CANADA

REPORT SERIES No. 2

NORTH-CENTRAL BAFFIN ISLAND
FIELD REPORT 1967

INLAND WATERS BRANCH
DEPARTMENT OF ENERGY, MINES AND RESOURCES
OTTAWA, CANADA, 1968

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PREFACE

This report contains a synopsis of the 1967 Baffin Island operation of the Geographical Branch and short field reports from the leaders of the field parties, based on a preliminary examination of field notes.

The field studies covered in this report were organized by the Division of Physical Geography, Geographical Branch. This Branch has since been reorganized and the function of the Division of Physical Geography are now taken over by the Division of Quaternary Research and Geomorphology, Geological Survey of Canada and the Hydrologic Sciences Division, Inland Waters Branch.

We are pleased to acknowledge the excellent cooperation received from other units of the Department of Energy, Mines and Resources in carrying out the program. The Surveys and Mapping Branch arranged for air photography and advised on the ground control of Decade Glacier and the Ekalugad sandur, and through the Geodetic Survey, for the survey of the movement stakes on the Barnes Ice Cap. The Marine Sciences Branch, particularly the Hydrographic Service, and the Bedford Institute of Oceanography, cooperated in the successful completion of the survey of the submarine geomorphology. The survey itself was done by a Department of Transport icebreaker.

The enthusiastic cooperation of all participants, scientists, student assistants and aircraft crews was essential to the successful completion of the operation and their contribution is gratefully acknowledged.

Olav H. Løken,
Head,
Glaciology Subdivision,
Hydrologic Sciences Division.

December 1967

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D. M. Barnett (May 11-June 8)	geomorphology
R. G. Barry (June 26-July 16)	climatology
G. Bowes (July 21-August 6)	field operations
D. Christian (May 11-August 28)	field manager
M. Church (May 12-October 4)	geomorphology - fluvial processes
J. Clough (May 11-June 18)	radio-echo sounding
L. Drapier, Miss (June 30-August 28)	geomorphology
A. Geiger (May 11-June 25)	geodesist - movement studies
D. Hodgson (May 11-August 6 & Aug. 16-Sept. 19)	geomorphology - glaciology
C. A. M. King, Miss (June 30-August 28)	geomorphology
P. Langlais (May 11-June 25)	surveying - movement studies
R. Rogerson (June 9-August 24)	geomorphology - glaciology
J. Ryder, Miss (June 9-August 28)	geomorphology
M. Strome, Miss (June 30-August 28)	geomorphology

STUDENT ASSISTANTS

P. Crompton, Miss (U. of T.)
(June 9-August 28)

T. Day (U. of B.C.)
(May 11-October 4)

J. Davis (Carleton)
(May 11-June 25)

J. England (Windsor)
(May 11-August 24)

B. Goodison (Waterloo)
(May 11-August 28)

J. Knight (Queen's)
(May 11-August 28)

J. Land (Oslo)
(June 9-August 28)

P. McLaren (Queen's)
(May 11-August 28)

T. Sookocheff (U. of T.)
(May 11-July 30)

R. Stock (Western)
(May 12-August 28)

ASSOCIATED GROUPS

H. Borns (U. of Maine) (July 21-August 12)	glacial geology
M. Stuiver (Yale) (July 21-August 12)	radio isotopes
T. Eisensmith (Yale) (July 21-August 12)	glacial geology
P. Webber (York) (June 30-August 24)	botany
R. Irvine (York) (June 30-August 24)	photography
J. Richardson (York) (May 11-August 24)	botany
N. Gray (McGill) (May 15-June 18)	geology
A. Bailes (U. of Manitoba) (May 15-June 25)	geology
L. Barron (McGill) (May 15-June 25)	geology
J. A. Parmalee (Dept. of Agric.) (July 12-July 19)	mycology
J. Seaborn (Dept. of Agric.) (July 12-July 19)	mycology

SYNOPSIS

of the 1967 Baffin Island Operations

Operations

Field operations started with the departure of the Austin Airways DC-3 from Ottawa on May 10. D. M. Barnett and D. Christian were in charge of the supply flights, which generally went smoothly and the aircraft returned south in early June.

For the rest of the field season the party was supported by two helicopters on charter from Spartan Air Services. A Bell G-4 was in the area from late May to late August. The second helicopter (Bell G-2A) was chartered jointly with the Wildlife Service of Canada which had a field party near Bowman Bay.

Most of the field personnel had returned to Ottawa by the end of August but M. Church and T. Day remained at Ekalugad Sandur until they were evacuated by icebreaker and returned to Ottawa in early October. D. Hodgson returned at the end of September after completing the submarine survey.

Due to early melting of the fiord ice, the Nudlung Fiord cache for Dr. Borns and Dr. Stuiver could not be located as planned. Unfortunately, the only alternative location proved unsatisfactory and the party returned south immediately after arriving in the field.

Fair weather conditions prevailed during the season and rarely interfered with aircraft operations.

No serious accidents occurred during the field season although Miss Crompton was evacuated to Frobisher Bay and spent some 10 days in hospital due to a severe cold.

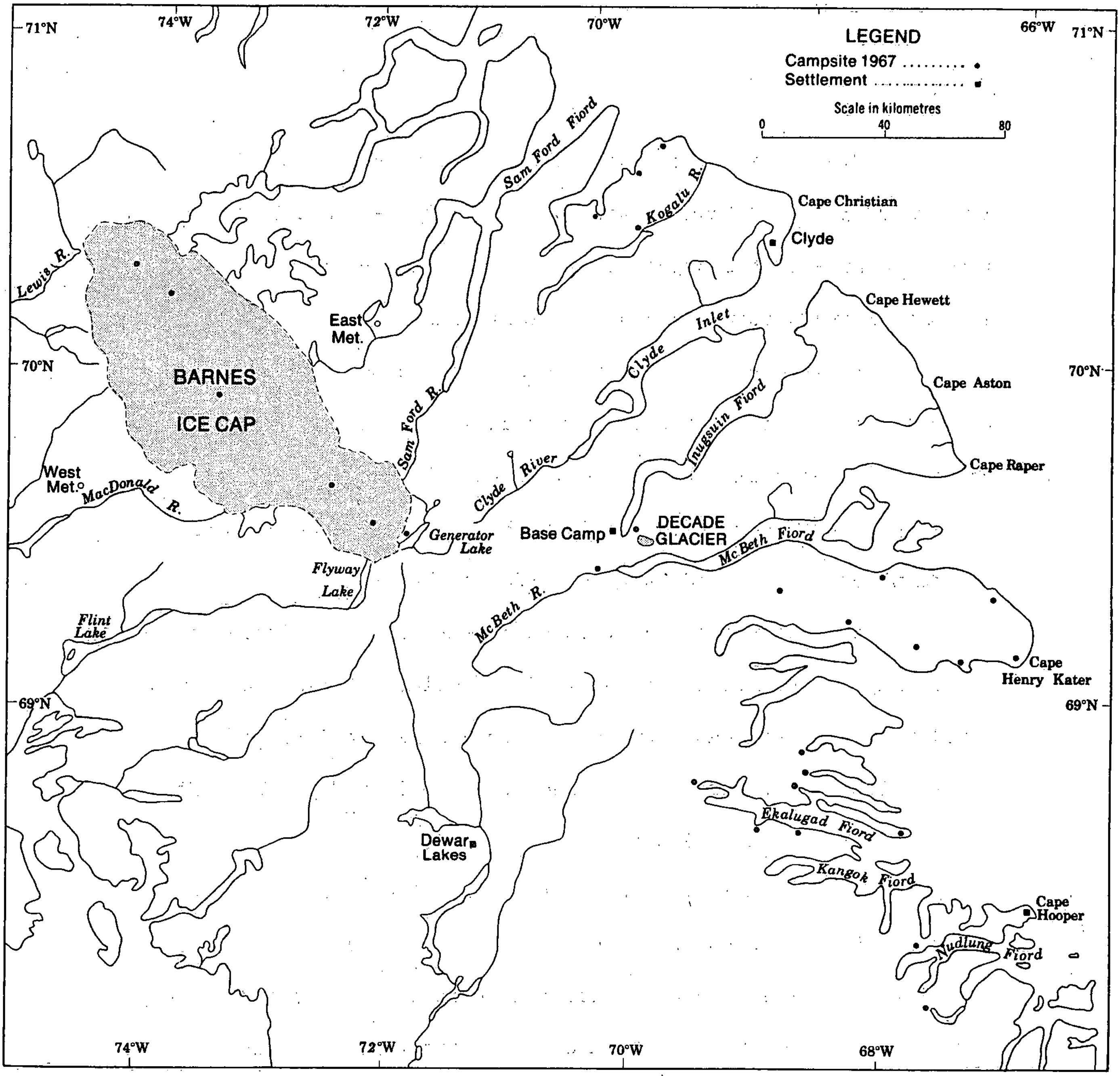

Figure 1 *Central Baffin Island with locations of 1967 field camps*

Programs

As in previous years the scientific projects could be broadly divided into two groups; geomorphology and glaciology-hydrology.

Geomorphology - The projects in this group were continuations of previous projects, the emphasis being shifted to new areas. J. T. Andrews made a reconnaissance survey of the Broughton Island area in preparation for a more detailed study of the raised marine shore features. This is a continuation of previous work in the Home Bay area where J. England filled in valuable details required to complete the 1966 work in that area.

Dr. King's work on Henry Kater Peninsula filled in a key gap in the regional coverage as logistics and operational difficulties had previously prevented work in that area. The Peninsula presents a smooth transition from the alpine topography along the middle part of the fiords to the coast areas, which resembles the Cape Christian region. In this manner glacial deposits can be traced continuously from the fiord area to the outer coast thus providing a vital link between the two regions which so far has been missing.

D. Hodgson continued the study of the submarine geomorphology which was started in 1966. Through the cooperation of the Marine Sciences Branch and the Department of Transport, the C.C.G.S. d'Iberville with a hydrographic party was made available for surveys between Bylot and Broughton islands.

D. Hodgson also investigated the area near Kogalu River to provide a link between previous work near Sam Ford Fiord to the north and Cape Christian to the south. Lack of clear and extensive deposits and difficulties with helicopter operations proved this assignment to be rather unsuccessful. Regional coverage was a major element of the preceding studies while the remaining studies had a stronger systematic emphasis.

J. Ryder continued her investigations of talus slopes and debris fans in the Ekalugad Fiord area. Members of M. Church's party worked on similar problems at the head of Ekalugad Fiord, thus providing additional information.

M. Church undertook a major project in fluvial geomorphology on the Ekalugad Sandur following a reconnaissance in 1966.

Glaciology-Hydrology - Studies on Decade Glacier and the Barnes Ice Cap continued. On Decade Glacier mass balance measurements were made in the early summer and hydrographs from Decade and Inugsuin Rivers were obtained throughout the summer. Dr. Stanley supervised the compilation of field data.

Mass balance measurements were done on the Barnes Ice Cap and the movement stakes from 1966 were resurveyed. A Scott Polar Research Institute radio echo sounding apparatus was successfully tested by J. Clough of the University of Wisconsin. Another new study was the establishment of a strain network on top of the South Dome.

Dr. Barry planned the establishment of three long-period recording meteorological stations that were set in along a NE-SW trending profile across the ice cap. The stations were intended to run for the summer season but operational difficulties prevented proper service and the records are unfortunately incomplete.

Other Disciplines

As in previous years the camp facilities were made available to other groups working in the area.

Dr. J. A. Parmelee, Department of Agriculture, spent approximately one week at Inugsuin base camp studying fungi.

Professor P. Webber of York University spent some eight weeks on ecological studies in Ekalugad Fiord and Mr. N. Gray and a party from McGill University studied geological features in McBeth Fiord for five weeks.

Dr. H. Borns, University of Maine and Dr. H. Stuiver were to study raised shore features and to collect shell samples for detailed isotope analysis but the project had to be abandoned (see above).

PRELIMINARY REPORT ON FIELD WORK ON BROUGHTON ISLAND, EAST BAFFIN ISLAND, N.W.T.

J. T. Andrews

Itinerary

September 11 - 12	Ottawa to Frobisher Bay.
September 13	Frobisher Bay to Broughton Island.
September 19 - 21	Broughton Island and stay in Frobisher.
September 21 - 22	Frobisher to Ottawa.

INTRODUCTION

Broughton Island lies 160 km SSE from Cape Hooper (see Andrews in Løken, 1966 Field Report on Baffin Island) and an equal distance NNW of Pangnirtung. The island is triangular in shape with the apex pointing due north. The island measures 20 x 13 km. Elevations are moderate and do not exceed 600 m but the only areas of really low relief occur on the northwest and northeast sides of the apex where glacial and marine deposits occur along a narrow strip bordering the coast.

Specific Location

The location of the island relative to the main fiord systems is important. The fiords of Maktak, Coronation, North Pangnirtung and Kangert merge 25 km south of the island and a deep trench, extending in places down to a depth of 600 m, leads NW across the continental shelf. A similar situation exists further north opposite Quajon Fiord. Between these two areas no major fiord extends into the interior and the shelf lies at a depth of 70-120 m. The north heading channel between Broughton Island and the mainland is very shallow and does not extend below 60 m. A deeper trench runs along the south shore of the island.

Glaciation

In the immediate environs (including the mountains directly west) of Broughton Island glacial erosion has a limited vertical range. The mountains are pyramidal in shape but faceted spurs extend to an elevation of 750 m (the mountains reach 900 m a.s.l.). Glacial deposits in the form of lateral moraines and sublateral channels were not seen above 650 m.

On Broughton Island the hill summits have been glaciated, but the presence of tor-like forms (first noted by Falconer, person. comm. in 1961) and deep solution pitting indicate that deglaciation occurred quite early. Solution pits were not observed at lower elevations whereas on the hilltops they reached depths of 12 cm.

A major lateral moraine system was traced. The moraine is highest at the extreme SW corner of the island and from there it splits into two branches, one extending along the south shore and the other along the west shore. At its highest point the moraine is about 350 m a.s.l. but there is a noticeable gradient along both sections and the moraines have declined to 100-150 m a.s.l. by their respective termini (general gradient of 1:60).

Former and Present Marine Forms

The most striking aspect of the geomorphology of Broughton Island is the evidence for a recent increase in wave energy. Two shore forms are common: (1) steep, actively eroded cliffs cut into a mixture of glacial, solifluction and marine deposits, and (2) shingle storm ridges, one 3-4 m on its landward side built by constructive waves moving in from the N and E. These latter forms are actively advancing.

The determination of the marine limit was extremely difficult. Along the east coast, marine cliffs in weakly bedded, non-fossiliferous clays extend to 7 m a.s.l. whereas shingle ridges extend up to 15 m a.s.l. and this is the most likely elevation of the marine limit.

Along the west coast all that can be said is that marine limit lies between 23 and 30 m, and if a shell deposit had not been discovered at 17 m a.s.l., these limits would have ranged from between 0 to 30 m a.s.l. A C14 analysis on the shell sample should greatly help in elucidating some of these problems. One other sample was collected for dating. This was a frozen seaweed, exposed by a recent storm immediately below high tide level. The seaweed was in a distinct stratum dipping into the present beach.

The present period of active coastal cliff erosion and encroaching shingle ridges is probably due to two factors, (1) the low marine limit and probable early deglaciation imply that the rate of rebound will be now slow (probably 0.1 m/100 yr.) and thus the present eustatic sea-level rise of about 0.3 m/yr. will be causing a marine transgression, and (2) improvement in climate since the 19th century has probably resulted in a reduction of pack-ice during the late-summer/early winter and a consequent increase in available fetch and energy.

FIELD WORK IN THE EKALUGAD FIELD AREA HOME BAY, EAST BAFFIN ISLAND, N.W.T.

J. H. England

(Figure 2)

INTRODUCTION

The field investigations were principally concerned with intensifying and expanding the program inaugurated by J. T. Buckley and J. T. Andrews in 1966; a program aimed at outlining the late-glacial and postglacial chronology of the inner part of the Home Bay area. The large Ekalugad moraine is the central glacial deposit of the area and was formed during the Ekalugad phase. A field program drawn up by J. T. Andrews and the writer was carried out by the author along with T. Sookocheff and P. McLaren between July 5 and August 8. Emphasis was on outlining the regional distribution of raised marine shore features in order to determine differential isostatic uplift. Particular attention was given to changes of the altitude of the marine limit on either side of the readvance moraine. The field work involved levelling of the marine limit and associated lower distinct marine features at numerous localities and the collection of organic material for age determination of the features by the C-14 method.

The field area included: the eastern end of "Doubledee Island" near the mouth of Ekalugad Fiord; the heads of Kangerdluak, Kangigfik and Pitchforth Fiord itself. In addition to the evaluation of the marine limits, attempts were made to determine the direction of ice movement using striae and boulder orientations. In a number of localities the weathering of the granite gneiss had destroyed the striae, thus making the emphasis on boulder orientations mandatory. Where both forms of

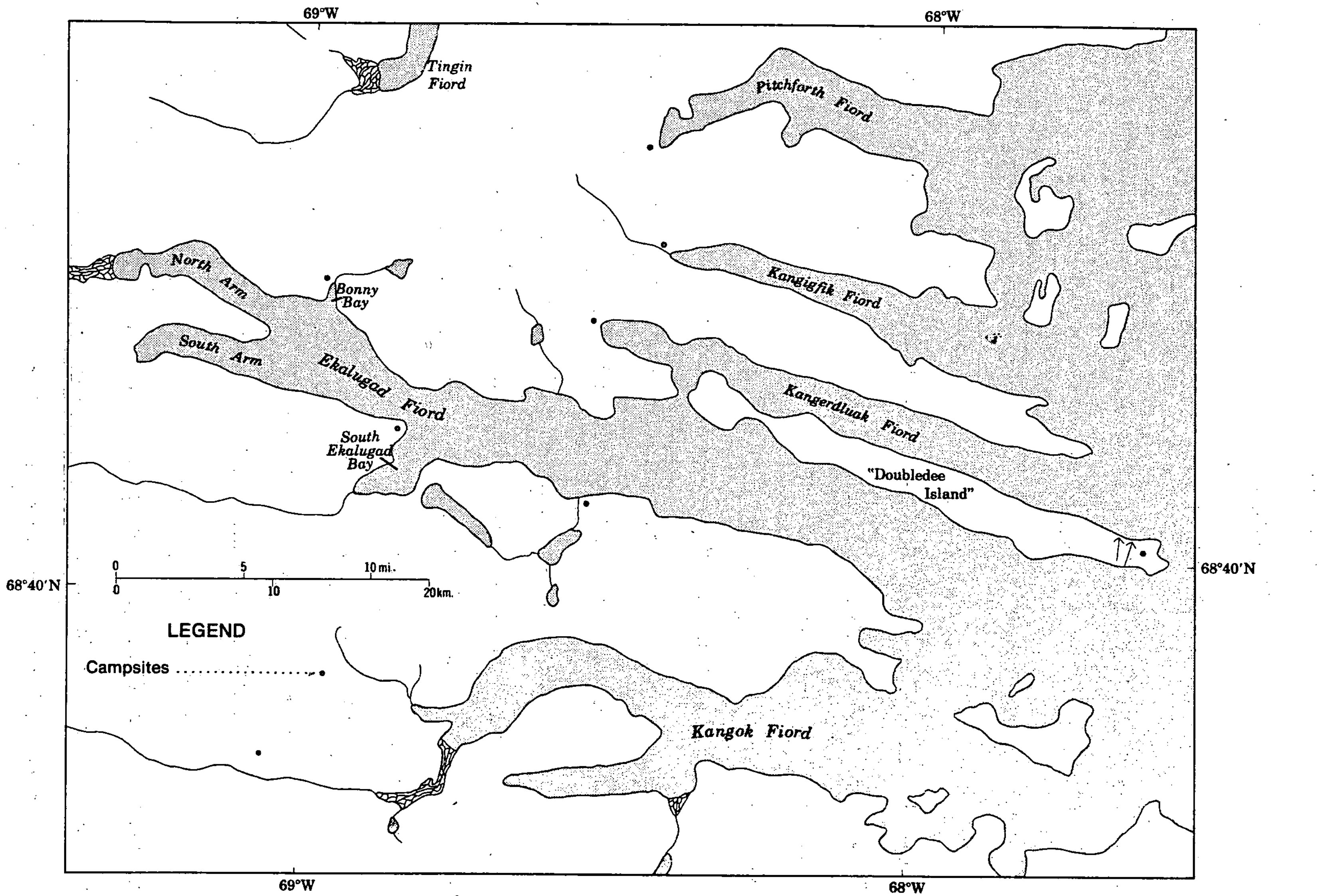

Figure 2 Ekalugad Fiord area

evidence appeared, a comparison of striae directions and boulder orientations was made. The main objectives of the field work were all successfully completed.

This report deals with the marine limits and related lower shore features throughout the field area. The features are described area by area, the sequence corresponding to that of the actual field work. First the four areas on the distal side of the Ekalugad moraine are discussed, and then follows the two areas lying on the proximal side of the moraine further in the fiord.

"Doubledee Island"

The island is approximately 35 km long and rarely exceeds 3 km in width. Its western part reaches an altitude of about 600 meters while in the eastern end the altitudes are lower, having a maximum of about 300 meters. The area investigated extended some 13 km westwards from the eastern tip and both the north and south shores were studied.

Physiographically the island is characterized by steep bedrock slopes and the absence of large drainage basins with broad valleys limits the number of areas that are available for deposition of large shell bearing deposits. Furthermore, the steep bedrock slopes are not conducive to the formation and preservation of beach features over long periods of time. Drift deposits on the slopes have been greatly disturbed by solifluction and only a few distinct breaks of slope occur.

The marine limit at the extreme eastern portion of the island was determined at 53 m a.s.l. with convincing beach features immediately to the west at 51.5 m a.s.l. In most cases the marine limit was determined by raised beach features deposited on the slopes; however, storm features often extended to slightly higher elevations. Approximately

6 km to the west of the eastern end of the island the altitude of the marine limit had increased to 57.4 m a.s.l. measured on a prominent beach. Further to the west, approximately 13 km from the east end, the marine limit had risen to 57.8 m a.s.l. The lower elevation of the marine limit at the eastern end of the island probably reflects the thinner ice cover in the more marginal parts of the ice sheet.

Shallow, steeply grading, coarse sand deltas occur at several localities around the island and probably reflects a period of relative sea level stability during their formation. Shells were notably absent in almost all of these deposits and were found in only one locality in a heavy marine clay at 16.6 m a.s.l. near the upper section of a shallow delta sequence. Some complete bivalves were found thus indicating that they were collected in situ. However, most of the shells were partly fragmented. Being the only shell collection from the island they should provide a very important, chronological reference.

Ice movement on the island was determined by striae and boulder orientation. Both methods show the ice movement direction to have been toward 6 and 18 degrees true North.

"Pitchforth Fiord"

The marine limit in Pitchforth Fiord was levelled at 78 m a.s.l. at the lip of an extensive delta. Additionally important terrace levels occur at 57, 37 and 21 m a.s.l. The large size of the delta and the remnant of a former end moraine a short distance inland from it suggest that an ice lobe acting as a sediment source occupied the valley at the time the delta was formed. Shells were collected for radiocarbon dating at 45 and 4.2 m a.s.l. The higher sample was stratigraphically related to the 57 m delta terrace and occurred in a lense of fine silt and gritty clay. The dominant species was Mya truncata. The lower shell deposit was located at a base of the 21 m delta terrace in a mainly silty matrix. A wide variety of species were found, among these Hiatella arctica and Chlamys islandicus. The latter species is significant as it indicates a marine environment warmer than the present.

A major outwash fan exists on the seaward side of the deposit described above and lichen colonies on two boulders at 1.5 and 3.5 m a.s.l. were recorded to check on the uplift data derived from the shell dates. On the opposite side of the fiord a marine bench was altimetered at 69 m a.s.l. and is considered to represent the marine limit in that locality.

"Kangigfik Fiord"

Kangigfik Fiord is to the south of and parallel to Pitchforth. From the fiord head a wide valley with braided streams continues inland and bifurcates one branch leading towards the west and the other towards the north. The valley to the north leads over to Pitchforth Fiord and appears to be the main source of ice flow moving into that fiord. Steep slopes prevail along the fiord but the sheltered bay at the head has provided a significant catchment basin which has resulted in deposition of a large delta formation.

Numerous marine benches, delta terraces and lateral drainage channels are present in both valleys although drift deposits are absent from the steep bedrock slopes. The marine limit at the head of Kangigfik Fiord is 77 m a.s.l. as shown by the two bench surfaces and the lip of a coarse delta. A very prominent lower level was levelled in five localities at an altitude of 69 m a.s.l. The extent of the transgression to this altitude is readily seen on the air photographs. Additional distinct beach features were measured at 55, 19, 13 and 5 m a.s.l.

An important shell deposit was located at the south side of Kangigfik Fiord in close proximity to the outlet from the large lake 1.5 km from the fiord head. The shells occurred in a rich deposit of massive clay along with an unidentified deposit resembling marl. The marine limit in this area is represented by a delta lip at 79 m.

Ice movements in the north and the northwest valleys of Kangigfik Fiord were respectively towards 23 and 10 degrees true North, both being heavily topographically controlled.

"Kangerdluak Fiord"

This fiord is really a bay along the north side of Ekalugad Fiord but resembles a fiord due to the presence of the long narrow "Doubledee Island". "Doubledee Island" is separated from the mainland to the west by a narrow strait and through this the main ice flow entered Kangerdluak Fiord as a diffluent ice stream from the main ice body in Ekalugad Fiord itself. Low valleys extend westward from the head of Kangerdluak Fiord and possibly small amounts of ice also flowed into the fiord from these valleys particularly in the early phase of glaciation.

Delta features were levelled at an altitude of 74 m a.s.l. at the head of Kangerdluak Fiord and these represent the marine limit. Additional deltas occur farther up the valley at altitudes up to 82 m a.s.l. These are, however, considered to be glacio-lacustrine as there is evidence that an ice-dammed lake was formed in the valley by the ice body further down-fiord. Shells were found at 21 m a.s.l. in a massive clay and will add to the C-14 dates already obtained by Andrews 1966.

Excellent striae preserved in the valleys west of the head of Kangerdluak Fiord clearly show that the ice flow was diffluent from the Ekalugad lobe. The ice movement was towards north and northwest.

"Ekalugad Fiord"

The fourth area of investigation includes the shores of Ekalugad Fiord west of approximately 69 degrees W. The Ekalugad re-advance moraine ends some 15 km to the east of this point and hence all the marine features in this fourth area lie on the proximal side of this moraine.

The major bay on the south side of Ekalugad Fiord is 'South Ekalugad Bay' at approximately 69 degrees W. On the northwest side of this the marine limit was levelled at 48 m a.s.l. on a coarse delta surface, the sediments of which were believed to be of glacial origin. A similar delta surface occurs approximately 3 km farther west and the marine limit there was levelled at 49 m a.s.l. Shells were located in an extensive silt bed at 3.3 m a.s.l. within this feature, and scattered shells were found in silt terraces at 43.4 m a.s.l.; however, no zone of concentration could be located thus preventing the collection of a sample for C-14 dating.

Still on the south side and some 6 km further west lies an extensive zone of ice-contact features and lateral drainage channels all of which are interpreted to have been formed close to base level.

The deposit indicates a period of relative stability of the ice margin. Superimposed on the surface of these glacial outwash features are a series of shallow, cobble beaches reaching a maximum altitude of 38.1 m a.s.l. This is interpreted as the marine limit. The difference between the marine limit of 38.1 m and the some 10 m higher marine limit 6 km farther west is explained by the prolonged stability of the ice margin in the area between the two localities.

The Ekalugad Fiord bifurcates farther west at a point where the marine limit lies at approximately 35 m a.s.l. Important beach terraces were also identified at 26.3 and 13.2 m a.s.l. in this locality.

An extensive delta series occupies the head of 'South Ekalugad Fiord' and the amount of sediments shows that a major sediment source existed; the ice margin was probably not far away when the deposit was formed. The upper portion of the main delta was likely formed during the marine limit phase as indicated by the grading surface which fuses with a distinct beach. The latter lies at 36.5 m a.s.l. and is considered as the marine limit while the lip of the highest delta terrace lies at 30.8 m a.s.l. Important terrace elevations also occur at lower altitudes e.g. 13.3, 9.0 and 2.2 m a.s.l. Shells were located in the upper beds of the main delta at the head of the fiord at 6.7 and 9.0 m a.s.l. Additional shells, in situ, were also obtained at elevations of 11.5 and 2.4 m a.s.l.

Bonny Bay is the major indentation on the north side of Ekalugad Fiord, and the head of this bay is occupied by a series of readvance moraines tentatively believed to be formed during the Ekalugad phase. A shell deposit was located at 30.1 m a.s.l. on the distal side of the youngest moraine at the head of the bay. This indicates that marine limit is higher than the former estimate of 26 m a.s.l. The shell sample should provide a maximum date for the deglaciation of the head of the bay. In several portions of Bonny Bay, sand terraces lie at higher elevations; however, these are believed to be of glacio-lacustrine origin as the re-entrant ice tongue would cause extensive ponding near the head of the bay.

Several raised shore features were observed between Bonny Bay and the head of the 'North Arm'. Approximately 1.5 km west of the bay the marine limit was altimetered at 41.8 m a.s.l. This feature was a series of beach remnants overridden by scree and solifluctions; however, all deposits had almost the same altitude. At the head of the 'North Arm' the marine limit lies at an altitude of 52.6 m a.s.l. while about 1.5 km further east it was measured at 49.2, thus showing an increasingly higher marine limit towards the head of the fiord. The 52.6 m marine limit lies on the distal side of the moraine that closes off the innermost part of the bay. Shells were found in this locality at 21 m a.s.l. and were collected in a scar, eroded in the silt terrace, from the upper portions of the deposit.

Summary

In order to gain a further understanding of the late and post-glacial history of the area, 15 determinations of the marine limit were made, some on the distal, others on the proximal side of the Ekalugad readvance moraine. In addition to this, 14 shell samples were collected for radiocarbon dating to provide an absolute chronology of the area and for the construction of uplift curves. Emphasis was also placed on determining major levels of raised shore features below the marine limit, particularly where such features could be dated.

WORK DONE ON HENRY KATER PENINSULA
DURING JULY AND AUGUST, 1967

C.A.M. King

(Figure 3)

Camp Sites in Order of Occupation and Areas Studied

July 5 - July 7	-	"Cache" camp. South-central part of the peninsula near the highland margin.
July 7 - July 16	-	"Bastion" valley camp. Western-central part of the peninsula within the highland zone.
July 16 - July 23	-	"Eskimo Point" camp. Central southern coast of the peninsula.
July 23 - Aug. 3	-	"Cape Henry Kater" camp. Far point of Henry Kater Peninsula.
Aug. 3 - Aug. 7	-	"Haar" Lake camp, (with Dr. J. D. Ives). Central outer coast of the peninsula.
Aug. 7 - Aug. 16	-	"Isabella Bay" camp. Central north coast of the peninsula.
Aug. 16 - Aug. 22	-	"Itirbilung Fiord" camp. Inner southern coast of the peninsula.

The positions of the camp sites are shown on the map (Figure 3). The northeastern part of the peninsula was examined by helicopter on August 15, and a brief visit was made to Aulitiving Island in Isabella Bay. On August 16, also with the help of the helicopter, the inland area between Isabella Bay and Itirbilung Fiord and Alexander Bay was visited.

During the field season we had two and a half days research with helicopter support, and the frequent camp moves enabled a considerable variety of different morphological features to be examined in some detail. These features ranged from the moraines of active glaciers to what is probably fairly old deposits on the outer coast.

