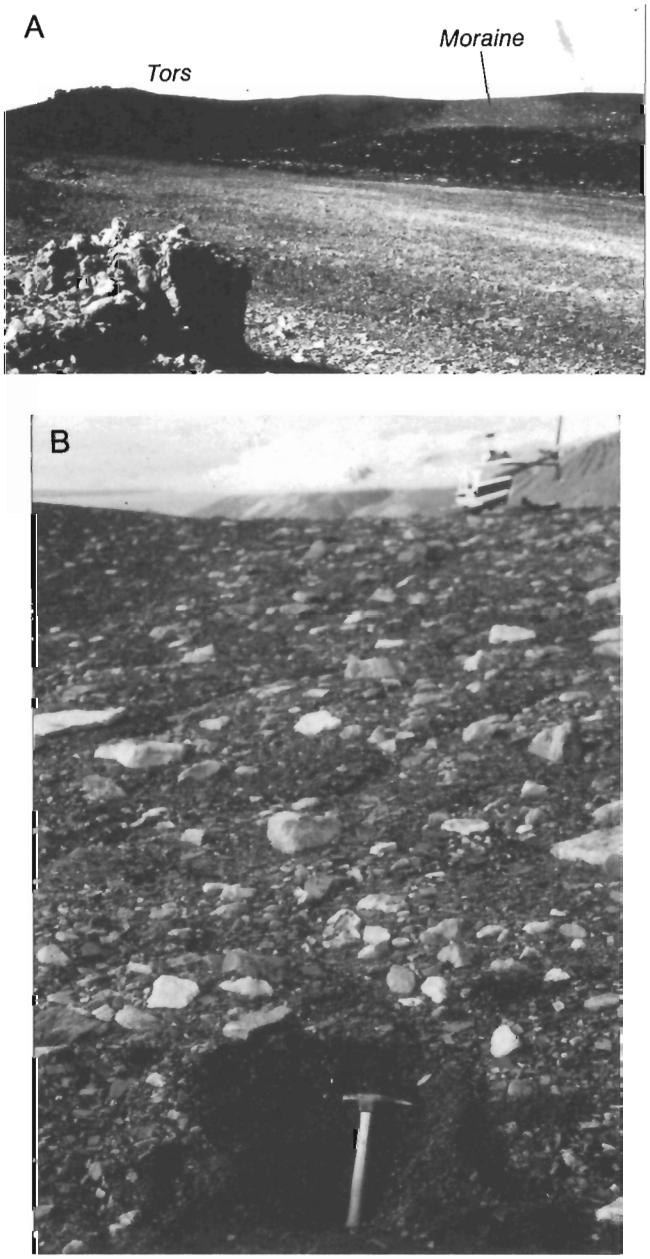


Figure 7. Near Tay Bay, tors developed in sandstone rock (arrows) stand in relief above weathered mudstone bedrock. Erratics of crystalline rock litter the tops of the tors and define stripes that are medial moraines across the surface of the mudstone (A). The erratics form only a surface litter and are not mixed within the soft, unconsolidated mudstone (B). The preservation of weathered landforms of preglacial origin indicates that the ice sheets that covered the island were nonerosive. 203640-N

Along the northern margin of Bylot Island, Proterozoic bedrock forms high coastal cliffs characterized by stacks and caves, and broad platforms at 20 to 40 ma.s.l.that may have been wave-cut. Sedimentary bedrock of Cretaceous-Tertiary and of Proterozoic ages forms broad, rolling lowlands that slope up to the crystalline mountain front on southern Bylot Island and on northern Baffin Island, respectively.

Areas dominated by native glaciation

Byam Martin Mountains, which represent the northward continuation of Davis Highlands on Bylot Island, form a central physiographic unit that is classically alpine in appearance. They are characterized by sharp, pointed peaks extending to 1800 m a.s.l.; deep, intersecting cirque basins; narrow, steep-walled cols; and horns (Fig. 5, 6). The glacial landforms are the product of both ancient and modern mountain glaciation. Numerous, modern valley glaciers and ice caps cover most of the mountain core, and only a few peaks and steep valley sides become snow-free during the summer. Large glacier tongues extend far out onto the lowlands from the Byam Martin Mountains and form an important element to the landscape. Arrêtes of the central mountains commonly display a saw-toothed outline resulting from rock pillars that stand as erosional remnants 10 m or more above ridge crests. At the few sites visited, crystalline rocks along the ridges were much weathered, breaking easily by hammer blow and having loose mineral grains at the surface.

The outer flanks of the mountains, at lower general elevation, have broad, rounded summits, commonly with tors at their crests, and are not characterized by landforms of mountain glaciation (see Fig. 6). Most of this lower region becomes snow-free by mid-summer and is mantled by a coarse, blocky rubble that is largely frost-shattered bedrock and contains few recognizable erratics. The broad hilltops appear to be part of the ancient erosional surface recognized to the south on Baffin Island and, as such, the outer flanks may be geomorphologically associated with the Baffin Upland surface.

Among the Byam Martin Mountains, east of Sermilik Glacier, is an area characterized by deeply incised, V-shaped valleys that appear to have formed as a result of prolonged fluvial erosion of the crystalline bedrock. With few modern valley glaciers, this relatively small area appears anomalous amid the large-scale landforms of mountain glaciation. One inland-sloping valley of apparent fluvial origin is truncated by the coastal cliffs of Pond Inlet, which indicates that erosion of the valley predates formation of the cliff and could be ancient. Minor tributary valleys in areas of mountain glaciation also have V-shaped profiles, and many are flooded by minor glacial lakes at their junction with modern glacial margins. If these valleys are of fluvial origin, as their geomorphology suggests, they must have formed during one or more periods of less extensive mountain glaciation, when their lower reaches were not blocked by ice.

Landforms developed in bedrock as a result of major expansion of local glaciers include extensive ice marginal meltwater channels, particularly in valleys leading toward the

northeastern coast of Bylot Island (see Fig. 6), and, possibly, truncated spurs or shoulders on valley sides well above modern ice surfaces. The spurs suggest upper erosional limits of valley glaciers. The meltwater channels outline margins of glaciers that extended to the sea, well beyond modern limits. The channels line hillsides to elevations of 300 m a.s.l. and overlook valley floors that are <80 m a.s.l. Near the coast, some of the channels are blocked by foreign glacial deposits, indicating that the the channels were established prior to at least one period of foreign glaciation.

Areas dominated by foreign ice sheets

Although the margins of Bylot Island, including most of the outer lowlands, have been glaciated by foreign ice, there is little morphological evidence of glacial erosion, and the ice sheets appear to have been generally protective of bedrock and preglacial landforms. Striae and glacially smoothed landforms associated with foreign ice are known at only one site, at <200 m a.s.l. on the northern coast near Cape Hay. They indicate erosion by ice flowing eastwards down Lancaster Sound.

Slight breaks in slope and "shoulders" on coastal cliffs may mark the limits of outlet glaciers in the marine channels. In contrast, long north-facing inlets on Baffin Island can be characterized by glacially polished bedrock and undercut valley margins that indicate active glacial erosion by northward-flowing ice.

The nonerosive character of foreign ice sheets on Bylot Island is well illustrated at one site near Tay Bay where landforms and features of preglacial weathering are preserved despite glaciation (Fig. 7). Weathering features are developed in Proterozoic sedimentary rock at the top of a minor hill set within a valley floor (Fig. 7A). Tors developed in carbonate-cemented sandstone at the crest of the hill stand

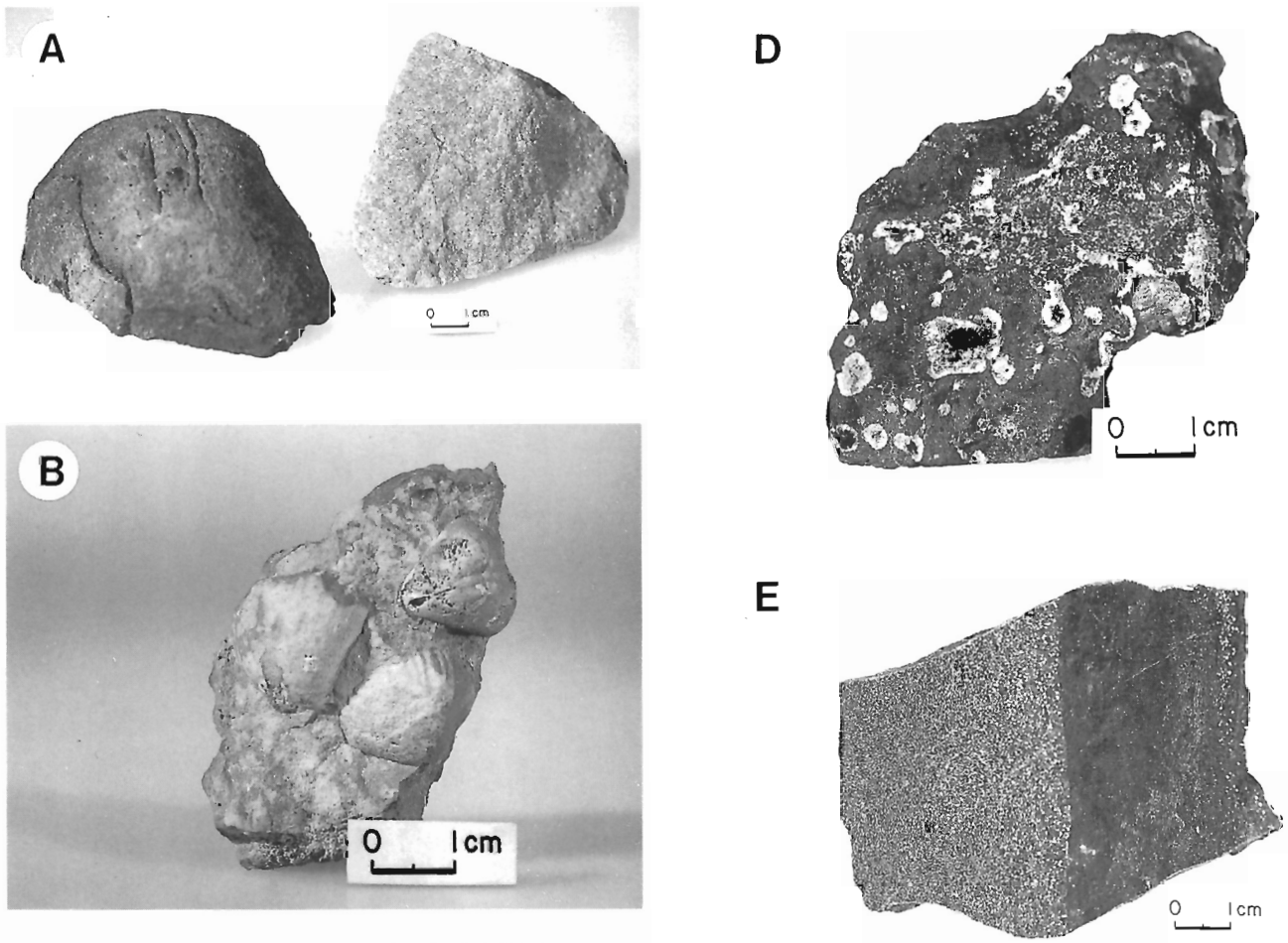


Figure 8. Erratics of foreign provenance found on Bylot Island include (A) pink and brown quartz sandstone of the Proterozoic Adams Sound Formation; (B), (C) fossiliferous rock of early Paleozoic age from north-central BaffinIsland or Foxe Basin; (D) amygdaloidal volcanics found only on northern Bylot Island and derived from Nauyat Formation in the Arctic Bay area of northwestern Baffin Island; and (E) massive specular hematite found near Sermilik Glacier and Mt. Herodier, and derived from Mary River Iron Formation on north-central Baffin Island. 203650-A,J,F,I,H

several metres above the surface of adjacent noncalcareous mudstone. The mudstone is poorly consolidated and deeply weathered, with numerous secondary concretions at its surface, and it can be easily trenched by shovel. Erratics occur on top of the tors, on the debris apron associated with the tors, and on the surface of the weathered mudstone, where they form well defined stripes interpreted as medial moraines. Erratics include crystalline debris as well as carbonate sedimentary rock. None were found within the mudstone, despite its soft, muddy character, indicating that it remained undisturbed during the passage of foreign ice. The crystalline erratics are angular and appear to be little weathered.

Modern glaciers

Modern valley glaciers, piedmont lobes, ice caps, and permanent snowfields are common within highland areas of the Eastern Arctic (Fig. 1), and have been inventoried by Bird (1967) and Mercer (1975). Ice cover on Bylot Island is estimated to be about 4900 km^2 (Bird, 1967), which is about half of its total area. In this report, glaciers are named according to published topographic (NTS) maps and to the Glacier Atlas of Canada, Bylot Island Area 46201 (Inland Waters Branch, 1969). Most ice cover occurs within the Byam Martin Mountains, where it is nearly continuous and is represented by numerous cirque and valley glaciers that flow north and south from the main topographic divide. Glaciers on the island are fed chiefly from storms that track northwards along Baffin Bay. The Devon Ice Cap to the north, however, receives considerable nourishment from an area of water at the head of Baffin Bay that remains ice-free during the winter (The North Water, Koerner, 1977)

For Bylot Island, glaciation limits (lower limits at which glaciers form) are estimated between 700 m and 1100 m a.s.l., and equilibrium line elevations (level marking the balance between net accumulation and net ablation) between 1000 m

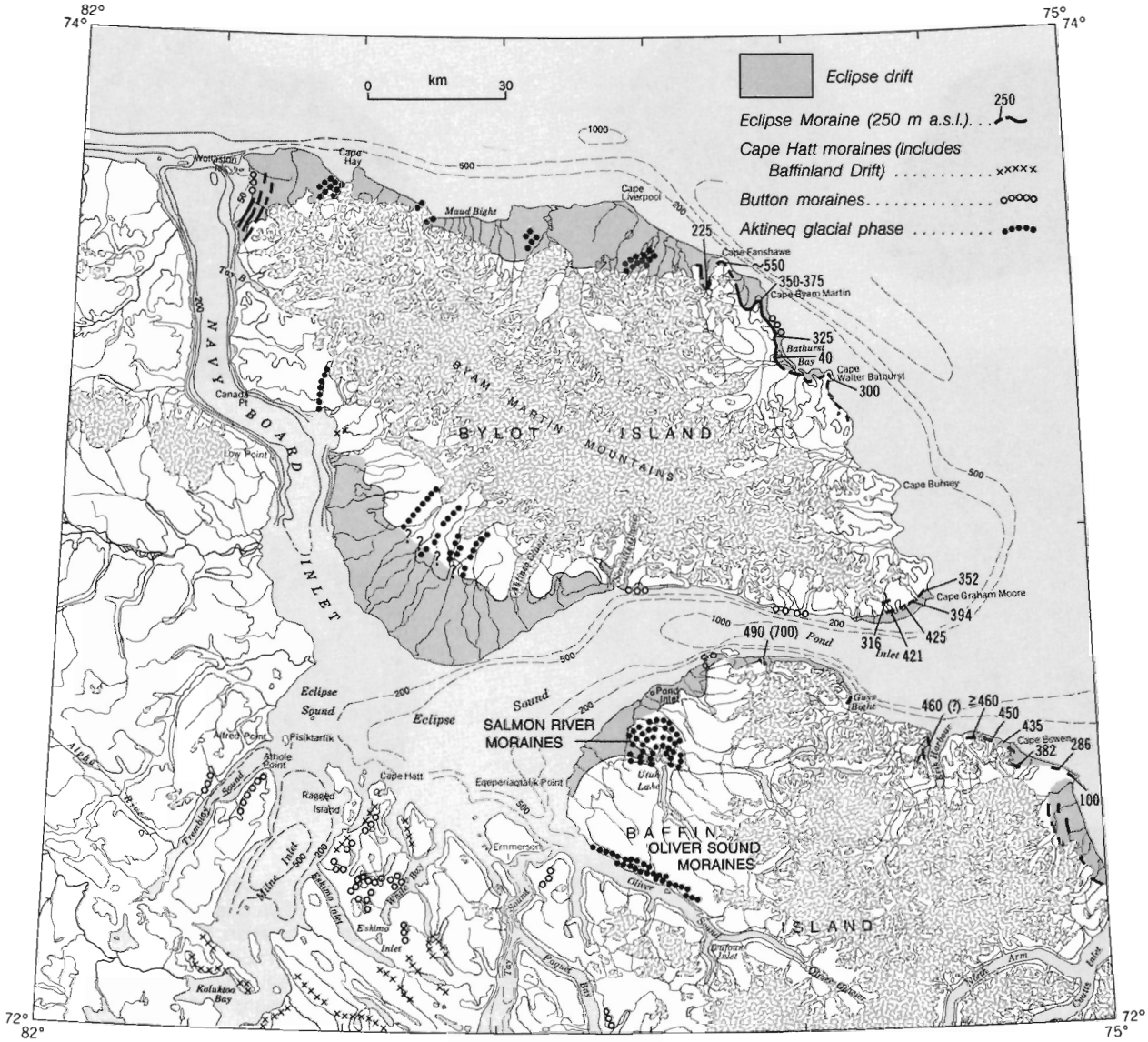


Figure 9. Summary of foreign and native ice marginal landforms and distribution of Eclipse drift.

and 800 m a.s.l. (Andrews and Miller, 1972). These estimates are considered by Andrews and Miller to be high for the region. Although most of the glaciers terminate on land, some as high as 400 m a.s.l., two calve directly into Lancaster Sound and others terminate near sea level. On northeastern Baffin Island and on Borden Peninsula, the margins of ice caps extend down to about 600 m a.s.l., with some outlet glaciers extending to sea level.

SURFICIAL DEPOSITS AND LANDFORMS

The surficial geological map that accompanies this report (Map 1686A) serves as a reference for the occurrence and distribution of surficial sediments and landforms. Most of the fieldwork was accomplished on Bylot Island, and much of the mapping on Baffin Island is based solely on interpretation of aerial photographs and is, consequently, less reliable. In

Limit of foreign (Eclipse) drift .....

Location and elevation (m a.s.l.) of foreign erratics inland of Eclipse drift (C, carbonate; Q, quartzite) Q:580

Stratigraphic section .....

River icing (aufeis) I

Figure 10. On southern Bylot Island a minimum estimate of foreign ice limits during Eclipse glaciation is based on the occurance of foreign drift. Rare foreign erratics of quartz sandstone found well inland of those limits are associated with an earlier, more extensive foreign glaciation named Baffin glaciation. NAPL T239L-84

common with most Canadian Arctic regions, surficial sediments are generally thin and discontinuous over bedrock. The deposits can vary laterally both in age and origin with little or no geomorphological variation, and over distances that are difficult to map at the scale used. Aerial photographs do not provide a sufficient basis for making stratigraphic distinctions, and the surficial map units are not subdivided according to distinct events. The surficial deposits and landforms , however, are the product of several foreign and native glaciations that are discussed in the chapter on Quaternary history. Geological evidence of the last major foreign glaciation, Eclipse glaciation, is widespread in surficial deposits and forms the principal basis for historical interpretation.

Drift provenance

As a basis for establishing debris provenance and major pathways of glacial transport, bedrock of the northern Baffin Island region is subdivided into four lithological suites: crystalline rock, volcanic rock, nonfossiliferous (Proterozoic and

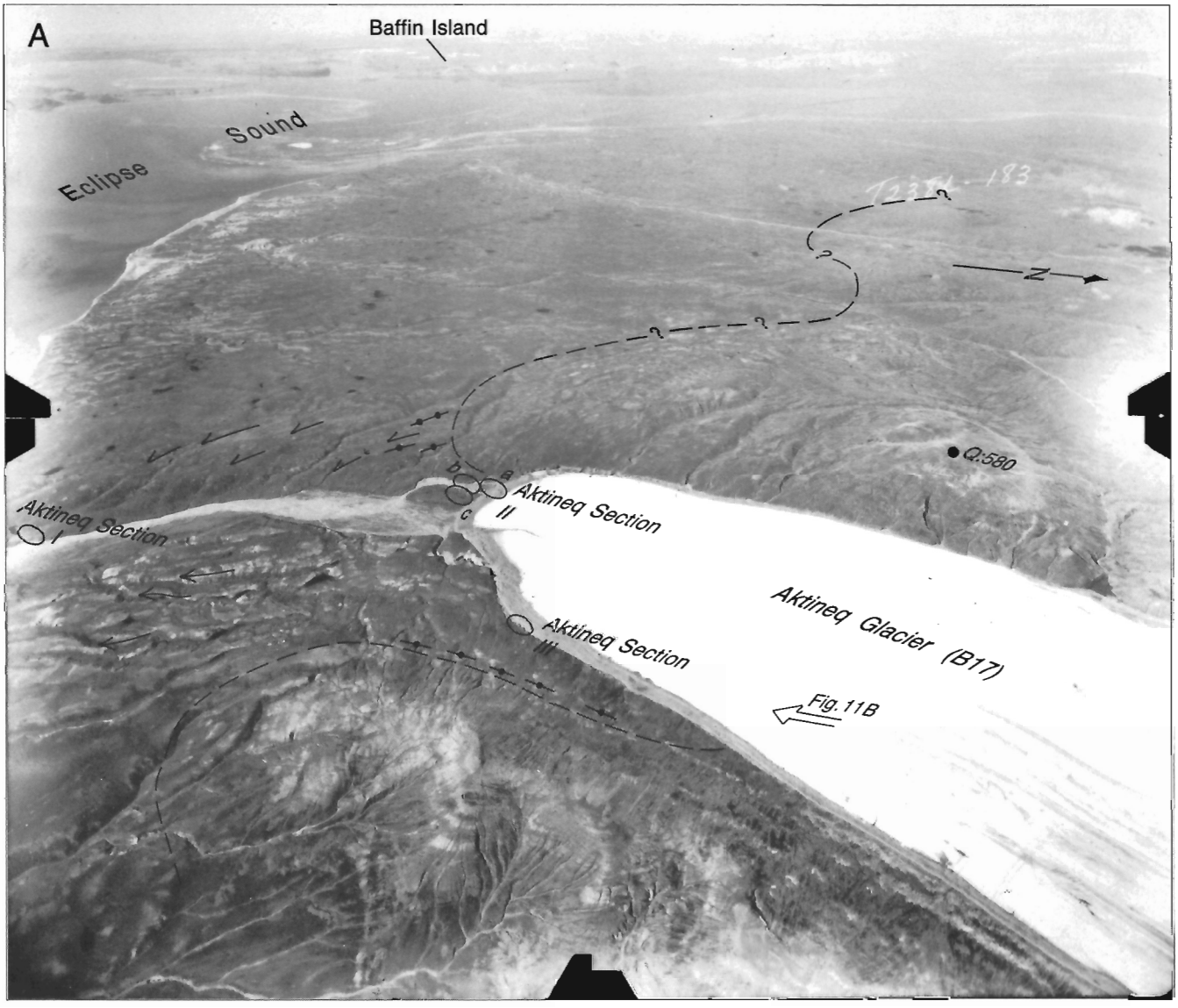


Figure 11. Adjacent to Aktineq Glacier, the inland extent of foreign drift (Eclipse drift) is coincident with a well defined bench at 350 to 370 m a.s.l. (A). Native ice marginal landforms in front of Aktineq include a large component of foreign debris, in contrast to Neoglacial moraines that contain virtually none. View given by Figure 11B is included. NAPL T238L-183; 203875-D

Figure 11. Continued.

Paleozoic) sedimentary rock, and fossiliferous (Paleozoic) sedimentary rock (Fig. 3). Sedimentary rocks, including limestone, dolomite, quartz sandstone, siltstone, and shale, outcrop widely over northern Baffin Island, Foxe Basin, and western Bylot Island. Bedrock of Ordovician to Early Silurian ages, which can contain macrofossils, is more restricted in areal extent and occurs in Foxe Basin, north-central Baffin Island, Brodeur Peninsula, and northern Borden Peninsula.

In areas of crystalline terrain on Bylot Island, erratics of sedimentary rock (Fig. 8A, B, C) can be easily recognized, even where few are present. Such erratics, including fossiliferous rock, are widespread around the outer margins of the island, where they form a significant and highly visible component (to 80 wt.%) of foreign drift. No erratics derived from bedrock younger than early to middle Paleozoic age were recognized that could have demonstrated a provenance either to the west or north of northern Baffin Island, and all foreign debris is thought to have been derived from bedrock of northern Baffin Island and, potentially, Foxe Basin to the south.

Volcanic rock outcrops at Arctic Bay on Borden Peninsula (Nauyat Formation), north of Fury and Hecla Strait, and at one site on northern Bylot Island. Erratics of volcanic rock (Fig. 8D) were found in foreign drift only on northern Bylot Island. Their red-brown, amygdaloidal character indicates that they are most likely derived from Nauyat Formation at Arctic Bay. Volcanic bedrock on Bylot Island is relatively minor in extent and is not known to be amygdaloidal (Jackson and Sangster, 1987). Thus, it is not considered to be the source of the volcanic debris in foreign drift adjacent to Lancaster Sound.

Due to their complex and varied lithology, crystalline rocks are not used in provenance studies, with the exception of massive, specular hematite (Fig. 8E) of Mary River Group that outcrops on north-central Baffin Island. Erratics of specular hematite occur in drift on plateaus along Milne Inlet, on Mount Herodier near the town of Pond Inlet, and on southern Bylot Island adjacent to Sermilik Glacier, as reported by Jackson and Davidson (1975). They have not been found elsewhere.

Sedimentary rock of Cretaceous-Tertiary age that forms the lowlands of Bylot and northern Baffin islands has not been used to establish drift provenance because it is easily disaggregated and does not form cobble or boulder-sized erratics. Finer grained constituents, however, could be of potential use in dispersal studies to track the movement of regional ice sheets into the crystalline highlands of Bylot Island.

Foreign drift

Foreign drift includes sediments transported by foreign ice sheets and deposited either directly from ice or as a result of ablation, as well as glacial sediments deposited within a marine environment. It contains 1 to >80 wt.% foreign debris and occurs typically as a grey to brown sandy diamicton forming a thin (<2 m), continuous to discontinuous surface cover, although it can vary from a thick (10 m) muddy diamicton to a boulder gravel. Hummocky drift, characterized by irregular mounds 10 m or more in height, occurs on northern Bylot Island, in front of glacier D91, and on Baffin Island, near Mala River and Cape Maccullough. Widespread fragments of marine shells at elevations greater than maximum limits of marine inundation, although uncommon, demonstrate that foreign drift incorporates preglacial marine sediments. Amino acid ratios of the glacially transported shells provide a basis for estimating the maximum relative age of glaciation, and most foreign drift is associated with Eclipse glaciation (Eclipse drift).

Bylot Island

Adjacent to the northeastern coast, beside Lancaster Sound, and to the southern coast, beside eastern Pond Inlet, foreign drift (Eclipse drift) is mapped to 300 m and 600 m a.s.l. across coastal mountain slopes and to 50 m to 250 m a.s.l. within valleys, and its inland extent is marked by a well defined morainic ridge (Eclipse Moraine) (Fig. 9). Across the southern and northern lowlands, foreign drift occurs to 270 and 370 m a.s.l. 10 to 20 km inland (Fig. 10, 11, 12), and there its inland extent is not marked by a moraine and has been identified by field mapping of foreign debris. An exception is known across a hillside east of Aktineq Glacier where the extent of foreign drift is marked by a morainic bench (Fig. 11 A, B). Adjacent to Navy Board Inlet, foreign drift has proven difficult to map because foreign and native debris is compositionally similar in that area of Proterozoic sedimentary bedrock and because there is no geomorphological evidence of a foreign ice limit.

Inland of foreign drift, and at greater overall elevation, scattered foreign erratics occur, although they are uncommon to rare (Map 1686A). Foreign erratics were not found within the central region of the Byam Martin Mountains. Few sites, however, were examined there because of difficulty of access and extensive snow cover, so the distribution of foreign erratics may be more extensive than reported here. The highest known foreign erratics are silica-cemented quartz sandstones that occur at 1136 m a.s.l. beside Sermilik Glacier, 10 km inland of the coast (Fig. 10). To the north, similar

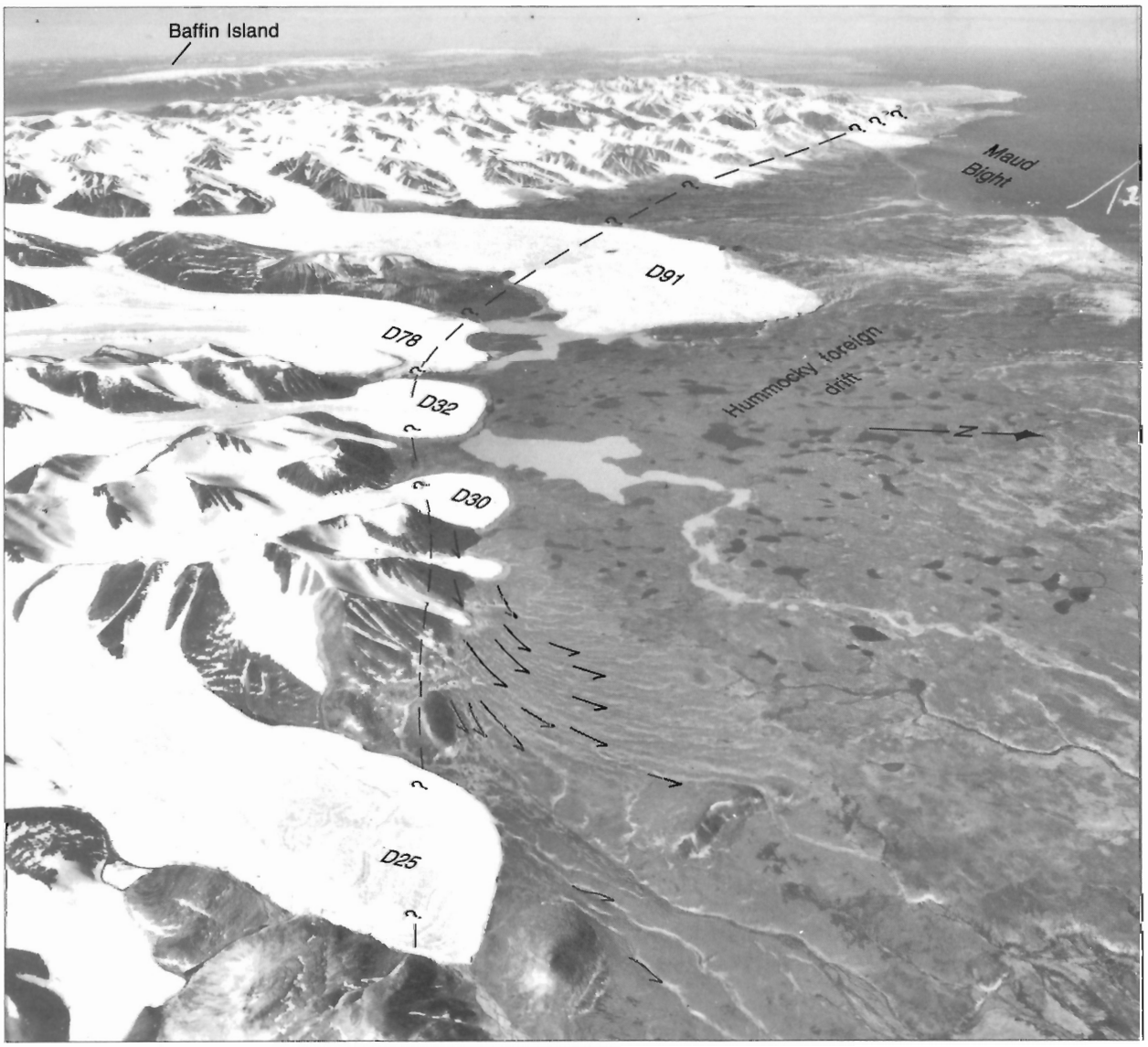


Figure 12. On the northern lowland of Bylot Island, eclipse glacial limits extend to the mountain front, inland of modern glaciers. NAPL T239L-111

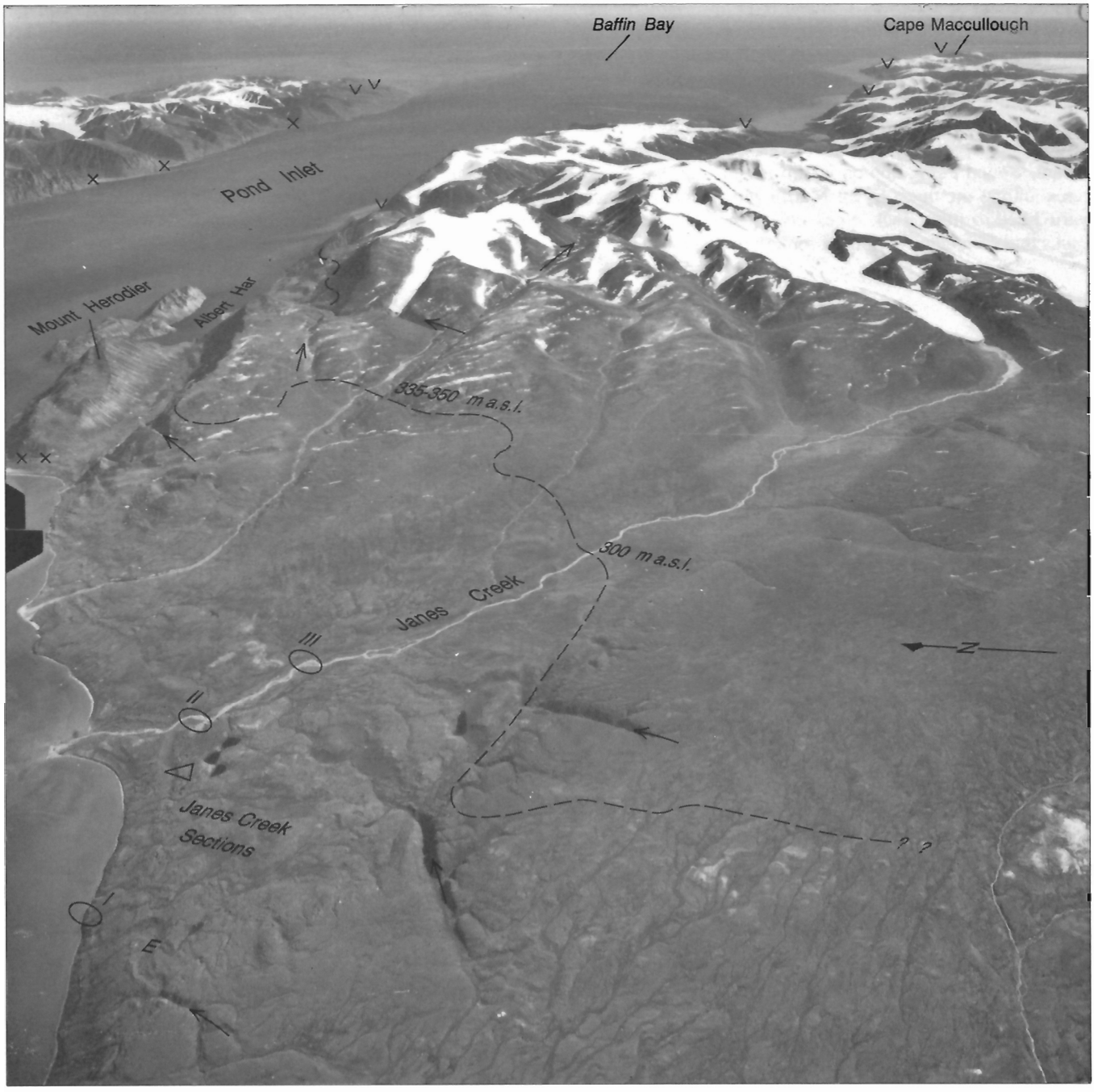
erratics occur at 820 m a.s.l. inland of Eclipse Moraine near Cape Fanshawe. Sandstones could have originated, conceivably, as native debris, derived from small, unmapped outliers of Proterozoic sediments in the mountains. Although such outliers could exist, given the geological setting described by Jackson et al. (1975), none are known and the sandstone erratics are considered to be foreign debris derived from Adams Sound Formation on Baffin Island. At lesser elevations among the outer Byam Martin Mountains, erratics of varied sedimentary rock types occur, including carbonate rocks that are unequivocally of foreign derivation.

Baffin Island

Foreign drift occurs on northern Baffin Island adjacent to Eclipse Sound and Pond Inlet (Fig. 13). The drift can be thick (1 to >2 m) near Cape Macculloch, across the outer Salmon River lowland (Fig. 13), and on Borden Peninsula near Mala River.

