The Cambridge University KJ 1970 (Iceland) Expedition

Final Report

CONTENTS

INTRODUCTION

This report of a small undergraduate expedition to Central Iceland has been written in five main sections. After this introduction is the Chronology of all the events that seemed of most importance to the expedition; many of the events are not self explanatory but this list helps to put them into perspective when they are retold in the narrative. The narrative is the third section and consists of mainly personal accounts of features of the trip that stand out in the minds of the storytellers. Details of expedition work are kept until the pertinent section later in the report. Section four and section five are given the rather loose titles of Administration and Projects. The latter takes in reports on the survey, the ice work, meteorology and a few allied subjects while administration covers the rest. Where possible these short reports are aimed at giving hints to future expeditions; the steam drill reported in section 5, 3.4 is especially recommended for use by modest expeditions wanting to do ablation work.

THE CAST

Richard Anderson	(R. A. L. A.)	:	Climber and food member
Chris Bradbury	(C. C. B.)	:	Surveyor
Tony Burch	(A. J. B.)	:	Surveyor and cinephotographer
Ken Jay	(K. G. J.)	:	Meteorologist cook and handyman
Brian Semple	(B. M. S.)	:	Leader and surveyor
Martin Sessions	(M. P. N. S.)	:	Secretary treasurer and glaciologist

CHRONOLOGY

1969	
August	Expedition conceived
December	Expedition approved
1970	
April	One week course in survey techniques
June	Freight assembled and shipped
Beginning July	Personnel depart for Reykjavik by air
10th July	Left Reykjavik for field
11th July	Reconnaissance from first camp
13th July	Main camp established by Svedja Stream
17th July	First parachute drop by U.S. Navy
19th July	First water samples collected
20th July	Second and final drop by U.S. Navy
22nd July	Main triangulation starts
24th July	First drilling for stakes on glacier
26th July	First ascent of Hammarin
	First visit by Icelanders
30th July	Plane Tabling starts
2nd August	Bridge Project starts
6th August	Drilling completed. First Ablation measurement starts
9th August	Bridge Project abandoned
13th August	Second visit by Icelanders
21st August	Stream flow measurements start
27th August	Final Plane Tabling completed
28th August	Last Ablation measurements taken
1st September	Picked up by Icelanders from field
8th September	Depart to Glasgow by air
End September	Freight arrives by sea from Iceland

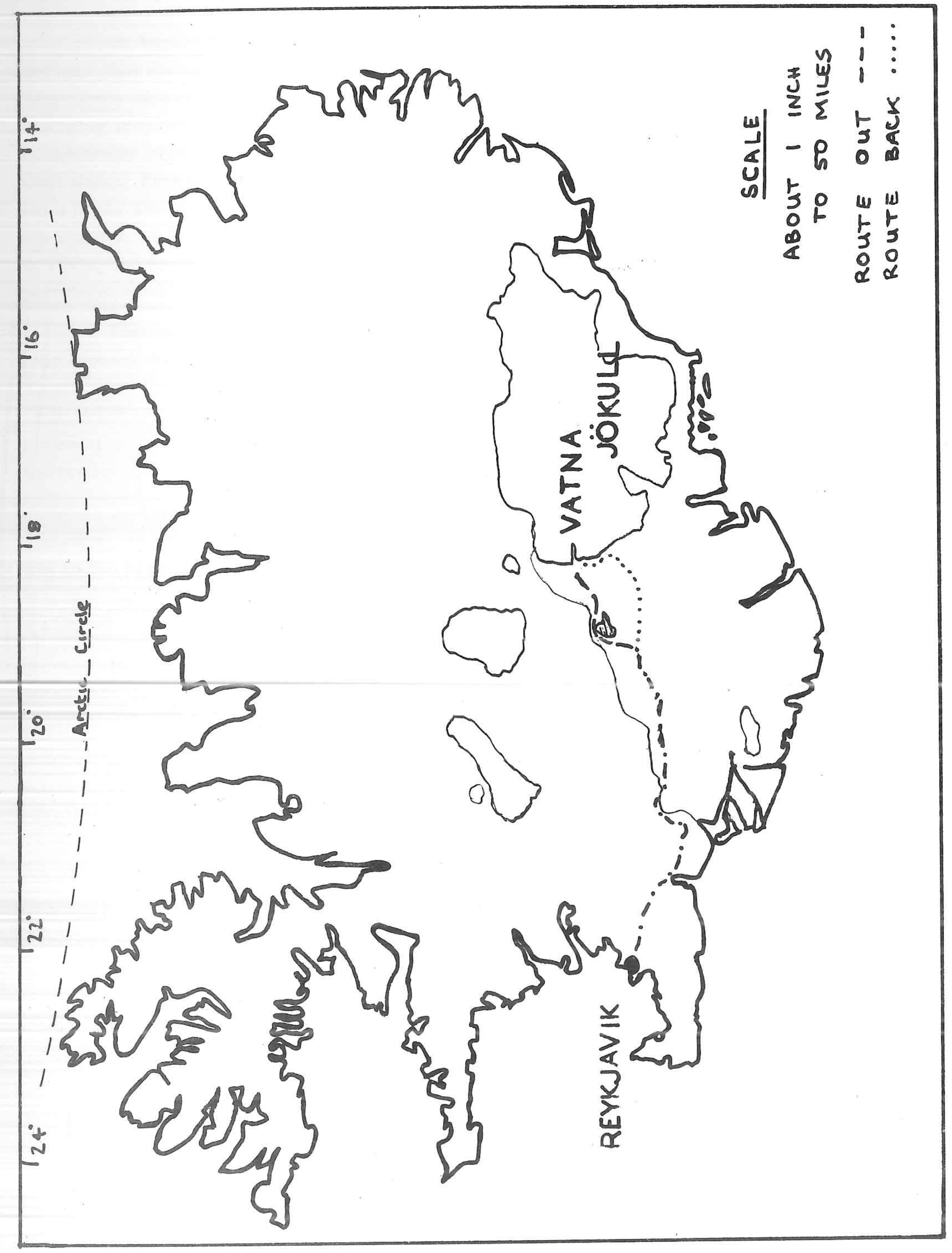


FIGURE 1 ICELAND

3. THE STORY

3.1 THE BEGINNING

In August 1969, Brian Semple (a 23 year old Lieutenant in the Royal Engineers) decided that during the summer of 1970 he would like to go to Iceland to survey a glacier. The survey aspect would be a good excuse for an expedition, a glacier was chosen because its changing features made it suitable for fresh mapping and finally Iceland because it was a compromise between the easily accessible areas of Norway and the very remote areas of Greenland. Research soon brought to light a series of surveys of an Icelandic glacier that had been made about every ten years, so with the last recorded visit in 1956 it was probably ready for another. A letter to Iceland brought a reply which revealed that a survey had been made in 1968, but intimated that the Iceland Energy Authority and Guttormur Sigbjarnarson in particular would be interested in a survey of another glacier, the Koldukvislarjokull.

Discussions with undergraduate contemporaries at Cambridge during early October soon showed that an expedition would be feasible, and so planning began. Martin Sessions, a Royal Navy Sub-Lieutenant, was the first to join Brian's party, and he was soon followed by Chris Bradbury, Tony Burch, Liz Clayton and Ken Jay. The expedition soon received the approval of the Cambridge Expeditions' Committee, adopted the name of the Cambridge University K. J. 1970 (Iceland) Expedition, and serious planning and fund raising began.

In April 1970, the party increased from six to seven with the inclusion of Richard Anderson, an experienced climber on both rock and ice. Richard had been planning his own trip to the Middle East, but the area's inherent instability forced him to call it off and left him looking for somewhere to go, and at the same time the K. J. expedition was without a climber.

By mutual consent a financial deadline of May the first had been set, which would mean that were the expedition not financially viable it should be called off, but the money and promises were there and preparations continued.

From the beginning of June the equipment began to be assembled and packed and then taken to Felixstowe to be shipped to Iceland. During the last week in June Liz decided that unless she could get back to Britain before the last week in August she would have to withdraw; as this was before the planned withdrawal from the glacier, it seemed unlikely that one person could be picked up early, so she withdrew and the expedition became six.

3.2 ICELAND

B. M. S.

On the first of July Brian Semple arrived in Iceland.

At Glasgow airport the queue at the check-in shuffled forward, it was a warm cloudy summer evening and this hotch-potch of travellers was moving on. The largest group were the American Students. These college boys and girls with their slung guitars and their rolled beds were doing their last things before they moved on back to the States.

On the plane I sat next to a Botanist from Yorkshire, this was his third trip to Iceland and he told me all I should know about the Iceland summer and fish that was cheap and the meat that was dear and sometimes it rains and sometimes it doesn't, and of course it didn't get dark at this time of year.

The Loftleidier terminal at Reykjavik was in their hotel on the edge of the municipal airport, and the coach that brought us from Keflavik airport left us there. After the rich disappeared inside and others took their taxis to lesser hotels, there were three of us standing at three in the morning in the promised light of a new Icelandic day. The Botanist with his one-man tent was off to the camping platz and a Canadian was going to the Youth Hostel; I joined him, and the three of us set off towards the town. After ten minutes walk we came to a very locked Youth Hostel, so the two of us tramped back and lay out on the benches of the terminal lounge. After a few hours of fitful rest we retraced our steps, found the door open and claimed a couple of beds in the still sleeping hostel.

At a more respectable hour I walked the fifty yards or so to the British Embassy to pay my compliments to Brian Holt the consul: "My dear chap everyone uses first names over here, – you're even listed that way in the telephone directory".

My next call was on Guttormur Sigbjarnarson at the Energy Authority; he was in conference but, I made an appointment for the early afternoon. When we met we discussed our journey to Koldukvislarjokull, and agreed on what the expedition would be doing there.

3.3 A POTTED HISTORY OF KOLDUKVISLARJOKULL

The area around Koldukvislarjokull is devoid of vegetation and life, neither is it on any natural route, so no real tracks have been made into the area. Information is thus very scanty and this encouraged the idea of an expedition.

North Tungnarjokull and Koldukvislarjokull were originally surveyed by plane table to a scale of 1:200,000 in the summer of 1938 by Agust Bodrarsson for the Danish Geodetic Institute. The present 1:100,000 map (Bland 76 published by Landmaelinger Island in 1966) is based primarily on this survey. In 1949 the U.S. Map Service published 1:50,000 maps of the area primarily based on a 1946 air survey. A further air survey of Iceland was made in 1960, but mapping of our area was not carried out. As far as can be discovered, no one has visited the area for any length of time since the 1938 survey, until 1969 when Guttormur Sigbjarnarson visited it by landrover. The French-Icelandic expedition to Vatnajokull in 1951 made a seismic sounding near Hamarinn. A survey beacon was found on top of this mountain and this may have come from that expedition. It is as a result of hydro-electric schemes around Thorisvatn, into which the Kaldakvisl flows, that the interest in the area is growing.

3.4 U.S. AID

The next members of the expedition were due into Reykjavik on the following Sunday, 5th July. On the Thursday previous Brian made a visit to the NATO Base at Keflavik. The main idea was to tell the Air-Sea Rescue people there that a party (including five British Officers) would be out on the Icecap, so that they might fly over occasionally to see that all was well. The Americans who operate the base were most helpful and Brian suggested that they might like to help further by air dropping some of the stores to cut down the land transport problem. "You get the chutes, we'll provide the plane", was the reply. This message was passed back to Britain and at about four o'clock on a Friday afternoon Major Perkins of the Cambridge University Officers' Training Corps began pestering the R.A.F. for some parachutes. Richard was able to collect the parachutes before flying the following Sunday. That Sunday Richard, Chris and Ken arrived at Reykjavik Airport, carrying in their hand luggage six parachutes to the amusement of the customs officers and the bewilderment of fellow passengers. Also on the plane was Keith Miller who was leading another Cambridge Expedition, which was

flying out later in the week for Greenland. He had permission to camp in an Icelandair hangar until they flew out and the Koldukvislarjokull party were invited to share their accommodation. Though a little draughty and despite the rattling of the corrugated iron walls, the hangar made an excellent jumping off point, where stores could be sorted and loaded on to pallets, for the air drop.

On the Tuesday the stores arrived by sea and that night Tony and Martin arrived by air. All evening Tuesday and all Wednesday morning were spent in assembling the pallets, first of all building them out of scrap wood found in the hangar, and then loading them with most of the food and unbreakable stores, apart from equipment that would be needed during the first week.

On the Thursday the pallets and parachutes were taken out to Keflavik and left in the care of Commander Burnham of the U.S. Navy and Captain Rockstad of the Air Force, who had undertaken their safe despatch.

3.5 INTO THE INTERIOR — B.M.S.

Our last meal taken in comfortable surroundings was eaten in a hut belonging to the Energy Authority at their camp at Tungnaa Bridge before we set off on our vehicle journey to the centre of Iceland. It was overcast and windy when the two landrovers driven by Guttormur and Birgir Jonnson left the camp at about 1730. The first 20km or so to the construction camp at the northern end of Lake Thorisvatn were along a well worn dirt road, but then that gave out and became a set of old landrover tracks. These tracks had been made by Guttormur in 1969, and we were following them. Tracks that had survived one winter were the only signs of regularity in an otherwise desolate region of mountains, hills, boulders and sand that stretched out on all sides. After five hours journeying covering 40km, and many stops and starts losing tracks and re-finding them, jacking the vehicles over rocks of lava and starting off again through wind and snow and the everlasting Icelandic day we arrived at what would be our first camp. We unloaded the landrovers and pitched our tents and then the undaunted drivers left us for their journey back to civilisation and we were on our own.

3.6 SYDRI HAGANGA—THE FIRST DAY — R.A.L.A.

We didn't rise from our tents on the lava desert until mid-day, excusing ourselves by saying we had gone late to bed the night before, and at that time it didn't really matter, for there was ample light to work with for most of the night.

After breakfast Brian asked Ken and me to find out the possibility of getting a theodolite across the Kaldakvisl river and up to the top of Sydri–Haganga (1284m.). So, having packed the sacks, we struck off towards the river, agreeing to be back by 2000 hrs. It was up and down all the way over the weathered chaotic remains of the lava and it took an hour to reach the point where the river enters its gorge to swing round the base of Sydri. Directly on the other side rose the distinctive shape of our mountain, but the river had to be crossed first. There were two courses open to us, either cross it where we stood, or try to cross further upstream, where it was braided. In those innocent first days we chose the first course, reckoning it quicker than a detour to the north. After a gingerly first attempt with boots off and breeches rolled up, I retreated to take my trousers off altogether. At the second attempt I was successful, but only just, and my shirt and vest got considerably wetter than I intended. Ken soon joined me on the Sydri side and we dried ourselves off with out sweaters, but the mosquitoes, excited by the human smell, were attacking first. Therefore, after a hasty bite, we departed rapidly, our pace soon slowing with the increasing gradient. The climb to the top of Sydri was not difficult, but scree underfoot made it tiring, and both of us were soon breathing heavily. Halfway up we travelled right to avoid a rock band and continued up the side of a snow patch. Eventually, as with all mountains if you climb for long enough the ground fell away to reveal the top and thankfully we staggered over to the summit. There we rested under a well constructed cairn, (built, we supposed by the pre-war surveyors) admiring the view until a snow shower blotted out the landscape.

