# Within and Without the Arctic Circle.

By N. E. ODELL.

(The substance of parts of this paper was read before the Alpine Club, February 7, 1933.)

DURING the past twelve years, often with geological exploration and research as the chief end in view, it has been my good fortune to visit some of the remoter mountains that either lie proximate to that romantic parallel of latitude the Arctic Circle, or are situated well N. of it. Many of these mountain ranges differ much one from another on account of widely varying climate and precipitation, apart from altitude, and their unfrequented if not unexplored character in many cases makes them formidable as well as strenuous propositions. Indeed, without qualm of exaggeration, the writer can say that in his experience the type of mountaineering involved in these expeditions is of an order of exaction usually much in excess of the average biggish Alpine excursion. In spite of the quite moderate altitude, often, of these Arctic and Subarctic ranges, the methods of approach, the long line of camps, and the heavy porterage necessary, apart from climatic conditions, place them more in a Himalayan category, and nowhere is this resemblance borne in on one so forcibly as amongst the giant glaciers of Greenland, or even of Spitsbergen.

In the following account it is my purpose to give an outline of impressions and experiences, on two recent summer expeditions to the mountains of North-east Labrador, and those of North-east Greenland, including an ascent of Beerenberg in the island of Jan Mayen.

## *North-east Labrador.*

Following much discussion of the project when the writer was at Harvard University, it was not till 1931 that Professor Alexander Forbes of Harvard Medical School was able to complete his plans for a survey and scientific expedition to the north-eastern coast and mountains of Labrador. My wife and I, who in the meantime had returned to England, were invited over to join an enterprise which later laboured under the unabbreviated and somewhat flamboyant title of the ' Grenfell-Forbes Northern Labrador Expedition.' Brief visits only had previously been

*Expedition photo.*]

'FOUR PEAKS' GROUP, AND HEAD OF RYAN'S BAY, LOOKING E. LABRADOR.

[*To face p.* 26.

*Expedition photo.*]

BISHOP'S MITRE FROM N. LABRADOR.

made to this wild and neglected region of the extreme N., most of our earlier information being based upon the reports of Professor R. A. Daly, of Harvard University,[1] and of our Honorary Member, Professor A. P. Coleman, of Toronto University,[2] whilst Sir Wilfred Grenfell, of southern Labrador fame, who was interested in the present expedition, had cruised along and described the main features of the coast.[3]

Although the southern portions of the interior of Labrador display scattered minor ranges of inferior elevation, with very occasional summits exceeding in all probability 3000–4000 ft., yet the greater part of the country is a slightly elevated plateau of moderate relief. It is only in the northernmost one-third of the peninsula, that is N. of latitude 57°, that bold mountain ranges worthy of the name are to be found. These are three in number: the Kiglapait Mountains, signifying in the Eskimo language, Great Sierra, or saw-tooth mountains, which lie to the N. of the settlement of Nain; the Kaumajet Mountains, or 'shining top range,' situated 60 miles further N. in the vicinity of Cape Mugford; and the Torngat Mountains, 'the home of the spirits,' extending for over 100 miles northward to the island of Killinek, off which lies Cape Chidley, at the entrance to Hudson Straits.

### *The Torngat Mountains.*

Of these three mountain groups, the most extensive and important is that of the Torngats. Various earlier reports had placed the height of some of its peaks at 8000–9000 ft., and therefore the loftiest on the Atlantic sea-board of America. But in the opinion of Coleman, Daly, and Sir Wilfred Grenfell, the altitude of the higher summits was nowhere considered more than 5500 ft. The results of our survey of 1931, carried out by triangulation and by aerial photographic means, and our various journeys into the interior, including many mountain ascents, have enabled a fairly comprehensive knowledge of the topography of the region, as well as of its geology and botany, to be obtained. The Torngat Mountains were found, moreover, by no means to comprise a single chain, but rather a

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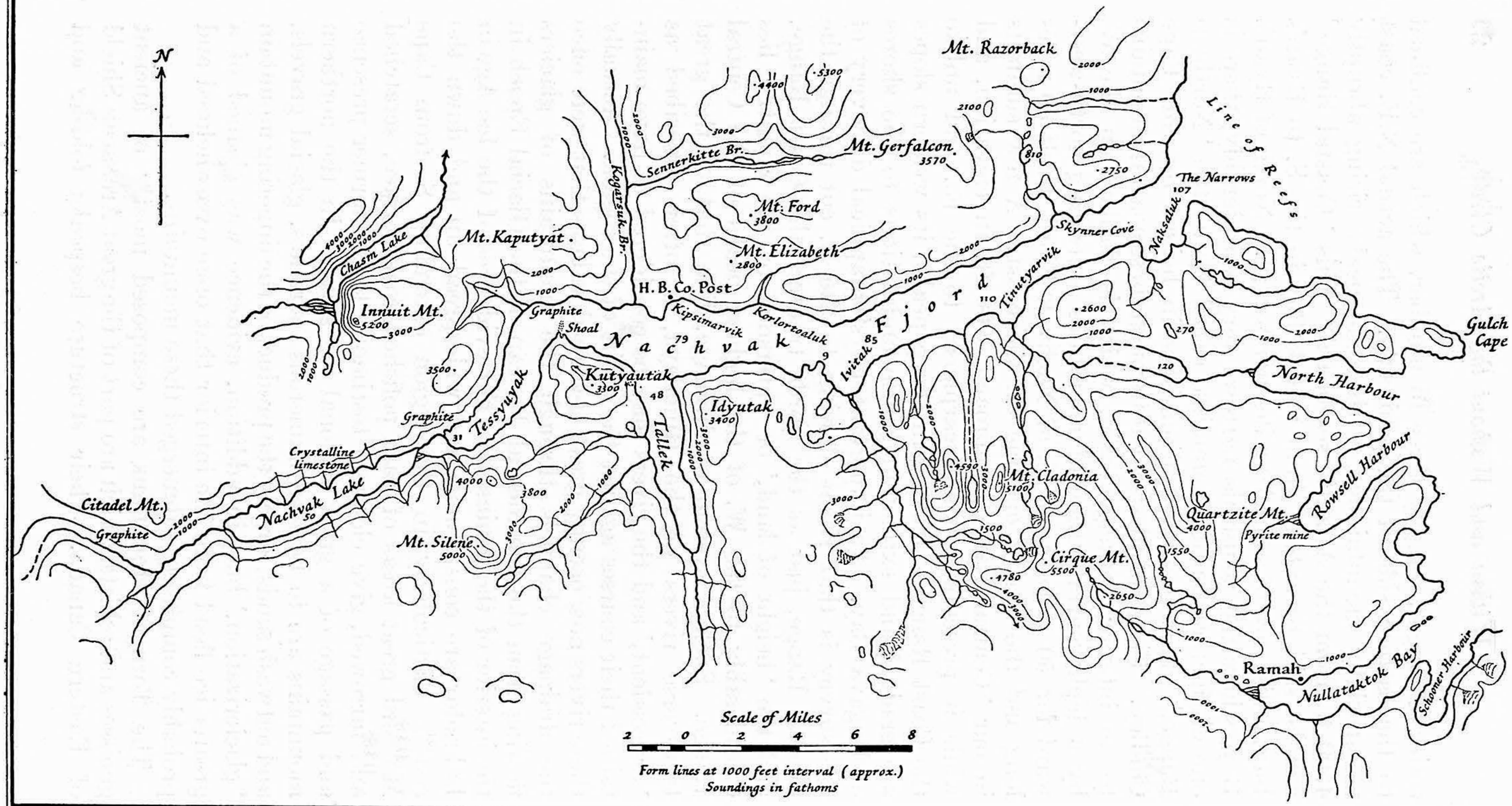
[1] 'The Geology of the N.E. Coast of Labrador,' *Bull. Museum Comp. Zool.*, Harvard College, vol. xxxviii, Feb. 1902.