Near Salmon River, foreign drift lies across the margin of the Baffin Upland, and extends farthest inland and to greatest elevation across the Salmon River lowlands (Fig. 13). Lobate terminal moraines (Salmon River moraines) associated with a glacier flowing northward out of Utuk Lake are not known to include foreign debris. Foreign drift extends inland of the Salmon River moraines and to greater altitude, however, indicating that foreign ice covered the lowlands prior to their formation. It is characterized as it is on southern Bylot Island, by numerous scattered mounds of stratified sand and gravel. Across the outer Salmon River lowland, flat-topped mounds are strung out along topographic contours at about 120 m a.s.l., suggestive of a discontinuous kame terrace formed at an ablating ice margin. Adjacent to Eclipse Sound, foreign drift extends to about 300 m a.s.l. and its inland limits are marked by an abrupt change in composition from dominantly foreign to native (Fig. 14).

Figure 13. Salmon River moraines (indicated by symbols) outline a large lobe of ice flowing northwards out of Utuk Lake Valley. The moraines, which are composed of crystalline debris, extend into areas of Eclipse drift and formed subsequent to inundation of the lowlands by foreign ice. NAPL T239R-158



Limit of foreign (Eclipse) drift .....

Eclipse Moraine V

Button (?) Moraine ..... ×

Esker ..... E

Proglacial meltwater channel .....

Glacial marine delta ..... △

Stratigraphic section ..... ○

Figure 14. On northern Baffin Island, east of Pond Inlet townsite, foreign drift extends to about 300 to 355 m a.s.l. Large meltwater channels with sills as high as 500 m a.s.l. were active when Eclipse Sound was blocked by foreign ice. Near the coast an esker leads from a meltwater channel to an ice contact glacial marine delta graded to 72 m a.s.l. at Janes Creek. Locations of moraines formed during Button glaciation, and of stratigraphic sections are indicated. NAPL T239R-71

Facies of foreign drift

Muddy drift. Extensive, thick (10 m) deposits of mud to sandy mud diamicton cover northern Bylot Island in the area of Cape Liverpool. Limited evidence from coastal sections near Cape Byam Martin indicates that sediments may include rhythmites and massive buried glacier ice (see Northeast coast section I, Appendix 3). Some melting out of buried ice is indicated by pitted landforms. The unit may have been deposited within an ice marginal lake, based on the presence of the rhythmites. Muddy drift is also interpreted to occur near Cape Macculloch, on the basis of aerial photographic evidence.

Ice marginal drift. Coarse, rounded boulders and boulder gravel form deposits more than 5 m thick at the northern end of Navy Board Inlet (Fig. 15). The sediments appear to have been derived largely from sedimentary bedrock that forms tablelands above 600 m a.s.l. in the area. Landforms, which include numerous short, morainic ridges and hillside meltwater channels, indicate that the sediments were deposited and modified along margins of a foreign glacier flowing northwards in Navy Board Inlet into Lancaster Sound.

Foreign moraines and ice marginal landforms

Bylot Island

Morainic ridges lying at the inland limit of foreign drift comprise a geomorphological unit named Eclipse Moraine that marks the maximum inland extent of the foreign ice sheet on Bylot Island during Eclipse glaciation (Fig. 9). Eclipse Moraine lies along the upper margins of coastal cliffs, wrapping around hills and looping inland to cross valley floors at lower elevation (Fig. 16). The moraine occurs as either a single, less commonly a double, ridge with crests rising 1 to 15 m above adjacent terrain (Fig. 17A, B, C).

Figure 15. View of northwestern Bylot Island shows foreign ice marginal landforms developed across the hillside to about 500 m a.s.l. Coastal sections are composed largely of marine sediments and glacial marine drift. Directions of meltwater flow are indicated by arrows; note person for scale is circled. 203640-M

Although the significance of the double ridge is not known, Eclipse Moraine is interpreted to have formed during only one regional glaciation in the absence of evidence to the contrary. The moraine is composed almost entirely of foreign debris, including most bedrock lithologies represented in the northern Baffin Island region, and includes rare fragments of marine shells, even at elevations higher than 300 m a.s.l. Carbonate sedimentary rock comprises a large proportion of the debris, and Eclipse Moraine stands in clear visual and lithological contrast with underlying crystalline bedrock. Along the northeastern coast, the moraine lies at 500 to 550 m a.s.l. across seaward-facing hills and declines in elevation toward the southeast over a distance of about 50 km, so that near Cape Burney it is <100 m a.s.l. Beside Pond Inlet, near Button Point, the moraine can be traced for about 10 km, declining eastward from about 400 to 375 m a.s.l.

Adjacent to northern Navy Board Inlet, ice marginal landforms lying at elevations below 500 m a.s.l. outline successive margins of a northward-flowing glacier in Navy Board Inlet. The glacier was constrained by coastal cliffs and spread outwards across low-lying terrain at the northwestern end of the island. There is no evidence that the landforms have been overridden by ice moving eastwards in Lancaster Sound, and thus they are either contemporaneous with, or postdate, formation of Eclipse Moraine along the northeastern coast of Bylot Island.

Short segments of foreign moraines also lie at low elevation (≤100 m a.s.l.) in the areas of Wollaston Islands and between Cape Byam Martin and Cape Burney (Fig. 17, 18A, B). The moraines appear distinct from Eclipse Moraine and are probably younger, based on amino acid ratios of detrital shells within them. Near Cape Byam Martin, the moraines lie to 20 to 40 m a.s.l., standing up to 10 m higher than terrain on their landward side and are cored by massive ice and thick (5 m) sequences of muddy rhythmites; isotopic analysis indicates the ice could be glacial in origin (see Northeast coast section I, Appendix 3). On southern Bylot Island, foreign ice marginal landforms at low elevation include: 1) short valleys on the outer lowland (possibly meltwater channels) that lie parallel to the coast, 2) moraines across the mouths of valleys between Narsarsuk Glacier and Button Point (Fig. 14), and 3) benches (protalus ramparts) projecting out of talus aprons at the base of coastal cliffs near Sermilik Glacier (Fig. 19). The benches lie at 70 to 80 m a.s.l. and slope landward. Although composed of angular crystalline boulders, compositionally similar to the talus, the benches could be related to foreign ice in Pond Inlet as foreign moraines at similar elevations (80 m a.s.l.) occur at the base of Mount Herodier (Fig. 14).

Baffin Island

Eclipse Moraine occurs on northeastern Baffin Island beside Pond Inlet, decreasing in elevation eastward over 50 km from about 500 to 600 m a.s.l. at Mount Herodier to 100 m a.s.l. or less at Cape Macculloch (Fig. 9). As on Bylot Island, the moraine is composed predominantly of carbonate sedimentary rock debris, and segments are clearly visible across the outer slopes of coastal mountains and within valleys.

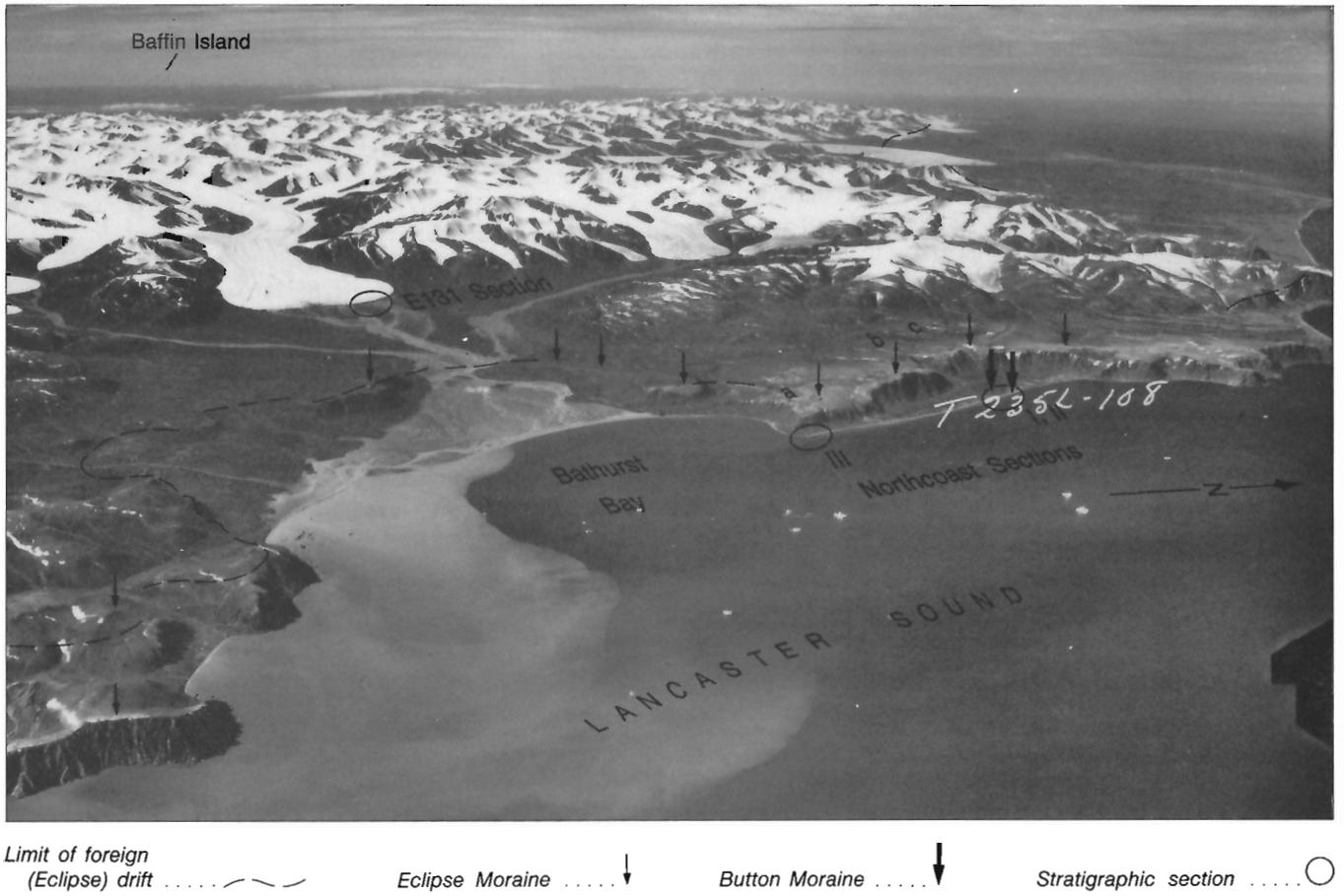


Figure 16. On northeastern Bylot Island, Eclipse moraine lies along the tops of coastal cliffs between 300 and 500 m a.s.l. and loops inland to cross valley floors at elevations of 30 to 250 m a.s.l. Moraines formed during later Button glaciation lie along the coast. Locations of stratigraphic sections (Appendix 3) are indicated by circles. NAPL T235L-108

Figure 17. Eclipse Moraine (black arrows) and moraines associated with Button glaciation (white arrows) are composed dominantly of sedimentary rock fragments and appear light colored in contrast to the crystalline bedrock that they overlie. (A) Eclipse Moraine forms a well defined single ridge (less commonly a double ridge), stands 2 to 20m above adjacent terraine (person circled for scale (B)), and can lie along the upper margin of coastal cliffs (C) 203639-L; 203639-R; 203099-H

An extensive series of moraines and kame terraces occur within the inlets of Baffin Island, including Milne Inlet, Tremblay and Tay sounds, and across the intervening peninsulas that outline the northern margins of ice sheets on Baffin Island (Fig. 9). The landforms are well within the glacial limits defined by Eclipse Moraine and thus are considered to be of post-Eclipse age. Distinct ice marginal features lie at different elevations along inlet walls, and several glacial events could be represented. In Milne Inlet, for example, a kame terrace at about 135 m a.s.l. slopes northward over a distance of several kilometres toward a glaciomarine delta at Cape Hatt, which grades to about 80 m a.s.l. On the hillside directly above, at about 150 m a.s.l., lies a second kame terrace that appears better vegetated. Differences in topographic setting and in vegetation cover, which was observed only from aircraft, indicate that the terraces may have formed during more than one foreign glacial event.

Native drift

Native drift includes sediments transported and deposited by local ice caps and mountain glaciers. It occurs typically as coarse sand and angular crystalline boulders in a thin (<1 m) discontinuous surface cover and is thickest (5 to 30 m) in areas of hummocky or ice marginal deposits. Hummocky drift occurs on the southern lowlands only within two broad valleys occupied by glaciers C93 and B7 (Camp) (Fig. 5). The hummocks are thought to be related to stagnation and in situ melting of local valley glaciers. On the southern lowlands, native drift is widespread as a veneer of crystalline erratics overlying disaggregated Cretaceous-Tertiary sedimentary bedrock. The boulders, particularly gneisses, are characterized by solution pits and loose mineral grains that suggest weathering during prolonged exposure. In contrast, crystalline rocks of Neoglacial and modern deposits are angular and unweathered. Crystalline erratics also occur at high

Figure 17. Continued.

elevation on many peaks among the outer Byam Martin Mountains and are considered to demonstrate a major expansion of native glaciers. Peaks of the central chain that were examined had no erratics, although none of the sites visited were stable and erratics could have been lost by mass movement downslope.

Ice marginal drift is composed of boulders and sandy boulder gravel and is characterized by numerous short morainic ridges, deposits of ice contact stratified drift, and ice marginal meltwater channels that outline the margins of native ice tongues (Fig. 5). The abundance of stratified drift indicates that meltwater was important in creating these deposits and landforms.

Native moraines and ice marginal landforms

Bylot Island

On northeastern Bylot Island, meltwater channels are incised in crystalline bedrock in front of glaciers E21, E35, E67, and E131 (Fig. 6). The channels formed at the margins of glaciers that fully occupied the valleys and extended beyond the modern coast. They form a series across valley sides, extending to about 300 m a.s.l., well above valley floors that are <80 m a.s.l. They are preferentially developed on northern slopes. Near the coast, some of the channels are occupied by Eclipse Moraine, indicating that the native glaciation occurred prior to Eclipse glaciation. There are no clearly defined native moraines on the valley floors to suggest a second, later native glaciation.

Elsewhere on Bylot Island, native moraines and ice marginal landforms outline the margins of native glaciers that extended 1 to 15 km beyond their Neoglacial limits subsequent to Eclipse glaciation. None of the landforms bear evidence of glaciation by foreign ice, although some extend to the coast and lie well within areas covered by foreign ice during Eclipse glaciation. In front of glaciers C55, C64, C78, C93, B7 (Camp), and B17 (Aktineq), such landforms commonly include ridges of stratified drift and meltwater channels. The absence of end moraines could indicate that the glaciers terminated with a marine environment during a period of higher relative sea level. In front of glaciers B17, D91, and C110, the native landforms contain a significant component of foreign clasts, in contrast to Neoglacial moraines of those glaciers which contain virtually none. The composition of debris in front of other native glaciers, including C28, C5, D181, is unknown.

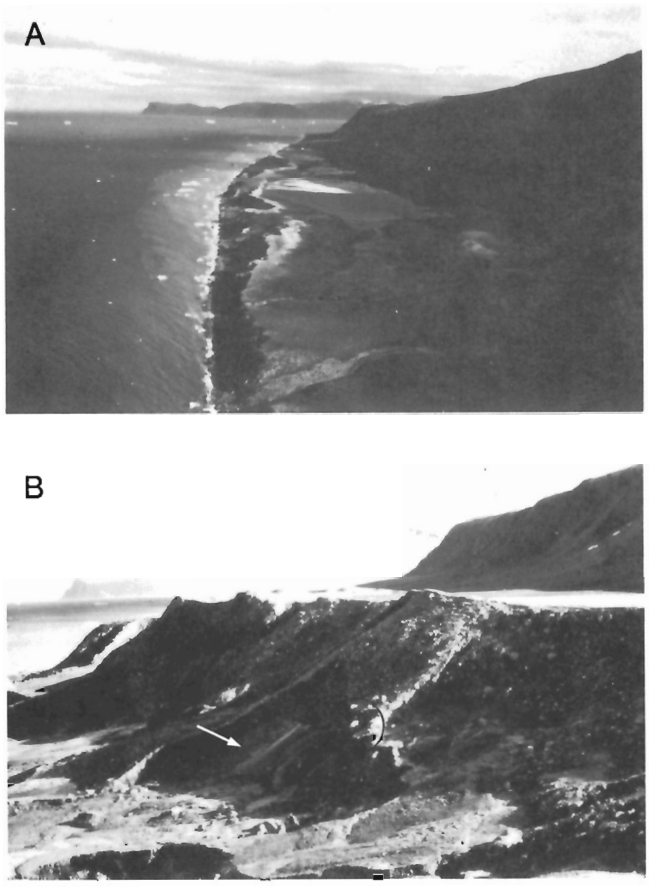


Figure 18. On the northeastern coast, moraines formed during Button glaciation lie along the coast, directly below Eclipse Moraine (A). The moraines include shell fragments having amino acid ratios of about 0.12 (AAL-1472) and overlie relict glacier ice (B) (indicated by arrow; scale indicated by person circled). 203638-J, 203639-B

Baffin Island

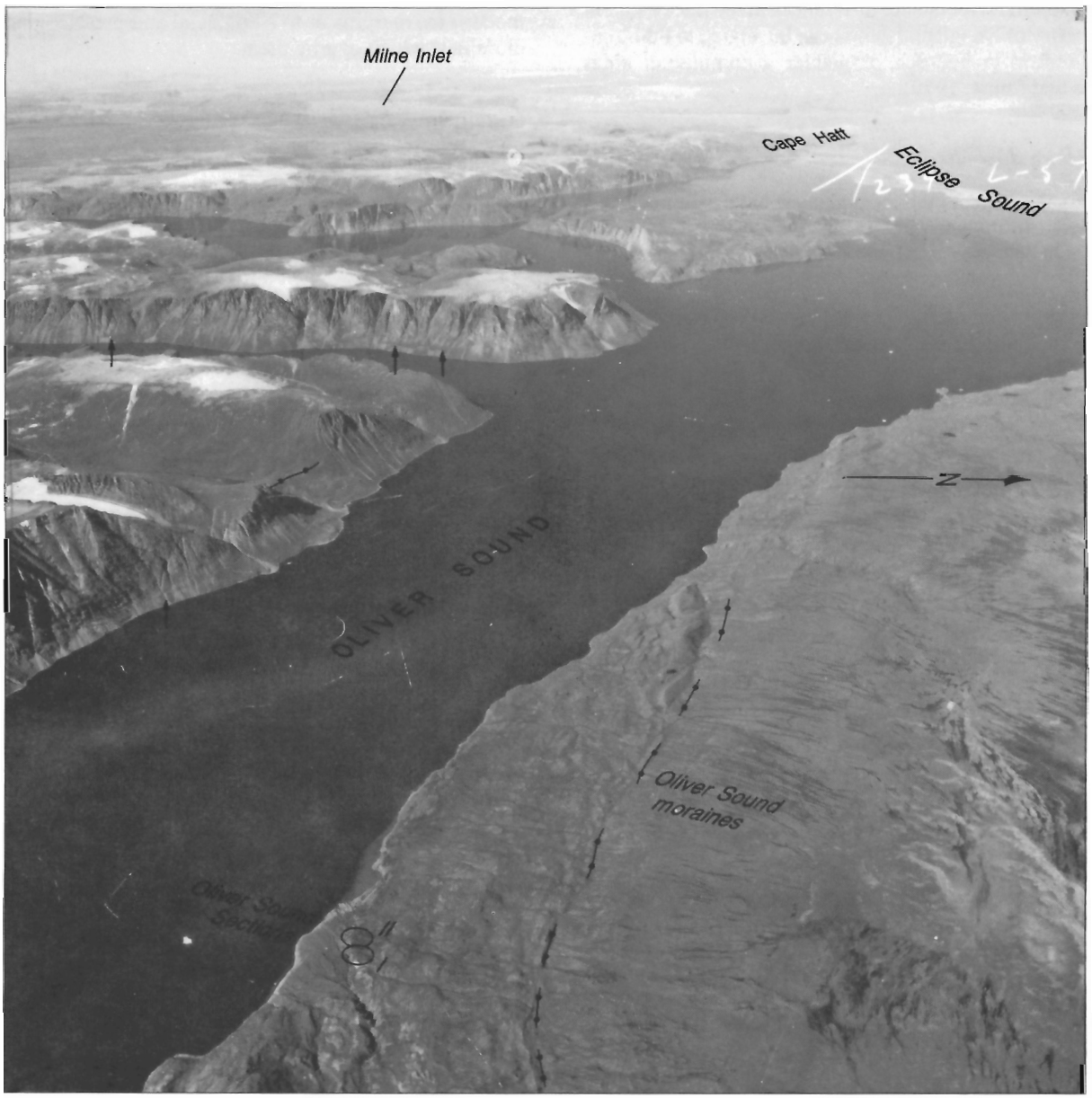
On northeastern Baffin Island, ice marginal landforms outline former margins of large glaciers in Oliver Sound, Salmon River lowlands, and Erik Harbour that appear to have been fed by local ice caps. The Oliver Sound moraines decline northward from about 400 m a.s.l. to sea level over a distance of 20 km (Fig. 20). Neither the Salmon River moraines near the outlet of Utuk Lake nor the Oliver Sound moraines are known to contain erratics of sedimentary rock, although they extend into areas of foreign drift.

Figure 19. East of Sermilik Glacier, morainic benches at 70 to 80 m a.s.l. lie along the coast and are interpreted to have formed during Button glaciation; the locations of related landforms are shown in Figure 14. 203638-C

Neoglacial and modern glacial deposits

The maximum extent of ice during Neoglacial advance of native glaciers is outlined by lateral and terminal moraines that lie within 1000 m, most commonly within 100 m, of large glaciers on Bylot Island (Fig. 11A, 21A, B). Most Neoglacial moraines are composed of angular and unweathered crystalline boulders. They are unvegetated, in contrast to older native and foreign deposits that they overlie, and some are ice-cored. Where Neoglacial moraines overlie foreign drift, native deposits are coarser grained because of their content of crystalline debris, and contain rare foreign debris. In front of some glaciers, neither Neoglacial nor modern deposits are present, and the glaciers terminate directly on older (pre-Neoglacial) sediments, indicating that they are now at Neoglacial maximum positions (Fig. 22A, B).

On northeastern Baffin Island, the Neoglacial advance may have extended to the limits of an earlier advance. There, Neoglacial moraines lie in contact with outer moraines that are relatively more vegetated and, possibly, older. No comparable deposits were found on Bylot Island.



Moraine ..... Morainic landform ..... Stratigraphic section .....

Figure 20. Oliver Sound moraines and ice marginal landforms decline northwards from 400 to 80 m a.s.l. over 20 km. The moraines are composed of crystalline rock and overlie a foreign drift unit that could predate Salmon River interglaciation. Younger morainic benches (protalus ramparts)in nearby fiords at about 100 m are indicated. NAPL T239L-57

Glaciotectonic thrust plates form part of the terminal moraines of at least four glaciers on Bylot Island (Klassen, 1982a; Fig. 23A, B). Individual thrust plates are between 5 and 10 m thick, and some multiple thrust plates are stacked more than 20 m thick above valley floors. The plates are composed of sorted outwash sediments that have been transported as intact frozen blocks and stacked in front of glacier ice during Neoglacial advance. Although some plates have been overridden by ice, others were formed in front of the glacier at its Neoglacial maximum and have never been overridden.

On southern Bylot Island, differences in the trace element geochemistry of Neoglacial debris can be related to lithological differences in bedrock of glacier accumulation areas (DiLabio and Shilts, 1979).

Glacial lake deposits

Regional ice sheets and local glaciers have dammed lakes at locations throughout the region during different glacial events. Glacial lake deposits are generally coarse sands, gravels, and boulder gravels forming continuous to discontinuous benches and mounds near former lake margins. The deposits are interpreted to have been formed by slumping of debris from valley sides and by inwash from ice margins. A few deltaic deposits, formed where rivers entered the lakes, have been identified on northern Baffin Island where ice flowing northward within the inlets diverted drainage inland, onto the intervening peninsulas. Stratified muds and sandy muds that form thick, blanket deposits on valley floors are known only in some valleys on northeastern Baffin Island, particularly near Guys Bight. There, lake sediments occur to elevations of about 300 m a.s.l. and extend inland either to modern ice margins or to Neoglacial and pre-Neoglacial (?) moraines, which overlie them.

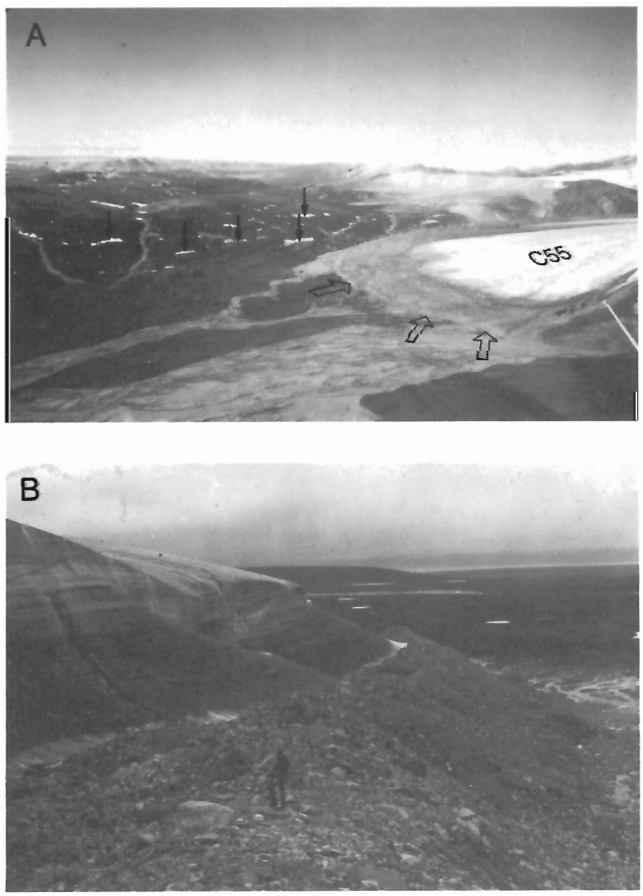


Figure 21. Neoglacial moraines (open arrows) occur in front of most large glaciers on Bylot Island, well within the limits of an earlier native advance outlined by snow-filled ice marginal landforms (solid arrows) (A). Neoglacial moraines are commonly ice cored and are dominantly composed of crystalline debris from the Byam Martin Mountains, even where they overlie the younger sedimentary bedrock of the outer lowlands (B). 203803-A, 203803-F

Glaciofluvial deposits

Glaciofluvial deposits include sediments and landforms deposited from glacier-fed streams either in contact with, or in front of, glacier ice during a period of glaciation. Fluvial sediments that now are subject to periodic reworking and flooding by modern meltwater streams are mapped as alluvial deposits. Glaciofluvial deposits are composed of well to poorly sorted, coarse sand, gravel, and boulder gravel; they can be kettled, particularly near the heads of inlets on northern

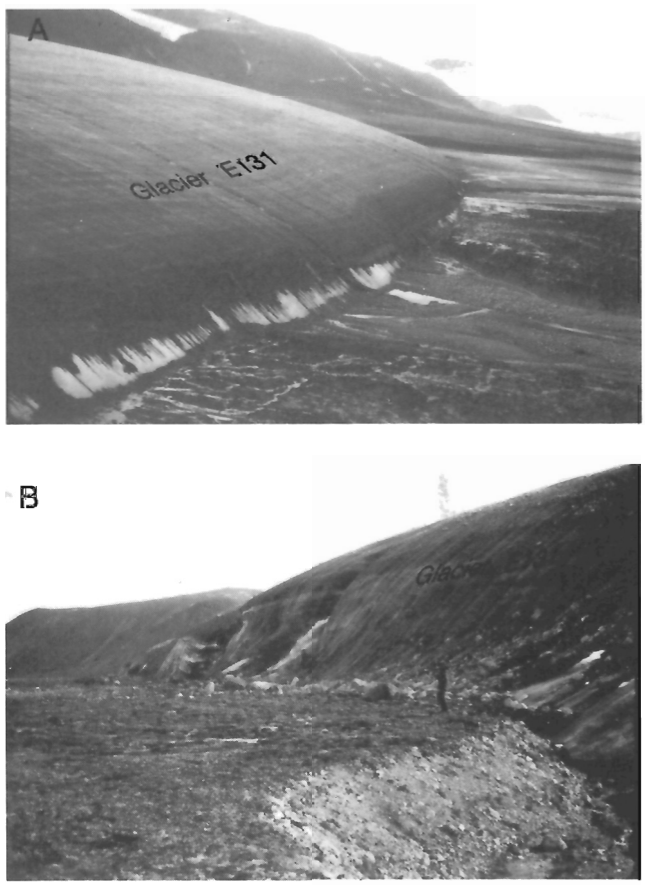


Figure 22. Some glaciers front directly on older, vegetated deposits and lack a Neoglacial terminal moraine (A). Glacier E131 section is developed within outwash exposed in foreground (B). 203640-K, 203639-S

Baffin Island. Outwash is the most common type of glaciofluvial deposit. It is extensive and more than 10 m thick across the floors of most large valleys, and is characterized by braided outwash plains and by terraces that can be graded to several distinct base levels. On Bylot Island, outwash has been graded to sea levels higher than present and overlies sequences of marine sediments at least 5 m thick at elevations less than 70 m a.s.l.

Facies of glaciofluvial deposits

Ice contact stratified drift. Sediments deposited on or against glacier ice typically form isolated mounds (kames) and short ridges (eskers) 10 to 30 m thick; most are associated with foreign ice. Ice contact deposits are limited in areal extent and those that are too small to map at the scale used are indicated by symbols. On southern Bylot Island, several large kames are mapped 10 km inland at 450 m a.s.l., near the estimated limits of Eclipse ice.

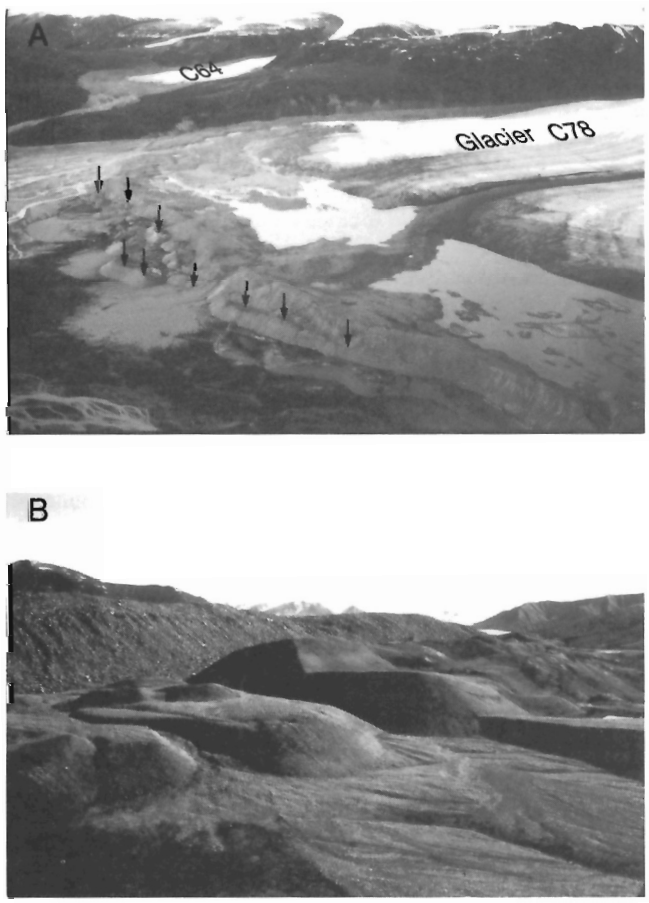


Figure 23. Glaciotectonic thrust plates (arrows in A) composed of outwash have been thrust upwards and stacked in front of advancing glaciers; they form a significant component of some Neoglacial terminal moraines on Bylot Island (B). The plates retain primary bedding structures and appear to have been transported and stacked as intact, frozen slices. 203639-J

The only known esker occurs on Baffin Island, about 1 km east of Pond Inlet townsite, and connects with an ice contact glacial marine delta that is graded to about 72 m a.s.l. and lies across the mouth of Janes Creek (see Janes Creek section II, Appendix 3) Fig. 14. The esker was deposited from meltwater streams originating within glacier ice covering the Salmon River lowlands. The flow of water through a meltwater channel incised in bedrock and parallel with the modern coast requires normal drainage patterns to be blocked by foreign ice in Eclipse Sound.

Stratified drift. Deposits occur generally as low, seaward-sloping pads and terraces that are typically thin (to 5 m) and discontinuous. They occur predominantly along upper margins of valleys within the lowlands of Bylot and Baffin islands. Of uncertain origin, the deposits may have originated on or against stagnant, ablating glacier ice, possibly as inwash within glacial lakes that formed against ice in Eclipse and Lancaster sounds. Stratified drift is mapped from marine limit to 165 m a.s.l., in the area of Maud Bight on northern Bylot Island, and to about 120 m a.s.l. on both the southern lowland and the Salmon River lowland of Baffin Island.

Marine deposits and landforms

Sediments deposited or modified in a marine environment occur throughout the area beside the modern coast. Marine sediments vary from coarse to fine, including mud, sand, and gravel. They are usually well sorted, thicker than 2 m, and extensive. Marine shells and shell fragments are common within them. The maximum elevations to which marine deposits occur depend on their age and on their location in relation to former ice sheet margins. Surficial marine sediments formed during at least three distinct periods of submergence, based on radiocarbon dates and amino acid ratios of in situ marine fauna and on geomorphological differences among landforms that suggest different age of formation. The older deposits of raised marine sediment occur only within stratigraphic section.

Coastal benches or platforms cut into crystalline and sedimentary bedrock are thought to have been formed by marine erosion during prolonged periods of sea level stability. They occur at 5 m a.s.l. beside northern Navy Board Inlet, at 15 m a.s.l. east of Canada Point, at 10 m a.s.l. and between 30 and 40 m a.s.l. at Maud Bight. Hodgson and Hasleton (1974) estimated a bench elevation of 20 m a.s.l. at Button Point, and Mathiassen (1933) estimated two distinct bench levels at 10 and 20 m a.s.l. near Janes Creek. Variation in elevation of the benches may relate to differential tectonic or glacioisostatic uplift, or both, if it is assumed that they all relate to one paleo-sea level and period of erosion. Similar features, described near 6 ma.s.l. on the central eastern coast of Baffin Island by Andrews (1978), have been interpreted to be associated with the last interglacial period.

Facies of marine sediment

Littoral (nearshore) deposits. This unit includes sediments composed of sand and gravel that were deposited in a nearshore, shallow-water environment characterized by beaches, bars, and spits. On southern Bylot Island, littoral marine sediments extend to about 90 m a.s.l. There, well defined flights of raised beaches in nearly unbroken succession are common between the coast and elevations of about 40 m a.s.l.. From 40 m a.s.l. to about 90 m a.s.l. marine landforms are subdued and are poorly defined, in comparison with those at lower elevation. The deposits at higher elevations are interpreted to relate to at least one older period of higher relative sea level. On northern Bylot Island, littoral marine sediments extend only to about 30 to 35 m a.s.l.

On northern Baffin Island, well defined marine landforms extend to about 50 m a.s.l., near Pond Inlet townsite, and increase in general elevation to between 80 and 100 m a.s.l. at the southern end of Milne Inlet.

Deltaic deposits. This unit includes mud, sand, gravel, and boulder gravel, was deposited in the form of classical deltas and delta fans where streams entered the sea. Sediments are composed of sequences more than 10 m thick that coarsen upwards and form single sets of large-scale, tabular cross-beds. Commonly, two distinct deltas occur together that grade to different sea levels; the lower, less extensive delta is inset into the higher delta along a modern stream that has downcut both. The delta sets are interpreted to be of different ages.

Deltas characterized by collapse structures related to melting out of buried ice and those that head against valley walls, without a modern fluvial source, are considered to have formed at glacier margins. Large ice contact deltas occur on the Mala River lowlands, on Borden Peninsula; along Milne Inlet (Fig. 24); and at Janes Creek, 3 km east of Pond Inlet townsite (Fig. 14). The deltas are graded to elevations of about 80 and 72 m a.s.l., respectively. Radiocarbon dating of shells indicates that the Cape Hatt delta is of early Holocene age at 9530 ± 180 BP (GSC-3318), although the delta at Janes Creek could be much older, based on amino acid ratios.

