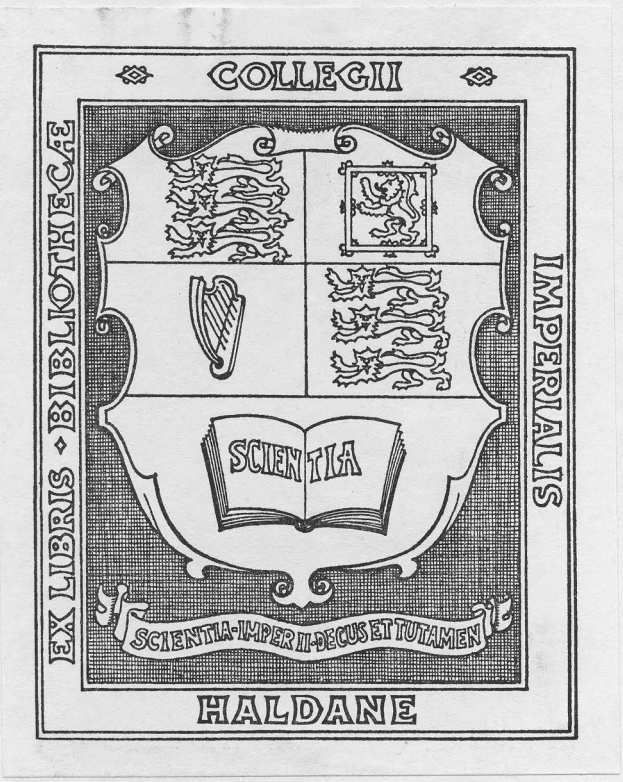
IMPERIAL COLLEGE

OF SCIENCE & TECHNOLOGY

SPITSBERGEN

1960

THE EXPLORATION BOARD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IMPERIAL COLLEGE SPITSBERGEN EXPEDITION

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F I N A L R E P O R T

November, 1960.

Foreword

The expedition and work described in this report were organised at very short notice. The party had planned to go to Jan Mayen in the summer of 1960 to continue with glaciological work started there in 1959. At the last minute, at about the beginning of June when food and equipment had already arrived, the expected transport was not forthcoming. With less than a month to go a switch of plans was made and the expedition was rerouted to Svalbard. This could not have occured without the very active support of several people and organisations. In particular we are grateful to L.P. Kirwan, and the Royal Geographical Society; A Stephenson, Peter F. Taylor and the Imperial College Exploration Board; W.H. Harland and P.F. Friend of the Sedgwick Museum, Cambridge; The Store Norske Kulkumpani and the Royal Norwegian Embassy in London. Without them the efforts which had already been made would have been entirely wasted.

J.R.F.

C.M.S.

P.S.

C.A.T.

Contents.

A1. Introduction

The Imperial College Spitsbergen Expedition began life as a consequence of the failure of the proposed 1960 Imperial College Jan Mayen Expedition to secure transport. The latter expedition was conceived as a follow-up to the 1959 visit to Jan Mayen, and it was planned to continue the glaciological investigations begun in 1959, broadening their scope. On the mountaineering side, it was hoped to attempt to penetrate into the crater of the Beerenberg and also to traverse the crater-rim from Peak Haakon to Peak Hakluyt.

Preparations to go to Jan Mayen were in an advanced state when news arrived from Norway that Forsvarets Anleggsdirektorat, who had previously thought it almost certain that they would be able to provide transport, would not now have sufficient room on their vessel. It was then decided both to seek alternative transport to Jan Mayen, and to investigate the possibilities of working instead in Spitsbergen and of obtaining transport.

Mr. W.B. Harland, who has been engaged on work on Spitsbergen Geology for some years, was contacted and Peter Smith went to Cambridge to discuss possible plans with him. It turned out that he was keen to have a triangulation done in Dicksonland which he wanted to be accurately mapped for geological purposes. This triangulation appeared to be just the sort of well-defined problem which the party could most usefully tackle at this short notice, and as Jan Mayen chances were then fast receding it was

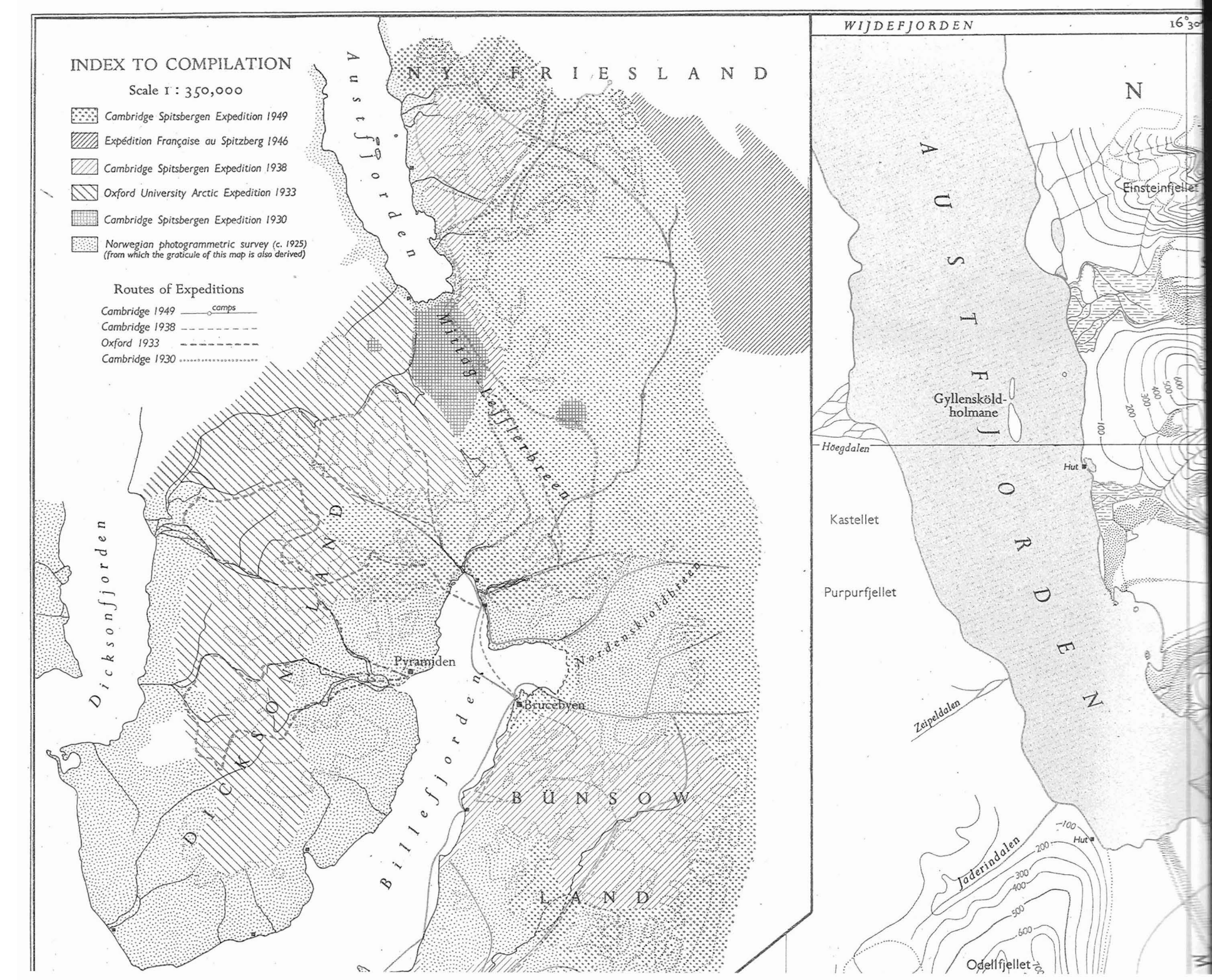
decided to attempt the survey. Mr. Harland assisted by supplying correct co-ordinates of some known points, aerial photographs, loaning a boat and outboard motor, and providing invaluable advice on conditions in general.

An enquiry to the Store Norske Spitsbergen Kulkumpani, at Harstad, resulted in an offer to take the party from Aandalsnes to Spitsbergen for 180 Nw. Kr. single each. It is thought that this prompt acceptance might have been due to previous contact with the Norwegian Government concerning Jan Mayen and that it was their influence which secured us passages so quickly.

The expected cost of the Jan Mayen Expedition was some £150 below the estimate for the Spitsbergen trip. It was fortunate that the Imperial College Exploration Board and The Royal Geographical Society came to rescue with an extra £50 and £75 respectively. On this extra £125 the expedition managed to get by. To the above organisations we are profoundly grateful for their ready assistance at such short notice.

Description of the area.

The series of Islands which make up the Spitsbergen archipelago are situated some 600 miles N of the Arctic Circle between latitudes 76-81°N and longitudes 11°-26°E. The Islands are Norwegian territory, although the Russian Government have the lease of certain sections for coal mining purposes. No further general description of Svalbard will be given here, but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Expédition Française au Spitzberg 1946
Cambridge Spitsbergen Expedition 1938
Oxford University Arctic Expedition 1933
Cambridge Spitsbergen Expedition 1930
Norwegian photogrammetric survey (c. 1925)
(from which the graticule of this map is also derived)
Routes of Expeditions
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Oxford 1933
Cambridge 1930
NY FRIESLAND
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Mittag-Lefflerbreen
Dicksonfjorden
DICKSON LAND
Pyramiden
Nordenskiöldbreen
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WIJDEFJORDEN
16°30
N
AUSTFJORDEN
Einsteinfjellet
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Höegdalen
Hut
Kastellet
Purpurfjellet
ORDEN
Zeipeldalen
Jaderindalen
Hut
100
200
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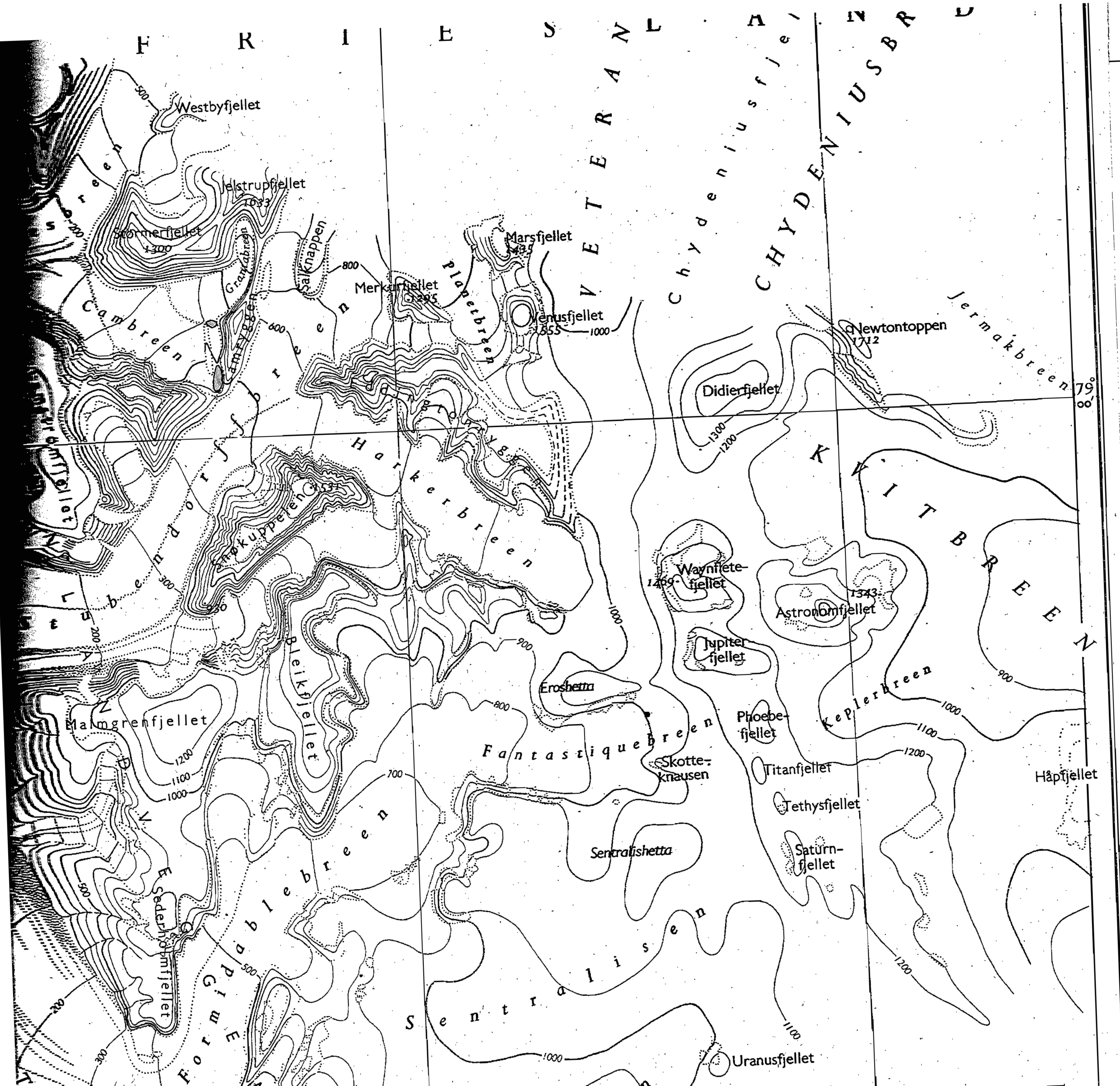
500
600
Odellfjellet