[2] 'North-eastern Part of Labrador and New Quebec,' Memoir 124, *Canadian Geol. Survey*, 1921.

[3] *Labrador*, W. T. Grenfell and others.

series of ranges, roughly three in number, which are confined to the eastern side of the peninsula. The actual N.E. coast is especially mountainous, with some peaks rising abruptly 4500 ft. from the Atlantic sea-board. This 'Coastal Range' can be said to extend from Saglek Bay in the S. to Ryan's Bay, a distance of some 70 miles northward. North of Ryan's Bay, where the peninsula narrows very considerably, there is one distinct range of mountains, called by us the 'Northern Range,' which gradually diminishes in height towards Cape Chidley. Fjords of all sizes cut through these coastal mountains to an interior drainage basin, which is flanked on the W. by a high central range of mountains extending north-westward for 50 miles from S. of Nachvak Fjord, itself 30 miles long and the largest opening on the coast. A few summits in our 'Central Range' approach 5000 ft. in elevation, and while it presents a bold escarpment to the E., and unlike the Coast Range is lacking in sharp peaks, its western slopes are gradual and extend in gentle undulations to the shores of Ungava Bay. An important physiographical discovery of the survey is that rivers flowing to the E. cut through the Central Range, just as the fjords transect the Coast Range, and the 'height of land,' or watershed of the country, lies considerably to the W. of the highest peaks of the Central Range. Such a system of drainage, like that of the great transverse rivers of the Himalaya, is often described as 'antecedent,' and the rivers may be considered to have maintained their courses against the uplift of the region. Actually these rivers now occupy great U-shaped valleys that were once the drainage channels through the mountains of glaciers flowing from the continental Ice-cap of the Glacial Epoch in the interior of the peninsula. For evidences of the Ice Age in Labrador are conspicuous and widespread up and down the coast. Particularly in the region extending S. from Cape Mugford great areas of bare polished rock-surface, scratched and furrowed, give eloquent testimony to the former presence and passage of a great regional ice sheet. In the northern mountains are to be seen numerous moraines, glacial gravels, and outwash sands, largely the product of the lingering mountain 'glacierization,' but, in addition, evidence was gleaned of a greater ice flood from the interior that once overwhelmed and probably completely submerged these mountains.

The Torngat Mountains are composed mostly of ancient gneisses and schists, which are part of the great Archaean Shield of Eastern Canada. Their structure bespeaks folding and




*By courtesy of R.G.S.*]

NACHVAK FJORD, LABRADOR, FROM PROFESSOR A. P. COLEMAN'S GEOLOGICAL MAP OF 1921.

compression at some early geological date. But the ancient range, or ranges, so formed had long since been worn down almost to a plain, ere the region was again elevated to be sculptured by the agencies of water, frost, and ice, to its present pronounced relief.[4]

We were a party of sixteen persons all told who sailed northward 'down the Labrador' in easy stages from Newfoundland. Our ship, the *Ramah*, was a well-appointed auxiliary schooner of about 70 tons burden, and Dr. Forbes, an enthusiastic yachtsman, apart from mountaineer and air-pilot, undertook to do his own navigation and piloting along this uncharted, treacherous and stormy coast. Attached to the expedition was an aerial section of two seaplanes, with a personnel of four, whose function it was to carry out the air photographic programme by which a large part of the survey was the more expeditiously to be accomplished. One plane was intended more or less for reconnaissance purposes, and if petrol supplies had proved sufficient it had even been suggested that I should have the unusual mountaineering facility of aerial conveyance with mountain-lakes as centres!

Calling at many places as we made our way along the coast, after not a few adventures, we eventually reached our base at 'Seaplane Cove,' in lat. 59° 22′ 31″ and long. 63° 47′ 02″. This had been reconnoitred from the air, and was situated at the entrance to a fjord known in the Eskimo tongue as Kangalaksiorvik, which has the quaint significance of 'the place where they hunt caribou when their hair is shed.' Here we were within the Coastal Range, and on the S. side of the group of the so-called 'Four Peaks,' about whose altitude, and no doubt on account of their fine proportions, there had already been much exaggeration by earlier visitors. Westward was Mount Tetragona, named and climbed, in 1916, by Coleman, who, however, has told me that he was quite unaware that the mountain had already been ascended in 1908 by E. S. Bryant and H. S. Forbes (a cousin of our leader), who had called it Mount Komaktorvik, after a neighbouring fjord. The ascent of Tetragona was made by more than one party of our expedition, and although its altitude was later computed not to exceed 4415 ft., it was clearly one of the highest points in the district and a dominating massif of fine proportions.

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[4] For a fuller account of the characteristics of the region and the work of the expedition see my article, 'The Mountains of Northern Labrador,' in *Geographical Journal*, vol. lxxxii, 1933.

