Seafloor evidence for glaciation, northernmost Baffin Bay

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Shaped seafloor features were recorded at three localities on C.S.S. Hudson Cruise 91–039, to northernmost Baffin Bay. They resemble glacially sculptured bedrock hills, varying from 2.5 to 3.0 km in length, with relief of 70 to >90 m, and they occur in water depths of 200 to 400 m. These well developed features occur to the west-southwest, east and north of Carey Øer, an isolated group of islands which bears strong evidence of having been overridden by glacial ice and on top of which marine shells in till are >40 000 years old. The sculptured features at each of the three sites are asymmetric, with well developed stoss and lee sides. Their shapes and orientations are consistent with the hypothesis of a southward-flowing Smith Sound Ice Stream expanding into northernmost Baffin Bay. The Smith Sound Ice Stream is believed to have existed most recently at the Late Wisconsinan gla-cial maximum, but southward-flowing ice reaching as far as Carey Øer at this time appears to be at variance with evidence assembled in the Dundas area, Green-land, which suggests a limited advance of ice during the Wolstenholme Fjord Stade.

Key words: Seafloor, glacial features, radiocarbon dating, Baffin Bay, Carey Øer.

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The main task of C.S.S. Hudson Cruise 91–039, in August and September of 1991, was to carry out a deep seismic refraction program in northernmost Baffin Bay (Figs 1, 2), in order to try to resolve the ongoing controversy concerning the origin of Nares Strait (e.g., Christie et al. 1981, Okulitch et al. 1990, Jackson et al. 1992a, Jackson & Reid 1994). Magnetic and gravity measurements were also made throughout the voyage, and a limited amount of shallow seismic reflection work was included in the scientific program (Jackson et al. 1992b).

A second task comprised both echo sounding and sediment coring to improve our understanding of marine surficial geology and Quaternary history in northernmost Baffin Bay. New areas were traversed, and two sites identified on C.S.S. Hudson Cruise 74–026 (cf. Blake & Lewis 1975, Ross & Falconer 1975) were revisited and cored (Fig. 2). The seafloor information complements the land-based data obtained around northernmost Baffin Bay (north of 76°) over the previ-

ous two decades by Blake (1975, 1977a, 1992a, 1992b), Weidick (1976a, 1976b, 1977), Kelly (1980, 1985, Kelly & Landvik 1990) and by Funder and colleagues (see Funder & Houmark-Nielsen 1990, Funder & Mejdahl 1994, Funder & Hansen 1996), especially with regard to: 1) ice extent at the last glacial maximum, and 2) the sequence of events during deglaciation. The main purpose of the present paper is to report the discovery of features on the seafloor which appear to be glacially sculptured bedrock. Also, new AMS ^{14}C-age determinations are presented which contribute to the chronology of events in northernmost Baffin Bay.

Methods

Ocean bottom seismometers (OBS's) were used in the deep seismic refraction program, and every point along the planned refraction lines was crossed three times:
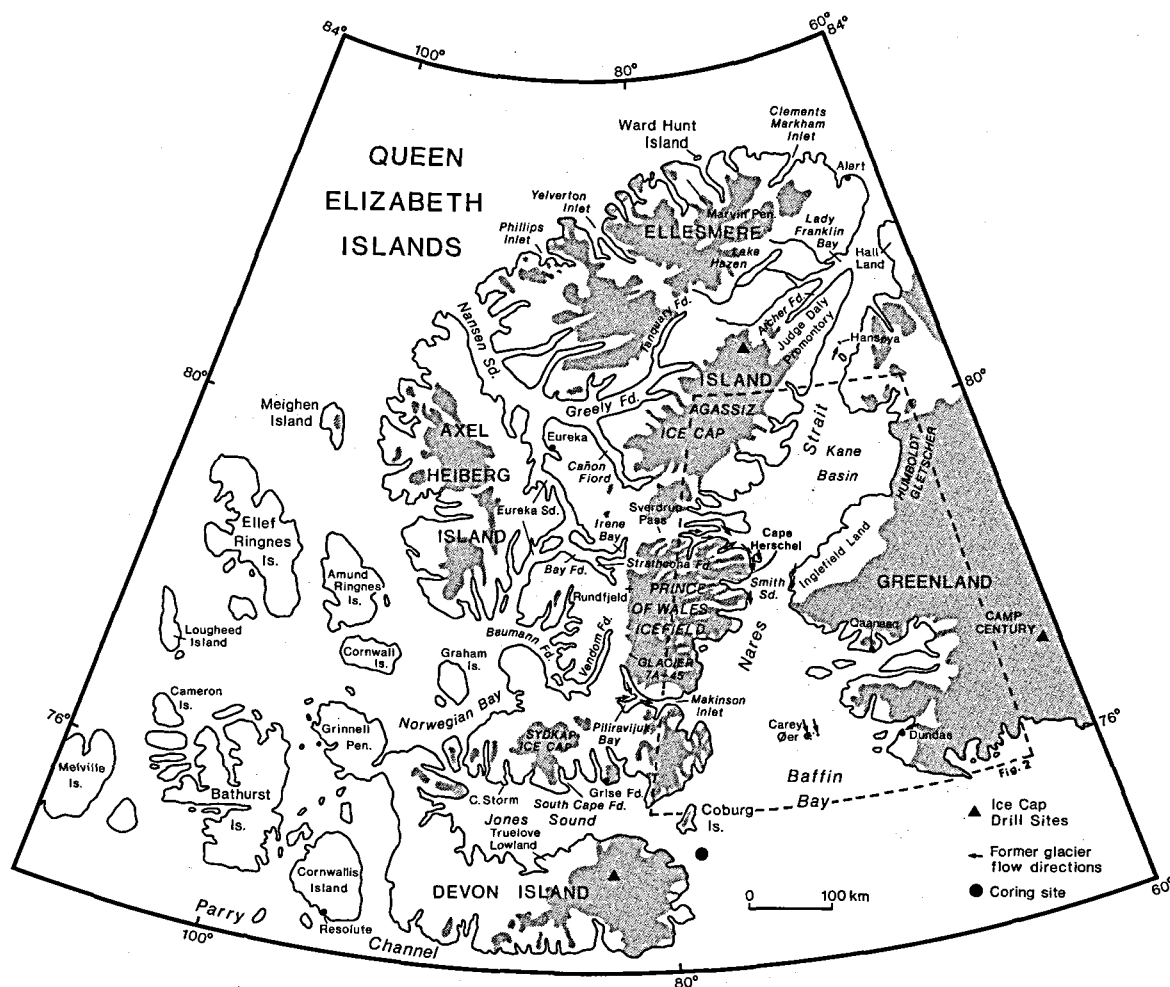
Fig. 1. Location map, Queen Elizabeth Islands and former ice flow directions along Nares Strait. The area covered by Figure 2, in which the seafloor glacial features occur, is outlined. The coring site SSE of Coburg Island is HU83–023–52, referred to in the text.