Westbyfjellet
Jelstrupfjellet
1633
Stormerfjellet
1300
Salknappen
800
Merkurfjellet
1295
Marsfjellet
1435
Planetbreen
Venusfjellet
1555
1000
Newtontoppen
1712
Jermakbreen
79°
00'
Didierfjellet
1300
1200
Chydeniusfjella
CHYDENIUSBREEN
VETERANEN
KVITBREEN
Harkerbreen
Snøkuppelen
1537
Cambreen
Stubendorffbreen
600
300
200
500
Waynflete-
fjellet
1469
Astronomfjellet
1343
Jupiter-
fjellet
Eroshetta
900
Phoebe-
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Keplerbreen
1000
1100
1200
Fantastiquebreen
Skotte-
knausen
Titanfjellet
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Håpfjellet
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Formidablebreen
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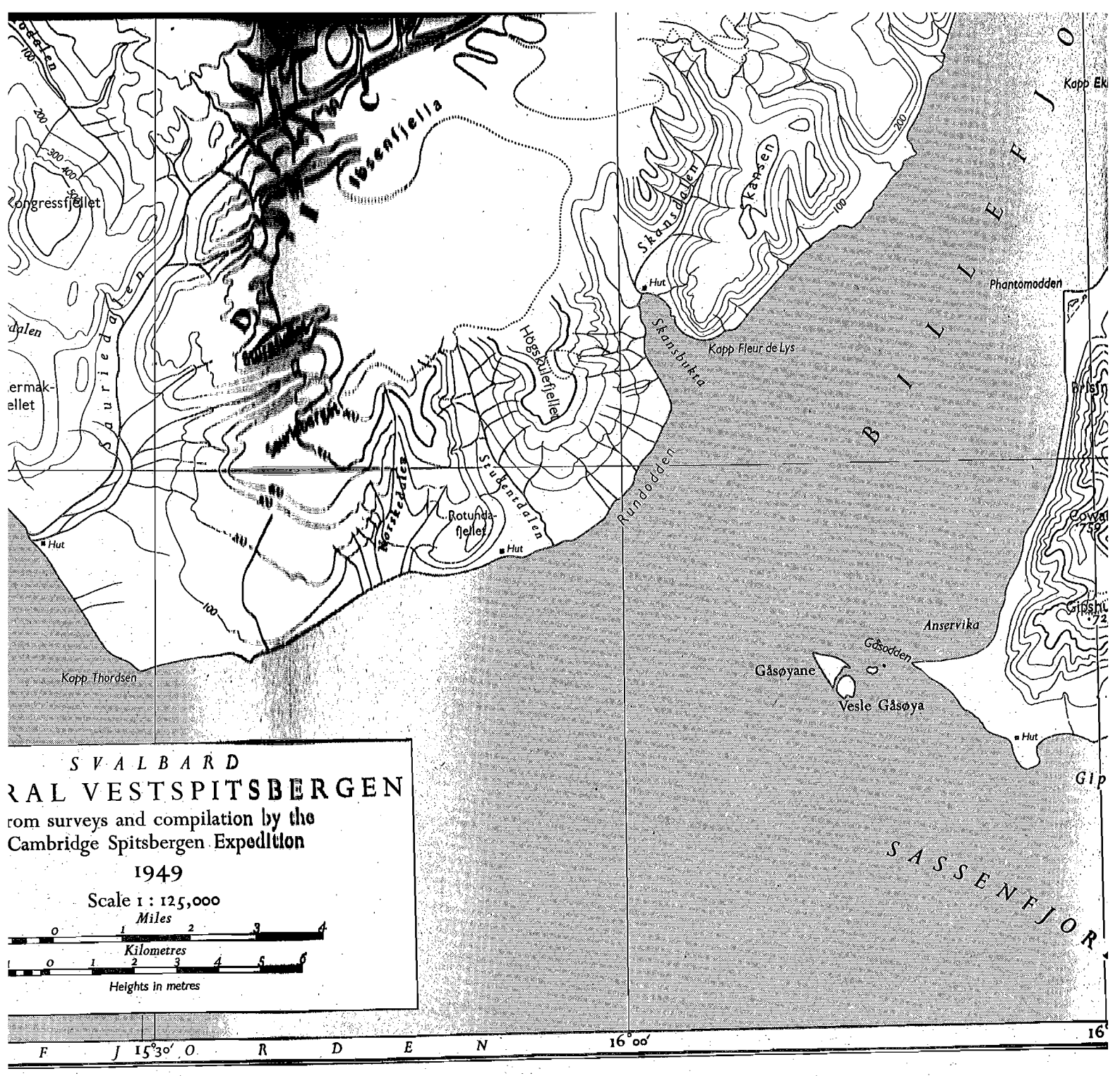


SVALBARD

RAL VESTSPITSBERGEN

rom surveys and compilation by the
Cambridge Spitsbergen Expedition

1949

Scale 1 : 125,000

Miles

0 1 2 3 4

Kilometres

0 1 2 3 4 5 6

Heights in metres

CENTRAL VESTSPITSBERGEN
Harland

the reader is referred to the R.G.S. library.

Dicksonland, the area on which the party were working, is situated between latitudes 78° 30' and 78° 45' N and longitudes 15° 30' - 16° 30' E. In the south it butts into Isfjorden, the biggest fjord on the Western coast of Svalbard. On its Western and Eastern sides it is contained by Dicksonfjorden and Billefjorden respectively.

The nature of the terrain changes considerably as one moves south from North Dicksonland. In the north the sedimentary rock has been deeply dissected and the land heavily glaciated so that the mountains rise steeply from broad U-shaped valleys to around 900m. A bed of resistant rocks, here at about 850m, and dipping gently southwards, has usually given rise to fortress-like cliffs barring access to gently rounded summit domes. Glaciers here are mostly small, in the higher valleys. South of a line Hugindalen - Mimerbukta the scene alters to rolling hills clad in loose scree, broad stony plains and small ice-caps. The valleys are less broad than farther north and the smaller ones especially more V-shaped. Some rivers (e.g. Sauriodalen) have cut deep gorges and are difficult to cross.

The area has been mapped around its seaward parts by the Norwegians; in the central part a sketch map by the 1933 Oxford University Arctic Expedition has added some detail. The northern part has also been touched by the Cambridge 1949 Expedition. A compiled

map from these three sources has been published by Harland (Geographical Journal, September 1952). This map was used as a guide for the triangulation. Results are discussed in Section B.

A2 Personnel

The expedition consisted of four people, who were either at, or coming back to Imperial College.

Peter Smith, B.Sc.,A.C.G.I.,D.I.C. (Leader) P.G. Civil Eng. Dept.
Member Imperial College Icelandic Expedition 1958.
Member London University Jan Mayen Expedition 1959.

John R. Fraser, B.Sc. Civil Eng. Dept. Research Assistant.
General climbing experience.

C. Martin Smith, B.Sc.,A.R.C.S., P.G. Chemistry Department.
Two years Antarctic experience with F.I.D.S.

Geoffrey A. Topping, B.Sc.,A.C.G.I., 3rd Year Civil Engineering
Member Imperial College Icelandic Expedition 1958.

A3. Transport.

On 4th July, Messrs. Kavli were kind enough to transport the ton of equipment and two members of the party from London to Newcastle on one of their lorries.

By 6th July, the party were assembled in Newcastle. The equipment was to be shipped to Bergen by the 'Venus', but the party, because of the delay owing to the change over of the Expedition's destination, were unable to obtain passages and had to fly to Bergen.

The equipment, conveniently contained in two large Bergen Line crates, arrived in Bergen on Thursday July 7th. The party had it loaded on the coastal steamer and departed for Aalesund the same evening. Next day (8th July) the party reached Aalesund and personnel and equipment were transfered to the local steamer going to Åndalsnes. The party arrived at Åndalsnes at 9.00 p.m. on the same evening and instituted inquiries about the coal boat, the 'Ingerfem', which was due to sail for Svalbard. Surprisingly, the 'Ingerfem' was set to sail next day in mid-afternoon. Correspondence with the Store Norske Kulkumpani to whom the ship was on charter had indicated that she would not leave Åndalsnes before July 10th. It is fortunate that the party had two days in hand at this stage.

Expedition members loaded the equipment on board next morning and by 3.00 p.m., the ship was underway. Petrol and

paraffin for the Expedition had efficiently been placed on board by the BP Company before the vessel sailed.

An uneventful journey up the Norwegian coast to Harstad followed. The party finally left Norway for Svalbard on the late afternoon of Monday July 11th. After a two-day passage on calm seas the grey coastline of Svalbard was sighted on afternoon of 13th July. The ship docked at Longyearbyen quay at about 9 p.m. that same evening.

Odd Skog, who was to transport the party to Dicksonfjord in his small launch was waiting to greet the party. Because of the calm weather the Expedition left immediately for Dicksonfjord, with half its equipment, and the borrowed Cambridge boat.

The trapper's hut in Oxasdalen, which had been intended as a base was reached at about 5 a.m. on Thursday July 14th. The remaining equipment which had been left at Longyearbyen was brought by Odd Skog to Oxesdalen one days later on a separate trip.