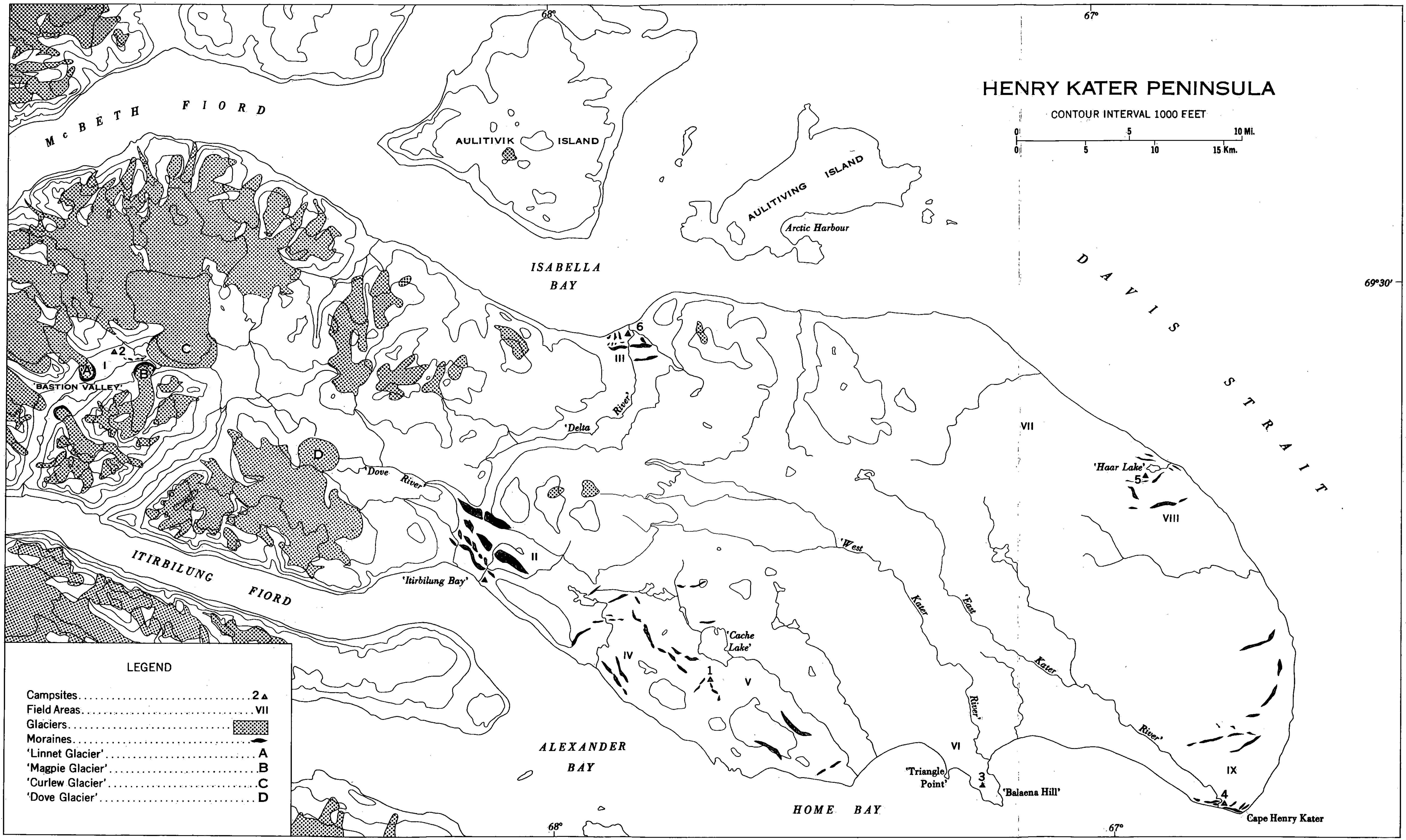

Figure 3 Henry Kater Peninsular

The Aim of the Field Work

The main aim of the field work was to study the geomorphology of the Henry Kater Peninsula, with particular emphasis on the stages of deglaciation in relation to changes in sea level. The peninsula extends furthest east of those that separate the major fiords. To the north lies McBeth Fiord and to the south Itirbilung Fiord. The former extends more deeply across the main axis of high ground that runs north-south near the heads of the fiords.

The most significant features studied were the moraines and the raised coastal forms, the latter including deltas and raised beaches. Shells were to be collected in as many positions as possible in order to provide data for the construction of uplift curves in various positions on the peninsula. These shell samples would also give information concerning the age of the moraines and the sequence of glacial events in relation to changes in sea level both within the fiord area and on the outer coast.

Methods of Study

The main methods of study included observations on moraines of all types and ages present. These measurements covered moraines actively accumulating, and still ice-cored, along the margins of the glaciers that protrude into "Bastion" Valley, to the very much older moraines of the outer coast. These latter moraines were of two very different types. The moraine studies included till fabric measurement, stone orientation observations, and stone size and roundness measurements, as well as cross-profiles surveyed by tape and Abney level.

Marine limits in the area covered were not distinct. However, a number of profiles were surveyed by levelling to features which appeared to approximate to the marine limit. In some instances delta lips were measured; in others, raised beach ridges indicated the maximum postglacial sea level. A number of raised coastal forms were also examined and levelled. These forms illustrated the changing coastal pattern during the different positions of the land-sea contact. The character of the modern beaches and the roundness of their shingle were also noted in a number of positions. These beaches form an interesting contrast to those on the western side of Baffin Island in Foxe Basin.

In all, 55 samples of marine shells were collected. These samples included nearly all the main arctic molluscan species. The heights from which the samples were collected ranged from 1.4 m to 56 m. above sea level. The distribution of shell samples is given briefly below, with the height range covered in each area:

Samples 1 - 5	-	"Eskimo" Point - 10 m to 33.8 m.
Samples 6 - 23	-	Cape Henry Kater - 6 m to 31.7 m.
Samples 24 - 26	-	Central outer coast - 30 m to 56 m.
Samples 27 - 39	-	Isabella Bay - 9 m to 32.3 m.
Samples 40 - 42	-	Northern outer coast - 5.5. m to 15.5 m.
Sample 43	-	Aulitiving Island, Arctic Harbour - 1.4 m.
Samples 44 - 55	-	Itirbilung Bay - 6.8 m to 48.1 m.

In addition to the 55 samples of marine shells, two samples of whalebone were collected. The first, only 1.6 m above sea level, at "Eskimo" Point, was situated on an old storm beach. The second, from delta deposits at an altitude of 29.6 m was found at Isabella Bay, and was almost the highest sample collected in this particular area.

The samples ranged from shells ploughed up into till and found mainly in fragmentary form, to whole bivalves found in situ in the marine deposits. Some of the shell samples came from beach deposits. These were found in very coarse sand rather than the finer silty material in which most of the whole bivalves were usually found. The heights of nearly all the samples were found by levelling or by theodolite (Wild T16) survey, but a few of the samples were measured only by altimeter. These latter samples were mainly those found in till and were samples which were not so critical from the point of view of elevation. Their dates should, however, provide information concerning the age of the moraines in which they were found.

The distribution of limestone erratics in the drift deposits and raised beach deposits was noted. These observations provide information concerning the direction of ice movement in the peninsula. Very few striations were found, partly on account of the paucity of rock outcrops in most of the area studied and partly due to the very coarsely crystalline nature of many of the rocks that were exposed.

Detailed evaluation of the results of the work carried out must await the analysis of the sediment samples and stone measurements, and particularly the dating of the most critical of the shell and bone samples. In this report only a very brief account of the main features at each of the sites visited will be given. The sites will be described from west to east. This is, in a broad sense, from the topographically highest to the lowest parts of the area.

The main areas considered are listed below and shown on the map, Figure 3.

I. "Bastion" Valley.

II. Itirbilung Bay. (The name is applied to the low stretch of coast along which the "Dove" and "Aufeis" Rivers reach the fiord.)

III. Isabella Bay. (The name is restricted for the purposes of this account to the low stretch of coast at which the "Delta" River reaches the fiord.)

IV. Alexander Bay. (The name is restricted to the low stretch of coast at which the "Jig-saw" Lake drains out to the sea.)

V. "Cache" Lake.

VI. "Eskimo Point".

VII. Northern outer coast.

VIII. "Haar" Lake - central outer coast.

I. "Bastion" Valley

"Bastion" Valley, so named for its magnificent vertical rock bastions, is a valley showing all the signs of active and recent glacial erosion. The trunk glacier that eroded the main valley has retreated, but tributary glaciers still protrude into the valley and the head of the valley is blocked by the piedmont lobe of "Curlew" Glacier.

Three of the glaciers which now protrude into the valley were visited and their moraines surveyed. The largest of these glaciers, "Curlew" Glacier has the smallest lateral and terminal moraine. The small dimensions of the moraine suggests that the ice of this piedmont lobe is now relatively inactive. The contrast in size of the moraines of the adjacent "Magpie" Glacier is striking. A small ridge, lying perpendicular to "Curlew" Glacier and almost reaching its snout, was surveyed and its fabric studied to determine its relationship to the two glaciers and its origin.

"Magpie" Glacier has a massive terminal moraine 80 m high, compared with the 10 m high moraine of "Curlew" Glacier. The terminal moraine of "Magpie" Glacier was found to show two stages of formation. The moraine has a step on which the rocks carry a dense cover of lichen, soil and vegetation. This indicates that the glacier snout must have been in the same position for at least several hundred years. The lateral moraine profile was also surveyed and this profile shows an outer stable moraine 500 m beyond an inner double ice-cored moraine. The moraines of "Linnet" Glacier were also surveyed and till fabric and orientation measurements made.

The character of these recent and active moraines was studied in order to provide a basis for comparison with those deposited earlier, often under different conditions.

II. <u>Itirbilung Bay</u>

Observations of the latitude and character of the moraine sequences in the next three areas were made to examine possible correlation between them. A marked similarity between the three areas was found and this aspect can most conveniently be considered for the three areas together. Each area forms a low stretch along the generally very steep, high fiord coast. Measurements were made by altimeter and surveys carried out over representative moraines within the sequence, which showed considerable differences in type. Orientation studies were also carried out for comparison with those in "Bastion" Valley.

Each of these three major low stretches of coast has been invaded by ice from the main fiord at a time when ice from more local sources was not so vigorous. This movement of ice inland has left a series of four moraine loops, in a convex inland lobate form in each embayment. The moraine loops in Itirbilung Bay are in general the highest, followed by those in Alexander Bay and Isabella Bay in that order. In each area the curvature of the fiord has facilitated the inland movement of ice at these points.

The highest shell sample in Itirbilung Bay was found near "Aufeis" River under the outermost of the moraine loops. The age of this sample should provide a date for this readvance. Other shell samples found in this area should provide dates for a fairly detailed uplift curve, as they range in elevation from 6 m to 37 m.

A spring-fed aufeis was also examined in this area. The spring, at 183 m, was fed from a lake at 200 m, which had no normal outflow, but which varied in level through 3 m. The "Aufeis" River draining this lake is clearly subject to considerable variations of flow and flood when the lake is suddenly drained.

III. Isabella Bay

One of the most conspicuous features of the Isabella Bay low embayment is the series of deltas at the coast and along the valley of "Delta" River stretching many miles inland. The coastal deltas contain shells, and their age should give an uplift curve for this area. The inland deltas did not contain shells. They were deposited into lakes dammed by the ice lobes that formed the moraine loops that have already been mentioned. The inland deltas ranged in height from 89 m behind the second moraine loop to a series lying between 127 and 202 m behind the innermost moraine loop.

IV. Alexander Bay

The moraine series in this area has already been mentioned. A marine limit elevation was obtained by altimeter on a reasonably distinct raised shingle ridge, which lay very close up against the outermost moraine loop, in a situation similar to the marine limit at the western side of Itirbilung Bay.

V. "Cache" Lake

Only a short period was spent in the field in this area, which lies in a low area surrounded on nearly every side by higher ground. The many shallow, small lakes and ridges of bedded material indicate dead-ice conditions in the deglaciation of this part of the peninsula. Moraine ridges were very small and were probably laid down along the edge of ice, the source of which lay in the local high ground to the west. This ice must have been moved down the open valley along the upper courses of "Dove" and "Aufeis" Rivers. Some observations were made in this area both on the moraines and on the stratified ridges in the dead-ice area.

VI. "Eskimo" Point

On either side of the north-south ridge of "Balaena" Hill and "Triangle" Point there are broad sweeping bays. Raised shore forms are conspicuous on the aerial photographs in this region, but on the ground the marine limit is not very distinct. However, a surveyed profile in "East" Bay, just east of "West Kater River" gave the level at which beach deposits merged into moraines at the marine limit. Surveys of the cuspate forelands which formed at successive levels as "Balaena" Hill emerged also provide comparable heights for the marine limit. "Balaena" Hill is now linked to the mainland by a sandy tombolo and blown sand features are well developed in the area. A conspicuous beach ridge at a lower level was surveyed in "West" Bay. It marks a stage in the emergence of the area. Postglacial shells were not found <u>in situ</u> in this area. Shells were found, however, in the drift and sub-drift deposits and these should provide a maximum date for ice cover. Striations of two ages and directions were also recorded in the area and limestone erratics were very numerous.

VII. <u>Northern Outer Coast</u>

During a visit to this area by helicopter two samples of probable postglacial shells were collected in deltaic and beach deposits in an area where the coastline is gently sloping. A marine limit elevation of a rather indistinct character was also measured.

A little further north, the coast becomes cliffed. The cliffs reach 67 m in height. They contain two layers of till separated by sands in the upper portion and marine strata in the lower part, including both silty material and stratified sands. A shell sample was collected near the foot of the cliff and this should provide a maximum for the overlying deposits and till.

VIII. <u>Central Outer Coast - "Haar" Lake</u>

Conspicuous moraines lie along the cliffs in this part of the coast. A survey from sea level across the moraine ridge revealed that it was much sharper in its relief than the moraines further south. The moraines also contain much larger boulders. Shell samples were collected in outwash associated with the moraines and from the till itself on the cliff top. These samples should provide an indication of the age of the moraines and the associated sea level at the time of their formation. The roundness of the moraine and delta stones was measured to compare with moraines elsewhere.

IX. Cape Henry Kater

The actual cape itself is morainic in character and the whole area around the cape is very rich in shells. The morainic forms are on the whole subdued, and flat dissected plateaux form the most conspicuous landforms. Beneath the moraine, surface shells *in situ* were collected in marine stratified deposits. Their age should date the period of moraine formation, which appears to have taken place beneath or at sea level in part.

A fairly conspicuous marine limit on raised shingle beach ridges was levelled a few kilometres north of the cape. Limestone erratics were very common in the area. Their plentiful supply suggests either a local source in Home Bay or very vigorous ice flow from western Baffin Island through Itirbilung Fiord. The latter seems the more likely owing to the increasingly numerous and large erratics to the east along the southern shore of the peninsula.

A late diversion of the "East Kater River" has occurred near the cape. This diversion leaves a now almost empty valley leading down to the cape. This valley, like so many others on the south side of the peninsula, lies parallel to the coast. It was probably initiated by meltwater flowing marginally to the ice which deposited the Cape Henry Kater moraine.

Conclusion

During the field season most of the landform types on the Henry Kater Peninsula were visited, although some only briefly. The variation in moraine type and age, and variations in marine limit levels within the area are of particular interest. The radiocarbon dating of the shell samples should throw considerable further light on the detailed chronology of events in the deglaciation of the peninsula with respect to sea-level changes.

I would like to acknowledge the help given in the field, and in preparation for the field, by my assistants, Miss Lyn Drapier and Miss Mary Strome. The completion of the field work was also entirely dependent upon the frequent visits of Dave Harrison and his helicopter to move our camp to new sites and for days of research in the helicopter. We are very grateful to him. On the whole, the weather was not very good during the second half of the field season and fog frustration on the outer coast lost us some days of work. Nevertheless, the field season was a pleasant one.

EGLINTON FIORD-KOGALU RIVER AREA

D. Hodgson

(Figure 1)

The objective of field work was to establish the pattern of deglaciation and the related sea-levels in this area and thus fill the gap between the Cape Christian area to the south and the Sam Ford Fiord area to the north, both of which had been studied previously. Results are somewhat inconclusive, for the highest well defined sea-level is much below the upper marine limits of adjacent areas, a situation which can hardly be ascribed to late ice. Furthermore, shells were found at only one site.

The area north of the Kogalu River is formed of hill masses rising to 700 m a.s.l. and divided by broad valleys. Towards the outer coast the valleys open out and major relief is restricted to a number of bedrock knolls. A series of marginal drainage channels, the highest at 350 m, swings north from the outlet of the Ayr Lake trough; at a lower elevation, the north bank of the Kogalu River is paralleled by marginal and sub-marginal channels. Ayr Lake abuts onto massive hummocky moraines, but no terminal or lateral moraines were noted elsewhere. A proglacial lake, draining to the outer coast, was contained between ice in the Kogalu valley and a glacier tributary to Eglinton Fiord at Ravenscraig Harbour.

Detailed field work was carried out in three localities:

1) Ayr Lake outlet

The 70 m slope break noted by Løken on the Clyde Foreland indicated the possibility of a marine incursion into Ayr Lake (elevation found to be 72 m ± 2 m seasonal change). The only evidence of marine action along the Kogalu River is a possible washing limit 38 m a.s.l., 10 km from the sea, and 25 km from Ayr Lake.

2) Ravenscraig Harbour

Beach ridges rise to 35 m a.s.l. around the bay W. of Ravenscraig Harbour. The sole shell collection (Hiatella arctica, Astarte striae) was taken from a bed of marine clay, projecting to the beach surface at 11 m.

3) Outer Coast

The highest beach ridges to the east of Cape Eglinton are at 23 m. A delta at 18 m may be related to the proglacial lake. The break of slope at the rear of a wave-cut bench, 7 km northeast of the Kogalu River, is close to 43 m.

GLACIAL INVENTORY - N. BAFFIN ISLAND

A number of the glaciers adjacent to Navy Board Inlet and Pond Inlet recorded by Falconer (1962) were rephotographed from the deck and helicopter of C.C.G.S. d'Iberville. Comparisons with the earlier photographs have yet to be made.

An overlapping series of photographs of a 15 km stretch of the southern shore of Pond Inlet includes a number of small glaciers and active talus cones. It is hoped that this project can be repeated in the future.

SUBMARINE MORPHOLOGY OFF THE NORTHEAST

BAFFIN ISLAND COAST

D. Hodgson

(Figure 4)

The reconnaissance survey of the submarine geomorphology along the east coast of Baffin Island that began in 1966 was continued in 1967 by C.C.G.S. d'Iberville with the assistance of the Hydrographic Service, Marine Sciences Branch. Sounding tracks [1] were run along most fiords, and across the continental shelf and slope, from Pond Inlet to Broughton Island excluding the area of the 1966 survey. For a 22-day period of late August and September, a total distance of 5700 km was covered, 2500 km in fiords and 3200 km offshore. Position fixes by radar and Loran provided uncontrolled plots with a probable accuracy of 100 m inshore and 0.5 km offshore.

The primary objective of the survey was to extend knowledge of glacial erosional and depositional forms to areas below present sea level and to the east of the modern coastline. Emphasis was placed on the following aspects.

Delineation of any troughs within the continental shelf.

Extension of profiles from the coast to the Baffin Bay basin floor.

Profiles of the fiords, including some detailed cross-profiles.

A study of the bottom medium using echograms. The 14 Kc frequency of the echo-sounder has a fair degree of penetration.

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1 Operating a conventional Kelvin-Hughes 26B echo-sounder.

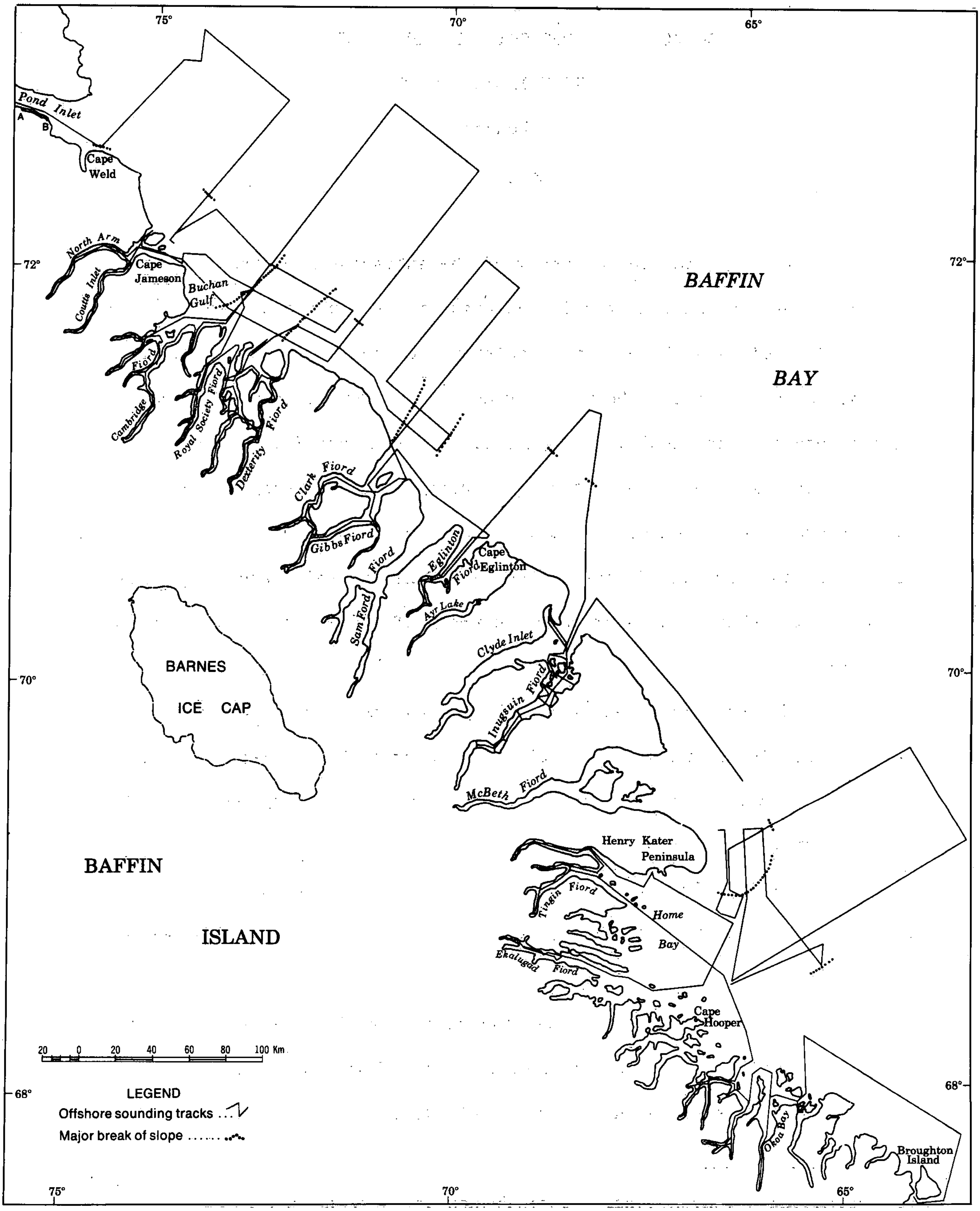

Figure 4 *Sounding tracks off east coast of Baffin Island*

PRELIMINARY RESULTS

As the echograms were not available up to the time of writing, the following observations are based on notes taken on board.

Troughs

Three major troughs were located, and cross-profiles indicate that they extend to the continental slope, they thus differ from the Clyde Inlet trough surveyed in 1966.

1. Channels from Buchan Gulf, Patterson Inlet and Isbjorn Strait converge into one trough trending northeast off Cape Cargenholm. The width near the shore is 45 km and the maximum depth 780 m - an overdeepening of 700 m below the adjoining shelf. Approaching the continental slope, 40 km offshore, the maximum depth is 830 m, an overdeepening of 550 m. The sides occupy less than half the total width and have slope elements exceeding 20°, but are generally $2^{\circ} - 4^{\circ}$. Local relief of the floor is less than 50 m. The upper slopes are paralleled by a ridge, possibly a lateral moraine, up to 50 m high and 5 km in width.

2. The Scott Inlet trough is a direct continuation of the Inlet, which in turn results from the confluence of Gibbs and Clark Fiords. Depths increase from 650 m within the coastal mountains to 850 m offshore - a 700 m overdeepening.

3. Parts of a Home Bay trough were defined, and again indicate a northeast trending axis, but with an asymmetrical cross-profile. The northwest slope falls from under 100 m to 700 m with slope values of $3^{\circ} - 6^{\circ}$, and rises to the southeast at less than 10°. Navigational problems prevented a survey of its relationship to the Alexander and Isabella Banks (the coast is too distant and too low for radar fixes, and the area lies

on the baseline of the Cape Christian Loran station).

Continental shelf and slopes

Of the nine tracks run as normals to the trend of the coastline, only four revealed the shelf and slope as two simple elements. The four show a remarkably uniform shelf, and even off the Henry Kater Peninsula there are no irregularities which can be interpreted as moraines. Slopes fall off from 6^{o} - 7^{o} near the top, to a near-level surface at 2000 m. The edge of the shelf lies at about 175 m.

The two northernmost profiles lie outside the 'Baffin basin' and level out at 900 m. From Cape Weld, the bottom falls steeply (6^{o}) to 650 m only 10 km offshore, suggesting significant erosion by Pond Inlet ice at least to this point.

The remaining profiles are considerably distorted where they transect troughs.

Fiords

Depths appear to be related to cross-sectional area and accessibility for inland (Foxe Basin ?) ice. Eglinton Fiord rarely exceeds 200 m, while both Gibbs and Clarke Fiords have 30 km long reaches with depths between 720 and 740 m. Although the maximum depths are commonly flanked by the highest mountains, shallow thresholds are not universal. Scott Inlet has a through channel which is at least 650 m deep from 60 km inside the coast to the continental slope. Buchan Gulf and Patterson Inlet are scattered with islands and rock pinnacles, as well as depths of 550 m, a degree of dissection equalled only in the Home Bay area. Through channels may represent major pre- or inter-glacial drainage lines subsequently modified by ice.

Extensive banks levelling at 10 m depth block the entrance to Dexterity Fiord, and the passage north of Nova Zembla Island.

Four cross-profiles of the middle reaches of Inugsuin Fiord demonstrate that the walls have the same inclination above and below sea level. The broad flat floor at 5-600 m must represent a considerable accumulation of sediments.

Bottom Types

It was hoped that relatively low frequency pulses would distinguish between different bottom types - at least fine sediments, till and bedrock. Apart from tracks on the shelf, it proved difficult to maintain a uniform trace intensity, owing to the rapid fluctuations in depths, and it is doubtful if meaningful interpretations can be made.

FIELD REPORT - ALLUVIAL FANS, ALLUVIAL CONES AND TALUS SLOPES

June M. Ryder

INTRODUCTION

Field work was divided between two projects - (1) the study of alluvial fans and (2) the investigation of other postglacial slopes, notably alluvial cones and talus slopes. The work on alluvial fans was a continuation of last summer's work[1] and was oriented towards a more detailed analysis of the distribution of sediment on the fans in conjunction with problems of sediment supply and movement across the fans. The study of alluvial cones and talus slopes concentrated on morphology and sediment distribution and included observations of process. It was impossible to make any long-term measurements since only a short time was spent in each area.

Field Areas

Field investigations were carried out in the four areas indicated on the location map, Figure 5. The alluvial fans adjacent to the 'Ekalugad Sandur' were studied in detail. Alluvial cones were located at the head of the most northerly arm of Tingin Fiord. Work on the talus cones was based in the vicinity of Nudlung Fiord, and various activities were carried out around Inugsuin Base Camp.

Alluvial Fans

During the summer of 1966 it was noted that many of the Baffin Island fans are in the process of aggradation - a relatively unusual state of affairs. Consequently, the 1967 project was aimed at

[1]Ryder, J. M. 1966: Field Report North-Central Baffin Island, Department of Energy, Mines and Resources, Geographical Branch, Ottawa.

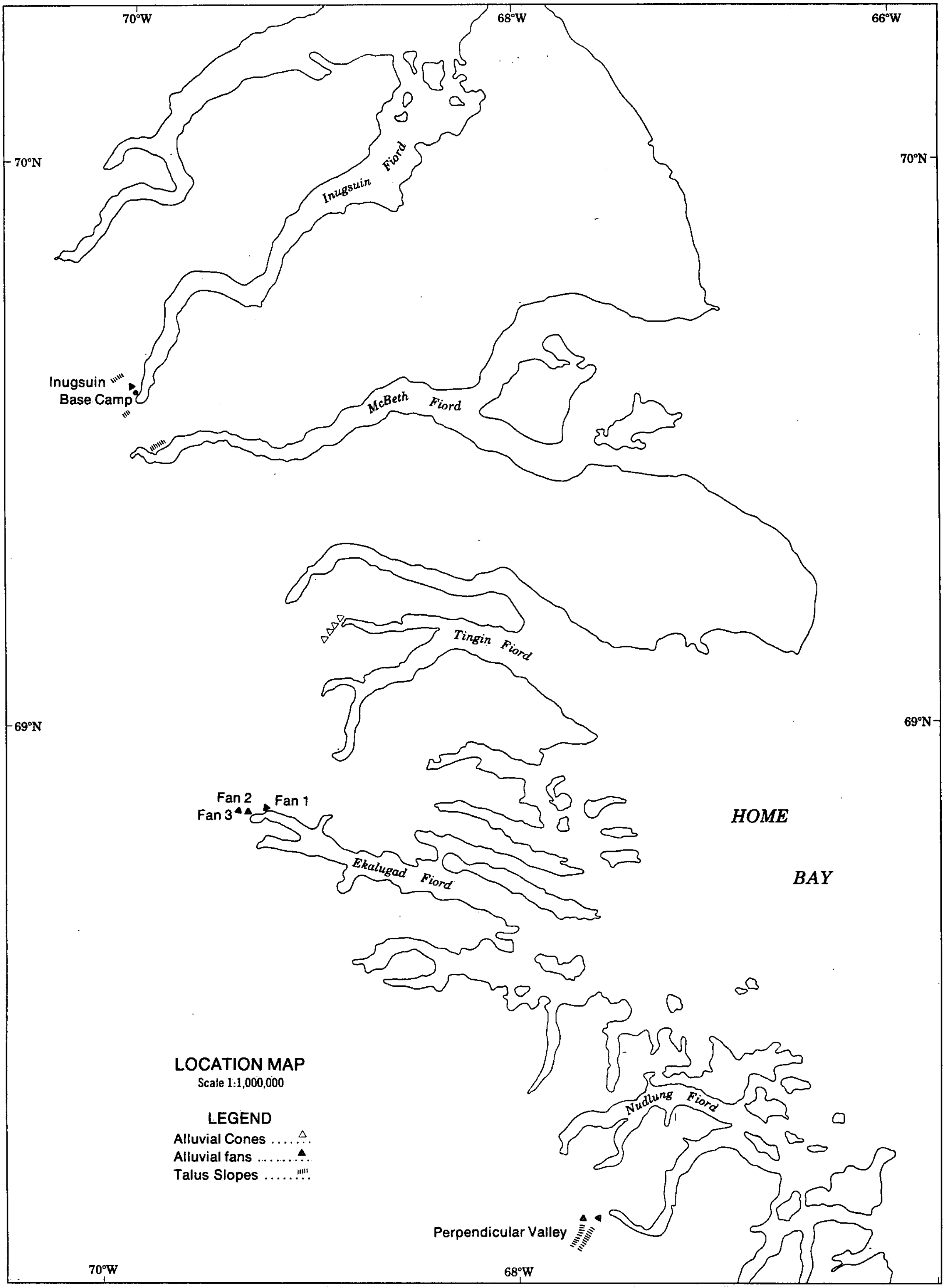

Figure 5 *Location of cones, fans and talus slopes*

determining the nature of this sedimentation and, if possible, the current rate of aggradation. Three fans (F1, F2 and F3) were examined in detail. The work was carried out in conjunction with M. Church's study of the Ekalugad Sandur (see page 53).

Stream gauges were established and discharge measurements made in order to establish rating curves at the apices of all three fans. Measurements were made at the toe of Fan 2 to determine any variations between apex and toe. Suspended sediment samples were taken regularly at both apex and toe of Fan 2 and periodically from Fans 1 and 3. Water samples for chemical analysis were collected from the toe of Fan 2.

Sediment size, shape, and composition were mapped in detail on the presently active surface of Fan 2 and along a profile following the center line of Fan 3. Sediment size and shape were also measured on the two older, high level surfaces of Fan 2. Results are not yet available, but there are some indications of interesting comparisons between the glacier-fed streams of Fans 1 and 3 and the non-glacial Fan 2 stream.

Measurements for comparative purposes were made on a large active fan in the Nudlung area. This fan is unusual in several respects. It is relatively steep, (with an average gradient of $8^{\circ}27'$) in comparison to other fans of similar size (slightly over 1 km from toe to apex) in Baffin Island. Also, the surface material of this fan is extremely loose and poorly packed with boulder-sized cavities beneath the surface layer.

Two old and inactive fans were studied - one in the Nudlung area and the other behind the Inugsuin Base Camp. Both consist of exceptionally coarse material. Particle sizes on the Nudlung fan were sampled briefly by measuring the intermediate diameter of the ten largest boulders at each of 17 sample stations. Particle size decreases from 794 mm at the apex to 366 mm at the toe over an average slope of $1^{o}40'$. Equivalent measurements of the coarsest material on the Inugsuin fan show a decrease from 926 to 800 mm with a slope of $6^{o}10'$. Intermediate diameter measurements of samples of 50 particles were also made on this fan and an adjacent smaller fan. From this data an estimate will be made of the nature of the discharge required to construct these fans.

Alluvial Cones

Alluvial cones are here defined as conical masses of debris with surface inclinations intermediate between talus slopes (over 30^{o}) and alluvial fans (generally under 14^{o}). Alluvial cones are fairly common along the steep walls of fiords and glacial troughs (particularly Tingin) in this part of Baffin Island.

A group of alluvial cones was studied at the head of the most northerly arm of Tingin Fiord, $69^{o}11'$N, $68^{o}55'$W, (see Figure 6). Fifteen adjacent alluvial cones (C1 - C15) are located along the southeast-facing valley wall below a spectacular series of cliffs which rise to just over 1,000 m a.s.l. The cones rise abruptly to elevations of approximately 300 m above a broad sandur that occupies the valley floor. They are all postglacial and appear to overlay glacial deposits - partially buried remnants of lateral moraine and kame terraces form benches on four of the cones.