once when the OBS's were deployed at approximately 12 kts, a second crossing was made at slow speed (~4 kts) using airguns as an energy source, and a third traverse was again carried out at normal speed (~12 kts), with stops to recover the OBS's, which were programmed to lift off the seafloor at pre-arranged times. Because of the differences in ship speed during each pass, the apparent shape of the individual bedrock features varies. Therefore the crossings of the feature at Site 1 (Fig. 2) have been replotted at the same scale. Except for brief intervals when the ship was recovering the OBS's, the 3.5 kHz echo sounder was operated continuously, yielding the records that form the basis for this paper.

The location of OBS line 1, along the edge of the North American continental shelf, was determined by H. R. Jackson from industry seismic reflection data compiled by K. Dickie (cf. Jackson et al. 1992a). This line was oriented NE–SW, from 76°53.5'N, 74°17.2'W to 75°11.5'N, 78°47.8'W (Fig. 2). OBS line 3, oriented NNW–SSE, lay along the Greenland continental shelf, from 77°42.2'N, 74°10.0'W to 75°40.3'N, 70°35.0'W. Navigation was by BIONAV, including a GPS receiver which allowed positioning to between 50 and 100 m (personal communication from A. E. Jackson, 1994). The orientation of these lines turned out to be particularly advantageous in terms of detecting evidence for former glacier flow, studied earlier by Blake (1977a) on Carey Øer.