A4 Diary

Date	J.R. Fraser	C.M.Smith	P. Smi
7.60.	Final preparations. Travelled on lorry to Bawtry.		Final p: By trai Rochdal
7.60.	Arrived Newcastle.	Arr.Newcastle	Arr.New
7.60.	Arr.Bergen.	Arr.Bergen.	Arr.Ber
7.60.	Equipment arrived in Bergen & was transfered to coast 22.15. hrs. (Norwegian summer time).		
7.60.	Arr.Aalesund 11.30. Changed ships and arrived Aandalsnes		
7.60.	Equipment loaded in 'Ingerfem' and sailed at 16.00		
7.60.		On board 'Ingerfem'	
7.60.	Arrived Harstad. Paid S.N.S.K. 720 Nw. Kr. for passage:		
7.60.		On board 'Ingerfem'. Plotted c:	
7.60.	Arrived Longyearbyen 21.00.		
7.60.	Left Longyearbyen 00.30 by launch, arriving at Dicksonf Slept, then began organising things.		
7.60.	Attempted unsuccessfully to boat to K.Nathorst. Built cairn on S 501 in evening.	As J.R.F.	Built on S 5
7.60.	Left by boat to Kapp Nathorst.15.00 hrs.Took bearings from Lykta S. and K.Nathorst.	Boated to K.Nathorst 15.00.hrs.Set up camp at Kulmdalen.	Ferri to K.N 01.00 Boat Natho: 15.00 Kulmd:
7.60.	Built cairn on Takefjellet W.	Built cairn on Citadellet W.	As C.J
7.60.	Built cairn on Takefjellet E.and T.508	Built Triungen cairn.Returned.	As C.
7.60.	Boated to Hugindalen. Packed 5 miles inland & camped. (Camp Altnafoadh)	As J.R.F.,but returned to base.	As C.
7.60.	Climbed T.501 & left flag.	Boated to K.Wijk hut	As C.
7.60.	Built T 509 cairn	Waited in K.Wijk hut, wind too strong to do Kongressfj.	As C

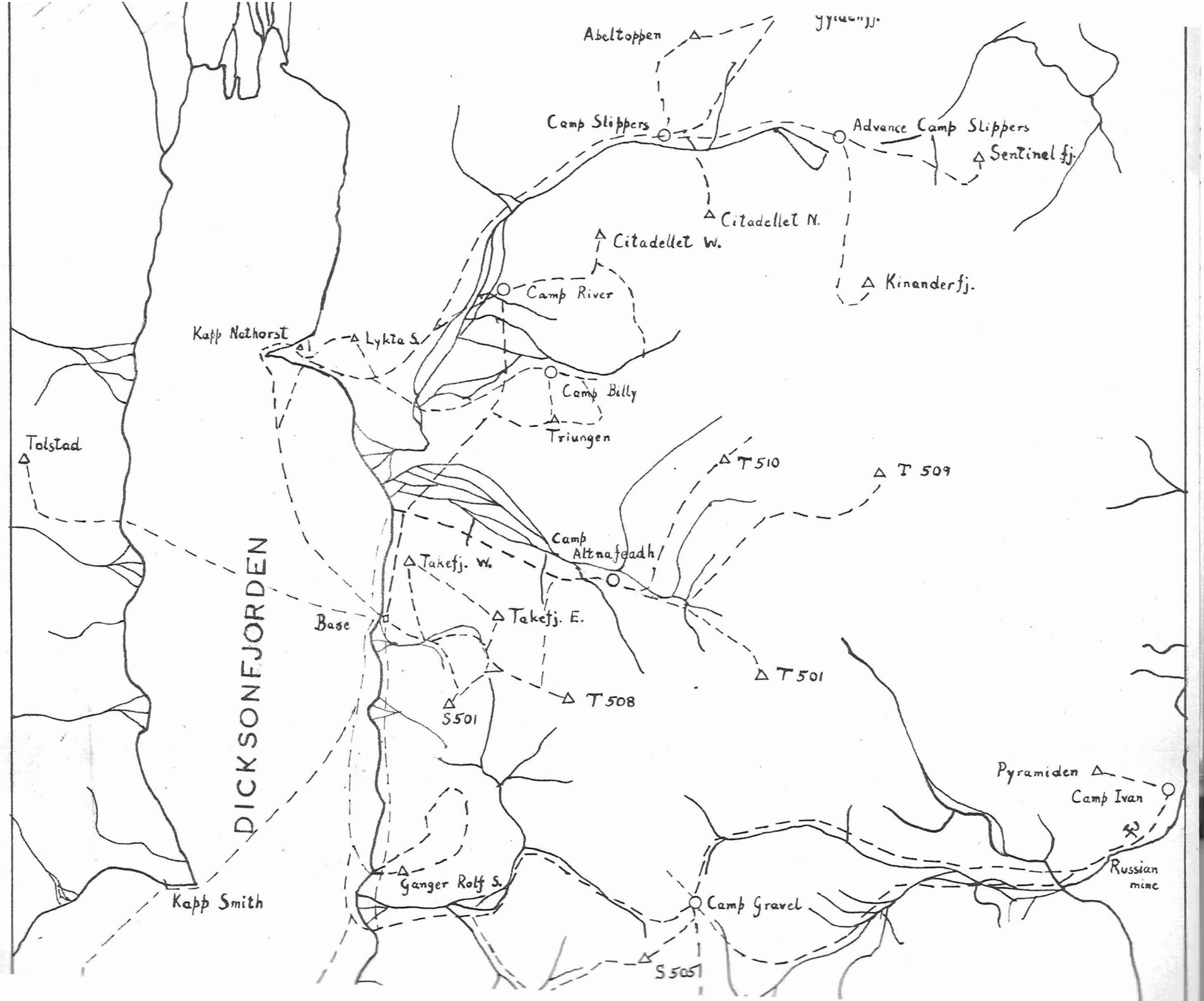
Date	J.R.Fraser	C.M.Smith	P.Smith	G.Topping
7.60.	Climbed Belvedere ridge as fast as poss.Built T510 cairn.	Climbed Kongrossfj. & made sketch. Returned to base.	As C.M.S.	As. J.R.F.
7.60.	Returned to base.Slept. General duties at base	General duties at base.Built dam.	General duties at base.Tarred boat.	As J.R.F. Tarred boat
7.60.	Boated to K. Nathorst. Back-packed 9 miles up Nathorstdalen and set up Camp Slippers.			
7.60.	Took bearings from Abol & Gylden. Slept. Investigated error in vertical circle.	Built cairn on Citadellet N. Slept. General duties.	As J.R.F.	As C.M.S. also participated in theodolite argument.
7.60.	Struck one tent and set up Advanced Camp Slippers 2½ miles up valley.			
	Bivouacked.Recuperated, then left for Kinander at 20.00hrs.Took bearings.	Took bearings from Sentinel.Struck camp & returned to Camp Slippers.	As J.R.F.	As C.M.S.
7.60.	Returned to Camp Slippers.Left for Citadellet N.19.00hrs. Took bearings.	General duties.Left for Citadellet N. with J.R.F.	Returned to Camp Slippers. Slept.Left for boat.	General duties Left for boat with P.S. 20.00hrs.
7.60.	Returned to C.Slippers. Confined to tent by rain.	As J.R.F.	Returned to base.Slept. General duties	As P.S.
7.60.	Shifted camp to a point between Cit.W. & Lykta S.Slept.15.00 to 22.00hrs.Meal then slept.	As J.R.F.	To bed 04.00. Up 16.00. Cleaned carburettor. Boated to Lykholmdalen. Set up Camp Moss 2 mls. inland .	As P.S.
7.60.	Left 01.00hrs.for Cit. W.but returned soon due to weather. Set out again 10.00hrs. Took bearings. Back to camp for meal then set out for Lykta S.	As J.R.F.	Slept till 16.00hrs. Built a cairn on S.505.	

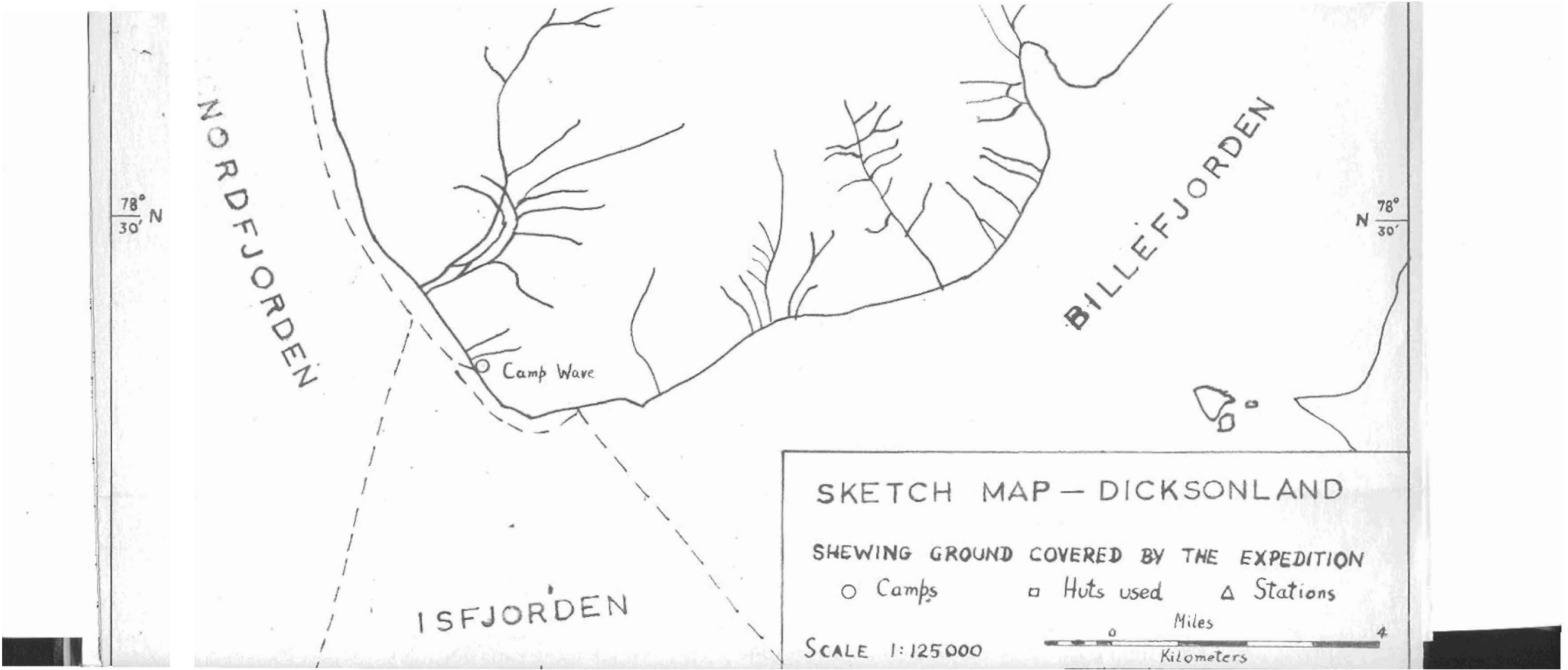
ate	J.R. Fraser.	C.M. Smith.	P. Smith.	G. Topping.
.60.	Took bearings from Lykta S. and then from K. Nathorst.Returned to camp 07.00 and slept till 20.00.Struck camp & back packed to foot of Triungen.		Climbed Ibsenfj,built cairn, sketched etc., Returned to base	
.60.	Took bearings from Triungen.Back packed to base. Slept. Recuperated in afternoon.		Rose at 16.00 hrs. Boated to Hugindalen and re-established Camp Altnafoadh	
.60.	Decided in view of bad weather not to follow others to Altnafoadh as planned. General duties at base. C.M.S. baked a cake. Booked results		Climbed T 510 but no bearings taken because of weather.	
.60.	General duties till 17.00 hrs. then walked to boat, met others and walked to Camp Altnafoadh Pitched second tent		Came down to boat for supplies, then returned to camp.	
.60.	General duties at camp.Left at 23.0Chrs.for T.510.	As J.R.F.	Climbed T 510 but too windy & dull for bearings Returned to camp and bed.	As P.S.
.60.	Back to camp.Slept.Left for T 509 in evening		Left at 15.00hrs for T 501	
.60.	Took bearings from T 509. Back to camp by 10.00 and bed.		Rose at 13.00hrs.Took bearings T 508 and S 501	
.60.	Struck camp & returned to base. General duties.Mail arrived.		Continued to Takefjellet (E & W) & took bearings.Down to base. Slept.General duties.	
.60.	General duties at base	As J.R.F.	As J.R.F. Made a sail for boat.	As J.R.F. & hair cutting.
.60.	Set off by boat for Lyckholmdalen. Back-packed, 6 miles to Trodalspasset and set up Camp Gravel.			
.60.	Took 1 tent, survey equipt. and 6 man days food to Pyramiden mine. Russians put us up for the night.			
.60.	Returned to Camp Gravel.	Stayed Pyramiden Mine	As J.R.F.	As C.M.S.
.60.	Reconnoitred towards Ibsenfj.	Left Mine.Set up Camp Ivan on coast E. of Mine.16.00hrs left for Pyramiden.	As J.R.F	As C.M.S.

ate	J.R. Fraser	C.M. Smith	P. Smith	G. Topping
.8.60.	General duties at camp	Arrived back amp Ivan bed 02.00 Up 06.00 to Mine, left about 09.00; arr. Camp Gravel 12.45	As J.R.F.	As C.M.S.
.8.60.	Climbed Ibsenfj. & took bearings.	Struck one tent & back-packed to boat. Walked to base.	As J.R.F.	As C.M.S.; al retrieved supplies lef at Camp Moss
58.60.	Took bearings from S 505 back packed to boat and boated to base	General duties at base. Booking results.	As J.R.F.	As C.M.S. Started map of triangles
16.8.60.	General duties at base. Plotting triangles. Booking results			
.8.60.	General duties at base	Set off in boat for Tolstad; did Tolstad and returned.	As J.R.F.	As C.M.S.
.8.60.	Left for Longyearbyen via Kapp Wijk from Base 16.00 hrs. Left Kapp Wijk hut for Longyearbyen 19.30.			Arrived Kapp Wijk Hut.
.8.60.	Camped south of Sauriedalen hut waiting for sea to moderate. Approached some Norwegians anchored up the coast to request lift for C.M. Smith. Were offered and accepted tow to Longyearbyen 19.30.			Hut duties & book work, a Kapp Wijk.