In a deeply recessed basin at the foot of the northern face of the mountain lies a small corrie-glacier typical of the region, and at the ice-front is a beautiful glacial lake of exquisite blue and green tints. In 1908 Bryant had photographed this ice-front from below the lake, and it is perhaps of interest that comparative photographs taken by me 23 years later show a considerable modification and shrinkage of the ice-front, although owing to extensive moraine-covering it was difficult to gauge the actual amount precisely : there appeared, however, to have been a retreat of some 80 to 100 yards. This corrie must be one of the wildest spots in all Labrador, and indeed one of the most impressive, since the northern cliffs of Tetragona fall in great precipices 2500 to nearly 3000 ft. to the glacier. Climbing on this face should prove of ample quality and quantity to eventual visitors to the locality. The ascent and traverse from E. to W. of Tetragona by E. Abbe, our botanist, and myself, involved little more than a walk to the top and a descent by steep rocks and a small glacier to a wild rock-filled glen. The ' day ' included a night out and a long walk to a distant camp some 15 miles in the interior. But long days, the result of wanderings in, and examination of, unknown country of the wildest and roughest description, came to be the rule rather than the exception. When bleak nor'-easters bore down on us from the icy Labrador current, holding us inactive for 3 or 4 days at a stretch, our inevitable reaction was to spin out the fine spells by inordinately long days of work. Indeed, the short nights of these latitudes lent distinct encouragement to this practice, and, moreover, the ubiquitous mosquitoes of these parts were usually less active during the cooler hours of night.

The site of the camp in the interior referred to was one I had been enabled to select during a flight with Dr. Forbes from Seaplane Cove. It was situated on a fjord-like lake, which was entrenched deeply in the folds of the Central Range, and from this as centre much of the surrounding mountain country could be explored and examined. Two notable peaks in the vicinity were ascended : ' Tower Peak,' about 4000 ft., and another which was computed by O. M. Miller, our chief surveyor, to be 4697 ft., and one of the highest of the whole Torngat Range. Neither proved to be more than a rough scramble, although the latter was typical of this region in entailing long traversing of boulder-fields. These extensive and exasperating fields of boulders, well termed ' Felsenmeer ' by Daly, which cover at times square miles of mountain slope and valley, are

*Expedition photo.*]

PART OF 'FOUR PEAK' GROUP FROM N. SUMMIT REACHED AT HEAD OF LARGE LAKE ON LEFT. LABRADOR.

[*To face p.* 32.

*Expedition photo.*]

MT. RAZORBACK (HIGHEST POINT ON EXTREME RIGHT), AND CAPE WHITEHANDKERCHIEF. LABRADOR.

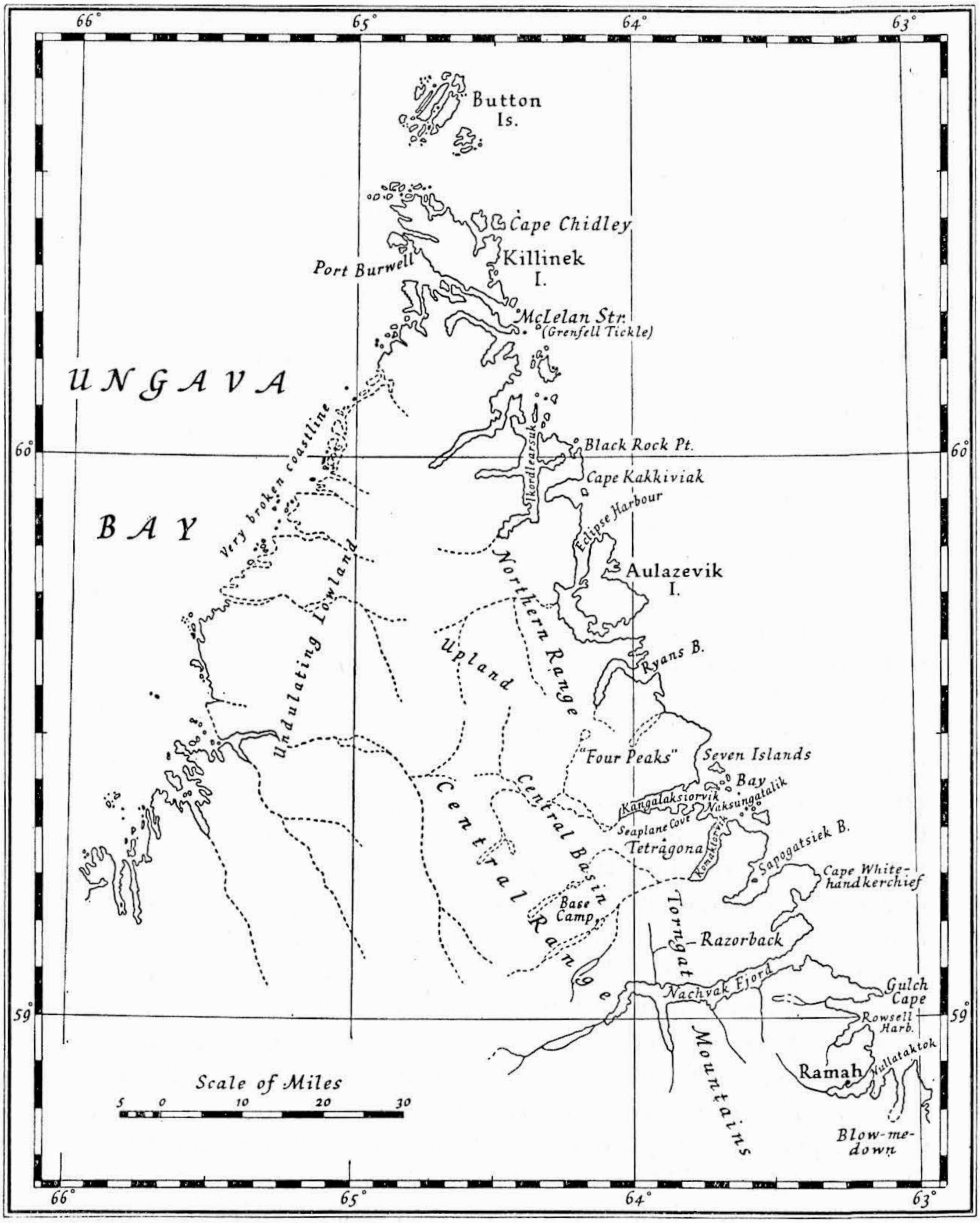
the result of the excessive frost-splitting and movement downhill ('solifluction') of all material, and they obtain in arctic and subarctic climates where there is much fluctuation of temperature on either side of the freezing-point. It was, moreover, on these mountains that I found clear evidence of their having been overridden by the ice-sheet from the interior, a thesis in which I find myself in opposition to my friend Dr. Coleman. The flat and rounded summits of many mountains of the Central Range, recalling those of Scotland and parts of Norway, are due to their being portions of the old land surface of pre-glacial times, but that dissected surface is one which has undoubtedly suffered modification by ice that was not local and came from the interior.