Neither of us felt like lugging a theodolite up the way we had come (even assuming the faint possibility we might get it across the river in our dinghy). After the snow shower stopped we circled the summit plateau looking for easier ascent routes. However, the other flanks of the mountain were in general no better—in fact in some places they were much worse. On our return to the East again we could see Brian and Tony building a cairn on Hill 1. Then it was time to start down.

As we wanted to know if it was any easier crossing where the river was braided, we chose a different descent route and soon reached the bottom after an exhilerating scree run, punctuated by a few photographic stops. Since our earlier crossing, the river had swollen considerably with melt water and we had an extremely unpleasant two mile walk, alternately wading and crossing mud banks, and pebble beds, in barefoot. At last we reached the shores of the lava desert. It seemed impossible that so much water could flow through the place where we had safely crossed before, but the explanation was simply that there was much more water flowing now, and I doubt if we would have been able to cross back where we had forded earlier. With our boots on once more we headed back to the camp, and as we found we were the first back, began to get the evening meal ready. It was then that we discovered the first loss of the expedition.

Ken had left his hat at the top of Sydri, and for all I know it is there still. Because, as our stay continued into the warmer weather, Kaldakvisl became so full that it could never be cross on foot again.

3.7 MOVING CAMP

The move to the main camp began early on Monday, 13th July, after a breakfast at 0600. The party all set off with their packs loaded with stores. The journey over the flood plain took about an hour and a half for the six kilometers, and about half an hour for the climb from the plain into the hills. The new camp was sited on the edge of the Svedja stream. This stream was bordered in places by wide flood plains, and the actual site was just above one of these plains which flooded many times before the end of the summer.

The air drop was due to take place in this area from that day at noon. When one o'clock came and the Americans hadn't, the expedition returned to the first site to strike camp and complete the move.

3.8 THE DROP

K. G. J.

"Don't worry you guys, we'll get the stuff to you somehow". John Rockstad's words echoed around my mind as we sat in our tents in appalling weather conditions, discussing our escape route from the desert prison we would be in when our food ran out in two days time.

We found the circumstances surrounding the supply drop by parachute very funny. We had told John Rockstad that we had nine days of food with us when we left for our area. On the

first fine day we were heartened to hear the approach of an aircraft. It descended, made several low passes across our valley, 'waggled' its wings, and flew off. First 'false pregnancy' ! The next day was fine too—a repeat performance with a different aircraft and a note addressed to "Expeditionary Force"(sic), accompanied by an international distress signal card, told us that the supply aircraft 'had not yet flown'(sic). How were we to interpret that?—second'false pregnancy'.

The next day the weather worsened dramatically and the following day, after a lot of rain, our planned dropping zone (DZ) turned into a lake! We reconnoitred a new DZ to the east which was much drier. On Friday, 17th July, I wrote in my diary: "It has obviously snowed quite a lot during the night—everything is white. No hope of the U. S. Navy coming today, cloud base is halfway up Hamarinn (approximately 1200m). Brian wrote 2 DAYS FOOD LEFT in the sand of the next basin to the west of the campsite".

At 1715 Martin shouted 'aircraft' and confusion followed. Some of the expedition members were still in their sleeping bags, as it was still snowing slightly, and the cloud base was very low. Brian made a snap decision to receive the drop in the second basin to the west, as the aircraft appeared low over the hills. Richard, who was late out of his tent, was seen to rush off in the opposite direction, towards the previously arranged DZ, hurriedly pulling on his trousers.

The aircraft made two circuits while we laid out a sheet of pink nylon to signal the wind direction, and on the third circuit, out came the first load. It landed intact ten yards from our wind direction signal. Three other loads followed on successive circuits, and just as it began to hail again the aircraft disappeared as quickly as it had appeared.

We were full of admiration for the U. S. Navy, for the weather conditions were absolutely appalling and the clouds covered all the mountain tops. This meant they must have flown all the way from Keflavik under the cloud base at unusually low altitude. John Rockstad's promise was fulfilled. A note on one of the boxes said that the final two loads would be dropped as soon as possible.

We made one small mistake. Two cans of paint were dropped in one load, and due to lack of compression space in the cans they had exploded all over the Daz, Fairy Liquid, and Toilet Rolls— nothing serious. The rest of our design, the crushable pallets and the slinging arrangements, were adequate.

Monday 20th July, the next available day for a supply drop, was even worse than the Friday. There were snow showers, low cloud and a 40mph wind. Again we were convinced that the Navy couldn't fly. However, at 1330 an aircraft appeared and again in appalling weather conditions it made a drop. The pilot was obviously not very happy with the worsening weather, and without any preparatory circuits the first load was ejected. It landed 200 yards from the camp site on a big rock which somersaulted it and caused one box to spill its contents— again there was no serious loss. The last load was less fortunate. Its parachute came off soon after leaving the aircraft door and the boxes plummetted 500 feet into a sand and gravel bank in the middle of the braided river near the camp site. According to Chris Bradbury, an eye witness of the impact, 'it went off like a small bomb'.

This package contained important items of scientific and climbing equipment as well as 6 days of food for all of us. Worst of all it had our 'goodies' box. It had to be recovered— if at all possible. It was snowing hard at this time and this, combined with a strong northerly wind, made the temperature below freezing. It would have been sheer folly to attempt to cross the several branches of the river to get the remains from the camp site side. An attempt from the far side, however, would be feasible. Both the strong wind and the fast current could help the rubber dinghy across to the load, and there would only be one major branch of the river to cross.

3.9 RECOVERING THE DROP

M.P.N.S.

At 1600 hours four of us; Tony, Richard, Chris and I, set off in driving snow with dinghy, ropes and sacks, to the ice bridge. From there we made our way round to the far bank, where some "small" streams had to be crossed before the main branch, 15m wide, which separated us from the wrecked load.

Starting well upstream, I frantically attempted to row the dinghy across, aided by the wind, but this first effort was a failure - as I couldn't get out of the dingy! On the second attempt, by paddling canoe style, I succeeded at the expense of wet feet. I then sent the dinghy back to the mud bank where the others were. Tony got in and I pulled him back to help me dig the remains of the load out of the ground. The 90mph impact had turned the ground into a quicksand and it presented a sorry sight. Sodden apple flakes were everywhere, rice bags had burst open, two ice axes lay broken; but the tinned food, although horribly contorted, was luckily still alright. The chocolate also had remarkable powers of survival.

We managed to ferry over all that we could recover, and two rucksacks were filled up with vital food. Then we started to make our way back to the tents after deflating the dinghy. Richard decided to take a short cut and made a standing jump across a 3m gorge! Then a rope was passed across to him and we slung our loads across the gorge. After rejoining him on the other side, we returned to camp at 2200, dog-tired, and in need of a welcome supper.

Fortunately, the pressure cooker, main component of the ice drill, was not severely damaged in the drop!

3.10 THE LONGEST DAY

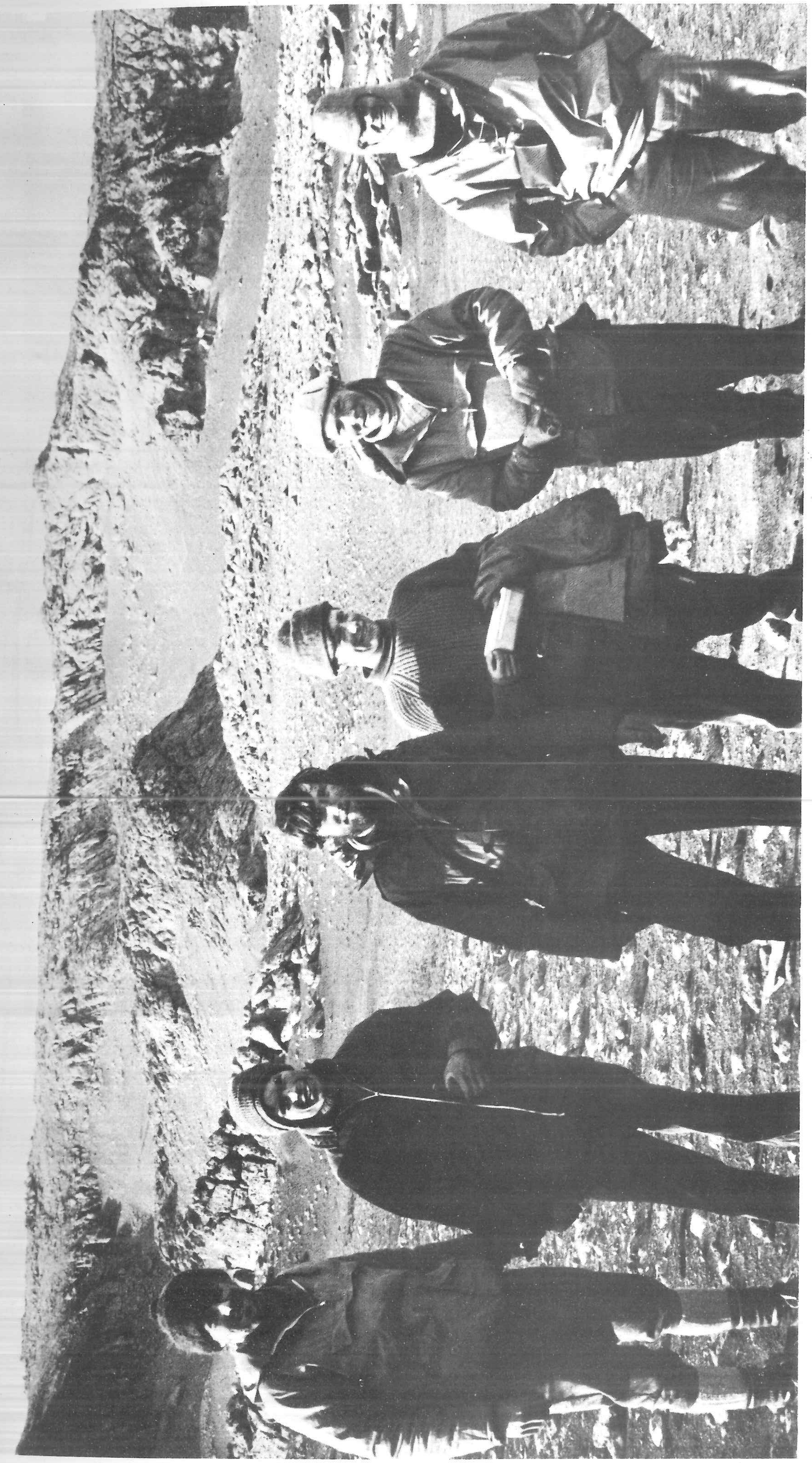
M.P.N.S.

Richard, Tony and I left camp at 0915 for the glacier, at this stage still covered in fresh snow. Two and a half hours later we were on the ice drilling the first stake hole. We wanted to drill as many holes as we could that day, so a technique was developed. One person carried the stove and the pressure cooker, another the stakes, drill and fuel for the stove, and the third, all our personal gear. We marched 500 paces to the next stake site, set up stove and pressure cooker, built up steam pressure, and began drilling, pumping the primus as much as possible to keep up pressure. On completion of a hole the complete cycle would start again, taking on average half an hour. Occasionally we would have the usual delays, such as the pressure cooker lid failing to seal, or the stove not working properly.

To keep spirits up, we had the odd cup of coffee, brewed up from pressure cooker water.

Moving over the glacier was generally exasperating; many times we fell through the ice crust into hidden melt streams, or waded through large patches of knee deep slush. Crevasses were also annoying, and once Richard fell into a thin one, up to his hips, struggled out– and then the next person did exactly the same!

We drilled one final hole for this day (the tenth) at 2230, and had a steam pudding, complete with complan sauce, to celebrate. After that we returned to camp, and the view of the sun setting over the Hofsjokull glacier 30km away was most memorable. I think that day was the most successful day of the whole expedition.