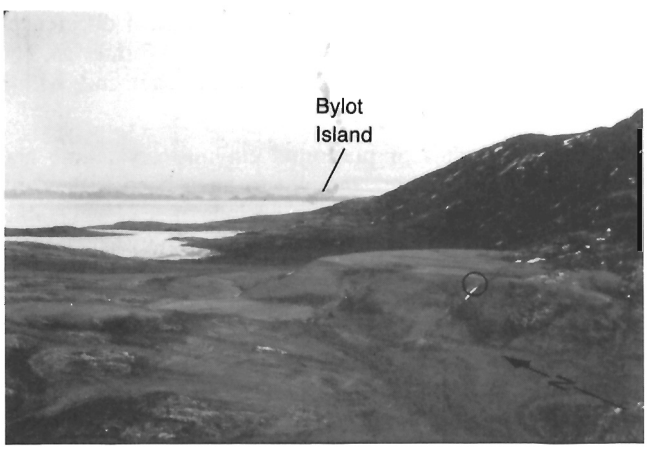


Figure 24. A glacial marine delta at Cape Hatt, northern Baffin Island, is graded to 80 m a.s.l. and containes in situ shells at its ice-proximal margin (circled) that have a radiocarbon age of 9530 ± 180 BP (GSC-3318). The delta marks the approximate limit of glacier ice during Cape Hatt glaciation. 203803-B

Alluvial deposits

Alluvial sediments deposited or modified by modern streams are subject to periodic flooding. The sediments are generally coarse, composed of sand and gravel. They are derived by fluvial erosion of older sediments that occupy valley floors, including outwash, glacial drift, and marine sediment, and modern glacial debris. Alluvial deposits are most extensive in two large valleys 20 km east of Canada Point, and in large valleys to the northeast, where modern streams have downcut older alluvial and glaciofluvial deposits on valley floors. Streams crossing the northeastern coast of Bylot Island now appear to be aggrading, and their lower reaches appear to be drowned and display prominant barrier bars and flooded estuaries.

Nonglacial deposits of minor areal extent

Colluvium. Colluvium (talus) is characteristically coarse gravel and boulders and includes aprons and coalescent fans formed at the base of steep slopes by mass wasting. Although common, it is not always extensive enough to form a mappable unit.

Eolian deposits. These sediments include well sorted coarse to fine sand transported and deposited by wind, and interbedded with organic material and thin sheets of outwash. It occurs as a blanket cover across the floors of two large valleys 20 km east of Canada Point and (unmapped) as dunes of minor areal extent along the southern coast of Bylot Island.

Organic accumulations. An organic mat more than 20 cm thick forms a continuous cover in poorly drained areas of southern Bylot Island. Organic accumulations do not occupy areas large enough to map elsewhere. The depressions may be related to melted ground ice in areas of relatively fine grained foreign drift. These areas, which are characterized by numerous shallow lakes, are a principal nesting habitat for snow geese.

Icings (aufeis). A layered accumulation of ice at least 3 m thick overlies outwash in a tributary valley at the western margin of Sermilik Glacier snout (Fig. 10). The ice has formed as a result of periodic flooding by the stream and persists with little apparent melting throughout the summer. Comparison of aerial photographs taken in 1961 with conditions during 1982 indicates the extent of this icing to have decreased in recent time.

Modern depositional environments

Glacial

Aspects of modern glaciers and glacial sedimentation presented here are based on direct observation, on the isotopic and crystallographic properties of glacier ice described by Lorrain et al. (1981), and on lithological and geochemical characteristics of glacial debris described by DiLabio and Shilts (1978, 1979). The following descriptions are based mainly on examination of 'Camp' (B7), Aktineq (B17), and Sermilik (B37) glaciers (Fig. 10) and illustrate the great potential of Bylot glaciers for glacial sedimentation studies. The work was facilitated by the near-vertical margins of the modern glaciers on Bylot Island, which are up to 30 m in height, that allowed examination of internal structure and stratigraphy. Features at glacier margins, however, may not represent conditions within the main body of the glacier. Many features observed in glaciers of Bylot Island are similar to those described by Shaw (1977) in glaciers of Antarctica.

The bulk of glacier ice is nearly free of debris and foliated on a large scale because of internal deformation (Fig. 25A, B, C, D). Most debris appears to be transported near the base of the glacier within a relatively thin (<5 m thick) zone consisting of lower nonstratified dirty ice and overlying banded ice (Fig. 25B, C). Nonstratified ice is 1 or 2 m thick and contains highly variable amounts of rock flour and clasts, presenting a characteristically debris-rich appearance. At its base, blocks of preexisting sediments can be incorporated within the glacier as frozen, intact rafts. At one location, waterlain sediments frozen within the glacier were seen to have internal bedding structures and in situ vegetation cover preserved despite glacial transport. (Fig. 25C).

Banded ice, which overlies the basal debris-rich zone, is characterized by beds having varied crystallographic and isotopic properties (Lorrain et al., 1981), and interbedded debris (Fig. 26A, B, C). In Aktineq Glacier, three types of ice banding are present. In order of decreasing relative abundance they include: 1) coarse grained, bubble-free ice , about 2 to 50 cm thick characterized by silty inclusions; 2) bubble-free, monocrystalline ice, 0.1 to 0.3 cm thick, interbedded with sandy layers of equivalent thickness; and 3) bubbly ice (Lorrain et al., 1981, p. 141). Isotopic analysis ($^{18}O/^{16}O$; $^{3}H/^{2}H$) indicates that the layers consist of ice originating from highland precipitation, represented by the coarse bubble-free ice, and of ice formed by refreezing of meltwater at the base of the glacier, represented by the bubble-free monocrystalline ice and by the bubbly ice. The presence of meltwater-derived ice at the base of Aktineq Glacier indicates that it is not "cold-based," or frozen, throughout.

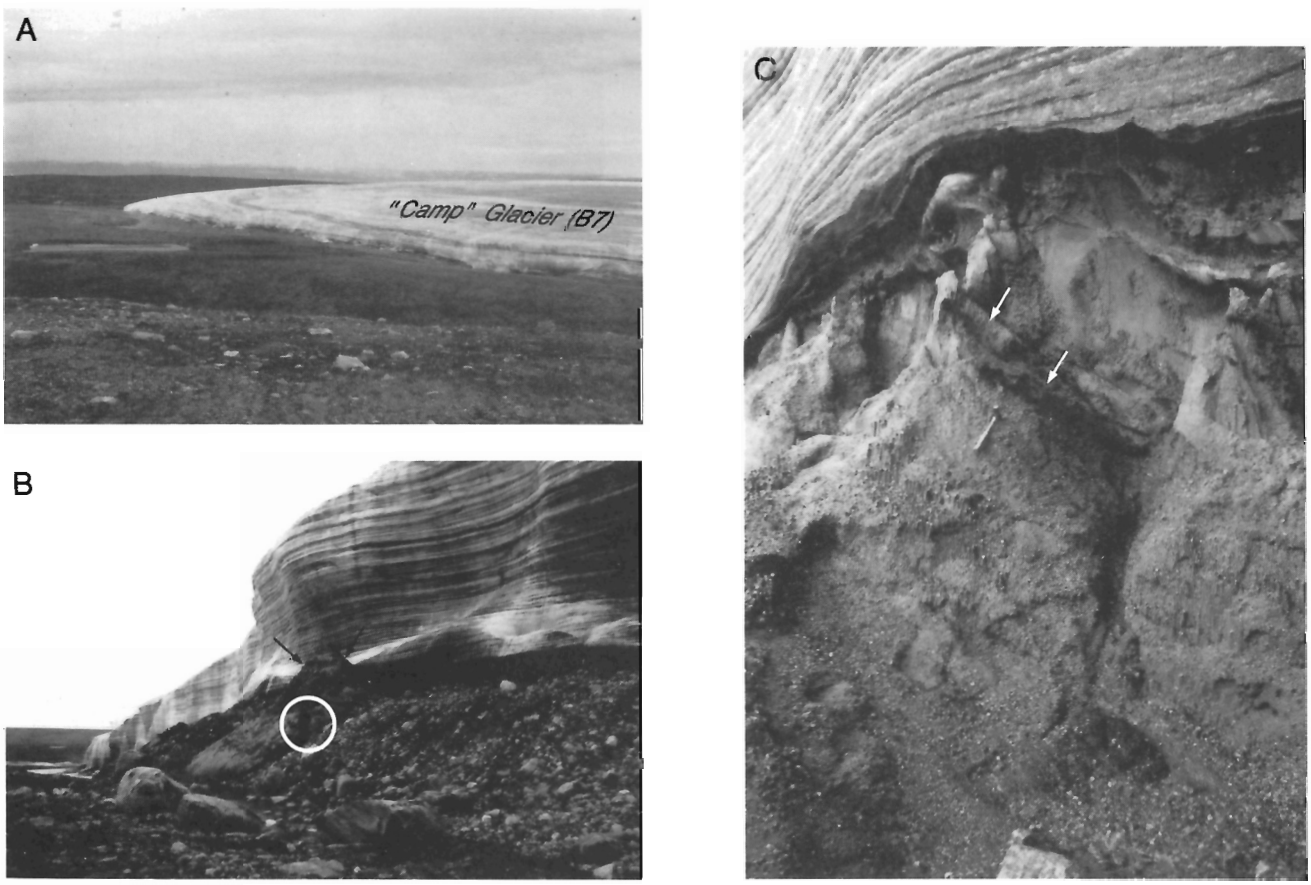


Figure 25. Modern glaciers present a stratified appearance caused by internal deformation and commonly have near-vertical margins 30 m in height (A). Debris is carried near the base of the ice and can include large, intact blocks of frozen waterlain sediments (adjacent to person (circled)) (B), which can retain tundra vegetation (arrows) (C). 20381-F, 204126, 203639

Debris interbedded with, and dispersed within, the layers of the banded ice zone generally appears to be finer than sand size, although large clasts are found. Some debris bands can be compositionally distinct from adjacent bands, and the compositional distinction can be preserved for significant distances along the glacier margin. For example, DiLabio and Shilts (1979) have described distinctive chlorite-rich bands in a marginal section of glacier B7 (Camp Glacier). The mineralogy and monolithic nature of the debris indicates that a large block (or blocks) of gneiss was crushed and sheared into place with little or no dilution by debris in adjacent bands (DiLabio and Shilts, 1979). Bedrock source areas of the chlorite-rich debris lie at least 5 km up-ice. Within glaciers on southwestern Bylot Island, most englacial debris appears to have been derived from crystalline rock of the highlands, even near the fronts of glaciers more than 10 km distant from the nearest crystalline bedrock. Geochemical characteristics of moraines reflect bedrock composition of glacial drainage basins in the highlands.

Differential flow and structural deformation of the basal debris-rich zone and of overlying glacier ice are marked by augen structures, which are cored by relatively coarse debris, and by both large- and small-scale recumbent folds outlined by ice foliation (Fig. 27A, B). Near glacier fronts, shear planes curve upwards towards the ice surface with debris bands drag-folded against them (Fig. 28). Folding and shear mechanisms within the glaciers can increase the thickness of debris-laden ice at the glacier margin, a conclusion also arrived at by Lorrain et al. (1981) from studies of Aktineq Glacier.

Englacial debris derives from the basal zones and from blocks of frozen sediment overridden by the glacier. It can be brought up along shear planes and accumulate on the stagnant glacier surface in terminal zones (Fig. 29). Combined with debris in transport on the glacier surface, which comes from valley walls up-ice, the surficial accumulations insulate and reduce the rate at which the ice melts. Large blocks and cones of debris-covered ice stranded on, and in front of, ablating glacier margins are common as a result. The stagnant, debris-covered ice blocks form hummocky ice-cored terrain, with minor kettle lakes scattered among them. Raised mounds of debris, appearing on the surface of the glacier as the surface lowers by ablation, consist of a thin sediment cover over a core of glacier ice. As underlying ice melts, water-saturated debris accumulates in unstable masses, and flows of local debris contribute significantly to sediment loads of meltwater streams.

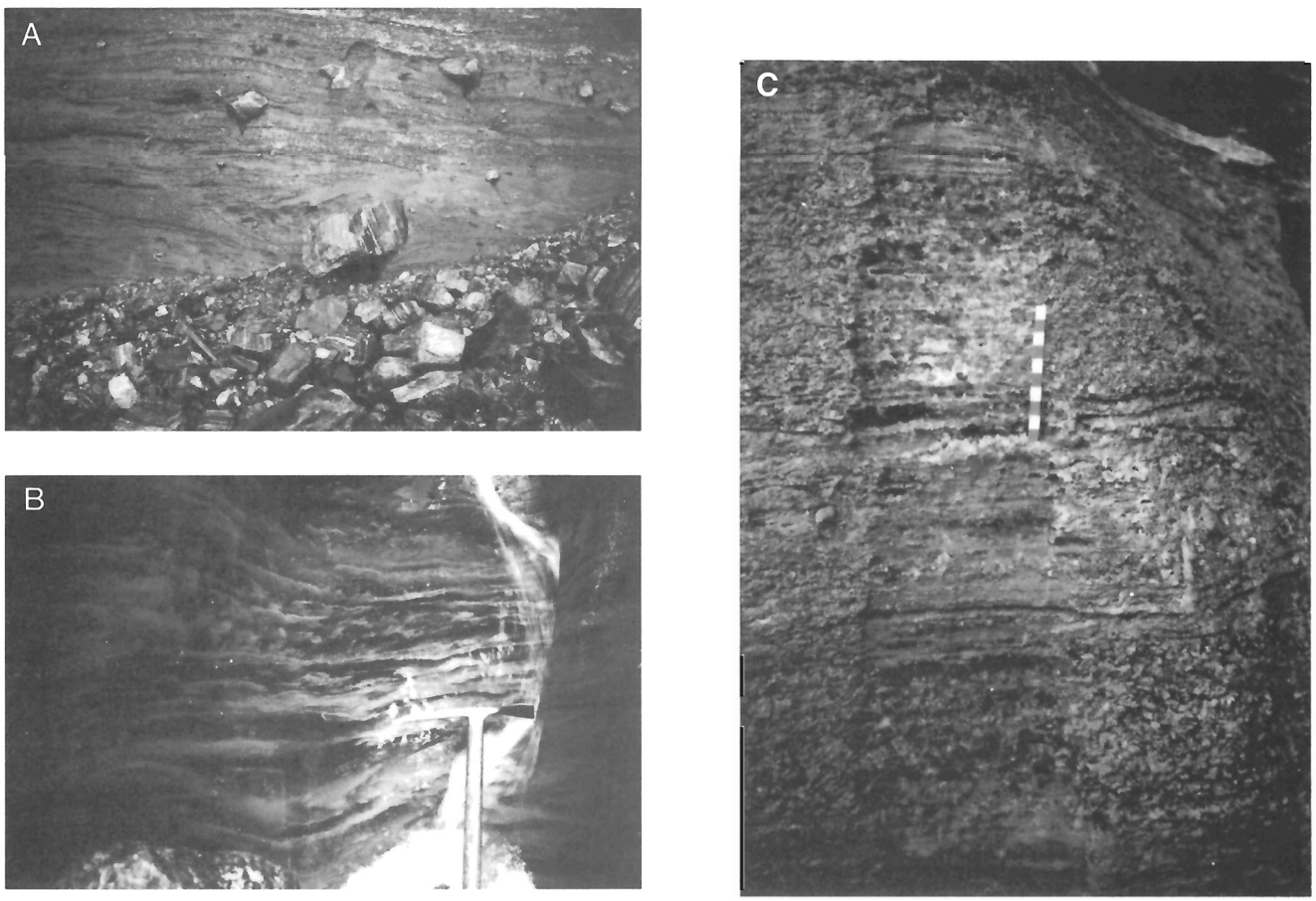


Figure 26. Above the lowermost zone of nonstratified basal debris, glaciers are stratified by variation in ice crystal structure and debris content (A, B, C). Isotopic evidence indicates that ice in the basal zone is derived from both glacier ice and meltwater. 203639-U, 203639-Z, 203640-R

Glacial lacustrine

Small lakes dammed by ice and by lateral moraines are common beside glaciers within tributary valleys and within the limits of Neoglacial moraines. Glacier margins show evidence of drawdown toward some of the lakes, in the form of steep, concave margins and crevasses. During summer months, lake waters serve as sediment traps within glaciofluvial systems along the ice margin and appear, from their muddy colour, to contain large quantities of suspended sediment derived from meltwater. Many lakes within tributary valleys have raised benches near their margins that mark higher lake levels, attained when glaciers achieved Neoglacial maximum positions. Near Aktineq Glacier, for example, the ice-dam has shifted recently, which allowed the levels of a large lake held against its northwestern margin to drop at least 5 m from those recorded on aerial photographs taken during the 1960s.

The modern glacial lakes lie generally within V-shaped tributary valleys that appear to have been graded to lower base levels by stream action, and the lakes indicate that glaciers on Bylot Island have been less extensive at some time in the past than at present. When fluvial erosion of the tributary valleys occurred is not known, although such erosion would appear to represent a prolonged period.

Glaciofluvial and fluvial

All major streams on Bylot Island are fed largely by meltwater and flow rates vary greatly both during the course of the season and diurnally. The meltwater streams can carry large sediment loads and can move large boulders in their bedloads. During the summer melt, flood waters occupy broad systems of braided channels where they downcut and rework older and more extensive outwash and marine deposits. Sandurs in the region of eastern Baffin Island were fully described by Church (1972).

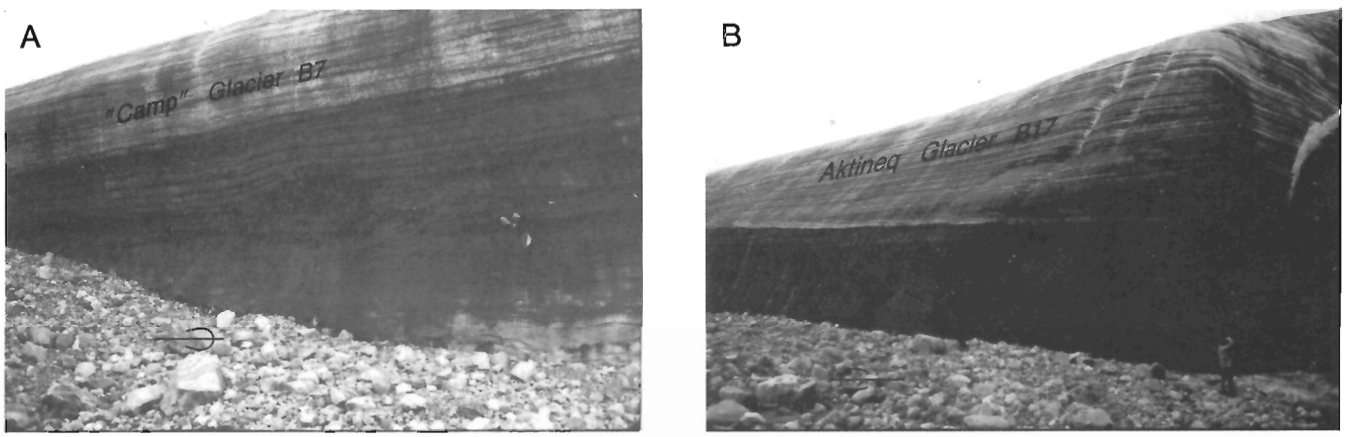


Figure 27. Evidence of differential glacial flow, marked by augen structures (A), and of recumbent folding (B, marked by arrows) occurs at glacier margins. 203639-N, 203640-S

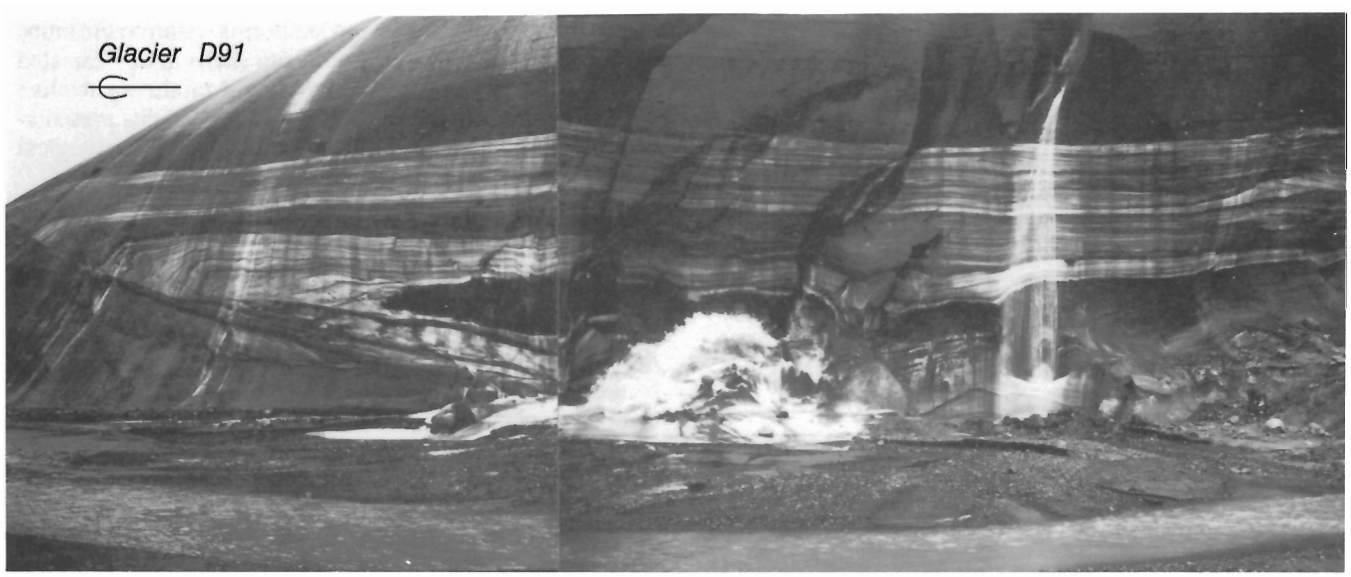


Figure 28. At glacier margins movement of ice along shear planes can be accompanied by drag folding . Ice flow direction right to left (Glacier D91). 203639-X

Figure 29. In front of ablating glaciers, ice is covered by supraglacial debris, derived from valley margins within the mountains, and by debris that may have been brought upward along shear planes near the glacier margins. As the blocks of debris-covered ice melt slowly, the debris is released either directly or by mass movement into meltwater streams (Aktineq Glacier). 203810-G

Figure 30. Estuaries on northeastern Bylot Island present a drowned appearance, suggesting ongoing submergance of that coast. 204126-B

Marine

The present coast of Bylot Island is composed of long gravel or sand beaches, bedrock cliffs without beach development, pocket beaches, and glacier ice, in decreasing order of extent (Sempels, 1982). Backshores of the long gravel beaches vary from gently sloping to wave-eroded cliffs developed in unconsolidated Quaternary sediments and in Cretaceous-Tertiary bedrock. The beach materials reflect partly the sediments forming backbeach cliffs. Large pieces of driftwood are common, particularly on southern Bylot Island where it is thought to include debris from travellers and from Pond Inlet townsite. Driftwood has not been found in raised marine sediments.

Obvious movement of beach materials occurs only after channels around the island clear of sea ice. Breakup occurs first along the northeastern and eastern coasts, and last along the southern coast in Eclipse Sound. Even after breakup, parts of some coastlines retain a frozen ice foot near low-tide levels which acts to stabilize beach sediments. Throughout the summer, depending on wind direction, pans of sea ice and bergy bits can crowd on shore, where they push up mounds of beach material. Large icebergs 70 m a.s.l. commonly ground within Eclipse Sound. The icebergs are thought to originate mostly from the Greenland Ice Sheet and to be transported by the Baffin Current into Lancaster Sound and, eventually, into Navy Board and Pond inlets. Near the base of coastal cliffs, large boulders carried on top of sea ice are commonly observed.

Large plumes of suspended sediment are carried into the sea in meltwater overflows from the mouths of rivers and large streams. The surface nature of these freshwater plumes can be seen in the lee of icebergs, where sediment-free water is evident as the muddy water is diverted around the bergs. Sediment in the plumes appears to represent an important contribution to modern nearshore and offshore sedimentation around Bylot Island, although no studies have been done.

Barrier beaches, backshore lagoons, and the drowned appearance of river mouths along the northeastern coast of Bylot Island indicate that the coast there is currently submerging, as is much of the coast of eastern Baffin Island (Fig. 30). Land adjacent to Eclipse Sound may also be submerging, based on wave-erosion of archeological sites (G. Marie-Roussillaire, personal communication, 1978).

QUATERNARY HISTORY

A summary of the foreign and native glaciations referred to in this report, including an estimate of their relative age and the comparative extent of ice during each, is given by Figure 31. The term "glaciation" refers here to distinct, separate advances of glacier ice, in the sense of an event, and may equate to stadials of Foxe Glaciation (Andrews and Miller, 1984). Interpretation of glacial history is based principally on evidence of the last major foreign glaciation of Bylot Island, Eclipse glaciation (Klassen, 1985), which is clearly represented by surficial deposits and landforms. Amino acid ratios of detrital shells in drift and of in situ shells in nonglaciated marine deposits indicate maximum and minimum relative ages of Eclipse glaciation. As background to this presentation of Quaternary history, the varied lines of geological evidence used, and their limitations, are described briefly.

Surficial deposits

Throughout most of the study area, Quaternary sediments are thin and discontinuous, and regional ice appears to have been nonerosive, suggesting that it was cold-based. Stratigraphic sections are almost entirely restricted to coastal areas and are composed commonly of marine sediments and of massive mud and sandy mud that contains large clasts as well as marine shells and shell fragments. The clasts include a significant component of foreign debris, and poorly sorted muddy sediments are thereby interpreted as glacial marine drift associated with regional glacial events. The term "drift", used in the same sense as Boulton and Deynoux (1981; p. 398), describes sediments deposited by glaciers in terrestrial or marine environments. Foreign erratics are relatively uncommon in modern beaches

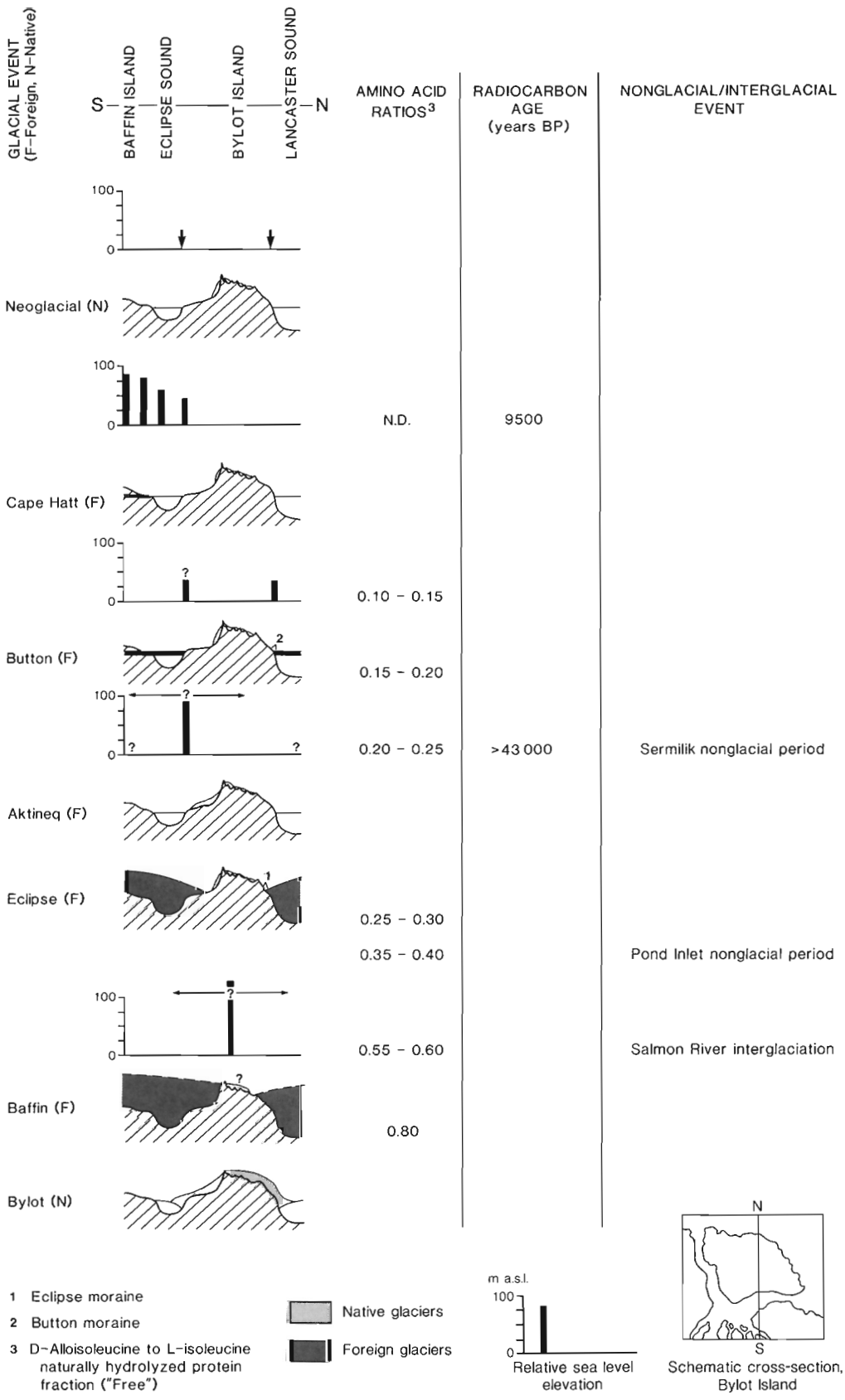


Figure 31. Stratigraphic diagram summerizing the extent and relative age of foreign and native glaciations, nonglacial periods, and patterns of marine submergence.

developed by wave erosion at the base of drift sections, and it is considered unlikely that rafting of foreign debris by sea ice, without regional glaciation, could account for the abundance of foreign debris within muddy sediments of the coastal sections.

Division of stratigraphic sections, and separation of drift units within them, is based on the occurrence of organic detritus and on zones of weathering (soils), which are considered likely to separate deposits associated with different glacial events. Units identified in coastal sections can be difficult to trace laterally because of both marked changes in facies and local slump. The principal basis for correlation of units among sections rests on amino acid evidence and the assumption that only one period of significant interglacial weathering is represented. Although future detailed study of sections and sedimentary structures may identify evidence of additional glacial and nonglacial events, the criteria identified here are considered to provide a reliable basis for stratigraphic subdivision.

Amino acid ratios

Ratios of the amino acids D-alloisoleucine to L-isoleucine in marine shells have been used to estimate the relative ages of glacial and marine deposits and to interpret and correlate stratigraphic units. Although the amino acid ratios can reflect the relative age of an organism, they can also reflect the thermal and diagenetic history of the shells from which they were obtained and must be interpreted with caution. Only "free" ratios, which are based on analysis of the naturally hydrolyzed amino acid fraction, are discussed. "Total" ratios, which are based on analysis of both the free and peptide-bound amino acid fraction, are not used in this report. In his discussion of the application of amino acid ratios to Quaternary stratigraphy of the Eastern Arctic, Miller (1985) suggested that total ratios can be significantly affected by variation in sample preparation technique.

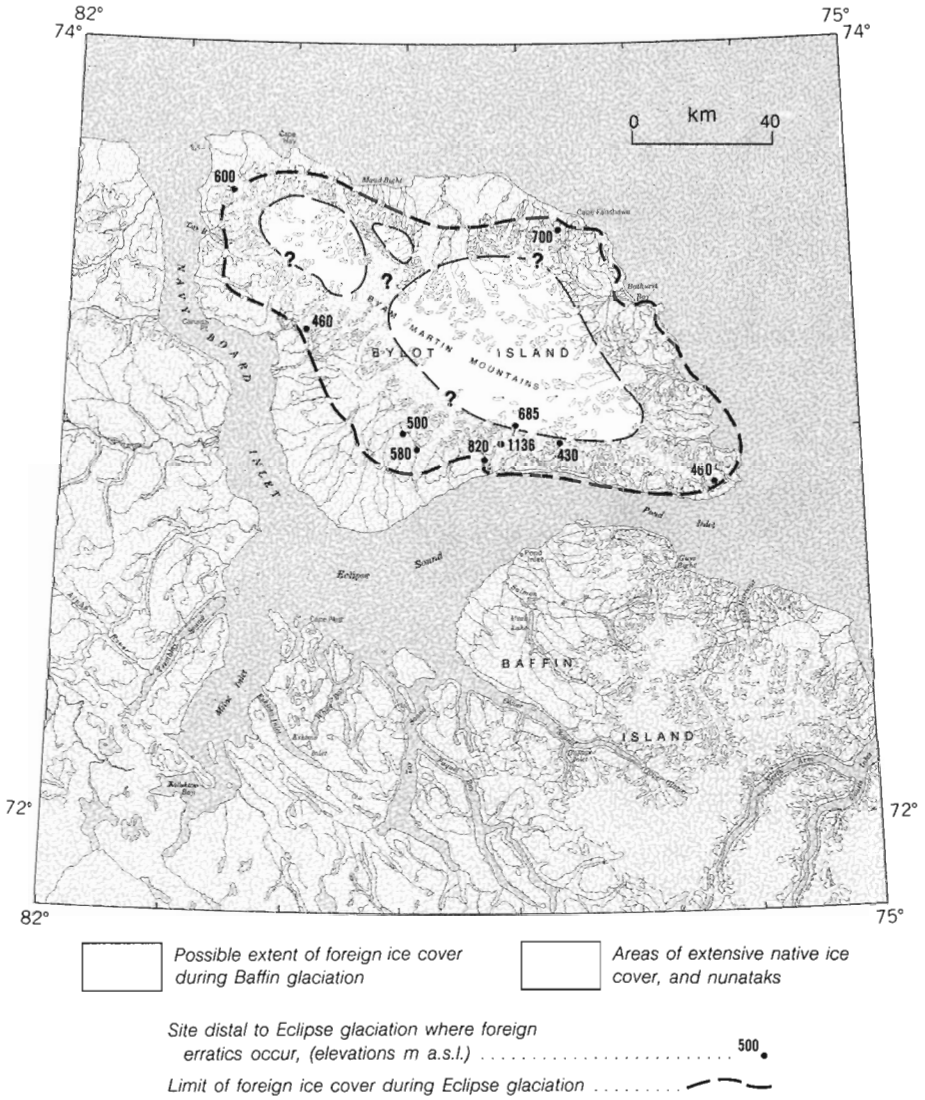


Figure 32. Extent of foreign ice during Baffin glaciation.

Shell collections analyzed for amino acids were made from the ground surface at sites located between sea level and elevations above 300 m a.s.l., as well as from recently exposed stratigraphic sections. Although they have experienced a wide range of weathering histories, amino acid ratios are assumed here to fairly represent their relative ages, in the absence of geological evidence to the contrary. This approach is supported by an apparent, internal consistency and stratigraphic order in amino acid ratios within and among sections; exceptions are noted in the text.

For samples collected from surficial deposits there can be considerable overlap in ratios between glacially transported shell fragments and in situ shells associated with periods of higher relative sea level (Fig. 2.2, Appendix 2). Detrital shells in Eclipse drift, for example, have ratios that are most commonly about 0.25 to 0.3, although they range between 0.15 and 0.95. In situ shells from marine sediments identified as having formed immediately following Eclipse glaciation are generally about 0.2 to 0.25, although they range between 0.1 and 0.4. Reasons for the apparent overlap in amino acid ratios between deposits of different ages are not entirely clear. They may include differences in thermal and diagenetic histories between shells in surficial deposits and in frozen sections, as well as incorrect stratigraphic associations. Detrital shells that appear "young," particularly near the coast, could be associated with later Button glaciation.

From radiocarbon analysis, shells of late Wisconsinan and Holocene age (i.e., <25 000 years) have amino acid ratios that are either not detectable or are <0.1 (free). In this report, shells having amino acid ratios of >0.1 are interpreted to be pre-Late Wisconsinan in age.

Events associated with regional ice sheets

Baffin glaciation

Baffin glaciation represents one or more regional glacial events that occurred prior to Eclipse glaciation. It is recognized by the occurrence and distribution of foreign erratics inland and above Eclipse glacial limits, and by foreign drift of pre-Eclipse age in stratigraphic sections. A pre-Eclipse age is assigned to drift units that are overlain either by well developed buried soils or by organic deposits of interglacial character (warmer than present), or both. The interpretation that interglacial conditions occurred prior to Eclipse glaciation is supported by comparatively weak soil development in surficial deposits of Eclipse drift and by amino acid ratios of shells in stratigraphic sections. Amino acid ratios of in situ shells associated with interglacial deposits are much greater than those of detrital shells in Eclipse drift (0.55 to 0.6 vs. 0.25 to 0.30). Recognition of Baffin glaciation as a single event assumes that high-elevation foreign erratics and stratigraphic evidence of old (pre-interglaciation) foreign glaciation are the product of one ice advance, and that only one period of interglacial weathering is recorded in sections. Such assumptions may prove incorrect, but are used here as the simplest interpretation in the absence of evidence to the contrary.

Most foreign erratics at high elevation are quartz sandstones, likely derived from Adams Sound Formation on Baffin Island. Although uncommon, they occur within the outer Byam Martin Mountains and on the southern lowlands near the crystalline mountain front 25 km from the coast (Fig. 10). The highest known occurrence is at 1136 m a.s.l. on a mountain ridge directly overlooking Sermilik Glacier, about 10 km inland. Carbonate detritus also occurs inland of Eclipse drift, although at lower overall elevations, and has been found at several sites among the outer mountains near Sermilik Glacier.