The finer and acuter form of the peaks of the Coast Range was naturally more attractive from a mountaineering point of view, and the group of the 'Four Peaks,' lying between Kangalaksiorvik Fjord and Ryan's Bay, next demanded our attention. Circumstances however did not permit of more than one of the group being visited, and this, about 4200 ft. in altitude, provided Dr. Forbes and myself with an excellent rock-scramble on gneiss for the last 700 ft. to the top. Our ascent from Kangalaksiorvik Fjord was undertaken to ascertain something of the configuration of the group, and it was particularly trying when within a short distance of the summit to have everything blotted out by a dense and chilly fog. But with the frigid Labrador current sweeping past just off-shore such is a not infrequent occurrence in these parts. Our aerial photographs of the 'Four Peaks' show, however, that there may be some interesting ridges and buttresses in that part of the group which lies between the sea and Ryan's Bay, and this may apply to one peak in particular which, seen from the N.E. off-shore, was originally likened by Sir Wilfred Grenfell to the outline of the Matterhorn. 'Four Peaks' is a gross misnomer, since our survey has indicated about thirteen peaks which rise abruptly from sea-level to about 4000 ft. or more, and as seen from the inner recesses of Ryan's Bay, one of the grandest fjords on the coast, this fine group, with its deep glacier-filled corries and rugged ridges and bastions, should give plenty of interest to a party of mountaineers using a ship as their base.

It is probable that one of the best climbing centres in the Torngat country is Nachvak Fjord, the largest fjord (30 miles) on the coast, and round Nullataktok Bay about 20 miles to the S. Mt. Razorback, which rises magnificently at the

entrance to Nachvak Fjord, has been described as without a parallel on all the eastern American coast-line, and its 3 or 4 miles of saw-toothed crest-line must have few rivals anywhere. As seen during an earlier flight over it, there had seemed to be something unusual as well as geologically distinctive about Razorback, but it was not until our last days in the north that its fine proportions and uncommon interest could be investigated. From a spectacular anchorage below its northern wall, Brewster Morris and I climbed the mountain and crossed to Nachvak Fjord, while our ship sailed round it to meet us at Skynner Cove on the fjord. Leaving the *Ramah* we first gained a small glacier, deeply recessed in the mountain side above, whose snout was at an altitude of not more than 1200 ft. At 1970 ft. by aneroid we had cut across a small well-filled bergschrund, and thence to the top of Peak 2, which is about 3500 ft., and is one of six major points on the full extent of Razorback, there followed as pleasant a climb over steep rough rock as one could wish for. The actual rock, though granite-like in consistency but with blue opalescent quartz, turns out to be one of rare occurrence, known as 'charnockite.' The crest of Mt. Razorback, reminiscent of the Lofotens, forms a very narrow ridge, and where towers of rock rise from it the climbing can be at times of considerable difficulty. Until our arrival on Peak 2 we were uncertain as to whether or not it would turn out to be the highest of the ridge. But it was soon clear that $\frac{1}{2}$ mile or so to the east Peak 1 rose about 100 ft. higher, and was separated from us by an attractive though difficult stretch of arête. Time would not permit of our including this also in the day's expedition and getting down to Nachvak through unknown country before nightfall. Turning our backs on the magnificent seaward view and the remarkable headland of Cape Whitehandkerchief at our feet, we commenced our descent on the southern side. A somewhat disintegrating couloir had to be negotiated giving out on ice-slopes at the head of a corrie-glacier below the highest eastern peak of the range. A good deal of step-cutting was necessary to gain the level floor of the glacier, which similar to others in the range was less than half a mile in length and terminated at an altitude of about 2100 ft. above sea-level. Also like others this glacier was in a stagnant if not waning condition, the water issuing from it being clear, and therefore indicative of little erosion by ice being in progress. Yet there was sufficient invisible material suspended in the water to give coloration to a chain of beautiful blue-green lakelets in the

wild rocky valley down which we made our way. A long ramble through unknown and unmapped country, over great stretches




*By courtesy of R.G.S.*]

NORTHERN LABRADOR, FROM SURVEYS BY THE GRENFELL-FORBES EXPEDITION, 1931.

of 'Felsenmeer,' and final adventures in partial darkness in a crevassed snow-filled gorge, brought us at last to the shore of

Nachvak Fjord, and our ship the *Ramah*, slumbering and at anchor. But the long extent of Mt. Razorback should provide numerous alternative routes and traverses of every grade of difficulty for the future enterprising explorer of this magnificent ridge, and it is unlikely that many, if any, mountains of the district will supply better sport.

## *The Kaumajet Mountains.*

The Kaumajet Mountains to the southward, in the vicinity of Cape Mugford, are constitutionally entirely different from the gneissic Torngat group, being of volcanic formation with a preponderance of coarse rough lavas. Its exceedingly steep sides to seaward prevent easy access in many parts, and the first essay of the writer's party from the 'Valley of the Twin Falls' at the southern end of Mugford Tickle [5] achieved success only after a steep rock-climb of 800 ft. Once above the lower, almost perpendicular crags, all is plain sailing, since the upper parts of much of the range do little more than undulate between 2000 and 3000 ft. Of considerable interest was the finding, at 2000 ft. on these upland areas, of erratic blocks dropped by the continental ice-sheet which, as in the Torngats, must once have submerged these mountains.

Though formidable in appearance, of easier access from the northern end of Mugford Tickle was the Bishop's Mitre, a mountain which forms such a striking feature and landmark on this section of the coast. Sir Wilfred Grenfell had landed here in 1911 and essayed the ascent, but he gracefully assures me he never reached the top. After a not-too-easy landing our route led over nothing more than a long shoulder of disintegrating rock and boulder slope, with but a final short crag to the highest point of the Mitre, 3750 ft. by aneroid. The prospect thence, after an opportune clearing of clouds, commanded a magnificent stretch of bold coast with ice-flecked blue waters, and mountains rising steeply out of deeply chiselled fjords. The other peak of the Mitre, a few feet lower and distant perhaps 100 yards, was later reached after an interesting descent of some 300 ft. into the gap between the peaks, and a steep re-ascent. This remarkable gap, cleaving the summit, is formed by a weathered-out dyke-rock, and it fell away on the seaward side in one long ice-filled couloir for 3500 ft., a truly impressive sight. Cairns were duly built on each peak, and

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[5] 'Tickle' is a Labrador name for a narrow tortuous channel.

a descent made to a col on the S.W., whence two farther peaks of the range in that direction were ascended by one of the party the same day. Westward of Mitre Peak, across a large cirque, rose Brave Mountain, the highest of the Kaumajets, which we estimated to be about 4200 to 4400 ft. ; but with so much of geological interest on all sides to examine time unfortunately forbade our reaching it. Looking out south-westwards over the undulating country of the interior, an interesting feature in the view was a distant range of rounded and peaked summits, perhaps 60 or 70 miles away, which estimated by Abney level appeared to be at least 4000 ft. in height : but this must be quite an exceptional altitude in the otherwise monotonously low country of the interior of the Labrador peninsula. And it will probably be a long time before even the exceptionally enterprising climber, having braved long stretches of the worst mosquito country in the world, thinks fit to lay siege to this or any other remote range of the interior : he has ample in the three major ranges of the coastwise region to occupy his attention for many years to come.