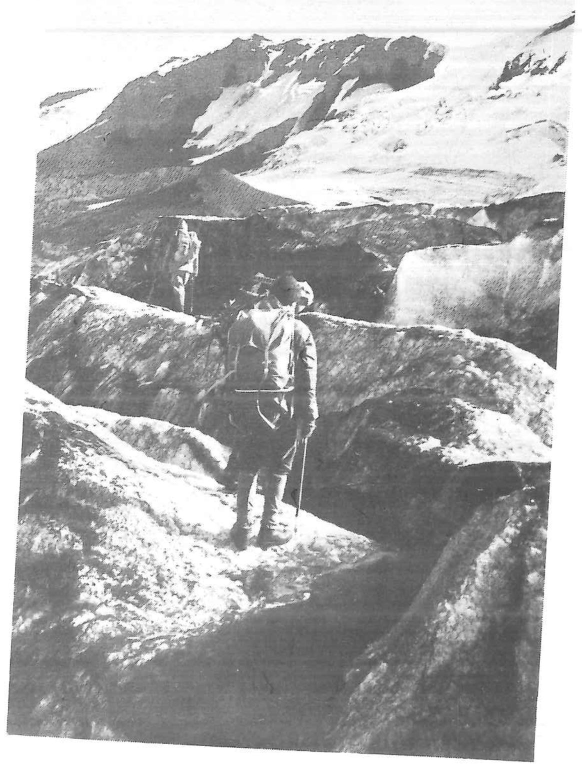


Left to Right: Tony, Martin, Ken, Chris, Brian, Richard

THE EXPEDITION JUST BEFORE THE RETURN TO CIVILISATION

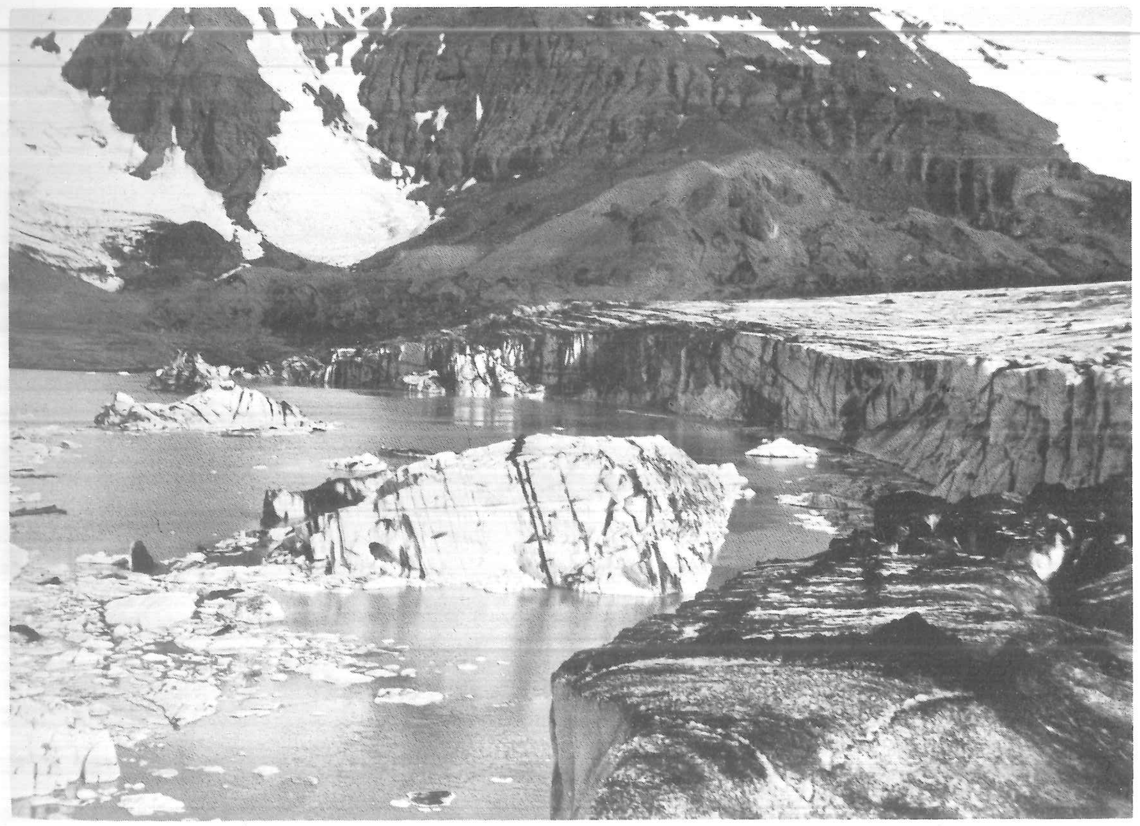
DRILLING JUST BEGINNING

THE SEVENTEENTH

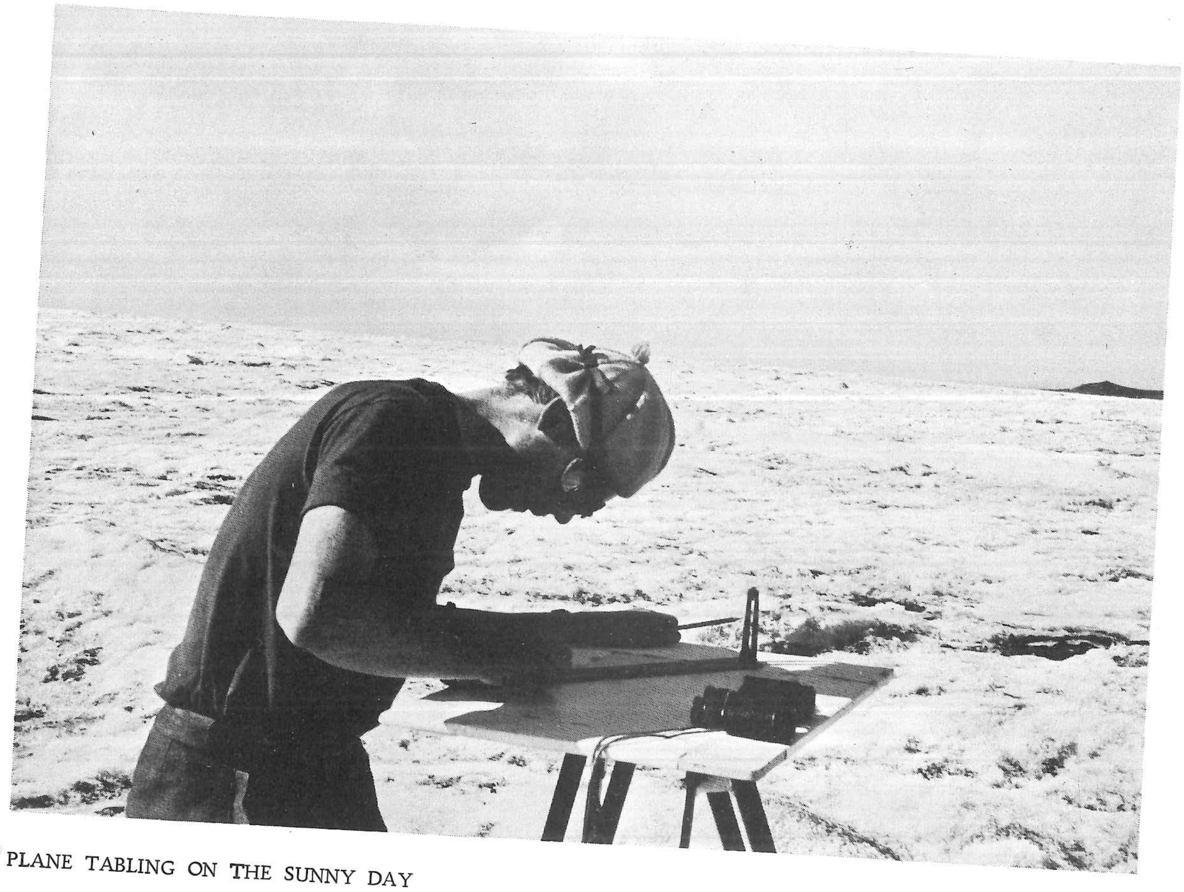


PRESSURE RIDGES AND CREVASSES

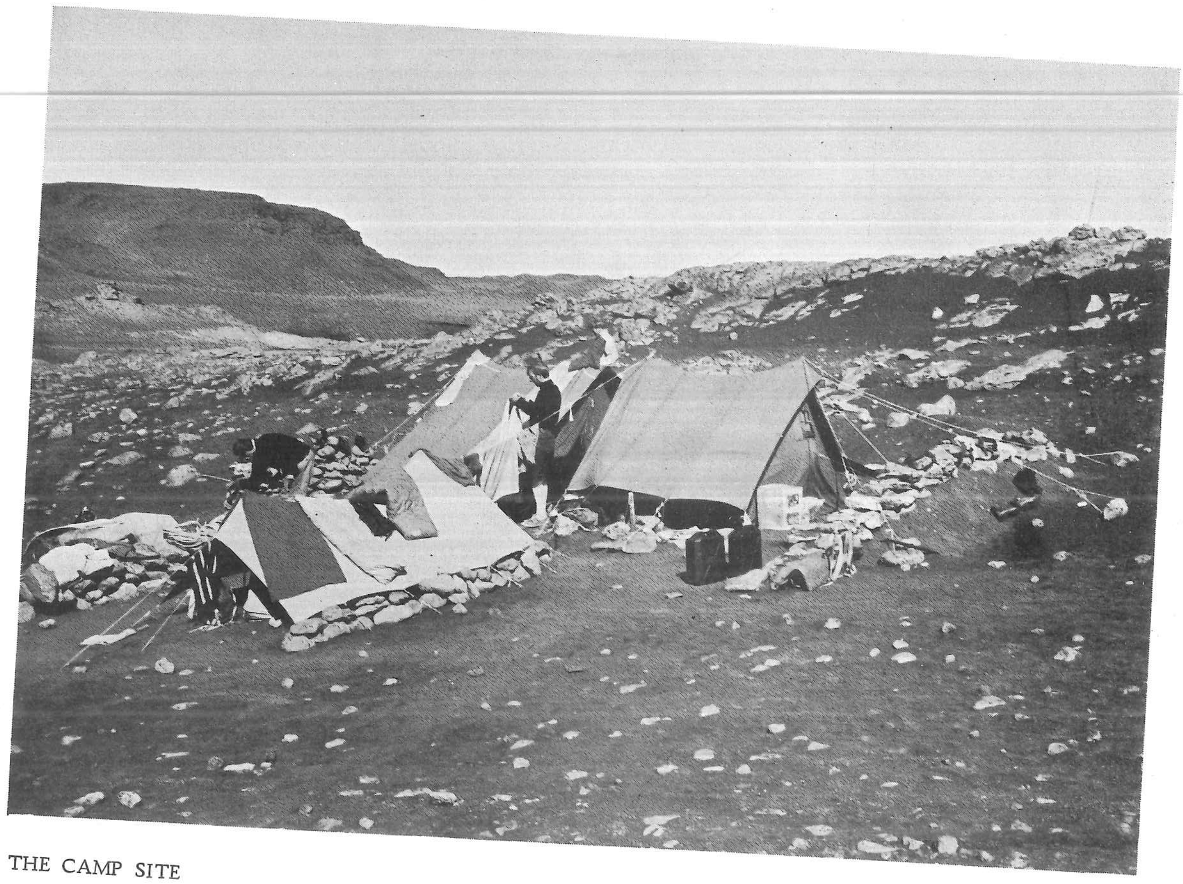
WALLOWING IN SLUSH NEAR THE TOP STAKE



ICEBERGS BELOW HAMARINN



PLANE TABLING ON THE SUNNY DAY



THE CAMP SITE

3.11 HAMARINN—OUR FIRST ASCENT

K.G.J.

26th July, 1970

Richard and I got up at 1130 as we had been on the ice that morning until 0100. We set out to cross Hamarskriki in a south easterly direction at 1350. We reached the edge of the ice to the south about an hour later and proceeded to rope up to traverse the ice in the direction of a spur which came down the western face of Hamarinn. From a high point, whilst crossing Hamarskriki we had decided that our best chance of climbing the mountain was up one limb of this spur. The spur divides into two branches about halfway down the face and the route up is blocked by a castellated rock band. This forms a near vertical face across the mountain at half height. It is regularly castellated by snow filled chimneys, which lead to the relatively easy ground higher up. We chose the shortest chimney for a first attempt.

It took us an hour and a half to reach the ice-bound moraine at the foot of Hamarinn. We had been hampered by a barrier of enormous, gaping crevasses where the ice turned a corner round the base of the mountain and cracked off into a lake full of huge bergs. The first few hundred feet above the flat glacier ice consisted of many ice ridges, covered with loose moraine. Once over these ridges we climbed on small scree, and very friable "tuff" until we came to the main obstacle of our climb. Fortunately, the chimney that we had chosen from afar was climbable without great difficulty and only a couple of short easy snow pitches. Above this loomed an enormous tower of very fragile yellow rock covered with a very hardy brown lichen. This was traversed right at its base and the side was climbed with a great deal of care! We took a short break for lunch (very belated).

The rest of the climb was on scree. The rock was broken into plates, and made a sound not unlike clay tiles knocked together. Again there were one or two easy snow pitches in almost ideal conditions. Having climbed our spur we had to traverse a corniced ridge to reach the summit (1556m). Whilst roping up to do this we caught a brief glimpse of the hills surrounding Grimsvotn before thin cloud swirled round them and began rapidly to approach us. The summit was marked by a broken survey beacon which was probably put there by the French Expedition to Vatnajokull in 1951. I have one very tattered and faded piece of pink material which was uncannily just lying on the ground unweighted by any of the loose lava which formed the summit. We hurriedly re-erected the remains of the beacon and built a sturdy cairn round it. Just as we finished this task the cloud enveloped us and we noticed a Brockenspectre. To see two huge halos around one's shadow is a real morale booster!

We took a slightly different route down; below the castellated rock band we ran down several hundred feet of excellent scree on the northern branch of the spur. The descent took just over three-quarters of an hour and we walked back to camp across a section of the Koldukvislarjokull lobe, after an eight-hour round trip.

3.12 THE RISE AND FALL OF THE CAPTIVE FERRY

A.J.B.

Just beside our camp site was a fast flowing glacier stream (the Svedja), which prevented direct access to the north of our survey area. The only route was a 3km walk on to the glacier and then on to the northern moraine. We decided that a "captive ferry" would provide a convenient method of crossing the river. Such a crossing would cut two hours (there and back) off the time for any work done in the north.

Brian, Chris and I took the dinghy, life jackets, ropes, parachute cord, pitons and karabiners to what (we thought) was a suitable site. The river at this point was about 15m. wide and fairly fast flowing. We then drew lots to see who would paddle first across the river, and Brian drew the short straw.

Brian prepared for his ordeal by changing into shorts, while Chris and I made the rope fast on the bank; rock pitons provided a good anchorage. Suitably clad, Brian tied both himself and the dinghy on to the rope and walked upstream as far as the rope would allow. Then Chris pushed the dinghy off as hard as he could. Brian paddled frantically, but he never managed to get more than 3m from the bank. Brian's worried expression, sterling paddling and pathetic progress raised a chuckle from the shore. Tactics for the next attempt were discussed with enthusiasm by all except Brian, who sported a continually dubious expression. The attempt itself failed again and it wasn't until the third try that Brian was successful; he managed to reach the far bank, but only by getting out and wading for the last bit.

Brian made the rope fast on the far bank while Chris and I tensioned it from our side. The next problem was to throw a length of parachute cord across to Brian; this was to be used for pulling the dinghy back and forth. We tied a stone to the end of the cord and tried to throw it across. We failed; several more goes also failed; until we hit on the idea of whirling it around our heads before letting go. All this time Brian, who was using the dinghy as a windbrake, was turning a delicate blue. Our next throw with the "sling" looked promising, but somehow, the stone became detached from the cord and whistled across the river. It narrowly missed Brian and hit the dinghy with a heavy thump : more laughter, at least from our side.

Eventually we got the parachute cord across to Brian, who attached the dinghy bow to the tensioned rope with a karabiner. Our intention was then to pull Brian back to us with the hauling cord, but the force of the stream proved too strong for us and we were unable to pull against the friction, where the karabiner ran through the tensioned rope. Finally the parachute cord broke. The dinghy was nearing midstream and Brian looked distinctly worried. An added problem was the "growlers" in the river bumping against the dinghy. Every time Brian attempted to pull himself along the standing rope, the bows of the dinghy submerged and the boat began to fill up. In desperation Brian finally climbed out of the dinghy in midstream and pulled himself, towing the dinghy, back to the far bank. He then waded back another way, further upstream, carrying the dinghy.

Thus, this "ferry" project was abandoned—but the problem still remained with us of how to cross the river.

