ARCTIC
VOL. 38, NO. 4 (DECEMBER 1985) P. 271-280

Quaternary Glaciomarine Sedimentation Interpreted from Seismic Surveys of Fiords on Baffin Island, N.W.T.[1]

ROBERT GILBERT[2]

ABSTRACT. Seismic reflection surveys using a compressed air source in nine fiords on Baffin Island provide information on the amounts of sediment deposited and the relation of sedimentation to events during late Quaternary glaciation. Five sedimentary facies can be recognised in the seismic records: (A) a basal facies of ice contact glacial sediment including moraines and deformed, stratified, glaciomarine sediment, (B) a lower glaciomarine facies of well-stratified sediment deposited in an ice-proximal environment, (C) a facies of acoustically transparent sediment deposited in a lower energy environment farther from sources of glacial sediment, (D) an upper, well-stratified facies similar to facies B and also interpreted as ice-proximal, and (E) a thin facies of modern sediment on top of the other materials. These facies are tentatively correlated with glacial events on eastern Baffin Island. Facies A and B are associated with the retreat of glaciers from the outer coast and continental shelf of Baffin Island during the early Foxe Period (>50 000 BP). Facies D is associated with the readvance of glaciers to form the moraines of the Baffinland drift during the Cockburn Substage of the Early Holocene. The intervening Facies C is associated with lower energy conditions and less sediment input in a long period between these events, and Facies E with the present environment in the fiords.

Key words: Baffin Island, fiords, sedimentology, continuous seismic profiling, Quaternary glaciation

RÉSUMÉ. Des études par réflexion sismique effectuées à l'aide d'une source d'air comprimé dans neuf fjords de l'île de Baffin fournissent des données sur la quantité de sédiments qui y sont déposés et sur la relation de la sédimentation aux événements de la glaciation quaternaire supérieure. On reconnait cinq facies sédimentaires dans les records sismiques: (A) un facies de fond composé de sédiment glaciaire en contact avec la glace, comprenant des moraines et des sédiments glaciomarins déformés et stratifiés; (B) un facies glaciomarin plus profond composé de sédiment mieux stratifié dans un milieu presque glacial; (C) un facies de sédiment démontrant une transparence acoustique, déposé dans un milieu à énergie inférieure, plus loin des sources de sédiments glaciaux; (D) un facies bien stratifié et plus élevé, semblable au facies B et interprété de même comme étant presque glacial; et (E) un mince facies de sédiment moderne reposant sur d'autres matières. Ces facies sont reliés de façon provisoire à des événements glaciaires survenus dan l'est de l'île de Baffin. Les facies A et B sont associés au recul des glaciers de la côte extérieure et du plateau continental de l'île de Baffin au cours de la période Foxe inférieure (50 000 avant notre ère). Le facies D est associé à la deuxième avance de glaciers formant ainsi les moraines du drift de Baffin au cours du sous-étage Cockburn de l'Holocène inférieur. Le facies C intermédiaire est associé aux conditions d'énergie inférieure et à la diminution de l'entrée de sédiments pendant une longue période entre ces événements, et le facies E est relié au milieu actuel des fjords.

Mots clés: île de Baffin, fjords, sédimentologie, prise continue de profils sismiques, glaciation quaternaire

Traduit pour le journal par Maurice Guibord.

INTRODUCTION

In 1982 and 1983 the Bedford Institute of Oceanography carried out studies of the sedimentology of ten fiords on the east coast of Baffin Island (Syvitski and Schafer, 1985). In this paper are presented results of geophysical surveys on nine fiords conducted during this program. Continuous seismic reflection profiles were made with a 0.66 L compressed air source (air-gun) and a Huntec deep towed, high resolution boomer system (Hutchins *et al.*, 1976). In total 476 km of seismic lines are available.

PHYSICAL SETTING

The fiords of eastern Baffin Island lie in the Davis Highland physiographic region (Fig. 1). In the south, much of Cumberland Peninsula is an ice-covered plateau 1500-2000 m above sea level, deeply dissected by fiords and through-valleys. Farther north the highest elevations occur along the mid and outer reaches of the fiords, whereas the western portions of the drainage basins lie in the rolling hills of the Davis Upland.

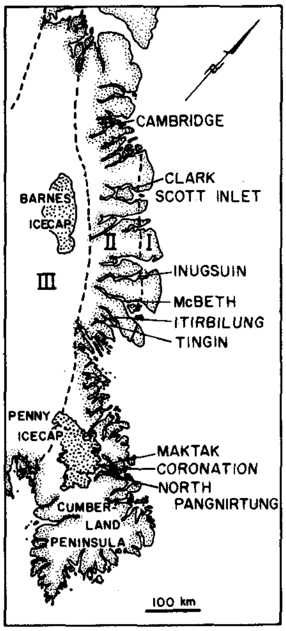


FIG. 1. Map of eastern Baffin Island showing the location of the fiords described and the physiographic regions: (I) Baffin Coastal Lowland, (II) Davis Highland, and (III) Davis Upland.

The physiographic characteristics of the fiords and their present drainage basins are summarized in Table 1 and Figures 2 to 6. The size of the drainage basins varies from 3584 km^2 (McBeth Fiord) to 1128 km^2 (Coronation). The basins vary from 70% (Coronation) to 12% (Cambridge) glacier covered. Generally, the glaciers in the drainage basins of the southern fiords are concentrated at the heads of the basins, while those

---

[1] SAFE contribution No. 2.

[2] Department of Geography, Queen's University, Kingston, Ontario, Canada K7L 3N6

TABLE 1. Morphometric data summary — Baffin Island fiords

Fiord	Basin area (km²)	Percent basin glacier covered	Fiord surface area (km²)	Maximum depth (m)	Outer sill depth (m)	Maximum calculated sediment thickness (m)
North Pangnirtung	2064	34.9	170	479	none	36
Coronation	1128	69.9	131	606	none	94
Maktak[a]	1132	46.6	60	320	none	58
Tingin	1228	36.8	218	523	180?	94
Itirbilung	2184	31.9	162	435	249	131
McBeth	3484	25.6	402	563	249	174
Inugsuin	2192	23.7	563	633	121	83
Clark	1324	39.6	144	720	?[b]	131
Cambridge	1992	12.1	219	708	439	171

[a] To the confluence with Coronation Fiord.

[b] Deep sill at 605 m in fiord, but Scott Inlet insufficiently sounded to determine bathymetry.

in the north are found in the highlands along the sides and toward the mouths of the fiords (Figs. 2–6).

Four of the fiords (Maktak, North Pangnirtung, Tingin and Inugsuin) do not have calving glaciers, and only in Coronation Fiord is there a large calving glacier occupying the full width of the main valley at the head of the fiord. In all of the other fiords except Inugsuin, sandurs at the fiord heads are the major present sources of sediment input.