## *The Kiglapait Mountains.*

Only a word or two can be said about this 'sierra,' the southernmost of the three northern groups. They are a wild rocky group about which little at present is known, although Mr. E. P. Wheeler, of Cornell University, has recently been making a geological investigation of them, and finds that their greatest altitude does not exceed 3000 ft. We anchored beneath them on our way N., and were greatly impressed by their seaward escarpments, but the aerial photographs of them taken in 1932, during the supplementary aerial survey under Dr. Forbes's auspices, reveal much of their area as a remarkably subdued ice-scoured highland. They are largely composed of the unusual gabbro-like rock anorthosite, with which is associated the well-known and beautiful iridescent mineral labradorite, which has been much exploited from the neighbourhood. Unlike the ranges farther N., the Kiglapaits are accessible during the summer by the ordinary Newfoundland Government steamer, which usually makes fortnightly trips as far as Hopedale or Nain, the latter of which is an important Eskimo centre of the Moravian Mission and the Hudson's Bay Company. And it is in this district that the Admiralty have just commenced the long-expected hydrographical survey, which will greatly facilitate navigation on

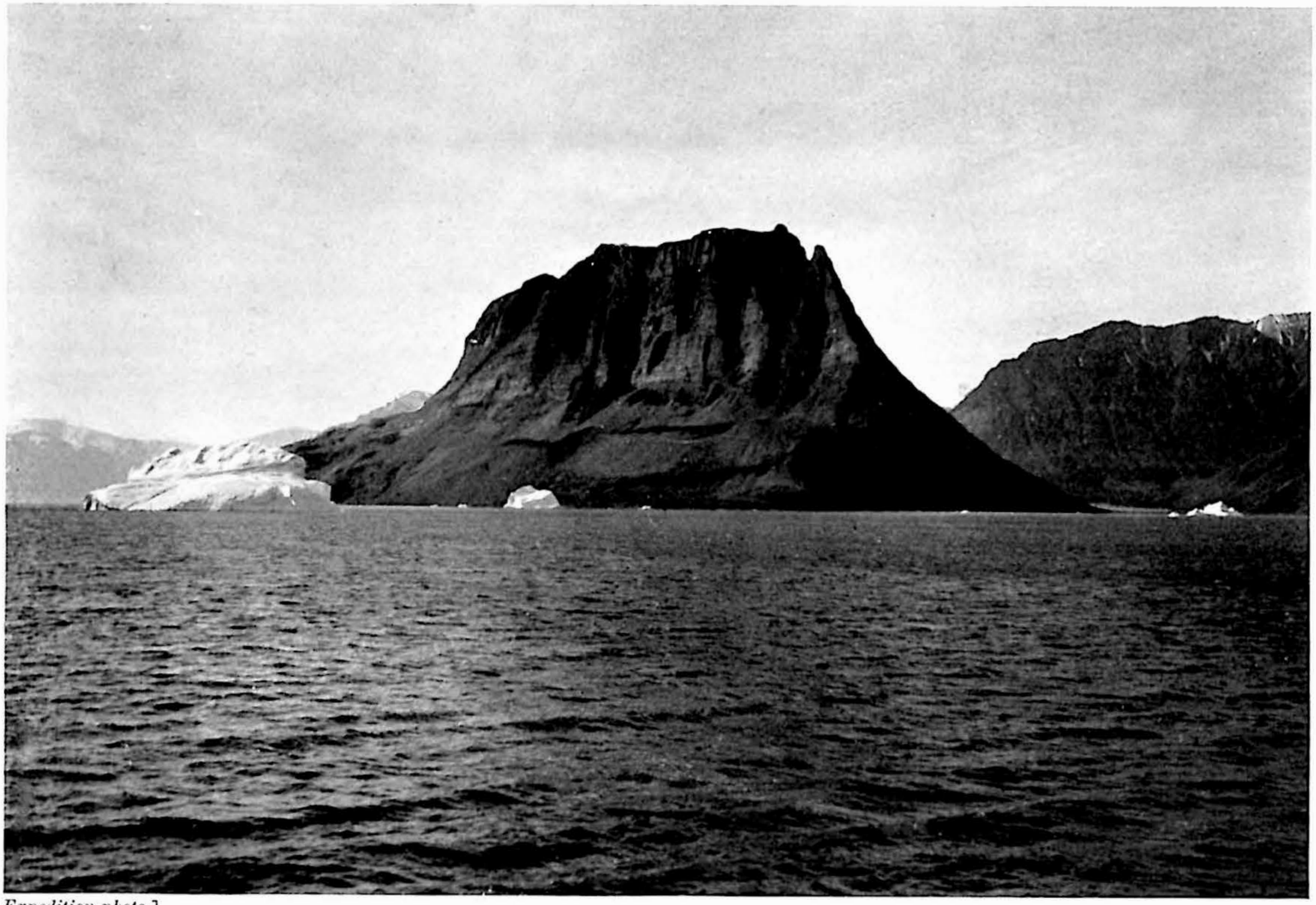
this intricate rocky coast, and encourage regular cruises to the mountains and fjords of the region farther N.

Summarizing, it can be said that apart from the magnificently wild scenery of the coast and fjords and the ever-present charm of exploring and pioneering in these far northern ranges, it would not appear that the expert mountaineer who ventures here will find climbing of a high order, except in one or two restricted areas. It is a country much like Norway and Scotland, where great areas of wild highland exist, and where really good peaks and precipices are somewhat few and far between. There are fine crags to be found, some of which are impossibly steep, both in the Central and Coast Ranges of the Torngats and the Kaumajets, and the prevailing crystalline rocks provide some excellently sound courses. But it is usual to find an easy side to many of these mountains, involving little more than rough walking or scrambling—but of the roughest type. The 'glacierettes,' for such only can they be called, which lie in the upper corries of some of the mountains, are nowhere longer than half a mile, and provide nothing but pleasant rambling and little real ice-work. The couloirs and gullies which rise from them to the crags can give, however, steep and excellent stretches of ice-climbing and step-cutting and, combined with certain rock-climbs, some all-round Alpine-like excursions.

Northern Labrador may be a somewhat remote and inaccessible mountaineering field to recommend, but he who desires unfrequented country of the wildest description, tempered by the interest of occasional contact with the friendly Eskimos, or who is able to partake in one or more of the many fields of investigation awaiting further research—to wit, geology, botany, etc.—will find a visit more than worth while—and particularly if love of the sea and of sailing is among his attributes.