3.13 THE ROPE BRIDGE

R. A. L. A.

After the "ferry" attempt to cross the Svedja, our attention turned to a "Burma Bridge", using two of our three climbing ropes. Such a bridge normally consists of a foot rope and two handrails ideally positioned just above waist level. The three ropes are connected with rope "stringers" to ensure that the load is taken as much as possible, equally between the three ropes, and also to cut down a rope's individual side sway.

A site was selected fairly close to the tents where the stream flowed through a small gorge, and Richard walked round the ice to the far side. The rock lining the gorge was somewhat friable, but rock pitons were driven in on both sides to provide anchorages. The foot rope was handed across first, followed by the two hand rails. All was made as tight as possible. Problems which had not properly been foreseen now began to appear. The first was that the height of the gorge on the far side was not sufficient to allow for sag. The whole bridge in fact sloped downhill from the near to the far side, and a man standing in the centre during the day when the river was full with melt water, got wet. The second problem was that the elasticity of the nylon climbing rope (designed to stretch under the load of a fall up to one third of its length) was too high and

try as we might, the ropes could not really be tensioned sufficiently.

However, it was thought the situation would improve with the stringers, and indeed at first it did so. Ken carried out this difficult job. It was necessary to balance with the foot catching the surface of the thundering torrent, leaving both hands free to attach the stringers. Unfortunately, after the first few were added to each side, the bridge became unstable; for the handrails were now so close to the foot rope that the centre of gravity of a man was above the triangle formed by the three ropes. Richard, in particular, was somersaulted completely on the trial crossing, much to the hilarity of the onlookers.

To prevent this instability it was thought the only solution would be to increase the height on the far side, by putting wooden props under the handrails. This would mean that the stringers could be slackened off without the sag reaching 'wettening proportions'. But it was then discovered that not enough wood remained from the parachute pallets to enable such props to be constructed. The situation at that stage was as follows:— either the bridge could be used fairly safely but sagged so much that a person got thoroughly soaked when using it; or if the stringers were tightened up so that a person did not get wet, he suffered the worse fate of somersaulting.

As a last resort it was decided one evening after supper to get all six members of the expedition pulling on the ropes to get maximum tension. This was done and Ken crossed successfully. But the bridge was not thought really safe until the heaviest member of the expedition could cross. Unfortunately, while he was in mid-span, one of the far anchorages pulled out and he and the bridge fell together into the torrent. Luckily he was quickly pulled out suffering from no more than a very cold immersion. After this incident, it was felt that no more time could be spent on the bridge, and the project was therefore abandoned.

3.14 PLANE TABLING

After leaving camp at about 0900 hours the plane tabling parties would have to walk for anything up to two hours before reaching the working area. Normally, Chris and Ken went to the Northern ice and Brian and Tony to the Southern part. However it is done, plane tabling requires much standing still and the cold wind penetrates warm clothing, numbing fingers and toes, ears and nose. After a couple of hours, lunch provided a welcome respite, but was also the augur for a long afternoon which was filled by a thousand and one thoughts of far away. The sighting and raying, the pacing and counting went on like some automatism.

The return walk to camp came as a relief to the weary and the evening meal a welcome refreshment.

3.15 THE RETURN

R. A. L. A.

On Monday night all of us forced ourselves into Brian and Tony's tent for supper and afterwards, in an attempt to take our thoughts off the constant abiding question, "when are the Icelanders coming to pick us up?", we began a desperate game of pontoon. By this stage the batteries of the few torches that had been brought (in the mistaken belief that they were not necessary in Iceland in the summer), were more or less flat, and the only light we had was the uncertain flicker of a home made paraffin lamp. It was cold, and a strong wind was blowing snow against the tent walls: winter had surely begun.

The bare facts were these: we had arranged to be picked up (we thought) last Saturday, and it was now Monday. We had enough food to last until Thursday, and if the Icelanders didn't come to pick us up by Wednesday, we would have to walk out, leaving all the heavy kit behind us. This prospect was not a happy one.

We had learned, on those waiting days, to spread breakfast out for as long as possible. Therefore on Tuesday morning Martin and I gave the cooking tent a late call. I thought the mornings the best part of those days. One could read comfortably, interrupted occasionally by a breakfast course, in the warmth of a sleeping bag, and hope that they might come that lunch time. After lunch it was worse, for as it got later and later the chances of their coming that day dwindled, and we realised that we would have to wait yet another night.

I got up for lunch, which was being cooked in Brian's tent. The night's snow had stopped, but it was still sufficiently cold to spend as little time between tents as possible. Lunch was the big moment in the middle of the day, now as with breakfast there would be no point in rushing it. Always we listened for the sound of vehicles, and always we were fooled by the wind.

But this time there was no mistake. We rushed out and there they were—two Landrovers and a jeep—all beautiful.

While two of us added the now surplus food to a mammoth lunch, the remainder quickly struck camp. I have a confused recollection of stuffing food down, packing sacks, and tying up tents and frequently stopping to warm my hands, made useless by the cold. Then after a delirious last round of photographs we bumped our way towards the weather station at Jokulheimar. It was an odd sensation to be driving past cairns that we had laboured for so long to build; but the driving was not at all simple, and it took us three and a half hours to cover the 30km to the weather station. When we arrived there we found that the keeper had already left for the winter, but the door was not locked, and we went in. Automatically we began dividing up our food, an exact portion for each man, but it wasn't until Brian pointed out that there was no longer any need to do this, that we could all see the absurdity of our actions.

From the weather station to the Energy Authority huts at Tungnaa Bridge there was a fair road, and it took an hour and a half. During this time I remember Tony trying to capture the exquisite sunset with his cine camera, but the vehicle was on the move and he was unsuccessful.

At the huts a mass of food was put before us, and after seven weeks of rationing none of us had any self control left. We consumed everything in sight, unashamedly. It was planned to catch a bus back to Reykjavik, but for some reason it didn't exist. However, as one of the Icelanders at Tungnaa Bridge wanted to go back to Reykjavik that night, we arranged for him to drive a Landrover and trailer (with suspect tyres) to take us and all our gear to Reykjavik. We departed at 2300 hours, after yet another meal. It was lovely to be sitting in the back of the Rover, a tight-knit group in the dark warmth. The engine oil pressure was low, probably as a consequence of a leak caused earlier in the day. One of the dinghy paddles fell off irretrievably; and finally, as forecast, a trailer tyre punctured. This meant the temporary abandonment of the trailer and transferrance of important stores to the already overloaded roof rack. But, in short, nothing really mattered any more: what was important, we felt, was that we had left the ice world of the Vatnajokull behind us. In particular I remember the lights of approaching Reykjavik being fantastically beautiful. It seemed that we had never really left civilisation, for we are always a part of it; but these lights heralded to me at least our return to the human village.

4. ADMINISTRATION

4.1. TRANSPORT AND MOVEMENT

4.1.1. TRANSPORT TO ICELAND AND BACK

(a) SEA

The Iceland Steamship Company operates a summer passenger service from Leith (Edinburgh) to Reykjavik, with sailings every two weeks. This service is always heavily booked and the expedition were unable to get suitable bookings. The same company also operate a weekly service from Felixstowe (Suffolk) which is primarily for freight but with limited passenger accommodation. The British Agents McGregor Gow and Holland were not helpful in providing information about passages from Felixstowe, and communication with the head office in Iceland proved equally unfruitful. But helpful and hopeful information was given by the Captain of one of the ships, during a visit to the port in early May. Arrangements for the shipping of freight were made through the Lema International Shipping Company of London. The situation was further complicated by a strike in Iceland during early June. During the week beginning 22nd June, the Agents informed us that two ships were due that week, that the freight would definitely be able to go on one of them, and it was likely that up to four passages would be available on one of them. In fact one ship arrived on the 27th, the second on the 29th, and both were booked up. The freight was loaded on to the Fjallfoss, and sailed to Iceland on the 30th June. This consisted of two 12 cubic feet wooden boxes, a bundle of tripods, and the plastic tubing used for work on the glacier and 30 'compo' one cubic foot wet strength cardboard boxes, containing the food.

For the return journey to the U.K. the freight again went by sea, and it was not possible to get passages.

(b) AIR

Two airlines fly regular services from Britain to Iceland. Loftleider fly a weekly schedule on Tuesday night from Glasgow to Keflavik—the main international airport serving Reykjavik. Two bookings were made well in advance for the 7th July, and that journey proved uneventful. When it was clear that travel from Felixstowe was somewhat hazardly, a telephone booking was made for one seat for 30th June, and although this booking did not reach the check-in desk at Glasgow, there were seats available on the flight. When passenger travel from Felixstowe proved impossible the last three bookings were made for an Icelandair flight, from London (Heathrow) to Reykjavik.

The return journey was provisionally booked on arrival in Iceland, for six seats on the flight from Keflavik to Glasgow on the 8th September. This journey was satisfactorily made.

4. 1. 2. TRANSPORT IN ICELAND

(a) REYKJAVIK AREA

There is a comprehensive municipal bus service within Reykjavik, although most places can be reached within thirty minutes on foot. For freight, there is a 'taxi' type van service which proved very efficient, but vehicles should be ordered when required, and not booked in advance.

(b) REYKJAVIK—KEFLAVIK

Coaches connect with all scheduled flights at Keflavik, for the fortyfive-minute journey to Reflavik. Most currencies are accepted for the fare of about 45p. There is also a regular service during the day with journeys about every two hours. The Reykjavik-Keflavik road is probably about the busiest in Iceland, and hitch-hiking is normally quite easy.

(c) TRAVEL BETWEEN MAIN TOWNS

There is both a comprehensive coach system, and an international air network. There are no railways in Iceland.

4. 1. 3. TRAVEL BY THE EXPEDITION TO KOLDUKVISLARJOKULL AND BACK

From Reykjavik to Tungnaa Bridge the transport was shared between the Energy Authority Landrover, and the scheduled bus service. This scheduled bus—twice a week—had not yet run that summer, but the operator was persuaded to put it on for four passengers and some freight at a charge of 1500Kr. for the 150km. From Tungnaa Bridge to the first camp site a second Landrover was provided to replace the bus.

Within the area there was no transport. The return journey from Koldukvislarjokull to Tungnaa Bridge was made with three Landrovers and from Tungnaa Bridge to Reyjavik on one Landrover with trailer.

The bulk of the equipment was dropped by parachute into the main camp area.

4. 1. 4. MOVEMENT IN THE KOLDUKVISLARJOKULL AREA

The terrain can be roughly divided into (a) the Lava Desert, (b) the outwash plains, (c) the Moberg hills, and (d) the glacier.

(a) The Lava Desert

The vehicle tracks follow a tortuously winding path with many short steep slopes. The lava is often very crumbly, and a good vehicle jack is needed to clear the vehicle over obstructions when the ground fails, and leaves the wheels off the ground. On foot the going is also very slow, either following the gaps winding between the lava, or up and down over the lava. In either case, following a compass bearing is difficult over this undulating ground.

(b) The Outwash Plains

By vehicle or foot, good progress can be made over these flat, firm areas. The only obstructions are the rivers. Generally, fording places for vehicles are not too difficult to find, but the water is very cold and flast flowing: this makes crossing by foot unpleasant, although not impossible. Water levels vary noticeably both throughout the day, and the season, depending on the rate of melt on the glacier. The river courses shift continuously, and the disappearance of vehicle tracks at the river's edge does not necessarily mean that the river is still fordable at that point. The main rivers, however, should be regarded as major obstructions. Compass bearings are relatively easily followed.

(c) The Moberg Hills

The hill slopes vary from steep to sheer. It is possible to walk or scramble over most of the area, but long detours may be necessary when travelling by vehicle. The hills would provide very good shelter for bivouac sites.

(d) The Glacier

To get on to the glacier, a narrow belt of loose, steep and sometimes muddy moraine must be crossed. There are also some stretches where the glacier broke off into the cliffs and access is impossible. Once on the glacier walking at the lower altitudes was quite easy—until the late summer when, for a few days, the ice became very slippery, crampons were not needed, and holes were clear of snow. Above the snow line, however, which became higher through the summer, progress could become very slow across wet slushing snow, and roping up was necessary because of the threat of unseen crevasses.

The routes used by the expedition are shown in figure 1.

Planning speeds for movement in the area are given in kilometers per hour for fit people:

Terrain	Foot	Vehicle
Lava Desert	2 — 3	3 — 4
Outwash Plain	5 — 6	30 — 35
Moberg Hills	2 — 3	3 — 4
Glacier Lower slopes	5 — 6	-
Upper slopes	1 — 3	-

Magnetic variation is over 20° in these parts, and there were large local variations in the hills. The angle of dip is also high and this greatly increases the time it takes the compass to settle, which was particularly tedious when trying to walk on a bearing.

4. 2 FOOD

REQUIREMENTS

By studying various reports from previous expeditions, the following design requirements for food were reached:—

(a) 3, 500 K Calories / man day, and a balanced menu in protein, carbohydrate and fat.
(b) The food should be as light as possible.
(c) Water would not be a problem.

(a) NUTRITIONAL VALUE

The food was planned for seven people and, although only six people went on the expedition, some food was lost in the drop. So, the actual daily calorific value remained around the 3,500 mark. This should have been higher, as most people lost weight (two stone in one case).

(b) WEIGHT

During planning, it seemed likely that all the expedition's stores would have to be carried into the area on our backs. For this reason the food was planned to be as light as possible. With the use of dehydrated food, the weight/man day was brought down to about $1\frac{1}{2}$ lbs., and twenty-one man days except for beverages, margarine and Kendal Mint Cake, could be packed in a Composition Ration box (10 x 10 x 18 ins.) Luxuries were limited. In fact, if the drop had been anticipated earlier, weight would not have been such a problem, and more food (specially tinned) could have been taken.

(c) WATER

Contrary to expectations, no one suffered ill-effects from glacier water. 3 x 5-gallon water containers were taken and, where possible, a full can was allowed to settle for twelve hours before use. For preference, water was collected from a melting snow patch (there was not colloidal particle suspension), but when this failed the Svedja stream was used.

RECOMMENDATIONS

Although the food was satisfactory, everybody was soon hungry. If weight permits, the following points should be borne in mind:—

(a) Salt

Just sufficient salt was taken, but everyone would have liked more. To allow for wastage, at least double our amount should be taken.

(b) Biscuits

Cream Crackers were a mistake. They were fragile and very low in calorific value. Ship's biscuits would be a far better solution.

(c) Sweets

Variety would be pleasant here. Sweets do appalling damage to teeth over long periods unless care is taken.

(d) The Psychological Aspect

This aspect was not properly appreciated in planning. For example, people found that they suffered from a lack of bulk. If at all possible, it is suggested that materials and apparatus for bread-making should be taken. Also, there should be food allowed for a periodic "blow-out", as this has a great morale-raising effect.