Previous observations on glacial geology

The northernmost Baffin Bay region (north of 76°) has long held a fascination for those interested in glacial phenomena, as numerous scientists passed this way on
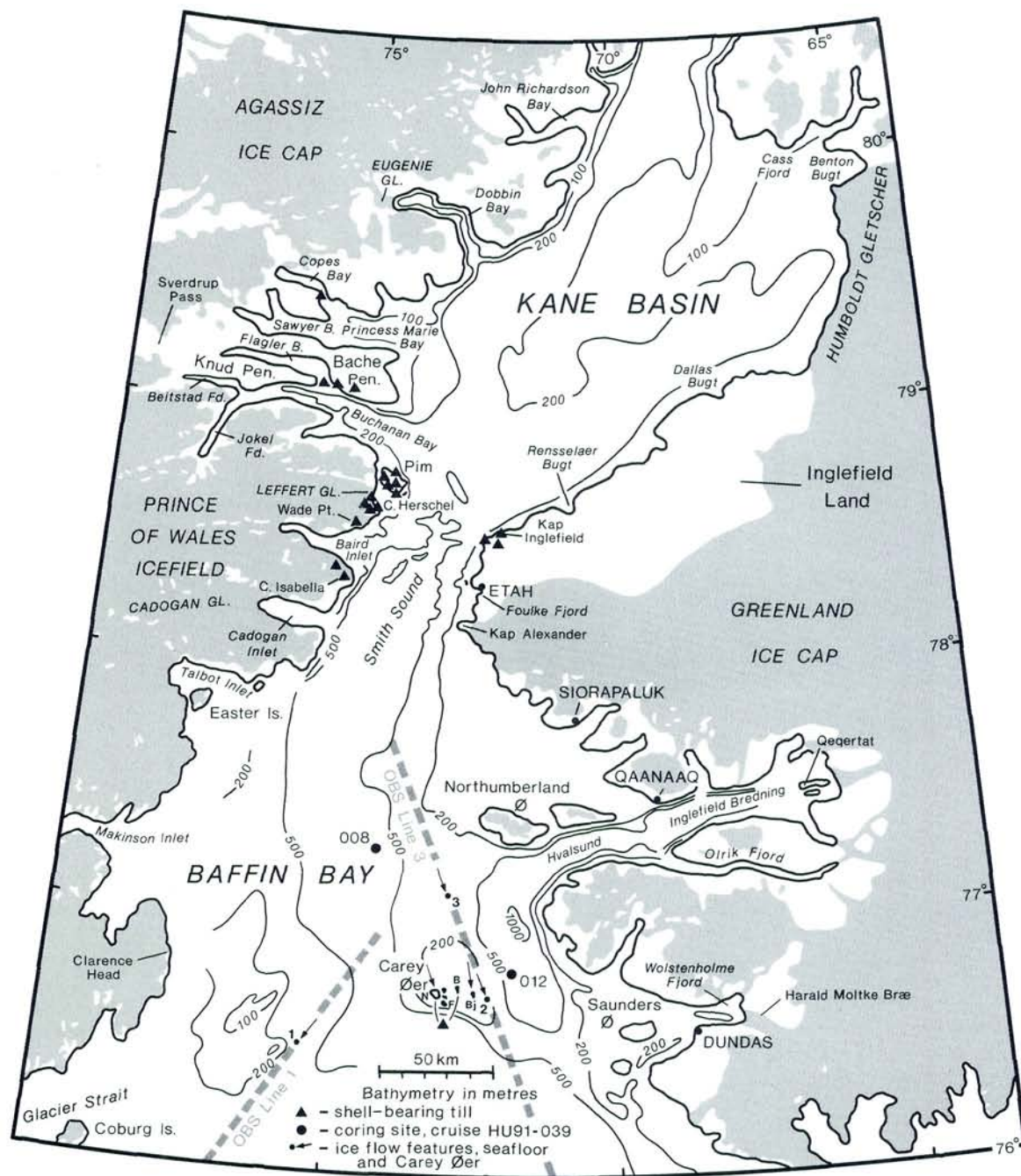
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Fig. 2. Location map and ice-flow indicators, northernmost Baffin Bay (adapted from Monahan 1980). The main island in Carey Øer is Nordvestø (N), and the other island on top of which shelly till was found is Bordø (B). Other islands are Björlings Ø (Bj) and Fireø (F). Figures 1, 2 and 3 refer to the seafloor features discussed in the text, along OBS lines 1 and 3. Coring sites HU91–039A–008P and –012P are also indicated; ^{14}C age determinations from 012P are listed in Table 1.

Fig. 3. Oblique aerial view northwestward along the north coast of Björlings Ø, Carey Øer. Note the rounded form of the main ESE–WNW ridge, approximately 1.6 km in length,which forms the backbone of the island. The direction in which ice flowed across the plateau is indicated by the arrow. W. Blake, Jr. July 23, 1976 (GSC–176789).

voyages of exploration in the late 19th and early 20th centuries. Although Nares (1878) noted the presence of red sandstone erratics on the gneissic summit plateau of the easternmost island (later named Björlings Ø), the first to describe the glacial features on Carey Øer was T. C. Chamberlin, who visited the islands as a member of the Peary Auxiliary Expedition of 1894. Chamberlin (1895a, b) observed the rounded shapes of Carey Øer and recorded the presence of glacial grooves on the summit of Björlings Ø. He also observed erratics of limestone, sandstone, shale and quartzite on the top of the island, at an elevation of 140 m. The striae recorded glacial movement from the north and, taken together with the known presence of Paleozoic rocks in that region, led Chamberlin (1895a, b) to conclude that the glacier which overrode Carey Øer came from Smith Sound and beyond (Fig. 2). His ideas as to the extent of glaciation in northernmost Baffin Bay were summarized in the form of a map (Chamberlin 1913), but this map was rarely cited until Prest (1990) called attention to its existence. In a brief visit to Carey Øer in 1965, Bendix-Almgreen et al. (1967) did not record striae, polished rock surfaces, or fossiliferous surface till, but they did note that glacier ice had smoothed the plateau of Nordvestø, the largest

island. They also commented on the widespread occurrence of erratics – limestone, sandstone, quartzite and conglomerate. These rock types are strikingly different from the orthogneiss, plus diabase, of which the islands are made up (Dawes 1991).

The first author of the present paper spent a month at the 'North Water Project' base on Nordvestø in 1976 (cf. Müller et al. 1973). Foot traverses were made over much of Nordvestø, and the summit plateaus of several other islands were visited by helicopter. Erratics were collected at each locality, and in some places the ground surface takes on a varicoloured aspect, so numerous are the pebbles, cobbles and boulders of quartzite, sandstone, dolomite, granite, etc. (Blake 1977a). Although a number of sedimentary lithologies are represented in the rocks of the Narssârssuk Group to the ESE near Dundas (Dawes 1991), the most logical source areas are to the north, for the rock types that occur as erratics on Carey Øer outcrop in Inglefield Land (Escher 1970, Dawes 1971). Furthermore, because of the sharp contacts between the diabase intrusives and the gneissic bedrock on the plateau of Nordvestø, the displacement of boulders of one type southward onto the other type of bedrock could be observed in a number of places.