### *North-east Greenland.*

Last summer (1933) Miss Louise Boyd, of San Francisco, conducted to the north-eastern coast of Greenland an expedition whose avowed intention was to explore and survey, both topographically and geologically, certain areas in the neighbourhood of the great Franz Josef Fjord. My wife and I, with interests of botany and geology respectively, were invited to join the expedition. Accordingly, in June, we resorted to Norway for a little preliminary training at Öie, that charming resort in the Sunnmöre (erstwhile Sondmöre) district in north-western Jotunheim. Ascents were made of Slogen,



*Expedition photo.*]

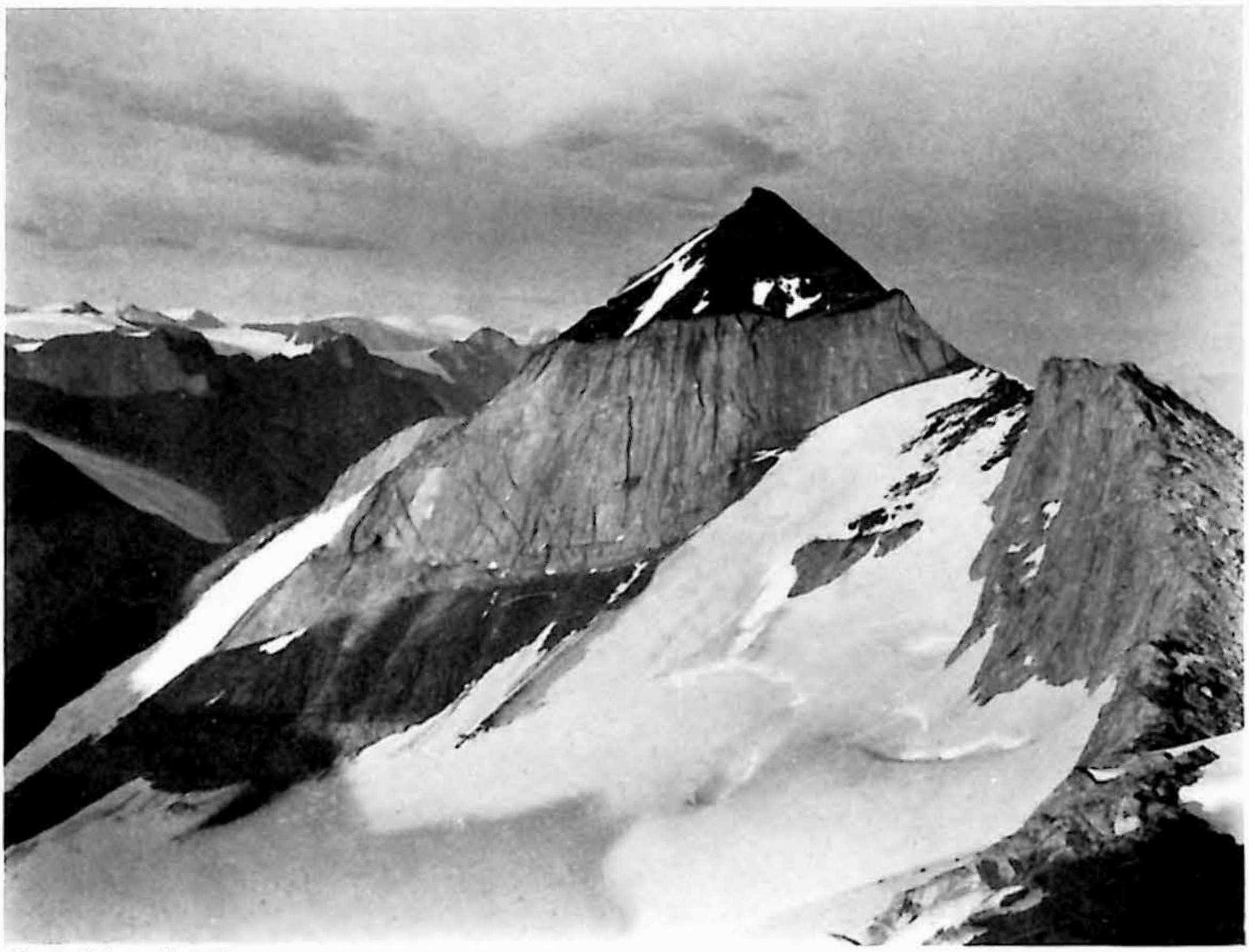
'TEUFELSSCHLOSS' FROM N.E. FRANZ JOSEF FJORD, N.E. GREENLAND.

[*To face p.* 38.

*Expedition photo.*]

BEERENBERG FROM W. JAN MAYEN.

(Shows Weyprecht Glacier descending from gap in crater.)



*Expedition photo.*]

NATHORST PEAK FROM RIDGE TO S.W. N.E. GREENLAND.

Smörskredtind (W. arête), and Kjeipen, in the brilliant weather which prevailed in Norway during the greater part of last summer, and in striking contrast to one's experiences of 1929. It was a pleasure to find C. W. Patchell, the presiding genius of Öie for so many years, in residence, and so heartily and hospitably ready to impart everything of local lore and interest; and particularly gratifying to discover that the Aalesund section of the Turist Foreningen had dedicated the only mountain hut of the district, at the foot of Smörskredtind, to him.

From Öie it was but four hours' run up the fjord to Aalesund, whence we eventually sailed for N.E. Greenland on June 28. Our expeditionary ship, the *Veslekari*, a sealing sloop of about 180 tons burden, had been fitted out in a style and degree of comfort quite unusual for the Arctic. Hugging the coast as far N. as the Lofoten Islands, and visiting the remarkable holed mountain of Torghatten *en route*, we thence struck westward across the Greenland Sea to Jan Mayen, that remote and extraordinary island which lies some 350 miles N.E. of Iceland.

Jan Mayen was subject to volcanic activity, probably within historic times, though it has now reached what is called the 'solfatara stage,' and only jets of hot air or gas in a few localities are in evidence. This remote island of only 32 miles in length is dominated by the great dormant cone of Beerenberg, rising to but a few feet short of 8000 ft. directly from the sea. Its flanks, once the channels of molten lava streams, are now the run-ways of great glaciers; and no more remarkable sight of such a character, where glacier competes with frozen lava over several thousand feet of descent, can be seen than on the western side of this beautifully symmetrical mountain. Mr. J. M. Wordie's Cambridge party of 1921 made the first ascent of this unusual peak, and though hampered by mist at the summit, they reported a thrilling impression formed by the scene from the crater rim, where one looked into a glacier-filled bowl of vast proportions. Through a remarkable breach in the northern rim pours the Weyprecht Glacier in a series of wonderful icefalls to the sea some 7500 ft. below.