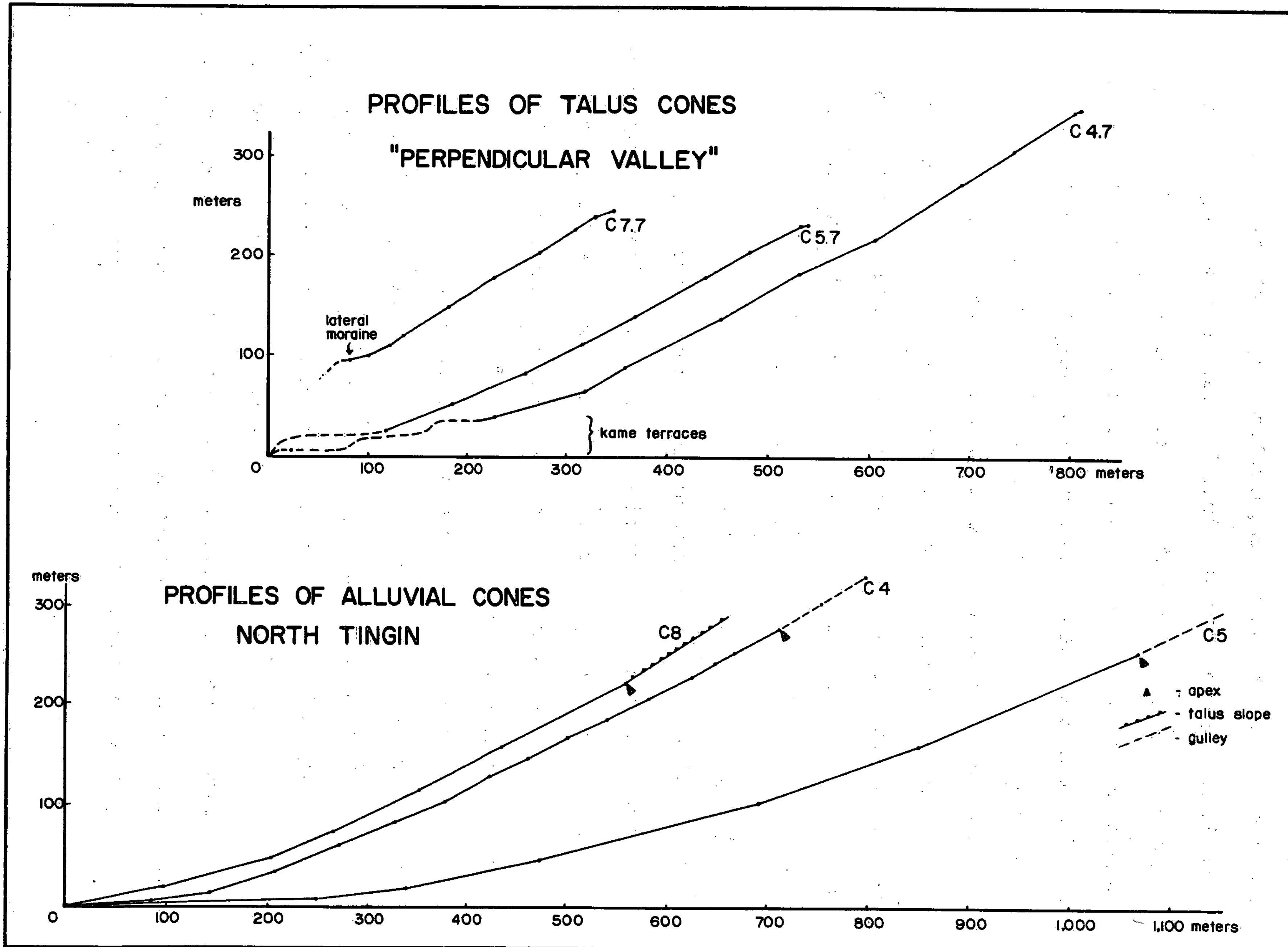

Figure 6 *Profiles of cones*

Profiles of four cones were measured in detail, two by theodolite (C3 and C4) and two by altimeter and Brunton (C5 and C8). Single slope measurements (by Brunton) were made on several other cones. All profiles are markedly concave in their lower sections with rectilinear or very slightly concave upper slopes, (see Figure 6). Maximum gradients approaching 30° occur near the apices. The debris choked gullies above the cones are usually slightly steeper with slopes of 32° to 33°. Gradients were measured on talus slopes in the same area for purposes of comparison. These averaged about 34° and are distinctly steeper than even the steepest parts of the cones.

Measurements were made of the size of material on the surface of the cones but the data analyzed so far has failed to reveal any overall gradation from apex to toe, or any variation with slope. Blocks with a diameter of 2 m are common on all parts of the slopes and blocks as large as 4 m are not unusual. Sorting is present, however, in the form of zones of material of uniform size that are aligned downslope. The actual size of the material is dependent upon the process of deposition (or erosion) active within that local area.

Material is brought to the cones by three processes: by small streams or torrents, by avalanches, and by rockfall. The importance of each process varies from cone to cone according to the characteristics of each basin. The detailed morphology of a cone surface reflects the dominant process within each local area.

Fluvial deposition and erosion by small streams is most active below the larger rock basins, particularly those which contain semi-permanent snowfields or those which carry drainage from the summit icefield, as do the six most northeasterly cones, (C1 to C6). Material is deposited chiefly in the form of torrent levees which consist of relatively coarse material and stand up to 2 m above the adjacent cone surface. Channels may be incised as much as 4 m below the general surface level on the steeper parts of the cones. Relatively fine material, including granule- to sand-sized particles, is exposed in the bed and banks of such channels and may be an indication that a much higher proportion of fines exists below a surficial layer of coarser material. Anastomosing series of levees are a prominent feature of most cone surfaces, although usually only one channel is active at any one time. Downstream, the pairs of levees usually terminate in a rounded "nose" of debris on the low-angle concave portion of the cones. Boulders in the levees and stream channels are slightly rounded.

Deposition from avalanches of mixed snow and rock gives rise to a highly unstable and loosely packed surface. Smaller blocks piled precariously upon larger are a characteristic feature. The material is extremely angular and no sorting is visible. Evidence of avalanche deposition was found upon all the cones investigated, and near cone apices, melting snow patches containing a high proportion of rock debris were common. However, only in the case of Cone 5 does avalanching appear to control the morphology of the cone. Its surface consists almost entirely of the typical unstable debris. Gradients are markedly lower than on the other cones (maximum 24°) and the whole profile is distinctly concave, (see Figure 6). A tongue of avalanche and rockfall debris extends from Cone 5 to constrict the sandur at this point. The basin above Cone 5 is unique within the group in having a large hanging glacier which may possibly contribute to (or initiate) many of the avalanches.

Material from rockfalls is concentrated on the upper slopes of the cones. The edges of the blocks show secondary chipping due to impact during fall. Only in the case of Cone 8 is rockfall material the chief component of the cone. This cone has no true basin but extends downward from the base of a talus slope which is collecting below a slight concavity in the face of the cliff; (see Figure 6).

The lower slopes of the cones are stable and vegetated, with torrent levees the only form of deposition.

Talus Slopes

A detailed study was made of talus cones in "Perpendicular Valley", located eight miles to the south of the head of Nudlung Fiord, 68°07'N, 67°40'W, (see Figure 6). Other talus slopes were briefly inspected at the heads of McBeth and Inugsuin Fiords.

Talus cones line both sides of "Perpendicular Valley". The valley walls are near vertical and rise 300 to 450 m above the cone apices. The valley is a typical "U" shaped glacial trough with remnants of lateral moraine standing between 80 and 120 m above the valley floor and decreasing in elevation in the present downstream direction. A series of kame terraces rise up to 40 m above the valley floor which is occupied by a broad and shallow stream on a gravel-paved bed. The lateral moraines and kame terraces are partially buried by the talus material which in places extends to the stream bed.

The talus slopes were classified according to the local geology and aspect, and representative slopes selected for measurement. Detailed profiles and grain size measurements were made on eight slopes. Profiles were recorded by Brunton and altimeter surveys, use of the theodolite being prohibited by the instability of the slopes. Detailed grain size measurements were made on samples of 50 particles selected at 2' intervals along a 100' tape placed along a contour. By this method it was hoped to obtain a representative selection of measurements across sorted zones which trend downslope. Three axes were measured on each particle in an attempt to determine if particle shape has any effect on slope or stability. Observations were made of lichen and vegetation cover and the degree of rock weathering in order to estimate the stability of the talus.

In profile the talus cones consist of three distinct sections, (see Figure 6). The longest and steepest facet is the central portion of the slope which is either rectilinear or slightly concave. Maximum gradients measured range between 30° and 35° and are located one third or one fifth of the way downslope from the apex. The short apical section is convex with gradients decreasing to 0° in some cases where a narrow ledge or platform has been formed by the impact of falling debris. At the foot of each talus slope there is a long concave section where the unstable talus grades into a more stable slope with lichen and vegetation and is controlled by solifluction and fluvial action. Average gradients measured over the entire cone range between 28° and 31°30'.

On the great majority of the talus cones, the largest material is found at the base and the finer material at the apex. Average grain size decreases from the 600 to 900 mm range at the toe to 100 to 200 mm at the upper convex break of slope. Granule- and sand-sized fines were frequently found on the flattened apices. A high proportion of similar fine material was observed in the craters left by the impact of large blocks at various places on the slopes, therefore it seems likely that the proportion of fines within the cones is much higher than would appear from the nature of the surface.

Very few of the cones examined show simple vertical size gradation. Many show a pattern of sorted rock streams aligned downslope, as described on the alluvial cones. The alternating arrangement of finer and coarser material is possibly related to the downslope movement of the surficial material by sliding or creep. Also, the apparent decrease in size of material upslope is very often a result of an increasing proportion of finer material, rather than an overall decrease in the size of the particles. Large blocks are common near the apices, particularly on cones where rockfalls originate only a short vertical distance above the apex and the momentum of the falling particles is insufficient to carry them far down the slope. Joint spacing in the bedrock also exerts a control on the size and sorting of particles on the slopes.

There appears to be no simple relationship between angle of slope and particle size, since there is a considerable variation in grain sizes across the long steepest facet of the cones where changes in gradient are small.

The effects of running water were observed on all cones examined and this may partially explain the comparatively low average gradients on these cones. Water from melting snow patches arrives at the cones' apices via a series of waterfalls, but the streams percolate below ground level within a few meters of the apex. However, torrent levees, no doubt formed during the period of maximum runoff, frequently extend the whole length of the cone. Usually, (but not always) they follow the cone margin, running adjacent to the rock walls down the upper part of the slope and then down the intersection between adjacent cones where a conical mass of fluvial material is built up.

STUDY OF CLASTIC SEDIMENTATION IN EKALUGAD FIORD, BAFFIN ISLAND

Preliminary Report - 1967

M. Church

INTRODUCTION

This report describes studies during the 1967 summer season of the form and environment of alluvial deposits at the head of Ekalugad Fiord, on the Home Bay coast of eastern Baffin Island.

The base camp for operations was established on May 29 at the seaward end of the outwash plain (sandur) at the head of the north arm of the fiord, where reconnaissance was carried out in 1966.[1] Work was carried on until August 23 by a five-man group consisting of Terry Day, Barry Goodison, John Knight, Robert Stock and Michael Church. Between June 18 and July 11 additional help was received from John Richardson. T. Day and M. Church remained until September 12 to observe conditions during the freeze-up period. Between June 26 and August 14 a party led by Miss June Ryder was also based at the Ekalugad camp to make special investigations of the alluvial fan deposits in the valley, and cooperative studies were carried out by the two groups.[2]

The Ekalugad Fiord project has attempted to understand the mechanics of terrestrial sedimentation in an area of the eastern

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[1] cf "Study of Clastic Sedimentation in Ekalugad Fiord, Baffin Island: Preliminary Report, 1966", in Field Report: North-Central Baffin Island, 1966, Geographical Branch File Report, 1967.

[2] cf Preliminary Report of J. M. Ryder, p

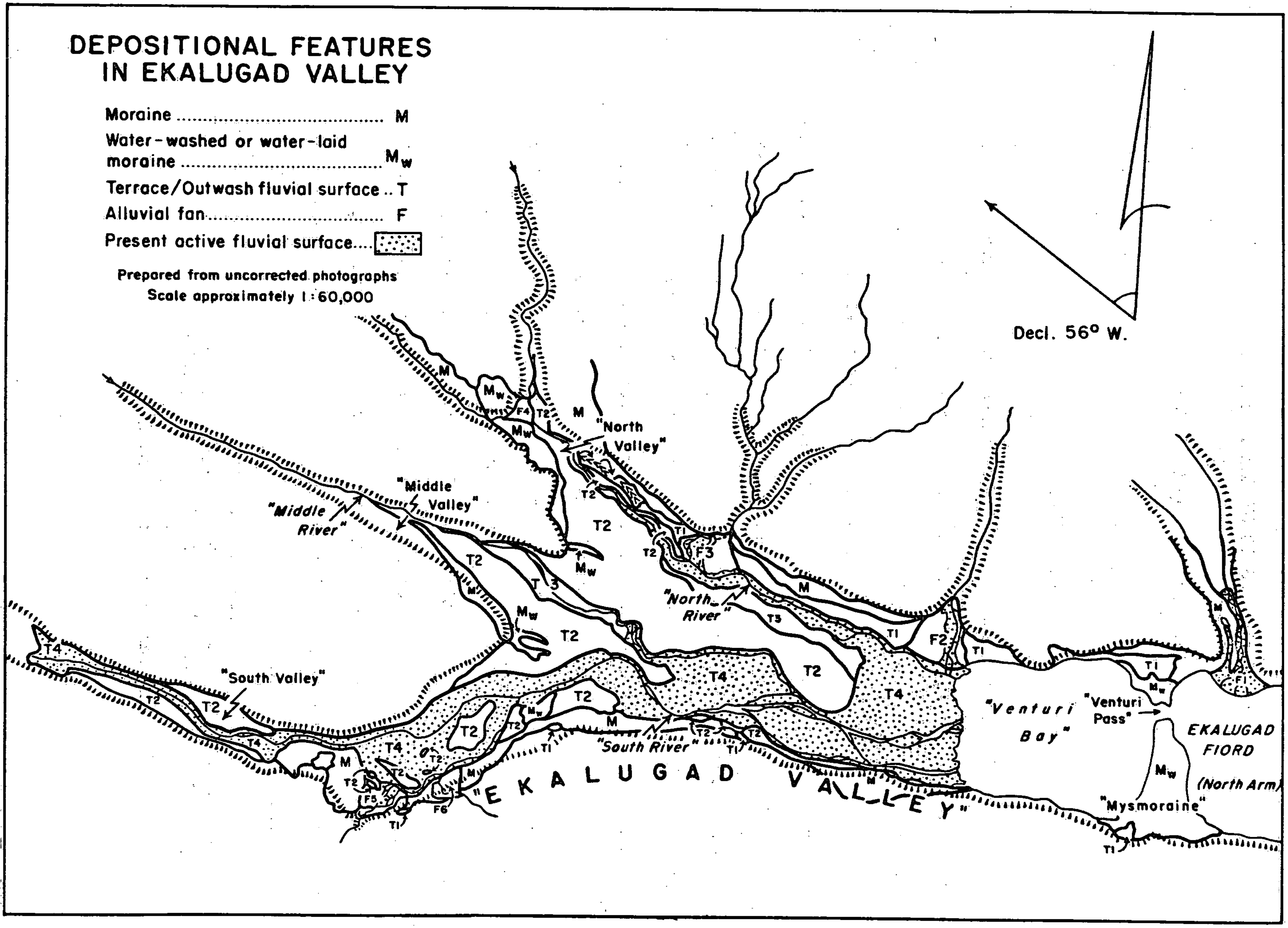

Figure 7 *Ekalugad Sandur area*

Canadian Arctic by a detailed study of a major alluvial surface. Three major aspects of study were pursued:

- the form of the recent sedimentary deposits;
- the erosional and depositional events that have given rise to the observed form;
- the environmental conditions under which the events occurred.

Field Objectives and Work Accomplished

The field program had seven main phases.

(1) Ground control was established for aerial photography from which a large-scale base map of the sandur will be compiled. Horizontal distances were surveyed by tellurometry on June 19 by Paul Langlais and Axel Geiger of the Topographical Survey of Canada. Five points were established. Twenty-eight points were levelled for vertical control using a Zeiss Ni 2 instrument, and precise procedures. The points were marked by large flare cloths for the photography flown on August 28. To provide an absolute datum, an automatic tide gauge was operated between July 22 and August 15, whence a mean sea level was established. Submarine soundings were made at 50 points off the end of the sandur in order to extend the contour map to show the submarine topography in the area of major sedimentary prograding at the end of the outwash.

(2) The morphology of the sandur was studied in two respects. First, to study the characteristics of the sediment distribution on the alluvial surface, a 200-meter square sampling grid was established, and at each sampling station measurements were made on ninety-six randomly selected cobbles of greater than 8 mm intermediate diameter.

Data were gathered for computing sediment size distribution, roundess, sphericity, shape factor, and sediment type. This last characteristic was assessed in terms of seven rock type categories which covered all the rock types found on the sandur. The data for this study was coded onto IBM forms in the field preparatory to analysis. In addition a sample of fines was collected at each site for grain size and mineralogical analysis. Field sieving and weighing determined the proportion of 8.4 mm and 4.2 mm fractions. The $<$2 mm fraction was returned to the Ottawa laboratory. This program of study was carried out only on the recent surface this summer. Neither time nor the compacted and vegetated nature of the older surfaces permitted their inspection. The program achieved,comprised 148 sample points involving 46,832 measurements made on 14,208 cobbles. An attempt to study the submarine deposits at the distal end of the sandur was abandoned when the marine sampler proved impractical to operate in gravelly bottom material.

(3) The channels on the sandur were studied by means of long profile surveys and cross-section studies at selected points to determine the hydraulic geometry of the sandur channels. Surveys of the thalweg and energy grade (at low flow) were made in South and Middle Rivers, the two channels on the sandur where extensive erosion and deposition occur. Survey stations were approximately 50 m apart (150 ft.) and extended over 9 km in South River and 8 km in Middle River. Survey of North River was precluded by flow conditions. Elements of the hydraulic geometry were studied at seven points in South River, and four points in Middle River to determine the adjustments of channel form to varying flow levels. Bottom gravels were also measured at

these points to determine a roughness factor for the channel sections. About fifty miscellaneous cross-section surveys will be available for a further study of the adjustment of the channels to streamflow and sediment load.

Detailed studies of bar growth and change were carried out at several sites to provide direct data concerning the influence of sedimentation on the resulting morphology. The three areas mapped in 1966 were resurveyed, and extensive changes were recorded at the major sedimentation area along Middle River after high flows in early July. Three further areas of river bars were surveyed and the distribution of sediment was studied at two of the sites.

(4) In order to provide basic hydrological data of flow frequency and run-off pattern across the sandur, stream gauges were set in all the major streams and on the main alluvial fan streams in the valley. Table I summarizes the extent of the records obtained. The combination of heavy rains and very rapid snow melt that occurred in early July produced unusual floods that exceeded the designed capacity of all the river installations. No serious dislocation of records occurred however, except on Fan 1 later in the month, where the gauge was lost during a high flood. The rating curves to accompany the gauge records were established by means of current metering and relative salt dilution measurements. Only on North River was considerable difficulty experienced in obtaining accurate measurements. Here the stream offered no site suitable for current metering at high flow, and dispersion was insufficient for electrochemical measurements to be reliable. A serious dislocation was sustained in the program when one of the two current meter

Table I

Stream Gauging Records at Ekalugad Valley, 1967

River	Period of Record	Rating Points	Remarks
'North'	June 22-September 7	3: current meter 10: salt dilution	Ott Type XX Gauge. Possible shift in stage control on July 14.
'Middle'	July 6-September 8	10: current meter 1: salt dilution	Stevens Type F Gauge. No record between July 14, 1900 hrs., and July 15, 2000 hrs., when river flow overtopped the gauge well.
'South'	July 5-September 8	9: current meter 1: salt dilution	Ott Type XX Gauge (to July 21); Staff gauge (July 21-August 2). Stevens Type E Gauge (from August 2). Original gauge washed out in flood of July 21.
Fan 1	June 30-July 19	3: salt dilution	Stevens Type E Gauge. Gauge washed out by flood on July 23. Rating curve not completed.
Fan 2 (Upper)	July 3-July 28	14: salt dilution	Stevens Type E Gauge (to July 27). Attempted installation of Ott Type XX Gauge on July 27, but the gauge did not operate satisfactorily.
Fan 2 (Lower)	July 1-August 21	7: salt dilution	Staff gauge.
Fan 3	July 5-August 12	6: salt dilution	Monroe gauge.

counter boxes arrived in the field unserviceable, and the other proved to be defective. The purpose of obtaining two ratings for the Fan 2 stream was to study seepage losses from the channel between the top and the toe of the fan.

(5) Studies of sediment transport were carried out in order to assess the magnitude and frequency of present sediment movement. A summary of the solution and suspended load sampling programs is given in Table II. With each suspended load sample, relative conductivity and temperature of the river water were measured. These data will be used to extend the solution load sample results to a more complete record of the solution load carried by the streams. The solution load water samples have been returned to the Industrial Waters Laboratory of the Inland Waters Branch for analysis. The suspended load sample, taken with a DH-46 sampler, were normally of 1-litre volume, though samples of as much as 3 litres were taken to provide checks on sampling accuracy. The samples were filtered in the field, and the filter papers have been returned south for ashing and weighing.

A projected direct sampling program of bed-load transport could not be carried out, because of the unfortunate juxtaposition of work schedules and peak flow. Bed material moves only at near bankfull stage in the sandur streams: nearly all such flows occurred in early July when it was necessary to work on the prior task of gauging and rating the streams. However, a series of twenty sets of size-graded cobbles, established at various points in the channels along with peak stage recorders successfully yielded information on bed transport competence at various flow levels. This data, along with the information

Table II

Summary of Sediment Sampling Program

Sampling Site	No. of Solution Load Samples	No. of Suspended Load Samples
Lower North River	11	55
Upper North River	—	13
Lower Middle River	11	44
Upper Middle River	2	25
Lower South River	9	30
Upper South River	2	99
F1	—	4
Lower F2	12	52
Upper F2	—	46
F3	—	13
Totals	48*	381

*One miscellaneous sample (of rainwater) was taken.

collected on the size of bed materials, may be used to make computed estimates of bed-load transport by several available techniques. This will in some measure replace the direct measurements, which were the only major objective of the summer not achieved.

(6) A program of meteorological observations was carried out during the season in order that correlative studies may be made between the frequency of run-off and sediment transport events on the sandur and their local weather controls. The main records were obtained at a site on the high terrace near the main camp, where

readings were made at 0700 hours and 1900 hours local (0001 and 1200 Z) of the following elements:

- 12-hour maximum and minimum temperatures;
- dry bulb and wet bulb temperatures, as a sling psychrometer measurement;
- 12-hour precipitation;
- 12-hour run-of-wind;
- present wind (as a 5-minute integration) and direction;
- snow on ground;
- sky condition;
- horizontal visibility;
- actual pressure (taken at the camp);
- present weather.

In addition, a thermohygrograph record was kept in the screen. The record extends from June 3 until September 10. Approximately 4 km away at the upper camp, records were kept between June 8 and August 20 of the same elements (except pressure). These records will provide a controlled check on the local variability of conditions within the valley. Because much of the contributory watershed feeding the valley streams is at high elevation, a meteorological station was established at 820 m on the north side of the valley. A screened thermohygrograph, a rain gauge, and a run-of-wind anemometer were left here and checked weekly. The duration of record was from July 3 to August 20. Between July 10 and August 20 experimental measurements were made of the evaporation from an open pan, and wind and temperature profiles within 5 m of the ground were made at the regular observation times.

(7) Sources of sediment supply to the sandur were studied in two respects. Reconnaissance of the bedrock geology was carried on, and samples of rock gathered for mineralogical analysis to compare bedrock character with that of the sandur sediments. Also, it was observed in 1966 that considerable material is derived for the present surface by erosion of former surfaces, now extant as terraces. Accordingly, 118 erosion stakes were placed along the terrace scarps and were measured at the beginning and end of the season to provide data on scarp retreat by mass wasting and river erosion.

The 1967 Season

The 1967 summer season was characterized by six distinct weather and run-off periods. Almost the entire month of June was cold and windy. The ground was generally snow covered at the beginning of the month, and although melt proceeded slowly, large amounts of snow remained at low elevations at the end of the month. The main rivers broke up slowly through the month but no significant run-off occurred, and it was not possible to install the river gauges until after July 1. The mean temperature for June was $1.4^{\circ}C$, with a mean maximum of $3.8^{\circ}C$, and a mean minimum of $-0.7^{\circ}C$. 43 mm of precipitation fell, the bulk of it as snow.

Beginning on June 29 was a warm, clear period that extended for 15 days, until July 13. Temperatures rose very rapidly, and on July 8 a maximum of $16.5^{\circ}C$ was recorded. The mean temperature for the period was $7.0^{\circ}C$. With this sharp change in the weather, the bulk of the spring snow melt occurred very quickly, and North and Middle Rivers flooded to very high levels - Middle River was over bankfull.

Between July 14 and July 19 two heavy storms occurred (bringing 27 mm and 22 mm of rain respectively) and these, on top of high snow melt, produced the maximum floods of the season on North and Middle Rivers, and on the fan streams. Peak discharge on North River was about 166 m^3s^{-1}, and on Middle River is estimated to have been 40 m^3s^{-1} (the gauge was overtopped). Both estimates exceed the maximum expected flood. Most of the sediment transport in these rivers occurred at this time.

Between July 20 and August 1 occurred the warmest period of the summer. The daily maximum temperature during this period averaged 12.8°C, and on July 25, 21.0°C was reached. The mean temperature for the period was 8.9°C. Beginning on the morning of July 20, a large pond dammed up behind the icefall in the upper South Valley began to drain, producing a catastrophic flood in South River. The peak discharge of 199 m^3s^{-1} was reached at 1100 hours on July 21, when the gauge was swept out. Large quantities of sediment were eroded and moved during the flood, which spread out over a considerable portion of the lower sandur, and afterwards the channel pattern was changed in many places, though several features of the channel remained surprisingly stable. About 6 x 10^6m^3 of water was discharged during the flood. For the balance of the period the rivers continued at moderate flow levels and most hydrological work was completed at this time.

After August 1, right through the month, the weather was stormy and unsettled. One major storm on August 10 produced a moderate flood in all rivers, but later in the month precipitation mostly came as snow at higher altitudes and water levels remained low. Mean temperature for the period was 5.3°C, and the average minimum was 3.5°C, indicating frequent freezing at the upper levels of the watershed.

After the first of September the weather turned cold and freeze-up began. By the 10th temperatures were remaining continuously below freezing and the rivers had been reduced to a trickle under fresh ice. Fresh snow fell, apparently to stay, on September 5. The season thus ended quite early this year.

Associated Projects

In addition to the main project, two related studies were carried out during the season with the general support of the party.

Barry Goodison (University of Waterloo) carried out a hydrometeorological study of the Fan 3 watershed. In order to determine the water budget, the basic gauge record of the Fan 3 stream was supplemented by observations of snow cover and soil moisture measurements throughout the contributory basin. Local weather was studied by a series of seven screened thermographs placed at regular elevation intervals in the watershed up to 900 m, and anchored by the high meteorological station. A network of fourteen rain gauges was visited weekly to determine precipitation in the basin. In addition, temperature and precipitation were measured at two sites in the F1 basin to provide comparative data from a glacierized watershed. In the analysis of the data it is hoped to pay considerable attention to the physical distribution of water and its control throughout the season by the weather elements and physiography of the basin. This will contribute a measure of greater understanding to the necessarily correlative studies of the relations of weather and run-off in the larger main project area.

Robert Stock (University of Western Ontario) completed a study of the form of the talus and debris slopes in the valley, and the distribution of sediment upon them. In the course of the study 23 talus features were surveyed. A group of talus cores on the north side of Middle Valley (south facing) were selected for closer studies of the extent of rockfalls and talus movements, and for studies of the microclimate of the cliffs above the cores. In this way it was hoped to learn something of the order of magnitude and frequency of talus forming activity in the valley. Movement pins on the talus surface, precise surveys of the slopes, painted markers, and tarpaulin and rope traps at the tops of the taluses were all used to attempt to assess the extent of activity. Records were kept of observed rockfalls. Successful measurements were made by all these techniques. Microclimate was studied by means of thermographs, maximum-minimum thermometer installations, and a sunshine recorder placed at various points on the cliffs. Though one season's observations cannot hope to index the rate of development of the cores, something has been learned of the relative order of activity on them. This work will provide interesting data on one of the sources of sedimentary material for the outwash plain.

Further Stages of the Project

Further work on the Ekalugad sandur will include analysis from aerial photographs of the river channel patterns, particularly a study of their evaluation over a period of years. Also, map and photo studies will be made of a number of sandur deposit areas along the east coast of Baffin Island, in order to determine more generally the characteristics of the recent fluvial deposits in this environment.

The deposition of coarse, fluvial materials is a major factor in landscape development in Arctic environments. For the results of the present study to be usefully incorporated into general knowledge of erosion and sedimentation in the Arctic, the relative degree of activity of the Ekalugad sandur must be assessed. Reconnaissance studies carried out elsewhere (Lewis River, Tingin Fiord, "South Nudlung" Valley in Baffin Island, and on Banks Island, N.W.T.) suggest that this is a moderately active surface - probably representative of such areas at the present day, though considerably more active than most other outwash areas along the Home Bay coast.

Material collected at Ekalugad Fiord, and earlier at Lewis River in central Baffin Island,[3] provides the basis for a general analysis of proglacial outwash surfaces. The problems of alluvial deposition and channel braiding that are central to such a study are of general fluvial geomorphology. The particular relevance here is to determine why the conditions leading to such landscape features are so prevalent in proglacial situations. In fact, there are great similarities between glacial meltwater streams or streams in extreme nival environments and rivers in arid environments. Both exhibit great and rapid variations in discharge and carry heavy sediment loads. Areas of rapid sedimentation and channel braiding are common elements for both. Therefore, this study will have wider reference

[3] cf "Lewis River Studies: 1965 Season. Preliminary Report" in "Field Report North-Central Baffin Island, 1965". Geographical Branch File Report, 1966.

to problems of riverine morphology and stream processes. This has recently been an intensively studied field and a great deal of comparative data exists upon which to draw in helping to formulate the conclusions of this study.

This study will be presented in the Department of Geography at the University of British Columbia for the Ph.D. degree by the writer.

APPENDIX I

Weather

(a) Work Conditions

Working conditions were very poor at Ekalugad Fiord during the 1967 season, even granted the higher humidity and more generally cloudy conditions that can be expected along the Home Bay coast than in most other sectors of the field region. Snow remained on the ground until virtually the end of June, and there was almost no run-off. Consequently the establishment of camps and construction of equipment was all that could be accomplished, and beyond regular meteorological observations almost no scientific results were realized during the month. It was necessary to install stream gauges and carry on discharge measurements during early July, when in a normal season most of the work would have been accomplished in June.

During July the weather was much improved, yet the juxtaposition of rapid snowmelt and heavy storms in the early and middle part of the month meant that most of the season's run-off occurred during the first three weeks. This rather contracted run-off period was insufficient to accomplish all the observations of streamflow and sediment transport that had been planned. Normal seasonal peak run-off in early and middle August, which comes from the melt on the upland snowfields during this period, did not appear this year. August was cold and wet, and freezing temperatures prevailed on the uplands for much of the month. The persistently wet conditions made it difficult to carry out even the program of morphological studies in the valley.

Snow reappeared to stay soon after the beginning of September, so that after September no scientific work could be done.

The following table of workable days represents all days on which it was feasible to carry on outside work. The results may be somewhat misleading unless it is realized that even on days when it is possible to be out, wind often restricts the tasks that can be accomplished, and wind-chill may greatly reduce work efficiency in many jobs. Winds averaged higher than 15 km hr^{-1} in June, August and September (10 days), and this, coupled with prevailing humidities of greater than 80% in all months, often made tasks very difficult.

Table of Working Days at Ekalugad Fiord
Summer Season: 1967

	May	June	July	August	September	Season
			Number of Days			
Workable	3	18	27	25	7	80
Unworkable		12	4	6	5	27
Total	3	30	31	31	12	107
			Percentage of Days			
Workable		60	87	81		75
Unworkable		40	13	19		25

(b) <u>Ice Conditions</u>

Material was hauled on the fiord by skidoo until June 9, when the development of slush and shore cracks ended skidoo operations here. It was possible to use the skidoo upvalley until about June 15, when bare patches of ground began to grow very large.

It was still easy to walk on the fiord ice on June 30, but after the rivers began to flow in early July, the bay ice began to break up rapidly around the river mouths. By July 8, kayak travel was easy on the bay along the edge of the sandur. From this time the ice broke up and drifted out steadily until the bay was clear of ice on July 17. Outside Venturi Bay, ice cover on the fiord was still about 85% at this date. The fiord ice shifted in and out with the wind for about a week after this.

In September the bay began to freeze on still nights after September 6.