The Quaternary history of eastern Baffin Island is described by Miller *et al.* (1977), Andrews (1978, 1979), and Andrews and Ives (1972, 1978). During early stages of the Foxe Glaciation (more than 50 000 BP) ice extended to the outer coast of much of Baffin Island and onto the continental shelf in front of the major fiords. Lateral moraines that may relate to this event occur on the flanks of Scott Trough (Løken and Hodgson, 1971) and Broughton Trough (Gilbert, 1982b).

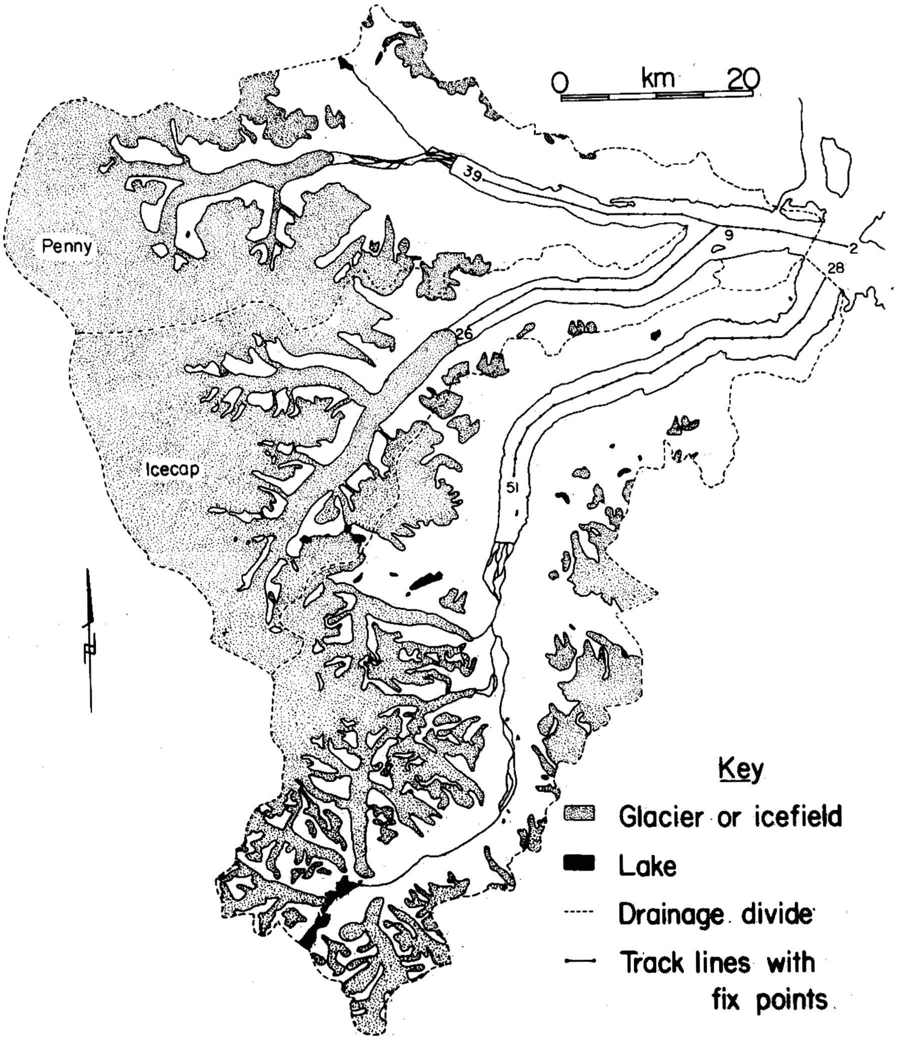


FIG. 2. Maktak Fiord (north), Coronation Fiord (centre) and North Pangnirtung Fiord (south) from National Topographic Maps at scale 1:250 000. The seismic track lines refer to profiles shown in Figure 7.

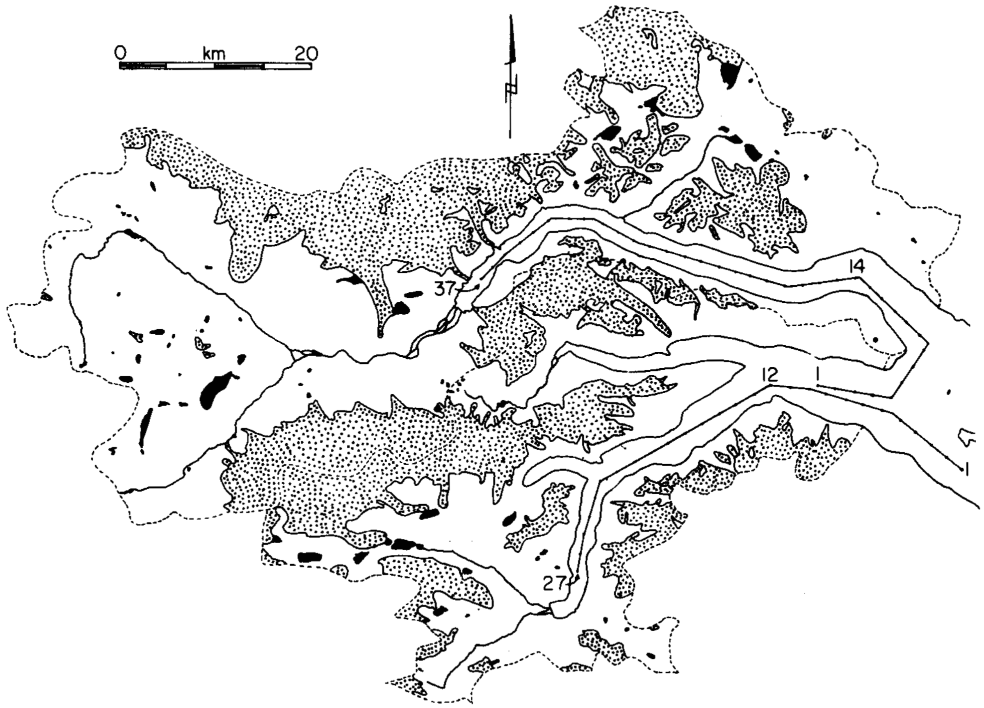


FIG. 3. Itirbilung Fiord (north) and Tingin Fiord (south) from National Topographic Maps at scale 1:250 000. The seismic track lines refer to profiles shown in Figure 7.