FOOD FOR ONE MAN DAY

Item	K. Cal/oz.	Amount
Porridge	120	2.5 oz.
Egg Powder	125	0.6 oz.
Soup	-	0.3 pt.
Vesta	700	1 man portion
Vegetable (dried)	100	0.3 — 0.6 oz
Potato Powder	160	0.8 oz.
Sugar	120	7.5 oz.
Complan	125	1.5 oz.
Salt	-	0.2 oz.
Dried fruit (raisins, etc.)	70	1.3 oz.
Vitamin tablets	-	one
Spangles	-	1 pkt
Cheese, processed	150	2 oz.
Chocolate, milk	210	2 oz.
Kendal Mint Cake	200	2 oz.
Cream Crackers	-	6
Coffee } for 378 man days		6 lbs.
Cocoa } for 378 man days		6 lbs.
Tea } for 378 man days		3 lbs.

LUXURIES (for 378 man days)

Apple flakes	1 portion / day
Syrup	4 lbs.
Steak and Kidney pudding	4 lbs.
Marmalade	5 lbs.
Pastes (Meat and Salmon)	14 jars
Corned Beef	3 lbs.
Chicken Supreme	3 lbs.
Chicken Mince	4 lbs.
Steamed Puddings	5 lbs.
Jelly Powder	4 oz.

4.3

NOTES ON EQUIPMENT

4.3.1. GENERAL EQUIPMENT

TENTS

(a) Whymper – 2 taken.

Insufficient guys. Flysheet does not protect rear enough, and window at rear leaked under driven rain. Door system inefficient; "A" pole mechanism unstable, tends to lean over to one side which causes fraying of tent material. Pleasant to stand upright inside. Good for cooking. Adequate for three men and kit. Really only good for base camp use in moderate conditions.

(b) Blacks Mountain – 1 taken.

Older model. Excellent, except for guys, which are not thick enough.

STOVES

Optimus Model III – 3 taken

Paraffin. Heavy, but otherwise excellent. Need weekly maintenance and cleaning for best results. Must carry spares.

PARAFFIN CONTAINERS

3 x 4½ galls, and 3 x 1 gall. – W.D. models – both good.

RUBBER DINGHY

7 ft. /2 man inflatable – weight 20 lbs.
In general (except for one occasion, when it was vital) not very useful. Not recommended for future expeditions to the area.

SPARE TENT MATERIAL

–not taken, but would be useful. Patching material taken from parachutes.

STRING

300 ft. of thick sisal – very useful – essential for Whymper tents in windy conditions.

WATER CONTAINERS

(a) 5-gallon M.O.D. Type – 3 taken – present M.O.D. design, are plastic, and have the following features:–

(1) Threads, on closure cap, wear quickly.
(2) Uncomfortable handles.
(3) Too heavy when full.
(4) Black colour difficult to pick out in dark.

Until M.O.D. produce a better pattern – old 4½-gallon metal Jerry-can is better.

(b) Water Bottles – 6 taken – present M.O.D. design good.

BINOCULARS

Essential for survey. Army type not waterproof – otherwise good.

4.3.2. PERSONAL EQUIPMENT

SLEEPING BAGS

(a) Blacks "Icelandic Standard"
Not warm enough in cold weather. Not wide enough. Need at least "Icelandic Special" in the future.

(b) Fairey "Everest"
Very warm, but bulky. New model with nylon outer should be an improvement in this respect.

RUCKSACKS AND PACK FRAMES

(a) Rucksacks "Tripax" (Brown Best)
Uncomfortable. Not waterproof. Buckles came off rucksacks. No pockets. Frame not designed for separate use. Useless for anything other than light loads for short periods.

(b) Karrimor "Everest"
Large capacity – very hard-wearing.

(c) Karrimor "Sac des Crimpons"
Good climbing sack – Crampon straps would be useful.

(d) M.O.D. Pack Frame
Easier to fit loads to than Karrimor (see below), but not so comfortable.

(e) Karrimor Orienteer
Extremely comfortable. Not so good for cubical loads as M.O.D. frame. Webbing bands poorly designed; bands fray easily.

MATTRESSES

(a) Lilo
Comfortable. Tend to slide around.

(b) Karrimat
Do not have psychological feeling of warmth as very thin. Long use makes them thinner.

HEADDRESS
Indispensable as 60% of body heat is lost through head. Good for cold nights.

SNOW GOGGLES
Conventional goggles get steamed up and restrict vision more than sun glasses (Polaroid are best). Some form of protection is essential; – also good against dust. Important to take spares.

SHIRTS

(a) "Viyella" type – Good but expensive.

(b) Woollen – Very warm, but matt and shrink on back because of rucksack sweat.

ANORAKS

(a) Black double cotton. – Windproof, comfortable, showerproof, dry out slowly.

(b) Holly Hanson. – Very wind and waterproof, suffer from condensation inside. Dry out very quickly.

(c) Cagoules (Peter Storm) – Light and easily packed. Tend to rip easily–need spare material for repair. Proofing wears off.

(d) Naval foul weather gear. – Good for really bad conditions–otherwise hot to walk in. Pockets useful.

GLOVES

(a) Leather Outer. Hard-wearing—not waterproof.

(b) Polyurethane/Nylon. Waterproof, not hard-wearing. Suggest thicker gauge material.

(c) Dashstein Mitts. Oiled wool, excellent for real cold. Suffer from disadvantage that one cannot use instruments with them on.

(d) Woollen Gloves. Not as warm as Dachsteins. Can work on most instruments. Good protection against cut hands etc. For really delicate work in cold conditions, suggest silk gloves.

TROUSERS

(a) Climbing Breeches.

(i) "Moleskin" — Fairly warm and wind-proof — dry out slowly.

(ii) "Bonneville" — Very warm and wind-proof. Shower-proof. Dry out very fast. Rough round crutch—need lining.

(b) Combat trousers. — Heavy.

(c) Over Trousers (Peter Storm). — Suffer from same defects as Cagoules.

(d) Naval Foul Weather Trousers. — Not warm enough in really cold conditions.

GAITERS

(a) Karrimor Canvas Zipped. — Canvas shrinks when wet and zipps are almost impossible to do up.

(b) Karrimor Polyurethane/Nylon Unzipped. — Excellent in every respect.

LONG JOHNS

After long periods, pleasant to change into something to go to sleep in. Good for cold nights.

SOCKS Personal preference here. No complaints.

FOOTWEAR

(a) Boots.

(i) D.M.S. (M.O.D.) Very light. Flexible soles. Get wet easily, but dry out quickly, continuous use for two months will destroy them.

(ii) Hawkins "Hellvelyn" — Good.

(iii) "Mountain" — Good.

(b) Gym Shoes. — Indispensable.

(c) Waders. Not taken—would have been very useful.

BOOT POLISH. Not enough taken. Require 200ml for two months daily polishing.

LACES. Need at least two spare pairs.

BOOKS. Not enough 'serious' reading matter taken. Lack of dictionary felt.

TORCHES. Only taken by two members, and batteries ran out. Need light in tents at night, apart from midsummer month. Small Tilley lamp would be good: gives warmth, too.

4.3.3. CLIMBING EQUIPMENT

No technically difficult climbing was undertaken during the expedition, but as it was uncertain beforehand what difficulties might be encountered, a fairly comprehensive selection of equipment was taken.

Comments.

Ropes.
3 x 120 ft No. 4 ropes were taken. It is recommended, for a similar expedition in future, that No. 3 ropes are used, as they are lighter and quite strong enough.

Crampons.
Towards the end of our stay, the glacier ice became very slippery and, even to remain upright, crampons were essential. Several sorts of crampons failed because, it is thought, the majority of the expedition wore flexible boots. This caused repeated flexing of the shank connecting front and rear points and led to fracture. Also, one set of crampons suffered from splayed front points. It is suggested that if an expedition is not going to engage in any serious snow and ice work, instep crampons should be taken.

Ice Axes.
4 Massey-McInnes axes were taken and found to be very heavy. Also, if not checked, the ferrules have a tendency to unscrew. For ordinary use on a glacier, ordinary wooden axes are the answer.

4.4. FIRST AID

All of the expedition knew something of the elements of first aid, and two had been on first aid courses, but no-one was given this job specifically. The medical supplies were divided into three small two man day kits, and a supplementary base kit. These contained:—

(a) Day kits, Elastoplasts, zinc tape, bandages and lint dressings, cotton wool, triangular bandage, Paracetamol tablets (headaches) and Bruladide antiseptic cream.

(b) Base kit, replacements for the Day kits and Penicillin tablets, anti-diarrhoea tablets, Morphia syrrettes, splints, glacier cream, and oil of citronella (insect repellant).

In addition, each man carried a "First Field Dressing" which is an antiseptic pad and bandage and a tube of Uvistat cream, for protection against Ultraviolet Radiation, when on the glacier in sunny weather.

There were many minor cuts on hands and fingers, which often took a long time to heal, and were exacerbated by the cold and dryness of the skin. The "Elastoplast Airstrip" dressings proved unsuitable because the adhesion would not stand up to hard wear: Zinc oxide adhesive tape over the Elastoplast was more successful. Items which were not taken, but seem necessary in retrospect, are:— a general stomach upset tablet or powder, and a laxative. Items taken by individuals included lipsyl and foot powder.

The Icelandic Rescue Organisation maintain an Air Rescue Service, and had a serious injury occurred they could have been contacted via the weather station at Jokulheimar (30 km) and a doctor brought in either by helicopter or parachute. It was estimated that Medical Assistance could be obtained within 24 hours, weather permitting.

4.5 CAMP ROUTINE

At our first camp site we fell into the trap of getting up late, and going to bed late. This works as well as any other system as long as daylight is continuous; but with day getting shorter and night getting longer, it would soon have become untenable. As soon as we moved to the permanent camp we tried to wake up at seven o'clock, and be away to work by nine o'clock. This routine was broken only for bad weather when snow, bad visibility, or high winds made any scientific work impossible.

We had two regular commitments; Meteorological Observations were made at 1000 and 2200 daily, and at 1600 if anybody was in camp, and the river level gauge board was read at these same times.

Cooking arrangements soon fell into a pattern. Breakfast was cooked in the tent by one of the two pairs living in the Whymper. Whoever wasn't doing breakfast found it very easy to wake up the other pair. Breakfast usually took just over an hour to cook; that is, to produce about five pints of porridge, three omelettes, and four pints of coffee. This left four of the six members over half an hour to pack and to be away by 0900.

Each box of rations contained enough food for three days, and lunches for the three days were made up upon opening a new box. The evening meal was prepared by the first pair to return to camp. They also assumed the responsibility of providing water. This was obtained from a patch of north facing snow about 200m from the camp, which was used in preference to stream water, as it contained no colloidal silica particles and conveniently dripped from the edge of the patch into a waiting water carrier.

No party was back later than 2000, except occasionally when a long day was planned, and the main meal took about two hours to cook and eat, at a leisurely pace. After washing up and packing up, preparing for the morning and doing the meteorological observations, it was time to drink a cup of cocoa and retire to a warm sleeping bag, at some time between 2300 and midnight.

4.6 COMMUNICATIONS

4.6.1. RADIO

The Expedition requirement was:

(a) 4 portable, light weight, short range (5 miles) transceivers. Probably VHF or UHF.

(b) 1 light weight HF set, working as a rear link to the weather station (25 km).

In practice, the expedition ended up by having no radios at all. M.O.D. were unwilling to lend us sets because of implications of military training. Several civilian firms were approached (Pye, Plessey, Rediffon and S.T.C.) all without success, though S.T.C. might have been able to help with (a) if they had been given more notice.

It turned out that the lack of radio communication was not serious but, in the event of an emergency, it might well have been. Short range communication would have been particularly useful in speeding up survey operations.

4.6.2. OTHER METHODS

Copies of the International Distress signs for signalling to aircraft were taken. L L is the sign for All O.K., and this was written out in stones, near our camp, so that any passing aircraft would know we were alright.

4.7 FINANCE

Finance is always one of the major problems of any expedition. Right at the start of the planning stage, costs were roughly estimated, and it turned out that our original forecasts were more or less accurate. It was also agreed that personal contributions by expedition members would not exceed £75, and it was on this basis that fund raising went ahead.

EXTRACT OF ACCOUNTS

INCOME		£	s	d
Donations by firms		85.	0.	0.
Donations by Funds, etc.		475.	0.	0.
Donations by Cambridge Colleges		104.	0.	0.
Personal Contributions by Expedition Members		300.	0.	0.
Sale of Food		3.	15.	6.
Total	£	967.	15.	6.

EXPENDITURE		£	s	d
Food		107.	14.	2.
Travel (Air)		370.	7.	0.
(Iceland)		13.	18.	6.
Transport of equipment		40.	1.	9.
Insurance		70.	0.	0.
Local expense		24.	6.	6.
Equipment				
(Scientific)		22.	6.	9.
(Photographic)		34.	4.	0.
(General)		45.	12.	11.
Printing and Stationery				
(excluding Final Report)		7.	5.	0.
Report production		135.	19.	0.
Donations, Map etc		95.	19.	11.
Total	£	967.	15.	6.

5. PROJECTS

5.1 SURVEYING AND MAPPING ETC.

5.1.1. PLANNING

From a study of maps available in Britain it appeared that triangulation of a control network within the working area would be possible from two third order Icelandic Triangulation (Trig) stations. If possible this was to be done by direct observations from the two stations, but if the stations proved too difficult to reach then an inaccessible base would be set up from suitable hills. Co-ordinates of these two stations were obtained from the Military Survey Office in Britain.

Once in Iceland, a visit to the Iceland Survey Department (the "Landmaelinger Island") showed that Iceland had recently been reco-ordinated, and the co-ordinates previously obtained were no longer valid. Furthermore, one of the selected stations had not been reco-ordinated. However, the director of the Landmaelinger Island had led the 1938 survey of our area, and he assured us that about half a dozen stations would be visible from the area, and that normal visibility would allow sightings on stations up to 50 km distant. The plan was now changed to using Sydri Haganga, and resect the position of Hill 1, using the other Trig stations (see figure 2).

This would provide a base from which to co-ordinate stations to be plotted on the plane tables.

5.1.2. EQUIPMENT

All the Survey equipment was borrowed from the Cambridge University Engineering Laboratories. Basically what was required was a theodolite, and two plane tables with their accessories. The theodolite available from the C.U.E.L. was a Watts Micrometer. This old and heavy instrument was ideal from neither its weight nor its accuracy, but was chosen because of the cost of hiring a light weight instrument.

The Barometer/Altimeter brought for meteorological use was also used in the surveying.