At least two of our party, with the mountain fever strong upon us after four days' imprisonment in a rolling sloop, were anxious to view and photograph this summit scene, as well as ascertain the actual size of the crater, and the writer had designs on a collection of volcanic rocks to supplement that made by Wordie from the upper parts of the mountain. Having camped at about 2600 ft. on the S.W. slopes,

Walter A. Wood (A.C.) and I made our way up vast névé slopes, in thick mist, to an altitude of 5300 ft. by aneroid. A circuitous route amongst large crevasses followed, and at 6000 ft. a sudden and short-lived clearing of the atmosphere revealed an astonishing view of the glacier we had come up, and the barren lava fields beyond to the ocean. Ahead of us lay a wide snow couloir sweeping up to the ice-encrusted rim of the crater. It was apparent that this was the route of Wordie's party, and wishing to adopt his suggested alternative for the upper part, and in order to examine some rock outcrops *en route*, we struck across the couloir to its northern confining buttress, which gave a mostly steep ice-climb to the top. We looked over the edge into a mist-filled abyss and longed in vain for a glimpse of the ice-filled crater, said to be half a mile in diameter. We climbed along the crater rim in a northerly direction over several ice-towers, and just as we were deciding to retreat, owing to driving hail, a startlingly close lightning flash and simultaneous peal of thunder drove us precipitately off the exposed summit. The ice being in good condition we were able to make good use of our crampons in a part run and glissade, by numerous short cuts, down to our camp, which we reached in 2 hours from the summit, compared with 7 hours for the ascent. Following through to the coast, and making a brief visit to the observation station of the Austrian Polar Year Party, we were on board the *Veslekari* by 11 P.M. Our last sight of Beerenberg next day was the view of this superb mountain clear from crater-rim to sea-girt base, its glacier draperies dazzlingly reflecting the golden Arctic sun.

The East Greenland pack-ice belt gave no trouble last summer, and we reached the historic headland, Hope-with-Hope (lat. 73°), by July 13. But land-fast ice hugged the entrance to Franz Josef Fjord, which was to be our route to operations along the border of the continental Ice-cap. Meanwhile we busied ourselves for 10 days in the coastal fringe of islands and the lower hill and tundra country around Mackenzie Bay, although by dint of a lengthy trek I managed to reach the Giesecke Mountains, and ascend a great flat-topped summit called Breidhausen of not more than 3000 ft. Herds of musk-oxen were seen, and numerous arctic hare, but no hungry polar bear that might have warranted the additional item of a gun amongst one's equipment. This included a load of specimens, during a hard 16 hours' trek : one soon learnt to dispense with modern weapons, and to rely solely in case of eventualities on one's trusty ice axe or geological hammer !

By July 23 the ice in Franz Josef Fjord had eased, and we commenced our voyage up this great and spectacular water-way, which runs 100 miles inland to glaciers descending directly from the Ice-cap. After some geological work on the western side of Ymer Island we crossed to Andrée Land, in order to examine the neighbourhood of the remarkable mountain named by the Austro-German Expedition in 1870 'Teufelsschloss' (or 'Devil's Castle'). This rises abruptly from the fjord to a height of about 4300 ft., and its precipices are of stratiform quartzites and shales of most varied and intensest hues. It must have been the subject of admiration, and perchance of challenge, to everyone who has passed by, and certainly not the least so to us. Its impregnable walls on all sides seemed to offer little hope of an ascent, except by the stiffest of climbs. However, from an anchorage in a little bay on its north-western side, it could be seen that the upper crags threw down great slopes of scree which would effectively reduce the length of severer ascent.

Wood and I left the shore at an unusual hour for such a task, at 4 P.M. Such, however, are the advantages of these northern latitudes that one cannot be benighted, and on many occasions summits were visited within the midnight hours. Some 1500 ft. of screes were surmounted in 40 minutes, and another 1500 ft. of scrambling up rotten rock brought us to the foot of a vertical wall of yellow quartzite. Cracks and chimneys were soon espied, and not more than 400 ft. of excellent climbing gave out on to the scree-covered S.W. shoulder of the mountain. There, to our surprise and almost disgust, we saw that at this corner (S.S.W.) an ascent could be made by easy steps and scree-runs almost to the plateau-like summit. The highest point on the S.E. side of the latter was reached at 7.45 and, finding no signs of a previous ascent, we duly recorded the occasion by a cairn and completed the record by inserting a grape-juice bottle therein. A more astounding view of vividly coloured peaks around and of the deep blue ice-flecked fjord far below, it would be hard to imagine, but as on all these occasions the business of topographical and geological survey in hand kept us more than occupied during the full hour spent on the summit. By means of the easier slopes spotted on the ascent we made all speed downward, and reached the shore within 6 hours of our departure therefrom. The *Veslekari* was all excitement to be off in answer to a wireless call for help from the Norwegian Government ship ashore in a fjord some 100 miles to the southward. All that night we proceeded

at about 9 knots, which was well in excess of our normal full speed, only to hear by morning that the stranded vessel had meanwhile been refloated.

Our next objective was Ice Fjord, whose narrow winding cañon is notorious for its icebergs. However, last summer was so favourable in this respect that we had no difficulty in steaming to its head. Here one was pent in by steep mountain walls and the great ice-fronts of the Jätte and De Geer Glaciers, which descend from the Inland Ice-cap. These are wont to 'calve' immense bergs from time to time, setting up veritable 'tidal' waves, and covering the fjord with ice-blocks of all sizes. No footing on these dangerously active ice-fronts could be obtained, and our only access into the mountains was by the one steep valley whose glacier did not reach the fjord. A geological reconnaissance was made into these previously unexplored mountains, and from a camp at about 3700 ft., in the course of two hard days, a good many summits of between 7000 and 8000 ft. were explored and roughly mapped. Looking southward from one of these we could see Petermann Peak, the highest of the region (9650 ft.), the first ascent of which was made by Wordie's Cambridge party in 1929.[6] But in this view of even greater interest were, apparently, Wordie's 'Mystery Lakes,' lying in ice-free country between us and Petermann Peak, and beyond a great bend of the Jätte Glacier.