Very little is known of glacial limits during the long period following this maximum until deposition of the well-defined Baffinland drift. This drift includes a series of prominent moraines resulting from the last advance of the Laurentide ice in eastern Baffin Island during the Cockburn Substage of the early Holocene between 8000 and 9000 BP (Andrews and Ives, 1978). The outer limit of the Baffinland drift is located seaward of the present head of Maktak, McBeth, Inugsuin, Cambridge and possibly Tingin fiords. It does not reach Itirbilung Fiord and extends only to the western edge of the drainage basin of Clark Fiord (Andrews and Ives, 1978). It is probable that for much of the Foxe Glaciation between the time of maximum ice extent and the deposition of the Baffinland drift, the fiords were nearly or completely ice free (Miller *et al.*, 1977) and sea level may have been some tens of metres below the present level (Andrews and Ives, 1978).

THE SEISMIC DATA

The seismic track lines were laid out in straight line segments as nearly as possible along the middle of the fiords (Figs. 2–6). Fix points were located at 1 nautical mile intervals (1.85 km) except in Inugsuin and Clark fiords, where they were at 2 nautical mile intervals (3.71 km). Navigation by radar ranging was reported from the ship's bridge.

Transcriptions of the air gun records are presented in Figure 7 to show the general patterns of bathymetry and sedimentation in the fiords. Water depths and sediment thicknesses are plotted at 0.62 km intervals. Water depth is calculated assuming sound velocity in water of 1480 $m \cdot s^{-1}$. Sediment thickness is calculated from Hamilton's (1974) model. The velocity of sound at the sediment surface is calculated as 1525 $m \cdot s^{-1}$ from Anderson's (1974) equations and data on porosity in cores from the Baffin Island fiords reported by Hein and Longstaff (1983) and Andrews (1983). A linear increase in velocity with depth into the sediments of 1.0 s^{-1} is assumed (as Hamilton, 1974), which gives a calculated maximum velocity of 1700 $m \cdot s^{-1}$ at the maximum depth of 175 m. These values are similar to those reported by Bornhold (1983) and Solheim and Grønlie (1983) for fiords in British Columbia and Norway.

QUATERNARY SEDIMENTARY ENVIRONMENTS

Cores of sediment recovered from the Baffin fiords are 5-12 m long (Syvitski and Blakeney, 1983). Thus, at most sites only a small fraction of the total sediment accumulation may be examined directly. Interference on the nature of sedimentary environments during most of the long period of deposition can only be made from the seismic records. In those records, five distinct sedimentary facies can be recognised:

- Facies A: ice-contact and ice-proximal glacial sediments deposited on the bedrock floor of the fiords. Two subunits may be distinguished in some locations:
  A1: massive, largely structureless sediment interpreted as till, and
  A2: glaciomarine sediments deformed by push of an advancing glacier,
- Facies B: lower stratified glaciomarine sediments,
- Facies C: unstratified glaciomarine sediments,
- Facies D: upper stratified glaciomarine sediments, and

FIG. 4. Inugsuin Fiord (north) and McBeth Fiord (south) from National Topographic Maps at scale 1:250 000. The seismic track lines refer to profiles shown in Figure 7.

- Facies E: a surface veneer of acoustically transparent sediments.

These facies have been drawn onto the profiles of Figure 7. Not all are present everywhere in the fiords, and in a few cases, especially toward the mouths of the fiords, it is not possible to distinguish among facies even where those nearby are clearly recognisable (for example, in Tingin Fiord, Fig. 7d). Figure 8 shows the suggested sequence of glacial events associated with each depositional environment.

Facies A1 is characterized by an irregular surface and a relatively structureless interior, as seen in the absence of clear acoustical reflectors. Where echoes from the fiord sides interfere and at the sills, it is difficult to distinguish Facies A1 from bedrock. It is possible that these materials may include some pre-Pleistocene, nonglacial sediments, although there is no seismic evidence to distinguish sediments or sedimentary rocks beneath the glacial materials. The sediments of Facies A1 occur in three forms on the fiord floors. In some cases, as in North Pangnirtung Fiord (Fig. 7a), they form a blanket up to several tens of metres thick. Elsewhere (especially in McBeth and Inugsuin fiords — Figs. 7f and g) they partially fill hollows in the fiord floor, smoothing the bedrock topography. In other locations, the best example of which is Cambridge Fiord (Fig. 7i), they occur as recessional moraines, which add considerable relief to the fiord floor.

Contorted, stratified sediments (Facies A2) overlie the ice-contact glacial sediments, especially in the central basin of Itirbilung Fiord (Fig. 7e) and behind the inner sill of McBeth Fiord (Fig. 7f). Strong acoustic reflectors dip up-fiord, suggesting a sequence of shear planes or folds. The sediments are interpreted as glacial and glaciomarine sediments that have been overridden and deformed by an advancing glacier (Fig.

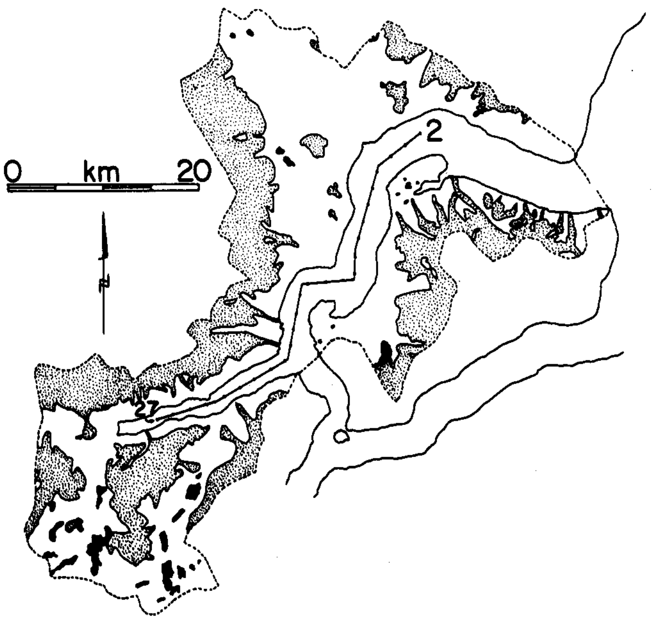


FIG. 5. Clark Fiord from National Topographic Maps at scale 1:250 000. The seismic track line refers to the profile shown in Figure 7.