Continued on next page.....

te	J.R. Fraser	P. Smith	G. Topp:
3.60.	Arr. Longyearbyen 04.00 & slept. Arranged transport from Dicksonfjorden to Longyearbyen & thence to Norway for 4th-7th Sept. Arranged for C.M.Smith to remain in Longyearbyen until 25th August, then transport for him to Norway. Bought extra film. Collected mail. Left at 19.00. Arr. at Camp Coal at 20.30 & stayed till 00.20.		At
3.60.	Sailed for Dicksonland 00.20. Landfall at 0.200 east of KappThordsen in heavy sea to refuel. Continued at 02.30 & rounded Kapp Thordsen at 02.50. Arr. Kapp Wijk hut 04.30.		Kapp Wi
3.60.	Sitting out bad weather & resting in Kapp Wijk hut.		
8.60.	As 22.8 60. Made out weather diary.		
8.60.	As 22.8.60.		
8.60	Climbed Kongressfj & took incomplete set of bearings, & no photos (misty).		
8.60.	Returned by boat to base camp.		
8.60.	Bad weather rest day. Plane table prepared for use.		
8.60.	Climbed Ganger Rolf & took bearing & photos Set up 2 plane table stations on plateau.		
8.60.	Climbed T 508 and set up the plane table at cairn. Tarred boat.		
9.60.	By boat to K.Wijk. climbed Kongrossfj & did complete round & photos, Left supplies at hut of some surplus food & paraffin.	Plane tabling in Hugindalen.	As J.R.I
8.60.	Rest day at base.	As J.R.F. Also plane tabled around base.	As J.R.I
3.60	---------- Packing began. ----------		
9.60.	---------- Packing finished. ----------		
-7th inc.	Awaiting arrival of 'Nordsyssel' to take us back to Longyearbyen.		
0.60.	Returned to Longyearbyen on board 'Nordsyssel'.		
-11th	In Longyearbyen.		
9.60.	Sailed for Norway on board 'Ingerfem'.		


Abeltoppen
Camp Slippers
Advance Camp Slippers
Sentinel fj.
Citadellet N.
Citadellet W.
Kinanderfj.
Camp River
Kapp Nathorst
Lykta S.
Camp Billy
Triungen
Tolstad
T 510
T 509
Camp Altnafeadh
Takefj. W.
Takefj. E.
Base
DICKSONFJORDEN
T 501
T 508
S 501
Pyramiden
Camp Ivan
Russian mine
Ganger Rolf S.
Kapp Smith
Camp Gravel
S 505


78° 30' N
NORDFJORDEN
Camp Wave
BILLEFJORDEN
N 78° 30'
ISFJORDEN
SKETCH MAP — DICKSONLAND
SHEWING GROUND COVERED BY THE EXPEDITION
○ Camps
□ Huts used
△ Stations
SCALE 1:125000
0
4
Miles
Kilometers

Weather Summary

14th	July	Calm, cloudy, some drizzle.
15th	"	South wind, cloudy.
16th	"	Fine, hot, good visibility.
17th	"	Driving rain and mist on top.
18th	"	Fine, good visibility.
19th	"	Fine, breezy later.
20th	"	Fine, windy, good visibility, cloud later.
21st	"	Very windy(Snowon T509 Wet at Kap Wijk) cloudy, snow on top.S.W. wind.
22nd	"	Low cloud esp. in N. Less wind.
23rd	"	Cold, cloudy, windy.
24th	"	Fine, hot, good visibility.
25th	"	Light cloud cleared to give fine hot clear day.
26th	"	Fine, hot clear day, good visibility.
27th	"	Low cloud formed early. Dull later. Brief clearance in evening.
28th	"	Rainy, cloudy.
29th	"	Dull.
30th	"	Cloud dispersed to give fine clear day.
31st	"	Fine, hot, clear.
1st	August.	Fine, clear, breezy.
2nd	"	Cold, breezy, cloud.
3rd	"	Dull, windy, drizzle.
4th	"	Dull, strong N. wind, snow on top.
5th	"	Fine, clear, windy early.
6th	"	Fine, clear.
7th	"	Cloud from S., wind risen.
8th	"	Low cloud, windy, calmer later.
9th	"	Calm, bright, High cloud, lowering.
10th	"	Dull, calm.
11th	"	Chilly, dull.
12th	"	Snow, north wind, dull at first, cleared, clouded again.

Weather Summary (Continued)

13th	August	Dull, snow early inland.
14th	"	Bright, windy, snow later inland.
15th	"	Cloudy, bright patches, windy later.
16th	"	Bright, breezy, some cloud.
17th	"	Bright, calm, clouding from NW. wind rose.
18th	"	Fine, warm, clear, east wind later.
19th	"	E. wind, dull.
20th	"	Dull, drizzly.
21st	"	E. wind, cloudy.
22nd	"	High E. wind, low cloud.
23rd	"	E. gale, bright, dull later.
24th	"	Low cloud, wind moderated and in S.W.
25th	"	Clear at first, turning to cloud, snow and S.W. wind.
26th	"	Low cloud.
27th	"	Low cloud.
28th	"	Sun, cloudy later.
29th	"	Fine, warm, clouding, then clearing again later
30th	"	Fine, warm.
31st	"	Fine, warm.
1st	September.	Fine, warm, clouding later.
2nd	"	Dull.
3rd	"	Dull.
4th	"	Dull.
5th	"	Dull.
6th	"	Dull.
7th	"	Dull, strong south wind.
8th	"	Dull.
9th	"	Bright, some sunshine.
10th	"	Sunny, strong E. wind.
11th	"	Bright, strong E. wind.

Weather Summary - Notes

It will be seen that the weather may change with great rapidity.

Also note that in July there were 9 "fine" days out of 17 while in August there were 8 out of 31.

The weather in this area is often very local e.g., while base camp was suffering dull weather, it was often sunny in the mountains to the south west.

There seems to be a tendency for the sky to be clear in the direction from which a wind is blowing.

North or north west wind often resulted in clear weather, sometimescold.

South or south west wind invariably brought low orographic cloud, which hampered survey.

Only one typical frontal sequence was experienced, i.e. on 16th- 17th July. Strong anticyclonic weather conditions occured on 18th - 19th July, 24th-26th July, 30th July - 1st August and probably 29th Aug- 1st September.

Occasionally very low banks of cloud spread along valleys and over cols, apparently independent of the prevailing fine conditions.

Note the very low level of precipitation. At sea level only a few hours of moderate rain were experienced in the period 14th July to 20th August. Very light falls of snow occured infrequently above 700m in early August, and thereafter were more common.

General Notes on Expedition

The following are but a few brief notes on various details and points which might be useful to the organisers of future expeditions. No attempt has been made to put them in order, either chronological, or of importance.

I. In summer, many of the broad river valleys in northern Dicksonland (e.g. Hugindalen, Nathorstdalen) are difficult to cross on account of the swift glacial streams they contain. It was generally found that fording these streams was easier down in the main part of their delta near the sea. Even this was usually a cold wet process. These same river valleys when they contain glacial mud (as opposed to river gravels) are usually very hard wet going. The glacial streams are at their lowest between about 6.00 am and 10.00 am in fine weather. There is a considerable diurnal variation of these streams. Waders were useful sometimes.

II. From the survey point of view it is necessary to take advantage of all the calm clear weather possible. The Expedition found that it was best to employ two staggered theodolite parties. One of these parties, at any one time would be working and the other sleeping Twelve hours later the reverse system would be in effect. This method has the advantage that only one set of camping gear need be used and that it makes the maximum use of a short spell of good weather. It falls down of course, when the weather becomes bad, since four people in one mountain tent, at

any one time, is a little cramped.

III. The party were somewhat troubled by mosquitos during July. They were particularly noticable on the lagoon flats near Kapp Wijk and in the broad muddy valleys. 'Kylol' was somewhat effective, and a 'Flit' spray gun produced devastation. The disadvantages of carrying a 'Flit' gun are obvious.

IV. The glaciers in Northern Dicksonland all seem to be retreating and are not heavily crevassed. Parties on these glaciers (above the firn-line) were always roped as crevasses can occur in the most unexpected places.

V. A small boat is a great advantage to any party working in Dicksonland. The Expedition received the loan of a 17ft. wooden boat and Atco outboard motor from Mr. W.B. Harland of Cambridge University The only disadvantage found with a boat of this size was that she was difficult for two men to drag up a steep beach. The low capacity (150 cc) Atco boat-impeller was found to be excellent for boating in the fjords. It was possible to get 25 miles/gall at about 4 Knots. Fuel for the motor should be filtered before use. A sail for the boat, primarily for use in emergencies, was made from a tarpaulin sheet. This was useful when the wind was astern, but was only used in a light breeze. A successful crossing of Isfjorden was achieved using the boat and motor on the return from Longyearbyen to base.

VI. The weather in the fjords changes with great rapidity. Winds can blow different ways at different levels. When a journey is

planned (particularly by boat) great care should be taken to observe the weather changes. Mid-fjord conditions are hard to assess from shore.

VII. There are several huts along the coast of Dicksonland. These are shown in the general map contained in the introduction. In general they were in the following states in August, 1960.

Kapp Wijk Hut - A large hut. A few provisions (2 man-weeks) left there. In good condition. Stove works.

Oxasdalen Hut - Small one man trapper's hut. Served as a Base for 1960 Expedition when used in conjunction with tents. (2 man-weeks provisions left there) Stove works.

Sauriedalen Hut - small one man hut in good condition. Stove. No provisions.

Kapp Smith Hut - Small hut, battered. Old stove. Water might be a problem.

Note - Future Expeditions should not rely on provisions left by 1960 Expedition. If an expedition intends to use a hut for any length of time, tools, nails, roofing felt, brown paper and tar would be handy.

VIII. The valleys in the southern point of Dicksonland are more Vee-shaped than those in the North. In some cases great deep gorges have been formed by the rivers, which are quite incrossable in their deepest parts. The upper two thirds of Sauriedalen is particularly bad as far as a deep gorge is concerned.

IX. Driftwood is plentiful on the shore of Dicksonfjord and could be used as a structural material if necessary as well as for firewood. It may conveniently be transported by towing through the water, (either by boat, or pulling along from the shore). A good saw and axe are necessary tools.

X. Mountaineering in Dicksonland involves little of technical difficulty. The buttresses are of rotten rock and must be avoided and ascent sought via the glaciers, snowslopes or screes. Only in the case of a few peaks is rock climbing essential to reach the summit, and this would be only a few short pitches (e.g. Citadellet North). In July, snowslopes tend to be slushy, often with underlying ice, but harden up when the sun is off them. Later in the season much of the ice is bare, and the remaining snow may be in an excellent firm condition. Crampons could be useful in places, but are not essential items of equipment. Some glaciers which in July are covered with melting snow are everywhere dry a little later in the season. Where scree is of consolidated red mudstone it provides good footing; it is suspected that this is fluid with water during the spring ablation season, but by July the mud is quite hard, cementing the surface together. Yellow limestone scree is usually extremely unstable and should be avoided if possible. In central and south Dicksonland it is usually small, and provides first class running to compensate for a penitential climb. Objective dangers include: stonefalls which may occur from steep buttresses and can be quite large after rain; avalanche conditions

were observed on one snowslope of about 35° and somewhat slushy; certain glaciers have tricky crevasse systems; rock in general is rotten. Two pairs of boots for each member of the party should be taken: hard wear is to be expected. Small brass screws, and black Bostic are useful for repairing boots.