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Fig. 4. View south-southwestward at a rounded outcrop of gneiss in a saddle on the plateau of central Nordvestø, Carey Øer. The former direction of ice flow was toward the deep valley whose west wall is visible on the skyline. W. Blake, Jr. August 11, 1976 (GSC–177578).

Striated outcrops were found on the summit plateaus of both Björlings Ø (Fig. 3) and Fireø (the southernmost island), as well as at numerous sites on Nordvestø (Fig. 4), even on the highest ridge at an elevation of >220 m. The outcrops were typically rounded on the north-facing stoss sides and plucked on the lee (south) sides. In addition, the gross morphology of the islands – i.e., cliffs tend to be better developed on the south sides (Fig. 3) – suggests overriding of the islands by glacier ice moving from north to south.

Offshore, the 500 m-depth contour defines a trough leading southward from Smith Sound as well as one which originates in Inglefield Bredning; these troughs would have channeled ice streams towards Carey Øer (Fig. 2). In fact, the erosive action of ice streams may have played a major role in creating the troughs (cf. Pelletier 1966, Keen & Barrett 1973), but glaciers are not mentioned by Monahan & Johnson (1982) in their discussion of the physiography of Nares Strait. The sharp bend in the trough leading from Hvalsund and Inglefield Bredning may be structurally controlled, but it also may depict how the ice stream from the northeast was deflected southward by the more powerful Smith Sound Ice Stream coming from the north. Only 35 km northeast of Carey Øer, depths of over 1000 m are present in the trough leading southward from Hvalsund.

Fragments of marine shells, occurring as erratics in the till veneer and at elevations above 100 m, were found on both Nordvestø and Bordø (Fig. 2). The shell sites were both located in saddles, just where the flow of ice across the islands would have been concentrated. This flow carried with it marine sediments dredged from the seabed to the north. Accelerator mass spectrometry (AMS) age determinations were made on two separate shell fragments from 120 m asl on Nordvestø; one was *Hiatella arctica*, the other was *Astarte borealis*, and both results were >40 000 BP (Ua–4451 and –4452, respectively; Table 1).

Ice sculptured bedrock on the seafloor

In view of the sculpture documented on Carey Øer it is not surprising that evidence for the southward flow of glacier ice is also present on the seafloor, especially as Site 2 is only 7.5 km ESE of Björlings Ø (Fig. 2), i.e., closer to Björlings Ø than that island is to Nordvestø.

The most striking landform among those traversed during the course of Cruise 91–039 was along OBS line 1, just over 60 km WSW of Nordvestø (Fig. 2). This feature, centred at approximately 76°35'N,

Table 1. New radiocarbon age determinations, Carey Øer and environs

Sample no.[1]	Species[2]	Lab.no.	Apparent age (T½ = 5570) Normalized to $\delta^{13}C = -25‰ (R_{CONV})$[3]	Corrected to $\delta^{13}C = 0‰ (R_{CORR})$[3]
Core HU91–039A–012P (76°48.3'N, 71°51.5'W; water depth, 823 m)				
184–188	benthic forams	Ua–3366	10 930 ± 105	10 530 ± 105
188–190	benthic forams	Ua–3367	10 805 ± 145	10 405 ± 145
190–195	benthic forams	Ua–4998	10 815 ± 130	10 415 ± 130
Nordvestø, Carey Øer (76°43.5'N, 73°11'W; ~120 m asl, shell fragments in till)[4]				
76–119A	Hiatella arctica	Ua–4451	>40 000	–
76–119B	Astarte borealis	Ua–4452	>40 000	–

[1]For the core increments the sample number corresponds to the depth in cm.
[2]Benthic foraminifera identified by Karen Luise Knudsen, Århus Universitet. Species of *Cassidulina* dominate in all three basal core samples. Pelecypods identified by W. Blake, Jr.
[3]Tandemlaboratoriet (Ua) at Uppsala Universitet normalizes to –25‰ vs PDB, following the recommendation of Stuiver & Polach (1977). The first column gives the ages as reported by Tandemlaboratoriet. The second column shows the ages corrected to 0‰, so as to make them directly comparable to ^{14}C ages from the GSC and København (cf. Tauber 1979). Following Mörner & Funder (1990), no additional correction has been made for the reservoir effect, believed to be negligible in the North-West Greenland area.
[4]For Ua–4451 and –4452, the inner 51% and 39%, respectively, of shell material was used for the age determinations (personal communication from Göran Possnert, Oct. 1994).

75°12'W, is illustrated in Figs 5 and 6. It is interpreted as being a shaped bedrock hill – a gigantic whale-back – 3.0 km long and rising approximately 80 m above the general level of the seafloor. At the highest point recorded on the three traces the top of the hill is at a depth of ~353 m. The northeast-facing side is clearly the rounded stoss side, whereas the southwest slope is the steeper and plucked lee side. Much of the bottom to the northeast is level at a depth close to 440 m, and the seabed adjacent to the base of the rock hill, characterized by many point reflectors, is interpreted as being composed of unconsolidated material.