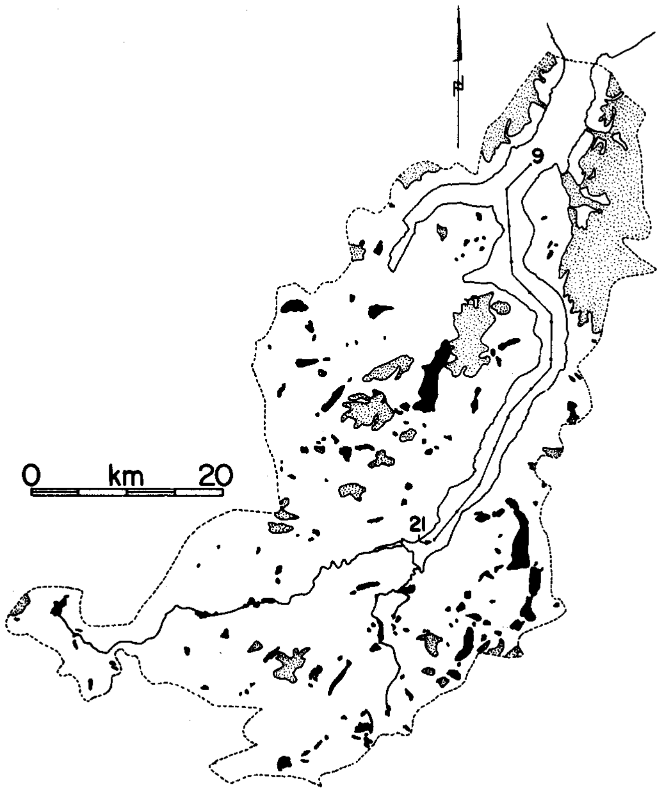
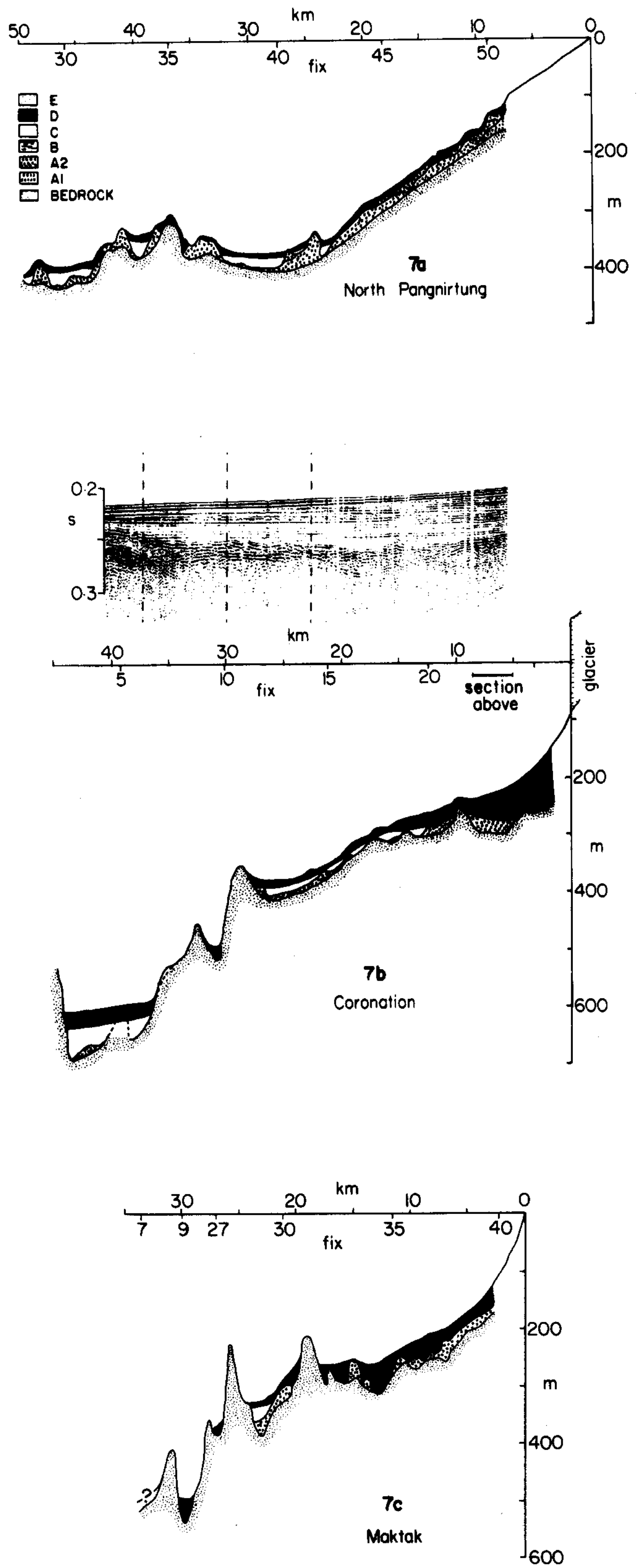
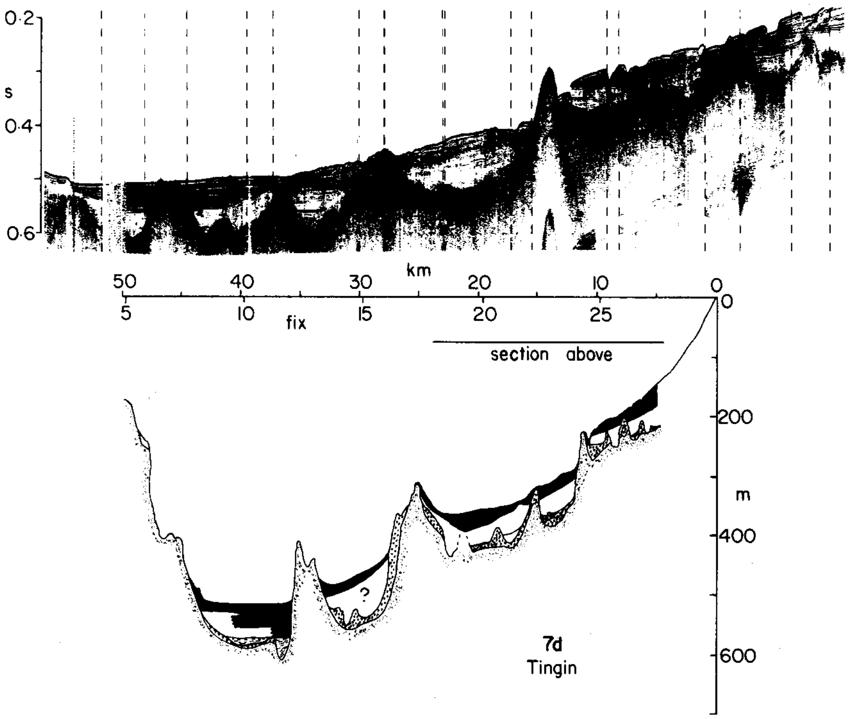
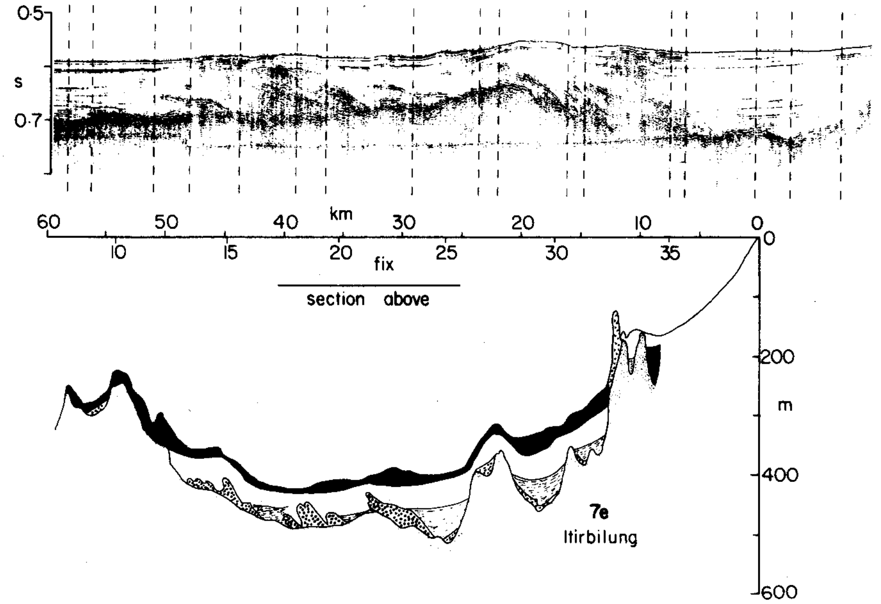