5.1.3. PRELIMINARY WORK IN THE FIELD

The first camp was sited within easy reach of Sydri Haganga and Hill 1. On the day after the expedition arrived at the camp one pair went to Hill 1 to resect, and a second pair to Sydri Haganga to reconnoitre a route to the top. The visibility from Hill 1 was good except that the cairn on Sydri was not intervisible, and a multitude of cairned hills made positive identification of three other Trig stations impossible. Readings were taken on four stations in the hope that co-ordination from two sets of three would give the same result.

The reconnaissance to Sydri proved that it would not be a viable proposition with the theodolite and tripod. The plan was now revised to resecting Hill 1 and another smaller feature, and so provide a co-ordinated base. However, the calculations proved the readings inconsistent, and this meant that at least one of the Trig stations had been misidentified.

The move to the main camp, which was in the mapping area, took us to where Sydri was clearly visible. We were also able to positively identify a second Trig station, Hnottottaalda, about 30 km away. They were not well positioned relative to each other from the working area, but it was possible to set up a base line using inaccessible base calculations. A period of bad weather followed when it was impossible to make theodolite measurements, and it was only possible to build cairns, that would provide the control for the plane tabling.

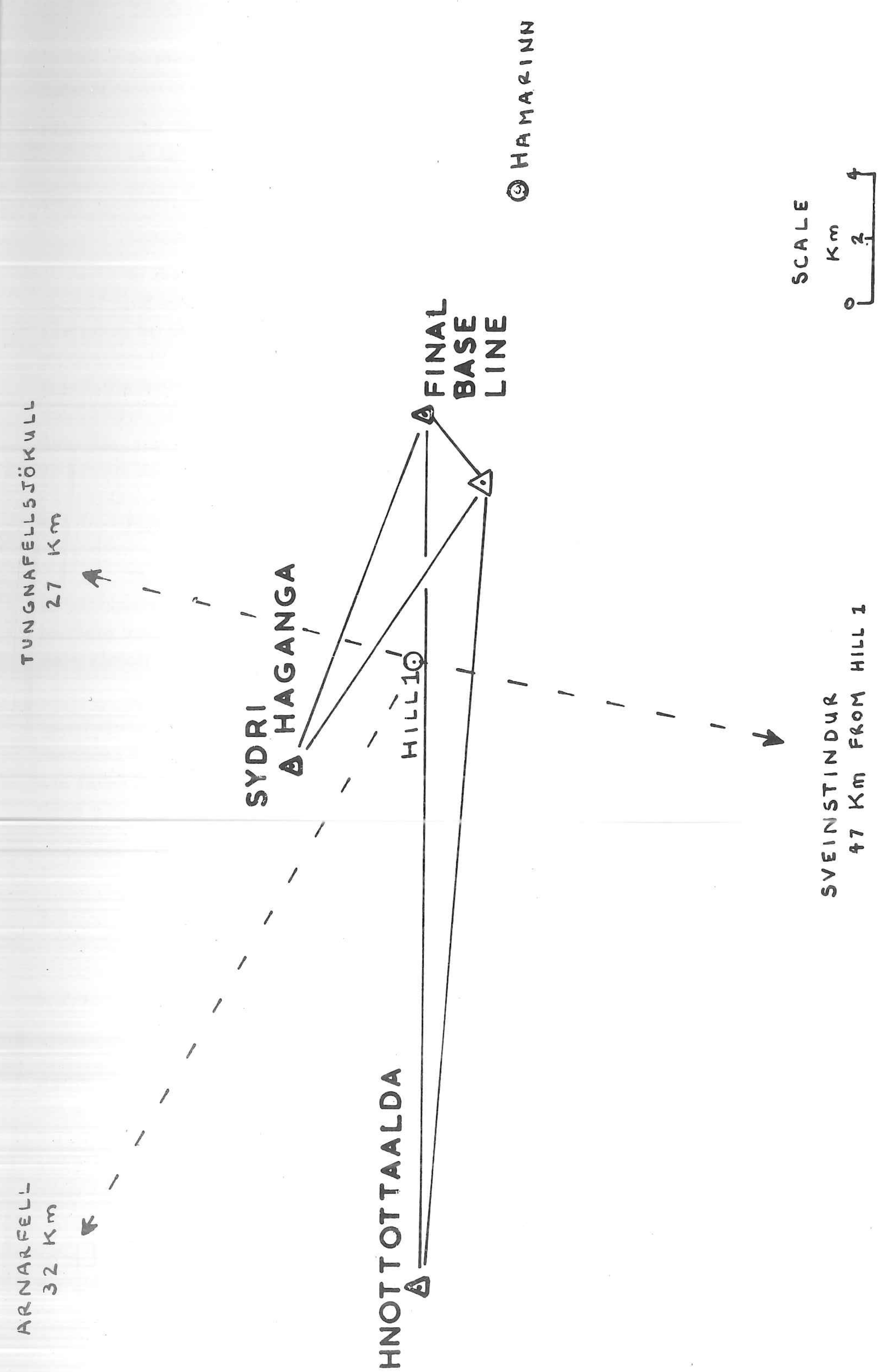


FIGURE 2 COORDINATION OF THE BASE LINE

5.1.4. TRIANGULATION

In the triangulation, the following departures from normal practice were made for the sake of economy of effort, but not so as to affect the accuracy required for plane table plotting.

(a) The theodolite was set up as close as possible to a cairn, but no attempt was made to set up over the centre;

(b) From the base line, further points were triangulated with only two angles measured.

Computation was carried out by logs and a Curta hand calculator.

In the initial triangulation, apart from the two base stations, nine other parts in the central land area were co-ordinated. Subsequently, two more were triangulated by theodolite and seven by plane table. The large number of stations was an attempt to ensure that three stations could be seen from most parts of the area. It was a mistake to triangulate so many by theodolite because a mistake in the co-ordinates of one station was not picked up as early as it should have been. It would have been better to triangulate more stations with the plane table directly.

5.1.5. PLANE TABLING

The two plane tables divided the area between north and south. On the northern board which covered a large area of glacier, the technique of traversing a contour was used. On the southern board,positions on the ice were resected, and lines of slope were rayed on. Bright flags were almost essential for marking places in a landscape of great similarity.

In the very hilly inland area much use was made of an altimeter. Heightenings were taken along a line between two points fixed on the plane table and the paced position, and measured height logged. Any change of atmospheric pressure was allowed for, because the start and finish heights were known. This was a particularly good way of working on a bad day, because there was a minimum of standing around, and end positions couls always be fixed on a better day.

5.2 METEOROLOGY

5.2.1. OBSERVATIONS

On arrival at base camp, a meteorological station was set up. The site chosen for the station was the summit of a small rise out of the lee of the surrounding hills. A screen was constructed out of the materials available (cardboard, wood and stones) and this housed a maximum thermometer, a minimum thermometer and a thermograph. An aneroid barometer, an anemometer and a whirling hygrometer were also used. Two rain gauges were set up, one at the station and the other 4 km to the north by the edge of the glacier.

The instruments were read at 1000 and 2200 hours daily and at 1600 if anyone was in camp. At the same time a note was made of the state of the sky, the strength and direction of the wind, the visibility, and the prevailing conditions. At the end of each day an estimation was made of the hours of sunlight.

One problem was that the thermograph was often put out of action by dust which rapidly accumulated in the ink cup on the pen.

The readings are summarised in a Table (5. 2. 3.), presented in the same style as the Icelandic weather reports ('Vedrattan'). The most important parameters are shown graphically in figures 3 and 4 together with Ablation (5. 3. 2.) and River Discharge (5. 3. 5.). Figure 5 shows the wind rose for the period of our stay.

5.2.2. WEATHER

The general situation was very variable and rapid changes of conditions occurred frequently. Conditions on the glacier were often quite different to conditions off to the west of the glacier over the lava plains. Examples of this were days when the wind blew from the glacier to the west, resulting in clouds being formed above the edge of the glacier. On other occasions the hills 10 km to the west of the glacier were enveloped in cloud and rain whilst the glacier enjoyed much brighter conditions. Snow may fall at any time during the summer particularly when the wind blows from the North-East. Driving squalls of rain or snow were quite frequent. The higher hills were quite often hidden by cloud.

No significant difference in the amount of precipitation was observed between the two rain gauges. With reference to figures 3 and 4, the most significant factor for the rate of ablation is the minimum temperature which has a similar shape to the 'ablation factor'. This is supported by the ablation stakes being 150 to 400 m higher than the station. Ablation affected the river flow more than rainfall, which often took the form of snow over the glacier, freezing on contact.