In Figure 6 all three passes across this feature have been combined by C. G. Currie using Autocad, so as to make allowance for the differences in ship's speed at each crossing. Because the ship's track diverged slightly on each occasion, the plots demonstrate the variability in the shape of the feature along essentially parallel lines, as close to one another as the ship could navigate.

The surficial marine sediments over most of northernmost Baffin Bay, including the area around Carey Øer, are classified as shelf deposits of glaciomarine origin; gravelly sandy mud of Latest Pleistocene – Early Holocene age dominates, although the deep trenches bracketing Carey Øer contain Holocene glaciomarine clayey silt (Zarkhidse et al. 1991). The sculptured bedrock hill WSW of Nordvestø occurs in an area characterized by the presence of basement at the seafloor (Jackson et al. 1992a). This interpretation of bedrock is based on data derived from industry airgun arrays, which were not tuned to detect unconsolidated sediments. A thin sediment cover may be present on this feature, but if so, the sediment thick-
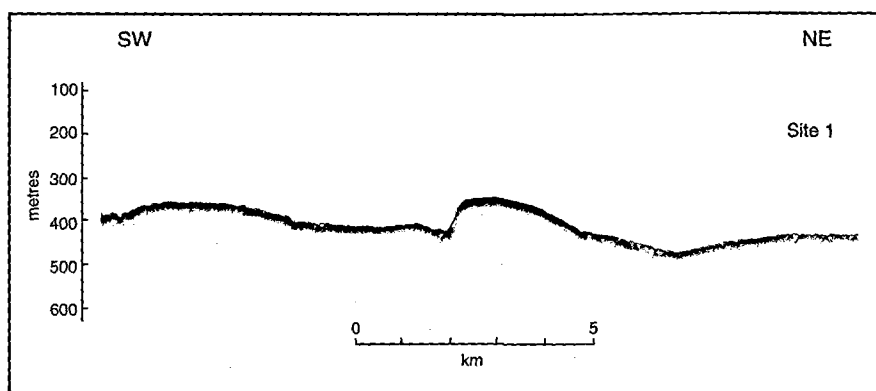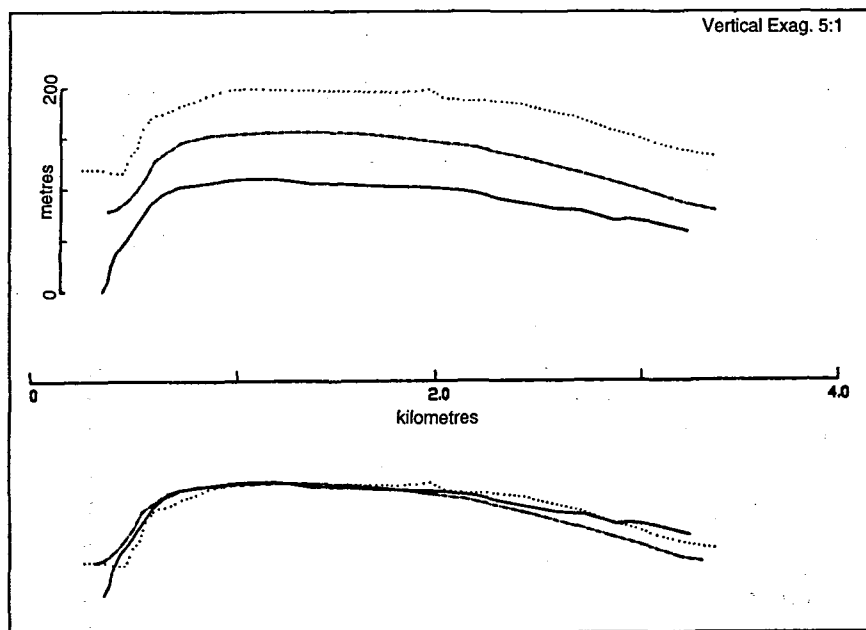

Fig. 5. Echo sounding trace (3.5 kHz) of an 80 m-high shaped bedrock feature ~60 km WSW of Nordvestø, Carey Øer (site 1 in Fig. 2). This trace was made with C. S. S. Hudson travelling southwestward at 3.5–3.6 kts (Day 235, 2155 to 2225 hours).

Fig. 6. Autocad plots of three crossing of the same feature WSW of Nordvestø.

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ness is less than the limit of acoustic resolution (± 1m). Thus there is no record of iceberg scour on the hill, although the surrounding sediments clearly have been scoured, and iceberg disturbance of the seabed at depths of >400 m has been recorded at numerous sites in Baffin Bay (Lewis & Woodworth-Lynas 1990).

The most prominent feature to the east of Carey Øer is shown in Figure 7 (Site 2). It is 2.5 km in length and, as noted earlier, this feature is only 7.5 km ESE of Björlings Ø, centred at approximately 76°42.6'N, 72°14.8'W. This hill rises 90 m above the adjacent seafloor (to the northwest) to a depth of 194 m, and it is near the southeast corner of the plateau on which

Carey Øer are the high points (Fig. 2). The seafloor drops off to the SSE to depths exceeding 650 m. To the northwest there is an extensive plain at ~260 m depth. As with the sculptured hill to the WSW of Carey Øer, this feature is noticeably steeper on its south-facing (lee) side, and it exhibits a gentler stoss slope toward the NNW, in the direction from which the ice flowed.