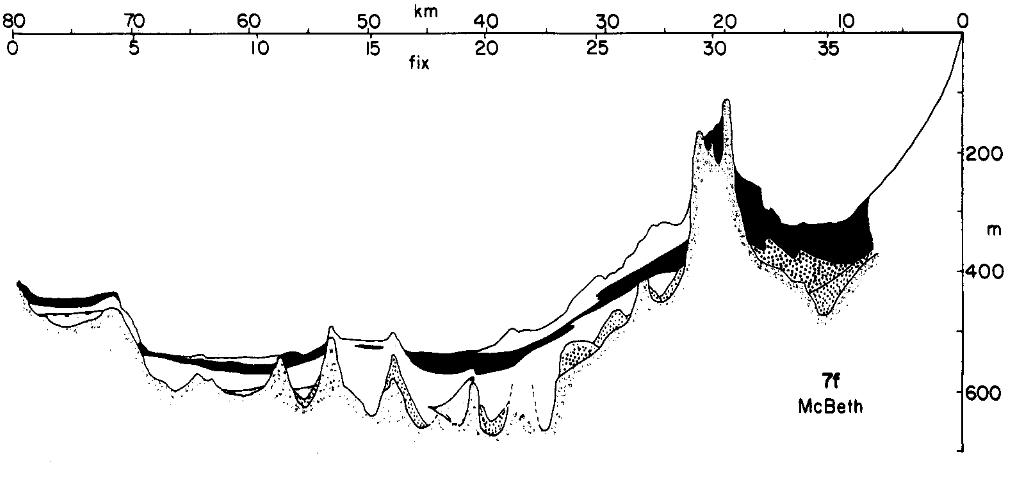
FIG. 6. Cambridge Fiord from National Topographic Maps at scale 1:250 000. The seismic track line refers to the profile shown in Figure 7.

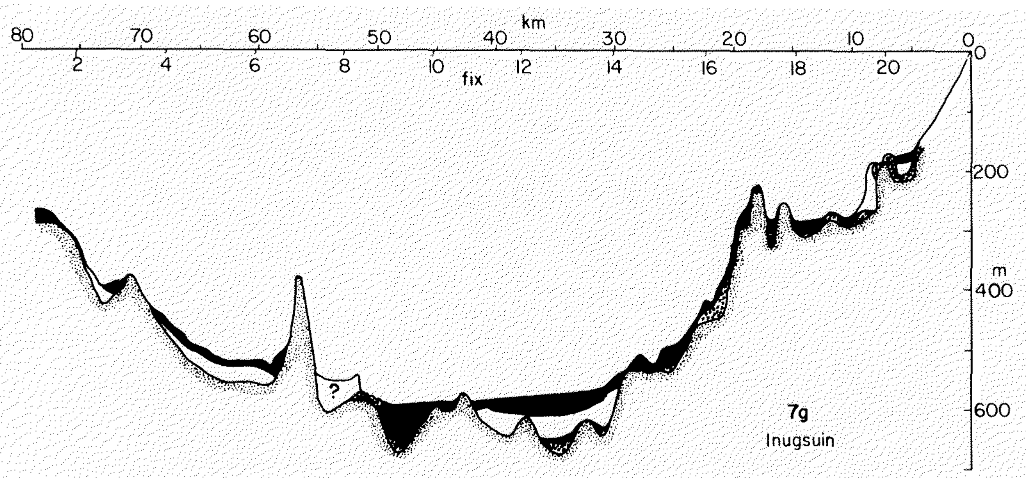
FIG. 7(a-i). Facies interpretation of air-gun seismic profiles. Distances are from the head of each fiord. Fix points are shown in Figures 2 to 6. Vertical exaggeration is 50 times. Vertical scale of the selected sections of the air-gun record shown above the profiles is the two-way travel time of sound in seconds.

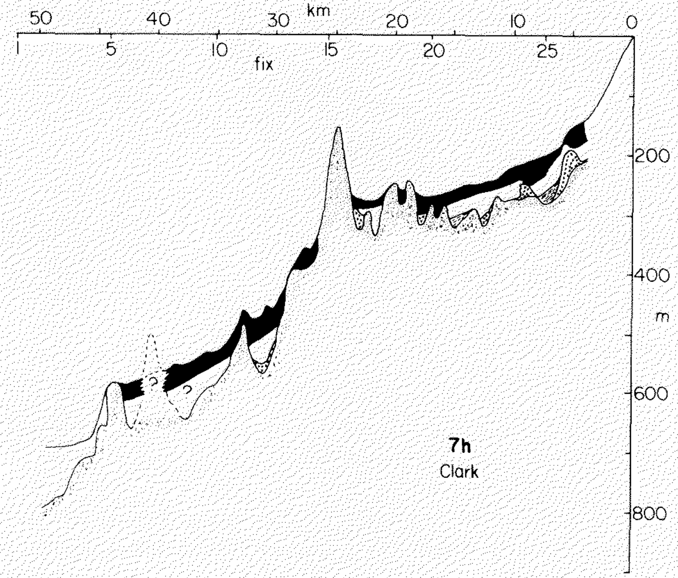



0·2
s
0·4
0·6
km
50
40
30
20
10
0
5
10
fix
15
20
25
0
section above
200
m
400
600
?
7d
Tingin