XI. Eating out in Norway can be expensive. Meals on the coastal boats are particularly so. For this reason the party equipped themselves with a "boat-crate" of cold food, and had about only one bought meal per day. Costs of meals on coastal boats are approx 6 - 10/-. A reasonable meal can usually be obtained in a coastal town for 5/- if the eater is discerning in his choice of restaurant. Milk and fish dishes are cheap.

XII. Packaging

Most of the equipment was packed in wooden crates, although a few kitbags were also used. Most of the crates were tea-chests 14"x14"x18". A tea chest with lid nailed on and two steel bands round it makes quite a secure package. The bands were fitted by means of a **Securitas** banding machine. Any old addresses on the crates were painted over and the latter were stencilled with the expedition name, route and destination. The basic food ration was apportioned into lots of 6 man-weeks, a suitable quantity for one tea chest. Other chests held the extra 'base' foods, equipment etc. Some of these had to be of different shapes and sizes, to accommodate such items as spades, plane-table, ice-axes, outboard motor and the like. For the return journey, rope was taken with which to tie up the returning crates; this lashing had to be secure since it was to be utilised for hoisting the crates on route.

A5. Financial Statement on October 31st 1960.

Income:	£	s.	d.
Grant, Royal Geographical Society.	95.	-.	-.
Grant, Mount Everest Foundation.	170.	-.	-.
Grant, Imperial College Exploration Board.	150.	-.	-.
Personal Contributions 4 at $40 each.	160.	-.	-.
Total	£575.	-.	-.

Expenditure.	£	s.	d.
Transport.	258.	15.	-.
Freight.	52.	19.	9.
Sundry Equipment, Expenses Etc.	61.	19.	5.
Food, Accommodation.	23.	3.	-.
Food for Field.	89.	2.	-.
Film.	23.	13.	4.
General Equipment.	48.	19.	9.
Total	£558.	12.	3.

Balance is a credit of £16. 7. 9. Certain other items are still to be paid for e.g. the production of this report. It is estimated that the above credit should cover these.

A6. Equipment.

The following is a list of equipment taken by the expedition, with comments:

No.	Item and comments.
1.	1 axe: very necessary
3.	Altimeters: see survey section.
1.	Atco Boat impellor: see general diary.
4.	Airbeds (Lilos): heavy, but good, not used in field.
4.	pkts. Brillo pads: useful, 2 pkts. would have sufficed
1.	Bow saw and spare blade: very necessary.
1.	Boxwood alidade : see survey section.
1.	Tube Bostick: very useful for general repairs.
4.	yds Bunting Material: 2 yds white: 2 yds red. Used for making marker flags on some cairns.
5.	Assorted billies: sets are preferable. Better with attached wire handles.
1.	Polythene washing bowl: a base amenity.
8.	large polythene bags (8'x4') intended as Bivouac bags: never used.
15.	Smaller polythene bags: very useful for storing food.
5.	lb. cotton waste: very useful.
6.	Tubes 'Copydex': never used.
2.	balls sisal cord: very necessary.
1.	ball thin cord
6.	lb. candles: 4 lb would have been enough : needed in Sept.
1.	Cine camera tripod: useful.
4.	Prismatic compasses.
1.	Curta Calculating machine: never used.
6	pkts. detergent ('Tide') - necessary for washing up in sea water. 3 pkts would have been enough.
1.	Entrenching tool: Superseded by spade.
1.	Fly spray: (Flit): Good but cumbersome; could be replaced by pressured fly spray. Little used after end of July. Only used base.

Equipment (Continued)

No.	Item and comments.
3.	files (assorted). Used once.
4.	polythene funnels: Very useful around base
17. 22	620) 120) F P 3 films: For survey purposes.
12.	pots, Glacier cream: never used.
	Ground sheeting: taken for repairing tent ground sheets. never used.
1.	6'x6' Ground sheet: useful for keeping rain off important items. Finally nailed to roof of hut in Oxasdalen.
4.	pairs crampons: not essential in Dicksonland.
4.	pint mugs: should be of equal capacity & enamelled.
4.	Sets: knife, forks and spoons.
1.	Ice drill: never used.
4.	ice axes: indispensable.
1.	Large leather brief-case: for official papers.
6.	Rolls toilet paper: quality varied. British best.
6.	Karabiners: Used occasionally on glacier travel.
1.	Kitchen Knife: Useful at Base.
6.	Kitbags.
1.	Inflatable 'Beaufort' lifejacket. Never used, fortunately. -Ideal ; + spare CO_2 cylinder. 4 should have been taken.
1.	Headlamp & spare batteries: useful.
1.	Rubber torch & spare batteries: useful.
1.	bicycle lamp & spare batteries: useful.
1.	bottle linseed oil: for waterproofing ice axes.
1.	bottle Lubricating oil: useful.
	Maximum - minimum thermometer: Kept a useful record at Base.
6.	doz. packets Safety matches: 4 doz would have been enough.
120.	Lifeboat safety matches: never used in field; work excellently in wind.
	Medical Kit: see section on medical kit.

Equipment (Continued)

No.	Item and Comments.
2.	Charts: scales 1: 200,000 and 1: 350,000
2.	Maps: Harland's 1949 1: 125,000.
2.	Maps: Unpublished (Cambridge) 1: 50,000
3.	1 pt. Optimus Stoves: Very good, tend to get blocked after prolonged use. One of stoves, which had previously been soldered, failed in field. A liberal supply of washers & new nipples needed.
4.	Optimus repair outfits & new burner & spare pan support- Washers and nipples only used.
2.	pair Pliers: handy around base and on engine.
6. 5.	rock pitons) ice pitons) never used.
7.	metal plates: necessary for Base.
2.	pressure cookers: useful at Base, especially for dehydrated foods.
4.	pack frames: not used much. Superseded by 'Bergen' Rucsacs.
2.	Plane tables (18"x18" & 12"x18") & tripods: See Survey Section.
24.	galls paraffin (6 jerry cans): 2 jerry cans would have been sufficient (1pt/day approx)
20.	galls petrol (5 jerry cans): 3½ jerry cans used. see comments in general diary.
	100 ft. 1½" Cre.Hempropc: In valuable for mooring boat.
5.	120 ft. full weight nylon climbing rope: Only one rope used at any one time.
2.	Small rucsacs: very useful for day trips.
	100 yds thin rope: necessary; particularly for roping crates at end.
6.	bars soap: necessary at Base.
	Solid fuel: Profol - 5 pkts (about 80 bars) Used for startin Metafuel - 150 bars) primuses. Inferior to meths.,but more portable; Profol better than metafuel,but more difficult to light.
1.	spade: useful around Base.
2.	Screwdrivers: both used.
6.	rolls 'Sellotape' - very useful - almost essential sometimes.
5.	spare Sleeping bags: Necessary as extra sleeping bags.

Equipment (Continued)

No.	Item and Comments.
1.	pair skis & skins: used only once; never in course of work.
20.	/0'. $\frac{3}{4}$" $\frac{3}{4}$" ramin wood stakes: used as markers on cairns; too many
6.	midget tin openers: Ideal
1.	12'x9' tarpaulin sheet: used as sail for boat & also for protecting crates from bad weather.
	5' polythene tubing: very useful for siphoning petrol.
	$1\frac{1}{2}$ galls tar: used for tarring boat: sticky
1.	Telescopic alidade : never used.
1.	Theodolite - Watts Microptic No. 1.
1.	100' Steel tape) See Survey Section
1.	100' Linen tape)
1.	Wrench: an excellent and useful tool.
	Assorted woodscrews: never used.
1.	packet 'Vim': useful.

In addition to the above list people took various personal items. Those included sleeping bags, clothing (including underwear, sweaters, windproof suit)and cameras Etc.

Various bearings on the outboard motor gave cause for anxiety from time to time and any expedition using this kind of motor is strongly advised to take a grease gun and grease with them.

A6 Medical Supplies Taken

It should be noted that the choice of the Expeditions medical supplies was governed by the idea that it would be impossible to treat serious illness or injury. Had these occurred the person would have been evacuated to Longyearbyen or Pyramiden. Accordingly only a spartan medical kit was taken as below.

Taken	Used	Suggested Quantities	Remarks
Bandages W.O.W. B.P.C. 1" x 3	-	3	packing bad for Expeditions.
" " " 3" x 3	-	4x2"	
Emergoplast Dressing 1½" wide, 2 x 1 yd.	1	2	ditto
Lint plain 1 x 4 oz Pkt.	-	1	ditto
Cotton Wool B.P.C. 4 oz	a little	1	ditto
Strepsol 3 bottles	1	3	polythene bottles would be better
Surgical Spirit 8 oz.	-	-	
Codeine Compound Tablets 4x100	4 tabs	100	
Tullogras, 1 tin, 4 x 4"	-	1	
Tabs. Phenolphthalein gr. 2, 2x25	-	50	
Alimox Tabs. 3 x 30	6 tabs	10	
Mycota Foot Powder, 1 tin	-	1	
Soltan Sun burn cream, 3 tubes large	-	-	
Mylol, 6 tubes large	2	2	Fairly effective.
Tabs. Dramamine 50	12	50	
365 All purpose cream, 4 x 1 oz	1 tin	2	
200 tabs. Sulphasuxidine, 0.5 gramme	-	200	
5 x 100 Tabs. Halazone	-	-	
Triangular banages large 3	-	2	
" " medium 3	-	-	
Sterile dressings 9	-	3	

Medical Supplies Taken (Continued)

Taken		Used	Suggested Quantities	Remarks
Safety Pins	3 doz	6	2 doz	
Neoymycin Cream	2	-	1	
Calcipen Tablets (V)	50 tabs	-	50 tabs	
Nicorbin Tablets (Glaxo)	500 tabs	50	200 tabs	

With the exception of the Nicorbin tablets (Supplied by Glaxo), Boots Pure Drug Co. Ltd., kindly supplied the expedition with the above medical equipment. For the help they gave to the expedition at such short notice we are very grateful.

It should be noted that for expedition use packing should be in tin or polythene rather than paper or glass.

A7 The Expedition Food.

Two types of ration were taken. The basic "field ration" was supplemented by a varity of foods intended for us at base. Forty-two men weeks of field rations were taken, in seven tea-chests each of which contained approx. six man weeks supply of each item.

In selecting food for the field ration the main criterion was a high food value/weight ratio and accordingly a large proportion of dehydrated food was chosen. On most trips it was desirable to keep weight to a minimum but sometimes a certain amount of base food found its way to camp to augment the somewhat spartan field rations. No member found these inadequate.

The base foods were taken in possibly too much variety, since fancy dishes tend to involve complicated cookery and waste time, but this can be an asset in bad weather.

Certain items, such as raisins had to be packed by the expedition in polythene bags made up from 500 gauge sheet. Other itmes, like sugar, were not packed sufficiently well in their original bags and also went into polythene.

Appended are lists 1) of the basic field ration.
2) of all the foods taken and left.

1. Basic Field Ration (8 man-days)

2 lb Lifeboat biscuits	1lb Jam, honey, syrup or peanut butter
1 lb Dehydrated meat.	1½ tins dehydrated vegetables.
1¼lb Porridge oats.	1lb dried milk.
1½lb Sugar.	3oz. tea and/or coffee.
1lb Margarine.	4 packets soup.
3lb Chocolate	½-¼lb Cheese.
1lb date or fruitarian cake	½lb Kendal Mint cake or rum fudge.
½lb rice, barley, lentils, marmite or curry powder.	2oz. salt.

1) Quantities Taken.

The letter F in the remarks column indicates - 'field' food.

Quantities of all food taken and left.