Farther north, also along OBS line 3, another prominent sculptured bedrock hill was identified, at approximately 77°07.1'N, 72°59.5'W (Figs 2, 7). This site (3) is approximately 120 km south of the entrance to Smith Sound and 30 km southwest of Northumberland Ø,

Fig. 7. Echo sounding traces (3.5 kHz) along OBS line 3. The upper trace shows a 90⁺ m-high bedrock feature 7.5 km ESE of Björlings Ø, Carey Øer (site 2 in Fig. 2). This trace was made with C.S.S. Hudson travelling north-northwestward at 4.9–5.2 kts (Day 245, 1650 to 1720 hours). The lower trace shows a 70⁺ m-high bedrock feature 30 km southwest of Northumberland Ø (site 3 in Fig. 2). This trace was made with C.S.S. Hudson travelling north-northwestward at 4.0-4.1 kts (Day 244, 1625 to 1750 hours).
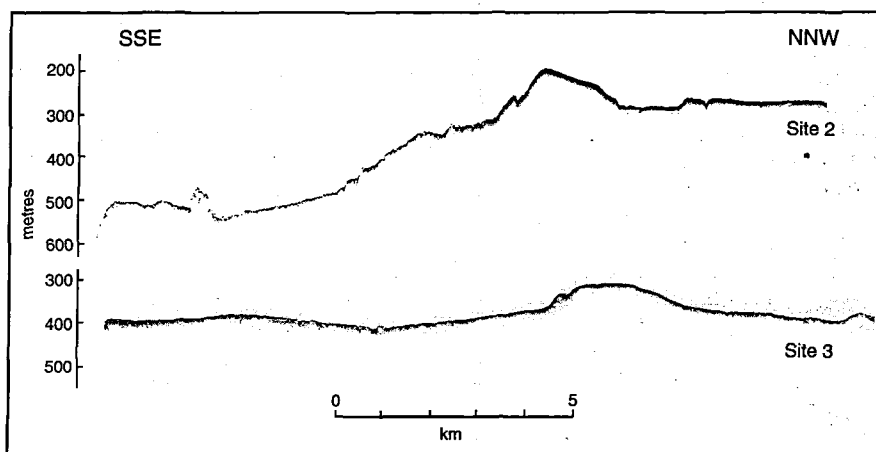
astride the shallower area between the two deep troughs where depths exceed 500 m. Much of the relatively smooth seafloor to the NNW and SSE of this 3.0 km-long feature lies between depths of 384 and 402 m, and the highest point on the hill is at 316 m depth. Like the other stoss-and-lee hills described above, this asymmetric feature is more gently sloping toward the NNW, in the direction from which the overriding glacier flowed.

Discussion

The earlier observations and collections from Carey Øer proved the passage of glacier ice across this isolated island group at some time in the past. The seafloor features documented here provide additional evidence that glacier ice once extended as much as 200 km southward from the confines of Smith Sound. The intense glacial scouring in the latter region, as well as in Makinson Inlet, Ellesmere Island (Fig. 1), has been documented in a series of papers (Blake 1977b, 1978, 1992a, 1992b, 1993, Blake et al. 1992).

Because the sea bottom features were crossed along a single, predetermined track (in actual fact three parallel tracks close to one another), we only know their shape in that orientation. It is worth noting, however, that on the western side of the central deep trough in northernmost Baffin Bay, the areas outlined by the 100 m contour are elongate in shape (cf. Pelletier 1966, Monahan 1980). That the configuration of these features is roughly parallel to the orientation of the ship's track along OBS line 1 is fortuitous, but it may also be that an enormous lobe of ice, flowing southward from Smith Sound, was expanding both toward the southwest and the southeast as it reached the wider part of Baffin Bay. On the east side of the central trough, numerous striae observations made on Carey Øer by Blake (unpublished data) are oriented approximately NNW–SSE, and all five of the major islands are elongated in NW–SE orientation. Furthermore, the seafloor features, ~2.5 to >3.0 km in length, are comparable in size to the major islands in Carey Øer; these range from 1.5 to nearly 5.0 km in NW–SE orientation.

A search of the bathymetric records of earlier scientific cruises to northernmost Baffin Bay has revealed that few ship's tracks are oriented so that features like those discovered in 1991 would have been noticed. One possible exception is at a site some 50 km southwest of Saunders Ø, centred at ~ 76°21.4'N, 70°36.8'W, in 146 m of water. There an asymmetric feature was crossed by C. S. S. Hudson steaming southward on Cruise 78–029. This 2.5 km-long 'high' ressembles those crossed on the 1991 cruise; it has a gentle stoss side to the north, a steep lee side to the south. Relief is ~36 m, and to the south the bottom drops off quickly to depths of over 600 m.