0·5
s
0·7
60
50
40
km
30
20
10
0
10
15
20
fix
25
30
35
0
section above
200
m
400
7e
Itirbilung
600


80
70
60
50
km
40
30
20
10
0
0
5
10
15
fix
20
25
30
35
200
m
400
600
7f
McBeth

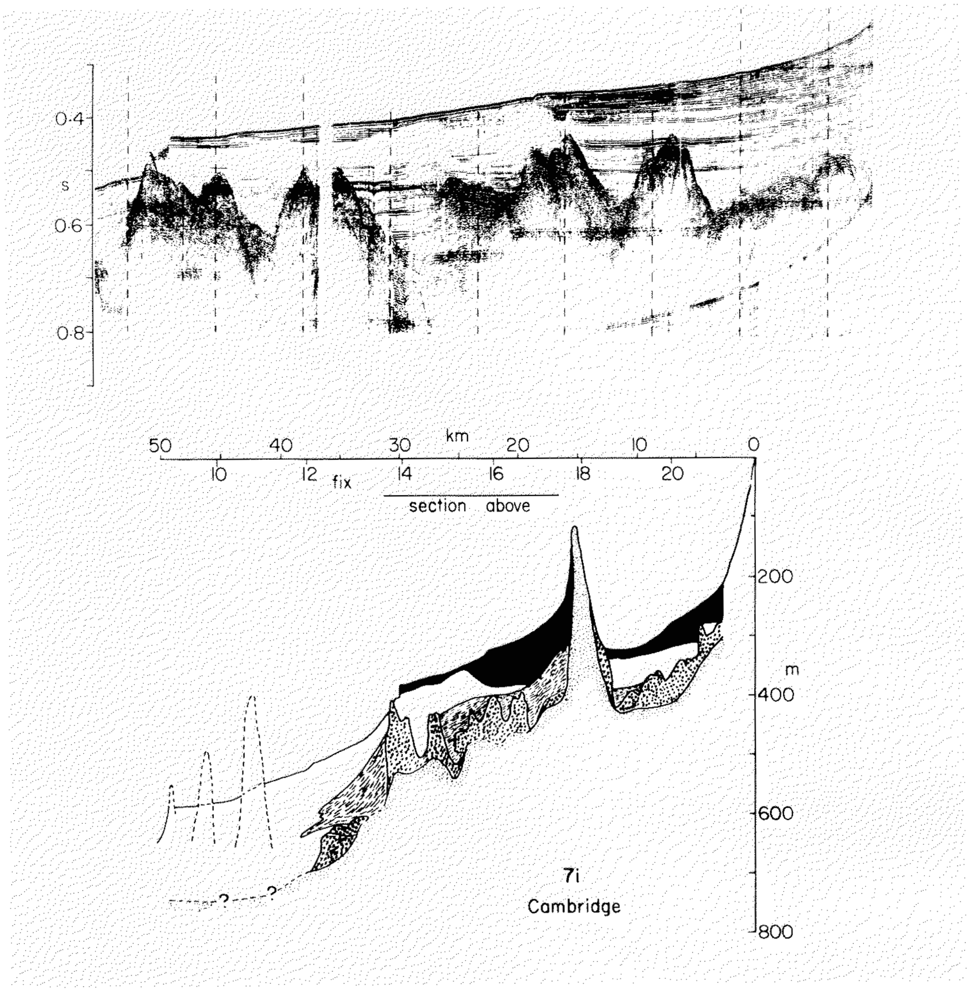




8c). If the glacier was partially floating, the basal shear stress may only have been sufficient to deform but not remove these materials. Nearby, in a cut-bank of McBeth River at the head of the fiord, a series of overthrust faults in the raised glaciomarine sediments (Fig. 9) is thought to be similar to those in the seismic record. Elsewhere, large-scale thrust blocks have also been ascribed to glacial overriding (for example, Houmark-Nielsen, 1983; Sjørring, 1983).

Facies B and D are composed of sediments with strong parallel and approximately horizontal acoustic reflectors throughout. Where only one stratified facies occurs, it is shown on Figure 7 as Facies D. The lower Facies B is generally thin and restricted to the immediate vicinity of the moraines (Facies A1), except in Cambridge and Itirbilung fiords, where its thickness is comparable to that of Facies D. The large number of closely spaced reflectors in this facies (for example, in Tingin Fiord, Fig. 7) may represent coarser sediments deposited from gravity flows in an environment of high energy associated with a large and rapidly varying sediment input, as occurs in the vicinity of an active glacier (see also Aarseth, 1980; Bornhold, 1983; and Solheim and Grønlie, 1983). That this pattern also occurs in the modern sediments in front of Coronation Glacier (Fig. 7b) is evidence supporting this interpretation.

Between the upper and lower stratified Facies B and D occurs an acoustically transparent layer of sediment. In some locations, especially in the distal regions of Cambridge Fiord (Fig. 7i) and possibly Clark Fiord (Fig. 7h), these sediments constitute most or all of the sedimentary record. The lack of acoustic structure suggests these sediments were deposited in lower energy, quieter conditions when glaciers that were the major sources of sediment supply had retreated farther from the sites of deposition in the fiords. Although occasional reflectors do occur in these sediments, they are widely spaced and generally weaker than those of Facies D. The high energy events associated with pulses of inflowing sediment and with



gravitational processes in the fiord, which would provide strong acoustic reflectors, appear to occur with lower frequency and magnitude.

On the surface of most of the fiord sediments is a thin veneer of acoustically transparent material (Facies E). At most sites it is thin enough to be masked in the bubble pulse of the air-gun record and is only clearly seen in the Huntec high resolution record. It is mapped in Figure 7 only where it is more than about 10 m thick, as in McBeth Fiord, seaward of the inner sill (Fig. 7f). The sediments of Facies E are associated with present conditions in the fiords. With the exception of North Pangnirtung, Coronation and Maktak fiords, large glaciers are no longer contributing sediment to the fiords and conditions may be similar to those under which sediments of Facies C were deposited. Rates of sedimentation during the last 6000 years are of the order of 0.5 mm·a^{-1} (Andrews *et al.*, 1984), suggesting that, on average, about 3 m of Facies E may have been deposited since the retreat of ice from the Baffinland moraines.

DISCUSSION

In the absence of direct evidence from the sediments, the following sequence of events is interpreted from the seismic records of sedimentary environments.