ABSTRACT OF WEATHER: EKALUGAD FIORD STATION
SUMMER - 1967

Date	Temperature (°C) Max.	Min.	Mean	Ppt. (mm)	Relative Humidity 0700	1900	Mean Wind (km/hr) To 0700	To 1900	Cloud (10) 0700	1900
JUNE										
4	1.5	-1.0	0.3	0.5	95	82	7.49	16.06	10	10
5	1.0	-1.0	0.1	T	100	95	11.18	20.83	10	10
6	0.5	-1.5	-0.4	0.5	65	73	32.20	22.83	10	10
7	1.5	-0.5	0.2	T	95	65	8.18	21.10	10	10
8	2.5	-1.0	1.0	0.3	73	78	26.19	17.46	8	8
9	6.5	-3.5	1.8		80	70	4.51	15.01	7	10
10	2.0	-1.0	1.1	T	82	78	17.37	17.58	> 9	10
11	1.5	-2.5	0.4	T	67	77	13.79	17.85	> 9	10
12	3.5	0.0	1.2	0.2	73	77	15.85	27.36	3	> 9
13	2.0	-1.5	1.2	1.0	71	82	20.33	10.11	9	10
14	5.5	2.0	3.5	0.3	75	68	18.29	19.49	> 9	7
15	2.5	-0.5	0.9	T	78	86	14.33	21.74	10	10
16	1.5	-1.5	0.2	T	82	76	25.04	34.74	> 9	9
17	1.0	-2.5	-0.9		89	95	24.20	24.15	10	10
18	4.0	-1.5	0.8		95	82	11.35	9.06	10	9
19	9.0	-0.5	4.1		87	84	6.13	12.91	8	8
20	4.5	1.5	3.4	03	87	75	22.17	25.96	7	10
21	6.0	0.5	3.4	8.1	79	92	18.46	16.33	10	10
22	0.0	-1.0	-0.4	20.1	100	98	19.20	22.13	10	10
23	3.0	0.0	1.6	3.3	92	82	32.51	25.18	10	10
24	4.0	0.0	2.0	0.5	87	86	18.24	15.80	10	10
25	3.5	0.0	1.4	T	77	92	8.42	9.69	10	10
26	4.5	0.0	2.2	T	92	87	11.66	10.20	10	> 9
27	5.5	0.0	2.3	1.1	100	87	11.07	13.80	10	10
28	0.5	-1.5	-0.2	7.1	94	95	26.20	28.91	10	10
29	5.0	0.0	2.2		86	80	11.71	8.04	10	9
30	9.5	1.0	4.9	T	96.5	80	11.11	5.33	9	5
Mean/ Total	3.4	-0.5	1.4	43.3	83.7		17.40		9.26	

T = trace

ABSTRACT OF WEATHER: EKALUGAD FIORD STATION
SUMMER - 1967

Date	Temperature (°C) Max.	Min.	Mean	Ppt. (mm)	Relative Humidity 0700	1900	Mean Wind (km/hr) To 0700	To 1900	Cloud (10) 0700	1900
JULY										
1	11.0	0.0	4.8		95	70	7.43	8.13	10	<1
2	11.0	2.5	7.4		72	78	21.93	23.77	> 9	2
3	11.0	3.5	6.3		82	59	6.90	14.99	< 1	4
4	12.0	5.5	8.6		69	70	18.63	27.58	8	1
5	14.0	4.5	10.4		73	76	7.81	20.11	0	0
6	14.0	6.0	10.2	T	72	88	12.43	14.53	9	10
7	13.5	5.5	9.4	0.7	83	69	8.62	12.34	10	3
8	16.5	4.0	10.2		81	64	2.66	5.13	6	0
9	8.5	2.0	4.7	T	93	96	4.68	10.58	10	8
10	8.0	3.0	4.8		88	82	4.38	12.02	> 9	> 9
11	7.0	1.5	3.5	T	N.O.	95		9.24*	N.O.	10
12	6.0	-1.0	2.5		91.5	91	4.73	13.24	1	1
13	13.5	-0.5	7.6	0.6	76	96	4.06	12.58	> 9	10
14	9.0	4.0	7.2	26.2	93	85	6.59	7.15	10	10
15	9.5	4.0	7.4	0.4	93	88	9.57	7.73	10	10
16	8.5	3.0	6.4	2.3	92	76	4.72	7.07	10	9
17	9.0	3.0	6.7	2.7	78	69	10.42	9.66	8	10
18	6.0	1.5	3.1	19.3	96	91	22.52	23.32	10	10
19	6.0	1.5	3.8	2.5	100	84	6.77	16.94	10	7
20	8.0	2.0	5.3	0.1	84	81	7.74	15.66	10	1
21	10.0	1.0	5.7		84	78	4.54	11.53	< 1	7
22	11.5	3.5	8.1		82	64	2.80	11.69	6	0
23	18.5	6.5	13.2		67	58	3.28	14.28	0	2
24	19.0	11.5	15.1		74	68	28.39	20.15	> 9	8
25	21.0	11.0	14.6		81	58	14.52	18.53	> 9	5
26	18.0	7.5	11.6		84	82	4.23	9.44	4	<1
27	12.0	6.5	8.8		83	67	2.48	15.04	< 1	<1
28	13.5	4.5	8.9		70	65	3.59	16.47	0	<1
29	10.0	4.0	6.9		76	89	2.19	18.44	1	1
30	8.0	3.5	5.5		88	84	12.68	22.63	10	10
31	8.5	4.0	5.9		93	89	21.71	24.34	10	7
Mean/ Total	11.4	3.8	7.6	54.2	80.39		11.88		5.87	

T = trace

*24 hrs.

ABSTRACT OF WEATHER: EKALUGAD FIORD STATION
SUMMER - 1967

Date	Temperature (°C) Max.	Min.	Mean	Ppt. (mm)	Relative Humidity 0700	1900	Mean Wind (km/hr) To 0700	To 1900	Cloud (10) 0700	1900
AUGUST										
1	8.5	4.0	5.8		85	77.5	15.48	24.27	10	5
2	6.5	4.5	5.1	T	83	94	16.67	23.19	10	10
3	8.0	5.5	5.9	0.1	93	93	10.36	18.45	> 9	10
4	8.0	4.5	6.0	0.3	92	85	14.44	22.62	10	6
5	7.0	4.5	5.1	0.2	82	88	10.24	19.63	1	10
6	4.5	4.0	4.2	2.5	95	100	21.71	13.55	10	10
7	7.0	4.5	5.9	1.1	96	93	6.68	9.80	10	10
8	11.5	5.0	8.4	4.3	83	73	5.35	13.18	> 9	7
9	12.0	5.5	8.7	0.4	74	84	10.50	9.92	10	10
10	9.5	6.0	7.4	18.0	84	93	10.53	16.04	10	10
11	11.5	4.5	6.1	1.8	85	96	5.00	4.93	9	10
12	9.5	4.0	6.8	0.3	93	79	25.39	16.59	> 9	> 9
13	5.5	4.5	4.8	8.6	96	96	21.79	26.23	10	10
14	8.0	5.0	5.1	16.8	96	82	18.83	13.56	10	10
15	6.0	3.5	4.2	16.3	75	92	9.76	21.55	> 9	10
16	6.5	3.0	5.0	11.4	96	81	21.63	11.35	10	> 9
17	6.5	2.0	4.2	0.5	81	96	16.34	13.98	9	10
18	6.0	2.0	4.0	0.8	95	84	7.93	9.54	10	> 9
19	4.0	2.5	3.9	0.3	92	96	15.16	16.94	10	8
20	11.5	1.5	7.4	T	88	64	5.39	23.53	9	10
21	9.0	5.0	6.8	T	82	75	22.38	14.21	10	10
22	5.5	3.5	4.6	2.5	88	92	11.48	9.64	10	> 9
23	5.0	3.0	3.7		87	88	9.34	13.88	10	10
24	3.5	2.0	2.9	29.5	95	92	20.24	25.92	10	10
25	6.0	2.0	4.1	7.4	100	90	17.78	2.33	10	10
26	6.5	3.0	4.7	0.3	78	76	23.63	35.16	10	8
27	4.5	3.0	4.1		61	88	27.13	19.75	9	10
28	12.5	2.0	6.8		76	68	10.31	16.68	< 1	2
29	7.0	2.0	4.5		88	100	2.52	12.39	6	10
30	7.0	2.0	5.2	T	78	92	9.33	14.19	> 9	10
31	8.5	1.0	4.1	1.2	84	71	4.82	25.93	1	10
Mean/ Total	7.50	3.52	5.34	124.6	86.44		15.27		8.97	

T = trace

ABSTRACT OF WEATHER: EKALUGARD FIORD STATION
SUMMER - 1967

Date	Temperature (°C) Max.	Min.	Mean	Ppt. (mm)	Relative Humidity 0700	1900	Mean Wind (km/hr) To 0700	To 1900	Cloud (10) 0700	1900
SEPTEMBER										
1	4.5	-1.0	0.8	0.5	94	71	32.53	36.47	> 9	10
2	4.0	0.0	1.5	T	74	78	33.54	32.28	> 9	7
3	2.5	-1.0	1.1	1.7	82	86	27.63	10.00	10	10
4	8.0	0.5	5.0	19.6	89	81	19.55	24.72	10	6
5	1.5	-1.0	0.2	1.8	100	94	15.04	20.52	10	7
6	3.5	-3.0	-0.1		70	85	2.49	8.68	1	2
7	0.5	-3.5	-1.4	3.2	85	99	2.67	10.70	10	10
8	1.0	-2.5	-0.5	2.2	95	61	9.71	14.44	10	10
9	-1.5	-6.0	-3.4	T	70	80	9.88	20.80	7	8
10	-1.0	-3.5	-2.4	0.5	86	79	19.52	9.68	10	10
Mean/ Total	2.30	-2.10	0.08	29.5	82.95		18.04		8.35	
Season Mean/ Totals	7.07	1.96	4.44	251.6	83.46		15.07		8.03	

T = trace

GLACIOLOGICAL MEASUREMENTS OF DECADE GLACIER 1967

A. D. Stanley and D. Hodgson

INTRODUCTION

To investigate the mass balance of a representative glacier in a mountainous area of the Arctic, glaciological measurements have been made of Decade Glacier on the east coast of Baffin Island. The program was started in 1965 and now constitutes part of a continuing I.H.D. project. In 1966, the mass balance was obtained by K. Simpson of the Inland Waters Branch who measured the accumulation in late May and remained at the glacier throughout the summer to obtain ablation measurements and meteorological observations. However, the field party left the glacier on August 26 before the end of the ablation period.

In 1967, glaciological investigations were restricted to measurements of the winter accumulation in late June and a series of profile surveys later in the summer.

LOCATION AND ACCESS

Decade Glacier (lat. 69°38'N, long. 69°48'W) is on the southwest flank of the mountain range along the northeast coast of Baffin Island. From the accumulation zone at an elevation of 1,450 metres the glacier extends northwestward for 6 km to a terminus at 400 metres. The glacier is about 80 km due east of the Barnes Ice Cap and 120 km northeast of Fox 3, a DEW Line Station more than 450 km north of Frobisher Bay.

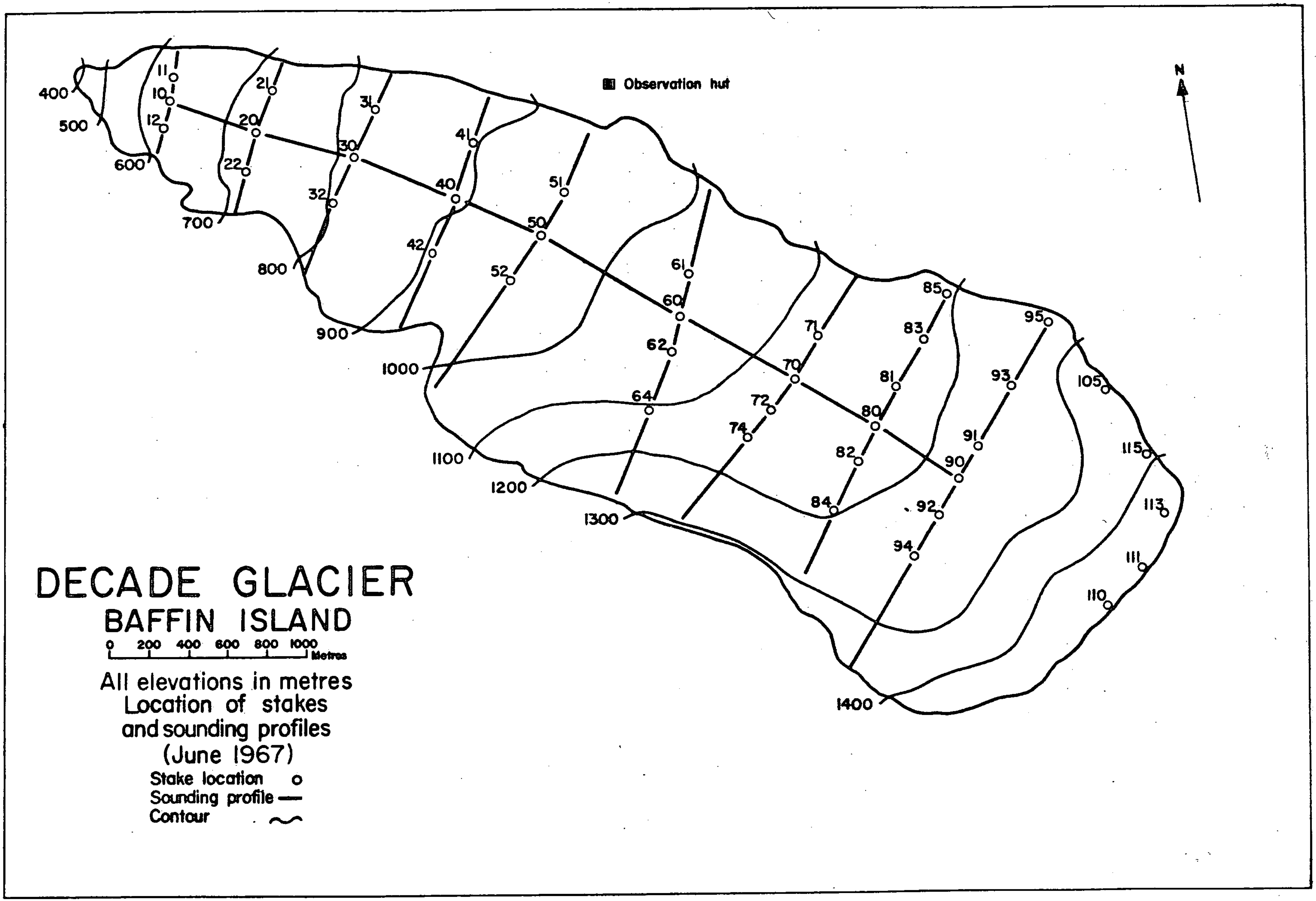

Figure 8 *Stakes and sounding lines on Decade Glacier*

The glacier is on the southeast side of Inugsuin Fiord near the base camp at the head of the fiord. From the base camp the glacier is accessible directly by land or by boat across the fiord and then by foot. The route crosses tundra for 4 to 5 km and then up steep rock walls to an A-frame hut that has been erected near a lateral moraine on the northeast side of the glacier at an elevation of 950 metres.

FIELD PROGRAM 1967

In 1967 accumulation measurements were made in late June after the snow had started to melt. Between June 29 and July 2, D. Hodgson and two assistants of the Geographical Branch were stationed at the glacier to measure the accumulation and obtain data to determine the total ablation for 1966. The depth of snow was measured at 39 stakes and 197 soundings taken at 50 metre intervals along transverse lines and a profile down the length of the glacier. The location of stakes and sounding profiles is shown in Figure 7. Eighteen sets of measurements obtained from 9 pits dug along the centre line of the glacier gave density values ranging from .27 to .43 g. cm^{-3} with an average of .35 g. cm^{-3}. Accumulation observations were plotted and contoured to give the accumulation map shown in Figure 7 .

RESULTS OF FIELD WORK

Mass Balance for 1966

Readings and snow depths at each of 39 stakes were used to determine the position of the 1966 summer surface. These measurements show that after

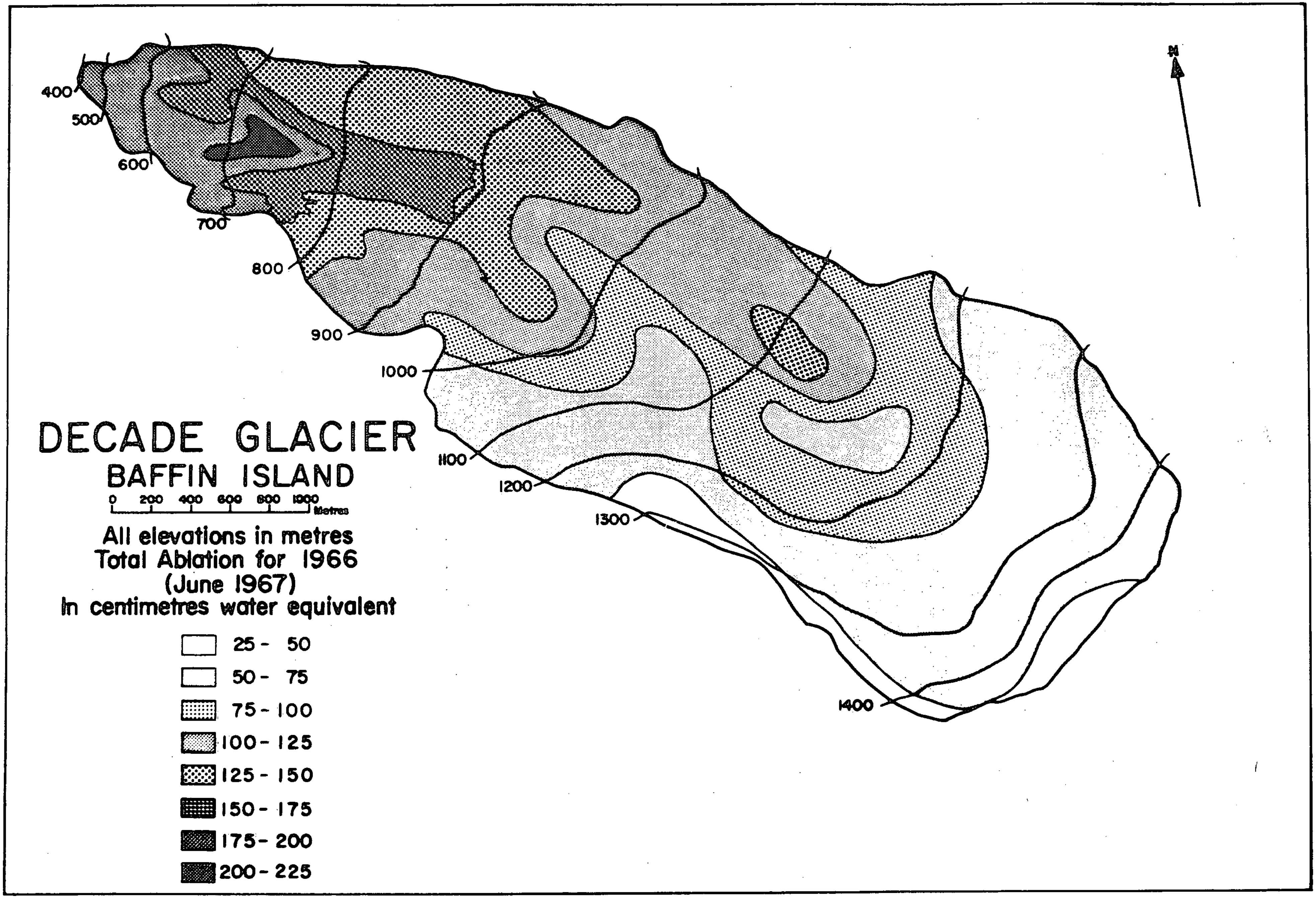

Figure 9 *Decade Glacier - 1966 summer balance*

the field party left the glacier on August 25, 1966, there was an additional 10% melt before the end of the ablation period.

The work of Simpson (see 1966 Field Report) showed that the accumulation as measured on June 28, 1966 was 2.27×10^6 cu. m. which represents a mean specific accumulation of 26 cm of water equivalent over the 8.7 km surface area of the glacier. From the beginning of the melt period to August 25, stake measurements showed that 7.53×10^6 cu. m. of water equivalent had been melted from the glacier. This represents a specific ablation of 87 cm water equivalent. The highest ablation (184 cm) was recorded near the snout and the lowest, less than 40 cm in the highest part of the accumulation area.

When the 1966 field party left the glacier in late August all the snow had melted and ablation continued to give a negative net balance. Measurements taken in June 1967 at 39 stakes indicate that during the summer total ablation was 8.4×10^6 m^3 - a specific value of 97 cm water equivalent over the glacier surface. For the period 1965-66 the glacier had a negative balance of 72 cm.

Accumulation Measurements 1966-67

The total winter accumulation to July 2, 1967 was 2.24×10^6 m^3. This represents a specific accumulation of 26 cm water equivalent over the 8.7 km^2 glacier surface. Measurements at 39 stakes and 197 soundings taken along the same profiles measured in 1966 gave snow depth ranging from 30 to more than 200 cm. The greatest depths occur near the snout on the northeast side and on the southwestern part of the glacier at higher elevations.

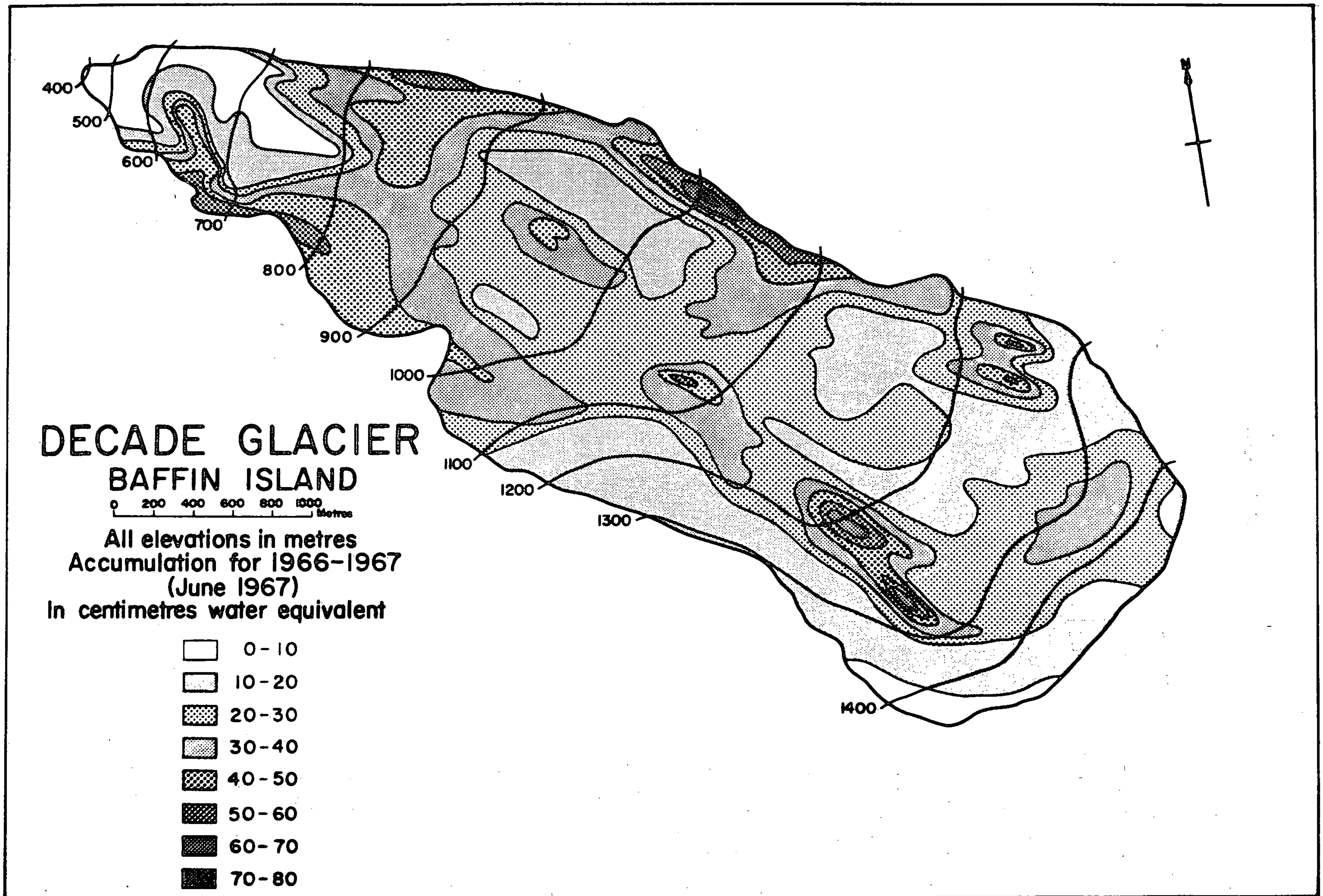

Figure 10 *Decade Glacier - 1966-67 winter balance*

CONCLUSIONS

Measurements taken at the end of the accumulation period in 1967 show that the 1965-66 budget year was negative with a specific net balance of 73 cm of water equivalent.

The accumulation for the winter of 1966-67 had a mean specific value of 26 cm of water equivalent and the distribution of snow was similar to that of previous years. When the field party left the area in late August all the snow had melted from the glacier and the net balance was negative.

DISCHARGE MEASUREMENTS OF THE DECADE AND INUGSUIN RIVERS - 1967

A. D. Stanley and J. Land

FIELD PROGRAM - 1967

The program for 1967 was to continue the collection of meteorological data and to determine the discharge for the Decade and Inugsuin Rivers. Discharge measurements for the Decade River were first obtained in 1965 and were continued in 1966 when the present rating curves for the Decade and the Inugsuin Rivers were established. All hydrological observations in 1967 were made by J. Land between June 18 and August 22. A Stevenson screen with a thermohygrograph was installed near the Decade River gauging site and the record was supplemented with continuous meteorological records at base camp. Figure 11 shows the daily discharge.

WORK ACCOMPLISHED

Decade River - All hydrologic measurements in 1967 were made at the gauging site selected in 1965, some 2.5 km downstream from the glacier at an elevation of 80 meters a.s.l. A standard met. screen was erected at the site and an OTT automatic stream gauge was installed in the river and recorded the stage continuously from June 23 until August 22. The stage readings were used to calculate the discharge based on the rating curve established by W. Rannie in 1966. This rating curve was checked during the course of the summer with five salt tests, and there appears to be no significant change in the stream channel from the previous year.

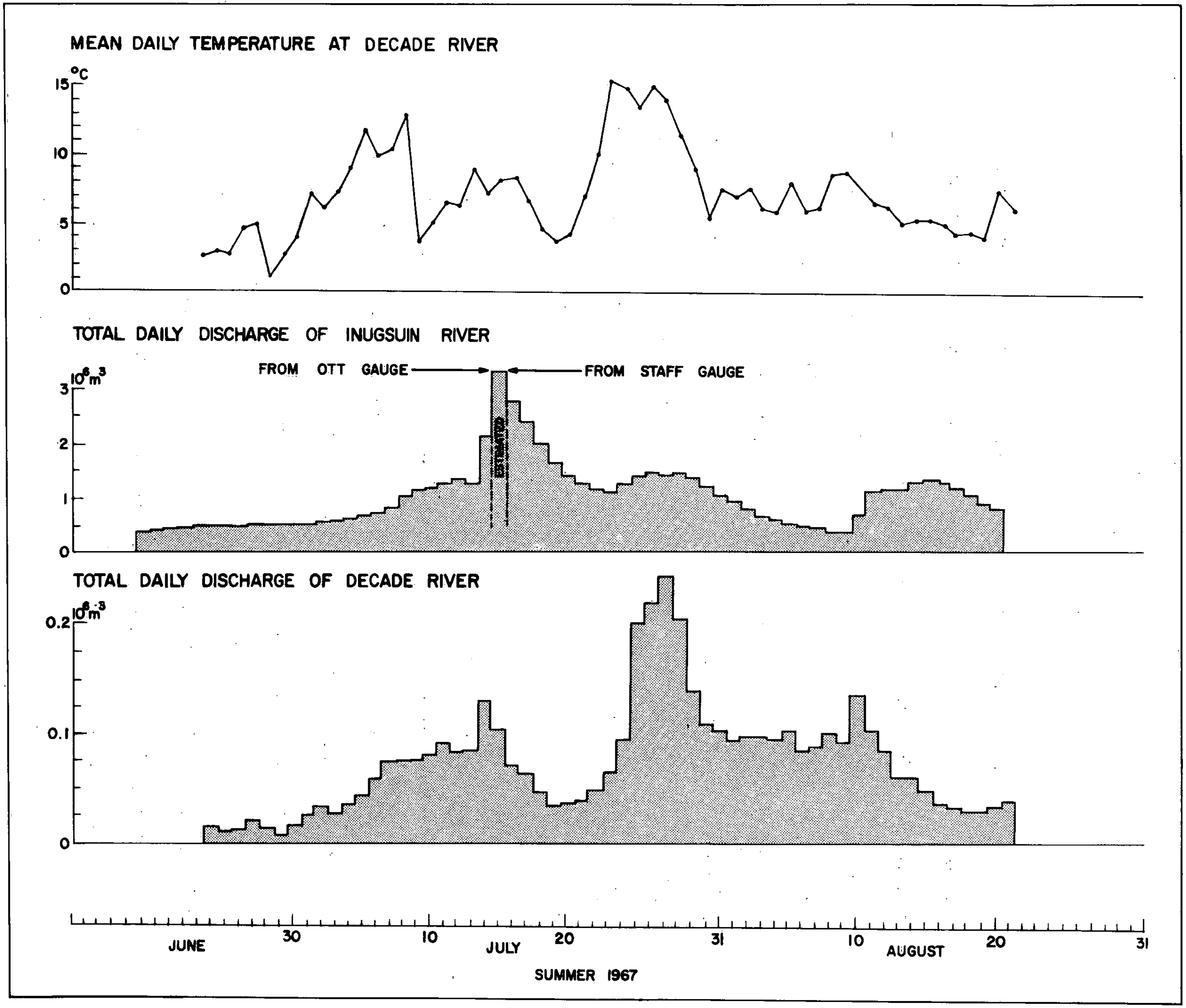

Figure 11 *Mean daily temperature at Decade River camp. Daily discharge of Inugsuin and Decade Rivers*

Inugsuin River - In 1965 a staff gauge was placed in the Inugsuin River close to the base camp but later a continuous recorder was installed at the outlet of Kudloo Lake. In 1967, this recorder was reinstalled following the instructions of W. Rannie. The stage was measured automatically by an OTT recorder from June 19 until July 15 when the recorder was swept away by a flood. From July 16 until August 20 the discharge was obtained using a staff gauge located near the base camp where the river has a well-defined bank and the flow is confined to areas of bedrock. Readings were taken every three hours but one was omitted during the night.

To obtain further information of the hydrology of the Inugsuin River basin, the water levels of the four large lakes were measured at the beginning and at the end of the field season.

RESULTS OF 1967 FIELD PROGRAM

Decade River - Between June 24 and August 21, 1967, the total discharge of Decade River was 4.43 million m^3. In late June when the OTT gauge was installed the discharge was approximately 10,000 m^3 per day but it rose to more than 30,000 m^3 per day by early July and remained above that level for the rest of the observation period. There were three periods with daily discharge of more than 120,000 m^3. Two of these can be attributed to heavy rainfall but the highest discharge occurred between July 25 and 28 with cloudless sky and high temperatures when most of the snow cover had melted from the glacier's surface. From the early part of August the weather became gradually cooler and the daily discharge fell progressively to 41,500 m^3 on the last day records were available (August 21). When the party left the field, the temperature at the gauging site was still well above freezing.

Inugsuin River - During the period of observations from June 19 to August 20, the total streamflow was 64.6 million m^3. This run-off is equivalent to an average of 52 cm of water distributed evenly over the 125 km^2 of the Inugsuin River Basin. The measured precipitation at the base camp for the period of observation was 10 cm of water.

Only 3% of the Inugsuin River drainage basin is covered by glaciers and snowfields, consequently peak discharges are less influenced by temperature conditions. Daily fluctuations are less noticeable and a peak in July was related to a rainstorm when more than 39 mm of rain fell at base camp.

To determine storage changes in the Inugsuin River basin, the levels of the four large lakes were measured at various times in 1965 and 1966. These measurements were repeated in 1967, at the start of the field season on June 19 and again on August 22 before the field program was terminated. The levels of the lakes are shown below in comparison with results obtained in the final measurements in 1966 and 1965.

WATER LEVELS OF LAKES IN THE
INUGSUIN RIVER DRAINAGE BASIN 1967
(Given in centimeters below a benchmark near the shore of each lake.)

		1967		1966	1965	
		June 19	Aug. 22	Aug. 19	May 21	Aug. 9
Kudloo Lake	(c. 2.7 km^2)	132	98	160	202	173
Kyak Lake	(c. 3.5 km^2)	145	115	114	193	164
Koonooloosee Lake	(c. 5.0 km^2)	240	215	207	254	229
Koonooloosee Lake	(c. 4.9 km^2)		573	555	600	551

INUGSUIN RIVER - 1967
DISCHARGE IN CUBIC METERS

Date	June	July	August
1		517,000	943,000
2		555,000	815,000
3		598,000	685,000
4		625,000	600,000
5		662,000	534,000
6		725,000	484,000
7		823,000	449,000
8		1,039,000	416,000
9		1,164,000	408,000
10		1,193,000	679,000
11		1,251,000	1,130,000
12		1,310,000	1,158,000
13		1,261,000	1,160,000
14		2,124,000	1,285,000
15		3,316,000	1,344,000
16		2,757,000	1,275,000
17		2,400,000	1,175,000
18		2,001,000	1,070,000
19	384,000	1,674,000	933,000
20	407,000	1,427,000	810,000
21	435,000	1,298,000	
22	461,000	1,165,000	
23	470,000	1,142,000	
24	482,000	1,229,000	
25	484,000	1,415,000	
26	484,000	1,463,000	
27	490,000	1,437,000	
28	500,000	1,466,000	
29	500,000	1,352,000	
30	501,000	1,220,000	
31		1,058,000	
TOTAL	5,598,000	41,667,000	17,353,000

Total for period June 19 to August 20: 64,618,000

DECADE RIVER - 1967
DISCHARGE IN CUBIC METERS

Date	June	July	August
1		26,100	95,000
2		34,300	98,700
3		25,900	100,700
4		34,900	96,300
5		42,600	104,400
6		59,100	86,400
7		74,100	89,300
8		73,700	103,200
9		75,400	93,500
10		81,000	138,200
11		91,700	103,400
12		83,200	86,800
13		82,800	60,600
14		131,400	62,100
15		103,200	50,800
16		71,700	39,000
17		63,500	36,000
18		47,800	32,500
19		35,400	30,700
20		37,400	36,800
21		39,300	41,500
22		48,400	
23		66,600	
24	14,100	94,900	
25	10,300	201,500	
26	11,200	219,700	
27	20,800	244,100	
28	12,600	205,400	
29	7,000	140,000	
30	15,600	110,500	
31		105,600	
TOTAL	91,600	2,751,200	1,587,900

Total for period June 24 to August 21: 4,430,700

MASS BALANCE MEASUREMENTS - BARNES ICE CAP

O. H. Løken

Mass balance measurements were made in late May-early June on some 200 accumulation/ablation stakes along the A, C, D, E, G, H, I, J and K lines (Figure 12). The 10 stakes along the A line were all new while the others had been measured at least once before. The F line was not surveyed and none of the C stakes south of the G line were found.