If the glacial origin assigned to the features illus-trated in this paper is correct, then when were they sculptured? Two vastly different ideas have emerged with regard to the extent of ice during Late Wisconsin (Late Weichselian) time, both around northernmost Baffin Bay and farther north on Greenland, Ellesmere Island and Axel Heiberg Island (e.g., see Dawes 1987, England 1987, 1996, Hodgson 1989, Hughes 1987, Kelly & Bennike 1992, Lemmen et al. 1994). Kelly & Landvik (1990) and Funder & Houmark-Nielsen (1990), as a result of their participation in the 1986 NORDQUA Field Excursion to Saunders Ø and sites along and near Wolstenholme Fjord, placed the limit of Late Weichselian ice at the mouth of that fiord (Fig. 2). That is, they argued for a limited extent of Late Weichselian ice, the maximum position of the major outlet glacier (Harald Moltke Bræ) in the fiord being ~20 km west of its present front during the Wolstenholme Fjord Stade. Funder (1989) had earlier suggested that Late Wisconsinan ice filled the whole of Nares Strait and northernmost Baffin Bay, including Carey Øer, and Weidick (1976a, p. 437) had indicated that Carey Øer were covered by coalesced ice sheets ("presumed extent of the Inland Ice during maximum glaciations"), without specifying a particular time. In the latest compilation, published in this journal, Funder & Hansen (1996, Fig. 2) place the limit of ice at the last glacial maximum (LGM) to the west of Saunders Ø, i.e., farther west than the limit proposed in 1990, but still not as far as Carey Øer. The LGM limit of the ice flowing out of Kane Basin is placed at the southern entrance to Smith Sound, and the limit at 10 ka is juxtaposed to the south, still well over 100 km north of the seafloor feature at Site 3 and over 150 km north of Carey Øer (Funder and Hansen 1996).

On the basis of a study of striae and other ice-flow indicators, Blake (1977b, 1992a, b, 1993, and Blake et al. 1992) postulated that a major outlet glacier, the Smith Sound Ice Stream, flowed southward through Smith Sound into northernmost Baffin Bay in Late Wisconsinan time. This ice stream derived from the coalescence of the Greenland and Innuitian ice sheets over Kane Basin (Fig. 2). Evidence for this ice flow pattern is provided by the orientation and freshness of the striking glacier sculpture along both sides of Smith Sound as well as by the occurrence in the surface till at high elevations (i.e., above the Holocene marine limit) of marine shells, dredged from the sea bottom to the north. The concept of a Smith Sound Ice Stream is also in accord with Kravitz's (1982) analysis of the sediments in Kane Basin. Similar sculptured features have been created in Makinson Inlet by a major outlet glacier draining eastward into northernmost Baffin Bay.

The very significant emergence that has taken place in inner Makinson Inlet during Holocene time, as well as at Cape Herschel in Smith Sound, necessitates the former presence of a vastly thicker and more extensive ice load (e.g., see Tushingham 1991; Peltier 1994). This is despite the existence of major ice caps on both sides of northernmost Baffin Bay and Smith Sound

today; i.e., ice depths of up to 800 m on the Prince of Wales Icefield (Koerner 1977), 225 km northwest of Carey Øer and 1390 m on the Greenland Ice Sheet at Camp Century (Fig. 1), 300 km east of Carey Øer (Dansgaard et al. 1969). The question remains, however, how far southward did the Smith Sound Ice Stream extend at the last glacial maximum?

Reeh (1984), in his reconstructions of the glacial ice covers of Greenland and the Canadian arctic islands, produced two maps covering the Nares Strait region. In the first reconstruction, where the ice margin (ice sheet/ice shelf transition line) is placed at the 200 m depth-contour, Carey Øer remain ice-free, at least in terms of major ice sheets. In the second reconstruction, where the ice margin is extended to 600 m depth, Carey Øer are overridden by coalescent ice from Greenland and Ellesmere Island, and the ice margin is depicted as lying to the south of the 76th parallel (cf. Fig. 2). Even had the ice not extended this far south, Carey Øer still may have been overridden.

With regard to deglacial chronology based on ^{14}C age determinations, the oldest Holocene sample collected by Blake in 1976 on Carey Øer was basal peat (99–104 cm depth) in a core on the Nordvestø plateau (8940 ± 90 years, GSC–2440; Brassard & Blake 1978). The NORDQUA group's work on Saunders Ø and along adjacent coasts in 1986 yielded several additional radiocarbon ages close to 9000 BP. The oldest Holocene result was 9150 ± 95 years (K–4781) on *Hiatella arctica* and *Mya truncata* shells (Mörner & Funder 1990), although a value of 9880 ± 500 (M–723) had been reported earlier for marine algae in a moraine at the head of Wolstenholme Fjord (Crane & Griffin 1959). A slightly younger age of 8620 ± 125 (K–3504) was derived for a sample at 43 m asl composed of *Hiatella arctica* and *Mya truncata* from Qeqertat at the head of Inglefield Bredning (Fredskild 1985). Similar values have been reported from the opposite side of Baffin Bay (Fig. 2), the oldest results being on the same shell species in the 9000 to 10 000 year-range near Clarence Head (Blake 1981, 1993). The only other ^{14}C ages from a marine sediment core in northernmost Baffin Bay are from HU83–023–052 (75°35.2'N, 78°41.5'W; Fig. 1), in 512 m of water some 30 km southeast of Coburg Island (MacLean et al. 1984). The oldest Holocene date from this core, on shell material at 480–505 cm depth, is 8410 ± 200 BP (Beta-9712; Williams 1990).