1. The ice-contact sediments (Facies A1) and the proximal glacial sediments (Facies B) were deposited during the period of glacial retreat from the maximum advance beyond the Baffin coast. Minor readvances during the period of retreat modified sediments, especially of Facies B, to produce the glacially deformed Facies A2. The small amount of Facies B in most fiords suggests that retreat may have been rapid.

2. Facies C was deposited in a relatively quiet, low energy environment. Evidence from foram assembleges in Baffin Bay sediments (Aksu, 1979) indicates that from about 40 000 BP to 9000 BP arctic water dominated Baffin Bay, as occurs presently. This suggests a colder and perhaps drier environment and, in turn, that the glaciers were less extensive and less active during this period. Sediment input and high energy gravity flow events would be less common than during the deposition of Facies B and D. Circulation may have been restricted, associated with less inflow and longer periods of ice cover. In distal portions of the fiords deposition of Facies C occurred when the major glaciers had retreated upfiord, especially where intervening sills interrupted the distribution of sediment to these areas. Where Facies C occurs at the head of fiords

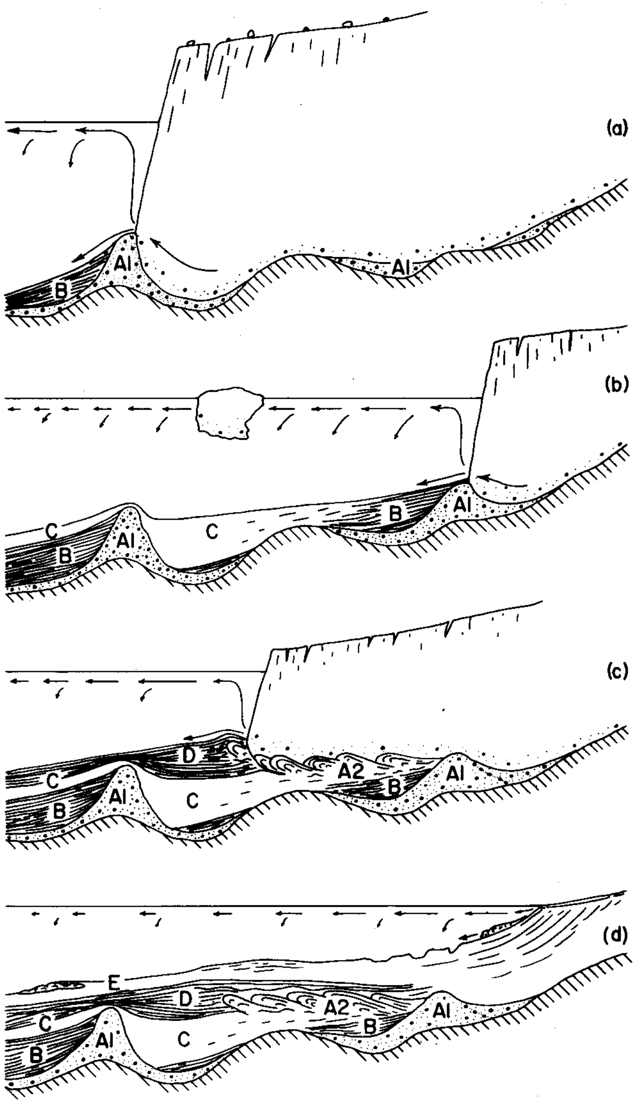


FIG. 8. Sketch of the general sequence of glacial and glaciomarine sedimentary environments in the fiords of Baffin Island as interpreted from the seismic records. Capital letters refer to facies described in the text.

beneath Facies D, it is probable that major glaciers had withdrawn some distance from the fiords, or even from the drainage basins.

3. Facies D was deposited during reactivation of the higher energy, proximal sedimentary environment brought about by a readvance of major glaciers to the heads of the fiords.

4. As the glaciers withdrew again, a thin veneer of acoustically transparent sediment (Facies E) was deposited on top of the sedimentary sequence and represents the sedimentary environment at most sites today.

Without the control of dates from these sediments correlations are tentative. However, for the fiords north of Maktak a general pattern of circulation corresponding to the glacial events presented by Miller *et al.* (1977) is reasonable. The retreat from the early Foxe maximum more than 50 000 BP is marked by Facies A and B. The major readvance of glaciers to form the Baffinland drift 8000-9000 BP brought large glaciers to the heads of the fiords, during warmer and probably wetter conditions when subarctic water occupied Baffin Bay (Aksu, 1979), and resulted in the deposition of Facies D in an environment of high sediment input. The seismic record provides no direct information on the long period from 50 000 to 8000 BP of glacial and climatic fluctuations in this period. However, if sediments of Facies C are from this period, then areas where they have accumulated may be fertile sites for deep drilling.

FIG. 9. Raised glaciomarine sediments about 5 m above sea level along the north side of the McBeth River valley near the delta. These sediments are interpreted as being similar to those of Facies A2 in the seismic record, with faulting caused by an overriding glacier flowing from the left (upfiord). Field of view is about 15 m.

In the three most southerly fiords, North Pangnirtung, Coronation and Maktak, a different pattern is evident. Here sediments are still coming from large, active glaciers at or near the fiord heads (Fig. 2), and Facies D represents an environment of contemporary deposition. An additional difference between these fiords and the rest is that the total amount of sediment accumulation here is less, especially considering the large sources at the heads of the fiords.

A number of factors may account for this. First, the parts of the basins draining to the sides of the fiords are small, and there are no significant sources of sediment. Second, sediments may be more easily passed from these fiords as there are no sills, and the fiords open into Broughton Trough, which crosses the continental shelf at depths between 300 and 700 m (Gilbert 1982a,b). In the deepest basin in the outer portion of the fiords (below 500 m) sediments are up to 80 m thick (Fig. 7b). Similar deposits occupy the basins in the inner portions of Broughton Trough (Gilbert, 1982b). This suggests that currents are transporting the sediment from the central portions of these fiords and that only where protected and dammed in deep basins is it able to accumulate significantly. Finally, they have a relatively large tidal range (Energy, Mines and Resources, 1970), which may contribute to a more vigorous circulation of their waters.

CONCLUSIONS

1. The accumulation of sediment in the fiords of Baffin Island bears little relation to the present physiography of the

fiords and their drainage basins. The northern fiords have large accumulations of sediment but fewer and smaller glaciers in their drainage basins, with the result that there is probably less sediment input. In southern Baffin Island, North Pangnirtung, Coronation, and Maktak fiords have little sediment accumulation by comparison, but large, active glaciers are currently contributing large sediment loads.

2. Other mechanisms, including the morphology of the fiords, tides and currents are important factors in determining the sediment distribution patterns and especially the total sediment accumulation in the fiords.