Glacially transported shell fragments near glacier C79 at 500 m a.s.l. and inland from Eclipse glacial limits have amino acid ratios of about 0.8 (AAL-1478) and indicate a maximum relative age of Baffin glaciation. In sections at Salmon River, Oliver Sound, Button Point, and glacier E67 (Fig. 3.1, Appendix 3), foreign debris within pre-interglacial marine sediments is associated with Baffin glaciation; although the sediments are waterlain, foreign glaciation is required to transport the debris to the sections. Amino acid ratios of in situ shells from the marine sediments are about 0.55 to 0.6 (Table 2.2, Appendix 2) and indicate a minimum relative age of Baffin glaciation. Because the shells underlie interglacial deposits, the ratios also indicate a maximum relative age of interglacial conditions (Salmon River interglacial, Fig. 31).

The distribution and elevation of foreign erratics indicate that regional ice sheets inundated much of Bylot Island during Baffin glaciation and could have flowed northward across the topographic divide (Fig. 32). Channels around the island would have been completely filled by ice, and grounded glacier ice would have extended well out into Baffin Bay. Baffin glaciation was much more extensive than that associated with later Eclipse glaciation and occurred during a time bracketed by shells characterized by amino ratios of 0.8 and 0.6.

Eclipse glaciation

Debris transport and internal flowpaths

Fossiliferous erratics derived from Paleozoic bedrock of either north-central Baffin Island, or Foxe Basin, or both, occur in Eclipse drift on southern Bylot Island. The main path of glacial transport would have been northward across Baffin Island to Eclipse Sound, where the ice likely split into two streams, one of which moved northward via Navy Board Inlet and the other eastward via Pond Inlet (Fig. 33A, B). Erratics of specular hematite from iron formation of Mary River Group found beside Milne Inlet, near Sermilik Glacier, and on Mount Herodier on northern Baffin Island support the proposed flow path.

On northern Bylot Island the provenance of foreign glacial debris, and volcanic rock derived from Arctic Bay in particular, demonstrates glacial transport northward within Admiralty Inlet then eastward within Lancaster Sound (Fig. 33A). Erratics of fossiliferous sedimentary rock of early to middle Paleozoic age were most likely derived from bedrock

of north-central Baffin Island, Brodeur Peninsula, or northern Borden Peninsula. A glacier issuing from Admiralty Inlet would be, by itself, insufficient to fill Lancaster Sound, and it is proposed that ice flowing out of Admiralty Inlet merged as a tributary glacier with a larger glacier stream in Lancaster Sound. The volcanic and sedimentary rocks from Admiralty Inlet were transported eastward in Lancaster Sound as part of a lateral or medial moraine and eventually deposited on the northern Bylot Coast in Eclipse Moraine. The ice bearing the debris was not significantly displaced from the southern margin of Lancaster Sound by ice flowing northward off Borden Peninsula or out of Navy Board Inlet, indicating limited glaciation elsewhere in the northern Baffin region. The interpretation of limited glaciation by local ice caps and mountain glaciers during Eclipse glaciation is further supported by evidence presented below.

Extent and configuration of foreign ice

The configuration of Eclipse Moraine indicates that Lancaster Sound, Navy Board Inlet, Eclipse Sound, and Pond Inlet were occupied by major outlet glaciers of the Laurentide Ice Sheet during Eclipse glaciation (Fig. 33). Although the channels are deep (1000 m), outlet glaciers were fully grounded within them; foreign ice attained elevations of 500 m a.s.l. on Bylot Island, and ice of that thickness (1500 m) could not have been floating, a conclusion also arrived at by Hodgson and Haselton (1974).

In Lancaster Sound and Pond Inlet, reconstruction of the surface configuration of the ice sheet during Eclipse glaciation can be based on the outline of Eclipse Moraine and on internal flow paths indicated by the transport of foreign debris (Klassen and Fisher, 1988). Where foreign glaciers flowed

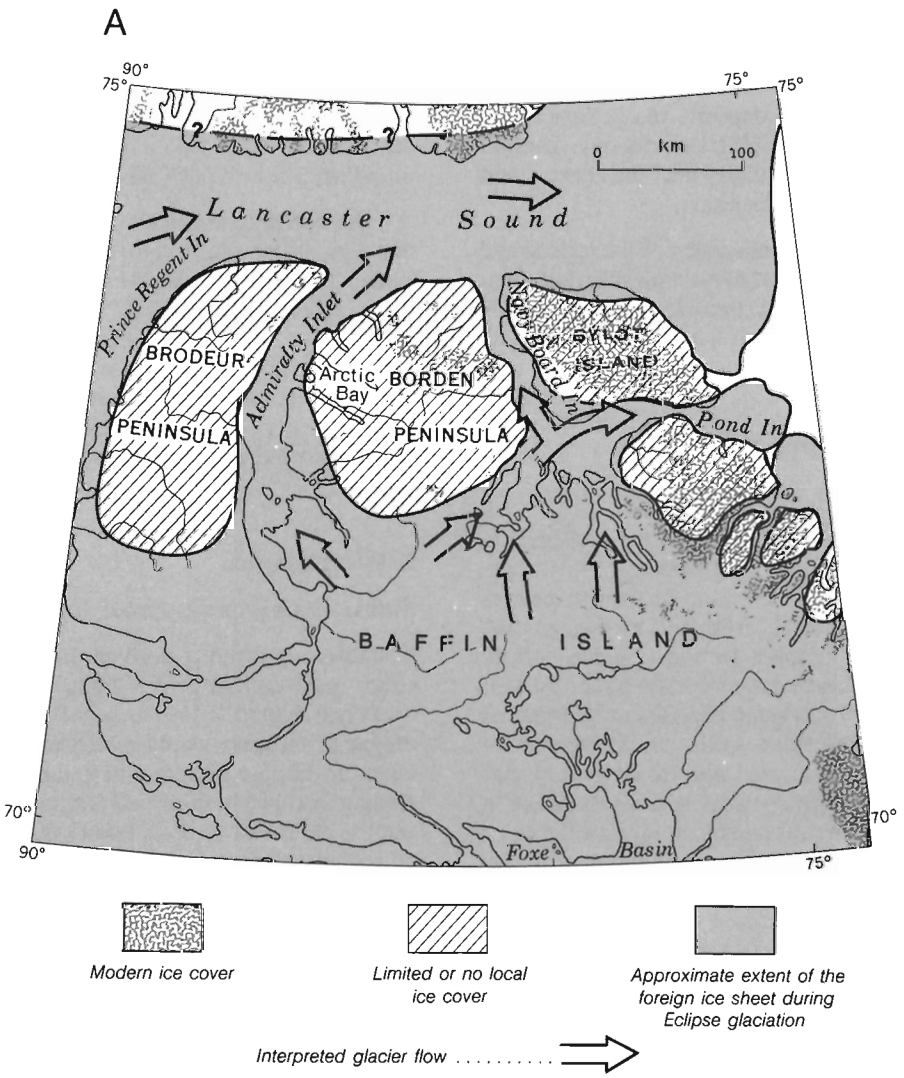


Figure 33. Extent of foreign ice during Eclipse glaciation showing the main regional flowpaths (A) and configuration of the ice sheet around Bylot Island (B).

out of the sound onto Bylot Island, the lateral and terminal moraines that they formed on valley walls can be used to define the surface shape of the glaciers (Fig. 34). The moraines indicate that ice projected up to 10 km into valleys as tongues from the eastward flowing glacier in Lancaster Sound (Fig. 35). The configuration of the moraines, as well as the transport of foreign debris onto Bylot Island, clearly demonstrates that the ice surfaces declined inland; the direction of flow within glaciers, and of debris transport, is in the direction of net surface slope. The profiles of the glaciers can be extrapolated seaward to estimate ice surface elevations in Lancaster Sound and to reconstruct the main glacier offshore (Fig. 36A, B). The profile shown for Lancaster Sound lies along an offshore escarpment that forms a major physiographic break from deep (about 1000 m) to shallow (<200 m) water and is thought to have constrained the bulk of ice grounded in the sound. The ice sheet in the sound had surface contours shaped convex toward Baffin Bay (Fig. 34).

A similar reconstruction for ice in Pond Inlet is based on the trace of Eclipse Moraine near Button Point and on northeastern Baffin Island. No evidence has been found of ice flowing southward into Navy Board Inlet, out of Lancaster Sound, and the ice marginal deposits at the northern mouth of the Inlet are either contemporaneous with, or younger than, Eclipse Moraine. The Navy Board Inlet moraines, which occur to 500 m a.s.l., are correlated with Eclipse glaciation, based on the magnitude of glacier ice that they represent.

Eclipse Moraine is not recognized on either Bylot or Baffin islands in areas adjacent to Eclipse Sound, and consequently the full extent of Eclipse ice in those areas is interpretive, keyed to the ice extent marked elsewhere by Eclipse Moraine and to the general distribution of foreign drift. Foreign ice extended onto the lowlands of southern Bylot Island to about 300 to 375 m a.s.l., 10 to 20 km inland, and to equivalent elevation and distance inland on the Salmon River lowland of northern Baffin Island.

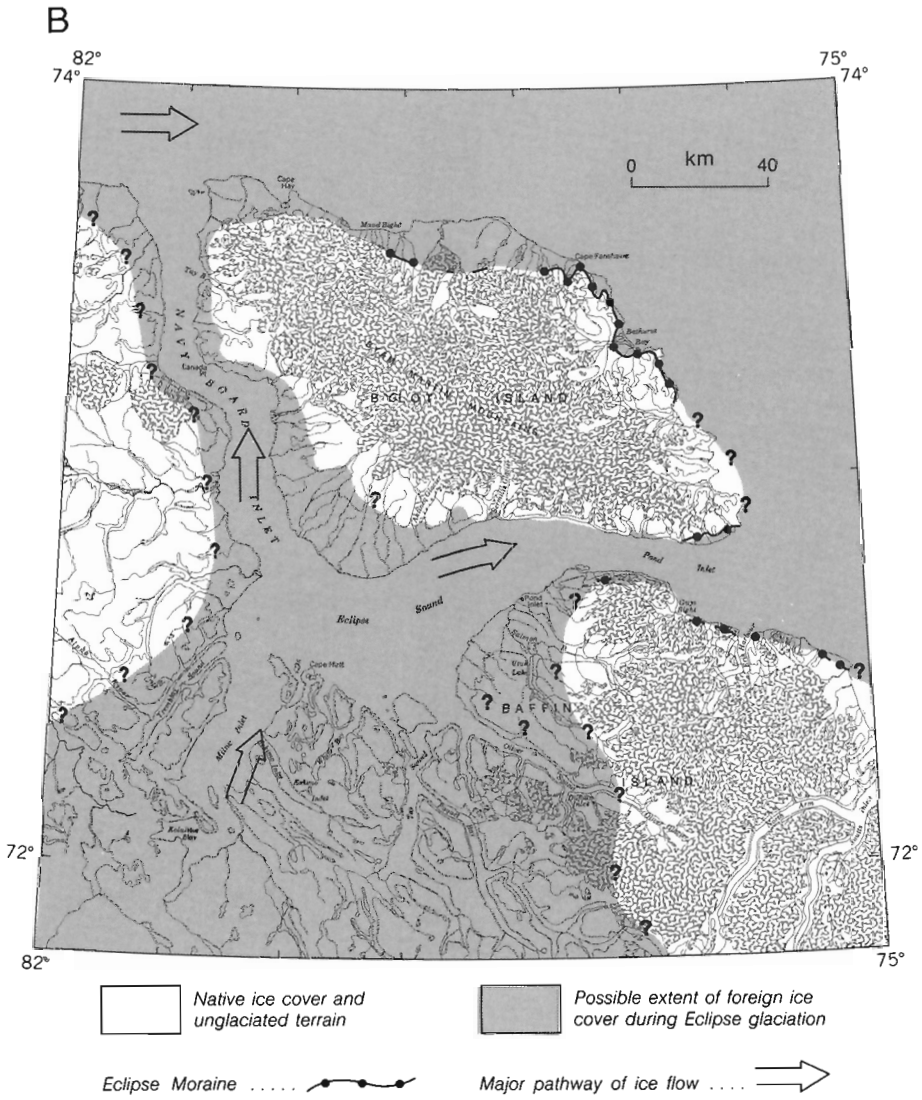


Figure 33. Continued.

Interaction between native and foreign glaciers

Where Eclipse glacial limits are mapped inland of the modern and Neoglacial limits of local ice, there was undoubtedly interaction between foreign and native glaciers. Foreign debris occurring inland of modern glaciers, in some cases to elevations more than several hundred metres above them, indicates that foreign ice caused a reversal of the normal directions of outward flow and "backfilled" valleys. Examples include the large glaciers D181, D119, and D91 in the north, and B17 (Aktineq), B37 (Sermilik), and A17 (Kaparoqtalik) in the south, among others, where foreign debris occurs on hillsides directly above modern ice (Fig. 10, 11). Native ice contacted by foreign ice would have remained dammed against the topographic divide during the maximum of Eclipse glaciation as foreign ice flowed onto Bylot Island.

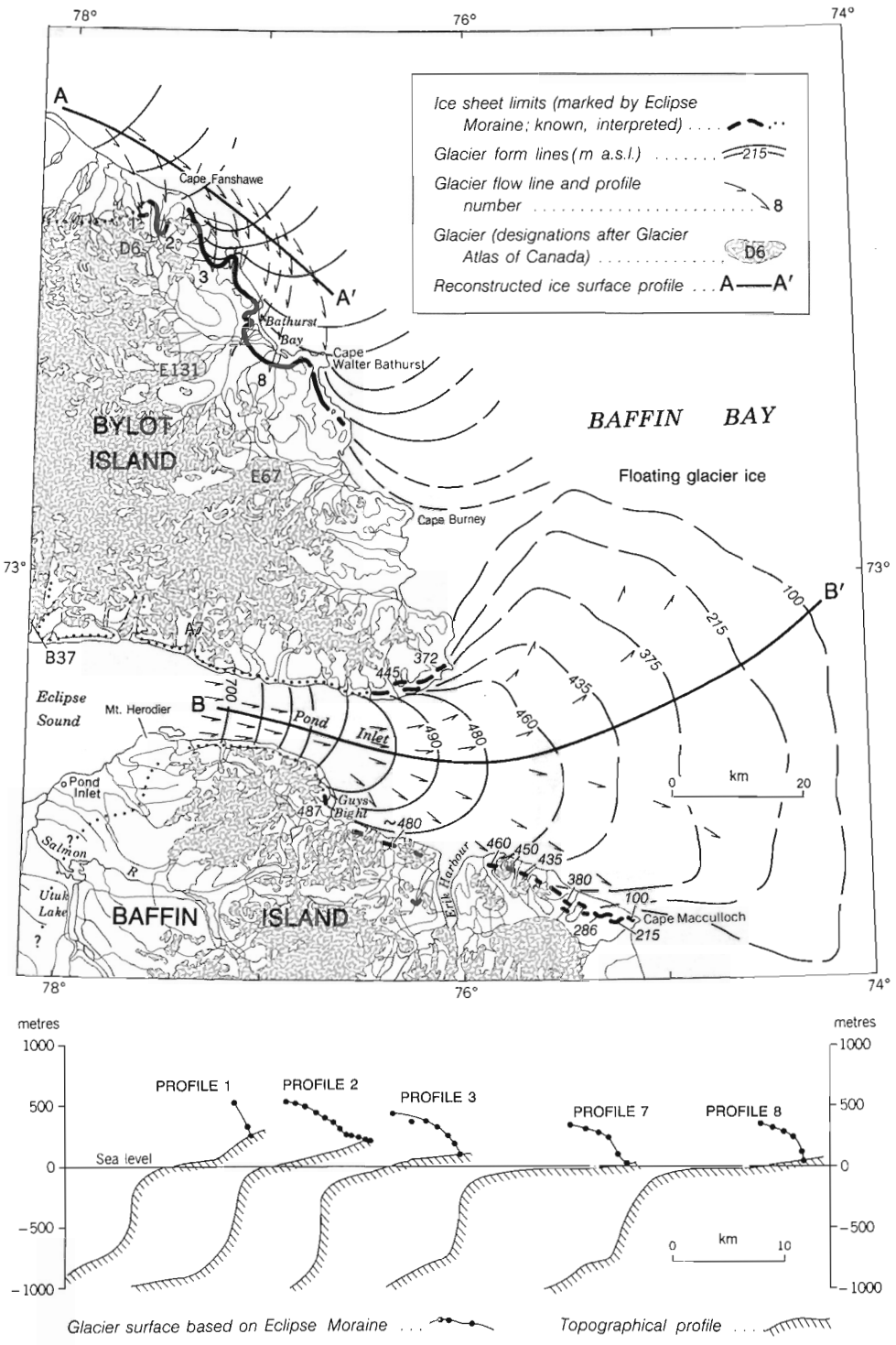


Figure 34. Surface profiles of foreign glaciers entering valleys on the northeastern Bylot Island, based on the configuration of Eclipse Moraine on valley walls. Topographic profiles include the submarine escarpment offshore.

Along the northeastern coast, where foreign ice did not extend inland of modern glaciers, there is no evidence of interaction between foreign and native ice. In the valley west of Cape Fanshawe, for example, a well defined lobate segment of Eclipse Moraine projects nearly 10 km up-valley to within 1 km of glacier D6. It does not appear that the foreign glacier, or the moraine itself, has ever been in contact with glacier D6 (Fig. 35, 37). Although the separation distance is greater (about 5 km), a similar relationship occurs at Bathurst Bay in front of glacier E131 (Fig. 16). There, as first noted by Hodgson and Haselton (1974), an ice contact delta occurs on the distal (inland) side of Eclipse Moraine, demonstrating a landward-sloping foreign ice surface and a separation between foreign and native glaciers during formation of the Moraine. In both cases the inference is that the native glaciers have been no more extensive than at present since Eclipse glaciation. Similarities among reconstructed profiles of foreign ice derived from the shape of Eclipse Moraine on valley sides further indicate no interaction between foreign and native glaciers (Fig. 34).

Glacial lake sediments in valleys on northeastern Baffin Island extend to about 300 m a.s.l., and are overlain by Neoglacial moraines near the margins of modern glaciers. They are interpreted to have been deposited in lakes dammed by foreign ice in Pond Inlet during Eclipse glaciation. They demonstrate that the valleys on northeastern Baffin Island were also largely free of native ice during and since Eclipse glaciation.

Age of Eclipse glaciation

Amino acid ratios of detrital fragments of marine shells in Eclipse drift provide a basis for estimating the maximum relative age of Eclipse glaciation (Table 2.3, Appendix 2). The ratios of detrital shells range from 0 .15 to 0.8; most are about 0.30. The lowest ratios (0.15 to 0.22; AAL-2468) are based on analysis of shell fragments in Eclipse Moraine at 375 m a.s.l., and do not accord with the chronology presented here. The ratios may reflect lower average diagenetic temperatures, associated with the high elevation and northern side

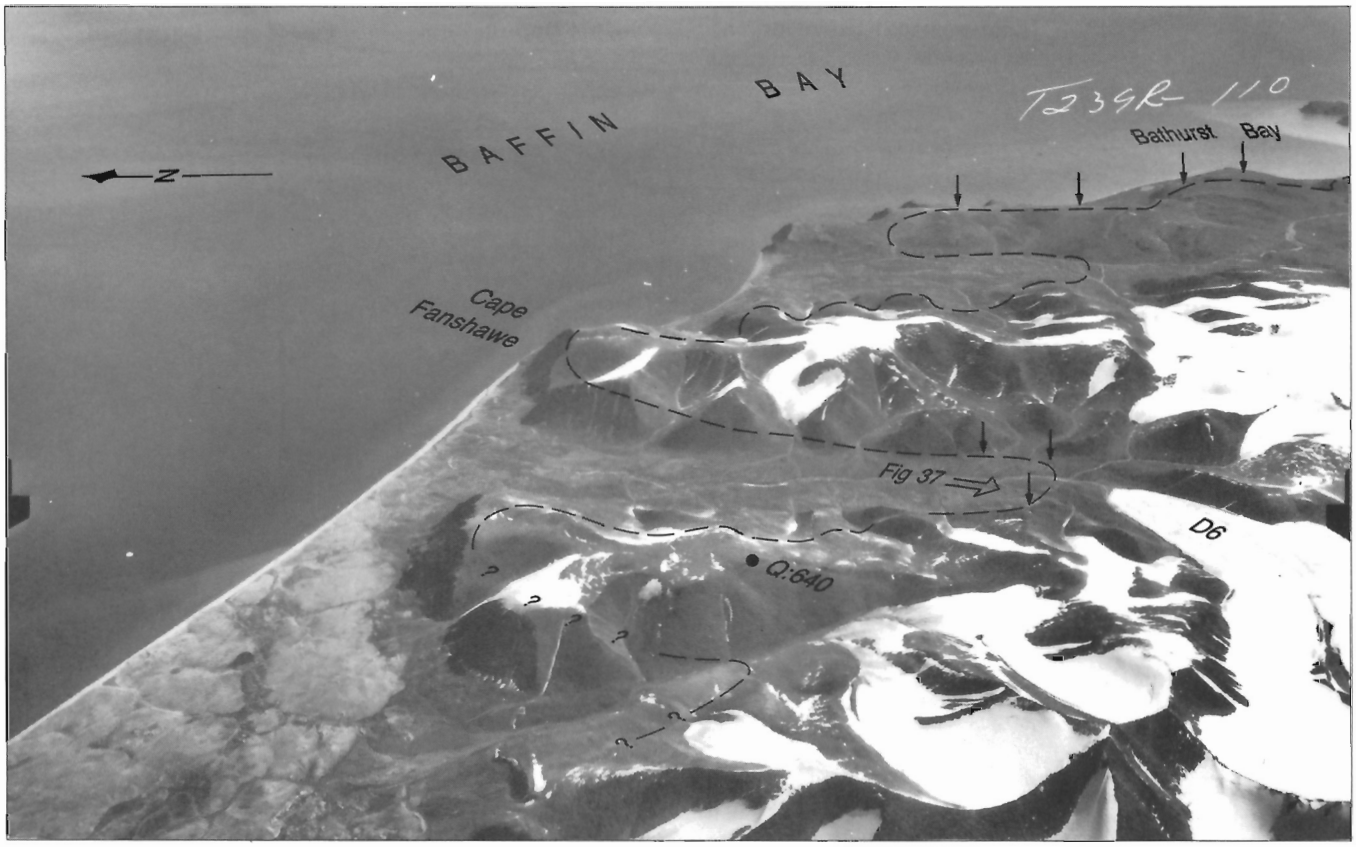


Figure 35. On northeastern Bylot Island, Eclipse glacial limits are marked by the inland limits of Eclipse drift and by Eclipse Moraine. Eclipse Moraine lies across the valley floor in front of glacier D6 at 240 m a.s.l. and shows no evidence either of having been formed in contact with native ice or of having been glaciated since its formation. View given by Figure 37 is indicated, along with the location of a foreign erratic of quartz sandstone associated with earlier Baffin glaciation. NAPL T239R-110.

of Bylot Island, and may indicate a relative age that is only apparently young. A minimum relative age for Eclipse glaciation is based on amino acid and radiocarbon analysis of in situ marine shells from raised marine deposits in the area of Eclipse Sound that appear, from geomorphological and stratigraphic evidence, to have formed subsequent to Eclipse glaciation. Three sites where such sediments exist are known; Canada Point (Fig. 38), Pond Inlet townsite, and Janes Creek III (Fig. 15).. Amino acid analysis of the in situ shells indicates ratios ranging between 0.1 and 0.4, with modal values of about 0.2 to 0.25 (Table 2.5, Appendix 2).

Although amino acid ratios of detrital shells in Eclipse drift are generally greater than those of in situ shells in younger marine deposits, ratio values overlap considerably. Reasons for overlap are not entirely clear and may include a difference in thermal and diagenetic histories between shells in surficial deposits and in frozen sections as well as an incorrect association of some drift, particularly near the coast, with Eclipse glaciation. Some detrital shells having ratios of "young" age may be associated with Button glaciation.

Radiocarbon analysis indicates that the in situ shells are >43 000 radiocarbon years in age. However, the "finite" dates of ~30 000 radiocarbon years are treated here as "infinite," because of the possibility of contamination by modern carbon (see Table 1.1, Appendix 1). From the above evidence, Eclipse glaciation is older than shells having amino acid ratios of about 0.2 to 0.25, and younger than shells having ratios of about 0.25 to 0.3, and occurred prior to Late Wisconsinan time, more than 43 000 years ago.

Button glaciation

Button glaciation refers to one or more expansions of foreign ice sheets on Baffin Island during the interval following Eclipse glaciation and prior to the last foreign event, which is named Cape Hatt glaciation. It is named for Button Point, where stratigraphic evidence of a post-Eclipse glacial event was first recognized. Distinction between Button and Eclipse glacial events is based on amino acid ratios and on limited stratigraphic evidence that Button and Eclipse drifts are separated by organic-bearing sediments. Glacial drift containing detrital shells having amino acid ratios in the range of 0.15 to 0.20 is considered younger than Eclipse marine sediments. Foreign glacial deposits containing shells characterized by Button age ratios are known at the surface at various sites around outer Bylot Island at elevations <140 m a.s.l. (Table 2.5, Appendix 2).

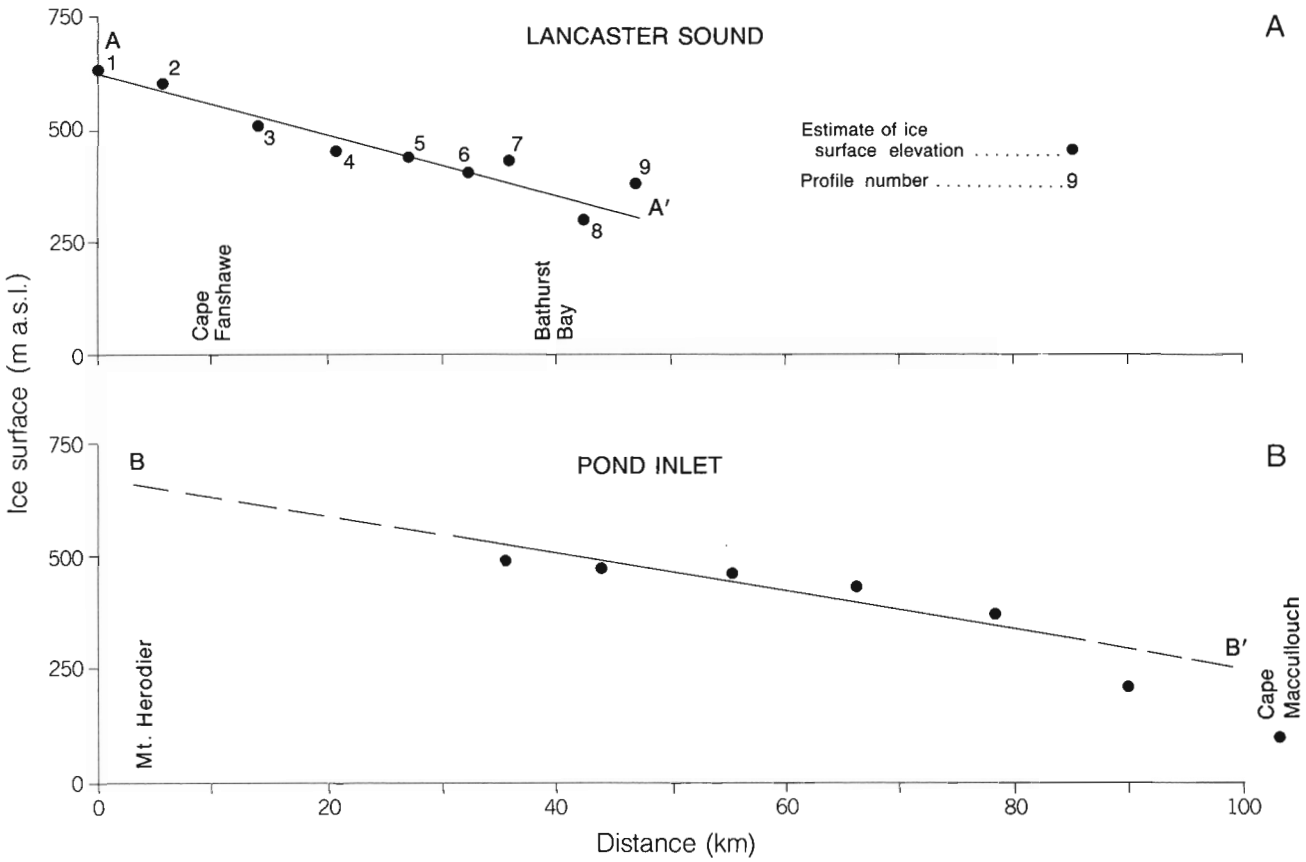


Figure 36. Reconstructed ice surface profiles of the major, eastward flowing outlet glaciers in Lancaster Sound (A) and in Pond Inlet (B). Surface elevations along profiles AA' and BB' are based on seaward extrapolations of profiles given by Figure 34, and on the elevation of Eclipse Moraine along Pond Inlet.

Stratigraphic evidence of Button glaciation is limited. At Button Point, foreign drift of Button age overlies marine sediments of Eclipse age (Button Point Sections I to V). At the mouth of Aktineq Creek, amino acid ratios of detrital shells and a minor interval marked by iron oxide stain and organic debris indicate a basis for separation of Button drift from Eclipse drift, but the stratigraphic evidence is inconclusive (see Aktineq Creek section I, Appendix 3). Beside Sermilik Glacier, the upper surface of foreign drift containing detrital shells of Eclipse age is also marked by minor iron oxidation in soil development and organic debris (see Sermilik Glacier section I, Appendix 3). The drift is overlain by a thick sequence of glaciofluvial sediments that contain abundant, striated foreign debris in their lower part, indicating a debris source related to foreign ice. In their upper part, the stratified sediments contain Button age shell debris, are almost entirely crystalline in composition, and have current features that indicate water flow off Bylot Island. The stratigraphic evidence suggests a distinction between the lower foreign drift (Eclipse), and the overlying glacial fluvial sediments (Button).

Figure 37. Eclipse Moraine in front of glacier D6; location of view is given by open arrow in Figure 35. 203803-X

Despite their coastal locations, there is no evidence of Button glaciation either at Janes Creek, east of Pond Inlet townsite (see Janes Creek section II, Appendix 3), or at Canada Point, where Button marine sediments directly overlie Eclipse marine sediments. The extent of ice during Button glaciation is speculative and based largely on the known occurrence and distribution of Button age shells in drift (Fig. 39). Ice appears to have been restricted to the outer margins of the island at elevations <140 m a.s.l. where it was probably confined within marine channels and likely floating. The position of relative sea level then is unknown. Landforms that could be the product of Button glaciation include minor valleys that lie parallel to the southern Bylot coast at about 100 m a.s.l., which may be lateral meltwater channels; morainic benches at 70 to 90 m a.s.l. at the base of coastal cliffs east of Sermilik Glacier (Fig. 19); and moraines at about 80 m a.s.l. at the base of Mount Herodier on Baffin Island and across valley mouths east of Narsarsuk Glacier on Bylot Island (Fig. 14).

At the northern end of Navy Board Inlet, shell fragments at the surface of a moraine ridge 100 m a.s.l. and 1 km inland have amino acid ratios of 0.15 (AAL-906). The ridge marks changes in the pattern of older ice marginal landforms of Eclipse glaciation that extend farther inland and to much greater elevation (500 m a.s.l.). Farther east along Lancaster Sound coastal moraines at 20 to 40 m a.s.l. (Fig. 18) also contain detrital shell fragments of Button age (AAL-1472, 2629).

Figure 38. Marine delta at Canada Point contains in situ shells having amino acid ratios of about 0.25 and 0.15 (AAL-1218, 2623) and radiocarbon age of >43 000 BP (GSC-3410). Although the delta may have formed during two distinct periods of higher relative sea level, the lack of either geomorphological or stratigraphic evidence of glaciation indicates that it formed subsequent to Eclipse glaciation. 203803-V

On northern Baffin Island, moraines and kame terraces outline the margins of a foreign ice sheet covering the southern two-thirds of the peninsulas between Milne Inlet and Tay Sound and extending northward from the inlets into Eclipse Sound (Fig. 39). Because the ice marginal deposits occur at greater elevation (150 to 250 m a.s.l.) than those of the later Cape Hatt glaciation (<135 m a.s.l.), they are tentatively associated with Button glaciation.

Cape Hatt glaciation

Cape Hatt glaciation is a glacial event of late Wisconsinan or early Holocene age during which ice flowing northward across Baffin Island extended northward within Milne Inlet, at least to Cape Hatt (Fig. 39). The extent of ice in Milne Inlet is marked by kame terraces at about 135 m a.s.l., that lead to an ice contact marine delta at Cape Hatt (Fig. 24). The delta, which grades to 80 m a.s.l., formed about 9530 ± 180 BP (GSC-3318), based on analysis of articulated shells collected at the ice proximal end of the delta at 75 m a.s.l. The extent of ice in adjacent inlets is not easily identified; it may be marked by ill defined benches at about 100 m a.s.l. that are largely buried by colluvial (talus) deposits. The regional extent of ice during Cape Hatt glaciation is greater than indicated by Cockburn Moraine (Baffinland Drift), which has been identified by Hodgson and Haselton (1974) at the southern end of Milne Inlet.

Events associated with native glaciers and ice

Native moraines and ice marginal landforms mark several distinct periods of expansion by native glaciers, based on the relative extent of ice that they define and on geological relations between the moraines and foreign glacial deposits of Eclipse glaciation. Three episodes of major native glaciation can be recognized that include a pre-Eclipse glaciation of great magnitude, named Bylot glaciation, a deglacial phase of Eclipse glaciation, named Aktineq glacial phase and Neoglaciation.

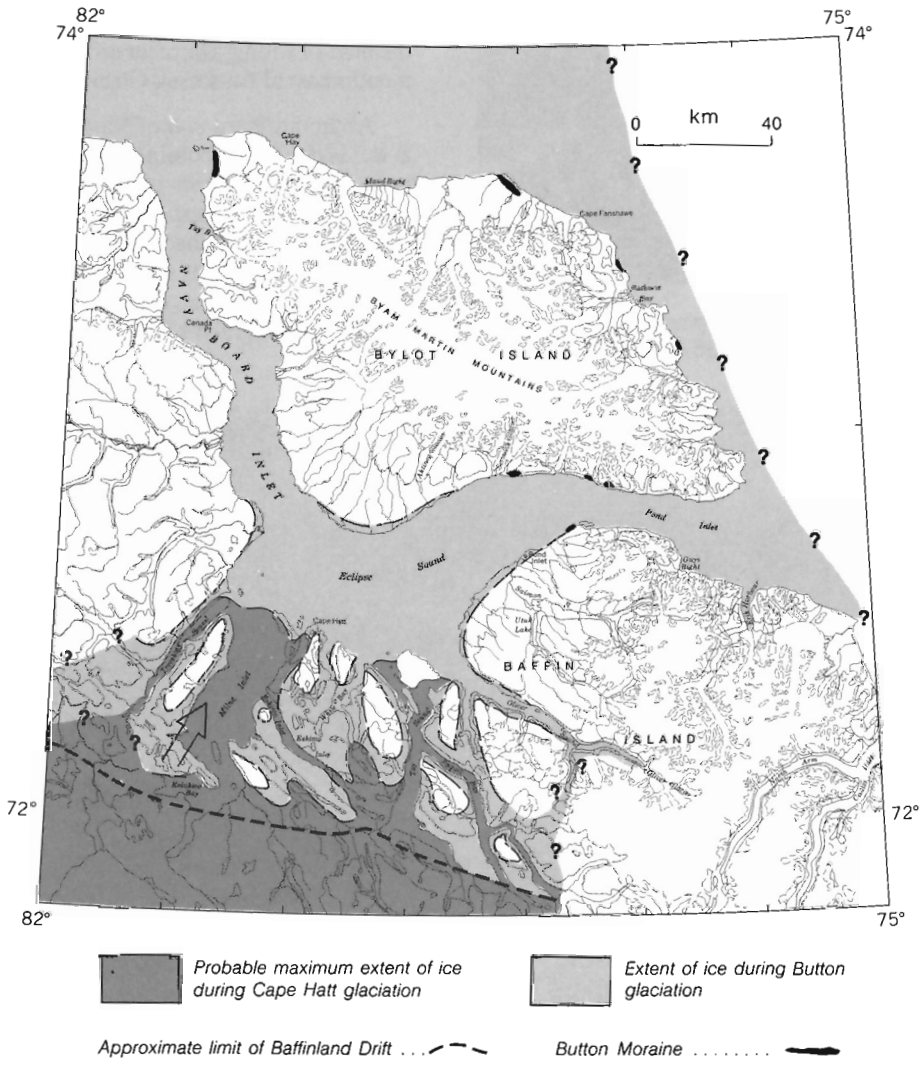


Figure 39. Extent of ice during Button and Cape Hatt glaciations.