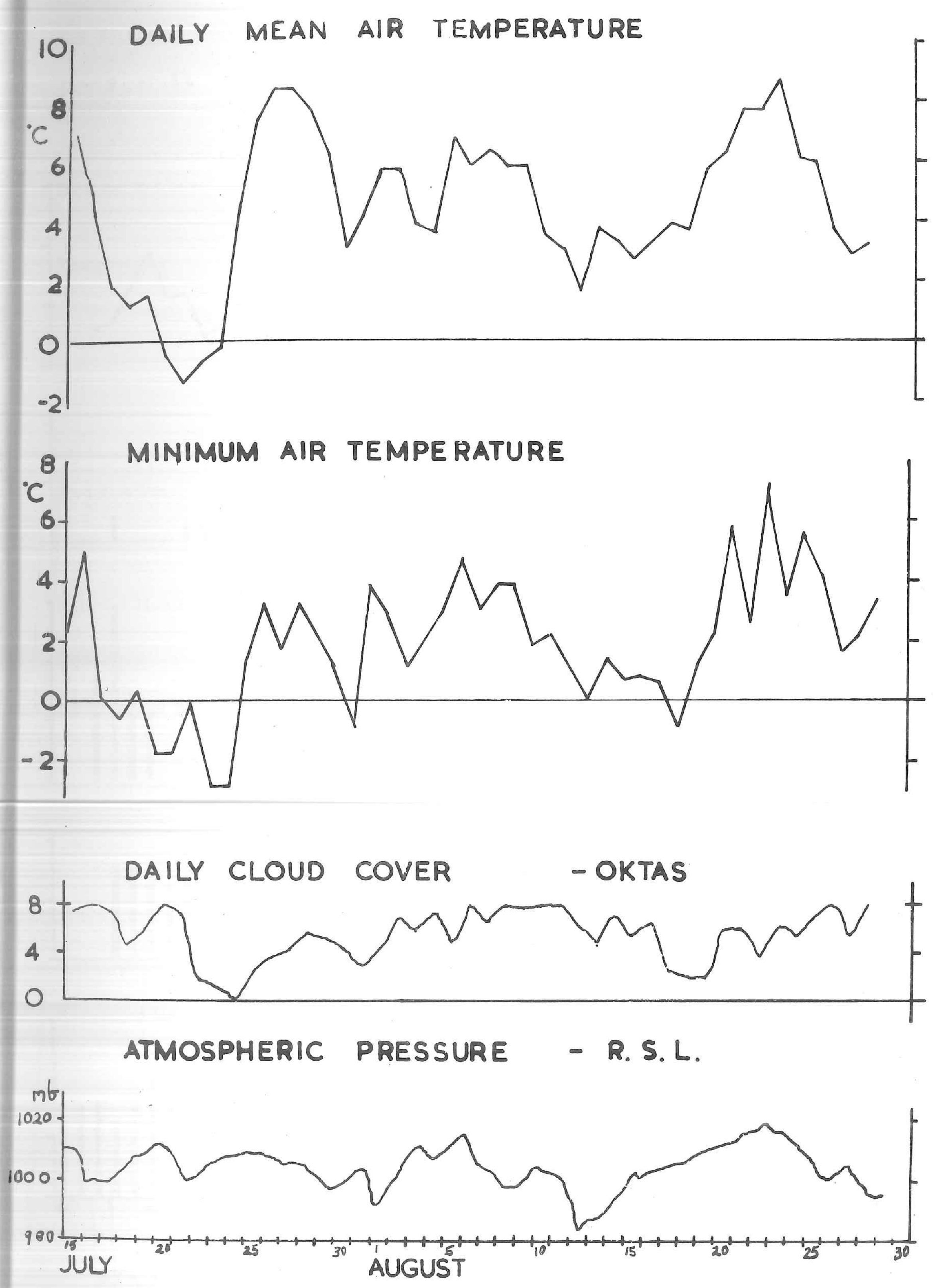


FIGURE 3 METEOROLOGICAL DATA

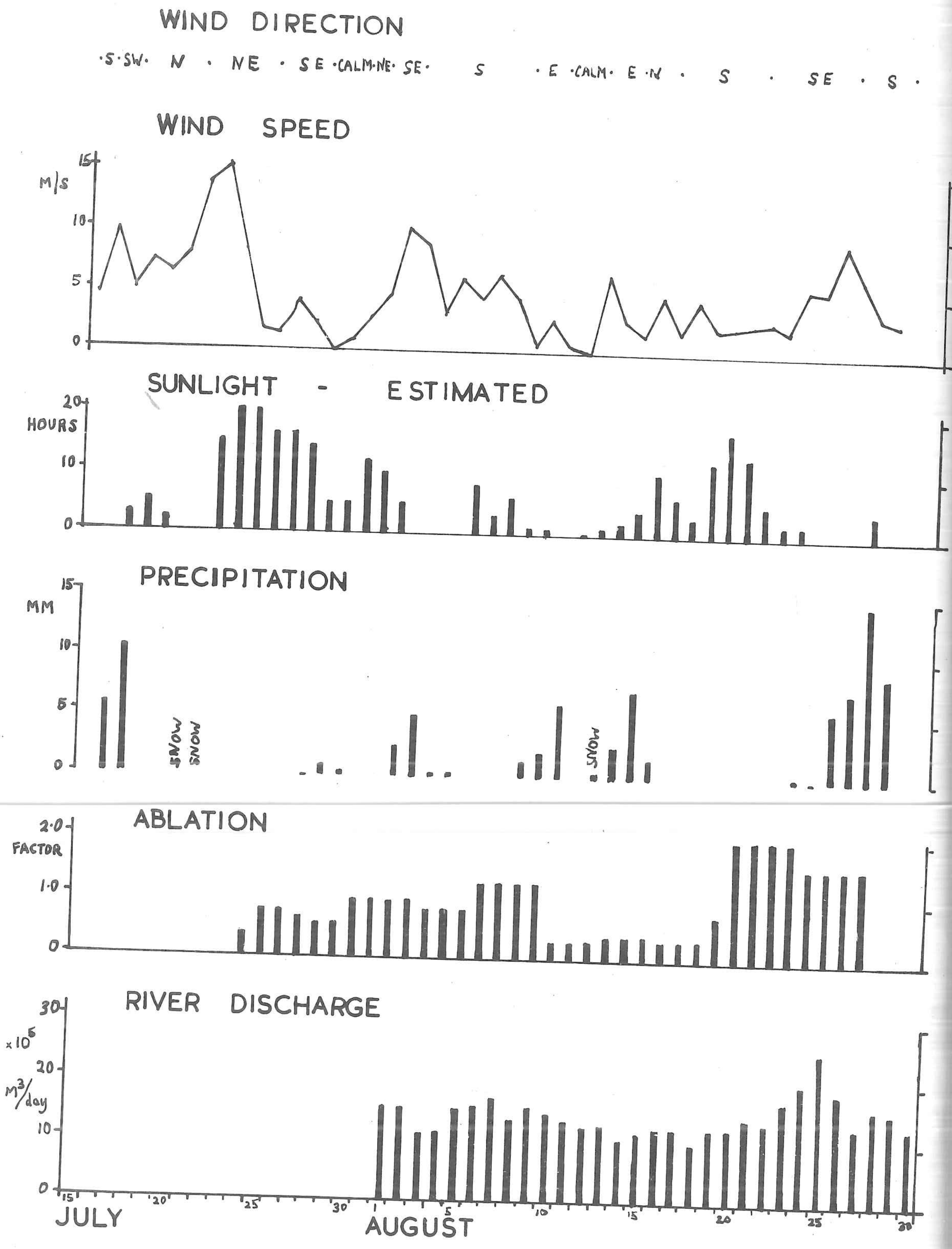


FIGURE 4 METEOROLOGICAL AND ABLATION DATA

5.2.3. SUMMARY OF METEOROLOGICAL READINGS

Subject	Unit	Desig.		July 15 to 31	August 1 to 28	Overall
Pressure (r. s. l.)	mb		Mean	1005.2	1004.0	1004.4 (+15.4, -11.4)
Temperature	°C		Mean	3.7	4.8	4.7
		Maximum	Mean	9.5	9.2	9.3
			Highest	14.7	15.7	15.7
			Date of	27/7	22/8	22/8
		Minimum	Mean	0.6	2.4	1.9
			Lowest	-2.8	-0.9	-2.8
			Date of	24/7	18/8	24/7
Precipitation	mm		Total	17.1	65.1	82.2
		Most per 24 hours		10.3	14.4	14.4
			Date	17/7	27/8	27/8
Relative Humidity	%		Mean	73	82	79
Cloudiness	oktas			5.0	5.95	5.6
Frequency of Winds	%		N	21	3	10
			NE	23	3	11
			E	2	13	9
			SE	21	25	23
			S	8	20	15
			SW	8	4	6
			W	-	3	2
			NW	2	-	1
			Calm	15	29	23
Wind Speed	m/s		Mean	5.8	4.1	4.8
Number of Days		Wind	8 Beaufort Scale	1	0	1
			9 Beaufort Scale	0	0	0
		Precipitation	0.1mm	6	16	22
			1.0mm	2	12	14
		Snow		2	1	3
		Overcast		2	7	9
		Clear		1	1	2
		Frost		6	1	7
		No snow cover		16	28	44
		Full snow cover		1	0	1
		With Complete readings		17	28	45

Dates of:	Last Frost	Earliest Frost	Last Snowfall	First Snowfall
(heavy)	24/7	30/8		
(light)	31/7	18/8	21/7	12/8

Height of Meteorological Station: 930 m. Position of Station: 64 30 N 17 59 W.

5.3

GLACIOLOGY

5.3.1. VARIATION OF GLACIER EXTENT

In the area between Northern Tungnarjokull and Koldukvislarjokull there are two lake beds, Hamarslon and Hvitalon. These lake beds each border on the two glacier lobes.

In 1938 Hamarslon stretched between both lobes, and was about 1 km long[1]. In 1946 the lake was only 0.6 km long, with Northern Tungnarjokull occupying about half the original lake[2]. This confirmed the advance recorded and photographed by Hannisson and Sigurdsson in September and October, 1945[3]. Aerial photographs of 1960 show Hamarslon to have enlarged to 1.2 km, with the retreat of the Tungnarjokull. On the same photographs Koldukvislarjokull is heavily crevassed, which was not as we found it. Measurements from the 1946 and 1960 records show that the Koldukvislarjokull must have advanced some 200 m into Hamarslon. Hamarslon in August 1970 occupied about a quarter of the original lake bed, and was scattered with icebergs broken off the Tungnarjokull.

Hvitalon has a more varied history. In 1938, it stretched between both lobes, but in 1946 it was empty. While the Tungnarjokull had advanced into the lake by about 0.3 km, Koldukvislarjokull had retreated sufficiently to allow the river to pass between the glacier and the moraine. In 1960 the lake was full again and the river flowed on the southern side of the moraine, which was caused by a southerly glacial movement of about 200 m. In 1970 the river was again flowing to the north of the moraine, and the lake was empty; the river course through the lake bed was about 10 m below lake bed level. After flowing out of the lake area, the river flows along an ice gorge and under the ice, but this ice bridge was breaking up throughout the 1970 summer leaving an area of about a quarter of a square kilometre detached from the glacier. There are no known reports of surges of the Koldukvislarjokull, but the evidence points to a surge during 1959–60.

5.3.2. ABLATION RATE MEASUREMENT

METHOD

A network of 28 stakes was set out on the Koldukvislarjokull (see map). The main line of 14 stakes was set out along a line of greatest slope from 1070 m altitude to 1320 m with a spacing of between 400 and 500 m. Three branches crossed the main line at about 1100 m, 1175 m and 1240 m altitude. The method and system of numbering is given in Stanley[4].

The stakes were 3.5 m long, made of 22 mm diameter plastic piping. Each was sunk to a depth of between $2\frac{1}{2}$ and 3 m into holes made by the steam drill (section 5.3.4.). The stakes then froze in their holes except stake 110 (the lower stakes unfroze during the last week of August). A measure of the exposed stake was made every 3 or 4 days, and together a brief description of the changes of the glacier surface (snow levels etc.). Comprehensive readings were made for the month of August. One round of readings took about 8–10 hours from campsite to campsite.

A snow pit was dug at stake 1, and this is reported in section 5.3.3.

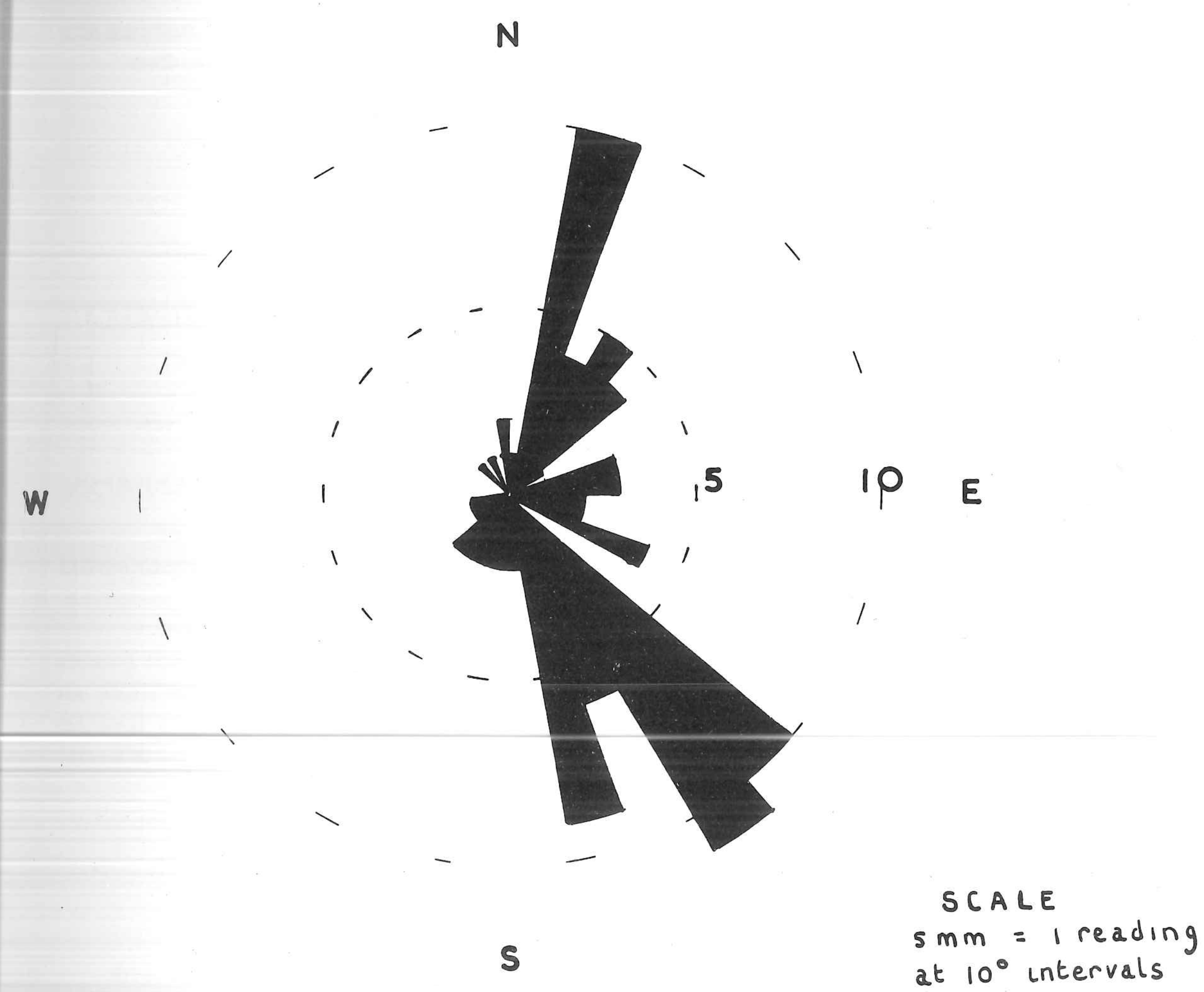
CRITICISMS OF THE METHOD

(1) The stakes were 22 mm diameter and the steamdrill nozzle 25 cm, but the melted hole could widen to over 30 mm at the top. This extra melting had not been allowed for, and it increased the time for freezing in the stakes.

(2) Wind pressure caused the stakes to lose verticality, and enlarged the top of the holes.

(3) The changing face of the glacier produced different final conditions for the stakes; e.g. being in a melt stream and experiencing forced ablation, or exposure on an ice hump.

Distances precluded a greater range of altitude and a higher frequency of readings.



URE 5 WIND ROSE

ABLATION RATES : PRESENTATION OF RESULTS

The amounts that the stakes had ablated out were measured periodically from 25th July to 28th August, with readings for all stakes taken from 3rd August onwards. These amounts of snow and ice that had melted were converted to the equivalent amounts of water (w. eq) using the method described in Stanley[4]. The specific gravity of snow and ice was estimated from surface conditions and from the density measurements made in the snow pit analysis.

A graph of Ablation Rate (y cm of w. eq per day) versus height (h) is shown in figure 6 for the period of 3rd to 28th August. A linear least squares fit is also shown which 'predicts' that there should be no melting above 1550 m for this time of year.

NON-DIMENSIONAL ABLATION RATIO (r)

Successive ablation readings for one stake are :

$$y_1, \; y_2, \; y_3, \; \ldots\ldots \; y_n \;\; \cdot\cdot \;\; \text{cm of w. eq}$$

taken at times

$$t_1, \; t_2, \; t_3, \; \ldots\ldots \; t_n \;\; \cdot\cdot \;\; \text{day - hours}$$

In general there will be differences $(y_n - y_{n-1})$

for periods $(t_n - t_{n-1})$ etc

The total ablation for the whole period of 3rd to 28th August is

'Y' cm of w. eq for the total time 'T'.

The non-dimensional ablation ratio (r) is such that

$$r = \frac{(y_n - y_{n-1}) \,/\, (t_n - t_{n-1})}{Y \,/\, T}$$

'r' is computed for all stakes for one period and a mean '$\bar{r}$' is worked out.

A plot of $\bar{r}$ against date is shown in figure 4, enabling comparisons to be made with the meteorological results and the river discharge rate. There was considerable variation in $\bar{r}$ since for some periods $\bar{r}$ was as low as 0.3, while towards the end it reached 2.0. Constant ablation would be given by 1.0.

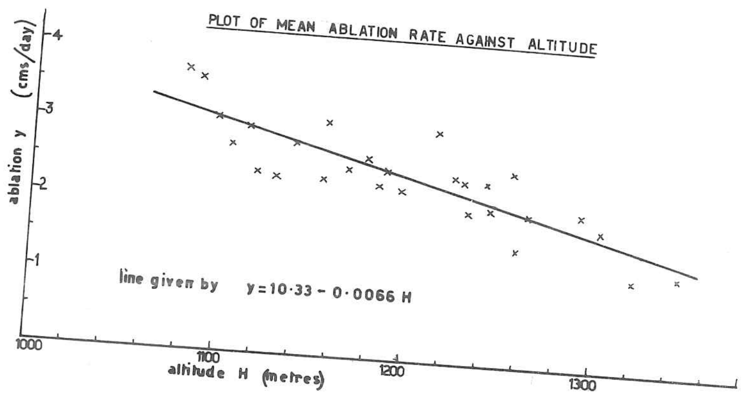


FIGURE 6 ABLATION RATES

5.3.3. SNOW PIT ANALYSIS

At an altitude of 1340 m on 20th August, a snow pit was dug near the top stake (No. 1) in accordance with (4).

The following notes are in amplification of figure 7, which shows the water equivalent of snow plotted against depth.

ICE LAYERS

Two of these were recorded, starting at 12 and 165 cm respectively. The top centimetre or so of the lower one was a dark, dirty colour, which could have resulted from the previous summer's melt.

ICE BANDS

There were several of these, mostly 2 cm in thickness.

ICE STREAKS

These ranged in thickness from 0.5 to 2.5 cm and were mostly found in the upper region of the snow pit face (between 20 and 95 cm)– possibly resulting from short warm periods earlier in the year. The colour of these streaks varied from blue to grey.

ACCUMULATION ESTIMATION

The water equivalent of snow down to the top of the 170 cm ice layer is estimated to be 110 cm (derived from figure 7).

Over the three weeks that ablation readings were taken, the stake near the snow pit ablated 40 cm. If this reading is extrapolated, a value of about 70–80 cm w. eq is reached for the whole summer's ablation. Assuming that no ablation takes place in the winter, and also that this year was climatically similar to last, then this gives a total accumulation for the year of 180–200 cm of water equivalent.