Our immediate interest now lay in the unexplored country between Petermann Peak and the Jätte Glacier, a complicated tract of mountain nunataks and glaciers bordering the Inland Ice-cap. Access to this seemed more promising from the head of the main Franz Josef Fjord than Ice Fjord, and August 5 saw us making our way up to the former *viâ* what must be one of the most impressively spectacular passages in the world. At one point the great cliffs of Ättestupan fall 5900 ft. sheer into the fjord, and glaciers plunge down to the water's edge from nearly similar elevations. Into the head of the Franz Josef Fjord flows the great Nordenskiöld Glacier, which, as is usual with these active arctic ice-streams, contributes its quota of bergs and ice-débris to the waters of the fjord, and some seasons makes it impossible to approach within 4 or 5 miles of the ice-front. In this respect conditions were favourable last summer, for we were able to make a landing on the N. side of the fjord, at a point which often is

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[6] *A.J.* **42,** 241–52, with map.

quite impossible of access, and within 2 miles of the Nordenskiöld front. A not too promising opening in the abrupt mountain barrier suggested a possible way into the district of the 'Mystery Lakes.' An exciting preliminary reconnaissance showed that this was the case, and during a long day's trek from the fjord two of us reached the snout of Wordie's Gregory Glacier, from which we could view the 'Mystery Lakes' at close quarters. A chain of camps was established and a survey of the district by photo-theodolite accomplished. The lakes themselves, if not mysterious, turned out to be of considerable interest. An upper one of about three-quarters of a mile in length drained into a lower one of larger size, which was pent up by the great lateral wall of the Jätte Glacier. Scattered around the lake-basin, but above the present surface of the lake, were huge blocks of ice, one of which was 50 ft. in height. Examination showed that the lake was none other than a 'Märjelen See,' which periodically increased or diminished in volume, according to the drainage facilities in the retaining ice-dam of the moving Jätte Glacier, and that during a higher stand of the lake-level bergs must have calved from the ice-cliff, now towering some 500 ft. above the water, and floated out to their present anomalous positions. During a first exploration of these lakes, my wife and I also made our way some miles up the great Jätte Glacier itself, in the direction of the Inland Ice-cap, but one's movements on this gigantic ice stream were much impeded by its pinnacled and crevassed surface. Important geological evidence was however obtained from its moraines, as well as from the great mountain faces of the Petermann Range, cut by the glacier and seen in section in its upper reaches.

Attention was now paid to the latter range, extending N. from Petermann Peak itself, as well as to the mountains S. of the Gregory Glacier. Several fine summits were ascended, either in company with my wife or with Walter Wood. Of these the chief were a fine Rothhorn-like peak of about 8700 ft., rising some 10 miles to the N. of Petermann Peak, and second or third only to it in altitude in the immediate neighbourhood; and Nathorst Peak (*ca.* 7800 ft.[7]), lying between the Gregory and Nordenskiöld Glaciers. The former gave in its upper parts over 2000 ft. of rock-climbing and scrambling on excellently firm quartzite, all with perfect inward dip, as well as a midnight view of unspeakably delicate tinting over

[7] Wordie's figure was 8480 ft., but this is much too high.

the Inland Ice-cap and mountain nunataks, from a remarkably sharp and isolated summit. This point seems to be identifiable with Wordie's Mt. 'Gog,' as seen from the Cambridge Peaks across the Nordenskiöld Glacier (see '*G.J.*' Sept. 1927, opp. p. 229).

Nathorst Peak yielded, besides important topographical and geological data, an expedition of great variety, and from our northern approach a successful issue seemed at first by no means assured. The northern face drops in great precipices to a very steep and broken glacier, and an extensive flanking movement to the S.W. was at once indicated. This led us up the Gregory Glacier almost to the foot of Petermann Peak, and thence north-eastward over a glacier pass and a number of subsidiary summits to a lofty saddle perched at 7000 ft. The latter lay between a remarkable yellowish granite feature, dubbed by us 'Orange Crest,' and Nathorst Peak itself. The final 600–700 ft. gave a climb that under worse snow conditions might have proved really hard, and from the summit it appeared that the eastern arête should probably give the easier final approach. But from whatever side the peak is attacked it will always be a worthy expedition. An hour of observations on the narrow crest with a chilly wind and temperature of 23° F. drove us precipitately down to the saddle, and wishing to avoid the long détour to the S.W., we decided on a direct descent of the steep northern face. Donning crampons we embarked on a hard ice couloir at a measured inclination of 40°–45°, which led us in one fell swoop of 1000 ft. to a steep cascading glacier, and thence through well-sealed crevasses to the main 'Nathorst Glacier,' whose junction with the Gregory Glacier, some 1200 ft. above our present point, we had crossed earlier in the day. From the top of the peak this precipitate descent, totalling 3100 ft. in 50 minutes, cut off, without doubt, many miles of détour, but the long return to our nearest camp in the Gregory Valley, heavily loaded as we were with rock specimens and instruments, seemed to eke out a sufficiently lengthy expedition of 19 hours.

An interesting geographical discovery hereabouts was the fact that the Gregory Glacier is in two parts, the upper portion, which swings past the foot of Petermann Peak, taking an abrupt turn to the S.E. out of its natural valley and flowing into the Nordenskiöld Glacier on the N. side of Nathorst Peak. The apparent lower continuation of the Gregory Glacier, towards the 'Mystery Lakes,' as seen by Wordie's party from the top of Petermann Peak, is in actuality another glacier

whose head-snows lie in a cirque some 5 or 6 miles N. of that peak.

Geological findings, moreover, were of considerable interest, not the least being that some of these mountains, which now rise several thousands of feet above the existing glaciers, carried 'erratic' material on their summits, a clear indication of the once enormously greater size and height of the Inland Ice-cap, which at an earlier age must have submerged them. Important evidence, too, was gleaned as to the structural history of these ancient mountains of 'Caledonian' and 'Hercynian' age, their mode of folding, and the granite intrusions within their predominant sedimentary quartzites.

Other expeditions in the neighbourhood, some of which had to be accomplished solo, if particularly strenuous and lengthy on account of concurrent topographical and geological work, yet afforded some of the most delightful days that it has been my lot to spend on the mountains, whether of higher or lower latitudes. A summer expedition in a good ice season on the coasts, such as last year, need have few troubles and little anxiety, provided the skipper knows his job and moves warily in these uncharted waters. One brief lapse and disaster may follow, as might have befallen the *Veslekari* when she ran aground at high spring tide on a delta at the head of Geolog Fjord. The position was retrieved, however, after failure with kedge anchors in the soft mud, by making fast to a handy ice-floe and towing ourselves off with our own winch. If this pretty operation had failed, we might have had to spend a dark and hungry winter in the Arctic, since other ships had long since left the coast.

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## Five Traverses in Dauphiné.

By B. R. GOODFELLOW.

(Read before the Alpine Club, April 10, 1934.)

WHEN Graham Brown asked me to join him in 1933, my plans for a prior fortnight of guideless climbing made it impossible for us to join forces before the middle of August. It was likely enough that by that time there would be little or nothing left on Mont Blanc in the conquest of which I might hope to take a share. The long overdue summer of fine weather that 1933 gave us, made this probability a certainty.