Bylot glaciation

During Bylot glaciation, mountain ice caps and valley glaciers inundated either most or all of Bylot Island based on the widespread distribution of crystalline erratics on both the lowlands and isolated mountain peaks of the outer Byam Martin Mountains. Bylot glaciation could include several distinct glacial events of pre-Eclipse age and may be older than shells having amino acid ratios of 0.8. At present, there is no basis for recognition of more than one such ancient event.

Geomorphological evidence of Bylot glaciation includes lateral meltwater channels incised in crystalline bedrock at high elevation in front of glaciers E131, E67, E35, and E21. The extent of ice indicated by the channels is much greater than associated with the later Aktineq glacial phase. Near the coast, as noted by Hodgson and Haselton (1974), Eclipse Moraine occupies native meltwater channels, demonstrating that Bylot glaciation occurred prior to Eclipse glaciation.

Stratigraphic sections containing interglacial deposits occur within 1 km of E131, E67, Aktineq, and C5 glaciers and indicate that Bylot glaciation predated Salmon River interglaciation and marine shells having amino acid ratios of 0.55 (AAL-1705, 1832, 2466). None of the sections contain evidence of native glaciation despite their proximity to modern ice margins. In front of glacier E131 outwash directly overlain by modern ice (Fig. 22) includes a lower unit that is relatively indurated, partially cemented by iron oxides, and capped by a zone bearing fine grained organic matter (glacier E131 section, Appendix 3). The section represents two distinct periods of glaciofluvial deposition separated by a period of weathering and contains no direct evidence of native glaciation.

A section in front of glacier E67 includes ice-proximal marine sediments and glaciofluvial sediments that are deeply weathered and contain organic debris (Cache Creek section, Appendix 3). Intact shells from the marine unit have amino acid ratios of about 0.77 (AAL-1705), comparable with ratios for shells underlying interglacial deposits in Salmon River section.

In front of Aktineq Glacier, foreign drift overlies a unit of stratified sand and gravel bearing large shell fragments (Aktineq Creek section II, Appendix 3). Within the stratified unit crossbeds dip inland, indicating deposition from water flowing toward the modern glacier margin, and some of the clasts include polished and striated foreign debris, suggesting an environment proximal to a foreign ice margin (Baffin glaciation?). The section contains no evidence of native glaciation although it lies within a few hundred metres of the Neoglacial moraine. Amino acid ratios of the shell fragments are about 0.80 (AAL-2465) and are similar to ratios of shell fragments in pre-Eclipse foreign drift elsewhere on southern Bylot Island (AAL-1478). The ratios are interpreted to represent a maximum age of Baffin glaciation and a minimum age of Bylot glaciation.

In front of glacier C5, clayey mud containing intact, fragile shells is overlain by a complex sequence of stratified sand and gravel associated with ice marginal deposits of Eclipse glaciation (Northwest coast section I, Appendix 3). The shells, which are considered from their state of preservation to be contemporaneous with enclosing sediments, have amino acid ratios of 0.55 (AAL-1474) and indicate a maximum age of Eclipse glaciation. Because the section contains no evidence of native glaciation the shells also indicate a minimum age of Bylot glaciation.

Aktineq glacial phase

Where foreign ice extended inland of native ice during Eclipse glaciation, landforms defining a later major advance of native ice can include a significant component of foreign drift and are associated with Aktineq glacial phase (Fig. 40). The definition and foreign provenance of the native landforms is best seen in front of Aktineq and D91 glaciers. The composition and provenance of comparable native landforms in front of other glaciers, such as D181, D183, and D119, is not known. In view of the contiguous area of snow accumulation in the Byam Martin Mountains, it is difficult to explain why some native glaciers (e.g., Aktineq and D91) underwent major expansion subsequent to Eclipse glaciation whereas others heading in adjacent cirque basins (e.g., D6 and E131, on the northeastern margin) did not. The common highland area of accumulation would suggest that native glaciers would experience contemporaneous expansion throughout the island.

An explanation of the apparent differences in glacial history among native glaciers is based on their history of interaction with foreign ice. Evidence of a post-Eclipse advance by native ice is found only in front of glaciers that were directly overwhelmed by foreign ice and held against the topographic divide. It is proposed that during deglaciation, as foreign ice diminished, the native glaciers dammed on the island had an abnormally high volume of ice for their areal extent and, in re-establishing normal flow outward from the island, they surged to positions far in advance of their modern terminii, staying there until their excess volume ablated. The advance did not result from increased annual snow accumulation in the highlands, and it is associated only with native glaciers that were dammed by foreign ice. Post-Eclipse surges were probably short-lived and not enough local debris was entrained and transported to significantly change the foreign character of native landforms that resulted. This native advance is named Aktineq glacial phase and is interpreted as a late glacial (deglacial) phase of Eclipse glaciation. It is associated only with native glaciers that were in direct contact with foreign ice and is interpreted to have been relatively short-lived.

On northern Baffin Island, lobate and lateral moraines on Salmon River lowland and beside Oliver Sound (Fig.13) have been interpreted by Hodgson and Haselton (1974) to "...result from ice flowing from an independent post continental glaciation highlands icefield". Their interpretation was based on the observation that if the Salmon River and Oliver Sound moraines were the product of a foreign ice sheet, ice would have had to cross terrain at 1000 m a.s.l. and that, before this stage could occur, foreign ice would have occupied Salmon River lowland and Oliver Sound from the north. From fieldwork, the Salmon River and Oliver Sound moraines are

composed of crystalline debris and stratigraphically overlie Eclipse drift. The moraines show no evidence of having been overridden by foreign ice.

Sections in Oliver Sound (see Oliver Sound sections I, II, Appendix 3), indicate that foreign glacial debris was transported into the sound prior to the formation of Oliver Sound moraines and that there may have been a period of significant weathering intervening between the two events. Amino acid ratios of intact marine shells from the glaciomarine unit bearing foreign erratics were about 0.6 (AAL-2466), and these ratios compare with those of in situ shells in marine sediments at the mouth of Salmon River and glacier E67 (Salmon River and Cache Creek sections, Appendix 3) that also pre-date interglacial weathering (Salmon River interglacial).

Although the Salmon River and Oliver Sound moraines apparently represent a major, independent expansion of northeastern Baffin icefields of post-Eclipse age, intepretations by Hodgson and Haselton (1974) are inconsistent with evidence elsewhere of limited to no expansion of Baffin Island glaciers and ice caps subsequent to Eclipse glaciation. Glaciers on northeastern Baffin Island are fed by local icefields that are contiguous with those at the head of Oliver Sound and Utuk Lake, and evidence of major icefield expansion could be expected to be widespread. It is suggested that moraines on the Salmon River lowlands and in Oliver Sound may represent Aktineq glacial phase and formed by surge during the deglacial period of Eclipse glaciation, as ice held in Oliver Sound and Utuk Lake valley was allowed to establish northward flow.

Neoglaciation

Most large local glaciers have terminal moraines either close to or in contact with their margins that are composed largely of angular, crystalline rock debris, are frequently ice-cored, and have little to no colonization by lichens and plants. A few glaciers front directly on tundra with no intervening modern or Neoglacial terminal moraine (Fig. 22). Based on radiocarbon analysis of peat from a stratigraphic section capped by the Neoglacial moraine of Aktineq Glacier, DiLabio and Shilts (1979) concluded that the moraine formed within the past 400 years and that Aktineq Glacier was as far

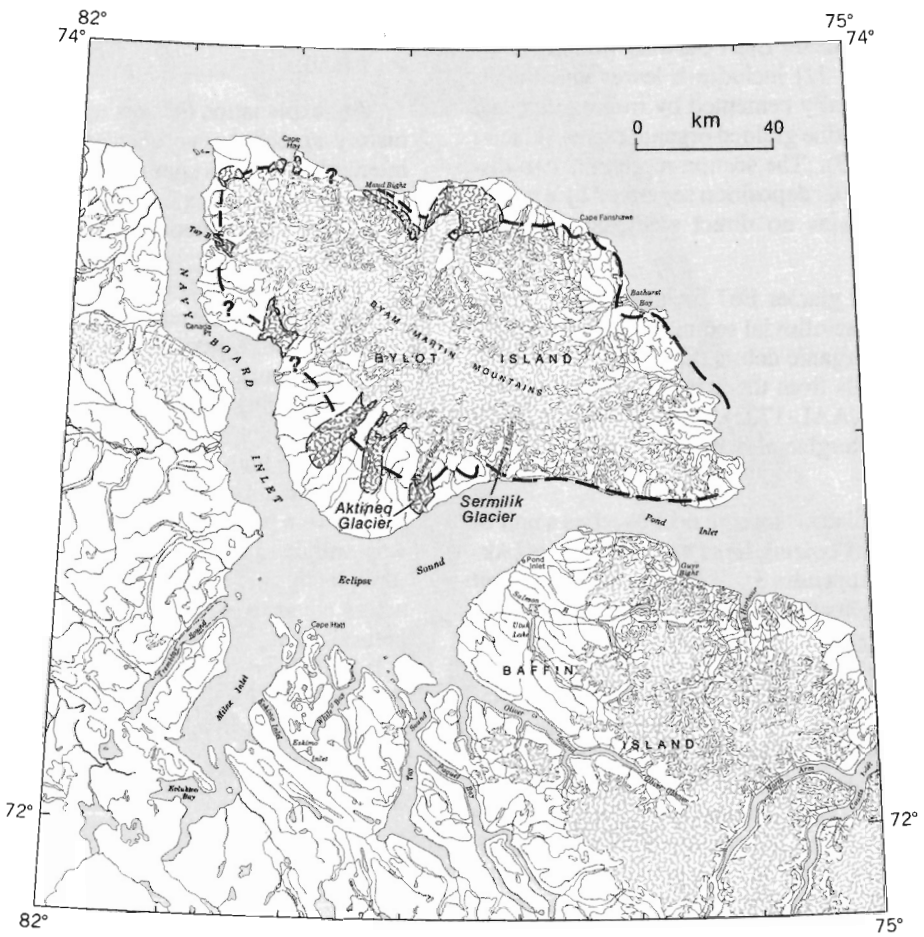


Figure 40. Extent of native ice during Aktineq glacial phase.

advanced then as it has been in the past 7000 to 8000 years, or longer. Glaciers B7 (Camp) and C79 attained Neoglacial maximum within the past 120 years, based on radiocarbon analysis of detrital organic debris within their moraines (Table 1.1, Appendix 1).

In some valleys on northeastern Baffin Island, terminal moraines near modern ice margins could have formed during two separate advances. In the valley at Guys Bight, for example, terminal moraines are composed of an outer ridge in contact with an inner, more poorly vegetated ridge. The inner ridge appears to be of Neoglacial age and, from its more vegetated character, the outer one appears to be somewhat older. On southern Baffin Island Miller (1973) has described multicrested moraines that formed during the interval of 3200 to 65 BP. In contrast with northeastern Baffin Island, no evidence recorded on Bylot Island suggests a pre-Neoglacial native advance that was similar in extent to the Neoglacial advance.

Most glaciers on Bylot Island appear to be either stationary at, or retreating from, positions attained during the Neoglacial maximum. Based on examination of historical records, Falconer (1962) concluded that no marked variation had occurred in the positions of ice margins within the few decades prior to his study. Comparison of positions of modern glaciers with those recorded on aerial photographs from 1958, 1961, and 1982 indicates recent retreat by some glacier fronts of up to several hundred metres (e.g., Sermilik and glacier C78). No change is evident in many others (e.g., glaciers B7 and E13) (Fig. 22). On north-central Baffin Island, small ice caps are still retreating from Neoglacial maximum positions, and from study of aerial photographs and fieldwork, Falconer (1966) documented a retreat of Tiger Ice Cap initiated within the past 300 years. Fieldwork during the present study found marginal retreat of several hundreds of metres of that ice cap since Falconer's work. Several small ice caps in the same area, which are recorded on topographical maps, have melted completely since the early 1960s.

Sea level history

Pre-Eclipse

Of five periods of change in relative sea level recognized in the study area, the two oldest are of pre-Eclipse age. They are recognized only by stratigraphic and amino acid evidence and do not appear as surficial deposits. Near Salmon River, marine sediments associated with the oldest marine event extend to at least 10 m a.s.l. and are overlain by beds containing organic debris of interglacial character (see Salmon River section, Appendix 3). The sediments contain paired shells characterized by amino acid ratios of about 0.6 (AAL-1832) and carbonate rock detritus glacially derived from north-central Baffin Island. The marine unit demonstrates a period of higher relative sea level subsequent to a foreign glaciation affecting at least north-central Baffin Island (Baffin glaciation) and prior to a period of interglacial conditions (Salmon River interglaciation). Based on amino acid ratios and, in part, on a stratigraphic position beneath a buried soil, correlative pre-interglacial marine units may be represented in Northwest Coast section II, Cache Creek section, and Oliver Sound section II, which all include marine sediments containing in situ shells having amino acid ratios of about 0.55 to 0.75 (AAL-1474, 1705, 2466). At Cache Creek and Oliver Sound, the marine sediments have been weathered.

Near Tay Bay and Button Point, marine shells and shell fragments, thought to be contemporaneous with enclosing sediments, have amino acid ratios of about 0.35 to 0.40 (AAL-924, 1831). The sediments may document a period of higher relative sea level that occurred prior to Eclipse glaciation and that could be related to a period of glacioisostatic depression resulting from a glaciation not recognized here.

Eclipse

The oldest nonglaciated marine deposits represented by surficial deposits and landforms are named Eclipse and are interpreted to result from glacial isostatic depression associated with Eclipse glaciation. The age of Eclipse marine sediments is based on amino acid and radiocarbon analysis of shells from sections at Canada Point, Pond Inlet townsite, and Janes Creek (Appendix 3). None of the marine sediments and landforms appear to have been glaciated (Fig. 14, 38), and the oldest in situ marine shells within them have amino acid ratios between 0.22 and 0.38 (Table 2.4, Appendix 2). Radiocarbon analysis indicates shell ages between at least 27 000 and 43 000 years BP (Table 1.2, Appendix 1). Thus, Eclipse marine sediments are considered to be more than 43 000 years old.

On the southern lowland of Bylot Island, Eclipse marine sediments form surficial deposits between the limits of Holocene submergence (35 to 40 m a.s.l.) and about 90 m a.s.l. Eclipse marine landforms, which include deltas and broad beaches, are geomorphologically subdued and are well vegetated in comparison with younger marine deposits (Holocene) at lower elevations. As a result of steep coastlines and active colluviation, Eclipse marine landforms are traced neither northward along Navy Board Inlet nor eastward along Pond Inlet. No marine sediments of Eclipse age are known on the northern or northeastern coasts.

Button

Button marine sediments are younger than Eclipse marine sediments and were deposited during submergence following Button glaciation. Based on amino acid ratios of 0.12 to 0.18 for in situ shells, Button marine sediments occur at Canada Point, Button Point, Navy Board Inlet, and Maud Bight (Table 2.6, Appendix 2). The extent and elevation of Button marine sediments and landforms in surficial deposits is unclear. On southern Bylot Island they may be nearly coincident with the extent of marine deposits of Holocene age or, alternatively, with Eclipse marine sediments to greater overall elevation. In contrast, on northern Bylot Island Button marine sediments form surficial marine deposits that extend from the modern coast to about 30 to 35 m a.s.l.

Holocene

Marine sediments of Holocene age, identified by radiocarbon analysis (Table 1.1, Appendix 1), form surficial deposits both on Bylot Island, adjacent to Eclipse Sound, and on northern Baffin Island. No raised Holocene marine sediments are known on northern Bylot Island. Holocene marine landforms are well defined and include flights of raised beaches, bars and spits, and deltaic deposits that are commonly poorly vegetated. Estimates of Holocene marine limits vary, but elevations generally increase from north to south. During Holocene time, marine emergence has been about 30 to 35 m in the areas of Button Point and Canada Point, 40 to 45 m on the southwestern Bylot lowlands, 50 to 60 m near Pond Inlet townsite, 80 m at Cape Hatt, and 100 m at the southern end of Milne Inlet. Additional records of marine emergence on northern Baffin Island are given by Falconer et al. (1965) and Hodgson and Haselton (1974). The general character of emergence is similar to that portrayed by Miller and Dyke (1974) and indicates a northeastward tilt to marine isobase patterns across northeastern Baffin and Bylot islands.

An absence of raised Holocene marine sediments and the drowned appearance of estuaries indicates that the northern coast of Bylot Island is still submerging and that it may not have been an emergent coast during Holocene time (Fig. 30). Based on archeological studies and wave erosion of archeological sites, the southern Bylot coast may recently have begun submerging (G.M. Rousillaire, personal communication, 1978).

Nonglacial periods

Throughout the study area, buried organic materials and soils representative of nonglacial periods occur within stratigraphic sections. Nonglacial periods are characterized by paleoclimatic conditions that were either similar to or warmer than present conditions, and by native glaciers that were likely no more extensive than at present. The term "interglacial" is used here either if analysis of plant and insect fossils indicates a paleoenvironment that was significantly warmer than present or if there is evidence of well developed soil weathering, or both. Soil development is described by qualitative criteria that include; 1) the thickness and extent of oxidation, 2) the thickness and extent of organic-rich horizons, and 3) the weathering of clasts. Amino acid analysis indicates that one interglacial period and two nonglacial periods can be distinguished.

Salmon River interglaciation

Interglacial deposits occur at Salmon River, Cache Creek, and Aktineq Creek sections. Sections containing well developed buried soils, although lacking organic material, also occur at Cape Graham Moore and Oliver Sound. Except at Cache Creek section, foreign carbonate detritus found in sediments stratigraphically beneath the interglacial soils demonstrates a pre-interglacial foreign glacial event (Baffin glaciation). At Cache Creek, a single fragment of quartz sandstone was found that may be foreign and could represent the same glacial event.

As the simplest interpretation, and in the absence of evidence to the contrary, interglacial fossils and advanced soil development are all considered to represent one interglacial period, named here Salmon River interglaciation, after Salmon River section where the evidence of interglacial conditions is best developed. Amino acid ratios of in situ shells within marine sediments stratigraphically beneath the interglacial horizons are similar, ranging between 0.6 and 0.8 (AAL-1705, 1832, 2466), and support that interpretation.

Interglacial deposits in the eastern Arctic have also been reported on north-central Baffin Island (Flitaway Interglaciation; Andrews, 1968), east-central Baffin Island (Cape Christian Interglaciation; Miller et al., 1977), and Ellesmere Island (Blake, 1974), and in the central Arctic on Somerset Island (Dyke, 1983). Amino acid ratios of shells associated with Cape Christian Interglaciation are about 0.6, and soil weathering and paleoclimatic descriptions offered by Miller et al. (1977) suggest a correlation between Salmon River and Cape Christian interglacial periods. Cape Christian Interglaciation could be about 300 000 to 400 000 BP, by use of amino acid raceimization kinetics (Szabo et al., 1981), and as such it may not represent the Sangamon Interglaciation.

Pond Inlet and Sermilik nonglacial periods

Buried organic materials occur in several sections (Appendix 4). In some cases either limited sample size, or the fine grained character of the organic debris has limited paleoclimatic interpretations. Amino acid-based stratigraphy, however, indicates that two nonglacial events (at least) may be represented, including an event preceding Eclipse glaciation, named here Pond Inlet nonglacial period, and one preceding Button glaciation, named here Sermilik nonglacial period.

Pond Inlet nonglacial period is represented by raised marine sediments of post interglacial and pre-Eclipse age at Button Point (Button Point section II), Canada Point (Canada Point section II), and Janes Creek (Janes Creek section III).

At two sites, located at Aktineq Creek (Aktineq Creek section I) and at Sermilik Glacier (Sermilik Glacier section, Ia), there is limited stratigraphic evidence of Sermilik nonglacial period. At both sites an organic-bearing zone lies between an underlying foreign drift containing shells with amino acid ratios of about 0.3 (AAL-1392, 2463) (Eclipse glaciation), and an overlying foreign drift, which at Sermilik Glacier contains shells having ratios of 0.18 (AAL-2464) (Button glaciation).

Regional correlations

The principal basis for regional correlations of glacial events within the eastern Arctic includes comparison of the relative extent of ice and of amino acid-based relative ages. Because ice crossing Baffin Island was fed by an ice sheet in Foxe Basin, the comparative extent of ice within the large inlets transecting Davis Highlands and leading to the Baffin Shelf is considered as a basis for correlating glacial events along the eastern and northern Baffin Coast. The general sequence of successively smaller foreign glacial events, as reported

here, has been described elsewhere in the eastern Arctic by Miller et al. (1977), Andrews and Barry (1978), and England and Bradley (1978), and to the south in northern Labrador by Ives (1978). Quaternary correlations in arctic Canada have been described by Andrews et al. (1984), Andrews and Miller (1984), and Miller (1985).

On Baffin Island, the last glaciation, named Foxe Glaciation by Miller et al. (1977), has been redefined by Andrews and Miller (1984) to relate to glacial events of the last major continental glaciation of Baffin Island and to be the equivalent of Wisconsinan Glaciation. On east-central Baffin Island, an early glacial event named Ayr Lake stade is associated with deposition of the Kogalu Member of the Clyde Foreland Formation during the maximum of Foxe Glaciation. During Ayr Lake stade, ice fed by an ice sheet located over Foxe Basin extended into, and fully occupied, the major inlets of eastern Baffin Island, crossing to the outer shelf margin of Baffin Bay or forming a major system of moraines that extend to the outer coast. Glacial sediments associated with Ayr Lake stade contain detrital shell fragments having amino acid ratios of about 0.3, and are overlain by marine sediments containing shells with amino acid ratios of about 0.25 (Miller et al., 1977). From similarities both in ice extent and in amino acid-based stratigraphy, Eclipse glaciation can be correlated with Ayr Lake stade of Foxe Glaciation.

On central and southern Baffin Island, limited evidence suggests a glacial event of intermediate magnitude subsequent to Ayr Lake stade during which a foreign ice sheet may have extended to mid-fiord positions. This event, which is younger and of lesser magnitude than Ayr Lake stade and Eclipse glaciation, would appear to correlate with Button glaciation. It is tentatively associated with glacial activity interpreted by Andrews et al. (1984) to have affected some parts of eastern Baffin Island between 80 000 and before 40 000 BP.

Cape Hatt glaciation appears generally to correlate with the Late Wisconsinan glacial maximum, the Baffinland stade of Andrews and Ives (1978), which has been reported on southern Baffin Island between 11 000 and 10 000 BP by Miller (1980). On Bylot Island, however, the oldest radiocarbon date that can be directly associated with an ice margin of Cape Hatt glaciation is about 9500 BP.

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APPENDIX 1

Details of radiocarbon dates

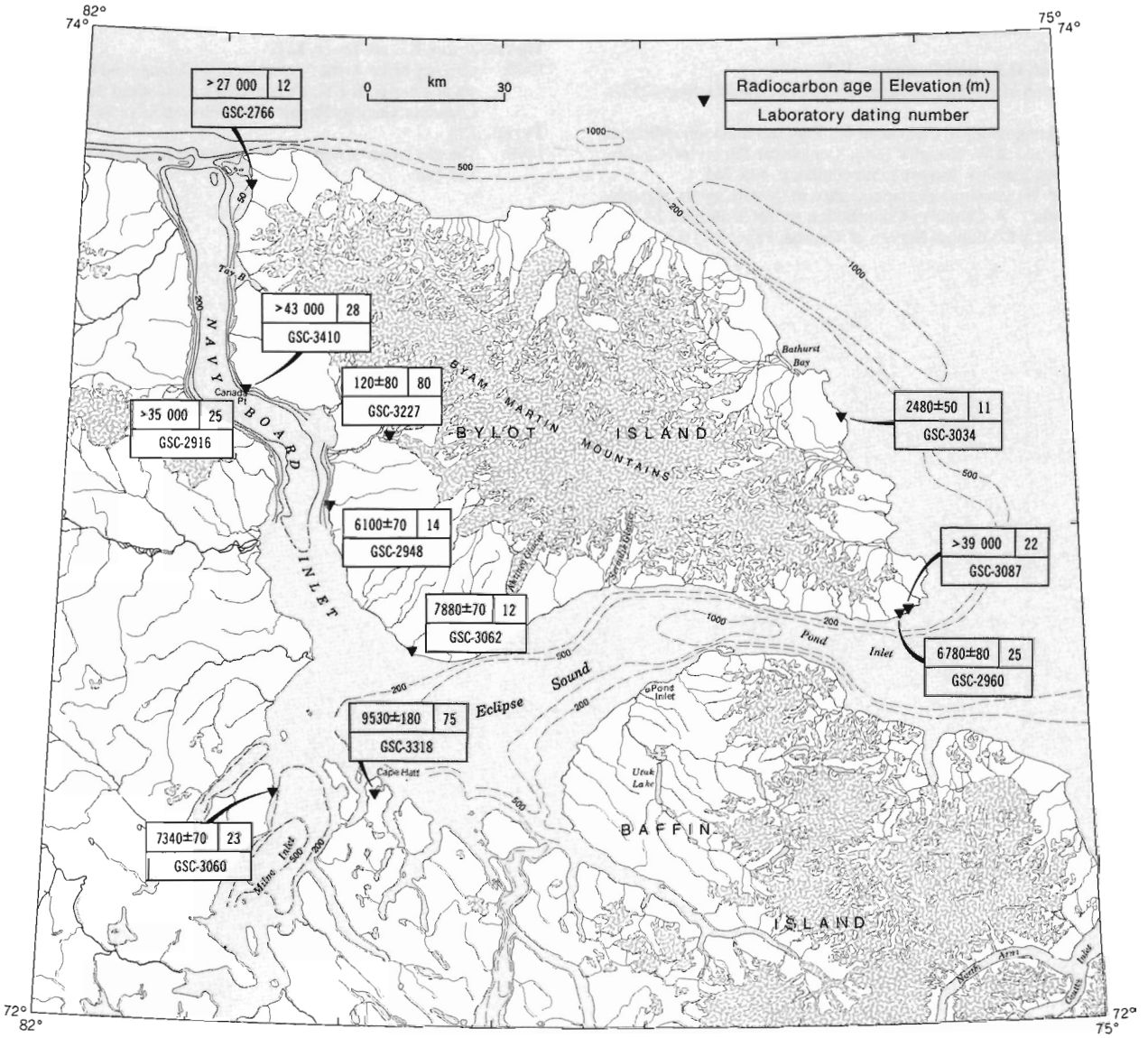

Figure 1.1. Sites of radiocarbon-dated samples. (see Table 1.1)

Table 1.1 Summary of radiocarbon dates of Holocene age.

Radiocarbon age	Lab. no.	Sample no.	Collection site	Elevation m a.s.l.	Location Lat.	Location Long.	Material Dated	Comments
6100 ± 70 (uncorrected)	GSC-2948	78KY3	Eclipse Sound section II	14	73°02'	80°09'	organic plant material	Basal organic mat from sequence of inter-bedded eolian sand and organic matter. Sequence caps marine sediments of crossbedded coarse sand and mud containing outsized clasts.
6780 ± 80 (uncorrected)	GSC-2960	78KY25	Button Point area	~25	72°49.9'	76°13.0'	organic plant material	Organic debris in beds within deltaic deposit of coarse sand and gravel graded to ~31 m a.s.l.. Although organic debris was terrestrial, deltaic deposit is interpreted as marine. Radiocarbon age is considered as estimate of minimum amount of Holocene emergence (See Report 4.1, Appendix 4).
2480 ± 50 (uncorrected)	GSC-3034	79KY529	Northeast Coast Section III	~11	73°13.8'	76°36'	organic plant material	Detrital organic material enclosed as bed within foreign drift (colluvial). (see Report 9, Appendix 3).
7340 ± 70 $\delta^{13}C$ = +2.4‰	GSC-3060	79KY1099	Northwest coast of Milne Inlet, Baffin Is.	23	72°27.5'	80°30.5'	marine shells	Intact, fragile shells of *Hiatella arctica* collected from coarse muddy gravel crossbeds forming part of delta graded to ~70 m a.s.l. Date is minimum estimate of deglaciation of Milne Inlet and indicates Holocene emergence of >70 m.
7880 ± 70 $\delta^{13}C$ = +1.5‰	GSC-3062	78KY20	Eclipse Sound section IV	~12	72°45.4'	79°34'	marine shells	Intact valves, some paired of *Mya truncata* collected from dark gray mud. Date is minimum estimate of deglaciation of Eclipse Sound and indicates Holocene emergence of >12 m. Other shell species present include *Hiatella arctica*, *serripes groenlandica*, and *clinocardium ciliatum*.
120 ± 80 $\delta^{13}C$ = -29.0‰	GSC-3227	79KY357	Neoglacial moraine – glacier C79	80(?)	73°11.9'	76°46.5'	wood	Twigs (*Salix*) collected from buried soil within a thrust plate forming part of Neoglacial moraine of glacier C79. Maximum extent of ice during Neoglacial time occurred subsequent to growth of twigs (see Report 4.2, Appendix 4).
9530 ± 180 $\delta^{13}C$ = +1.4‰	GSC-3318	81KY49 81KY69	Cape Hatt, Milne Inlet	75	72°27.0'	74°49.0'	marine shells	Intact paired valves of *Hiatella arctica* collected from muddy gravel forming an ice contact marine delta graded to ~80 m a.s.l. Shells are contemporaneous with enclosing sediments and date a position (maximum?) of Laurentide Ice Sheet lmargin during Late Wisconsinan/ Holocene time.

Table 1.2 Summary of 'old' radiocarbon dates.

Radiocarbon age (years BP)	Lab. no.	Sample no.	Collection site	Elevation m a.s.l.	Location Lat.	Location Long.	Material dated	Comments
>27 000 $\delta^{13}C$ = +1.3‰	GSC-2766	78KY09-07-78 (78KY100)	Northwest coast	12	73°42'	80°47'	marine shells	Shells include intact and paired valves of *Hiatella arctica* collected from gray marine mud. Unit has well defined upper contact, and is overlain by coarsening upward sequence of muddy sand and sand (see AAL-2627; Button marine sediments).
>35 000 (uncorrected)	GSC-2916	78KY2	Canada Point section I	~25	73°16.5'	80°45'	marine shells	Intact, paired valves of *Mya truncata* well preserved and collected in their position of growth from gravelly, muddy sand. Shells contemporaneous with enclosing sediments, and form "lower collection" associated with higher relative sea level following Eclipse glaciation.
>39 000 $\delta^{13}C$ = +2‰	GSC-3087	78KY03-08-78	Button Point section IV	~22	72°50.1'	76°11.3'	marine shells	Shell fragments, many withperiostracum intact, or nearly so, and some with internal lustre collected from pebbly mud (marine sediment? foreign drift?) (see AAL-932, -1639). Unit underlies surficial deposits of foreign drift.
>43 000 OF) (uncorrected) (>42 000 (IF) $\delta^{13}C$ = +0.8‰	GSC-3410	81KY95	Canada Point section I	~28	73°16.5'	80°45'	marine shells	Intact, paired valves of *Mya truncata* with periostracum and siphon sheath. Shells were collected in their position of growth within a deltaic deposit and are contemporaneous with enclosing sediments. The deposit does not appear glaciated and postdates Eclipse glaciation. Delta complex may have formed during two periods of change in relative sea level. Shells form the "upper collection." Amino acid ratios are about 0.15 (AAL-2623) (see also GSC-2916; AAL-1218). (OF = outside fraction; IF = inside fraction)

APPENDIX 2

Details of amino acid analysis

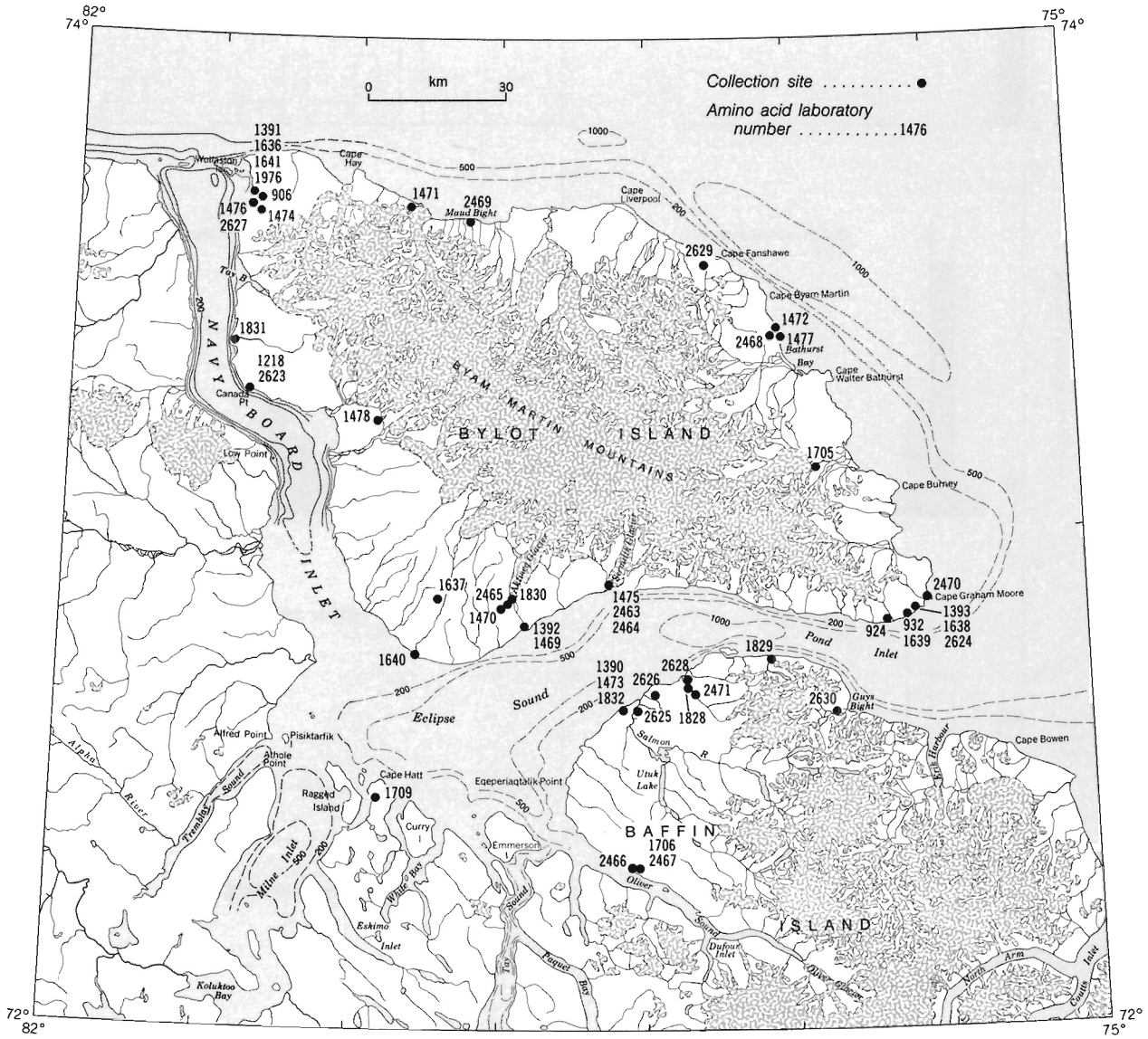

Figure 2.1. Location of samples for amino acid analysis.