Two parameters were determined during the spring survey.
1) The summer balance from last summer's season (1966) was determined by measuring the lowering of the ice (firn) surface from the preceding survey; from this the annual mass balance is calculated.
2) The winter balance from last winter was obtained by measuring snow depth and snow density.

<u>1965-1966 Mass Balance</u>

The mean monthly temperature at Dewar Lakes (central Baffin Island) was unusually high for August and September of 1966 and extensive melt resulted. The greatest mass loss was measured at the west end of the I line were a specific mass balance of -256 cm w.e. was measured at stake I-35. At H-30 a loss of 235 cm w.e. was recorded and losses in excess of 200 cm w.e. was found at two other stakes. Only <u>two</u> stakes showed a positive mass balance, one was near the top of the H line and the other at the top of the I line. The mass balance at these stakes was +1 and +25 cm respectively; only the latter can be considered significant in view of the errors involved in mass balance determinations.

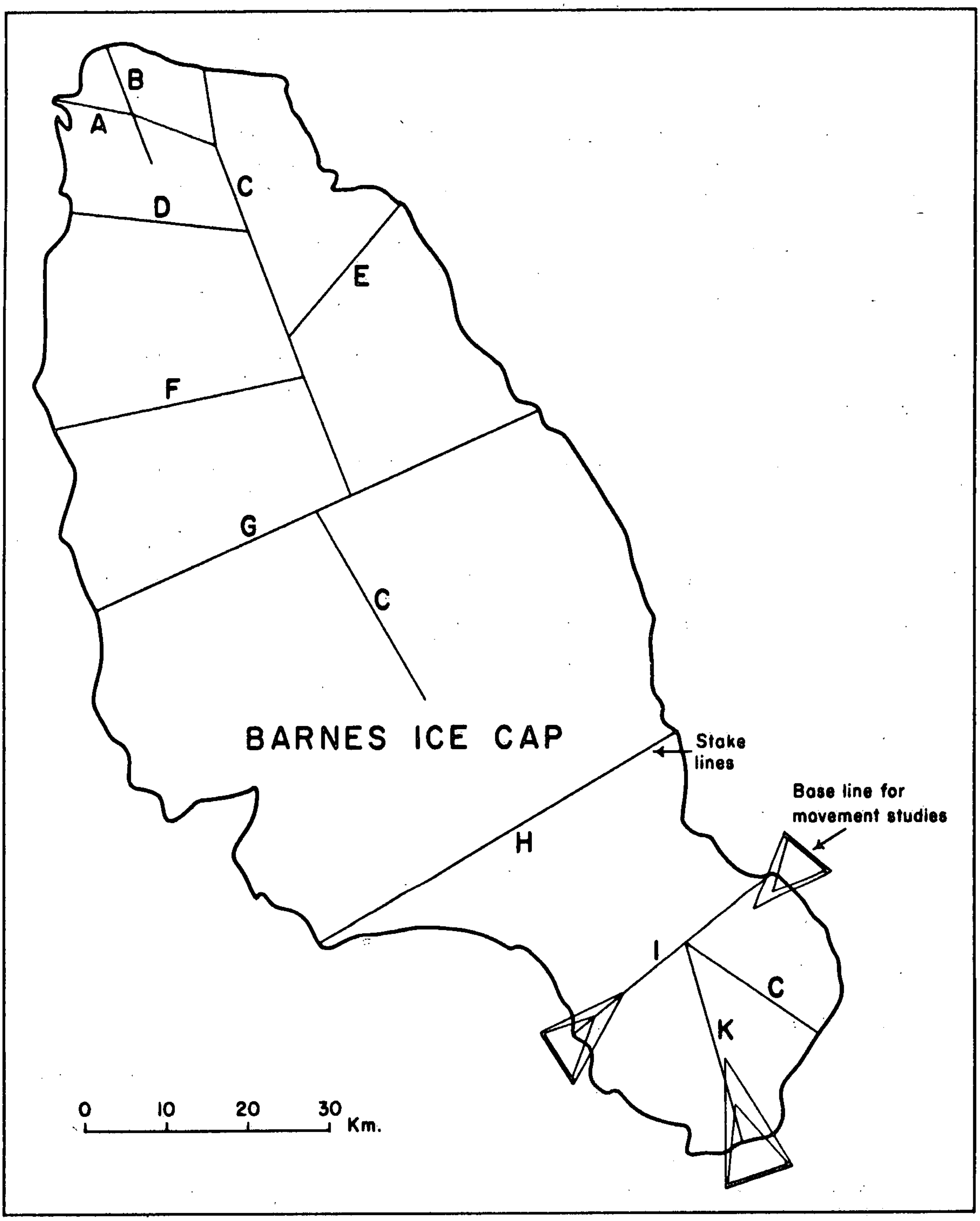

Figure 12 Stakelines on Barnes Ice Cap

As only two stakes showed positive mass balance, the equilibrium line was at or higher than the crest of the ice cap. The mean mass balance for the whole ice cap has been calculated at -93 cm w.e. for the year 1965-66.

The asymmetric distribution of the mass balance has been referred to in earlier Field Reports and was observed also this year. The NE-SW asymmetry was seen along all lines but was most pronounced along the I line. The mass balance became more negative towards the north although the loss at the south end is high due to the large surface areas at low altitude near the strongly curved part of the ice margin. The greater loss in the north is possibly explained by the thinner snow cover which leads to earlier exposure of low-albedo ice.

1966-1967 Winter Balance

Mean snow pack density was measured in snow pits at 33 stakes. Density values varied between .29 and .39 gr cm^{-3}; the mean of all readings was .35 gr cm^{-2}. The higher density values were most common on the south part of the ice cap, but there was no significant difference from the 1966 densities.

The maximum winter balance was measured at stake H-14 where 74 cm w.e. had accumulated since the end of the preceding ablation season. A maximum value of 64 cm w.e. was observed along the I line, near the crest of the ice cap. Along the G line the maximum value was 48 cm w.e. at a stake well to the west of the crest. Further north the winter balance decreased; typical values from the northern part was between 20 and 30 cm w.e. The larger winter balance on the northeast as compared with the southwest side was seen also this year, and was most significant at low altitudes. As in previous years, this asymmetry is most distinct on the southern part of the ice cap.

As indicated above, the larger winter balance on the southern as opposed to the northern part of the ice cap was present also this year. This N-S contrast was particularly strong in 1967, a fact which was related to 1) heavy snowfall in the south, and 2) to what appears to be a below average snowfall over the northern part of the ice cap.

RADIO-ECHO SOUNDINGS ON THE BARNES ICE CAP

J. Clough and O. H. Løken

During June 1967 electromagnetic soundings of ice depth on the Barnes Ice Cap were made. Figure 13 shows the tracks along which soundings were made.

The radio sounding equipment (SPRI-II) developed by Scott Polar Research Institute and manufactured by Randall Electronics was used. J. Clough operated the equipment which was borrowed from the University of Wisconsin. The SPRI-II consists of a 35 Mhz transmitter and a separate receiver. Both the transmitter and the receiver antennas were made of two parallel aluminum poles 4.25 m long (½ wave length). The reflected signal was displayed on a TEKTRONIX 321A oscilloscope, where the travel time of the reflected pulse was read off. One division on the display tube equalled 0.5 microsecond.

FIELD PROCEDURES

The transmitter and its antenna, powered by a 12-volt battery, were mounted across the seat of a skidoo (model Alpine). The receiver with antenna was mounted on a Nansen sled pulled 50 m behind the skidoo, in order to reduce transmitter noise. A shelter was built on the sled to protect the observer and to provide shadow for easy reading of the oscilloscope. The receiver and the oscilloscope were powered by a 12-volt car battery mounted on the sled.

Distances between individual depth measurements varied between ¼ and 1 km depending on the local variation of surface slope and the under-

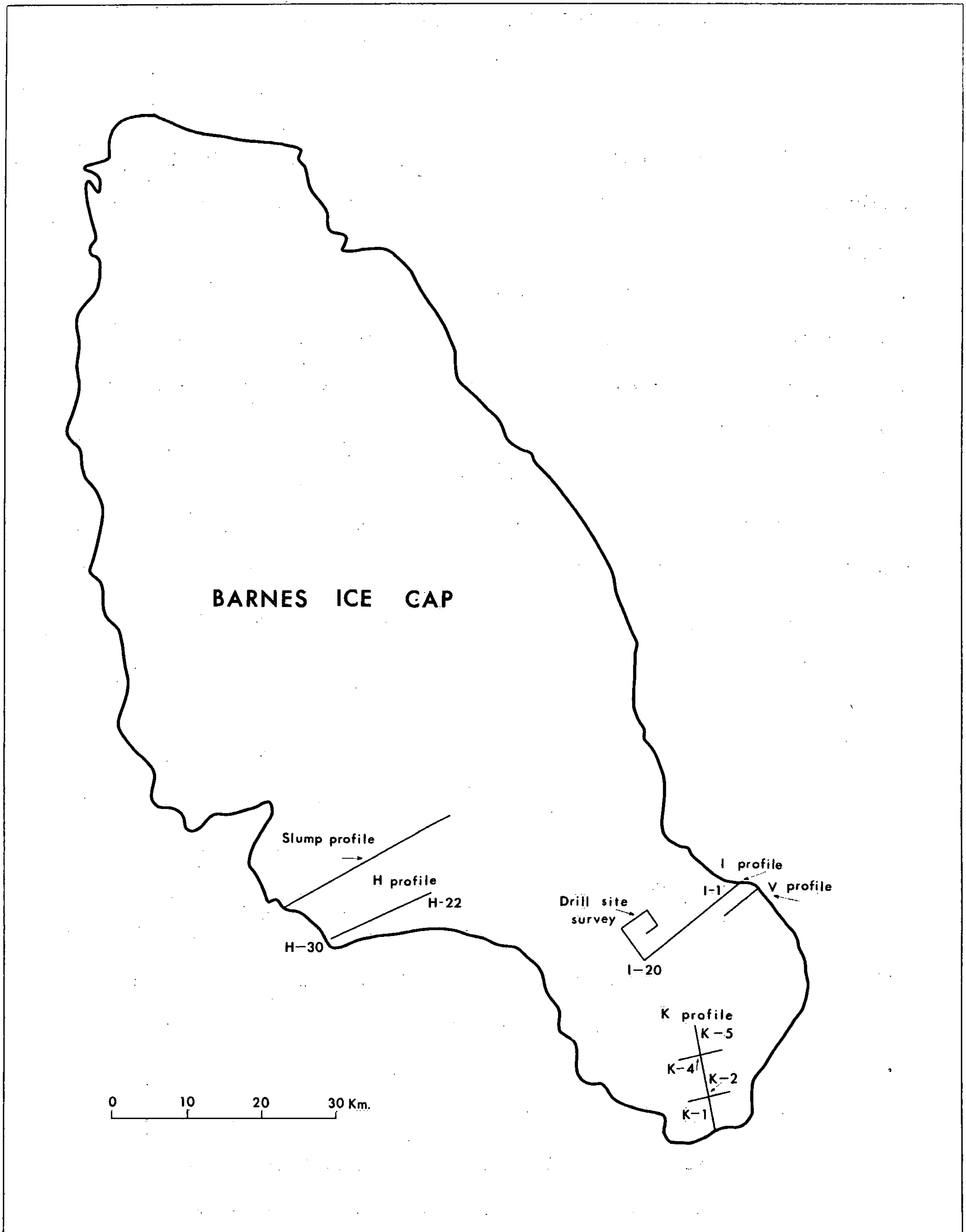

Figure 13 Sounding tracks on Barnes Ice Cap

lying bedrock topography. A simple bicycle odometer that could be read to the nearest 100 m and mounted behind the Nansen sled was used to measure distances. The odometer reading and the echo travel time were recorded at each location of ice depth determination.

The ice surface altitude was obtained from a Wallace and Tiernan altimeter at each spot reading and recorded with the other data. No temperature correction was applied to the altimeter readings in view of the small altitude differences.

During the depth survey the already established straight stake lines were followed and depth measurements were always made at each stake. Where no stake line existed, constant courses were maintained by a Brunton compass.

The survey team consisted of a minimum of three men: one to drive the skidoo, one to read the oscilloscope and the third to read the odometer. When we followed compass courses the operation could be accelerated by adding a fourth man on a separate skidoo to maintain correct course.

After overcoming initial difficulties in mounting and securing the equipment, the survey could be done at a good speed. With ice thickness measurements taken at 0.5 km intervals an average speed of 10-12 km/hr was easily maintained. The nature of the surface (i.e. slope, roughness and depth of loose snow) was the main limiting factor at greater speeds.

RESULTS

Velocity Determinations

The mean wave propagation velocity in the ice cap was determined in one locality by a wide-angle reflection experiment, and this value was

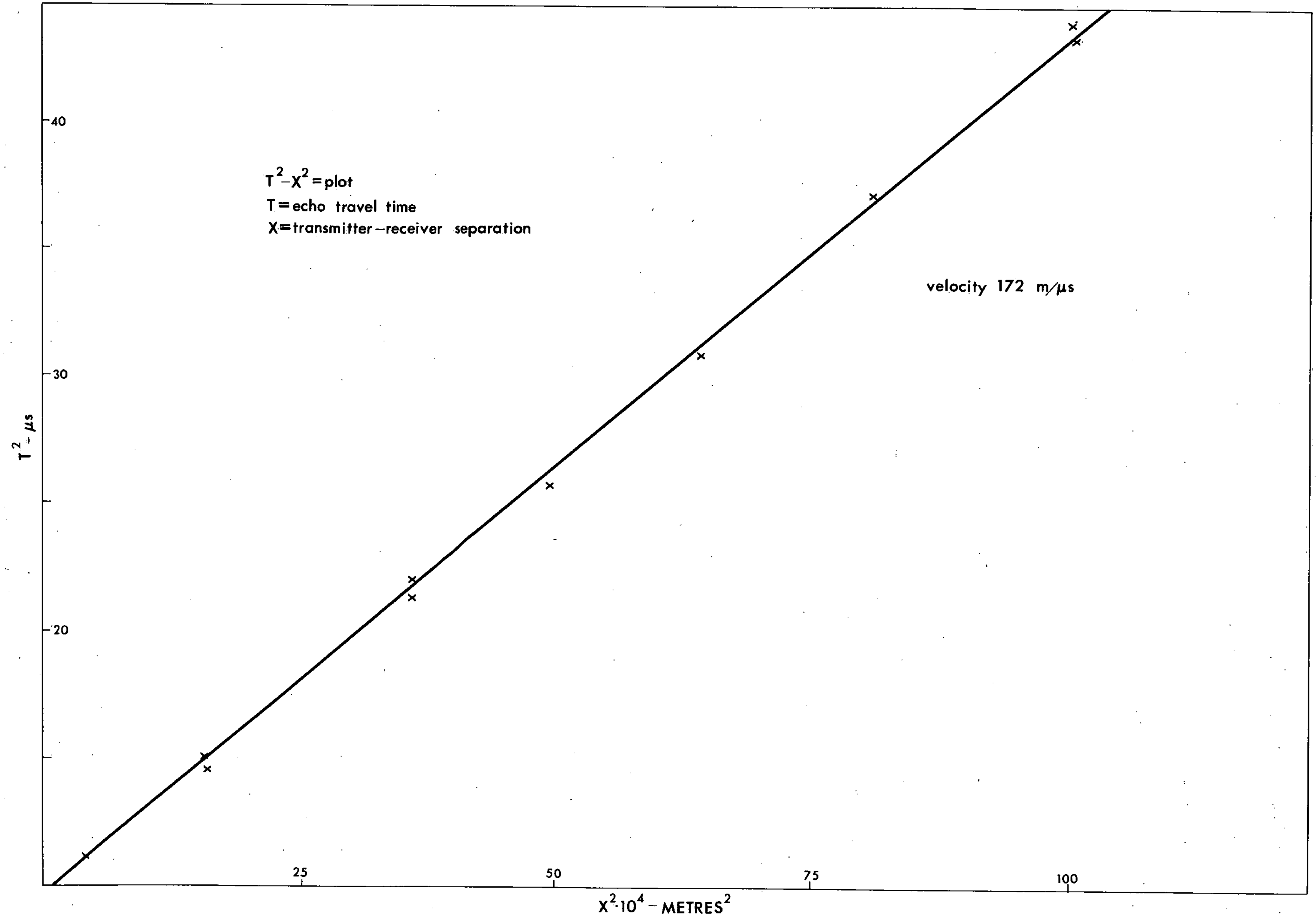

Figure 14 Barnes Ice Cap - Plot of echo travel time

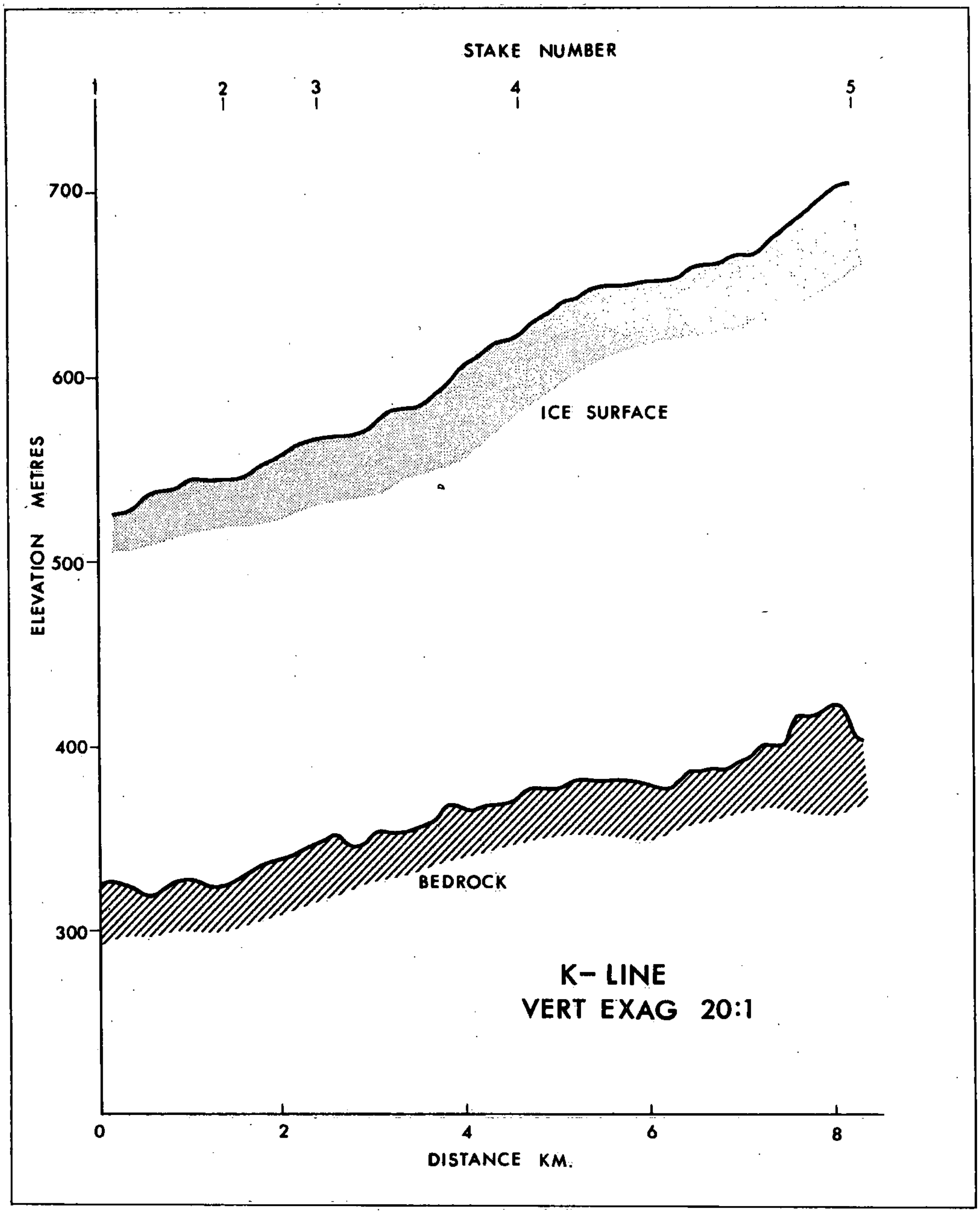

Figure 15 Barnes Ice Cap - Elevation of stakes - K line

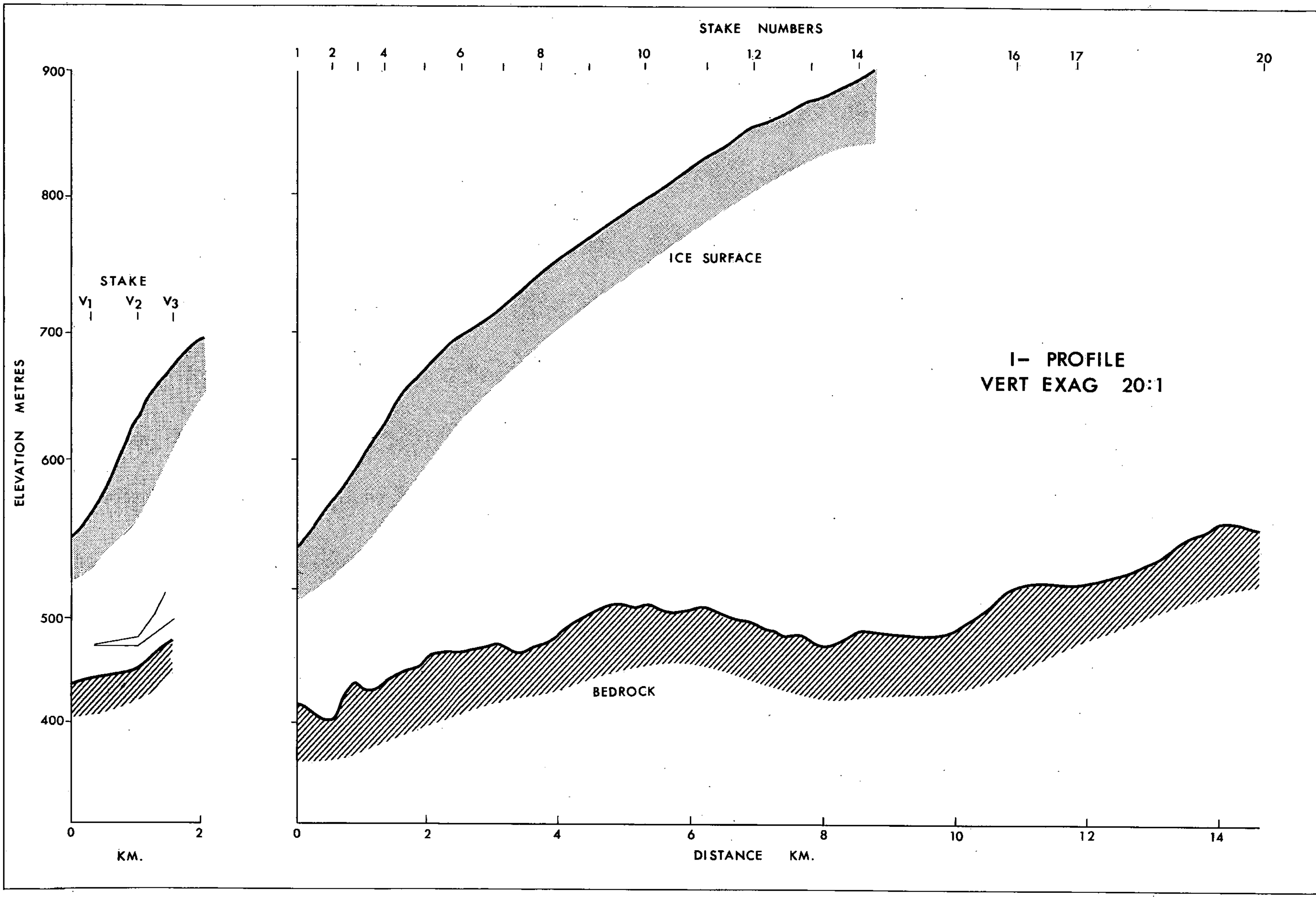

Figure 16 Barnes Ice Cap - Elevation of stakes - I profile

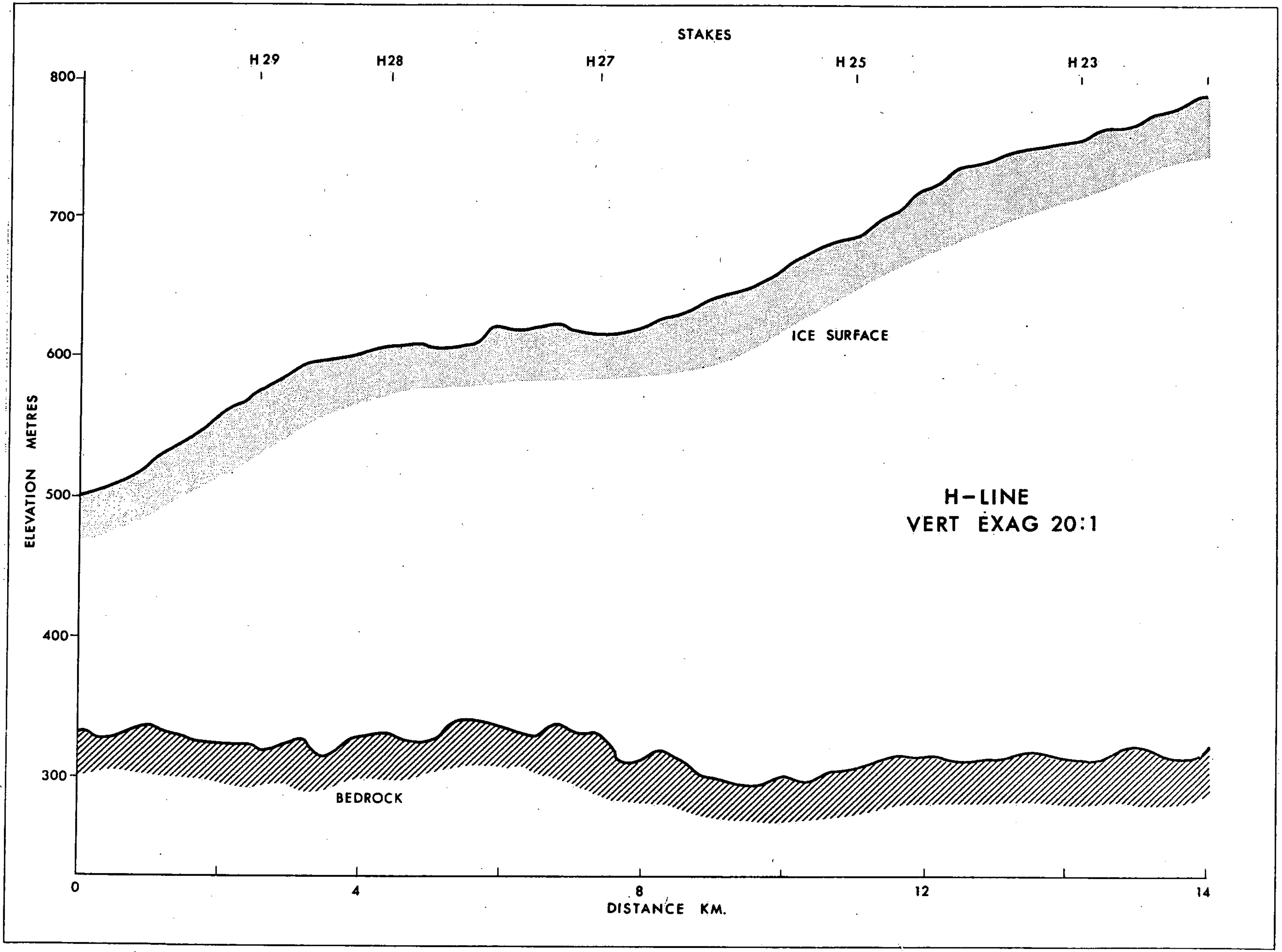

Figure 17 Barnes Ice Cap - Elevation of stakes - H line

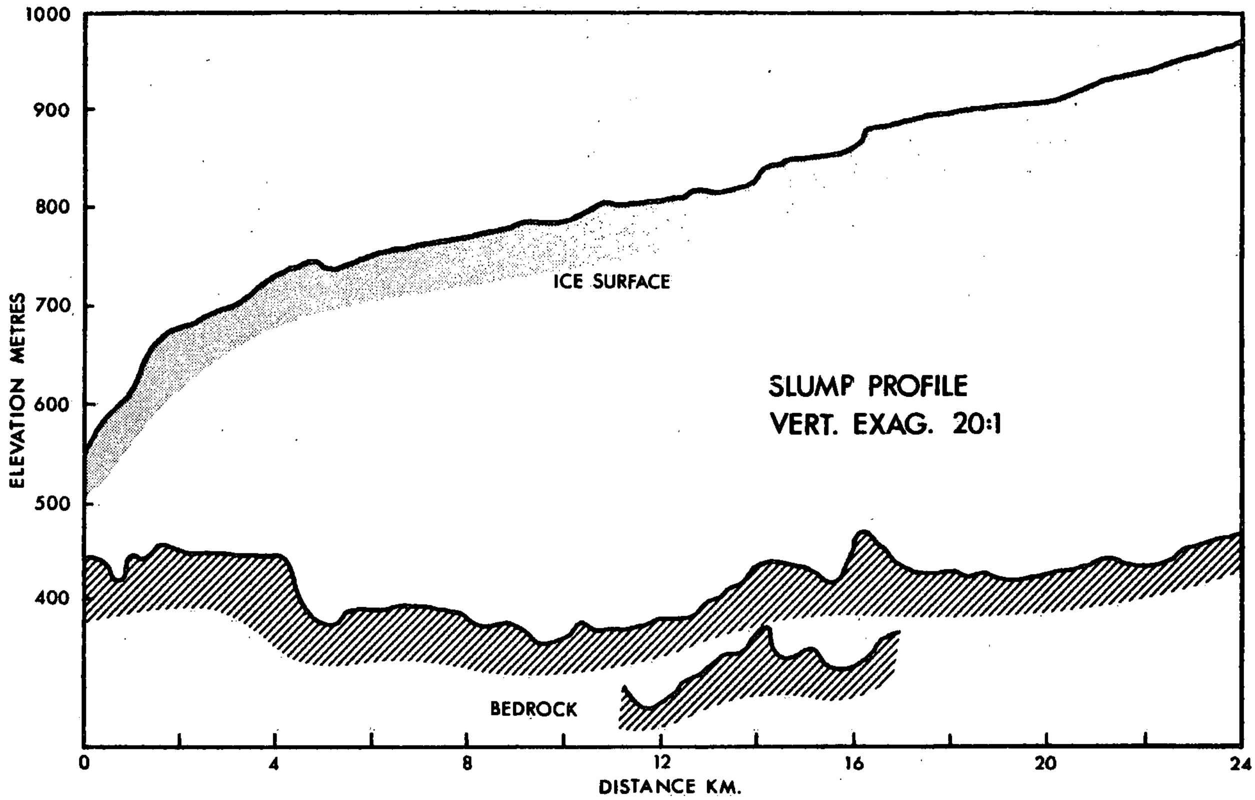

Figure 18 Slump profile

used to calculate all other ice depths. Echo travel times were measured for eight values of transmitter-receiver separation (x) and in Figure 14 x^2 has been plotted against the square of the travel time. The slope of the line gives the mean wave-propagation velocity at 172 m/microsec. The path of the reflected wave has not been corrected for refraction, but both antennas were close to the ice surface and the errors are believed to be small. Maximum error was estimated at ± 4 m/microsec.

Thickness Determinations

A distinct echo was obtained in all locations and in most cases only one echo appeared. Travel time of the echo was recorded in the field and later converted into ice thickness by multiplying with the mean wave velocity. Figures 15-18 illustrate the distribution of ice depths along the profiles.

The results from the drill site survey are not presented, because a breakdown of the odometer prevented accurate positioning. Ice thicknesses in the drill site area as shown in Figure 13 varied between 344 and 490 m, the highest values occurring near the crest of the ice cap.

Maximum recorded ice thickness was 550 m and clear reflections were obtained at this depth. No systematic variation in the strength and nature of the reflected echo was observed across the ice cap. The apparent absence of such differences is possibly related to the lack of permanent record of the oscilloscope traces.

The maximum ice thickness was measured under the highest parts of the ice cap where ice layers occur in the firn. Reflections from the internal ice layers did not interfere with the echo from the ice/bedrock interface.