	Manufacturer	Pack	Taken	Left		Remarks etc.
ridge.	A&E Scott,Ltd.	1½lb tin	45lb	10lb	F	
"spray" Milk	Nestles,Ltd.	1lb tin	20lb	7lb	F	
gar	Tate & Lyle	2lb bags	82lb	22lb	F	Was carried in polythene bags.
rgarine	Van Den Berghs & Jurgens,Ltd.	½lb tins	28lb	6lb	F	Specially packed in tins for us by Manufrs.
y Bentos rned Beef	Oxo,Ltd.	½lb tins	24lb	13lb	F	
f Cubes dehydrated)	M.O.F.	2lb tins	2lb	-		Good
mb Cubes	"	1½lb tin	1½lb	-		Tough
rk Cubes	"	1½lb tin	1½lb	-		Good
eaks	"	1lb tin	1lb	-		Good
nced Beef	M.O.F.	1lb tin	14lb			Lacks Flavour
ied Potato	Springlow	12oz tin	27lb	15lb	F	
rip Carrot	"	12oz tins			F	
nch Beans	"	4oz tins	1½lb	6lb	F	Good
ring Cabbage	"	4oz tins	1½lb		F	Good
rden Peas	"	12oz	4½lb		F	
oad Beans	M.O.F.	2lb	2lb	-		Excellent.
ck currents	"		5lb	2lb		Good with apple.
lberries	F.M.S.		5lb			
ple Rings	"		4lb			
uit Cake	H. &. P.	10oz tin	8lb	3¾lb		Could be used as field ration.
dge Bar	Horlicks	1oz foil	10½lb		F	Versatile;used for cooking & on biscuit in field.
te Bar	Gold Bough	8oz	18lb		F	Well packed.
uitarian ke	Maplotons	5oz	7½lb		F	

Quantities of all food taken and left.

	Manufacturer	Pack	Taken	Left		Remarks etc.
ed Fruit etc						
ns	Maconochie	1½lb	8 tins	1½lb		Luxury food.
ge	"	8oz tin	8 tins	8oz		"
wberries	"	8oz tin	8 tins	8oz		"
al Mint Cake.	Romneys	4oz pkt	100 brs.	43 Brs.	F	
mite	Marmite,Ltd.	4oz tin	6 tins	8oz	F	
ry Powder	Heinz,Ltd.	3oz tin	8 tins	11b	F	For flavouring the stew in field.
s Plum Pud.	"	11b tin	15 tins	61b		Excellent
s etc.						
ey	Chivers	11b tins	61b	31b		
rted jam.	"	11b tins	71b	11b		
up	Tate & Lyle	11b tins	41b	21b	F	
nut butter	Mapletons	11b tins	51b	11b		
erages etc						
	Hornimans	½lb pkt.	1½lb		F	
	Liptons	11b tins	31b	21b		Excellent
ink.Choc.	Cadburys	½lb tins	61b	41b		
rlicks	Horlicks,Ltd.	11b tins	61b	11b		
altine	Ovaltine,Ltd.	11b tins	61b	61b		
ffe Nescaf	Nestles	2oz tins	1½lb	11b		
up	Knorr Swiss	Foil pkt.	70 pkts.	23pkts		usually used in stews.
	Symingtons	Foil pkts				
	Eslcourts	Foil pkts				
ato Pwdr.	Chivers	½lb tins	31b	21b		
at	Maplotons	11b tin.	101b	5		liked by only half the party.
lt	Cerebos	1½lb tin.	31b		F	Not enough
eese		8-101b brs.	401b	16	F	Excellent ("Scottish Pride").
Complan"	Glaro	11b tins	41b			
e	Thames Rice Milling Co.		151b	101b	F	Needed to be packed in polythene bags.
isins	Australian Dried Fruit Board.		151b	41b		ditto ditto
mato Sauce	Keddie		7 tubes	5 tubes		

Quantities of all food taken and left

	Manufacturer	Pack	Taken	Left		Remarks etc.
[illegible]	Mapletons	½lb pkts				
[illegible]amix		1lb pkts				
[illegible]meat		½lb pkts				
[illegible]s,Mint.	Pascalls	7lb tin	7lb	5lb		
[illegible]Fr.Drops.	"	7lb tin	7lb			
[illegible]licks Tablets	Horlicks	2 boxes	2lb			
[illegible]Dried	Wilts.U.D.	Paper bag.	12lb			Base Use.
[illegible] Dried	Folton & Cropin.	" "	4lb			
[illegible]ita"	Ryvita	1lb tins	24lb	10lb		For use at base as change from Lifeboat biscuits.
[illegible] Beans		Bag	6lb	5lb		
		7oz tins	10 tins			
[illegible]mon		7oz tins				
[illegible]Salad	Heinz	8oz tin	1½lb			
[illegible]ite Pepper		1oz	½lb			
[illegible]ley		1lb	2lb	1lb	F	Used in stew
[illegible]tils & peas.		1lb	2lb	1lb		
[illegible]ples "Granny	Smith"	60lb Box	60lb	-		Excellent.
[illegible]caroni	Quaker		8lb	3lb		
[illegible]our	MacDougall		8lb	3lb		
[illegible]colate	Nestles	2oz bars 48 in tin	60lb	5lb	F	Specially tinned.
[illegible]eboat biscuit	Carr	1&2lb tins	70lb	23lb	F	Staple
[illegible]t biscuits	Carr	4lb tin	24lb	4lb		

In practice it was found difficult to measure angles to this accuracy, because of instability of the tripod foundations (both the cairn, if used, and the ground itself). Angles were accepted as being "accurate enough for the purpose" if the face left-face right values agreed to within 1 minute of arc. When the expedition first went into the field much time was spent, at certain stations, trying to improve upon this accuracy. In many cases angles agreed to with 20 seconds of arc, but at certain stations where the theodolite tripod was resting upon an insecure foundation it was not found that a 1 minute discrepancy could be improved upon.

In the first place there was much discussion as to the best and most efficient way of carrying out the cairning and measuring the angles. Finally it was decided that the expedition should split into two parties. In the first week the parties worked in Kulmdalen, the Takefjellets and Hugindalen establishing a system of cairns. At this stage neither of the parties carried a theodolite.

Each party reconnoited its particular area and decided on the best place to position their cairns (depending upon intervisibility, prominence,ease of access etc). A cairn was built by establishing a series of rings of large flat stones, each ring on top of the other, and the middle filled with rubble and small stones. Generally the cairns were 3 4 feet in diameter and 3'- 6" high. Usually a smaller diameter pile of stones was placed upon the top of the main body of the cairn to raise its height and provide a capping. When the theodolite was erected upon the

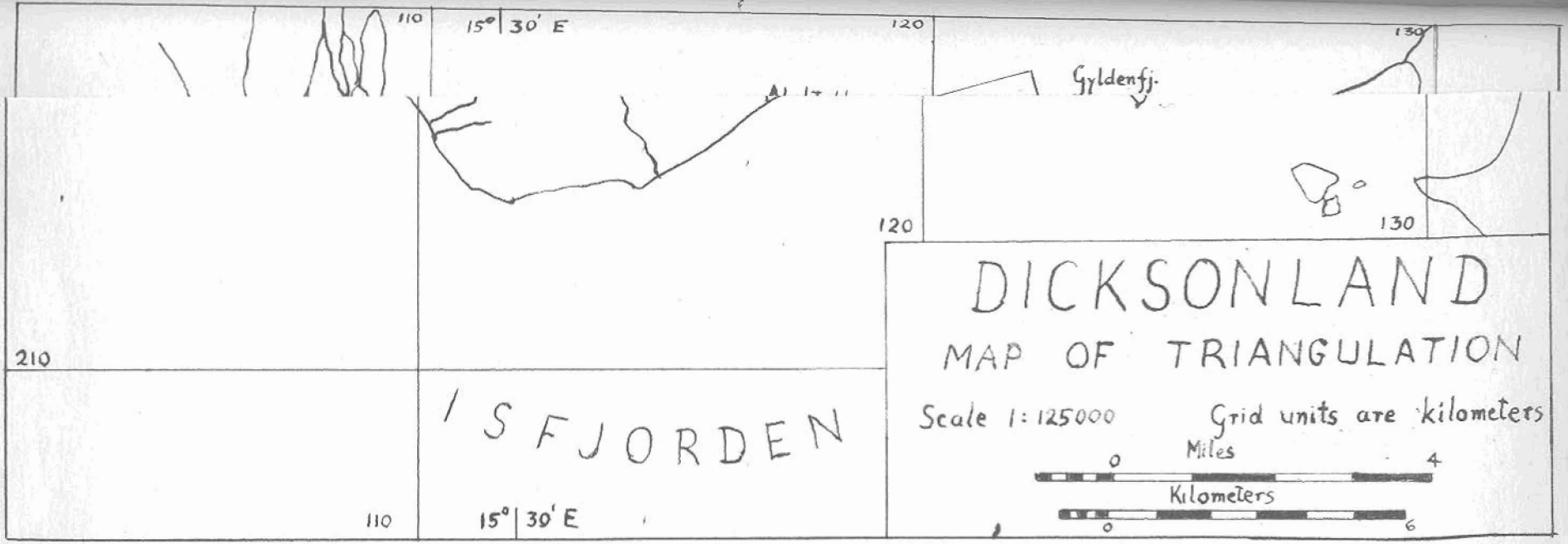
main cairn this smaller capping pile was removed so that the theodolite could be conveniently worked. It was found that the building of stable cairns is quite an art, and great care is needed in the selection of suitable base stones. In several cases, however (e.g. T508, S505) no large stones were available on the tops and the cairns were constructed as mounds of gravel with stakes and flags in them. T501 was a sharp snow summit with a flag.

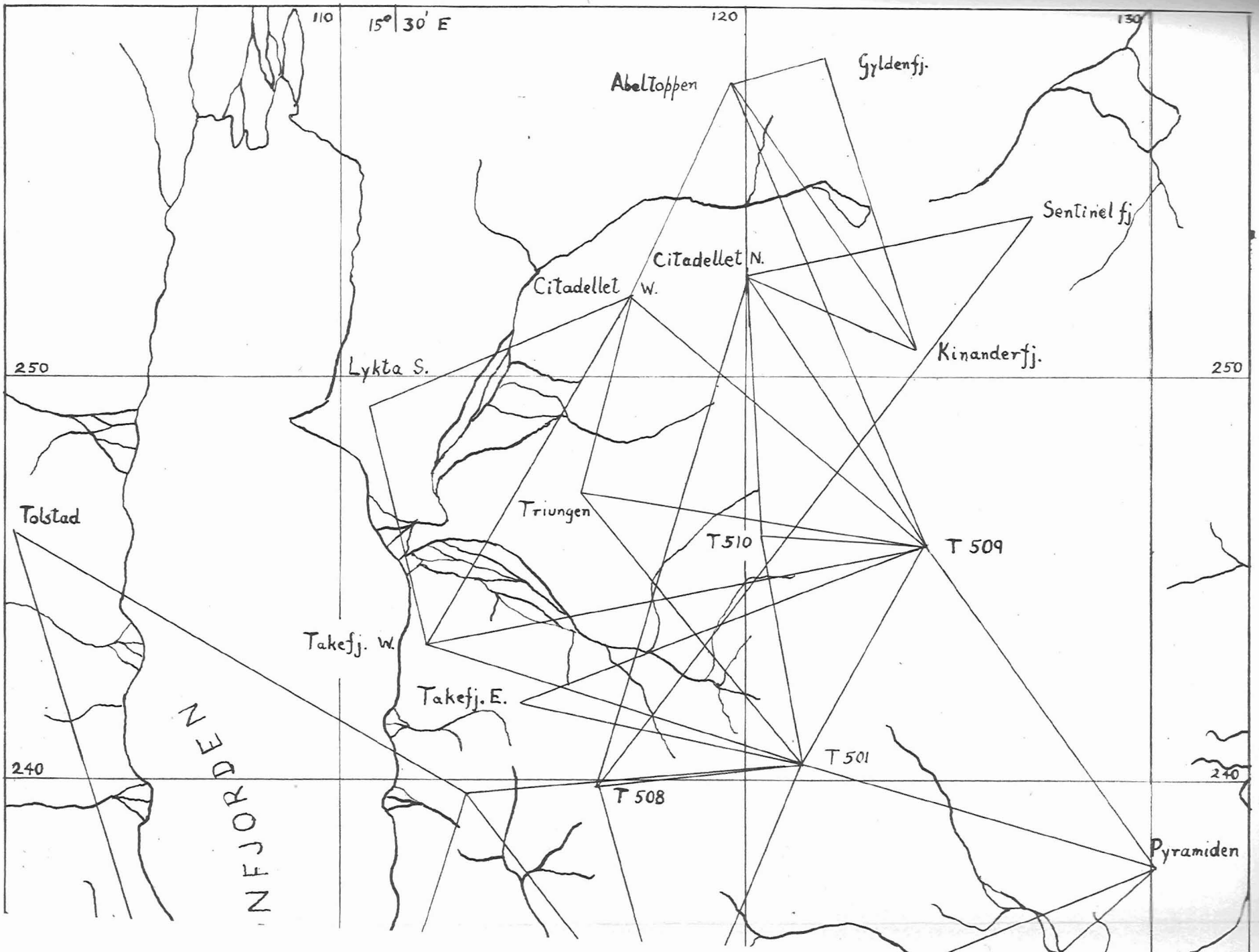
After the party had built a particular cairn, a 360 degree round of sketches was made and all prominent known peaks and features with their compass bearings were marked on this. At each cairn aneroid readings were taken every time it was visited.