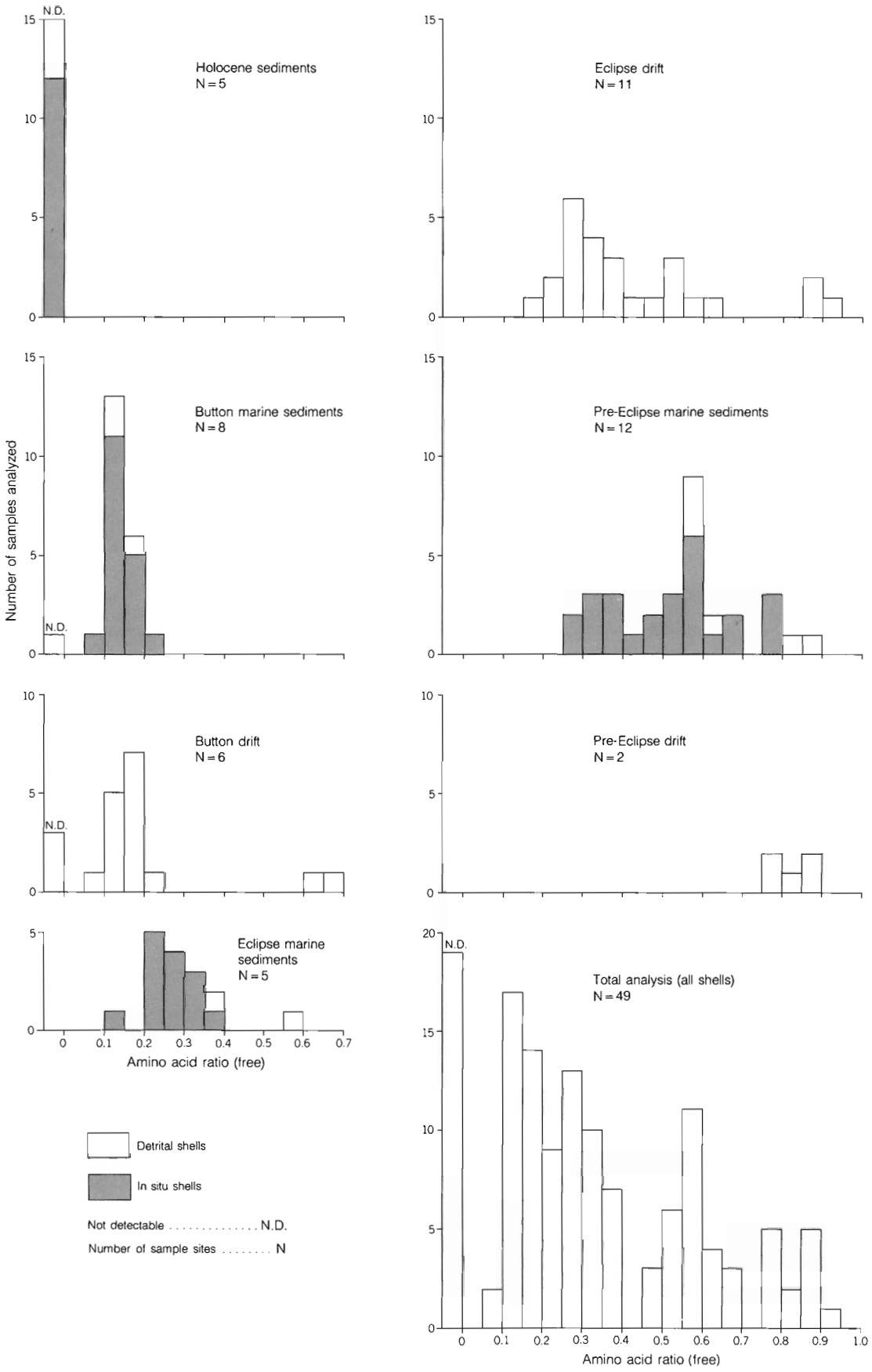

Figure 2.2. Histograms of amino acid ratios for detrital shells,in situ shells, and all data combined.

Table 2.1-2.7. Amino acid analyses.

Lab. no.[1]	Sample no.	Collection Site	Elevation m a.s.l.	Shell Species[2]	Amino acid ratios Free[3]	Total[4]	Comments
2.1 Amino acid ratios associated with pre-Eclipse drift							
1478	78BP264	Southern Bylot lowland	460	H.a.(?)	0.86 0.81	0.183 0.169	Small fragments from thin (< 1 m) patch of foreign drift overlying bedrock, site lies inland of estimated limits of Eclipse drift.
2465	81KY136	Aktineq Creek section IIb	~115	? H.a. H.a.	0.86 0.76 0.75	0.180 0.190 0.210	Shell fragments from thin (< 0.5 m) gravel unit beneath foreign drift. Gravel contains polished, striated, foreign erratics; crossbedding indicates water flow inland towards mountains suggestive of deposition in front of foreign ice in Eclipse Sound. Site located 200 m in front of Neoglacial moraine.
2.2 Amino acid and ratios associated with pre-Eclipse marine sediments.							
924	78KY27-07	Button Point section II	~7	M.t. M.t. M.t.	0.40 0.38 0.34	<0.040 0.057 0.066	Intact, paired valves contemporaneous with enclosing sediments. Other species include *Hiatella arctica, Serippes* sp., and a gastropod. Marine unit directly overlies a weathered horizon (soil).
1390	79KY304	Salmon River section	~3	?	0.42 0.43 0.51	0.044 0.051 0.045	Intact, paired valves contemporaneous with enclosing sediments. Species is *Macoma calcarea*, and ratios are not directly comparable with those of H.a. and M.t. Marine unit characterized by large-scale tabular crossbeds and underlies buried organic beds (interglacial) (see also AAL-1832).
1391	79KY385	Northwest coast section I	~4	?	0.60 0.55 0.55	0.077 0.064 0.070	Shell fragments from massive gray silt at base of section.
1393	78KY11	Button Point section IV	~8	M.t.(?)	0.30 0.26 0.26	0.024 0.022 0.020	Intact valves within coarse sand lying beneath foreign drift (Eclipse drift?) (see also AAL-1638; Eclipse marine sediments). Shells are contemporaneous with enclosing sediments.
1474	79KY427	Northwest coast section II	~80	H.a. H.a. H.a.	0.55 0.56 0.56	0.061 0.054 0.063	Intact, thin valves from clayey mud at section base. Shells considered contemporaneous with enclosing sediments.
1476	79KY1143	Northwest coast section I	~8	H.a. H.a. H.a.	0.50 0.49 0.45	0.064 0.061 0.069	Intact shells and shell fragments within sandy, crudely bedded sediments; sample from bed near upper contact (see AAL-1636).
1636	79KY1142	Northwest coast section I	~8	M.t. M.t. M.t.	0.54 0.56 0.51	0.140 0.150 0.150	Shell fragments and intact valves (see AAL-1476).
1705	79KY276	Cache Creek section	~30	H.a. H.a. H.a.	0.76 0.75 0.77	0.380 0.360 0.410	Well preserved, fragile valves contemporaneous with enclosing coarse sand sediments. Marine unit is weathered and capped by buried organic beds ("interglacial"). Section lies within 500 m of glacier E67.

Lab. no.[1]	Sample no.	Collection Site	Elevation m a.s.l.	Shell Species[2]	Amino acid ratios Free[3]	Total[4]	Comments
1706	79KY155	Oliver Sound section I	44	M.(sp.) M.(sp.)	0.87 0.83	0.350 0.290	Shell fragments from gray mud.
1831	78KY23	Canada Point section II		H.a. H.a. H.a.	0.37 0.37 0.32	0.060 0.066 0.047	Intact valves within muddy sand at base of deltaic complex. Shells contemporaneous with enclosing sediments and associated with barnacles and bryophytes. Marine unit overlies muddy, poorly sorted sediment containing numerous outsized clasts (prodelta slump?).
1832	79KY303	Salmon River section	~3	M.t. M.t. M.t.	0.59 0.59 0.60	0.160 0.170 0.160	Paired valves contemporaneous with enclosing sediments. Marine unit characterized by large-scale tabular crossbeds, and underlies buried organic beds ("interglacial") (see also AAL-1390).
2466	81KY44	Oliver Sound section II	23	M.t. M.t. M.t.	0.58 0.58 0.65	0.150 0.250 0.230	Intact shells and shell fragments, contemporaneous with enclosing sediments. Marine unit overlies mud containing abundant erratics of carbonate sedimentary rock. Overlying unit has upper contact characterized by soil weathering.
2.3. Amino acid ratios associated with Eclipse drift.							
1392	79KY97	Aktineq Creek section I	11	?	0.39	0.069	Small shell fragment collected from foreign drift characterized by highly polished, striated erratics.
1470	79KY163	Aktineq Glacier area	~230	H.a. H.a. M.t. M.t.	0.41 0.50 0.37 0.50	0.036 0.081 0.037 0.074	Small detrital shell fragments collected from ice contact stratified drift forming a ridge. Deposition occurred against Aktineq Glacier during Aktineq phase of Eclipse glaciation. Stratified drift contains abundant foreign erratics.
1471	79KY346	Northern coast: Cape Hay area	300	H.a.?	0.30	0.057	Small shell fragment found within foreign drift (Eclipse drift).
1475	79KY1094	Sermilik Glacier section Ia	70-75	M.t.? M.t.?	0.29 0.30	0.081 0.026	Small shell fragments within foreign drift (Eclipse drift) near base of section.
1637	79KY201	Southern Bylot lowland	163	H.a. H.a. H.a.	0.86 0.91 0.89	0.140, 0.330 0.290 0.170	Intact, robust valves in surficial deposits of proglacial stratified drift. Shells are considered much older than Eclipse glaciation. Ratios are similar to those found in pre-Eclipse drift on the southern lowland (see AAL-1478).
1828	79KY183	Janes Creek section II	47	H.a.? H.a.? H.a.?	0.58 – –	0.220, 0.200 0.076 0.085	Small shell fragments within muddy beds near base of ice contact delta graded to ~72 m a.s.l. Ratios indicate population of mixed ages.
1829	79KY262	Pond Inlet section	80	H.a.? H.a.? ?	0.33 0.31 0.36	0.057 – 0.089	Small shell fragments within coarse sand and gravel at base of ice contact stratified drift complex extending to 230 m a.s.l., formed at margin of foreign glacier in Pond Inlet during Eclipse glaciation.

Lab. no.[1]	Sample no.	Collection Site	Elevation m a.s.l.	Shell Species[2]	Amino acid ratios Free[3]	Total[4]	Comments
2630	81KY67	Guys Bight section	100-110	? H.a.? H.a.?	0.26 0.49 0.50	0.083 0.109 0.101	Small shell fragments from massive pebbly muds 32 m thick. Muds are glacial lake deposits formed during Eclipse glaciation. Section lies within 0.5 km of modern glacier, and has not been glaciated.
2463	81KY23	Sermilik Glacier section Ia	70-75	H.a. H.a.? M.t.?	0.29 0.29 0.29	0.067 0.051 0.065	Small shell fragments from Eclipse drift near base of section. Shells overlain by organic beds.
2468	81KY53	Cape Fanshawe-Bathurst Bay area	~375	H.a. H.a. H.a.	0.15 0.22 0.21	0.042 0.037 0.050 ±	Small shell fragments from Eclipse Moraine lying at top of coastal cliffs. Ratios indicate an age younger than estimated for Eclipse glaciation and their interpretation is problematic. Shells are assumed to be older than indicated by the ratios.
2.4 Amino acid ratios associated with Eclipse marine sediments.							
1218	78KY02	Canada Point section I	~25	M.t. M.t. M.t. M.t.	0.23, 0.26 0.13 0.24 0.22	0.022 0.016 0.030 0.020	Intact, paired valves within gravelly, muddy sand bed. Shells form "lower collection" and occur within Eclipse marine sediments deposited following Eclipse glaciation. Shells contemporaneous with enclosing sediments (>35 000 BP, GSC-2916). Ratios of 0.13 are associated with shells of "upper collection" from an overlying bed.
1473	79KY416	Salmon River section	~13	H.a.? H.a.?	0.36 0.58	0.060 0.118	Detrital shell fragments within gray, poorly stratified mud interpreted as Eclipse marine sediment. Variation in amino acid ratios indicates shell population of mixed ages.
1638	78KY22	Button Point section IV	~12	H.a. H.a. H.a.	0.25 0.23 0.24	0.055 0.054 0.044	Intact valves contemporaneous with enclosing coarse sand. Unit overlies foreign drift (Eclipse) (see AAL-1393; pre-Eclipse marine sediments).
2626	81KY100	Pond Inlet airstrip	60-65	M.t. M.t. M.t.	0.32 0.29 0.38	0.059 0.035 0.053	Large, angular shell fragments from coarse sand and muddy sand capping deltaic sequence at townsite. Shells not abraded and retain part of periostracum. Although only fragments found, they are considered contemporaneous with enclosing sediments.
2471	81KY71	Janes Creek section III	~46	M.t. M.t. M.t.	0.30 0.25 0.32	0.035 — 0.038	Intact valves, well preserved within muddy sand and considered contemporaneous with enclosing sediments. Shells formed subsequent to Eclipse glaciation.
2.5 Amino acid ratios associated with Button drift.							
906	78KY09-09-78 Site 2	Northwest coast area	~100	H.a. H.a. H.a.	0.14,0.14 0.15 0.14	0.016, 0.018 0.017 0.024, 0.024	Intact, robust valves and fragments, collected at surface of moraine ridge, ~1 km inland.
1469	79KY84	Aktineq Creek section I	18	H.a. H.a.	0.25 0.62	0.028 -	Small shell fragments collected from foreign drift. Fragments found within 1 m of upper contact. Amino acid ratios indicate fragments are of different ages. Enclosing sediments associated with Aktineq phase of Eclipse glaciation.

Lab. no.[1]	Sample no.	Collection Site	Elevation m a.s.l.	Shell Species[2]	Amino acid ratios Free[3]	Total[4]	Comments
1472	79KY395	Northeast coast section I	~13	H.a. H.a. H.a.	0.12 0.67 0.60	0.023 0.063 0.072	Shell fragments from discontinuous bed of sorted coarse sand within foreign drift. Range of amino acid ratios indicates population of mixed ages.
1641	79KY367	Northwest coast section I	~12	H.a. H.a. H.a.	N.D.[7] N.D. N.D.	0.021 0.020 0.018	Intact valves and shell fragments from foreign drift. Amino acid ratios are similar to those of Holocene shells.
1830	79KY493	Aktineq Creek section IIc	110-120	H.a.? H.a. M.t.?	0.18 0.23 0.13	0.022 0.025 0.023	Small shell fragments from foreign drift overlain by Neoglacial moraine of Aktineq Glacier.
2464	81KY24	Sermilik Glacier section Ia	~120	H.a. H.a. H.a.	0.15 0.18 0.18	0.041 0.037 0.060	Shell fragments from coarse sand and gravel complex (ice-contact stratified drift) graded to ~135 m a.s.l. Unit contains foreign debris, particularly near its base.
2629	81KY59	Northeast coast: Cape Fanshawe	60	H.a.? H.a.? H.a.?	0.05 ± 0.18 0.18	0.038 0.046 0.045	Small shell fragments collected at surface of foreign drift.
2.6. Amino acid ratios associated with Button marine sediments.							
932	78KY 03-08-78	Button Point section IV	22	H.a. H.a. H.a.	0.18, 0.20 0.13 0.10	0.017 0.017 0.020	Shell fragments in dark gray, pebbly mud underlying foreign drift at surface. Shells contemporaneous with enclosing sediments.
1639	78KY 03-08-78	Button Point section IV	22	M.t.	0.09 0.12 0.13	0.024 0.028 0.027	
1477	78BI129	Northeast coast section II	~8	H.a. H.a. H.a.	0.18 0.13 0.14	0.020 0.017 0.019	Detrital shell fragments from coarse sand (nearshore marine sediments).
2623	81KY40	Canada Point section I	~28	M.t. M.t. M.t.	0.15 0.15 0.21	0.023 0.027 0.026	Intact, paired valves with periostracum and siphon sheath. Shells, collected in position of growth, are contemporaneous with enclosing sediments. They form "upper collection" associated with period of higher relative sea level subsequent to Eclipse glaciation (>43 000 BP, GSC-3410).
2624	81KY75	Button Point section V	20-24	M.t. H.a. H.a.	0.14 0.17 0.14	0.027 0.035 0.023	Intact valves from dark gray pebbly mud. Shells contemporaneous with enclosing sediments. Unit underlies foreign drift forming surficial deposits.
2627	78KY100	Northwest Coast section I	12	H.a. H.a. H.a.	0.10 N.D.[5] 0.10	0.018 0.021 0.020	Intact values, some paired from gray marine mud. Unit has well defined (disconformable?) upper contact, overlain by coarsening upward sequence of muddy sand and gravel (>27 000 BP, GSC-2766).
2469	81KY55	Northern coast: Maud Bight	30-32	M.t. M.t. M.t.	0.15 0.18 0.12	0.029 0.026 0.021	Intact, paired valves from coarse sandy gravel forming raised beach deposit. Shells contemporaneous with enclosing sediments. Marine sediments apparently unglaciated may extend to ~60 m a.s.l.

Lab. no.[1]	Sample no.	Collection Site	Elevation m a.s.l.	Shell Species[2]	Amino acid ratios Free[3]	Total[4]	Comments
2470	81KY63	Cape Graham Moore section	~27	M.t. H.a. H.a.	0.15 0.14 0.10	0.034 0.031 0.031	Intact and paired valves near base of muddy sand and sandy gravel sequence capped by outwash. Marine unit overlies buried organic matter and weathered foreign drift.
2.7. Amino acid ratios associated with Holocene sediments.							
1640	78KY20	Eclipse Sound section	11	H.a. H.a. H.a.	N.D.[5] N.D. N.D.	0.019 0.018 0.016	Intact, paired valves from dark gray mud. Shells contemporaneous with enclosing sediments (7880 ± 70 BP, GSC-3062).
1709	80KY1	Delta at Cape Hatt	75	H.a. H.a. H.a.	N.D. N.D. N.D.	0.028 0.029 0.027	Shell fragments from coarse muddy gravel forming ice contact marine delta at entrance to Milne Inlet, Baffin Island. Shells contemporaneous with enclosing sediments (9530 ± 180, GSC-3318).
2467	81KY45	Oliver Sound section II	34	M.t. M.t. M.t.	N.D. N.D. N.D.	0.018 0.019 0.017	Intact valves, some paired within muddy sand. Shells contemporaneous with enclosing sediments.
2625	81KY68	Salmon River area	20-22	M.t. M.t. M.t.	N.D. N.D. N.D.	0.012 0.009 ± 0.016	Paired valves contemporaneous with enclosing sediments. From sandy mud that coarsens upward to sand and sandy gravel; forms part of deltaic landform graded to 25 m a.s.l.
2628	81KY70	Janes Creek section I	23	M.t. M.t. M.t.	N.D. N.D. N.D.	N.D. N.D. 0.013	Intact valves from mud that coarsens upwards into sand and sandy gravel and forms part of terrace graded to 32 m a.s.l. Shells contemporaneous with enclosing sediments.

[1] Amino acid laboratory (AAL) number; INSTAAR, University of Colorado.
[2] H.a. = *Hiatella arctica.*
M.t. = *Mya truncata.*
[3,4] Ratio of D-Alloisoleucine to L-Isoleucine:
[3] Free:: ratio based on naturally hydrolyzed fraction
[4] Total: ratio based on free and peptide bound fraction
[5] N.D. Not Detectable

APPENDIX 3

Description of stratigraphic sections

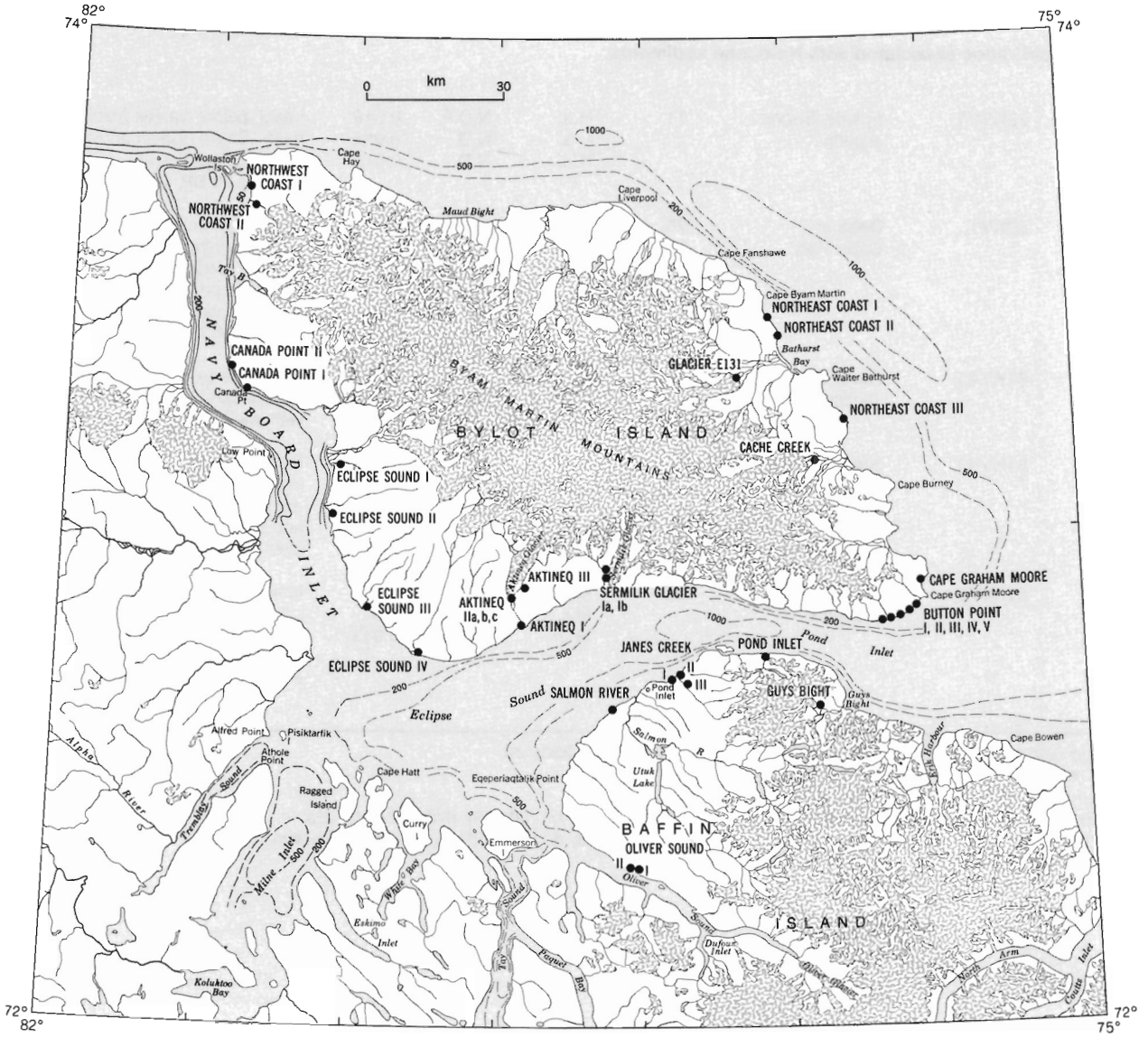

Figure 3.1. Location of stratigraphic sections.

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Northeast coast section I

Coastal section exposed between Bathurst Bay and Cape Fanshawe on northeastern Bylot Island; 73°26.9'N, 77°5.1'W. Elevation of section top 15 m a.s.l. (Fig. 3.2).

Unit	Description	Thickness (m)
A Colluvium	Grey to brown-grey sandy mud to muddy sand; lower portion contains outsized clasts, some rounded; bedded; contains discontinuous 10 cm wide bed of coarse sand.	0.8
B (Debris flow?)	Grey-brown sandy mud diamicton (Ba); well compacted; contains large deformed inclusions of bedded, sorted coarse sand. Upper contact is well defined.	1.2
	Brown, fine to medium grained sand (Bb), 0.2 m thick; lies along lower contact and intrudes into overlying unit around intraformational sand bodies; upper contact is well defined.	
C Foreign drift (Button)	Grey mud to sandy mud diamicton, containing fragments of marine shells, and discontinuous beds and lenses of bedded coarse sand and sandy gravel; foreign rock debris, including fossiliferous sedimentary rock, is common; shell fragments, collected from discontinuous gravel bed at ~12 m a.s.l., have amino acid ratios of 0.12 and 0.65 (AAL-1472). Upper contact is well defined.	
	Bed of pebbly sand (Cb) ~ 0.5 m thick marks apparent separation between overlying grey drift (Ca) and underlying grey-brown drift (Cc).	<1 to 5
D Ice	Massive ice, coarsely crystalline; contains minor (<0.5 cm) pockets of grey silt; isotopic ratios are -36.2 δO^{18}‰ and -266 δH^{2}‰, indicating ice could be of glacial origin; unit varies in thickness, and is discontinuous along strike.	8
E Glacial lake sediments	Grey, laminated mud to clayey mud; contains few outsized clasts and thin beds of muddy drift. Elsewhere, in nearby coastal sections, laminae are disrupted and broken.	2
Slump	Slump to modern beach.	3

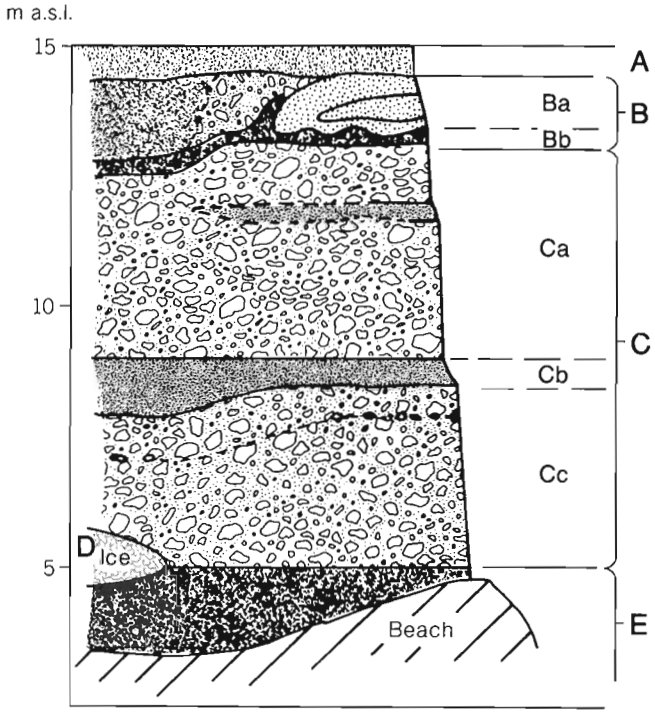

Figure 3.2. Schematic diagram of northeast coast section I.

Northeast coast section II

Coastal section located west of Bathurst Bay; 73°23.9′N, 77°00′W. It is developed in a coastal platform at the base of a bedrock cliff (Fig. 3.3) that is >100 m in height.

Unit		Description	Thickness (m)
A	Foreign drift(?) Rockfall(?)	Large, angular bouldery rubble forming surface litter; containing abundant foreign debris, including carbonate sedimentary rock, some containing macrofossils.	<0.5
B	Marine sediments (Button)	Well sorted, laminated to thin bedded coarse sand and pebble gravel (Ba), 1 m thick. Well sorted sand, coarse sand (Bb), 8 m thick, forming tabular crossbeds; marine shell fragments have amino acid ratios of 0.13 to 0.18 (AAL-1477).	9
C	Foreign drift (Button)	Grey to grey-brown mud diamicton; containing foreign rock debris; upper contact is well defined; unit varies laterally in thickness.	<0.5-4
D	Littoral marine sediments(?)	Boulders in matrix of coarse sand and pebble gravel; clasts are coarse (>10cm) and well rounded and do not include foreign erratics; unit pinches and swells from <0.2 to >4.5 m; upper contact well defined.	<0.2 to >4.5
E		Brown muddy sand diamicton not known to contain foreign debris.	<0.5
	Slump	Slump to modern beach.	4

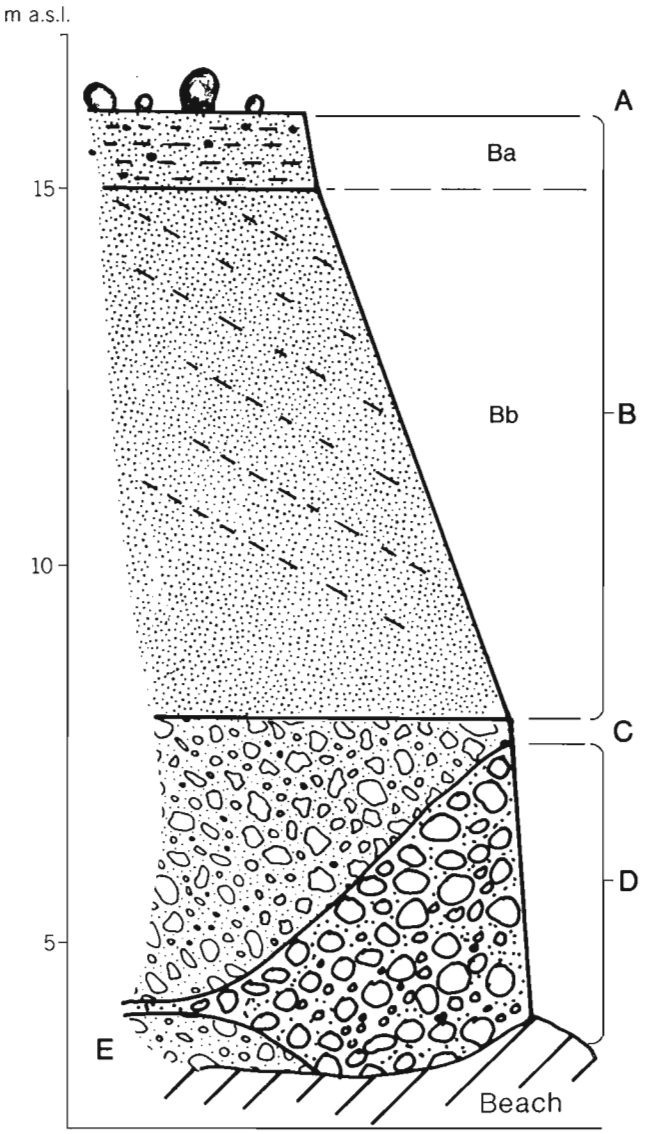

Figure 3.3. Schematic diagram of Northeast coast section II.

Northeast coast section III

Coastal section, developed within a moraine ridge behind the modern beach; 73°14.0'N, 76°40'W. Elevation of the section top (crest of the moraine ridge) 23 m a.s.l.

Unit	Description	Thickness (m)
A Foreign drift (Button)	Grey-brown sandy mud diamicton (Aa); contains angular foreign debris, including carbonate sedimentary rock. Unit caps the moranic ridge. Discontinuous bands of organic matter can occur at base. Loose brown sand (Ab) forms basal part of unit; internal laminae parallel sloping ridge surface.	<0.5
	This unit, and sediments derived from it by mass wasting, lie across valley floor. In a nearby coastal section, the sediments are ~1 m thick and contain bands of organic debris (see Report 4.9, Appendix 4), including detrital "balls" that date 2480 ± 50 BP ((GSC-3034), and provide a minimum age of the enclosing sediments.	
B Marine sediments (Littoral)	Well sorted, brown, fine to medium grained sand, grading downwards into grey silty sand. Horizontal beds 20-40 cm thick are truncated against the sloping contact with overlying drift.	1 to 2.5
C Foreign drift	Grey silty sand diamicton; upper contact is gradational. Unit, and those overlying, are interpreted to have been pushed up by foreign glacial to form the glacier moraine ridge.	0.5
D Marine sediments (Littoral)	Boulder conglomerate with coarse sand matrix. No foreign debris found within unit. Unit forms cliff faces in Quaternary sections along much of the north coast of Bylot Island.	2+
Slump	Slump to modern beach and sea level	9

Canada Point section I

A stream-cut section developed within a deltaic landform at Canada Point; 73°16.5'N, 80°45'W. Elevation of section top ~30 m a.s.l.

Unit	Description	Thickness (m)
Marine deltaic sediments	Small boulder gravel; composed predominantly of sedimentary rock derived from Proterozoic units on Bylot Island; little matrix material; surface forms a broad, seaward-sloping terrace.	2
	Bouldery sandy gravel, and poorly sorted gravelly sand forming 2 m thick beds having shallow seaward dip; sandy beds contain paired, well preserved marine shells of *Mya truncata*, many of which retain periostracum cover and have siphuncle sheaths attached. Radiocarbon age is >43 000 BP (GSC-3410), and amino acid ratios are 0.15 (AAL-2623).	4-6
	Coarse bouldery gravel and sandy gravel; forms large-scale topset and foreset beds; contains paired and single intact marine shells of *Mya truncata* in upper topset beds. Radiocarbon age is >35 000 BP; (GSC-2916, 3410) and amino acid ratios are ~0.23 (AAL-1218); unit forms "buttresses" standing as erosional remnants between gulleys.	~10
Slump	Slump to modern stream.	

Notes. The section, and that of Janes Creek section III, are key to the interpretation of the age of Eclipse glaciation. The deltaic deposit does not appear to have been glacially eroded since its formation nor does it contain stratigraphic evidence of glaciation. Consequently, the shells are interpreted to provide a minimum estimate of the age of Eclipse glaciation. Amino acid ratios suggest that the deltaic sediments could relate to two distinct ages of marine sedimentation; the lower shell collection defines Eclipse marine sediments, and the upper shell collection defines Button marine sediments.

Canada Point section II

A coastal section located about 2 km north of Canada Point and exposed along a stream downcutting a deltaic deposit; 73°23.6'N, 80°51'W. Elevation of section top ~22 m a.s.l.

Unit	Description	Thickness (m)
Marine sediments	Sandy, pebbly gravel; slight reddish hue in upper part caused by weathering; contains fragments of robust marine shells.	2
	Coarse boulders and coarse sand matrix; boulders are well rounded and closely packed; unit forms a near-vertical face in section; upper contact is well defined.	3
	Well sorted, brown, coarse sand contains thin muddy interbeds; forms part of deltaic sequence with topset, foreset, and bottomset beds. Tabular cross-beds are <1 cm to >1.5 m thick, and bedding planes are marked by detrital coal fragments. Bottomset beds are composed of muddy sand and contain a variety of well preserved marine fauna, incluing bryophytes, barnacles, and molluscs having amino acid ratios of ~0.36 (AAL-1831). Upper contact is well defined.	14
	Dark-grey pebbly, muddy sand; contains about 20% coarse, angular clasts; upper contact is well defined.	1
	Well sorted, coarse brown sand; contains numerous cobbles and small boulders.	1
Slump	Modern stream at ~2 m a.s.l.	0.5

Eclipse Sound section I

Stream cut section on southern Bylot Island about 2 km inland of the coast; 73°8.1'N, 80°4'W. Elevation of the section of the section top ~40 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Sand, silty sand, and organic matter; interbedded. Bedding is contorted within 1 m of section top, likely due to periglacial action.	2
Alluvial sediments	Pebbly sand, stratified; well defined upper contact.	0.5 to 1
Foreign drift	Sand and dark grey sandy mud, interbedded; sand beds have some graded bedding, some of which pinch out over short distances; contains foreign rock debris, including fossiliferous sedimentary rock; upper contact is well defined.	2
	Massive, dark grey mud diamicton grading upwards into sandy mud with sand interbeds; contains marine shells and shell fragments; upper contact marked by 10 cm thick bed of clayey mud.	6.5
Reworked bedrock	Poorly consolidated to non-consolidated sand similar to underlying bedrock and containing inclusions of shelly, dark grey mud.	1
Cretaceous-Tertiary bedrock	Sandstone, poorly consolidated.	4
	Stream at 24 m a.s.l.	

Eclipse Sound section II

Section located at the southwestern coast of Bylot Island; 73°02.0'N, 80°9'W. Elevation of the section top 13 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Sand and organic matter, interbedded; organic material collected from base formed 6300 ± 70 BP (GSC-2948)	1.5
Marine sediments	Well sorted and pebbly sand form single set of tabular crossbeds capped by topset beds; upper contact well defined.	1.5
	Dark grey, sand mud; contains some (<5%) outsized pebbles and boulders, and shell debris; upper contact well defined.	4.5
	Brown, coarse sand, interbedded with fine- to medium-grained, dark brown to dark grey sandy silt; bedding undulatory.	1
	Modern beach.	

Eclipse Sound section III

Coastal section located on Bylot Island near the mouth of the creek draining glacier C93; 72°50.9'N, 79°54'W. Elevation of section top 15 m a.s.l.

Unit	Description	Thickness (m)
Marine sediments	Coarse sand, gravel and pebbly gravel; forms coastal terrace.	1.5
	Brown-grey sandy mud and mud containing: pebbles and cobbles; intact and fragmented shells; a folded inclusion of well sorted coarse sand within the upper portion; and foreign rock debris, including fossiliferous sedimentary rock. Boulders in the upper portion, were coated with bryophytes. Unit contains fewer outsized clasts and becomes sandier near the base.	3
	Brown, fine sand; laminated.	0.3
	Well sorted, dark grey sand; laminated and interbedded with medium brown coarse sand.	0.5
	Poorly sorted, pebbly, coarse sand.	<0.5 to 2
Slump	Slump to modern stream.	

Eclipse Sound section IV

Coastal section located near the mouth of the creek draining glacier B7 on Bylot Island; 72°45.4'N, 79°35'W. Elevation of the section top 14 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Sand.	0.5
Marine sediments	Coarse sand containing minor interbeds of mud.	0.5
	Dark grey-brown sandy mud; coarsens upwards; contains various species of intact marine shells having radiocarbon age of 7880 ± 70 BP (GSC-3062).	1.5
Cretaceous-Tertiary bedrock	Quartzose sandstone.	9.5

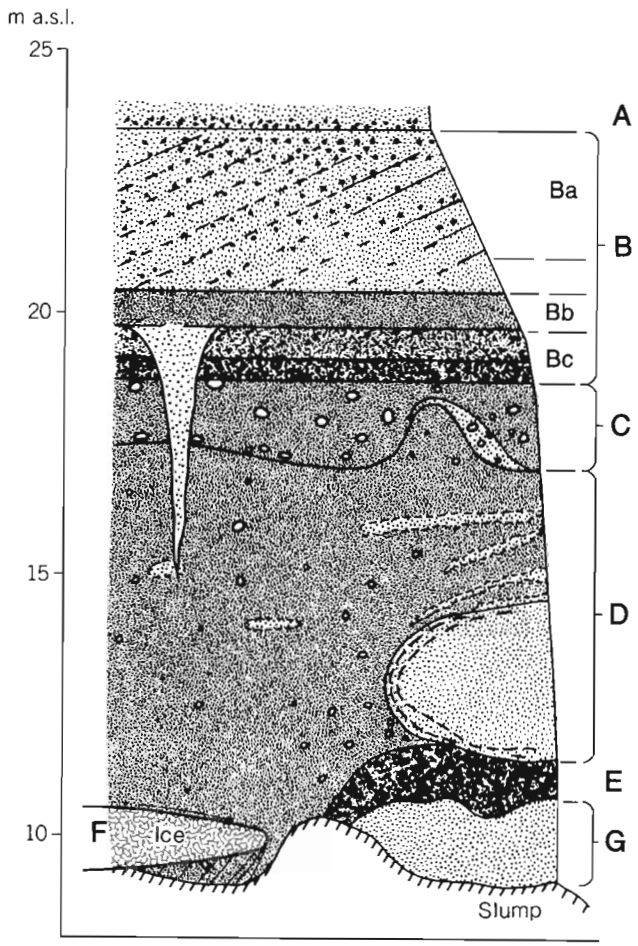

Figure 3.4. Schematic diagram of Aktineq Creek sectionI.