Perhaps most interesting are three new ages on benthic foraminifera extracted by K. L. Knudsen from near the base of piston core 012P, collected on Cruise HU91–039A. This core site (at 76°48.3'N, 71°51.5'W) is only 40 km northeast of Björlings Ø (Fig. 2) but is within the eastern deep trough at a depth of 823 m. Corrected results of 10 530 ± 105 BP (Ua–3366; 184–188 cm), 10 405 ± 145 BP (Ua–3367; 188–190 cm) and 10 415 ± 130 BP (Ua–4998; 190–195 cm) have been obtained from this core (Table 1), which additional ^{14}C dating indicates is ~7500 years old at the top. The lowermost dated horizon is in a laminated clay unit just 10–15 cm above a diamicton (with striated clasts) at least 30 cm thick at the base of the core. This compact material caused refusal of the piston corer. The ^{14}C determinations are deemed accurate, as foraminifera and pelecypod fragments higher in Core 012P agree closely in age. These ages are older than the post-last glaciation marine shells from strata exposed above sea level on Saunders Ø, and they also predate the basal peat on Nordvestø, although moss growth may well have commenced prior to 9000 BP. One explanation for the time difference could be that a calving bay developed along the trough, which resulted in more rapid ice retreat there than on the adjacent islands. Furthermore, if Carey Øer and the other islands and coasts had not retained a cover of glacial ice, the effect of which was to exclude the sea, they should exhibit strata containing marine fossils which are as old as those in the trough, but they do not appear to do so.

Conclusions

Seafloor features that resemble glacially sculptured bedrock hills 2.5 to over 3.0 km in length were recorded at three sites in northernmost Baffin Bay on C.S.S. Hudson Cruise 91–039. Because the ship's track across each feature was at approximately the same azimuth on each of three occasions, their exact shape cannot be defined. However, all three features are markedly asymmetric, with well developed stoss and lee sides. The features are consistent with the hypothesis of a southward-flowing Smith Sound Ice Stream which expanded into the wider part of northernmost Baffin Bay and overrode Carey Øer. Although such an event presumably occurred on numerous occasions throughout the Pleistocene, stratigraphic evidence is not yet available to pinpoint the timing of the most recent inundation by ice from the north. In particular, a Late Wisconsinan glacial advance this far south is difficult to reconcile with the limited westward ice advance proposed by Funder & Houmark-Nielsen (1990) and Kelly & Landvik (1990) for the Wolstenholme Fjord stade less than 100 km to the east of the easternmost seafloor feature described here. On the other hand, the southward flowing ice stream in the deep trough on the east side of Carey Øer may have had a damming effect on the westward flow of ice out of Wolstenholme Fjord.

In the latest compilation (Funder & Hansen 1996), the limit of southward-flowing ice at the last glacial maximum, as well as at 10 000 BP, is placed at the southern entrance of Smith Sound. However, the fact that the oldest ^{14}C ages in Smith Sound are some 1500 years younger than those at the site of Core 012P suggests to us that the Smith Sound Ice Stream may well have extended farther south at the LGM. We need more signatures from the ocean bottom to resolve the ques-

tion of glacial ice extent at the Late Wisconsinan glacial maximum, for at present we are operating with a limited data set. Better correlation between units exposed on land and marine sediment facies is also required in order to precisely define the various positions of changing ice margins through time.

Acknowledgments

Dansk sammendrag

Morfologiske havbundsformer er observeret på tre lokaliteter på C.S.S. Hudsons togt 91–039 i den nordlige Baffin Bugt. De ligner glacialt udformede grundfjeldsbakker, varierende fra 2.5 til 3.0 km i længde, med relief på 70 – >90 m på vanddybder af 200–400 m. Disse veludviklede former er fundet vestsydvest, øst og nord for Carey Øer, en isoleret øgruppe med tydelige spor af gletschererosion. Tillaflejringer på toppen af øerne indeholder marine skaller, der er dateret til >40,000 år. Havbundsformerne er på alle tre lokaliteter asymmetrisk med veludviklede stød- og læsider. Deres form og orientering er i overensstemmelse med hypotesen om en isstrøm i Smith Sund, der bevægede sig mod syd og bredte sig ud i

den nordlige Baffin Bugt. Isstrømmen antages senest at have optrådt under Wisconsin (Weichsel) maksimum. Imidlertid strider det mod iagttagelser i det nærliggende Dundas området i Grønland at isen skulle have strakt sig så langt sydpå som til Carey Øer på dette tidspunkt, idet der her tilsyneladende kun var tale om et mindre fremstød, Wolstenholme Fjord stadiet (Funder & Houmark-Nielsen 1990). Muligvis blokerede isstrømmen i det dybe trug på østsiden af Carey Øer gletscheren i Wolstenholme Fjord.

Eftersom de ældste 14C dateringer i Smith Sund er ca. 1500 år ældre end dem fra kerne 012P fra det dybe trug nordøst for Carey Øer er det sandsynligt at Smith Sund isstrømmen rakte længere mod syd end den sydlige ende af Smith Sund under sidste istids maksimum (cf. Funder & Hansen 1996).

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