Secondary or Multiple Echoes

In two areas of the ice cap, multiple echoes were seen on the oscilloscope: 1) along parts of the slump profile and 2) along the V-profile. Such multiple echoes may be caused by reflecting layers within the ice cap, as layers of particularly dense ice or layers of morainic material. The multiple reflections under the V-profile may be caused by morainic material as shear moraines occur along this section of the ice margin. The second echoes under the slump profile may, on the other hand, be caused by side echoes.

The nature and distribution of these secondary echoes cannot be fully determined without a continuous record of the oscilloscope trace.

SURFACE MOVEMENT AND STRAIN NET MEASUREMENTS - BARNES ICE CAP

O. H. Løken, A. Geiger and P. Langlais

(Figure 19)

Movement stakes were set in and surveyed during the 1966 field season and they were resurveyed in 1967. The network for strain measurements was established on the top of the South Dome during the same season.

The movement stakes were set out in three groups: one group of three stakes along the northeast margin of the ice cap in order to study the surface movement behind a shear moraine; for comparison purposes another group of three stakes was set in behind the southwest margin where there is no shear moraine; and finally a third group of five stakes was established near the south end of the ice cap to study the ice flow towards the Generator Lake depressions. In 1966, all stakes were surveyed by tellurometer and theodolite measurements relative to base lines laid out on bedrock adjacent to the ice cap. The location of stakes and base lines is shown in Figure 19 .

During the 1967 field season all stakes, except for I-31 and I-33 which had melted out, were resurveyed. Measurements of the base lines were completed and they were connected by an open traverse. The location of all survey points were determined relative to an arbitrary coordinate system, the axes of which lies approximately E-W and N-S respectively. The results of the observations are shown in the table.

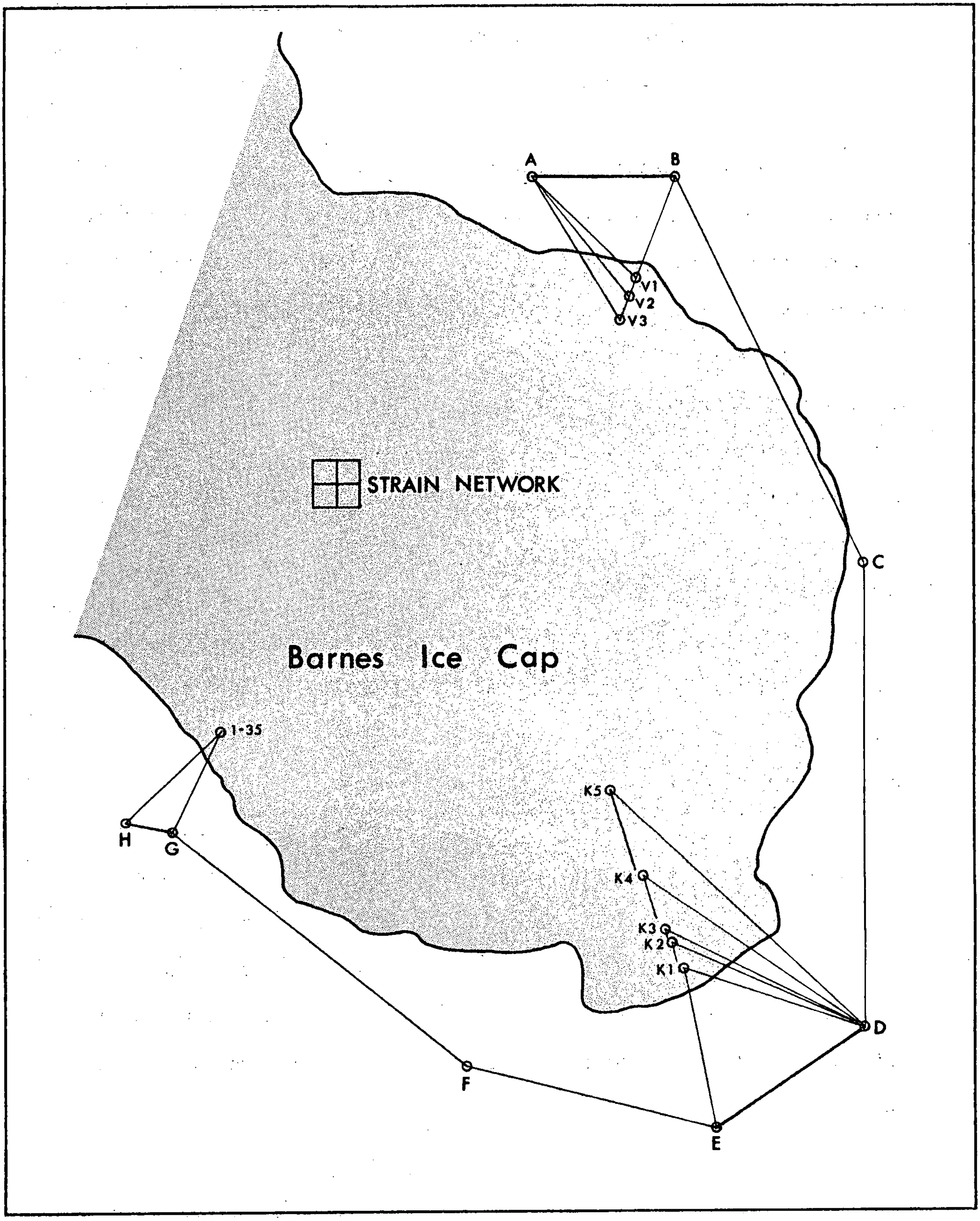

Figure 19 Barnes Ice Cap - location of movement stakes and strain net

Stake	Movement since 1966 survey (in m)	Direction of Movement azimuth	Ice Depth (D) at stake (1967) (in m)	Shear Stress $I = \alpha\rho g D$ bar
K1	5.63	$163^{\circ}26'$	198	0.37
K2	10.24	$166^{\circ}51'$	219	0.41
K3	15.00	$163^{\circ}40'$	219	0.41
K4	21.71	$158^{\circ}30'$	250	0.47
K5	24.19	$162^{\circ}26'$	301	0.56
V1	3.57	$23^{\circ}28'$	129	0.9
V2	4.91	$16^{\circ}20'$	198	1.1
V3	4.09	$15^{\circ}01'$	215	1.5
I35	2.29	$260^{\circ}20'$	N/A	N/A

There is a steady increase in velocity from K1 to K5, that is with increasing distance from the ice margin and all stakes lie in an area of compressive flow. The V-line shows no systematic change of velocity in relation to distance from the ice margin (increases from V1 to V3). The reason for this is not known.

Stake I35 and V1 lie at approximately the same distance from the ice margin on the southwest and the northeast side of the ice cap respectively. The surface velocity at I35 is substantially less and this may be related to the nature of the ice margin near the two localities.

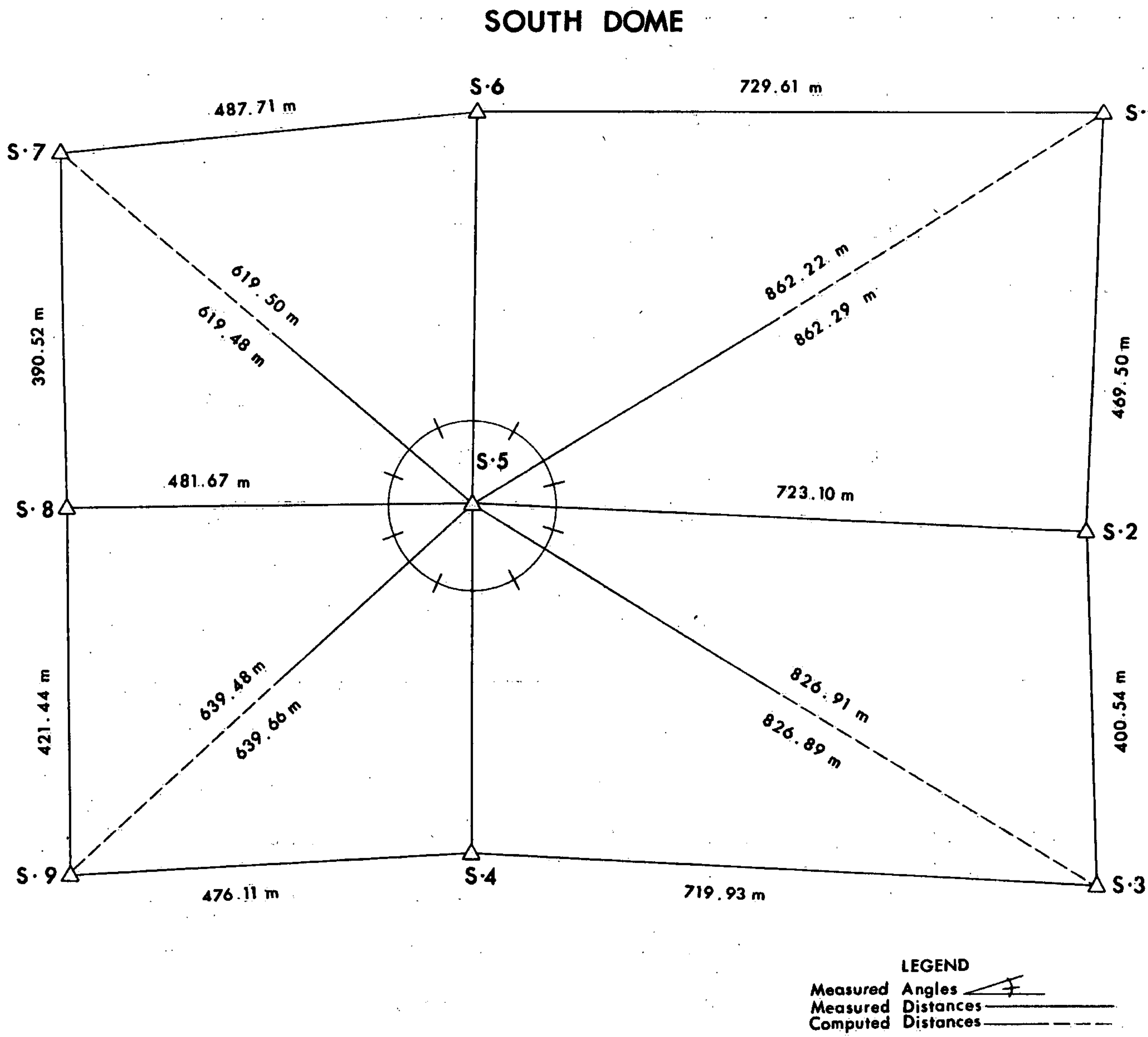

Figure 20 Barnes Ice Cap - strain network

From mass balance measurements and surveys of surface elevations at the stakes it is possible to determine the net change in the position of the ice surface, to see if the glacier is gaining or losing in thickness. The analysis is not yet completed.

The depth measurements allowed bottom shear stresses to be calculated; the average surface slope of the ice cap between K1 and K5 was used in the calculations as deviations from the average slope are small. Shear stresses at the V stakes were calculated in a similar manner, although there, the slope decreases with increasing distance from the ice margin and the figure for V3 is too large. The table shows, however, that the shear stresses at the V stakes exceeds those at the K stakes by a factor of greater than 2. The reason for this is not obviously clear.

The K stakes lie very close to a flow line as the velocity vector at each stake lies less than 10° off a line connecting the stakes, and the mean horizontal strain rate between the various stakes is:

K5 - K4	$.9 \times 10^{-3}$ years^{-1}
K4 - K3	3.1×10^{-3} " "
K3 - K2	4.9×10^{-3} " "
K2 - K1	3.5×10^{-3} " "

Strain Net

The strain net shown in Figure 20 was set out on the South Dome with the centre stake as close as possible to the highest point. Distances between adjacent stakes were taped and angles at the centre stake were measured. This will permit changes in the size and shape of the network to be determined at a later date.

The dome area is characterized by divergent flow and the horizontal divergence must be compensated by a positive mass balance if the ice cap is in equilibrium. The purpose of the strain net is to study this relationship.

METEOROLOGICAL FIELD PROGRAM

Preliminary Report - 1967

R. G. Barry

The objectives of the summer 1967 field program in Baffin Island were:

1. to operate unmanned weather stations on and around the Barnes Ice Cap with a view to providing some indication of the representativeness of the regular D.O.T. and DEW Line network and also to maintain a general record of summer conditions in the ice cap area;
2. to establish more systematic summer weather records at Inugsuin Fiord base camp.

The writer visited the field area between July 1-13 in order to check the installations at base camp and the unmanned sites ('East Met.' and 'West Met.') and the operation of the observational program. The weather stations at Cape Dyer, Cape Hooper, Clyde, Dewar Lakes, Frobisher Bay and Longstaff Bluff were also visited (Figure 1).

The station locations and observing programs are summarized in Table 1. The program was conducted in the field by D. Christian assisted by other members of the base camp party. Records were also maintained at Ekalugad Sandur by M. Church.

The unmanned ice cap station was installed on June 27, but attempts to re-locate it from the air during July were unsuccessful. Further research was deferred until 1968 when it is hoped to recover the instruments and any records by ground travel. Bad weather at the end of the field season in mid-August prevented access to the

East Met. side and records for the end of the period will be collected in 1968.

Table 1

Station Locations and Programs

Name of Station	Location	Elevation m - a.s.l.	Operation	Observations	Comments
Inugsuin Fiord	69°35'N, 69°58'W	c.10	June 1-Aug. 20	3-hourly synoptics 07-01 E.S.T. Sunshine 5/7-20/8. Actino. 13/6-20/8	
East Met.	70°14'N, 72°03'W	c.300	June 11 -* (July 26)*	Monthly thermohygrograph and wind-speed direction recorder at each	1-4/7 Temp. missing
West Met.	69°42'N, 74°32'W	c.300	June 29 - August 16		See p. 107
Ice Cap	69°54'N, 73°02'W	c.1,075	June 27 -?*		Records not retrieved

* See text.

1967 Summer compared with average

Table 2 demonstrates that June and August were cooler than average, daily maxima being affected much more than minima, while in July, Cape Hooper and Clyde were warmer than average. Precipitation departures from normal for the three summer months were noticeably positive at Dewar Lakes (+3.25") and Longstaff Bluff (+2.80"), but negative at Clyde (-1.81").

Table 2

Temperature and Precipitation Departures from Normal, 1967
(Meteorological Branch, Department of Transport Records)

		Longstaff Bluff	Dewar Lakes	Clyde	Cape Hooper	Frobisher
June	Δ T	-1.7	-4.9	-2.5	-1.6	-1.3
	Δ P	+0.73	+1.08	+0.06	+0.91	-0.18
July	Δ T	-1.3	-1.0	+0.8	+2.0	-0.3
	Δ P	+0.80	+0.76	-0.87	-0.24	-1.42
Aug.	Δ T	-3.6	-2.1	-1.7	-1.0	+0.5
	Δ P	+1.27	+1.39	-1.00	+0.55	+1.25

Δ T = Departure of mean daily temperature, ^{o}F.

Δ P = Departure of monthly precipitation, in.

Comparison between Stations, 1967

Tables 3 and 4 summarize the basic data recorded at the various field and permanent stations in June - August 1967. Inugsuin Fiord is clearly much warmer than neighbouring sites and compares most closely with Frobisher. Ekalugad Sandur is similar in July, but is a degree or so cooler than Inugsuin in June and August. The precipitation records for July and August show marked differences between the two head-of-fiord stations on the one hand and the coastal stations of Clyde and Cape Hooper on the other, in July and August. In June, however, the total precipitation and particularly the snowfall at Ekalugad most closely matches the amounts at Cape Hooper.

Table 3

Temperature (^{o}F) and Precipitation (in.) Data

	Dewar Lakes	Inugsuin Fiord*	Clyde	Ekalugad Sandur+	Cape Hooper	Frobisher
June						
Mean Maximum	31.3	40.2	36.2	(38.8)	32.9	42.2
Mean Minimum	24.5	31.6	27.2	(30.7)	25.6	32.1
Highest	42	49	42	49	43	49
Lowest	19	27	22	26	21	25
Total Precip.	1.56	0.63	0.44	1.70	1.39	1.11
Snowfall (w.e.)	0.80	0.27	0.44	1.23±	1.39	0.22

*Temperatures June 1-4 estimated from thermograph and available observations.

+June 4-30 only. ±Measured w.e. (Snow depth x 0.1 = 0.90").

	Dewar Lakes	Inugsuin Fiord	Clyde	Ekalugad Sandur	Cape Hooper	Frobisher
July						
Mean Maximum	48.8	53.2	49.5	52.7	49.1	53.2
Mean Minimum	36.7	39.6	33.3	39.2	37.3	38.5
Highest	67	69	64	70	65	72
Lowest	29	33	28	30	25	35
Precip.	2.07	2.14	0.04	2.13	0.18	0.67
August	(August 1-20 only)					
Mean Maximum	42.6	48.4	43.8	46.0	39.5	50.7
Mean Minimum	33.7	41.0	33.2	38.2	32.2	39.1
Highest	51	55	53	55	49	57
Lowest	29	38	32	34	29	34
Precip.	2.35	1.22	0.24	4.90	1.66	3.33

Table 4

Temperature Data (^{o}F) for the Unmanned Stations

July (excl. 7, 8)	West Met.	Longstaff Bluff	Dewar Lakes	June 11-30	East Met.	Inugsuin Fiord
Mean Max.	52.3	49.8	48.4		37.6	40.4
Mean Min.	40.3	39.0	36.8		27.0	32.5
Highest	71	71	67		46	49
Lowest	34	30	29		20	27
August 1-16				**July 5-26**		
Mean Max.	43.4	45.3	43.2		47.8	53.0
Mean Min.	36.4	37.0	34.3		36.5	39.6
Highest	52	57	51		64	69
Lowest	32	31	29		26	33

The data from East Met. indicate a rather steep mean lapse rate of 4.2^{o}F/1,000 feet (7.7^{o}C/km) between Inugsuin Fiord and the site. A comparable value cannot readily be obtained for West Met. since the July records are subject to some uncertainty. The screen was blown over on July 6; it was temporarily operated resting on the ground from July 8 and was re-erected on July 29. This may have caused maxima to be too high. Moreover, Longstaff Bluff is subject to the influence of cold air over Foxe Basin, where the ice is always late to clear.

Tables 5 and 6 show the distribution of wind direction frequencies at East Met. and West Met. At the eastern site the prevailing wind is SE, except during late afternoon-evening when it is NW. At West Met. the prevailing direction is E except at

Table 5

Percentage Frequency of Wind Directions at East Met.
July 6 - August 8, 1967

Time	Direction (tens of degrees) 35-02	03-07	08-11	12-16	17-20	21-25	26-29	30-34	calm or lt.var.
01 E.S.T.		0.4	0.4	3.7	2.2	4.4	0.4	0.7	0.4
04		0.4	0.7	5.5	1.5	1.8	1.1	1.5	
07		0.4	0.0	6.6	1.1	1.5	0.7	1.8	0.4
10		0.4	0.4	5.9	1.5	2.2	0.7	1.5	
13		0.0	0.0	5.9	2.9	1.1	1.5	1.1	
16	0.4	0.0	0.7	2.6	2.6	1.5	1.1	3.7	
19		0.0	0.4	2.9	1.5	1.1	1.1	5.5	
22		0.4	0.7	1.8	2.2	1.5	2.9	2.6	0.4
Adjusted total	0.4	1.8	3.3	35.0	15.4	15.1	9.6	18.4	1.1

Table 6

Percentage Frequency of Wind Directions at West Met.
July 1 - August 16, 1967

Time	Direction (tens of degrees) 35-02	03-07	08-11	12-16	17-20	21-25	26-29	30-34	calm or lt.var.
01 E.S.T.	0.5	2.1	3.5	1.9	1.6	1.3	0.5	1.1	
04	0.8	1.6	4.0	1.9	1.6	1.3	0.0	1.3	
07	0.8	1.3	4.0	2.4	1.3	1.3	0.3	1.1	
10	0.3	1.1	2.9	2.7	2.4	1.9	0.5	0.8	
13	0.5	0.8	2.9	1.6	3.2	2.1	0.8	0.8	
16	0.3	0.3	4.0	1.6	2.4	2.1	1.3	0.5	
19	0.5	0.3	5.3	0.5	2.4	1.6	0.8	0.8	0.3
22	0.5	1.6	2.9	2.9	1.6	0.8	1.1	0.8	0.3
Adjusted total	4.3	8.8	29.5	15.4	16.5	12.5	5.3	7.2	0.5

13 E.S.T. when S winds are slightly more frequent. For comparison, the July average 1961-65 at Dewar Lakes is 28 per cent E winds, whereas at the east coast stations of Cape Hooper (1961-65) and Clyde (1951-60) the prevailing winds are respectively W (17 per cent) and NW (59 per cent). The pattern of easterly flow accords with the location of a mean low over southern Baffin Island while the northwesterly components may be indicative of ridging over the eastern mountains. Although the Inugsuin Fiord winds are undoubtedly strongly channeled by topography, it is interesting in this connection to note that there is a marked predominance of N winds (Table 7).

Table 7

Percentage Frequency of Wind Directions at Inugsuin Fiord
July 1 - August 20, 1967

	Direction (tens of degrees)								
Time	35-02	03-07	08-11	12-16	17-20	21-25	26-29	30-34	Calm
01 E.S.T.	7.3	2.9	1.5	1.0	3.9	1.0	2.0	2.5	2.9
07	6.9	3.4	1.0	1.5	2.0	4.9	0.5	1.0	3.9
13	6.9	5.9	1.5	2.0	2.0	3.4	0.0	2.0	1.5
19	5.9	5.4	2.9	2.9	2.9	2.9	1.0	1.0	0.0
Adjusted total	25.9	17.6	6.9	7.3	7.3	10.8	3.4	6.4	8.3

Sunshine and Radiation at Inugsuin Fiord

Few data on sunshine or solar radiation are available for Baffin Island. Sunshine is recorded at Frobisher while radiation measurements are made only at Resolute, although Sagar (1966) has also made measurements of these parameters on the Barnes Ice Cap. A standard Campbell-Stokes type sunshine recorder and a Robbitsch type actinograph were installed on the low hill behind base camp

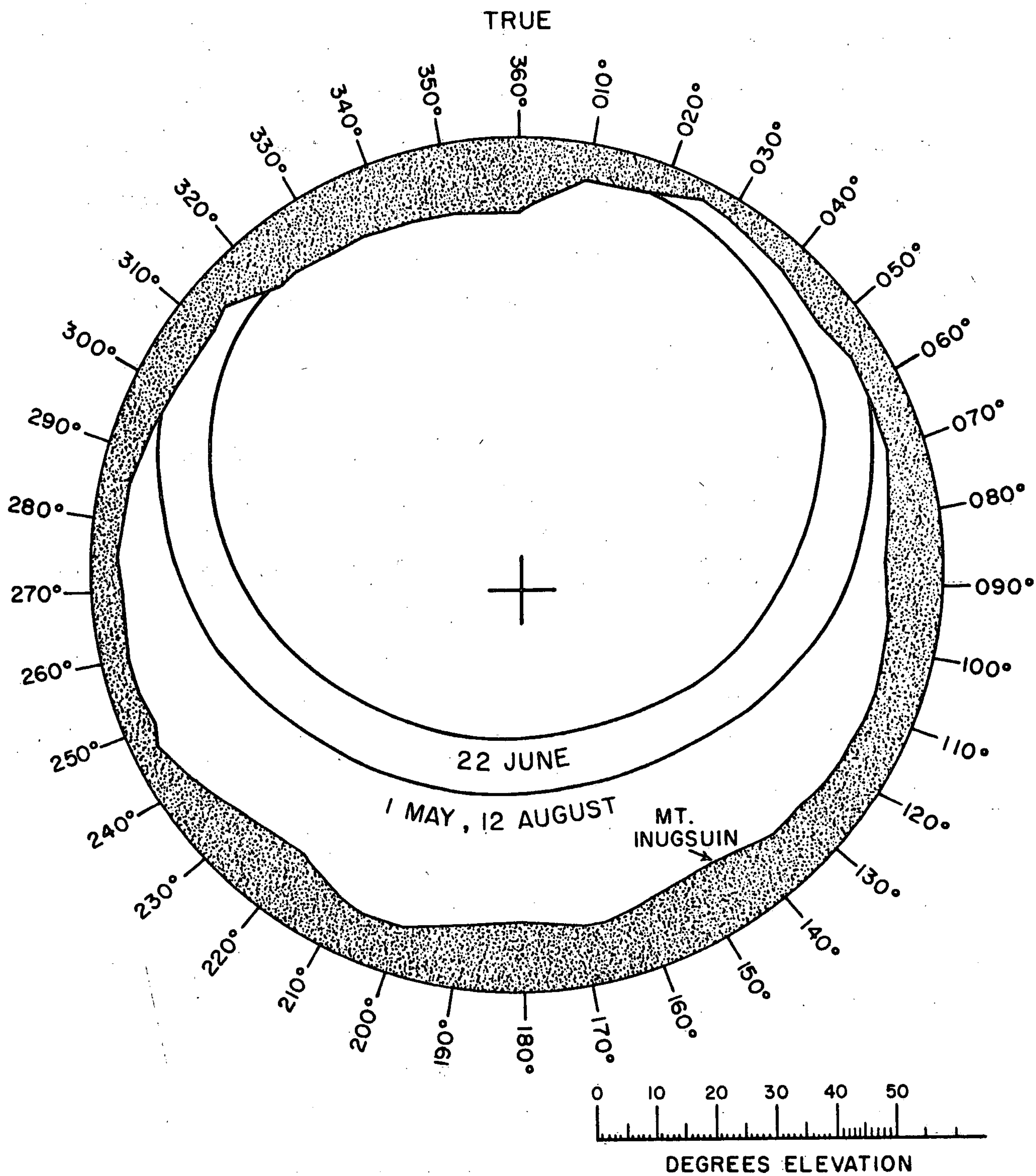

Figure 21 *Horizon diagram for moraine ridge behind Inugsuin base camp and solar altitude*

(elevation c. 25 m). Figure 21 shows a horizon diagram for this location and two solar paths. Corrections were not made to either record for the mountain cut-off. The effect is most serious during June and the first half of July.

The average daily bright sunshine for the period July 5-August 20 was 5.9 hours. An hour or less was recorded on 13 days and a maximum of 16.4 hours occurred on July 28 and 29.

Figure 2 illustrates the daily solar radiation amounts (based on a field calibration of the actinograph with a Kipp solarimeter over a total of 90 hours of clear sky conditions). The graph shows the extra-terrestrial radiation value and the theoretical surface receipt under clear skies with an atmospheric transmission coefficient of 0.8. There is good agreement between the latter curve and actual receipts on the sunniest days.

Further Studies and Recommendations for Future Programs

The field program described above is one small part of a much broader investigation of the climatic characteristics of the island. In this connection a synoptic classification of pressure patterns is being developed and it is hoped to analyze the local weather at the various sites with reference to this classification in the near future. One obvious problem is the question of representativeness of the existing station network. The incomplete results from one summer provide an insufficient measure of this, although some useful information has already been obtained. It would seem desirable from the points of view of maximizing the data collected and reducing the number of 'service' visits to the

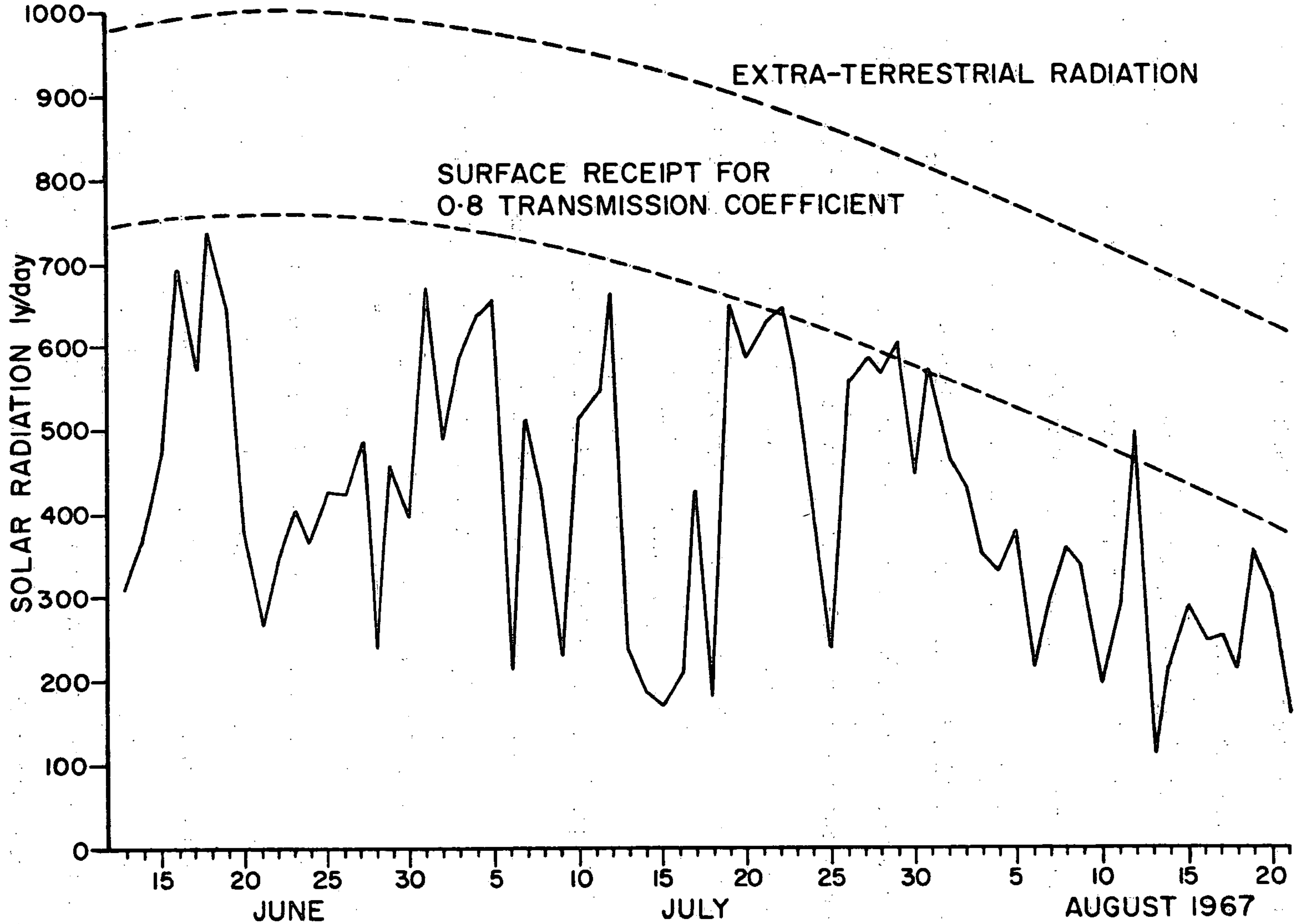

Figure 22 *Solar radiation receipts for Inugsuin Fiord*

unmanned sites to install fully automatic weather stations capable of operating for at least 3 to 6 months. Such a program should be undertaken for a minimum of 3 summer seasons. Useful information could also be obtained for little outlay in cost or time if other field parties (such as those at Bowman Bay and Foxe Bravo) were supplied with a maximum and minimum thermometer, and a thermohygrograph in a screen. This is far preferable to readings at selected (often non-standard or irregular) hours.

The detailed tabulations of the results for each of the field sites is appended. The writer wishes to acknowledge the substantial contribution made to this overall program by D. Christian in both the field operations and the data reduction.

REFERENCE

Sagar, R. B.
1966 : Glaciological and climatological studies on the Barnes Ice Cap. 1962-64. Geog. Bull., v. 8, 3-47.

THREE-HOURLY ABSTRACT OF WIND - WEST MET STATION

ELEV. 304 METERS A.S.L. AUGUST 1967

	01-04 EST		04-07 EST		07-10 EST		10-13 EST	
Date	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
1	080	4.2	090	4.2	130	2.2	120	3.9
2	080	5.3	090	4.4	090	4.4	090	5.3
3	090	6.1	090	6.7	100	6.7	095	6.9
4	085	2.5	080	2.8	070	1.4	070	2.5
5	085	5.3	090	5.3	090	4.7	125	5.0
6	085	8.1	100	8.6	120	7.8	110	6.7
7	080	4.4	085	3.1	150	1.1	220	1.4
8	180	1.4	240	1.7	240	2.8	250	4.2
9	180	1.9	180	2.2	190	3.6	190	5.6
10	120	4.7	150	3.6	180	4.2	240	2.2
11	250	1.9	320	4.4	330	6.1	330	6.9
12	350	3.1	350	2.2	350	2.8	060	1.9
13	145	4.2	130	9.7	120	10.6	115	12.5
14	130	4.4	150	3.6	190	4.7	230	6.1
15	130	3.3	170	5.0	120	4.4	110	5.8
16	070	3.9	070	3.6	110	4.7	110	6.7
17	090	4.7	070	3.9	360	1.9	045	3.6
TOTAL		69.4		75.0		74.1		87.2
MEAN		4.1		4.4		4.4		5.1

THREE-HOURLY ABSTRACT OF WIND - WEST MET STATION

ELEV. 304 METERS A.S.L. AUGUST 1967

	13-16 EST		16-19 EST		19-22 EST		22-01 EST	
	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
	180	3.3	110	5.6	110	5.8	070	4.4
	080	6.7	085	6.9	090	6.7	090	3.6
	095	6.9	085	4.7	145	6.1	140	2.8
	085	5.3	080	4.2	070	4.7	050	5.0
	120	4.4	080	3.6	060	3.6	100	3.9
	110	6.7	090	5.8	080	4.4	085	4.7
	240	2.2	080	1.7	130	1.1	190	1.4
	210	3.3	170	1.9	180	3.1	200	3.3
	180	5.6	175	4.2	150	5.3	130	8.6
	250	2.8	250	3.9	270	1.9	270	1.7
	355	6.9	030	5.6	360	4.4	360	3.3
	090	3.9	250	4.4	210	3.6	150	4.7
	110	10.8	100	6.9	080	4.7	120	3.9
	210	6.4	200	2.8	150	1.4	060	3.3
	090	6.4	090	5.8	085	4.7	080	4.2
	110	5.3	100	4.7	080	5.0	080	5.0
TOTAL		86.9		72.7		66.5		63.8
MEAN		5.1		4.3		3.9		3.8

Site dismantled 1530 EST.