Aktineq Creek section I

Section cut by Aktineq Creek, about 500 m inland of the coast; 72°49.1′N, 78°48′W. Elevation of section top 24 m a.s.l. Description is a composite (Fig. 3.4) based on examination of three sections located along 100 m of cutback.

Unit	Description	Thickness (m)
A Eolian sediments	Well sorted coarse sand and organic debris, interbedded; some beds contorted by periglacial action.	<0.5
B Marine sediments	Well sorted, medium- to coarse-grained, sand and pebbly sand (Ba); sequence coarsens generally upwards; sediments flat-bedded in upper portion (<0.5 m thick), form single tabular set of crossbeds in middle portion (2.5-3 m thick),and are massive at base (<0.5 m thick); crossbeds dip seaward; upper contact well defined.	3.5
	Grey mud and clayey mud (Bc), coarsening upward to sandy mud (Bb); contains pebbles and small inclusions of sorted coarse sand; upper contact gradational with overlying unit.	0.5
C Foreign drift (Button)	Grey sandy mud diamicton containing foreign rock debris; at base of unit pockets of coarse sandy gravel occur and a poorly developed stone line; large (>2 m length) vertical, frost wedge cracks infilled with sand originate within lower portion of overlying unit and cross-cut this unit; upper contact gradational.	1-1.5
D Native drift (Aktineq glacial phase)	Grey to grey-brown sand and muddy sand diamicton containing minor foreign debris (in comparison to overlying and underlying units), sorted coarse sand as lenses and poorly defined beds; near base a large block (2-3 m) of Cretaceous-Tertiary sandstone forms a recumbent fold opening landward that indicates ice movement seaward; unit cut by large-scale, sand-filled ice wedge casts; upper contact well defined, marked by a 2 cm wide band of iron oxide (possibly a buried soil) wavy in section, having an amplitude of about 1 m	
	Nonglacial conditions represented by finely divided organic matter and wood fragment within upper part of unit; pollen analysis (Report 4.4, Appendix 4) indicates a paleoclimate possibly warmer than present, and associated with Sermilik nonglacial interval. Fragments of marine shells have amino acid ratios of 0.25 and 0.62 (AAL-1469).	6-9
E Foreign drift (Eclipse)	Dark grey mud and muddy sand diamicton; containing abundant foreign rock debris, and shell fragments having amino acid ratios of ~0.4 (AAL-1392); lower portion massive; upper portion laminated with coarse sand; upper contact well defined; foreign erratics highly polished and striated, similar to those within mud at base of Sermilik Glacier section Ia.	1.5
F Ice	Ice containing debris isotopic ratios of -25.4 to -31.9δO^{18}‰ and -217 to -246δH^{2}‰ indicate ice could be glacial in origin. Laterally discontinuous.	1-2
G Cretaceous Tertiary bedrock	Brown, poorly consolidated quartzose sandstone bedrock; reworked within upper 0.5 m; well defined upper contact marks an erosional surface with cut channels.	1.5
Slump	Slump to modern stream at 8 m a.s.l.	<1

Aktineq Creek section IIa

Section cut by meltwater stream from Aktineq Glacier within 100 m of Neoglacial terminal moraine; 72°52.3'N, 78°54'W. Elevation of section top estimated at 117 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Well sorted coarse sand; capped by tundra vegetation	~1
Foreign drift	Brown grey muddy sand diamicton containing foreign lithologies; upper contact well defined.	~2
	Grey muddy sand diamicton; unit pinches out laterally; upper contact well defined, marked by 2 cm band of iron oxide stain and discontinuous stone line.	
	Small woody fragments found within 0.5 m of upper contact.	<1m
Cretaceous-Tertiary bedrock	Poorly consolidated grey sandstone.	

Aktineq Creek section IIb

Section cut by meltwater in front of the Neoglacial terminal moraine of Aktineq Glacier; located directly across a small valley from Aktineq Creek section IIc; 72°53.3'N, 78°53'W. Elevation of the section top estimated at 117 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Coarse sand capped by tundra vegetation.	0.3
Drift/ colluvium	Grey to brown-grey sand diamicton contains organic matter; upper contact poorly defined.	0.7
Foreign drift	Dark grey muddy sand diamicton containing foreign clasts; upper contact well defined, possibly marked by stone line.	2
Glacial fluvial	Coarse sand and pebble gravel; coarse clasts, including polished and striated foreign debris unit crossbedded, with crossbeds dipping inland toward Aktineq Glacier, indicating water flow opposite to modern direction; contains fragments of marine shells having amino acid ratios of 0.75-0.85 (AAL-2465).	0.5
Cretaceous-Tertiary bedrock	Poorly consolidated, grey sandstone.	

Aktineq Creek section IIc

Section cut by meltwater stream at the outer edge of the Neoglacial terminal moraine of Aktineq Glacier; 72°52.3'N, 78°53.3'W. Elevation of section top estimated at ~117 m a.s.l.

Unit	Description	Thickness (m)
Native Neoglacial drift	Coarse angular boulders, related to the Neoglacial terminal moraine of Aktineq Glacier, forms surface litter.	0.5
Eolian sediments	Brown, medium grained sand; contains organic matter; capped by modern tundra vegetation.	
Outwash	Sand and gravel; appears gradational with overlying unit.	<0.5
Foreign drift (Button)	Brown, muddy sand diamicton containing foreign clasts; upper contact well defined	0.5-1
	Brown to grey-brown muddy sand diamicton; contains shell debris having amino acid ratios of 0.13 to 0.23 (AAL-1830); unit bouldery in upper portion, contains thin subparallel interbeds of brown coarse sand and of dark-brown (organic-rich?) beds.	1.5-2
Reworked bedrock(?)	Grey sandy mud, exposed by digging beneath slump; may be discontinuous because not found in second section located a few metres away.	<0.5
Cretaceous-Tertiary bedrock	Poorly consolidated grey sandstone.	

Note: Origin of marine shells of Button age is problematic because the section lies more than 2 km from the coast, higher than 100 m a.s.l., and shows no obvious geomorphological evidence of Button glaciation.

Aktineq Creek section III

Section cut by meltwater stream following outer limits of Neoglacial advance on the eastern margin of Aktineq Glacier; 72°53.3'N, 78°50'W. Elevation of the section top estimated to be ~200 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Coarse sand and organic matter, interbedded; contains some boulders thought derived from underlying sediments by frost heave.	0.6
	Organic matter.	<0.05
	Laminated mud and sandy mud.	<0.05
Foreign drift (Eclipse)	Poorly sorted sandy gravel; clasts are subangular to subrounded and include foreign debris; contains poorly defined sand lenses.	0.6
Cretarous-Tertiary bedrock(?)	Well sorted pebble conglomerate; clasts are well rounded and weathered, some altered to clay; displays well developed soil porfile having fine grained dark grey organic material near top and iron oxidation beneath; well defined upper contact.	
	Grey coarse sand.	~6
Slump	Slump to modern stream.	~3

Sermilik Glacier section Ia

Near the terminus of Sermilik Glacier, at its western side, adjacent to the meltwater stream flowing against the Neoglacialmoraine ridge; 72°54.6′N, 78°17′W. Surface elevation of the section top 133 ma.s.l. (Fig 3.5).

Unit	Description	Thickness (m)
A Eolian sediments	Fine to coarse sand; includes rootlets, and laminae of detrital organic material.	1-2
B Stratified drift	Fine to coarse brown sand (Ba); characterized by large-scale foreset beds, some of which dip towards Sermilik Glacier, and by isolated beds of gravel and bouldery gravel; contains abraded fragments of detrital shells having amino acid ratios of 0.15 to 0.18 (AAL-2464).	20-30
	Fine to coarse brown sand (Bb); characterized by near vertical beds, indicating melting out of buried ice, and by highly polished, striated foreign erratics of carbonate rocks distinctive in appearance and similar to those found in basal part of unit (Bc) and in basal unit of Aktineq Creek Section I.	20-30
	Brown-grey to dark grey sandy mud to muddy sand (Bc); contains highly polished, striated foreign erratics of carbonate rock, small fragments of detrital shells having amino acid ratios of 0.3 (AAL-2463), and detrital wood (see Report 4.10 Appendix 4); interbedded and gradational over 1-2 m with overlying brown sand.	1-2
	Coarse sand (Bd); sharp upper contact; unit of variable thickness and pinches out laterally.	<0.5
C Foreign drift (Eclipse)	Dark grey, muddy sand diamicton contains foreign erratics, shell fragments having amino acid ratios of 0.3 (AAL-1475), and large block inclusions of weathered bouldery gravel and of massive coarse sand; becomes less sandy and contains fewer outsized clasts toward base; sharp upper contact.	
	Block inclusions of gravel, believed frozen at time of their incorporation, and are similar to underlying unit.	5-6
D Outwash	Boulder gravel, flat-bedded; no foreign debris known; sharp upper contact; clasts weathered and some disintegrate easily.	2
Slump	Slump to lateral metlwater stream of Sermilik Glacier at 68 m a.s.l.	

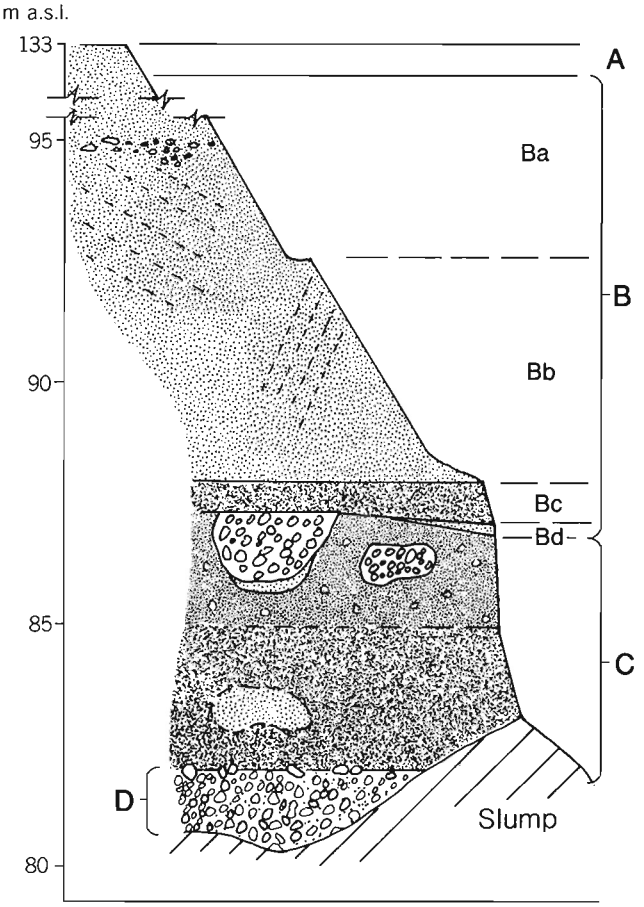

Figure 3.5. Schematic diagram of Sermilik Glacier section Ia.

Sermilik Glacier section Ib

Section exposed by meltwater stream following the outer edge of the Neoglacial moraine of Sermilik Glacier, ~100 m inland of Sermilik Glacier section Ia; 72°54.9'N, 78°17'W. Elevation of section top ~135 m a.s.l.

Unit	Description	Thickness (m)
Foreign drift	Dark grey mud diamicton; including foreign rock debris.	3
Outwash	Sand and pebbly sand; forms single set of tabular crossbeds that dip toward Sermilik Glacier.	
	Imbricated bouldery gravel, contains middle bed of brown sand and sandy gravel <0.5 m thick bearing foreign rock debris; weathered clasts of bouldery gravel disintegrate easily by hammer blow; upper contact well defined.	4.5
Foreign drift	Dark grey sandy mud diamicton; contains foreign rock debris; outsized clasts, relatively abundant in upper portion; sorted sand may by present as thin interbeds beneath slump cover at base of unit.	3.5
Slump	Slump to lateral meltwater stream of Sermilik Glacier.	

Northwest coast section I

On the coast of northwestern Bylot Island, near Wollaston Islands; 73°40.9′N, 80°47′ W. Elevation of the section top ~25 m a.s.l. (Fig.3.6).

Unit	Description	Thickness (m)
A Marine sediments (Holocene or Button)	Coarse sandy gravel and pebble gravel: containing fragments of marine shells (Aa). Unit forms surface terrace extending along coast.	0.5
	Coarse sand and pebbly sand; forms single tabular set of planar crossbeds (Ab); coarsens upwards.	5
	Grey mud and sandy mud, interbedded (Ac); contains few outsized clasts; upper contact gradational over <0.5 m.	4
	Dark gray, clayey mud (Ad); contains abundant (~5%) pebbles within lower portion and paired shells and shell fragments having amino acid ratios of ≤0.1 (AAL-2627); upper contact well defined.	
B Foreign drift (Button)	Grey and dark brown-gray sandy mud; containing numerous outsized clasts, deformed inclusions of sorted coarse sand give appearance of crude bedding to unit; paired shells and shell fragments having amino acid ratios that are not detectable (AAL-1641); upper contact sharp marked in placed by boulders and poorly sorted sand.	5
C Marine sediments (pre-Eclipse)	Gray-brown muddy sand to sand with outsized clasts, interbedded; contains intact marine shells having amino acid ratios of 0.45 to 0.50 (AAL-1476), and 0.50 to 0.56 (AAL-1636); upper contact well defined and marked by discontinuous pebble line and by thin (20-30 cm) bed of coarse sand stained by iron oxides and containing abundant, detrital shell fragments. Clasts include shale and fossiliferous limestone.	4
D Marine sediments (pre-Eclipse)	Massive dark grey mud with few pebbles; contains shell fragments having amino acid ratios of 0.55 to 0.60 (AAL-1391); upper contact well defined, marked by discontinuous pebble line; contains foreign clasts.	2
Slump	Slump to sea level.	3

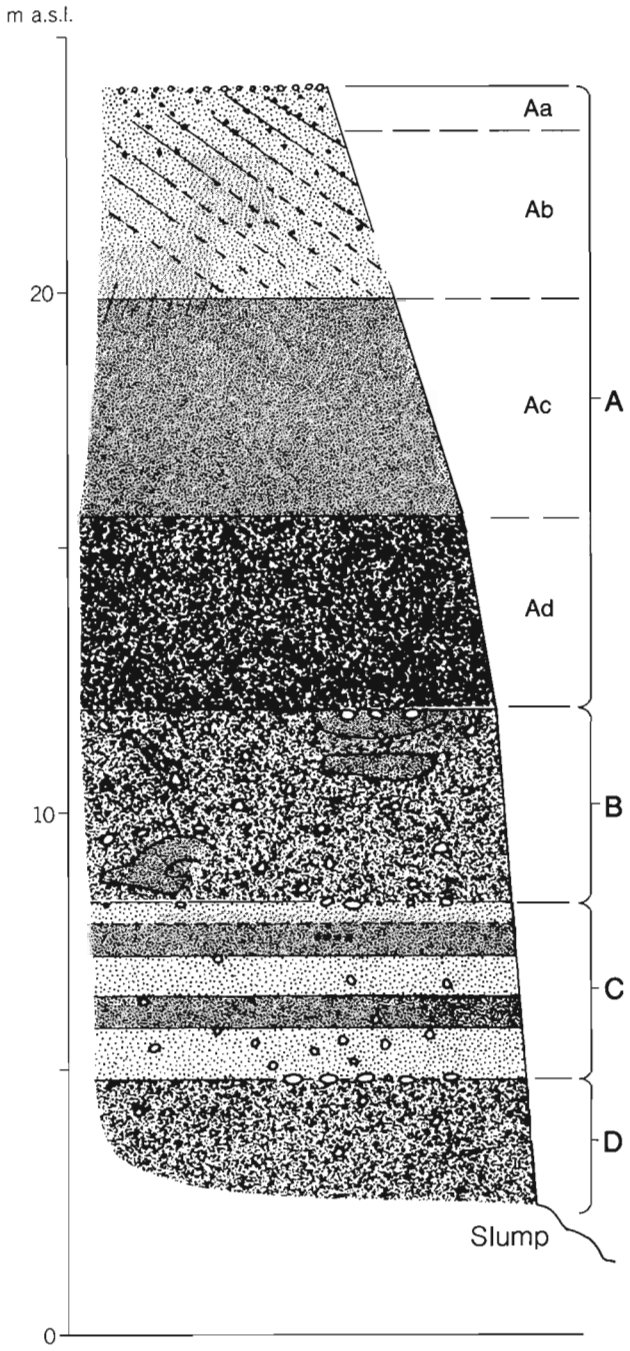

Figure 3.6. Schematic diagram of Northwest coast section I.

Northwest coast section II

On northwestern Bylot Island, beside the creek draining glacier C5 and about 2 km inland from the coast; 73°38.9'N, 80°43'W. Elevation of the section top ~107 m a.s.l.

Unit	Description	Thickness (m)
A Ice-contact stratified drift (Eclipse)	Coarse gravel lag, bedded; forms terrace related to ice marginal deposits of Eclipse glaciation.	0.5
	Coarse sand and pebble gravel, interbedded; contains thick abraded shell fragments; becomes generally finer grained towards base.	2.0
	Clayey silt.	0.2
B Stratified drift (Eclipse?)	Coarse boulder gravel to sandy boulder gravel; clasts are subangular to subrounded 10-40 cm; upper part forms near-vertical face in section due to intraclast support; lower part sandier; shell fragments found in surface slump.	9.0
	Bouldery, sandy gravel	5
	Bouldery, muddy sand.	4.5
C Marine sediments (pre-Eclipse)	Brown mud to sandy mud, coarsens upwards contains coarse boulders, and intact valves of fragile marine shells having amino acid ratios of ~0.55 (AAL-1474) within mud and clayey mud near base.	13.0
D Proterozoic bedrock		7.5
	Stream	

Note: Section is largely obscured by slump and the nature of contacts between units and structures within units is not well known.

Glacier E131 section

Section exposed in a cutbank beside a meltwater stream 50 m from glacier E131 on northeastern Bylot Island; 73°19.4'N, 77°18.9'W. Elevation of section top estimated at 63 m a.s.l.

Unit	Description	Thickness (m)
Outwash	Well sorted coarse sand and pebble gravel forming two sets of tabular crossbeds; no foreign erractics found; upper surface forms outwash plain covered by tundra vegetation. No angular boulders seen similar to those observed either within modern moraine 50 m away or at surface of Cache Creek section.	
	Section consists of two units interpreted to be of different ages; upper portion loose, nonconsolidated and lower portion relatively indurated, characterized by iron oxide stain. At contact between the units, finely divided organic material occurs (see Report 4.11; Appendix 4).	

Cache Creek section

Section exposed in a cutbank beside a meltwater stream ~300 m in front of glacier E67 and 6 km inland on northeastern Bylot Island; 73°8.2'N, 76°49'W. Elevation of section top (estimated) 35 m a.s.l. (Fig. 3.7).

Unit	Description	Thickness (m)
A Native drift	Coarse (<0.2-1 m), angular crystalline boulders form surface cover of single-clast thickness.	<0.5
B Outwash/ glacial lake sediments	Sand and muddy sand; bedded; contains finely divided organic debris (see Report 4.6, Appendix 4) in <5 cm thick bed at base.	1
C Outwash (pre-Eclipse)	Boulder gravel; clasts well rounded and forming a framework; matrix composed of organic material (see Report 4.5; Appendix 4) and coarse sand; occurs as a channel fill deposit set within underlying sediment.	
D Marine/ glacial marine sediments	Well sorted, massive, grey, coarse sand; includes zones of pebbly sand (Da); mottled by patches of iron stain; upper contact well defined. Unit contains: a) large, irregular lenses of poorly sorted sand and muddy sand (Db) stained by iron oxides and containing weathered (rotten) clasts; b) interbedded mud and sandy mud (Dc) containing minor lenses of sand and intact shells some of which retain their periostracum cover having amino acid ratios of ~0.75 (AAL-1705); c) bouldery, sandy gravel (Dd), in contact with small (<2 m x 0.5 m) bodies of coarse sand having near-vertical bedding, demonstrating an ice-contact origin.	3
Slump	Slump to stream at ~29 m a.s.l.	

Cape Graham Moore section

Near Cape Graham Moore on southeastern Bylot Island, beside a creek and about inland 200 m from the coast; 72°51.7'N, 76°7'W. Elevation of the section top ~35 m a.s.l.

Unit	Description	Thickness (m)
Outwash	Boulder gravel forming outwash plain. No foreign debris found within unit.	2
Marine sediments (Button)	Muddy sand and sand, contains coarse clasts, and intact marine shells having amino acid ratios of 0.10 to 0.15 (AAL-2470) gradational contact with overlying unit.	5
Fluvial(?)	Well sorted, coarse- to medium-grained brown sand, massive, laterally discontinuous; contains discontinuous and contorted beds of organic material (see Report 4.12, Appendix 4); upper contact well defined.	<0.5
	Well sorted, coarse dark brown sand, iron-stained, laterally discontinuous; upper contact well defined.	<0.2
Outwash	Coarse boulder gravel; boulders closely packed with intraclast contact; coarse sand matrix component increases downward. Unit contains foreign rock debris. Many coarse weathered clasts disintegrate readily; carbonate sedimentary rocks have well developed solution pits indicating in situ weathering. Iron stain well developed in upper part of unit and decreases downward over 1.5 m; weathering suggests interglacial conditions (Salmon River interglaciation?).	4
Slump	Slump to modern stream level at 18 m a.s.l.	6

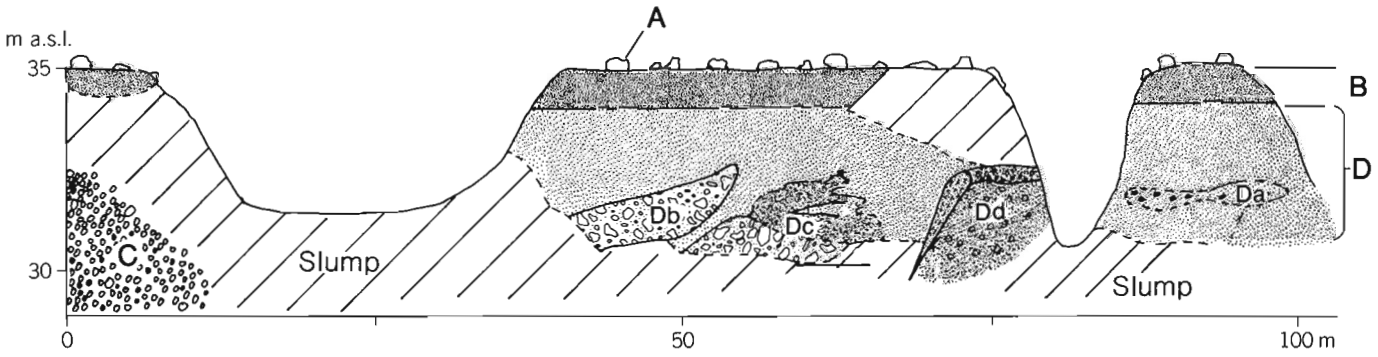

Figure 3.7. Schematic diagram of Cache Creek section.

Button Point section I

A coastal section 2 km west of Button Point; 72°48.9′N, 76°23′W. Elevation of the section top is about 17 m a.s.l. (Fig.3.8).

Unit	Description	Thickness (m)
A Foreign drift (Button)	Poorly sorted, grey, muddy gravel, containing numerous angular boulders and including foreign erratics.	>2 m
Slump		~6 m
B Marine sediments	Well sorted, coarse sand and pebbly sand; forms single set of tabular crossbeds; nature of upper contact unknown.	>3
C Foreign drift	Massive, dark grey mud and clayey mud with some outsized clasts (Ca); contains weathered gneiss, pockets of sorted sand, and fragments of marine shells. Upper contact well defined.	4.5
	Grey brown, sandy mud with outsized clasts (Cb); some clasts have disintegrated in situ; nature of upper contact unknown, may be gradational	2.5
D Marine sediments	Sand and sandy mud; forms single set of tabular crossbeds (2 m thick) with laminated topset beds (<0.5 m thick) and massive, coarse sand base (1.5 m thick); contains paired marine shells within massive sand. Upper contact well defined, internal contacts are gradational between the lower massive sand and overlying crossbedded sand.	3.5
E Marine sediments	Boulder gravel with well sorted, coarse sand matrix; sand and base of boulders are iron-stained and considered to mark a buried soil(?)	0.3-0.4
	Muddy sand and pebbly sand; contains small shell fragments.	0.5
Slump	Slump to modern beach ~2 m a.s.l.	2

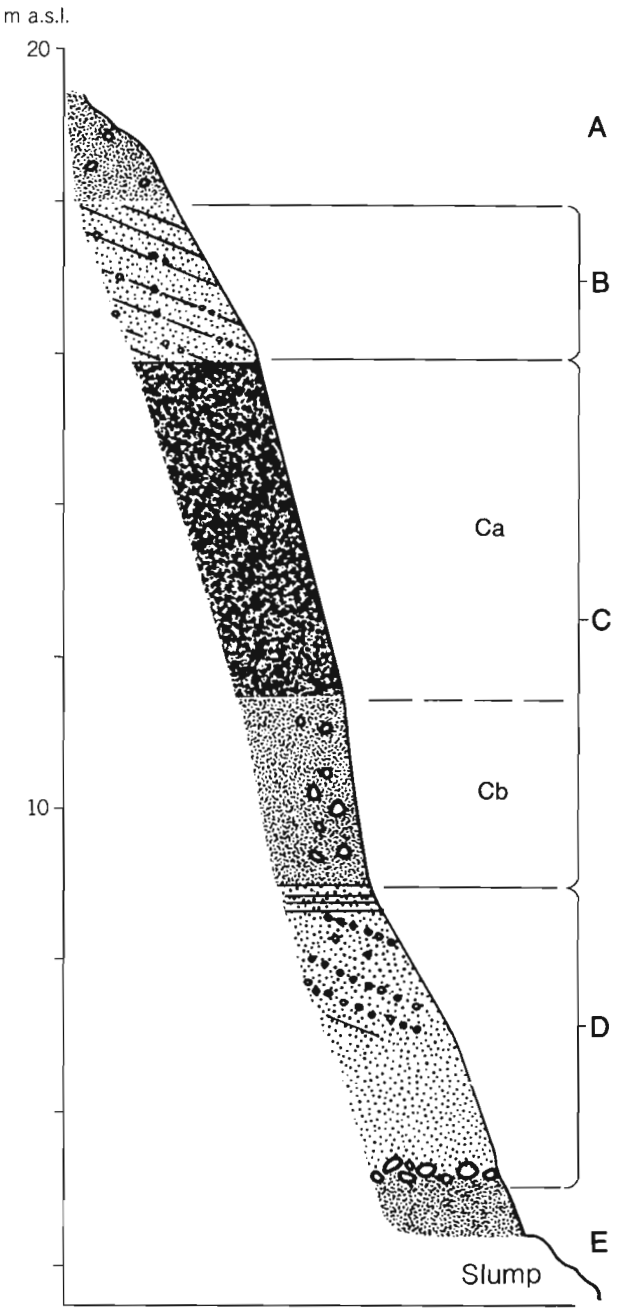

Figure 3.8. Schematic diagram of Button Point section I.

Button Point section II

A coastal section 2 km west of Button Point; 72°49.0′N, 77°22′W. Elevation of the section top ~26 m a.s.l. (Fig. 3.9).

Unit	Description	Thickness (m)
A Foreign drift (Button)	Grey, sandy, muddy gravel; contains large angular boulders, including foreign erratics. Unit found at surface along coast.	≥2
B Marine sediments	Sand and muddy sand containing outsized, angular to rounded clasts (Ba). Upper contact well defined.	1
	Boulder layer of single-clast thickness (Bb); clasts angular.	>0.5
	Pebbly coarse sand and sandy gravel (Bc); forms single tabular set of planar crossbeds capped by massive sand.	1.5
C Foreign drift (Eclipse(?))	Dark grey sandy mud and muddy sand containing detrital shell fragments and foreign carbonate rocks. Unit becomes sandier upwards. Upper contact well defined.	4
D Marine sediments (pre-Eclipse)	Garnetiferous coarse sand, pebbly sand, and sandy gravel forming single, tabular set of planar crossbeds (8 m thick) dipping seaward (Db), capped by flat-bedded topset beds of coarse sand (<1m thick) (Da) and underlain by sequence coarsening upward from muddy sand to coarse sand (Dc). Includes foreign rock debris. Upper contact well defined. Basal unit of muddy sandy contains intact and paired marine shells having amino acid ratios of 0.34 to 0.4 (AAL-924).	9
E Marine sediments	Boulder layer (Ea). Upper surface of many boulders, and sand around their bases, stained by iron oxides considered to mark interval of surface weathering.	<0.5
	Well sorted, brown, garnetiferous, coarse sand (Eb); trough-crossbedded, containing organic material (see Report 4.3, Appendix 4), small fragments of marine shells, and bone; upper contact well defined, marked by discontinuous muddy sand layer.	2
	Coarse gravel, found by digging beneath slump	
Slump	Slump to modern beach ~2 m a.s.l.	2

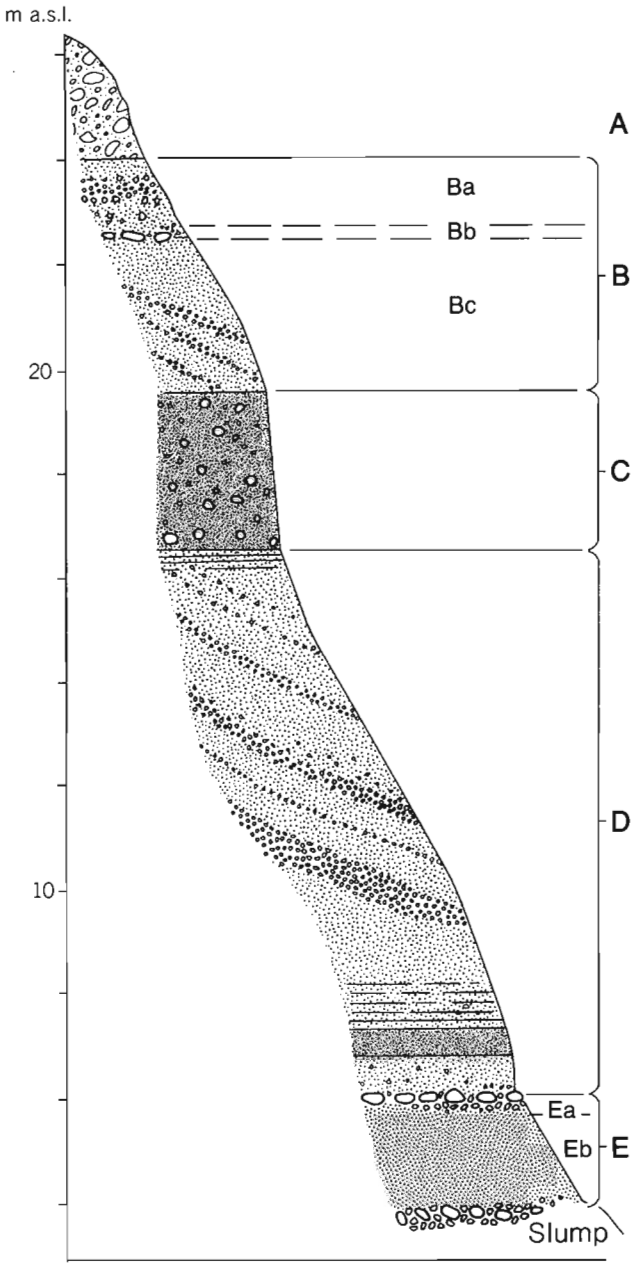

Figure 3.9. Schematic diagram oof Button Point section II.

Button Point section III

A coastal section 1.5 km west of Button Point; 72°49.5′N, 76°16′W. Elevation of the section top ~24 m a.s.l. (Fig 3.10).

Unit	Description	Thickness (m)
A Foreign drift (Button)	Grey, poorly sorted, sandy, muddy gravel; contains numerous large angular boulders, including foreign erratics.	>2 m
B Marine sediments	Well sorted, sandy gravel (Ba); contains some boulders; upper contact well defined.	1.5
	Grey, poorly sorted, sandy gravel and bouldery gravel (Bb); crudely interbedded.	2
C Foreign drift	Grey sand and muddy sand (Ca) diamicton; include beds of muddy coarse sand containing rounded pebbles; nature of upper contact unknown.	3
	Well sorted, sandy, pebbly gravel (Cb); upper contact well defined.	
	Dark grey mud and sandy mud (Cc); contains pebbly beds of single-clast thickness; upper contact well defined.	4
D Marine or glacial marine sediments	Coarse gravel and sandy gravel (Da); clasts are rounded to sub-rounded; upper contact well defined.	2
	Coarse sand, laminated (Db); upper contact well defined.	1
E Marine sediments	Boulder gravel, closely packed with intraclast contact, forming near-vertical face; coarse sand and pebble matrix; much weathered crystalline rocks disintegrated readily by hammer blow; upper contact well defined.	2
Slump	Slump to modern beach at ~2 m a.s.l.	3

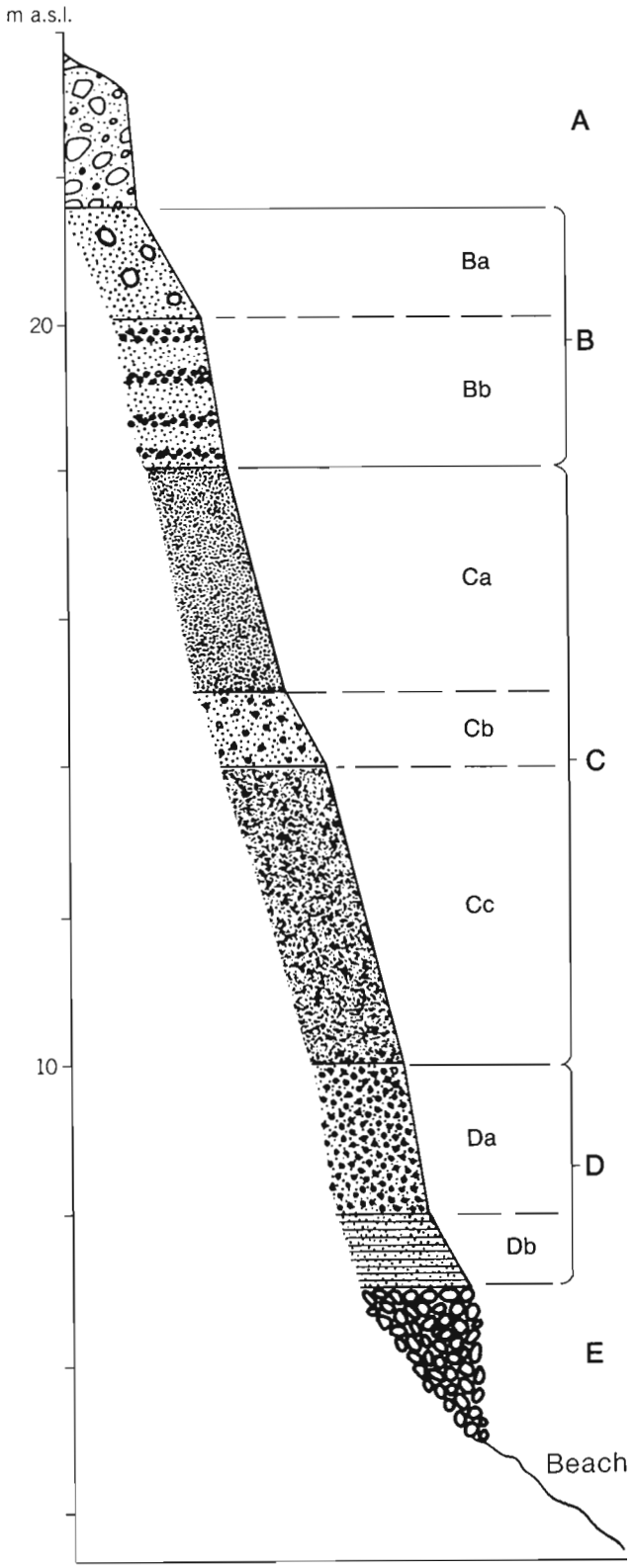

Figure 3.10. Schematic diagram of Button Point section

Button Point section IV

A coastal section 1 km west of Button Point; 72°50.2′N, 76°11′W. Elevation of the section top ~22 m a.s.l. (Fig. 3.11).