The first serious attempt at theodolite work was not made until the Takefjellet Hugindalen, Kulndalen cairning had been done. It was decided that it would be best to start at the known Norwegian points in the north (Lykta South, Abeltoppen, Gylden) and work south. This meant that one party had to do the cairning of the southern parts of Nathorstdalen at the same time as the theodoliting was being done. Every attempt was made to integrate cairning and theodoliting, but only in one case was it unnecessary to visit a new station twice.

When the cairning of the whole northern area was complete, and the weather was good theodolite work was continued round the clock, one party sleeping whilst the other worked, and vice-versa.

The procedure at any particular theodolite stations was as


110
15° 30' E
120
130
Gyldenfj.
120
130
210
ISFJORDEN
110
15° 30' E
DICKSONLAND
MAP OF TRIANGULATION
Scale 1:125000
Grid units are kilometers
0
Miles
4
Kilometers
0
6


110
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Abeltoppen
Gyldenfj.
Sentinel fj
Citadellet N.
Citadellet W.
Kinanderfj.
250
Lykta S.
250
Tolstad
Triungen
T 510
T 509
Takefj. W.
Takefj. E.
NEJORDEN
240
T 501
T 508
240
Pyramiden

follows: he upper part of the cairn was dismantled and the theodolite and tripod erected upon the remains of the cairn as firmly as possible. The theodolite was levelled, and a "face left" round taken to all known stations. Readings were taken of both vertical and horizontal angles. The round, to the same stations, was repeated in the "face right" position. The actual angles were calculated on the spot by the man booking and one or both the roundswere repeated if horizontal angles differed by more than 1 minute of arc. Vertical angles often differed by as much as 3 minutes. Time was spent trying to find the source of this error and adjusting the theodolite. In the end it was decided that the instrument was out of adjustment and this could not be improved upon. Finally a round of photographs, taken in a clockwise direction, at thirty degree intervals and starting at a known station was taken with the photo-theodolite attachment. After the round of the known points was complete, time was usually spent scanning the mountain tops for possible other cairns, and taking angles to these if seen.

Working on mountain tops can be a very cold occupation. For this reason each member of the expedition was equipped with a duvet (down) jacket and windproofs. Sometimes, even wearing all available clothes it was impossible to stay at the instrument for very long. On other occasions it was possible to sit happily, at a particular station, for several hours in shirt sleeves.

As would be expected the main feature which hampered work was the weather. For this reason it was necessary to be ready to

occupy a station at any time, night or day when an improvement of the weather was shown. Lighting, particulary towards the end of the expedition, and at night was sometimes too bad for rounds to be taken. Even from minute to minute changes in lighting were enough to make a distant cairn at one time distinguishable and then merge into its back-ground. Cairns seen into the sun were particularly difficult to pick up. Also, it was difficult to see cairns on low dark tops from above at any time of the day.

When parties returned to Base the results were booked into a twinlock file in case the field books should be lost. When most of the stations had been occupied a plot was made of their positions and the coordinates approximately calculated graphically.

BIII. Calculations and conclusions.

The main difficulty in starting the calculations was to decide upon a satisfactory base length. This, naturally, is a length between two of the Norwegian stations which had previously been established in Dicksonland. Choice was limited to the rays between the following stations:

Kongressfjellet
Ganger-Rolf South
Likta South
Tolstad
Pyramiden
Abeltoppen
Gyldenfjellet.

When # possible systems of triangulation are examined, it becomes obvious in view of the rays already obtained between these

Calculation of coord's of:	Triangle (Closing Error)	Base Length Between	Side used in final calc. of coord's (A)	Coordinates N	Coordinates E	Ht. of Stn. as calc. along A (m.)	Aneroid height (m)	NORWEGIAN COOR'DS (if any) N	NORWEGIAN COOR'DS (if any) E	NORWEGIAN COOR'DS (if any) height
Ibsenfjellet *	Kongressfj Ganger-Rolfefj Ibsenfj (00'06")	Kongress - Ganger-Rolfe	Ganger-Rolfe - Ibsen	225.10589	116.04424	663.4	700			
Ibsenfjellet	Kongress, Ganger-Rolfe, Ibsen (00'05")	Kongress -Ganger Rolfe	Kongress -Ibsen	225.10591	116.04424	664.2	700			
S505 *	Kongress Ganger-Rolfe S505 (00'05")	Kongress. -Ganger -Rolfe	Kongress S505	233.05611	118.29050	667.7	702			
S505	Kongress. Ibsen. S505 (ab 20")	Kongress -Ibsen	Kongress -S505	233.05463	118.28720	667.7	702			
Pyramiden	Ibsen S505 Pyramiden (1'25")	S505 -Ibsen	S505 Pyramiden	237.81644	130.01444	950.7	976	237.81616	130.00857	935 (?)
T501	Pyramiden S505 T501 (00'20")	Pyramiden -S505	S505 -T501	240.41913	121.39513	970.8	1011			
S501	T501 S505 S501 (00'30")	T501 S505	T501 S501	239.76006	113.36636	755.3	812			
Tolstad	S501 Kongress Tolstad (00'00")	S501 Kongress	Kongress Tolstad	246.15531	102.06560	896.8	921	246.15189	102.07029	890.1
T509	T501 Pyramiden T509 (00'20")	T501 Pyramiden	T501 T509	245.58961	124.41752	992.4	1041			
T510	T509 T501 T510 (00 15")	T509 - T501	T509 - T510	246.03579	120.37275	568.7	616			
Takefjellet West.	T509 T501 Takefj W. (00'35")	T509 - T501	T509 -Takefj W.	243.50870	112.29253	609.7	642			

Triungen	T509 T501 Triungen (00'35")	T509 – T501	T509 Triungen	247.31116	115.82088	790.9	807			
Citadellet West	Triungen T509 Cit. W. (00'40")	Triungen T509	T509 Cit. W.	252.00760	117.13061	1005.9	1022			
Lykta South	Cit. W. Triungen Lykta S. (00'45")	Cit. W. Triungen	Cit W. Lykta S.	249.39526	110.73202	418.4	430	249.38868	110.73366	425.1
Citadellet North	T510 T509 Citad. N. (01'35")	T510 T509	T509 Cit. N.	252.44103	119.92492	977.6	1033			
Kinanderfj.	Cit. N. (00'10") T509 Kinander	Cit. N. T509	T509 Kinander	250.75423	124.07409	1017.1	1065			
Abeltoppen	Cit. W. T509 Abel (00'05")	Cit. W T509	T509 Abel	257.29836	119.59689	1117.9	1183	257.2862	119.5982	1123
Gyldenfjellet	Abel Kinander Gylden (01'30")	Abel Kinander	Kinander – Gylden	257.90533	121.93957	1125.5	1192	257.89914	121.93713	1121
Takefjellet East	T509 T501 Takefj. E. (00'35")	T509 T501	T509 Takefj. E.	242.10048	114.52155	602.9	624			
T508	S505 T501 T508 (01'15")	S505 T501	S505 T508	239.84051	116.33606	824.2	860			
Sentinel	Cit. N. T508 Sentinel (00'05")	Cit. N. T508	T508 Sentinel	253.898.04	126.96533	931.8	953			
Abeltoppen	By resection from Citadellet W. and Kinander.			257.29866	119.59786	1117.9	1183	257.2862	119.5982	1123

*These coordinates were used in the transfer of the triangulation to Pyramiden & onwards.

stations by the field party that the only really practical base is the Kongressfjellet - Ganger-Rolf South one. Others (e.g. Gylden - Pyramiden or Pyramiden - Kongressfjellet) are better in theory, but sights between these both ways were not obtained in the field.

Having picked a base there are a very large variety of ways in which the triangulation scheme can be built up. In selecting the system shown below, the main considerations were to keep the closing errors of the triangles as small as possible, and at the same time keeping shape of the triangles as near to the ideal equilateral as possible. The scheme chosen is shown in the attached table.

In the calculation of the coordinates, the error in the sum of each set of triangle interior angles was distributed evenly into the angles, so that the sum was $180^{\circ}00'00''$. Calculations of the coordinates was then done by ordinary plane trigonometry. Calculations were performed using six-figure trigonometrical tables, and an electric calculating machine.

On looking at the table of coordinates it can be seen that the two sets of coordinates for Ibsenfjellet differ only by 2cm on the Northing. This could be expected as the same triangle has been used to calculate both sets of coordinates. This check is one for arithmetical accuracy only. S505, on the other hand, has been calculated using two different triangles, and shows discrepencies of 1.5m. Northing and 3.2m Easting. This gives some indication of the expected accuracy of the coordinates, since the closing

errors of the two triangles used (5" and 20") are of the same order. A check against the geodetic coordinates of Pyramiden shows errors of 28cm, Northing and 5.8m Easting. It is suggested that the large easting error here is mainly caused by the 01' 25" misclosure of the Ibsenfj.- S05 - Pyramiden triangle, and that the Norwegian coordinates are substantially correct. On Lykta South the errors are 6.6m.Northing and 1.6m.Easting. At Abeltoppen they are 11.8 Northing and 1.3m.Easting by triangulation; by resection they are 12.0m.northing and 1.9m.casting. The agreement of the two coordinates calculated by different methods tends to suggest there may be an error in the quoted (Norwegian?) coorodinates. At Gyldenfjellet errors are 5.4m Northing and 2.4 m Easting, and at Tolstad 3.4m Northing and 4.7m Easting.

Summarising the errors of the calculated coordinates relative to the Norwegian ones are:

	Northing(m)	Easting(m)
Pyramiden	+ 0.3	+ 5.8
Tolstad	+ 3.4	- 4.7
Abel (triangulation)	+ 11.8	- 1.3
Abel (resection)	+ 12.0	- 1.9
Gylden	+ 5.4	+ 2.4
Lykta South	+ 6.6	- 1.6

The fact that the Northing errors are all positive, whilst the Easting errors seem to be random, points to the possibility of an error in the Northing coordinates of both Kongressfjellet and Ganger-Rolf. However, it may be that the errors,by chance,

fall into these groups.

The vertical heights have been calculated by averaging the angles taken at both ends of the ray relative to the horizontal line at the station whose height is to be calculated and at the station from which the height is to be calculated. In this way curvature and refraction (it is hoped!) corrections have been eliminated. Good agreement has been obtained considering the fact that the face left-face right discrepancies for vertical angles were as much as three minutes.