THREE-HOURLY ABSTRACT OF WIND - EAST MET STATION

ELEV. 304 METERS A.S.L. JULY 1967

Date	01-04 EST Dir.	01-04 EST M/S	04-07 EST Dir.	04-07 EST M/S	07-10 EST Dir.	07-10 EST M/S	10-13 EST Dir.	10-13 EST M/S
1	M	M	M	M	M	M	M	M
2	M	M	M	M	M	M	M	M
3	M	M	M	M	M	M	M	M
4	M	M	M	M	M	M	M	M
5	M	M	M	M	M	M	M	M
6	310	6.1	310	6.9	300	6.9	310	6.4
7	310	6.4	310	8.3	320	8.9	310	8.6
8	320	8.3	315	10.0	300	8.1	300	4.4
9	290	5.0	270	2.8	260	3.9	270	3.3
10	160	6.7	180	8.6	210	8.3	200	5.3
11	190	1.9	120	3.3	130	2.8	150	1.7
12	130	1.9	x	1.9	210	1.1	270	0.8
13	110	2.8	120	1.9	120	1.7	120	1.9
14	210	1.1	240	1.1	250	1.4	240	1.7
15	120	3.1	120	3.3	130	5.0	160	3.3
16	210	2.2	220	3.9	210	4.2	210	2.2
17	170	1.7	130	2.5	200	3.3	200	2.8
18	110	4.2	120	4.4	150	4.4	150	3.1
19	170	4.7	160	5.6	170	6.7	140	6.7
20	130	5.3	130	4.2	150	3.3	190	2.5
21	150	4.7	180	5.8	175	6.7	140	5.8
22	050	8.1	050	8.9	040	10.6	130	1.9
23	120	1.9	130	3.1	140	2.8	120	4.2
24	120	1.7	130	3.9	120	4.7	160	2.8
25	210	1.4	160	1.7	110	1.7	120	2.8
26	290	2.8	300	5.0	300	4.7	290	4.2
27	290	5.6	300	4.4	290	2.8	260	3.1
28	230	1.4	210	2.8	190	2.8	180	1.1
29	300	1.9	270	2.2	200	4.2	220	1.4
30	190	1.9	170	2.5	210	3.1	180	2.2
31	240	0.8	250	3.1	120	5.3	180	2.8
TOTAL		93.6		112.1		119.4		99.3
MEAN		3.6		4.3		4.6		3.8

x - variable - See below

Date	Hour - Est	Direction Notes
8	19-22	Swings from 300° to 090° through 180° - then back to 090°
8	22-01	Swings from 180° to 090° back through 180° to 270°
12	04-07	Swings from 120° - 360° through 090°

THREE-HOURLY ABSTRACT OF WIND - EAST MET STATION

ELEV. 304 METERS A.S.L. JULY 1967

	13-16 EST		16-19 EST		19-22 EST		22-01 EST	
	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
	M	M	M	M	M	M	M	M
	M	M	M	M	M	M	M	M
	M	M	M	M	M	M	M	M
	M	M	M	M	M	M	M	M
	315	6.9	320	1.9	315	5.0	310	5.0
	300	3.6	300	3.1	310	2.8	300	4.4
	320	7.2	320	4.7	320	4.7	310	7.2
	290	3.9	310	3.9	x	1.7	x	3.1
	200	3.1	120	0.6	150	3.3	150	6.7
	150	1.7	120	1.1	050	1.4	130	0.8
	150	4.2	140	3.3	140	3.1	140	2.8
	300	1.1	310	1.1	270	1.1	210	1.7
	160	1.4	240	0.6	230	0.6	180	0.8
	190	0.8	220	0.6	180	0.8	150	1.9
	210	1.7	300	0.8	270	0.8	220	1.1
	280	1.1	270	0.6	270	0.6	220	0.8
	150	1.9	130	1.9	120	2.8	110	3.9
	150	3.3	150	3.1	140	2.5	150	3.9
	150	5.0	130	5.0	140	3.6	140	3.3
	185	1.9	180	2.2	170	1.1	180	4.2
	110	7.8	120	5.6	110	5.6	045	5.8
	170	1.7	200	0.6	220	0.8	180	1.1
	120	1.9	140	0.8	270	0.3	210	0.8
	300	0.8	270	0.6	300	0.8	220	0.8
	360	1.4	090	0.8	090	0.6	210	2.8
	320	3.9	310	4.4	280	2.8	210	2.2
	230	1.4	210	1.1	200	0.6	180	0.3
	190	1.7	180	0.6	210	0.8	210	0.8
	310	1.1	300	0.8	190	0.8	250	0.8
	310	1.1	320	0.3	180	0.8	220	0.6
	300	0.8	330	0.6	300	0.3	270	0.8
TOTAL		74.3		50.7		50.1		68.4
MEAN		2.8		1.9		1.9		2.5

THREE-HOURLY ABSTRACT OF WIND - WEST MET STATION

ELEV. 304 METERS A.S.L. JULY 1967

	01-04 EST		04-07 EST		07-10 EST		10-13 EST	
Date	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
1	315	4.6	315	7.9	270	6.8	280	6.4
2	330	6.2	330	6.2	340	6.1	330	4.7
3	330	8.8	330	10.3	320	7.7	320	6.7
4	340	5.0	275	4.9	280	4.7	260	2.5
5	230	4.6	220	5.8	220	5.3	190	4.4
6	190	11.1	220	9.7	230	4.7	170	2.2
7	080	6.2	160	4.7	150	5.8	160	3.3
8	090	4.0	090	2.8	085	3.3	100	2.5
9	080	2.6	090	2.5	110	5.3	170	3.3
10	090	3.8	090	3.8	140	4.2	170	4.4
11	320	0.7	090	2.7	090	2.2	110	3.9
12	060	1.0	020	2.4	250	1.4	250	3.1
13	230	2.0	180	4.7	170	6.1	180	5.6
14	090	5.2	150	3.6	170	3.9	180	2.5
15	160	4.2	160	5.8	165	5.6	170	9.7
16	150	6.9	170	6.1	175	5.3	175	5.3
17	170	4.1	165	4.2	150	6.7	170	7.2
18	110	10.3	100	14.1	090	13.9	090	13.9
19	360	10.3	360	10.3	030	7.2	020	7.5
20	020	1.1	045	2.5	070	1.7	270	2.2
21	220	1.1	160	0.7	210	4.4	235	3.9
22	060	0.8	070	1.3	060	5.8	350	1.9
23	190	0.8	230	0.7	220	1.9	230	2.5
24	180	2.5	150	3.6	170	4.2	170	3.3
25	250	2.0	230	0.7	230	0.8	220	1.4
26	120	3.6	100	4.3	120	4.4	150	5.8
27	070	5.5	085	6.2	095	6.4	110	5.8
28	060	3.8	070	4.1	120	6.9	140	5.3
29	060	2.5	060	1.6	180	1.7	190	2.5
30	085	5.8	090	5.2	110	5.8	110	5.0
31	085	3.0	125	2.6	110	2.2	090	3.3
TOTAL		134.1		146.0		152.4		142.0
MEAN		4.3		4.7		4.9		4.6

x - variable - See below

Date	Hour - Est	Direction Notes
4	16-19	Swings from 270° through 180° to 090°
4	19-22	Swings from 090° through 180° to 240°

THREE-HOURLY ABSTRACT OF WIND - WEST MET STATION

ELEV. 304 METERS A.S.L. JULY 1967

	13-16 EST		16-19 EST		19-22 EST		22-01 EST	
	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
	275	3.9	300	3.6	330	5.0	320	5.3
	340	6.1	340	5.8	330	6.4	330	8.9
	340	6.4	340	6.9	340	5.6	340	4.7
	270	1.9	x	0.8	x	1.9	235	3.3
	165	5.6	170	9.2	170	13.1	175	15.0
	090	2.2	090	5.8	090	5.6	090	6.4
	170	1.7	180	2.8	130	2.2	100	4.4
	090	2.2	100	2.5	130	1.9	080	2.2
	110	4.2	080	4.4	090	4.2	070	3.6
	240	3.3	270	3.3	270	4.2	290	1.7
	120	3.9	090	5.6	100	5.3	090	2.2
	265	4.7	250	7.5	250	5.8	250	3.6
	180	6.1	180	5.6	130	3.3	100	5.0
	220	1.9	230	1.9	180	2.8	170	3.9
	150	8.6	170	9.2	140	7.5	150	7.5
	185	5.6	200	6.1	180	4.7	180	4.4
	140	8.6	130	9.2	135	9.7	135	9.2
	090	14.2	090	11.4	080	5.0	050	5.3
	025	8.1	020	6.7	020	5.0	020	4.7
	280	2.8	260	6.7	260	4.4	250	1.7
	265	4.2	270	4.4	280	4.7	320	2.5
	240	6.1	240	7.2	250	4.7	250	2.8
	230	3.3	230	4.7	210	3.1	190	1.7
	170	3.6	160	3.3	200	3.1	230	2.5
	120	10.0	090	4.4	140	3.1	140	3.9
	190	6.4	190	4.4	145	2.8	080	3.6
	085	8.3	085	8.6	065	5.3	070	4.4
	130	4.4	090	5.0	040	2.2	065	3.1
	170	3.3	090	3.1	070	4.2	080	6.4
	080	5.6	070	7.2	075	4.4	090	3.1
	090	5.8	080	4.7	060	3.9	060	4.7
TOTAL		163.0		172.0		140.4		141.7
MEAN		5.3		5.5		4.5		4.6

THREE-HOURLY ABSTRACT OF WIND - EAST MET STATION

ELEV. 304 METERS A.S.L. AUGUST 1967

	01-04 EST		04-07 EST		07-10 EST		10-13 EST	
Date	Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
1	120	6.1	120	5.3	120	4.2	180	3.1
2	120	3.1	120	5.7	120	5.4	120	4.5
3	120	1.7	120	3.9	120	5.3	120	5.3
4	120	3.9	120	4.7	120	5.8	120	3.9
5	120	3.1	120	4.4	120	5.3	180	3.3
6	120	3.3	120	3.9	120	3.9	120	4.2
7	120	1.7	120	2.8	120	3.1	180	1.9
8	160	1.1	120	4.4	120	3.9	180	1.1
9	200	1.4	200	1.4	200	3.3	190	4.2
10	160	3.1	140	2.8	140	5.3	120	3.6
11	320	0.8	120	2.2	120	1.9	140	3.6
12	270	0.8	210	0.6	120	3.3	120	5.0
13	310	1.1	210	3.1	110	6.4	110	6.9
14	120	4.7	120	5.3	130	4.4	170	4.4
15	120	1.9	130	3.6	130	3.3	170	3.3
16	300	0.6	270	1.1	290	2.2	250	4.2
17	330	0.6	310	0.8	210	0.8	120	2.5
18	280	0.3	180	0.6	200	0.8	190	0.8
19	360	0.8	130	1.4	210	0.8	200	1.9
20	020	0.8	090	0.3	240	0.8	300	4.2
21	320	4.4	320	3.9	330	3.3	320	2.8
22	240	0.6	200	0.6	140	1.4	150	3.3
23	240	0.6	130	0.8	130	1.7	120	1.7
24	050	1.9	020	1.1	280	1.7	150	1.4
25	310	1.4	310	1.1	300	1.4	130	1.7
26	060	1.9	060	7.2	040	5.0	040	7.5
27	120	1.1	360	0.3	250	1.9	240	1.7
28	050	1.4	090	0.8	180	0.8	290	1.4
29	360	0.3	270	0.8	200	0.6	210	0.6
30	120	2.2	130	2.5	120	2.2	130	2.5
31	340	0.8	040	1.4	150	1.4	190	6.1
Total		57.5		78.8		91.6		102.6
Mean		18.6		25.4		29.5		23.2

x - variable - See below

Date	Hour - Est	Direction Notes
6	13-16	Swings from 120° to 300° through 360° then back to 120° to 310° through 360°

ELEV. 304 METERS A.S.L. AUGUST 1967

13-16 EST		16-19 EST		19-22 EST		22-01 EST	
Dir.	M/S	Dir.	M/S	Dir.	M/S	Dir.	M/S
310	5.3	320	2.2	330	0.8	080	1.4
270	2.2	290	2.2	215	0.8	130	2.2
070	2.2	310	1.7	270	0.8	180	1.7
300	1.4	320	1.1	270	0.6	190	1.1
230	1.4	270	1.1	180	1.7	120	3.1
x							
VAR.	1.7	270	1.1	200	0.8	120	1.4
290	0.6	300	0.6	270	0.6	240	0.8
240	1.1	190	3.1	230	1.4	190	2.2
205	4.7	200	2.5	190	1.1	160	1.7
130	3.3	180	1.7	220	0.3	180	0.8
130	5.0	130	3.3	190	1.7	210	1.1
130	4.7	120	4.2	250	1.4	340	1.1
110	9.4	110	9.7	110	7.2	120	3.1
200	3.3	200	3.3	120	0.8	180	1.4
100	1.9	150	3.3	110	3.1	190	2.8
290	1.1	x	0.8	x	0.8	x	0.6
120	2.2	120	3.3	130	1.9	240	0.6
170	1.4	200	1.1	205	1.1	320	1.1
160	3.1	130	2.8	240	1.1	270	0.8
290	5.0	310	6.4	310	2.8	320	5.0
230	2.5	120	2.8	150	1.4	310	1.1
140	3.1	130	3.6	130	1.7	300	0.6
120	2.8	180	3.1	270	1.1	290	1.4
120	2.2	070	3.3	300	2.5	300	2.2
130	3.3	210	2.2	230	0.8	240	0.8
030	8.1	060	5.8	040	3.3	180	1.4
130	3.3	170	2.5	330	1.4	350	0.6
150	1.9	180	2.2	310	1.7	320	1.1
300	3.3	300	3.6	310	2.2	240	1.9
130	3.1	130	2.2	180	1.4	220	0.6
190	9.2	180	6.9	270	5.6	280	2.5
	111.9		93.7		53.9		48.2
	36.0		30.2		17.4		15.6

MONTHLY CLIMATOLOGICAL SUMMARY

ELEVATION 304 METERS — STATION McDONALD LAKE — PROVINCE BAFFIN ISLAND N.W.T. — MONTH AUGUST 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m = \frac{T_x+T_n}{2}$ 5	Heating Degree-Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour ___ST 11	Second Synoptic Hour ___ST 12	Third Synoptic Hour ___ST 13	Fourth Synoptic Hour ___ST 14	RELATIVE HUMIDITY Max. 15	Min. 16	Third Synoptic Hour ___ST 17	Fourth Synoptic Hour ___ST 18
1	52	42	94	47	18									68	53		
2	50	42	92	46	19									66	56		
3	50	42	92	46	19									66	53		
4	49	42	91	46	19									77	58		
5	48	36	84	42	23									78	55		
6	40	38	78	39	26									79	72		
7	42	38	80	40	25									78	68		
8	40	34	74	37	28									77	63		
9	41	36	77	39	26									77	62		
10	42	36	78	39	26									77	68		
11	46	36	82	41	24									77	50		
12	48	34	82	41	24									77	46		
13	38	34	72	36	29									77	72		
14	34	32	66	33	32									78	67		
15	40	32	72	36	29									78	53		
16	37	32	69	35	30									77	57		
17						Site Dismantled Aug. 16				15:00	EST						
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
SUM	6950	5820			397									1207	953		
MEAN	43.4	36.4	79.8	39.9										75	60		

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust, Sand 25	Blowing Snow 26	WIND 32 mph or more 27	39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) 32	33	34	35	NOTES 36
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
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22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
SUM																	
MEAN																	

CALCULATION OF MEANS	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour		
Mean of second Synoptic hour		
Mean of third Synoptic hour		
Mean of fourth Synoptic hour		
SUM		
MEAN		

CLIMATOLOGICAL MESSAGE

ATTN. CLIMATOLOGY	STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5)	HIGHEST (whole degrees) (2)	LOWEST (whole degrees) (3)	SNOWFALL (tenths) (sum 8)	TOTAL PRECIPITATION (hundredths) (sum 10)	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322)	DAYS WITH .04 INCH OR MORE PRECIPITATION (10)	BRIGHT SUNSHINE (tenths) (Form 2307)	HEATING DEGREE DAYS (sum 6)	MEAN PRESSURE (whole mb.) (mean 37)	MEAN RELATIVE HUMIDITY (whole %) (mean 38)
		A	B	C	D	E	F	G	H	J	K	L

Form 63-2320

MONTHLY CLIMATOLOGICAL SUMMARY

ELEVATION 304 METERS

STATION McDONALD LAKE PROVINCE BAFFIN ISLAND N.W.T. MONTH JULY 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m=\frac{T_x+T_n}{2}$ 5	Heating Degree Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour ___ST 11	Second Synoptic Hour ___ST 12	Third Synoptic Hour ___ST 13	Fourth Synoptic Hour ___ST 14	RELATIVE HUMIDITY Max. 15	Min. 16	Third Synoptic Hour ___ST 17	Fourth Synoptic Hour ___ST 18
1	44	38	82	41	24									75	49		
2	48	39	87	44	21									74	60		
3	44	35	76	38	27									76	63		
4	42	34	76	38	27									73	59		
5	46	38	84	42	23									72	50		
6	M	M	M	M	M									M	M		
7	M	M	M	M	M									M	M		
8	M	M	M	M	M									M	M		
9	56	44	100	50	15									68	52		
10	55	43	98	49	16									69	45		
11	61	46	107	54	11									76	47		
12	60	42	102	51	14									77	73		
13	42	38	80	40	25									77	72		
14	42	38	80	40	25									75	72		
15	41	40	81	41	24									77	61		
16	44	34	78	39	26									76	58		
17	44	35	79	40	25									78	63		
18	40	34	74	37	28									65	48		
19	46	34	80	40	25									69	43		
20	53	38	91	46	19									69	41		
21	58	40	98	49	16									75	39		
22	60	42	102	51	14									75	40		
23	60	40	100	50	15									77	40		
24	54	44	98	49	16									78	67		
25	50	42	92	46	19									74	44		
26	64	44	108	54	11									64	43		
27	71	52	123	61	4									62	42		
28	66	47	113	57	8									61	42		
29	71	46	117	59	6									57	44		
30	56	42	98	49	16									69	50		
31	51	44	95	48	17									66	53		
SUM	15175	11684			517									2007	1517		
MEAN	52.3	40.3	92.6	46.3										72	54		

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust, Sand 25	Blowing Snow 26	WIND 32 mph or more 27	WIND 39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) 32	33	34	35	NOTES 36
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
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24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
SUM																	
MEAN																	

CALCULATION OF MEANS

	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour		
Mean of second Synoptic hour		
Mean of third Synoptic hour		
Mean of fourth Synoptic hour		
SUM		
MEAN		

CLIMATOLOGICAL MESSAGE

	STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5)	HIGHEST (whole degrees) (2)	LOWEST (whole degrees) (3)	SNOWFALL (tenths) (sum 8)	TOTAL PRECIPITATION (hundredths) (sum 10)	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322)	DAYS WITH .04 INCH OR MORE PRECIPITATION (10)	BRIGHT SUNSHINE (tenths) (Form 2307)	HEATING DEGREE DAYS (sum 6)	MEAN PRESSURE (whole mb.) (mean 37)	MEAN RELATIVE HUMIDITY (whole %) (mean 38)
ATTN. CLIMATOLOGY		A	B	C	D	E	F	G	H	J	K	L

Form 63-2320

MONTHLY CLIMATOLOGICAL SUMMARY

ELEVATION 304 METERS — STATION "EAST MET. LAKE" — PROVINCE BAFFIN ISLAND N.W.T. — MONTH JUNE — 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m=\frac{T_x+T_n}{2}$ 5	Heating Degree Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour ___ST 11	Second Synoptic Hour ___ST 12	Third Synoptic Hour ___ST 13	Fourth Synoptic Hour ___ST 14	RELATIVE HUMIDITY Max. 15	Min. 16	Third Synoptic Hour ___ST 17	Fourth Synoptic Hour ___ST 18
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10	Site Installed - 17:00 EST																
11	28	23	51	26	39									100	84		
12	28	24	52	26	39									100	81		
13	28	20	48	24	41									100	88		
14	33	26	59	30	35									100	81		
15	30	25	55	28	37									100	77		
16	32	25	57	29	36									85	69		
17	37	22	59	30	35									86	66		
18	41	26	67	39	26									100	61		
19	36	23	64	32	33									100	70		
20	33	23	61	31	34									99	75		
21	33	27	60	30	35									100	76		
22	35	23	63	32	33									100	74		
23	38	23	66	33	32									100	63		
24	40	32	72	36	29									90	50		
25	40	28	68	34	31									85	44		
26	35	30	65	33	32									100	77		
27	41	32	73	37	28									100	60		
28	37	31	68	34	31									100	71		
29	40	27	67	34	31									100	68		
30	46	33	79	40	25									100	70		
31																	
SUM	752	540			662									1945	1405		
MEAN	37.6	27.0	64.6	32.2										97	70		

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust, Sand 25	Blowing Snow 26	WIND 32 mph or more 27	WIND 39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) 32	33	34	35	NOTES 36
1																	
2																	
3																	
4																	
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8																	
9																	
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27																	
28																	
29																	
30																	
31																	
SUM																	
MEAN																	

CLIMATOLOGICAL MESSAGE

ATTN. CLIMATOLOGY	STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5)	HIGHEST (whole degrees) (2)	LOWEST (whole degrees) (3)	SNOWFALL (tenths) (sum 8)	TOTAL PRECIPITATION (hundredths) (sum 10)	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322)	DAYS WITH .04 INCH OR MORE PRECIPITATION (10)	BRIGHT SUNSHINE (tenths) (Form 2307)	HEATING DEGREE DAYS (sum 6)	MEAN PRESSURE (whole mb.) (mean 37)	MEAN RELATIVE HUMIDITY (whole %) (mean 38)
		A	B	C	D	E	F	G	H	J	K	L

CALCULATION OF MEANS

	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour		
Mean of second Synoptic hour		
Mean of third Synoptic hour		
Mean of fourth Synoptic hour		
SUM		
MEAN		

Form 63-2320

MONTHLY CLIMATOLOGICAL SUMMARY

ELEVATION 304 METERS STATION "EAST MET. LAKE" PROVINCE BAFFIN ISLAND N.W.T. MONTH JULY 1967

DATE	Temperature: Max T_x	Min T_n	T_x+T_n	Mean $T_m = \frac{T_x+T_n}{2}$	Heating Degree Days $65-T_m$	Precipitation: Rainfall	Snowfall	Snowfall water equivalent	Total Precipitation	Sea Level Pressure: First Synoptic Hour ___ST	Second Synoptic Hour ___ST	Third Synoptic Hour ___ST	Fourth Synoptic Hour ___ST	Relative Humidity: Max.	Min.	Third Synoptic Hour ___ST	Fourth Synoptic Hour ___ST	DATE	Days with: Thunderstorm	Freezing Precipitation	Hail	Fog Ice Fog	Smoke Haze	Blowing Dust, Sand	Blowing Snow	Wind 32 mph or more	Wind 39 mph or more	Peak Wind Gust Direction	Speed	Time	(unassigned)				NOTES
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	M	M												M	M			1																	
2	M	M												M	M			2																	
3	M	M												91	76			3																	
4	M	M												94	40			4																	
5	52	38	90	45	20									94	85			5																	
6	44	36	80	40	25									94	53			6																	
7	49	41	90	45	20									94	74			7																	
8	45	34	79	40	25									94	94			8																	
9	44	32	76	38	27									94	55			9																	
10	50	35	85	48	17									94	58			10																	
11	49	35	84	42	23									94	53			11																	
12	50	37	87	49	16									95	91			12																	
13	40	32	72	36	29									95	78			13																	
14	41	35	76	38	27									94	78			14																	
15	41	38	79	40	25									95	80			15																	
16	40	32	72	36	29									97	66			16																	
17	41	33	74	37	28									94	81			17																	
18	36	26	62	31	34									M	M			18																	
19	40	30	70	35	30									M	M			19																	
20	48	32	80	40	25									M	M			20																	
21	54	39	93	47	18									M	M			21																	
22	56	42	98	49	16									M	M			22																	
23	60	44	104	52	13									M	M			23																	
24	52	44	96	48	17									M	M			24																	
25	55	42	97	49	16									M	M			25																	
26	64	50	114	57	8									M	M			26																	
27	M	M												M	M			27																	
28	M	M												M	M			28																	
29	M	M												M	M			29																	
30	M	M												M	M			30																	
31	M	M												M	M			31																	
SUM	10507	8028			488									1413	1062			SUM																	
MEAN	47.8	36.5	84.3	42.2										94	71			MEAN																	

CLIMATOLOGICAL MESSAGE

ATTN. CLIMATOLOGY	STATION NUMBER	Temperature: MEAN (tenths) (mean 5)	HIGHEST (whole degrees) (2)	LOWEST (whole degrees) (3)	SNOWFALL (tenths) (sum 8)	TOTAL PRECIPITATION (hundredths) (sum 10)	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322)	DAYS WITH .04 INCH OR MORE PRECIPITATION (10)	BRIGHT SUNSHINE (tenths) (Form 2307)	HEATING DEGREE DAYS (sum 6)	MEAN PRESSURE (whole mb.) (mean 37)	MEAN RELATIVE HUMIDITY (whole %) (mean 38)
		A	B	C	D	E	F	G	H	J	K	L

CALCULATION OF MEANS	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour		
Mean of second Synoptic hour		
Mean of third Synoptic hour		
Mean of fourth Synoptic hour		
SUM		
MEAN		

Form 63-2320

MONTHLY CLIMATOLOGICAL SUMMARY

BASE CAMP, 69° 35' N., 69° 58' W. STATION INUGSUIN FIORD PROVINCE BAFFIN ISLAND, N.W.T. MONTH JUNE 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m = \frac{T_x+T_n}{2}$ 5	Heating Degree Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour 01 EST 11	Second Synoptic Hour 07 EST 12	Third Synoptic Hour 13 EST 13	Fourth Synoptic Hour 19 EST 14	RELATIVE HUMIDITY First Synoptic Hour 01 EST 15	Second Synoptic Hour 07 EST 16	Third Synoptic Hour 13 EST 17	Fourth Synoptic Hour 19 EST 18	DATE 19
1	34	29	63	32	33		.4	.04	.04		1015.2	1012.9	1011.0	(100)	(97)	(98)	94	1
2	41	29	70	35	32					1009.1	1008.5	1006.6	1006.3	(86)	86	82	64	2
3	40	31	71	36	29	TR	TR	TR	TR	1007.0	1007.6	1005.5	1005.2	(85)	91	82	95	3
4	41	29	70	35	30					1006.0	1008.8	1008.2	1008.9	(83)	82	74	(84)	4
5	44	29	73	37	28					1009.1	1008.5	1006.1	1004.3	89	80	57	72	5
6	36	29	65	33	32					1000.5	999.0	999.0	999.3	81	88	74	86	6
7	39	29	68	34	31					999.9	1000.4	1001.7	1005.2	96	69	67	65	7
8	41	32	73	37	28					1007.8	1009.9	1010.1	1011.0	78	79	56	74	8
9	44	31	75	38	27					1009.0	1006.0	1003.1	1003.5	76	52	47	82	9
10	(38)	31	69	35	30					1004.2	1006.1	1007.2	1009.0	97	70	(66)	(60)	10
11	37	31	68	34	31					1010.3	1012.0	1013.0	1015.6	(83)	76	65	69	11
12	39	32	71	36	29					1017.0	1020.9	1021.4	1022.9	74	69	48	68	12
13	39	32	71	36	29					1022.8	1022.1	1017.5	1012.8	65	61	97	57	13
14	41	35	76	38	27					1011.0	1009.2	1007.5	1006.7	72	79	82	61	14
15	37	31	68	34	31		TR		TR	1006.2	1007.0	1006.6	1007.6	76	90	62	76	15
16	39	31	70	35	30		TR		TR	1008.7	1010.1	1009.0	1009.2	80	80	69	73	16
17	39	30	69	35	30					1009.0	1009.0	1007.3	1007.1	75	71	71	84	17
18	40	27	67	34	31					1006.9	1007.6	1007.0	1008.8	99	97	78	91	18
19	49	28	77	39	26	TR			TR	1009.9	1009.5	1006.5	1007.1	99	94	48	59	19
20	42	34	76	38	27	.03	1.6	.16	.19	1007.6	1010.5	1012.3	1013.7	69	62	59	91	20
21	41	34	75	38	27	.29	0.2	.02	.31	1013.6	1012.5	1011.0	1010.3	94	86	91	89	21
22	38	33	71	36	29	.03	0.4	.04	.07	1011.2	1009.7	1004.2	1000.6	85	88	77	97	22
23	41	33	74	37	28	TR	0.1	.01	.01	998.2	998.3	997.7	996.8	88	69	67	78	23
24	40	37	77	39	26	TR			TR	996.3	997.3	998.0	997.4	70	75	75	69	24
25	40	35	75	38	27					995.3	(994.3)	994.1	994.6	66	(62)	80	79	25
26	41	35	76	38	27	TR			TR	995.3	996.5	997.9	999.7	71	88	81	85	26
27	47	34	81	42	23	.01			.01	1000.7	1001.0	999.0	998.2	94	89	71	81	27
28	37	31	68	34	31		TR	TR	TR	998.7	1000.8	1002.6	1005.8	85	70	69	85	28
29	41	32	63	32	33	TR			TR	1007.7	1009.0	1009.8	1011.3	90	81	85	85	29
30	41	35	76	38	27	TR			TR	1012.0	1013.1	1013.1	1013.6	91	94	86	72	30
31																		31
SUM	1207	94.9			869	0.36	2.7	0.27	0.63	29191.0	30220.4	30195.9	30203.5	2497	2375	2164	2325	SUM
MEAN	40.2	31.6	71.8	35.9						1006.6	1007.3	1006.5	1006.8	83	79	72	78	MEAN

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust, Sand 25	Blowing Snow 26	WIND 32 mph or more 27	39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) Actinograph (arbitrary) 32	Langley/day 33	Sunshine/hours 34	Mean wind speed 01-01 EST M/S 35	NOTES 36
1																	
2																	Temperatures based on avail-
3																	able observations and
4																	thermograph records.
5																	Bracketed humidities estimated
6																	from thermohygrograph
7																	
8																	
9																	
10																	
11																	
12																	
13		1											22.8	307.8			
14													26.7	360.5			
15													35.1	473.9			
16													51.3	692.6			
17													42.3	571.1			
18													54.5	735.8			
19													47.6	642.6		2.5	Anemometer height 3.05 meters
20													28.3	382.1		3.9	Location - Moraine ridge
21													19.9	268.7		2.9	Moraine ridge height 25 meters
22													25.8	348.3		5.4	
23													29.8	402.3		10.6	
24													27.1	365.9		8.4	
25													31.5	425.3		6.8	
26													31.3	422.6		2.1	
27													35.0	484.7		5.9	
28													18.0	243.0		6.1	
29													33.8	456.3		1.3	
30													29.5	398.3		1.2	
31																	
SUM		1											590.3	7981.8		58.4	
MEAN													32.8	443.4		1.94	

CALCULATION OF MEANS

	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour	1006.6	83
Mean of second Synoptic hour	1007.3	79
Mean of third Synoptic hour	1006.5	72
Mean of fourth Synoptic hour	1006.8	78
SUM	4027.2	312
MEAN	1006.8	78

CLIMATOLOGICAL MESSAGE

ATTN. CLIMATOLOGY	STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5) A	HIGHEST (whole degrees) (2) B	LOWEST (whole degrees) (3) C	SNOWFALL (tenths) (sum 8) D	TOTAL PRECIPITATION (hundredths) (sum 10) E	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322) F	DAYS WITH .04 INCH OR MORE PRECIPITATION (10) G	BRIGHT SUNSHINE (tenths) (Form 2307) H	HEATING DEGREE DAYS (sum 6) J	MEAN PRESSURE (whole mb.) (mean 37) K	MEAN RELATIVE HUMIDITY (whole %) (mean 38) L