Unit	Description	Thickness (m)
A Foreign drift (Button)	Grey, poorly sorted, sandy, muddy gravel; contains numerous large angular boulders including foreign erratics.	>2
B Foreign drift (glacial marine)	Dark grey mud and sandy mud containing few outsized clasts and shell fragments having amino acid ratios of 0.1 to 0.2 (AAL-932) and 0.09 to 0.13 (AAL-1639). Nature of upper contact unknown.	10
C Marine sediments (Eclipse)	Well sorted, fine to medium-grained sand containing outsized clasts. Upper contact well defined. Upper part of unit contains boulders and paired shells having amino acid ratios of 0.23 to 0.25 (AAL-1638).	2
D Foreign drift (Eclipse)	Grey-brown muddy sand containing abundant angular outsized clasts, which include foreign rock debris. Upper contact well defined.	2
E Marine sediments (pre-Eclipse)	Well sorted, coarse sand; laminated to thin-bedded in upper portion; contains intact shells having amino acid ratios of 0.26 to 0.30 (AAL-1393); massive lower portion contains boulders. Upper contact well defined and marked by 5 cm thick bed of grey clayey silt.	2
F Marine sediments	Dark grey mud and clayey mud containing few pebbles and shell fragments. Upper contact is gradational over ~10 cm.	4
	Modern beach at ~2 m a.s.l.	

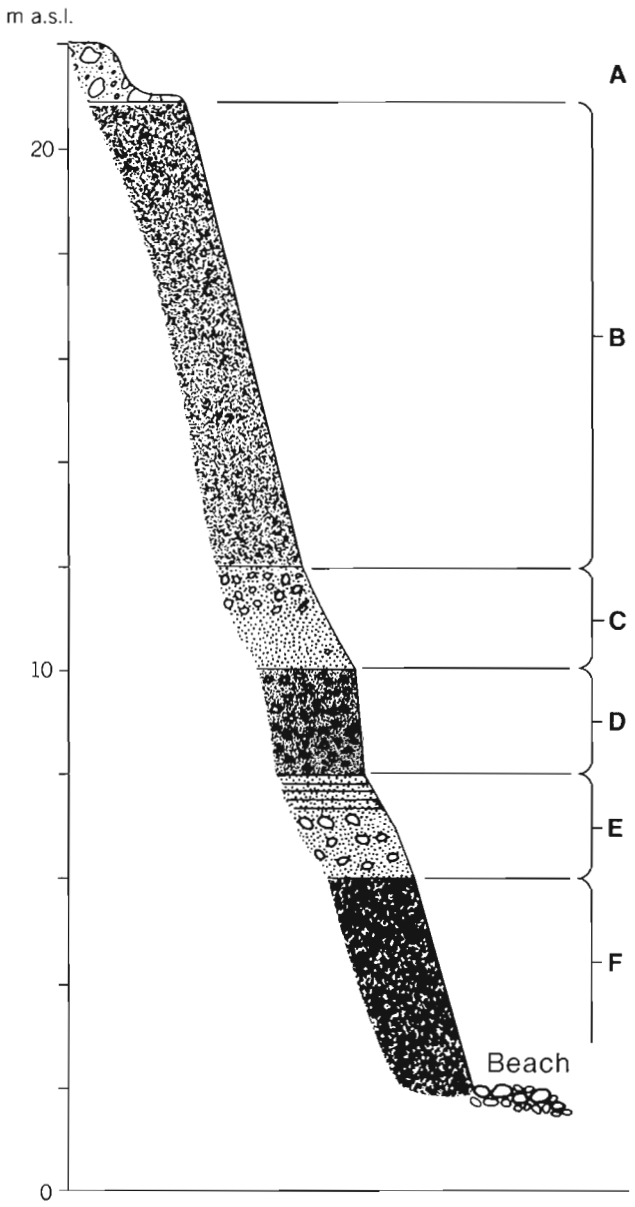

Figure 3.11. Schematic diagram of Button Point section IV.

Button Point section V

A coastal section located within 1 km and to the west of Button Point; 72°50.7′N, 76°9′W. Elevation of section top ~31 m a.s.l. (Fig. 3.12).

Unit	Description	Thickness (m)
A Foreign drift (Button)	Grey, poorly sorted, sandy muddy gravel; contains numerous large angular boulders, including foreign rock debris.	>2
B Marine sediments	Sorted, coarse sand, horizontally bedded; contains fragments of marine shells.	4
C Foreign drift	Dark grey sandy mud; contains outsized clasts of pebbles and cobbles, intact marine shells having amino acid ratios of ~0.15 (AAL-2624), and shell debris. Unit appears massive, containing inclusions of poorly sorted sandy gravel within lower portion. Nature of upper contact is unknown.	12
	A 1 m thick bed of brown, sorted sand containing organic matter (see Report 4.13, Appendix 4) could occur either within base of this unit or within underlying unit (Da).	
D Marine sediments	Sorted sand and sandy gravel (Da); contains small angular clasts, and fragments of marine shells. Upper contact well defined, marked by discontinuous beds of lamianted coarse sand; their lower contact may represent erosional surface within unit.	1
	Well sorted, grey-brown sand laminated (Db); contains shell fragments. Well defined upper contact marked by thin band of iron oxide stain may represent an unconformity.	2
E Glacial marine sediments	Dark grey mud; contains pebbles and shell fragments; massive, with minor laminae. Nature of upper contact is unknown.	2
Slump	Slump to modern beach at ~2 m a.s.l.	6

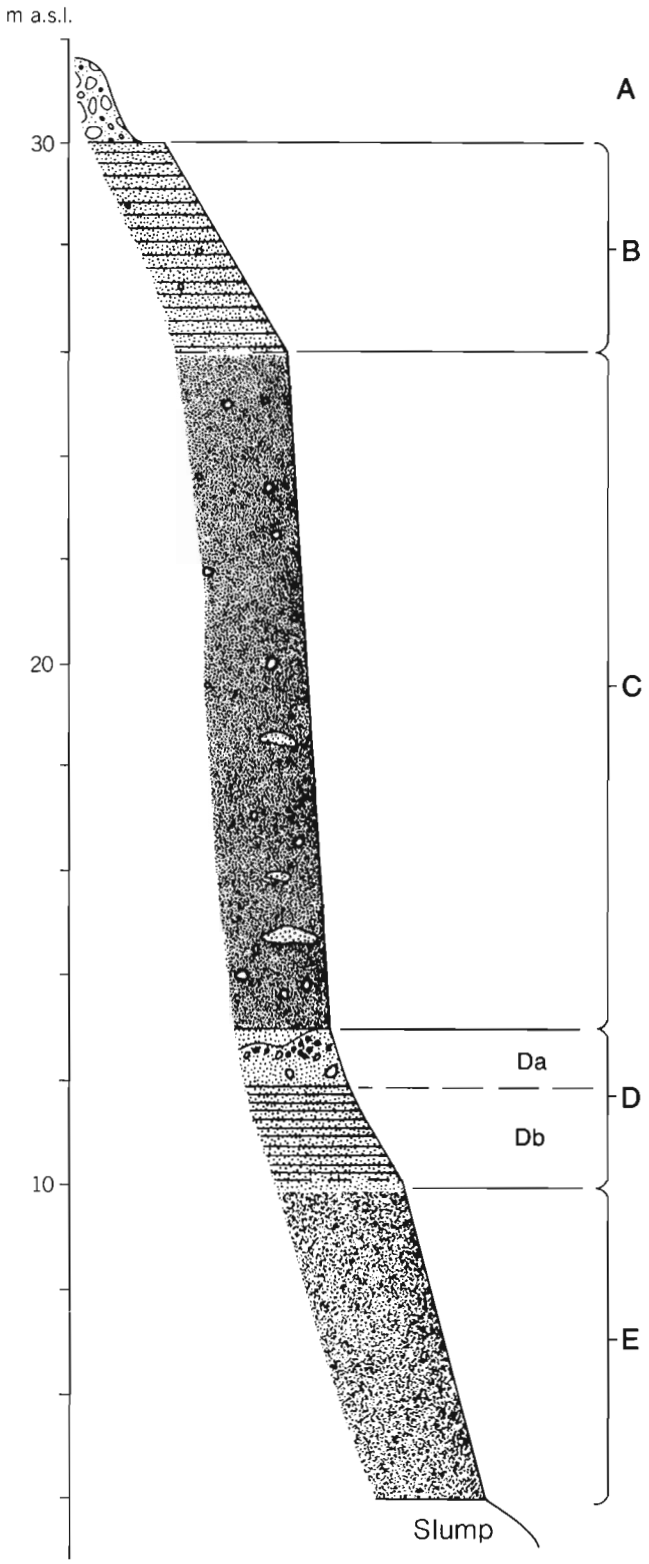

Figure 3.12. Schematic diagram of Button Point section V.

Oliver Sound section I

Stream cut section on the northeastern side of Oliver Sound, northern Baffin Island; 72°19.8'N, 78°02'W. Elevation of section top 65 m a.s.l.

Unit	Description	Thickness (m)
Glacial fluvial sediments	Coarse, sandy boulder gravel; imbricate structure; forms outwash plain related to lateral moraines in Oliver Sound.	1-2
	Poorly sorted sand containing numerous outsized clasts.	6
Marine sediments	Well sorted sand and pebbly sand forming single tabular set of crossbeds.	6.5
	Coarse sand and gravel containing beds of muddy sand gravel; may contain carbonate sedimentary rocks; origin of unit uncertain; upper contact well defined.	5-6
	Grey mud; contains fragments of marine shells having amino acid ratios of ~0.85 (AAL-1706); upper contact well defined.	2.3
Drift	Grey muddy sand containing abundant outsized clasts; only crystalline rock types seen, not known to contain carbonate sedimentary rocks.	5-7
(?)	Well sorted coarse sand; unit seen only in holes dug near top of slump cover.	–
Slump	Slump to stream level at 29 m a.s.l.	5-7

Oliver Sound section II

Stream cut section on the northeastern side of Oliver Sound, northern Baffin Island; 72°19.9'N, 78°02'W. elevation of section top 40 m a.s.l.

Unit	Description	Thickness (m)
Glacial fluvial sediments	Coarse, sandy boulder gravel; imbricate structure; broad outwash fan.	>2
Marine sediments	Well sorted sand and muddy sand; contains marine shells (*Mya truncata)* some of which retain their periostracum cover, and are paired valves; shells have amino acid ratios that are undetectable (AAL-2467).	8
Drift	Grey muddy sand containing erratics of crystalline rocks; no erratics of sedimentary rock found; compacted; hard; upper contact well defined.	1-2
Marine sediments	Coarse sand and gravel; contains marine shell fragments having amino acid ratios of 0.58 to 0.65 (AAL-2466); well defined upper contact marked by extensive iron oxidation considered to represent a period of surficial weathering (interglacial); clasts within unit commonly have secondary coating of carbonte.	~10
Drift	Grey, sandy mud containing abundant outsized clasts; contains erratics of carbonate sedimentary rock and fragments of marine shells; nature of upper contact unknown due to slump.	~10
Slump	Slump to stream level at 17 m a.s.l.	

Salmon River section

A coastal section lying about 2 km west of the mouth of Salmon River; 72°9.5′N, 78°11′W. Elevation of section top ~17 m a.s.l. (Fig. 3.13).

Unit	Description	Thickness (m)
A Eolian sediments	Sorted coarse sand and in situ organic matter; interbedded.	0.5
B Marine sediments	Sorted pebble gravel and sandy gravel; form single set of tabular crossbeds that dip seaward; contains abundant shell fragments of *Mytilus edulus* (species found as modern marine fauna locally) that indicate Holocene age. Upper contact well defined.	1.5
C Marine or glacial marine sediments	Dark grey mud and sandy mud; lower portion interbedded with green-gray silty sand; contains shell fragments having amino acid ratios of 0.36 and 0.58 (AAL-1473); massive upper portion contains few (<5%) outsized clasts; upper contact well defined and marked by discontinuous layer of boulders of single clast thickness.	2.5
D Marine sediments	Well sorted, coarse sand (Da); in lower portion, massive filling channels eroded in underlying unit, containing small fragments of organic detritus; in middle portion, interbedded with organic detritus in beds 1-3 cm thick; in upper portion, interbedded with pebbly sand. Upper contact well defined. Organic detritus from this unit contains taxa that represent Salmon River interglaciation (see Report 4.7, Appendix 4).	1.5
	Well sorted, coarse sand (Db), pebbly sand, and pebbly gravel; forming single set of tabular crossbeds dipping seaward; beds 0.1 to ~1 m thick and massive; contains paired shells having amino acid ratios of 0.60 (AAL-1832); bedding planes marked by detrital coal and plant debris (see Report 4.8, Appendix 4); upper contact erosional, marked by channel scours and by layer of boulders one-clast thick. Woody plant stems found flattened, likely by overriding by glacier ice.	9
Slump	Slump to modern beach	2

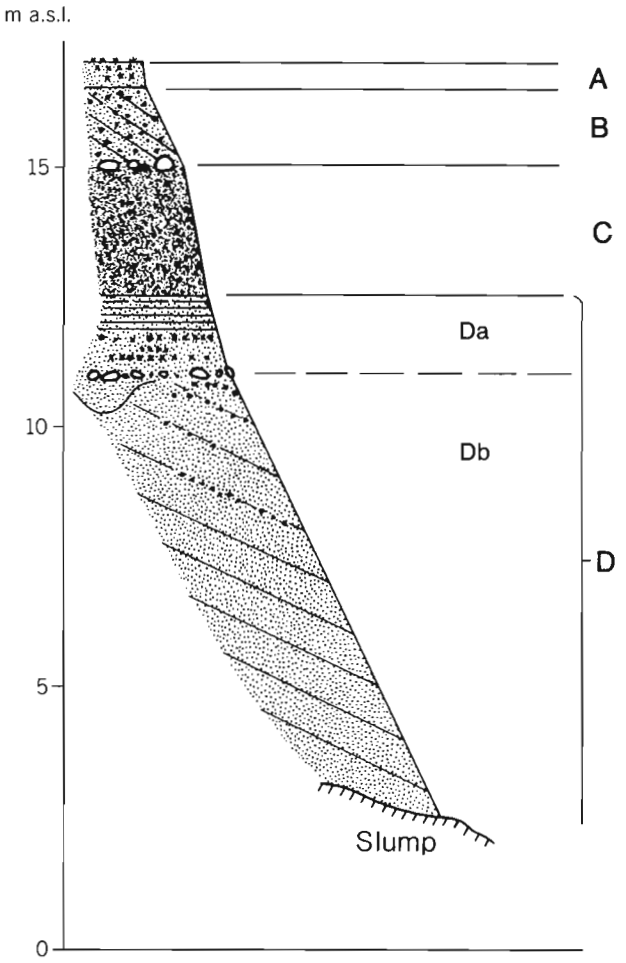

Figure 3.13. Schematic diagram of Salmon River Section.

Janes Creek section I

At the coast along Eclipse Sound near Janes Creek, about 6 km east of the town of Pond Inlet; 72°42.3'N, 77°48'W. Elevation of the section top 32 m a.s.l.

Unit	Description	Thickness (m)
Marine sediments (Holocene?)	Sandy mud grading upwards into sand and sandy gravel; contains intact marine shells near base having amino acid ratios that are undetectable (AAL-2628); forms broad coastal bench.	7
	Coarse sand grades upwards into coarse gravel and sandy gravel; no marine shells found; nature of upper contact unknown.	9
Cretaceous-Tertiary bedrock(?)	Grey, clayey mud, possibly weathered mudstone.	~6
	Well sorted silica sand; poorly consolidated.	1
Slump	Slump to modern beach.	9

Janes Creek section II

Section cut by Janes Creek within an ice-contact delta on northern Baffin Island about 1 km inland from the coast and 6 km east of the town of Pond Inlet; 72°42.4'N, 77°46'W. Elevation of section top 72 m a.s.l.

Unit	Description	Thickness (m)
Eolian sediments	Coarse sand interbedded with thin beds (<2 cm) of organic matter.	1.5
Ice contact stratified drift	Coarse sand and pebbly sand, form simple set of tabular crossbeds (amplitude 15-20 m) dipping eastward, parallel with coast; contains minor beds of muddy sand; overlying bottom set beds of sand and muddy sand (~5-10 m) contain thin beds (<0.2 m) of dark grey mud with abundant foreign rock debris and fragments of marine shells having amino acid ratios of 0.58 (AAL-1828).	
	Unit forms part of an ice-contact delta formed by water flowing eastward, along modern coast, against margin of foreign ice in Eclipse Sound. Head of delta complex connects with esker system lying along coast between section and Pond Inlet townsite.	20-25 m
Cretaceous-Tertiary bedrock	Brown to pink, quartzose sandstone; poorly consolidated in kupper portion	~5-10 m

Janes Creek section III

Stream-cut section beside Janes Creek on northern Baffin Island, about 2 km inland of the coast and 6 km east of the town of Pond Inlet; 72°42.0'N, 77°44'W. Elevation of the section top ~52 m a.s.l.

Unit	Description	Thickness (m)
Outwash	Coarse boulder gravel; imbricate structure; unit forms broad plain across valley floor.	1.5
Marine sediments (Eclipse)	Muddy sand grading upwards to coarse sand; contains intact marine shells near base having amin acid ratios of 0.25 to 0.32 (AAL-2471) near base; upper contact well defined.	5
Slump	Slump to stream level at 41 m a.s.l.	4.5

Guys Bight section

At Guys Bight on northeastern Baffin Island, 5 km inland from the coast, beside a meltwater stream in front of a large lobate glacier on the northern side of the valley; 72°39.0'N, 76°49'W. Elevation of the section top ~125 m a.s.l.

Unit	Description	Thickness (m)
Glacial lake sediment (Eclipse)	Massive, grey mud and sandy mud; contains outsized clasts (<5%) and inclusions of coarse sorted sand, gravel, and small shell fragments having amino acid ratios of 0.26 to 0.50 (AAL-2630); no foreign clasts of sedimentary rocks found.	32
	Stream level.	

Pond Inlet section

Section cut by stream on northern Baffin Island within a valley about 8 km east of Albert Harbour; 72°44.6'N, 74°49'W. Elevation of the section top 230 m a.s.l.

Unit	Description	Thickness (m)
Ice-contact stratified drift (Eclipse)	Sandy, bouldery foreign drift; contains erratics of fossiliferous carbonate rock; forms irregular mounds and hummocks across valley mouth.	~20
	Coarse sand, gravelly sand and muddy sand, poorly bedded; contains fragments of marine shells having amino acid ratios of ~0.35 (AAL-1829).	
	Section covered by slump and sedimentary structures obscured.	~100
	Slump to stream level at 79 m a.s.l.	

APPENDIX 4

Fossil Arthropod and Plant Macrofossil Reports

All fossil identifications (except for pollen) and comments are by J.V. Matthews, Jr., Geological Survey of Canada. Report numbers refer to unpublished Geological Survey of Canada Fossil Arthropods and Plant Macrofossil reports. W.H. Mode provided the pollen analysis and comments for 79KY84. Complete descriptions of referenced sections, and the stratigraphic position of organic materials within sections are given in Appendix 3.

Sample preparation typically involved a preliminary soaking, followed by sieving and "swirling" in water to float and remove the organic fraction. Sieve sizes were usually 0.18 mm, although finer sizes were used in some cases. A few samples were given an "oil treatment" to enhance recovery of insect fossils. More complete descriptions of preparation methods can be found in the original unpublished G.S.C. reports.

Abbreviations used here are as follows:

Fossil Arthropod Reports

+ + = taxon abundant;	el = elytron(a);	gt = genital fragments;	po = propodium;
+ = taxon present;	hd = head(s);	ov = oviposter;	ff = fragments;
r = taxon rare;	pr = pronotum(a);	wg = flight wing;	lv = larval;
p + = well preserved;	pp = puparia;	th = thorax;	ab = abdominal fragments;
p- = poorly preserved;	md = mandible(s);	cth = cephalothorax;	eh = ephippia;
			st = statoblasts.

Plant Macrofossil Reports:

+ + = taxon abundant;	p- = poorly preserved;	bd = bud or bud fragment;
+ = taxon present;	sd = seed (achene, fruit, nutlet, etc.);	cp = capsule;
r = taxon rare;	nd = needle(s);	br = bract.
p + = well preserved;	lf = leaf or leaf fragment;	

Report No. 4.1: 78KY25
Collection site: Button Point area, Bylot Island
Lat. 72°49.9'N, Long. 76°13'W

Fossil Arthropod Report 81-12

Insecta		
Coleoptera	"beetles"	
Carabidae	"ground beetles"	
Amara alpina Payk		+ pr
Arachnida		
Araneae	"spiders"	
Lycosidae	"wolf spiders"	
Genus?		+ cth

Comments. The picked residue consists mostly of filamentous plant fragments, probably from sedge stems. A few wood fragments are present (not rounded). Mosses were rare. Small mammal feces were present.

Amara alpina is a typical tundra ground-beetle and lives on Bylot Island today. Although the wolf spider fossil is too poorly preserved for identification, it is not an unexpected find for a high arctic assemblage. Several species probably live on Bylot Island today.

Plant Macrofossil Report 81-12

Cyperaceae		"sedge family"
Carex aquatilis Wahlenb.		+ + sd
Kobresia cf. *K. myosuroides* (Vill.) F. and P.		+ sd
Carex sp.		+ + sd
Juncaceae		"rush family"
Luzula sp.		+ sd
Salicaceae		"willow family"
Salix sp.		+ cp, lf (ff)
Polygonaceae		"buckwheat family"
Oxyria digyna (L.) Hill		+ sd
Ranunculaceae	"crowfoot family"	
Ranunculus hyperboreus Rottb.		cf (sd, p-)
Rosaceae		"rose family"
Dryas integrifolia Vahl.		+ lf

Comments. The plant fossils suggest damp tundra possibly with some standing water (*Carex aquatilis, R. hyperboreus*) with dry, scantily vegetated and possibly windblown sites nearby (*K. myosuroides, Dryas integrifolia*). All of the taxa are to be expected on Bylot Island today. Radiocarbon age is 6780 ± 80 BP (GSC-2960).

Report No. 4.2: 78KY26
Collection site: In front of glacier C-78, Bylot Island.
Lat. 73°11.9'N, Long. 79°46.5'W

Fossil Arthropod Report 81-11

Insecta		
Coleoptera	"beetles"	
Staphylinidae	"rove beetles"	
Aleocharinae		+ hd
Diptera	"flies"	
Tipulidae	"crane flies"	
Tipula?		+ hd, lv
Hymenoptera	"wasps and ants"	+ pp
Ichneumonidae	"parasitic wasps"	?
Arachnida		
Araneae	"spiders"	
Erigone sp.		+ + cth

Comments. The sample is unusual because of the number of well preserved spider fossils. Most species of *Erigone* prefer wet habitats. All of the taxa listed probably live in the area today.

Plant Macrofossil Report 81-11

Cyperaceae	"sedge family"
Carex spp.	+ sd
Eriophorum sp.	+ sd
Juncaceae	"rush family"
Juncus sp.	+ sd
Salicaceae	"willow family"
Salix sp.	+ bd

Comments. Most of the organic residue consists of filamentous plant fragments (probably from sedge stems), a few wood fragments, and some well preserved mosses. Rodent feces were also present.

All of the plant macrofossils are from taxa which grow on Bylot Island today. Radiocarbon age of the wood fragments is 120 ± 80 BP (GSC-3227).

Report No. 4.3: 79KY38
Collection site: Button Point section II, Bylot Island
Lat. 72°49.1'N, Long. 76°21.5'W

Plant Macrofossil Report 81-13

Ranunculaceae	"crowfoot family"	
Ranunculus sp.		+ sd (p-)
Rosaceae		"rose family"
Potentilla sp.		+ sd (p-)

Comments. Moss fragments are abundant but most are poorly preserved. A few wood fragments and fungal sclerotia were seen. Seeds are rare and poorly preserved. Those identified indicate little about the paleoenvironment or age of the sediments. Sample was collected from marine sands at base of section (see Unit Eb, Button Point section II, Apppendix 3).

Report No. 4.4: 79KY84
Collection site: Aktineq Creek section I, Bylot Island
Lat. 72°49.3'N, Long. 78°49'W

Plant Macrofossil Report 81-6
Comments. No identifiable fossils were seen in the organic fraction.

Pollen Report (W.N. Mode):

Grains	%
Alnus (alder)	1.4
Betula (birch)	10.5
Picea (spruce)	1.4
Salix (willow)	0.9
Ambrosia (ragweed)	1.4
Artemisia (sage or wormwood)	0.4
Cyperaceae (sedge)	2.8
Epilobium (fireweed)	0.4
Ericaceae (heath)	19.5
Filicales (ferns)	1.9
Lycopodium selago (fir club moss)	0.9
Sphagnum (peat moss)	0.9
unknowns	1.4
undeterminable	51.0
Gramineae (grass)	9.8
Total	99.6

Comments (W.N. Mode). "Many grains range from crumpled and thinned to degraded and to 'ghosts' – grains almost completely dissolved. Interpretation of such poorly preserved pollen is risky, though not so bad as in other media, such as marine or lake sediments, where poorly preserved grains may represent reworked pollen. Nevertheless, I believe that the birch-heath assemblage requires a climate warmer than present." Sample was collected from the upper metre of drift unit (see Unit D, Aktineq Creek section I, Appendix 3).

Report No. 4.5: 79KY275
Collection site: Cache Creek section, northeastern Bylot Island
Lat. 73°18.3'N, Long. 78°18.0'W
Stratigraphic position: Sample from weathered, glaciomarine sands at base of section (see Unit Db, Cache Creek section, Appendix 3).

Plant Macrofossil Report 81-10

Gentianaceae		"gentian family"
Menyanthes trifoliata L.		+ sd

Comments. Identifiable macrofossils are rare; however, the single fruit of *Menyanthes* is good evidence for a climate warmer than present because its present northern limit is far south of Bylot Island (Porsild and Cody, 1980).

Report No. 4.6: 81KY61
Collection site: Cache Creek section, northeastern Bylot Island
Lat. 73°9.7'N, Long. 76°50'W
Stratigraphic position: At base of surface cover of glacial lake(?) sediments (see Unit B, Cache Creek section, Appendix 3).

Fossil Arthropod Report 83-38

Arthropoda		
Insecta		
Coleoptera	"beetles"	
Staphylinidae	"rove beetles"	
Holoboreaphilus nordenskioeldi (Makl.)		+ + hd, el, pr
Curculionidae	"veevils"	
Genus?		+ + ff

Comments. The residue include a few small fragments of wood, but identifiable plant macroffosils are absent. Insect fossils are rare, but if a larger sample were studied *Holoboreaphilus* would clearly dominate. It is a beelte of wet, boggy habitats in both tundra and taiga regions. Bylot Island is probably close to its present northern distributional limit.

Report No. 4.7: 79KY305
Collection site: Salmon River section, Baffin Island
Lat. 72°39'N, Long. 78°09'W
Stratigraphic position: Sample collected from stratified sands within section (see Unit Da, Salmon River section, Appendix 3).

Fossil Arthropod Report 81-10

Coleoptera		"beetles"
Carabidae	"ground beetles"	
Dyschirius sp.		+ el
Pterostichus (Cryobius) brevicornis Kirby		+ pr
Pterostichus (Cryobius) sp.		+ hd

Comments. The organic material contains an abundance of coal and mosses. Insect fossils are rather rare, but they show that a larger sample would probably yield some climatically significant specimens. *Dyschirius*, sp. for example, contains several species, but most do not reach tundra, and so far as is known, none of the *Dyschirius* species range as far north as Baffin Island. The most northern species appear to have their present northern limit in eastern Canada in northern Labrador (A. Morgan, personal communication, 1988).

Plant Macrofossil Report 81-9

Potamogetonaceae	"pond weed family"	
Potamogeton Richardsonii (Benn.) Rydb.		+sd (p-)
Cyperaceae		"sedge family"
Carex aquatilis Wahlenb.		+sd
Carex sp.		+sd
Betulaceae		"birch family"
Betula sp. (dwarf shrub type)		+br, sd
Polygonaceae		"buckwheat family"
Rumex sp.		+sd
Caryophyllaceae	"pink family"	+sd (p-)
Stellaria? sp.		
Ranunculaceae	"crow foot family"	
Ranunculus aquatilis L. (= *R. trichophyllus* Chaix.)		+sd
Ranunculus sp.		+sd
Rosaceae		"rose family"
Potentilla sp.		+sd
Ericaceae		"heath family"
Empetrum nigrum L.		+sd
Haloragaceae		"water milfoil family"
Hippuris vulgaris L.		+sd

Comments. *Potamogeton, Hippuris* and *Ranunculus aquatilis* are water plants. *Carex aquatilis* grows near water. Thus, even though the fossils come from sandy (alluvial?) sediments, some of them originate from ponds, most likely on or near the former flood plain.

Three of the taxa listed (*Betula, Rumex,* and *Potamogeton Richardsonii* have northern limits far south of Pond Inlet (Porsild and Cody, 1980). No species of *Rumex* or *Potamogeton* grows even close to the northern part of Baffin Island. Because of this fact and because the disjunct taxa include both aquatic and nonaquatic plants, it may be assumed with confidence that the climate of the growing season was warmer than at present. In the eastern part of Canada the northernmost species of *Rumex* and *Potamogeton* do not grow far beyond treeline; thus, the growth season climate on northern Baffin Island at the time of deposition of KY305 may have been similar to that prevailing in low arctic Zone 4 type tundra (Young, 1971).

Report No. 4.8: 79KY306

Collection site: Salmon River section, Baffin Island
Lat. 72°39'N, Long. 78°09'W
Stratigraphic position: Collected from bedding planes of lower crossbedded sands (see Unit Db, Salmon River section, Appendix 3).

Fossil Arthropod Report 81-4

Coleoptera		"beetles"
Carabidae	"ground beetles"	
Pterostichus (Cryobius) sp.		+el
Genus?, cf. *Pterostichus*		+el (ff)
Amara (Curtonotus) sp.		+el

Comments. Insect fossils are rare and not indicative of any particular regional or local environment. It is worth noting, however, that the sample site is near the northern limit of all species of the subgenus *Cryobius* and the most arctic ground beetle species in Canada – *Amara (Curtonotus) alpina* Payk. – reaches its northern limit on Devon Island.

The elytral fragment tentatively referred to *Pterostichus* is unusual and does not resemble any of the species commonly found in northern assemblages,but not enough of the fossil is present to allow identification.

Plant Macrofossil Report 81-4

Cyperaceae	"sedge family"
Carex sp.	+sd
Ericaceae	"heath family"
Empetrum nigrum L.	++sd
Ledum sp.	+cp
Arctostaphylos? sp.	
Gentianaceae	"gentian family"
Menyanthes trifoliata L.	+sd

Comments. The plant macrofossils include some well preserved mosses, and coal and carbonized wood was abundant. Other plant fragments are well preserved and include some objects (e.g., *Ledum* capsule) which are not often seen as fossils. *Empetrum nigrum* "seeds" are abundant and dominate the small assemblage.

In spite of the small size of the assemblage it contains some interesting fossils. For example, according to Hultén (1968), Bylot Island and northern Baffin Island is just beyond the northern limit of *Ledum*. More interesting is that *Menyanthes trifoliata* does not even grow on Baffin Island (Porsild and Cody, 1980). Though conclusions based on a single fossil are often suspect, it does appear that the presence of *Menyanthes trifoliata* indicates a climate warmer than at present.

Report No. 4.9: 79KY529

Collection site: Northeast coast section III; Bylot Island
Lat. 73°13.5'N, Long. 76°36'W
Stratigraphic position: Organic matter in foreign drift, incorportated by mass wasting or periglacial processes (see Unit A, Northeast coast section III, Appendix 3).

Fossil Arthropod Report 81-6

Comments. Most organics look like finely macerated sedge or grass rhizomes, leaves or stems. Small wood fragments were also present.

The picked fraction contains only one fragment of an insect (probably from an Aleocharine staphylinid beetle) and no identifiable seeds or fruits.

Organic material has a radiocarbon age of 2480 ± 50 BP (GSC-3034).

Report No. 4.10: 81KY17

Collection site: Sermilik Glacier section Ia, Bylot Island
Lat. 72°49.6'N, Long. 78°4.8'W
Stratigraphic position: Collected beneath ice-contact stratified drift (see Unit Bc, Sermilik Glacier section Ia, Appendix 3).

Fossil Arthropod Report 83-39

Arthropoda		
Insecta		
Coleoptera	"beetles"	
Staphylinidae	"rove beetles"	
Olophrum latum Makl.		+el, pr
Crustacea		
Cladocera	"water fleas"	
Daphnia sp.		+eh

Comments. Insect fossils are rare. *Olophrum latum* is a northern species and can probably be found on Bylot Island today.

Plant Macrofossil Report 83-49

Bryophytes		+
Rosaceae		"rose family"
Dryas integrifolia Vahl.		+lf

Comments. Plant macrofossils are rare, and it is clear that a huge volume of sediment would be required to produce a meaningful macrofossil assemblage. A few small twigs (some with bark) remained on the 5 mesh sieve. *Dryas integrifolia* grows on Bylot Island today.

Report No. 4.11: 81KY58

Collection site: Section in front of glacier E131, northeastern Bylot Island
Lat. 73°19.4'N, Long. 77°18.9'W
Stratigraphic position: Collected at the top of indicated, iron-stained outwash comprising the base of the section (see Glacier E131 section, Appendix 3).

Plant Macrofossil Report 83-45

Bryophytes		+
Ericaceae		"heath family"
Cassiope sp.		+lf

Comments. Macrofossils of plants are rare. The only identified plant, *Cassiope*, grows on Bylot Island today. No insect fossils were seen.

Report No. 4.12: 81KY65

Collection site: Cape Graham Moore section, southeastern Bylot Island
Lat. 73°1.8'N, Long. 77°3.7'W
Stratigraphic position: Collected from a coarse sand unit underlying outwash and marine sediments (see Cape Graham Moore section, Appendix 3).

Fossil Arthropod Report 83-37

Fossils:

Arthropoda		
Insecta		
Coleoptera	"beetles"	
Carabidae	"ground beetles"	
Pterostichus (Cryobius) sp.		+hd, el (p-)
Curculionidae	"weevils"	
Lepyrus sp.		+el (ff)
Arachnida		
Acari	"mites and ticks"	
Oribatei	"oribatid mites"	+

Comments. In addition to the insect fossils listed above, fungal sclerotia are abundant. Insect fossils are rare and poorly preserved. All of the named taxa probably occur on Bylot Island today.

Report No. 4.13: 81KY73
Collection site: Button Point area, Bylot Island
Lat. 72°45.7'N, Long. 76°8.6'W
Stratigraphic position: Collected from sand unit (see units C and Da, Button Point section V, Appendix 3).

Fossil Arthropod Report 83-41

Arthropoda		
Insecta		
Coleoptera	"beetles"	
Carabidae	"ground beetles"	
Pterostichus (Cryobius) sp.		+ hd, el (ff)
Staphylinidae	"rove beetles"	
Genus?		+ el
Holoboreaphilus nordenskioeldi (Mäkl.)		+ el
Micralymma sp.		+ pr
Stenus sp.		+ pr, el
Leiodidae	"round fungus beetles"	
Agathidium sp.		+ el
Lathridiidae	"minute brown scavenger beetles"	
Corticaria sp.		+ pr, hd
Hymenoptera	"wasps and ants"	
Ichneumonoidea	"ichneumons and braconids"	+ ff
Arachnida		
Acari	"mites and ticks"	
Mesostigmata		
Trachytidae		
Trachytes sp.		+
Prostigmata		
Oribatei	"oribatid mites"	
Belboidea		
Epidamaeus sp.		+
Eremaeoidea		
Eremaeus sp.		+
Ameronothroidea		
Ameronothrus sp.		?

Comments. Insect fossils are rather rare and poorly preserved. *Agathidium* and *Corticaria* may not occur as far north as Bylot Island today, but both represent groups whose present northern distribution is poorly known. In *Arctic Arthropods* (Danks, 1981), the family Leiodidae (in which *Agathidium* occurs) is not listed, and *Corticaria* is listed only as an adventitious taxon in the low Arctic. All other taxa in the list, including the mites, probably occur in the region today.

Plant Macrofossils Report

Bryophytes	+
Cyperaceae	"sedge family"
Carex sp.	+sd

Comments. Plant fossils are very rare and those present indicate little about the former environment. A much larger sample would be required to yield enough plant macrofossils for any meaningful paleoenvironmental statement.

References

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