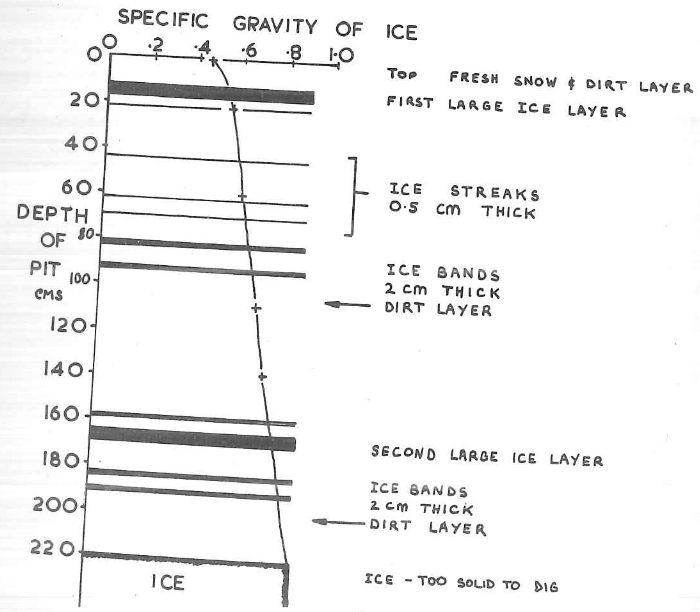


FIGURE 7 SNOW PIT ANALYSIS - 20 AUGUST

5.3.4. STEAM DRILL

INTRODUCTION

Many glaciological experiments require easily identifiable reference positions on the ice, from which measurements can be made (e.g. Ablation rates), and a convenient method of doing this is to drive a hole in the ice and insert a stake.

A method of drilling was required for holes of approximately one inch in diameter, and a depth of eight feet. Drills considered were:— a 2-stroke engine driven drill, a hand drill, and a steam drill. Such a drill should be inexpensive to make and be economic in use. Further factors were total weight of the drill and speed of drilling.

Consideration of these factors caused us to lean heavily towards a steam drill as described in (5).

DESIGN

A paraffin stove was the only convenient heat source. The heat output available from such a stove governed the primary design parameters:— nozzle diameter, working pressure, and steamflow rate. The principal dimensions and details are shown in figure 8. (N.B. A steam drill is no use for coring.)

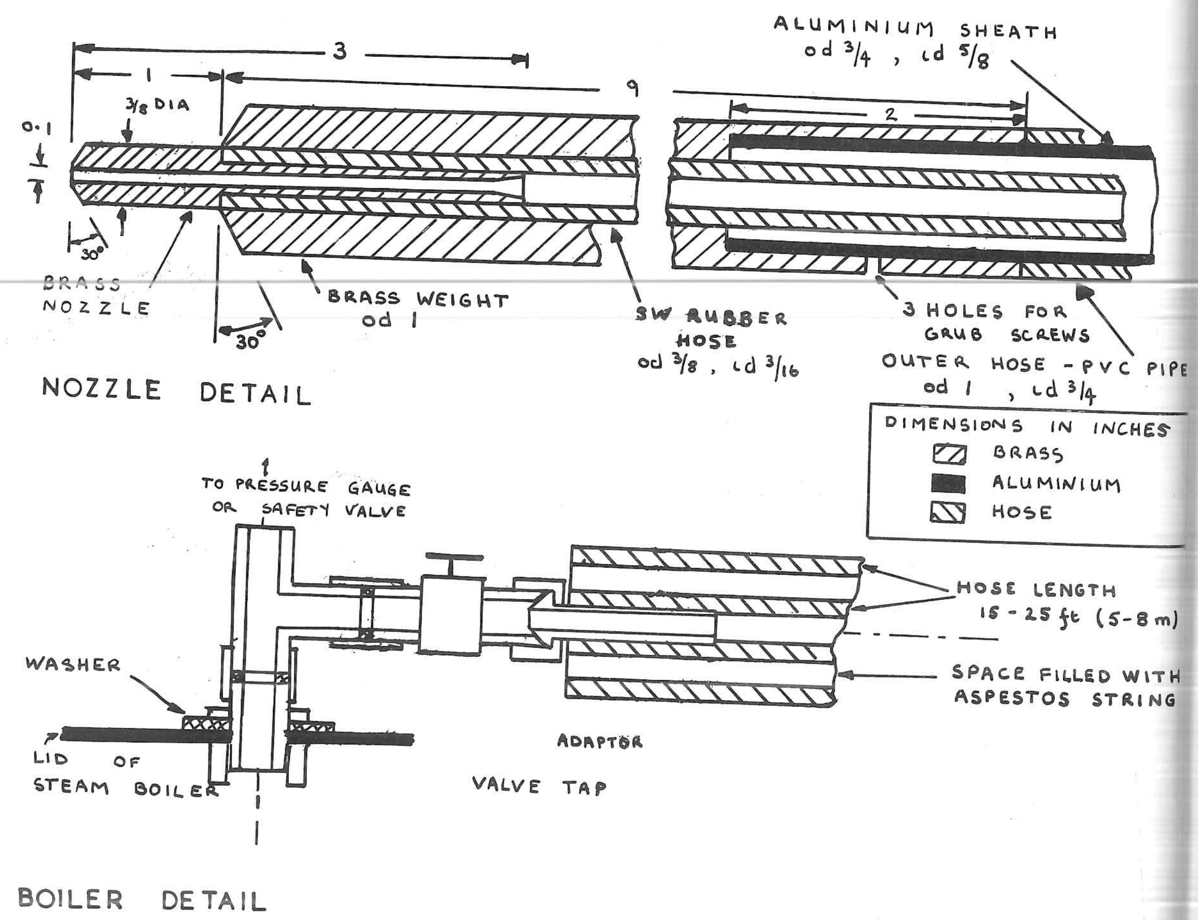


FIGURE 8 THE ICE STEAM DRILL

METHOD OF DRILLING AND PERFORMANCE

The water in the pressure cooker was heated until pure steam issued freely from the drill nozzle. Full heat output from the stove was required and a good wind-shield was necessary. The pipe was held vertically, and the nozzle allowed to melt into the ice. Once the nozzle was in the lip, slight pressure was applied, and care was taken to keep the drill vertical. When the hole was deep enough the drill was removed, and steam shut off. Packing and movement to the next site was fast, so that the water temperature was kept as high as possible, and time to raise steam at a subsequent site was reduced. The pressure cooker was initially filled up with around four pints of water, so that three holes could be drilled before refilling.

Raising of steam at a site took between 14 and 20 minutes, depending on initial water temperature and weather conditions. The actual drilling time for an 8 ft. hole was about 16 minutes. On average one pint of water and 0.3 pint of paraffin were used per hole. The actual diameter of the hole was 1.5 ins. (Drill diameter was one inch) at the top.

RECOMMENDATIONS

(a) Increase length of brass weight at nozzle to 12 inches. This would keep the drill more vertical.

(b) Increasing internal surface area of steam boiler by introducing vertical baffle plates with good thermal contact to boiler walls. This might reduce overall drilling time.

(c) Improved wind shield design. A makeship cardboard shield was used by us.

(d) Larger gas type tap (easier to handle).

(e) Use stakes with same diameter as drill.

APPENDIX

Materials and cost			£	s	d
(a)	Boiler —	Prestige "Skyline" (p.s.i. 15 max) pressure cooker, 7 pint capacity	4.	5.	0.
(b)	Piping —	18 ft. x 3/16 ins. i.d. rubber (SW) hose	1.	19.	0.
		18 ft. x ¾ in. o.d. clear p.v.c. hose	1.	10.	0.
		Brass rod 9 x 1 ins. o.d.		13.	6.
		Brass rod 2 x 3/8 ins. o.d.		1.	6.
		1/8 ins. pipe fittings. (T pieces, steam taps etc)		12.	6.
		Aluminium Tube 6 ft. x ¾ o.d.		18.	0.
		Asbestos string		3.	0.
		£	10.	16.	6.

5.3.5. STREAM FLOW MEASUREMENTS

The object of the flow measurements was to provide a daily mass flow rate figure which could then, in conjunction with the meteorological observations and the glacier ablation rate measurements, be split up into flow caused by surface run-off of precipitation and flow caused by melting of the ice and winter snowfall.

The method of measuring the mass flow rate was as follows:—

(1) A gauge board set up in the Svedja stream was observed twice a day. A simple technique also enabled the maximum level for the day to be observed.

(2) A rating curve, a graph of stream level against discharge, was constructed. This was done by plotting a profile of the river cross-section, and combining this with observations of the surface velocity distribution, at the site of the profile, for different river levels.

(3) From the rating curve, and a measurement of river level, the mass flow rate could be obtained.

(4) This was done for the measurements set out in (1), and these were plotted against time on a graph. By interpolation, and graphical integration, daily mass flow rates were obtained. (See Figure 4)

The method of measuring surface velocity distribution was as follows:—

(1) An attempt was made to use weighted floats, which would travel at the mean velocity of the water, over their depth. However, these proved unsatisfactory owing to the turbulence of the river. Pieces of ice which came down the river were used instead; and by timing these across a fixed distance either side of the profile, a measure of surface velocity was obtained.

The principal causes of inaccuracy in the measurements were as follows:—

(1) The variation of daily flow rate was large, with the result that it was necessary to make level measurements frequently. The site of the gauge board had, therefore, to be near the camp.

(2) The river was either braided or flowing rapidly over an uneven bed. The flow was thus highly turbulent, and the site for observations not ideal.

(3) Pieces of ice proved hazardous to recording equipment—it was demolished near the end of August.

From the graph it may be seen that the mean mass flow rate for the month of August was $1.4 \times 10^6 m^3/day$. The maximum recorded daily rate was $2.5 \times 10^6 m^3/day$, and the minimum was $1.0 \times 10^6 m^3/day$. This method was based on methods given in references (4) and (6).

5.3.6. REFERENCES

1.	1:100,000 Map—Bland 76	published by Landmaelinger Island (1966)
2.	1:50,000 Map	published by U.S. Map Service (1948)
3.	Sigurdur Thorarinsson	'Sudden Advance of Vatnajokull Outlet Glaciers (1930—1964) in 'Jokull' Misc papers No 44, Reykjavik 1964
4.	G. Ostrem and A. Stanley	'Glacier Mass Balance Measurements' Guide prepared by Canadian Dept. of Energy, Mines and Resources and Norwegian Water Resources and Electricity Board 1969
5.	Journal of Glaciology	'A steam—operated Ice Drill' Vol 5, June 1965
6.	Clark	'Plane and Geodetic Surveying' (Vol 1)

5.4 GLACIAL STREAM WATER SAMPLES

(DEUTERIUM AND TRITIUM)

Water samples from two different streams were taken throughout our stay at twice weekly intervals. They were collected on behalf of the Science Institute, University of Iceland, who will analyse them for deuterium and tritium content. Such analysis forms part of a national investigation which is briefly described below.

DENTERIUM CONTENT

Isotopic exchange between ice and water is found to take place in temperate glaciers. Such exchange causes homogenization of denterium during thaws, together with a general increase in denterium concentration. The ice is therefore more homogenous, and has a higher denterium content than precipitation on the glacier. Study of the different content gives information about the run-off ratio.

TRITIUM CONTENT

Atmospheric testing of thermo-nuclear weapons has led to large variations in tritium concentration of rain water. These variations are reflected in ground water samples, and depend on the history of the water. Tritium concentration knowledge is therefore useful in ground water hydrology study.

REFERENCES

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3.	P. Thedorsson	Summary in English of "Tritium in ground water and glacier in Iceland", in "Jokull" 1968, 18.
4.	P. Thedorsson	"Natural Tritium in groundwater Studies", International Atomic Energy Agency, Vienna, 1967.

5.5 PHOTOGRAPHY

Photography for itself was not a major expedition aim, but it was important as a record; of our activities, experiences, and of the area visited.

The main problem encountered was exposure setting. For a picture consisting of part snowscape and part landscape, built in exposure meters gave too low a reading. This was because of high reflectivity by the snow, and resulted in the land for many pictures being too dark. Built in meters proved only satisfactory for shots of either pure snow, or pure land.

Another problem was storage. Much of our equipment was stored outside tents under polythene sheeting, which had a "greenhouse effect" on a sunny day. It is thought that 200ft. of cinefilm became too hot by being left under the sheeting, and thus developed rodflashes superimposed on the film detail.

EQUIPMENT

Cine	"Quartz" Zoom, 8mm.
Still	Minolta, 16mm, II Ilford "Sportsman", 35mm. Halina, 35mm.
Film	5 x 35mm (36 exposures) Kodakchrome II Colour 16 x 35mm (36 exposures) Ilford P4 Black and White 7 x 16mm (20 exposures) 400 ft 8mm Ilford Standard
Developing	The Black and White films were kindly developed and printed by the Royal Naval Engineering College, Manadon.

5.6 FLORA AND FAUNA

FLORA

As was to be expected in our part of Iceland, the vegetation was very sparse. Unfortunately, no-one on the expedition had any Botanical knowledge, and as no pressings of flowers were taken, the expedition was unable to positively identify anything botanical.

FAUNA

INSECTS

Contrary to some reports, the expedition encountered very few of these. Mosquitoes were seen around the Koldukvisel on warm days, but there were fortunately none around our camp site. However, on very warm days, Houseflies and Bluebottles were seen around the tents.

Apart from some birds, nothing else was sighted here.

BIRDS seen were:—

Certain	One flock snow-buntings		
	White Wagtails	—	several
	Meadow Pippit	—	one
	Raven	—	one
Uncertain	Wheatear	—	one

6. ACKNOWLEDGEMENTS

Firms	Lea Bridge Industries Ltd British Petroleum Company Ltd Ind Coope Sir Alexander Gibbs & Partners Imperial Chemical Industries Marples Ridgway Ltd Ronson Products Ltd George Wimpey & Co Ltd Wolsey Ltd
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Cambridge University Bodies	Jesus College Pembroke College Queens' College The Engineering Department The Expeditions Committee
Iceland	Orkustofnun (National Energy Authority) Rannsoknarad Rikisins (National Research Council) H.M. Consul, Reykjavik Landmaelingar Island (Iceland Survey Dept)
Service Departments	The Royal Naval Engineering College, Manadon The School of Military Survey 39 Engineer Regiment (Airfields) B.D. Unit, Felixstowe The Queens Division Depot Cambridge University Officers' Training Corps The Iceland Defense Force (U.S. Navy & U.S.A.F.)

Although we have named particular bodies, the help they gave us was often through the kindness of individuals acting in much more than their official capacity. We feel that the following deserve particular mention, but we hasten to add that any omission in no way lessens our thanks, and we apologise if any absence causes offence.

Keith Miller	(C.U.E.D.)
D. S. Green, Esq	(C.U.E.D.)
Guttormur Sigbjarnarson	(Orkustofnun)