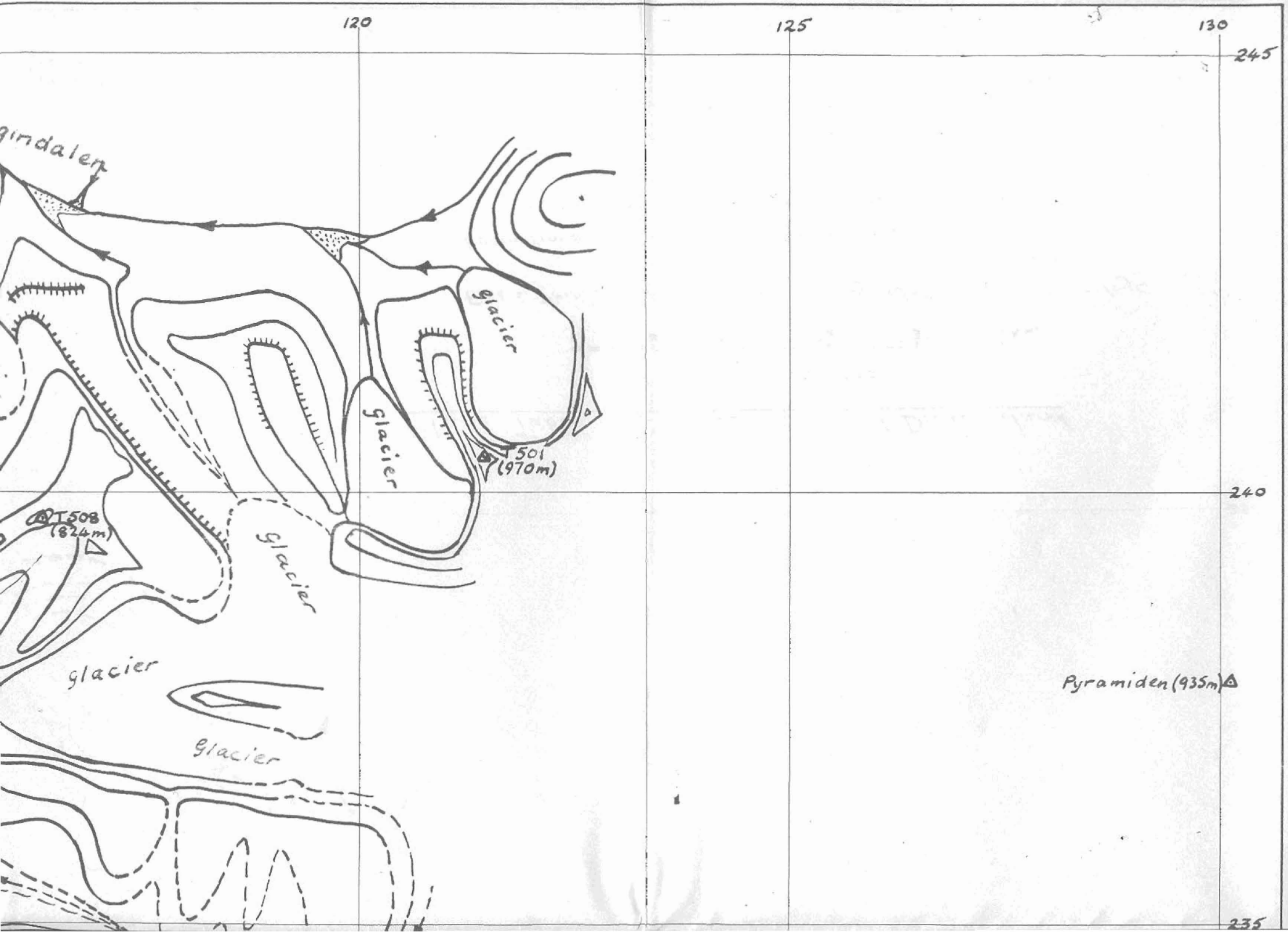
NOTE: The actual angles taken in the field and the calculations have been lodged with W.B.Harland, Esq., Sedgewick Museum, Cambridge.

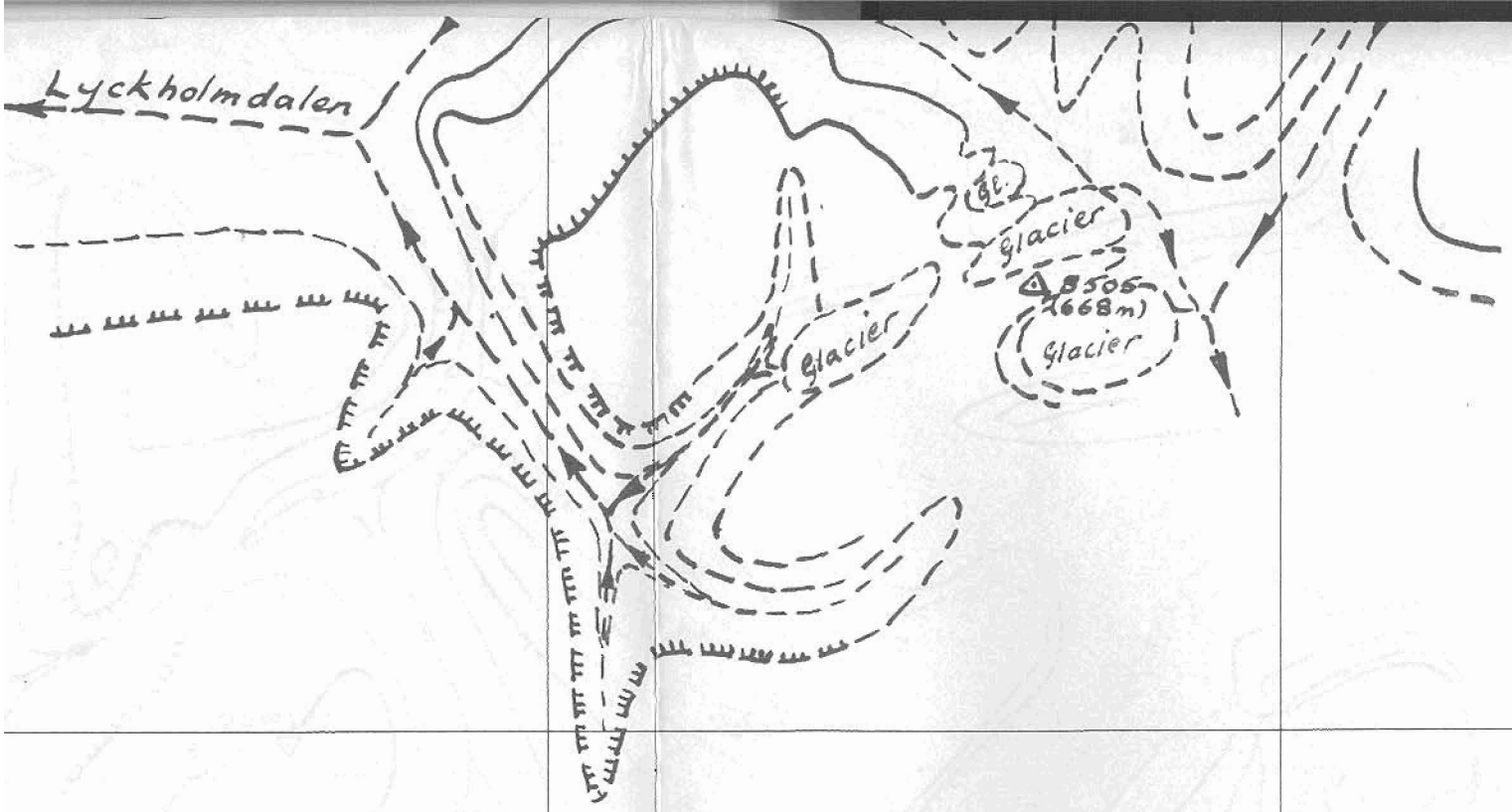
B4. Plane Table Work.

During the course of the triangulation it became apparent that certain areas of the existing map were very inaccurate. Not only were certain mountains wrongly positioned, but the general form of the land-scape was very different from that shown on the map.

Possibly the worst of these areas was that between Hugindalen and Lyckholmdalen. The other area which is suspected as being very bad is that east of Heimenfjellet, covering Ibsenfjellet and running eventually eastwards down to Skansbukta and Skansen. Only a few days were available at the end of the expedition to carry out plane-table work. This is regrettable since it is now felt that more time spent on making a full plane table map of Dicksonland, and less on the triangulation would have been more profitable. Because of the short time available the area between Lyckholmdalen and Hugindalen was chosen.

The graphical coordinates of the fixed points in area were plotted on to an 18" x 18" plane table sheet at 1/50,000 scale and this was taken into the field. Fixing by prismatic compass was found difficult, and the results were inaccurate. Thereafter fixing was done by three point resection using a Douglas protractor or a piece of tracing paper. The map shown was made from 8 points either known and fixed by resection. Because of the short time available contouring was not attempted. It was decided to mark rivers, coasts and glaciers, the bottom of screes, cliff edges


120
125
130
245
240
235
Pyramiden (935m)
glacier
glacier
glacier
glacier
glacier
T501
(970m)
T508
(824m)



230

Plane Table map

Fixed Points fro

Form lines are

Dotted form line

Cliff lines

25
ssfj

Ibsenfj
(663m)

110

115

120

230

of West Central Dicksonland

Scale 1:50,000

0 1 2 3 4 Km.

m triangulation by 1960 Imperial College Expedition

t approx. 200m. intervals

s indicate uncertainty

P.S. 10/60

225

125

130

and any other form line which would reasonably indicate the land form. It must be emphasised that the lines shown on the map are not contours but only form lines at approximately 200 m intervals. Some parts of the map are shown dotted. These parts could not be seen from the plane table stations and the dotted land form is put in from memory or from a sketch round done during the triangulation. If these limitations are born in mind it is thought that the plane table map is a more realistic portrayal of the country than the original map (Section A1).

Acknowledgements.

The Expedition would here like to acknowledge the help given by numerous individuals and firms: without their assistance the Expedition would have been impossible. Listed below are a few of our helpers. It is hoped that those people not mentioned will not think we are ungrateful. Lack of space prevents mention of them all by name.

Individuals.

Professor H.H. Read, F.R.S.
A. Stephenson, Esq.,
Professor J. Sutton.
P.F. Taylor, Esq.
Miss B. Falkingham.
Dr. G de Q Robin.
F.J. Annas, Esq.
W.B. Harland, Esq.
P.F. Friend, Esq.
L.P. Kirwan, Esq.
G. Harvey, Esq.
A. Sjursoth, Esq.
Miss M. Davies.
W.H. Ward, Esq.

Organisations.

Royal Geographical Society.
Scott Polar Research Institute.
Cambridge University Department of Geology.
Mount Everest Foundation.
Norsk Polarinstitutt.
Royal Norwegian Embassy.
Sysselmannen for Svalbard.

Organisations (Continued)

Russian Coal Mine,Pyramiden.
Imperial College Exploration Board.
Department of Civil Engineering, Imperial College.
Supplies Section, Imperial College.
Health Room, Imperial College.
Ministry of Agriculture and Fisheries.

Firms.

Kavli Limited.
Thos. Black, Ltd.
Robert Lawrie, Ltd.
C.B. Cow & Co.
Establishment Grain.
Ilford, Ltd.
Kodak, Ltd.
The B.P. Company, Ltd. (Norway)
Boots Pure Drug Company.
Northern Mail Order Co.
Samuel Putney.
Bryant and May, Ltd.
Atco, Ltd.
Unicream, Ltd.
Van den Bergh, Ltd.
Brown & Polson,Ltd.
Romney & Co.
Felton & Crepin, Ltd.
James Sawyer, Ltd.
Oxo, Ltd.
Templetons, Ltd.
Carr & Co.
Chivers, Ltd.,
Heinz & Co.

Firms (Continued)

Cadbury, Ltd.
Mapletons, Ltd.
Crosse and Blackwell, Ltd.
Ryvita, Ltd.
Horlicks, Ltd.
Maconochie Ltd.
The Nestle Co. Ltd.
The Thames Rice Milling, Co.
Marmite, Ltd.
Batchelors, Ltd.
Huntley & Palmers, Ltd.
Anglo Swiss, Co.
Australian Dried Fruit Board.
Cerebos, Ltd.
Glaxo, Ltd.
Horniman & Co.
Lipton & Co.
Laudaner & Co.
McDougall & Co.
Pascall Sweet Co.
Tate & Lyle, Ltd.
Wander, Ltd.
Keddie, Ltd.
Unigate, Ltd.

Many of the above firms gave food and equipment free or at reduced prices. We are particularly grateful for these concessions.