Form 63-2320

MONTHLY CLIMATOLOGICAL SUMMARY

BASE CAMP, 69° 35' N., 69° 58' W. STATION INUGSUIN FIORD PROVINCE BAFFIN ISLAND, N.W.T. MONTH JULY 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m = \frac{T_x+T_n}{2}$ 5	Heating Degree Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour 01 EST 11	Second Synoptic Hour 07 EST 12	Third Synoptic Hour 13 EST 13	Fourth Synoptic Hour 19 EST 14	RELATIVE HUMIDITY First Synoptic Hour 01 EST 15	Second Synoptic Hour 07 EST 16	Third Synoptic Hour 13 EST 17	Fourth Synoptic Hour 19 EST 18
1	53	35	88	44	21					1014.6	1013.1	1009.0	1008.1	85	80	70	45
2	49	34	83	42	23					1010.2	1010.6	1011.1	1012.0	52	65	77	83
3	52	35	87	44	21					1011.9	1010.6	1008.5	1008.8	94	65	50	55
4	55	42	97	49	16					1009.6	1010.8	1009.8	1011.1	62	62	48	62
5	60	43	103	52	13					1012.8	1014.8	1012.4	1012.8	69	53	42	45
6	55	46	101	51	14					1012.9	1010.9	1008.9	1007.5	61	59	63	66
7	54	41	95	48	17	.03			.03	1009.6	1010.7	1008.8	1008.4	80	91	81	68
8	64	40	104	52	13					1008.0	1007.7	1007.0	1007.6	82	55	43	71
9	42	36	78	39	16	.04			.04	1010.3	1013.6	1014.8	1016.0	84	97	97	97
10	42	35	77	39	16					1017.3	1018.7	1017.8	1018.1	94	97	94	84
11	52	38	90	45	20					1018.9	1020.7	1020.2	1021.2	92	89	67	84
12	46	36	82	41	24					1021.2	1020.9	1018.2	1016.5	92	90	82	80
13	53	42	95	48	17	.18			.18	1015.0	1015.0	1013.0	1011.0	82	75	86	74
14	49	40	89	50	15	1.57			1.57	1009.0	1007.7	1007.8	1007.2	96	93	79	85
15	51	43	94	47	18	.19			.19	1008.0	1009.0	1008.8	1008.3	78	89	89	74
16	50	41	91	46	19	.04			.04	1007.2	1006.5	1005.0	1006.3	69	87	89	73
17	49	40	89	50	15	TR			TR	1007.5	1009.0	1008.2	1007.9	75	74	72	64
18	45	33	78	39	26	.02	.7	.07	.09	1005.8	1002.0	999.3	1001.0	81	71	67	89
19	46	33	79	40	25		TR	TR	TR	1001.0	1002.7	1004.0	1006.6	97	97	74	71
20	42	33	75	38	27					1008.2	1009.7	1010.3	1010.0	87	83	81	90
21	48	34	82	41	24					1010.0	1009.9	1009.3	1010.0	97	90	83	69
22	51	39	90	45	20					1010.9	1010.7	1009.0	1008.6	83	78	73	71
23	68	42	110	55	10					1009.0	1009.0	1007.8	1008.0	86	57	31	71
24	65	49	114	57	8					1009.0	1009.9	1009.0	1009.0	56	61	73	64
25	66	44	108	54	11					1009.4	1011.5	1012.0	1015.0	77	65	42	77
26	69	43	112	56	9					1016.1	1015.6	1012.7	1012.0	87	70	59	68
27	60	44	104	52	13					1012.3	1012.9	1011.5	1011.9	77	81	74	64
28	60	44	104	52	13					1012.9	1013.4	1011.3	1011.4	75	67	54	54
29	55	41	96	48	17					1012.0	1013.3	1013.2	1014.0	78	81	64	73
30	47	40	87	44	21					1016.2	1018.0	1017.8	1018.0	88	83	73	79
31	51	43	94	47	18					1018.4	1019.2	1018.1	1017.7	78	76	61	61
SUM	1649	1229			540	2.07	.7	.07	2.14	31355.2	31368.1	31334.6	31342.0	2494	2381	2138	2211
MEAN	53.2	39.6	92.8	46.4						1011.4	1011.9	1010.8	1011.0	80	77	69	71

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust Sand 25	Blowing Snow 26	WIND 32 mph or more 27	39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) Actinograph (arbitrary) 32	Langley/day 33	Sunshine/hours 34	Mean wind speed 01-01 EST M/S 35	NOTES 36
1													49.3	665.6		2.5	Anemometer height 3.05 meters
2													36.1	487.4		2.9	Location - Moraine ridge
3													43.2	583.2		2.8	Moraine ridge height 25 meters
4													46.8	631.8		2.2	
5													48.8	658.8	8.4	3.8	Sunshine recorder installed
6													15.2	205.2	0.7	4.2	on July 5
7													38.0	513.0	6.2	1.3	
8													32.0	432.0	4.6	1.9	
9													16.7	225.5	0.5	1.4	
10				1									37.7	509.0	7.9	1.5	
11													40.6	548.1	6.2	2.8	
12													48.6	656.1	15.1	1.5	
13													17.6	237.6	0.4	2.6	
14					1								13.9	187.7	0.0	2.5	
15													12.6	170.1	0.4	2.7	
16													15.2	205.2	0.1	2.3	
17													31.4	428.9	6.1	2.9	
18													13.5	182.3	0.0	5.9	
19													48.1	649.4	11.3	1.7	
20													43.4	585.9	9.0	1.7	
21													46.5	627.8	13.9	1.5	
22													47.6	642.6	15.6	1.6	
23													42.4	572.4	16.1	2.5	
24													29.9	403.7	6.9	3.7	
25													17.8	240.3	2.9	3.7	
26													14.1	554.0	14.5	1.7	
27													43.7	590.0	16.2	1.8	
28													42.2	569.7	16.4	1.7	
29													44.4	599.4	16.4	3.7	
30													32.9	444.2	7.6	6.1	
31													42.4	572.4	12.7	6.3	
SUM				1	1								10526	14575.2	216.1	85.4	
MEAN													339.6	470.2	7.0	2.75	

CALCULATION OF MEANS

	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour	1011.4	80
Mean of second Synoptic hour	1011.9	77
Mean of third Synoptic hour	1010.8	69
Mean of fourth Synoptic hour	1011.0	71
SUM	4045.1	297
MEAN	1011.3	74

CLIMATOLOGICAL MESSAGE

	STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5)	HIGHEST (whole degrees) (2)	LOWEST (whole degrees) (3)	SNOWFALL (tenths) (sum 8)	TOTAL PRECIPITATION (hundredths) (sum 10)	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322)	DAYS WITH .04 INCH OR MORE PRECIPITATION (10)	BRIGHT SUNSHINE (tenths) (Form 2307)	HEATING DEGREE DAYS (sum 6)	MEAN PRESSURE (whole mb.) (mean 37)	MEAN RELATIVE HUMIDITY (whole %) (mean 38)
ATTN. CLIMATOLOGY		A	B	C	D	E	F	G	H	J	K	L

MONTHLY CLIMATOLOGICAL SUMMARY

BASE CAMP, 69° 35' N., 69° 58' W. STATION INUGSUIN FIORD PROVINCE BAFFIN ISLAND, N.W.T. MONTH AUGUST 1967

DATE 1	TEMPERATURE Max T_x 2	Min T_n 3	T_x+T_n 4	Mean $T_m = \frac{T_x+T_n}{2}$ 5	Heating Degree Days $65-T_m$ 6	PRECIPITATION Rainfall 7	Snowfall 8	Snowfall water equivalent 9	Total Precipitation 10	SEA LEVEL PRESSURE First Synoptic Hour 01 EST 11	Second Synoptic Hour 07 EST 12	Third Synoptic Hour 13 EST 13	Fourth Synoptic Hour 19 EST 14	RELATIVE HUMIDITY First Synoptic Hour 01 EST 15	Second Synoptic Hour 07 EST 16	Third Synoptic Hour 13 EST 17	Fourth Synoptic Hour 19 EST 18
1	50	43	93	47	18					1018.1	1019.0	1017.8	1017.9	74	78	70	75
2	50	42	92	46	19					1018.0	1018.7	1017.3	1016.3	78	78	75	71
3	46	42	88	44	21	TR			TR	1016.3	1016.2	1015.0	1015.0	83	82	78	85
4	48	39	87	44	21	TR			TR	1015.0	1014.7	1013.4	1012.4	86	86	85	81
5	53	41	94	47	18					1012.2	1011.3	1009.2	1007.1	90	85	74	62
6	47	42	89	45	20					1005.8	1005.1	1004.0	1003.9	69	80	80	80
7	47	41	88	44	21	.05			.05	1003.6	1004.3	1004.8	1006.1	86	91	85	83
8	54	43	97	49	16	.04			.04	1007.0	1008.1	1007.9	1008.8	98	89	65	63
9	55	45	100	50	15	.13			.13	1011.0	1011.4	1009.6	1008.3	66	62	61	80
10	50	44	94	47	18	.48			.48	1006.7	1005.1	1002.4	999.8	98	93	91	88
11	48	42	90	45	20	.04			.04	999.0	1000.9	1002.8	1006.1	98	93	81	84
12	51	42	93	47	18					1008.0	1010.0	1008.7	1008.0	86	86	69	78
13	47	41	88	44	21	.31			.31	1005.8	1001.2	996.2	992.0	86	86	84	55
14	46	40	86	43	22	.08			.08	990.0	988.6	990.2	989.2	90	93	79	70
15	48	41	89	50	15	.08			.08	987.0	989.2	988.2	989.4	87	70	48	74
16	43	40	83	42	23	.01			.01	989.3	990.5	993.1	995.6	88	79	66	82
17	44	38	78	39	26					996.2	997.0	996.9	998.3	73	75	67	87
18	45	38	83	42	23	TR			TR	999.2	999.7	1000.0	1002.0	85	85	78	78
19	43	38	81	41	24					1003.1	1006.4	1008.3	1010.0	73	71	73	78
20	53	38	91	46	19	TR			TR	1011.7	1010.0	1009.6	1009.0	92	66	41	61
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
SUM																	
MEAN																	

DATE 19	DAYS WITH Thunderstorm 20	Freezing Precipitation 21	Hail 22	Fog Ice Fog 23	Smoke Haze 24	Blowing Dust, Sand 25	Blowing Snow 26	WIND 32 mph or more 27	39 mph or more 28	PEAK WIND GUST Direction 29	Speed 30	Time 31	(unassigned) Actinograph (arbitrary) 32	Langley/day 33	Sunshine/hours 34	Mean wind speed 01-01 EST M/S 35	NOTES 36
1													34.1	460.4	4.4	5.7	Anemometer height 3.05 meters
2													31.5	425.3	8.6	6.6	Location - Moraine ridge
3													25.7	347.0	0.0	4.6	Moraine ridge height 25 meters
4													24.2	326.7	4.5	2.3	
5													28.5	384.8	5.3	4.2	
6													15.6	210.6	0.0	6.6	
7													21.7	293.0	.2	1.4	
8													26.6	359.1	4.2	3.3	
9													24.7	333.5	2.5	1.5	
10					1								14.4	194.4	0.0	0.9	
11					1								21.8	294.3	1.7	4.5	
12													37.0	499.5	10.2	3.3	
13													8.3	112.1	0.0	4.3	
14													16.3	220.1	1.7	2.7	
15													21.6	291.6	3.9	2.3	
16													18.4	248.4	1.0	2.8	
17													18.6	251.1	2.5	5.7	
18													15.8	213.3	0.2	3.4	
19													26.4	356.4	5.7	4.5	
20													22.9	309.2	5.6	4.9	
21													11.7	158.0			Observations discontinued at
22																	0100 EST on August 22
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
SUM					2								465.8	6288.8	62.2	75.5	
MEAN													22.2	299.5	3.9	3.77	

CLIMATOLOGICAL MESSAGE

STATION NUMBER	TEMPERATURE MEAN (tenths) (mean 5) A	HIGHEST (whole degrees) (2) B	LOWEST (whole degrees) (3) C	SNOWFALL (tenths) (sum 8) D	TOTAL PRECIPITATION (hundredths) (sum 10) E	DEPTH OF SNOW ON GROUND (inches) (12Z obs. for last day, Form 2322) F	DAYS WITH .04 INCH OR MORE PRECIPITATION (10) G	BRIGHT SUNSHINE (tenths) (Form 2307) H	HEATING DEGREE DAYS (sum 6) J	MEAN PRESSURE (whole mb.) (mean 37) K	MEAN RELATIVE HUMIDITY (whole %) (mean 38) L

ATTN. CLIMATOLOGY

CALCULATION OF MEANS

	PRESSURE 37	Mean Relative Humidity 38
Mean of first Synoptic hour		
Mean of second Synoptic hour		
Mean of third Synoptic hour		
Mean of fourth Synoptic hour		
SUM		
MEAN		

Form 63-2320

FUNGI OF CENTRAL BAFFIN ISLAND[1]

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INTRODUCTION

The Plant Research Institute, Canada Department of Agriculture currently carries a project to study the fungi of the Canadian Arctic. This large geographical area was little known mycologically until 1950 and until 1967 Baffin Island was still poorly sampled.

In 1967, 4 DEW line (Distant Early Warning) sites were used as working bases from which to collect fleshy saprophytic fungi, parasitic fungi and their host plants. All of these sites, except inland plateau Fox 3 are on exposed coastal locations and the opportunity to use the Geographical Branch Camp at Inugsuin Fiord as another base was greatly appreciated because its location, some 70 miles inland from the outer coast, offered habitat protection not found at the other sites.

The sites at which specimens were taken are located from the east to west coasts of Baffin Island approximately at mid-length. They are:

Cape Dyer (DYE Main 66°35'N61°37'W)

Cape Hooper (FOX 4 68°26'N66°44'W)

Inugsuin Fiord (Geographical Branch Camp 69°37'N70°02'W)

Dewar Lakes (FOX 3 68°37'N71°07'W)

Longstaff Bluff (FOX 2 68°56'N75°18'W)

The time spent at each site was governed by a first impression of the flora and by the weather conditions permitting air travel. Only 3 days each

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[1] This article has been submitted for publication in the Canadian Field Naturalist 1969.

were spent at Cape Hooper and at Dewar Lakes and about one week at each of the other sites. In this time some 500 specimens (phanerogamic and cryptogamic) were collected including some soil samples for future determination of soil fungi. In addition 450 specimens of mosses were made by J. R. Seaborn who assisted in the 1967 program.

The mycological specimens are deposited in the National Mycological Herbarium (DAOM) and many will be distributed in our normal exchange program. The vascular specimens are deposited in the Phanerogamic Herbarium (DAO); both herbaria are in the Plant Research Institute, Central Experimental Farm, Ottawa.

GENERAL OBSERVATIONS

On arrival at Cape Dyer on July 14, the plateau level of the lower camp was covered with up to 3 ft. of snow. Collecting was limited to southwest facing slopes leading to Sunneshine Fd. and plant growth was more advanced nearest the fiord and sea level. One week later and 200 hundred miles west at Cape Hooper, essentially the same snow conditions were experienced. Again collecting was limited to southerly exposures. Just four days later at the head of Inugsuin Fiord some 120 miles northwest of Hooper, snow was absent although Lakes 1. and 2. were partly ice-covered and plant growth was considerably in advance of that seen at the other sites. Plants of the base camp area have been listed by Hainault (1966). To this list can be added:

Carex marina Dew.

C. membranacea Hook.

C. ursina Dew.

Juncus albescens (Lge.) Fern.

J. arcticus Willd.

Eriophorum triste (Th. Fr.) Hadac.

E. vaginatum L. ssp. *spissum* (Fern.) Hult.

Puccinellia langeana (Berk.) Th. Sør.

Ranunculus sulphureus Sol.

Anemone parviflora Michx.

Draba hirta L.

Hippuris vulgaris L.

Saxifraga aizoides L.

S. nivalis L.

All but 5 of the above species were earlier recorded for the Isortoq Fiord area by Webber (1964) and their occurrence at Inugsuin Fiord was to be expected.

The flora of the east coast sites and the Dewar Lakes site is generally similar. Only at the west coast site of Longstaff Bluff did additional species appear. Here were found additional Leguminosae (*Astragalus alpinus* L., *Oxytropis maydelliana* Trautv. and *O. arctobis* Bunge) and Compositae (*Matricaria ambigua* (Ledeb.) Kryl., *Senecio congestus* (R.Br.) DC. *Chrysanthemum integrifolium* Rich.) These elements occur farther west along the mainland coast. A comparison of plant lists by Hainault and Webber (op. cit.) supports my general impression that the western coast of Baffin Island supports the richer flora. A number of causes may be responsible for this and a probable main factor is the slightly ameliorated climate. Accompanying an increase of species in the west will be an increase in the associated parasitic fungi.

In the following annotated list, the fleshy fungi (Agaricales) have been identified by J. W. Groves and Sclerotinias were named by Mary E. Elliott. The collection numbers are those of the author.

FUNGI IMPERFECTI

Cladosporium herbarum (Pers.) Lk. on Poa arctica R.Br. (3998 c Inugsuin). Primarily saprophytic following heavy incidence of mildew. A common saprophyte on a wide range of hosts.

Cylindrosporium serabrankowii (Bub.) Bub. on Astragalus alpinus L. (4042, 4151 Longstaff) and on Oxytropis maydelliana Trautv. (4150 a Longstaff). The latter is a new host for this parasite.

Phyllosticta sp. on Oxytropis maydelliana Trautv. (4150 b Longstaff). Temporarily assigned to Phyllosticta.

Selenophoma drabae (Fuckel) Petrak. (=Selenophoma donacis (Pers.) Sprague var. stomaticola (Baeuml.) Sprague & Johns.) on Arctagrostis latifolia (R.Br.) Giseb. (4051 b Longstaff). This fungus has a wide host range including many Cruciferae. The above grass is thought to be a new host.

PHYCOMYCETES

Peronospora parasitica (Pers.) Fr. on Eutrema edwardsii R.Br. (4070 b), on Draba sp. (4084), on Cochlearia officinalis L. (4147) all from Longstaff. Occurs on the undersurface of leaves of these and other Cruciferae in the arctic.

ASCOMYCETES

Cenangium arcticum Ehrenb. ex Fr. on Cassiope tetragona (L.) D.Don (3787 b Cape Hooper). Saprophytic on stems from previous season.

Erysiphe graminis DC. ex Mérat on Poa arctica R.Br. (3998 Inugsuin and 4021b, 4035 Dewar Lakes). Fairly common, known on other grasses and regularly associated with rust infection.

Helvella leucomelaena (Pers.) Nannf. On moist bare soil at sea level (4122 Longstaff). A fleshy discomycete, or cup fungus, black-brown and deeply cup-shaped.

Helvella queletii Bres. on disturbed wet gravel near airstrip (4087 Longstaff). Size: 1-4 cm diam., colour: dark brown.

Isothea rhytismoides (Bab. ex Berk.) Fr. on Dryas integrifolia M. Vahl. (3937 b Inugsuin and 4039 b Longstaff). Causing locally heavy infection at both sites. This fungus ranges widely in the northern hemisphere and is known only on Dryas.

Mycosphaerella chamaenerii Savile. stat. conid.: Ramularia chamaenerii Rostr. on Epilobium latifolium L. (4111b Longstaff).

Mycosphaerella saxifragae (Pass.) Lind on Saxifraga foliosa R.Br. (3885 c Inugsuin).

Peziza melaleuca (Bres.) Seaver. On disturbed wet gravel in close proximity to H. queletii; readily distinguished by smaller size, 1.0 cm diam. or less, and darker colour (4088 Longstaff).

Rhytisma bistortae (DC.) Rostr. on Polygonum viviparum L. (4157 C. Dyer). Symptoms as in the following fungus but found only rarely.

Rhytisma salicinum (Pers. ex Fr.) Fr. on *Salix arctophila* Cock. (4009 c Inugsuin, 4022 b Dewar L., 4091 b, 4133 Longstaff) and on *S. herbacea* L. (3930 Inugsuin, 4092 c Longstaff). Infection was usually heavier on *S. arctophila*. Widespread throughout the arctic and sub-arctic on numerous species of willow. The raised, black shiny fructifications on young leaves are easily observed. Maturity occurs over winter and ascospores are produced on necrotic leaves one to three years old.

Sclerotinia vahliana Rostr. on *Eriophorum angustifolium* Honck. (3894 Inugsuin, 4085 Longstaff), on *E. scheuchzeri* Hoppe (3807 b C. Hooper). Some general comparisons between *S. dennisii* Svreck and *S. valhiana* have been given by Savile and Parmelee (1964).

Scutellinia armatospora Denison among mosses on disturbed wet gravel, locally common (4086 Longstaff). The hymenium of this small discomycete is bright red.

Sphaerotheca fuliginea (Schlecht. ex Fr.) Pollaci on *Braya purpurascens* (R.Br.) Bunge (4071 b Longstaff). This powdery mildew was found only on *Braya* but is recorded on other Cruciferae and indeed other families.

BASIDIOMYCETES (Ustilaginales)

Anthracoidea elynae (Syd.) Kukk. var. *elynae* on *Kobresia myosuroides* (Vill.) Fiori & Paol. (3862 b, 3986, 3987 Inugsuin and 4191 C. Dyer.). A very common smut of the achenes.

Anthracoidea rupestris Kukk. on *Carex rupestris* All. As above the achene is replaced by a black ball of smut spores.

Schizonella elynae (Blytt) Liro. on *Kobresia myosuroides* (Vill.) Fiori & Paol. (4192). This leaf smut is known also from one alpine region in British Columbia. It is rarely collected and apparently this is the most northerly Canadian record.

Ustilago bistortarum (DC.) Körn on Polygonum viviparum L. (3841, 3842 Inugsuin; 4031 Dewar L.; 4158 C. Dyer). Occurs widely over the range of the host and in three distinct phases which have been treated also as varieties or even species. The phases are: inflorescence smut, leaf blade smut and leaf margin smut. Collections 3841 and 3842 from the same colony are the inflorescence and leaf blade phase respectively, supporting an earlier suggestion (Savile and Parmelee 1965) that the three phases are but a single species.

Ustilago vinosa Berk. ex Tul. on Oxyria digyna (L.) Hill (3924, 3946 a Inugsuin; 4135 Longstaff; 4159 C. Dyer). This inflorescence smut was found wherever there were good-size colonies of the host. All sites were moist but not wet, often located below a snowdrift.

Ustilago violacea (Pers.) Roussell var. violacea on Silene acaulis L. var. exscapa (All.) DC. (3929 Inugsuin, 4190 C. Dyer); and on Stellaria edwardsii R.Br. (3872 b, 4008 Inugsuin). Using hosts as a basis, this anther smut on S. edwardsii may be identified as U. violacea var. stellariae (Sow.) Savile. Observations of smut spores do not confirm this - their size intergrades with var. violacea indicating a need for additional study of this complex.

BASIDIOMYCETES (Uredinales)

Chrysomyxa ledi (Alb. & Schw.) deBary var. rhododendri (deBary) Savile on Rhododendron lapponicum Wahlenb. (3943 b, 3989 Inugsuin).

The host occurred sparingly at Cape Dyer and was not rusted. It was common on the dry protected slopes at the head of Inugsuin Fiord and rust infection was moderately heavy. We have one specimen from Frobisher Bay - the only other collection from Baffin Island. This and the following species of Chrysomyxa are examples of heteroecious rusts existing successfully far from their alternate host in this instance, 350-800 miles north of Picea. Spread over such a distance can be explained using this species as an example: once established from the closest Picea, the uredinia build up on Rhododendron and repeat on adjacent plants. From the west, south or east urediniospores could survive the 100-150-250 mile aerial dispersal from Southampton Is., Ungava or Greenland to Baffin Island and continue spread from Rhododendron to Rhododendron. If this is so, rust may be found on Rhododendron to its limit in northern Baffin.

Chrysomyxa ledicola (Peck) Lagerh. on Ledum palustre L. var. decumbens Ait. (3846 b, 3980 Inugsuin, 4028 Dewar L.: 4041 Longstaff). There was heavy infection at all collecting sites and these are at the northern limit of the host (Porsild 1957).

Chrysomyxa empetri (Pers.) Schroet. on Empetrum nigrum L. (4000 b, Inugsuin;4103, 4143 Longstaff). Light to heavy infection was encountered. Porsild (1957) shows widely dispersed host records north of 70° lat. and these rust collections may be at the northern limit of the rust.

Melampsora epitea Thuem. on Salix arctica Pall. (3706 b C. Dyer), on S. arctophila Cock. (3700a, 3743 C.Dyer; 3996 C. Hooper; 4022 c Dewar L.; 3864 b, 4009 b Inugsuin), on S. herbacea L. (4019 b Dewar L.; 4092 b Longstaff), on S. reticulata L. (3882 b, 3931 b Inugsuin; 4074 b, 4129 b Longstaff) on _Salix_ sp. (3835 a Inugsuin). The aecial state occurs on _Saxifraga_ in the arctic, but was not found. In the high arctic the rust generally overwinters in the buds of _Salix_ and survives without host alternation. Comparison of urediniospores originating from the different _Salix_ spp. shows slight differences but extensive study of the complex is required before such characters can be used in any taxonomic revision.

Puccinia arenariae (Schum.) Wint. on _Cerastium alpinum_ L. (4052 b, 4148 b Longstaff). Widely distributed throughout the world on Caryophyllaceae. It is especially widely represented in DAOM from alpine and sub-arctic regions.

Puccinia bistortae (Strauss) DC. on _Polygonum viviparum_ L. (3702 b C. Dyer; 3843 a, 3973 Inugsuin). Both uredinia and telia were present on young plants recently emerged from snow cover when collected on 14 July.

Puccinia eutremae Lindr. on _Cochlearia officinalis_ L. (4146 Longstaff). Infection was heavy on young plants otherwise only moderate in protected habitats along the rocky coast. Other susceptible Cruciferae include _Eutema edwardsii_. Our rust records do not extend farther north although hosts are amply recorded from the high arctic.

Puccinia pazschkei Diet. var _tricuspidatae_ Savile on _Saxifraga tricuspidata_ Rottb. (4145 Longstaff). The host is a wide ranging arctic-alpine species with which the rust is nearly co-extensive.

Puccinia poae-nemoralis Otth. ssp. _poae-nemoralis_ on _Poa arctica_ R.Br. (4040 a Longstaff). The host was locally common and just lightly infected with rust. As is usual for this species, only uredinia were present on the leaves.

Puccinia pedicularis Thuem. on *Pedicularis flammea* L. (4160 b C. Dyer). This is the first North American collection of this microcyclic rust. It was found only once, and then sparingly, although searched for diligently at all collecting sites. This rust is known also from northeast Greenland on the same host.

BASIDIOMYCETES (Exobasidiaceae)

Exobasidium vaccinii Wor. var. *vaccinii* on *Cassiope tetragona* (L.) D.Don (4020 b Dewar L; 4114, 4152 Longstaff; 4189 C. Dyer).

Exobasidium vaccinii - uliginosi Boud. var. *vaccinii - uliginosi* on *Vaccinium uliginosum* L. (3829 a Inugsuin, 4104 b Longstaff). *Exobasidium* is parasitic on leaves and is readily recognized. Leaves are slightly enlarged, often reddened and covered by a downy bloom formed by the fungus. The first species recorded here is common and widely distributed throughout the arctic; the second is mainly at low-arctic and sub-arctic sites.

BASIDIOMYCETES (Lycoperdales)

Calvatia cretacea (Berk.) Lloyd on soil in various plant associations. (3732, 3773, 3776 C.Dyer; 3907 Inugsuin; 4018 Dewar L; 4090 Longstaff). A common puffball, often abundant; in 1967 found up to 8.5 cm diameter. It is edible when young.

BASIDIOMYCETES (Agaricales)

These fleshy fungi are associated with a soil habitat where there is some decaying organic material. Occasionally they are associated with living plant material, although usually not as a parasite (cf. *Leptoglossum lobatum*). Many are edible, some doubtfully so and some are poisonous.

Notes about edibility are based on remarks by Singer (1962) and Groves (1962). Identifications herein are by Dr. J. W. Groves.

Amanitopsis inaurata (Pers.) Fayod. (3962, 3992 Inugsuin; 4172 C. Dyer). Scarce on moist slopes. Cap or pileus is silvery brown, shiny but not sticky. Widely distributed in Canada. Singer considers this in the genus Amanita which has a number of poisonous species.

Clitocybe luteovitellina (Pilat & Nannf.) Bigelow (3888, 3890 Inugsuin). Associated with sphagnum and having a predominantly northern distribution. Cap is pale yellow.

Clitocybe umbellifera (Fr.) Bigelow. (3772 C. Dyer). Widely collected in the arctic and often associated with mosses.

Cortinarius sp. (3731 C. Dyer; 3825 C. Hooper; 3886, 3975, 3994 Inugsuin).

Galerina vittaeformis (Fr.) Singer var. vittaeformis f. tetraspora (3887 Inugsuin). There is one previous Canadian collection in DAOM from Victoria, B.C. The genus contains edible and poisonous species and is therefore not widely used as food.

Hebeloma hiemale Bres. (3910, 3993 Inugsuin). Specimens in DAOM are mostly from northern Canada, a few from Ontario, and are often from an association with Dryas.

Hebeloma sordidulum (Peck) Sacc. (3749 C. Dyer; 3889, 3974 Inugsuin). These specimens are from Cassiope heaths and all specimens in DAOM are from north of tree line. Accordingly to Singer (1951) the species concept of the genus is not clear. At least one species is known to be poisonous.

Inocybe lorillardiana Murr. (4171 C. Dyer). Arctic collections in DAOM are often but not always from a Dryas association.

Laccaria tetraspora Singer (3775 C. Dyer). There are only 3 specimens in DAOM all from sandy habitats. Not amoung the species listed as being edible.

Lactarius speciosus Burl. (4153 Longstaff). Most species of Lactarius are edible but Groves (1962) warns that those with an acrid taste should be avoided.

Leptoglossum lobatum (Pers. ex Fr.) Ricken (4170 C. Dyer). This is a common fungus in the arctic, always growing parasitically on mosses. It is of doubtful food use -- pileus, or cap, very thin.

Omphalia onisca Fr. (3823, 3826 C. Hooper). Both collections are from low-lying wet sand. Fructifications small and poorly represented in DAOM.

Russula flava Rom. (4045 Longstaff). Rare on a grassy, stony beach. The slimy and sticky yellow pileus in this collection up to 6.0 cm diameter. Common in wooded regions of Canada and U.S.A. Most Russula species are edible -- Singer names R. foetans as being probably slightly poisonous. Groves reports R. flava as edible.

Russula fragilis Fr. (3958 Inugsuin). The cap is pale pink, tinged red, smaller than R. flava and with a like distribution. Groves considers the edibility of this species as doubtful.

Russula nigrodisca Peck (3908, 3976, 3990 Inugsuin; 4117 Longstaff). In this species the cap becomes bright red. During August of 1967 the fructifications became almost abundant on some slopes and the moist areas.

Russula venosa Vel. (3959 Inugsuin). The cap is dark orange-red. The fungus was growing adjacent No. 3958 in a wet runnel. Both fungi were rare at this site.

Stropharia aeruginosa (Curt. ex Fr.) Quél. (3909 Inugsuin). The cap is yellowish green. Some species in the genus are considered edible but are rarely eaten. Groves indicates that this species is reported to be poisonous.

Many saprophytic Ascomycetes and Fungi Imperfecti have been removed from 1, 2 and 3-year old stems and leaves of numerous plants. These await future study.

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GEOLOGICAL STUDIES ON BAFFIN ISLAND, 1967:

PRELIMINARY REPORT

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It is often assumed that all aspects of dyke intrusion and solidification are reasonably well understood. Although it is the simplest type of intrusive body, and we perhaps know more about it than the other forms, such a view is far from true. Recent petrological research has tended to concentrate on the intriguing, but almost hopelessly complex, problems of the more irregularly shaped intrusions completely ignoring the more subtle, but important, problems of dykes and dyke formation. If the intricate processes of magmatic intrusion and crystallization are ever to be understood much more attention will have to be given to the evidence offered by natural dykes and sills.

The 100 m wide olivine tholeiite 'Kigaviarluk Dyke' on Baffin Island is one of the best exposed dykes known to us. Its outcrop is remarkably perfect over a distance of 10 km and its complete width from contact to contact is available for the most detailed study continuously over a distance of 3 km.

Two weeks in June 1967 were spent on the field study of the 'Kigaviarluk Dyke'. Work consisted of detailed petrographic investigations, the measurement of ten sections across the dyke, collection of samples at carefully measured distances from the contact and the collection of data on the statistical orientation of joints at various distances from the contact. Some laboratory work has been done and much more is planned.

From the point of view of crystallization history the 'Kiaviusluk' Dyke' is even now more intensively studied than any other basic dyke.

Our field studies and laboratory investigations are directed towards the elucidation of the following problems:

i) the pre-emplacement crystallization and differentation history of the magma,

ii) the details of the dykes emplacement and the course of its syn-injection crystallization,

iii) the time required for its emplacement,

iv) the kinetics of contact processes,

v) the kinetics and mechanisms of static crystallization,

vi) the post-solidification cooling history and timing of joint development.

Obviously no definite conclusions can be drawn at so early a stage in the investigation but we can attempt to briefly summarize our views.

The initial event in the dykes history was the 'flash injection' of an olivine tholeiite magma. From certain observations on the modal variation of the diabase and an involved theoretical argument, too long to repeat here, we have concluded that this phase required between 8 and 18 years. During this time the composition of the magma filling the dilating fissure progressively became slightly less basic until the dilation and intrusion ceased. Crystallization proceeded under static conditions until almost the complete dyke was solidified. A new surge of a granodioritic magma then passed up the center partially mixing with the incompletely crystallized olivine tholeiite. The field evidence points to this phase being of the 'feeder type' and it probably fed surface lava flows. The prolonged flow of magma in the center of the dyke during this stage reheated the metasediments at the contacts and limited partial melting occurred.

One problem our detailed study of the marginal diabase has helped to solve is the growth mechanisms of the mineral phases in a solidifying magma. It appears that both the plagioclase and pyroxene crystal growth are controlled by a diffusion process.