3. Above basal ice-contact sediments on the fiord floor, marine sediments occur in a sequence of proximal glaciomarine material (Facies B and D) interspaced with a distal Facies C, although not all facies are present at all sites. In the southern fiords Facies C is a minor component of the total accumulation, whereas in the northern fiords it makes up a much larger part of the sediment.

4. The sedimentary facies correlate tentatively with the established glacial history of Baffin Island. Facies A and B relate to glacial retreat from the early Foxe maximum on the outer coast and shelf, Facies C to a long period of reduced sediment input associated with reduced glacial activity, Facies D with glacial advance and deposition of the Baffinland drift 8000 to 9000 BP, and Facies E with present conditions in the fiords.

ACKNOWLEDGEMENTS

The project was supported in part by a grant from the Natural Sciences and Engineering Research Council of Canada. I am grateful to Dr. J.P.M. Syvitski and Dr. C.S. Schafer for the opportunity to take part in cruises to the Baffin fiords and to use the geophysical data, to Brian MacLean for help in the field, and to officers, crew and scientific staff of C.S.S. *Hudson*. Comments on drafts of the manuscript by MacLean, Syvitski, D.J.W. Piper, J. Shaw and P. MacLaren significantly improved the content.

REFERENCES

AARSETH, I. 1980. Glaciomarine sedimentation in a fjord environment: example from Sognefjord. In: Orheim, O., ed. Glaciation and deglaciation in central Norway. Field Guide to Excursion, Symposium on Processes of Glacier Erosion and Sedimentation, Geilo, Norway. Norsk Polarinstitutt. 16-22.

AKSU, A.E. 1979. Baffin Bay in the past 100,000 yr. Geology 7:245-248.

ANDERSON, R.S. 1974. Statistical correlation of physical properties and sound velocity in sediments. In: Hampton, L., ed. The Physics of Sound in Marine Sediments. New York: Plenum Press. 481-518.

ANDREWS, J.T. 1978. Sea level history of arctic coasts during the Upper Quaternary: dating, sedimentary sequences, and history. Progress in Physical Geography 2:375-407.

______. 1979. Progress in relative sea level and ice sheet reconstructions Baffin Island N.W.T. for the last 125,000 years. In: Morner, N.-A., ed. Earth Rheology, Isostacy and Eustasy. New York: John Wiley. 175-200.

______, compiler. 1983. Quaternary piston cores. In: Syvitski, J.P.M., and Blakeney, C.P., compilers. Sedimentology of Arctic Fjords Experiment: HU 82-031 Data Report, Volume 1. Canada Data Report, Hydrography and Ocean Sciences No. 12, 14-1 to 14-69.

______, OSTERMAN, L.E., and KRAVITZ, J. 1984. Quaternary Studies on Baffin Island fiord cores. In: Syvitski, J.P.M., compiler. Sedimentology of Arctic Fjords Experiment: HU 83-028. Data Report, Vol. 2. Canadian Data Report of Hydrography and Ocean Sciences No. 28, 15-1 to 15-64.

ANDREWS, J.T., and IVES, J.D. 1972. Late- and postglacial events (< 10,000 BP) in the eastern Canadian Arctic with particular reference to the Cockburn Moraines and break-up of the Laurentide Ice Sheet. In: Vasari, Y., Hyvarinen, H., and Hicks, S., eds. Climatic Changes in Arctic Areas During the Last Ten-thousand Years. Symposium at University of Oulu, Oulu Finland, Acta University Ouluensis, Series A. Geol. No. 1. 149-174.

______. 1978. "Cockburn" nomenclature and the late Quaternary history of the eastern Canadian Arctic. Arctic and Alpine Research 10:617-633.

BORNHOLD, B.D. 1983. Sedimentation in Douglas Channel and Kitimat Arm. In: Macdonald, R.W., ed. Proceedings of a Workshop on the Kitimat Marine Environment. Canadian Technical Report of Hydrography and Ocean Sciences. No. 18:89-114.

ENERGY, MINES AND RESOURCES. 1970. Hydrographic Tidal Manual. Ottawa. 98 p.

GILBERT, R. 1982a. Contemporary sedimentary environments on Baffin Island, N.W.T., Canada: glaciomarine processes in fiords of eastern Cumberland Peninsula. Arctic and Alpine Research 14:1-12.

______. 1982b. The Broughton Trough on the continental shelf of eastern Baffin Island, Northwest Territories. Canadian Journal of Earth Sciences 19:1599-1607.

HAMILTON, E.L. 1974. Geoacoustic models of the sea floor. In: Hampton, L., ed. Physics of Sound in Marine Sediments. New York: Plenum Press. 181-221.

HEIN, F.J., and LONGSTAFF, F.J. 1983. Geotechnical, sedimentological and mineralogical investigations in arctic fjords. In: Syvitski, J.P.M., and Blakeney, C.P., compilers. Sedimentology of Arctic Fjords Experiment: HU 82-031 Data Report, Vol. 1. Canada Data Report, Hydrography and Ocean Sciences No. 12, 11-1 to 11-158.

HOUMARK-NIELSEN, M. 1983. Glacial stratigraphy and morphology of the northern Baelthav region. In: Ehlers, J., ed. Glacial Deposits in North-West Europe. Rotterdam: A.A. Balkema. 211-217.

HUTCHINS, R.W., McKEOWN, D.L., and KING, L.H. 1976. A deep tow high resolution seismic system for continental shelf mapping. Geoscience Canada 3:95-100.

LØKEN, O.H., and HODGSON, D.A. 1971. On the submarine geomorphology along the east coast of Baffin Island. Canadian Journal of Earth Sciences 8:185-195.

MILLER, G.H., ANDREWS, J.T., and SHORT, S.K. 1977. The last interglacial-glacial cycle, Clyde foreland, Baffin Island, N.W.T.: stratigraphy, biostratigraphy, and chronology. Canadian Journal of Earth Sciences 14:2824-2857.

SJØRRING, S. 1983. Ristinge Klint. In: Ehlers, J., ed. Glacial Deposits in North-West Europe. Rotterdam: A.A. Balkema. 219-226.

SOLHEIM, A., and GRØNLIE, G. 1983. Quaternary sediments and bedrock geology in the outer Oslofjord and northernmost Skagerrak. Norsk Geologisk Tidsskrift 63:55-72.

SYVITSKI, J.P.M., and BLAKENEY, C.P., compilers. 1983 Sedimentology of Arctic Fjords Experiment: HU 82-031 Data Report, Vol. 1. Canada Data Report, Hydrography and Ocean Sciences No. 12, various pagination.

SYVITSKI, J.P.M., and SCHAFER, C.T. 1985. Sedimentology of arctic fjords experiment (SAFE): Project Introduction. Arctic 38: 264-270.