TWO VISITS TO THE ANDES OF SOUTHERN PATAGONIA

By ERIC SHIPTON

(1) Lago Argentino

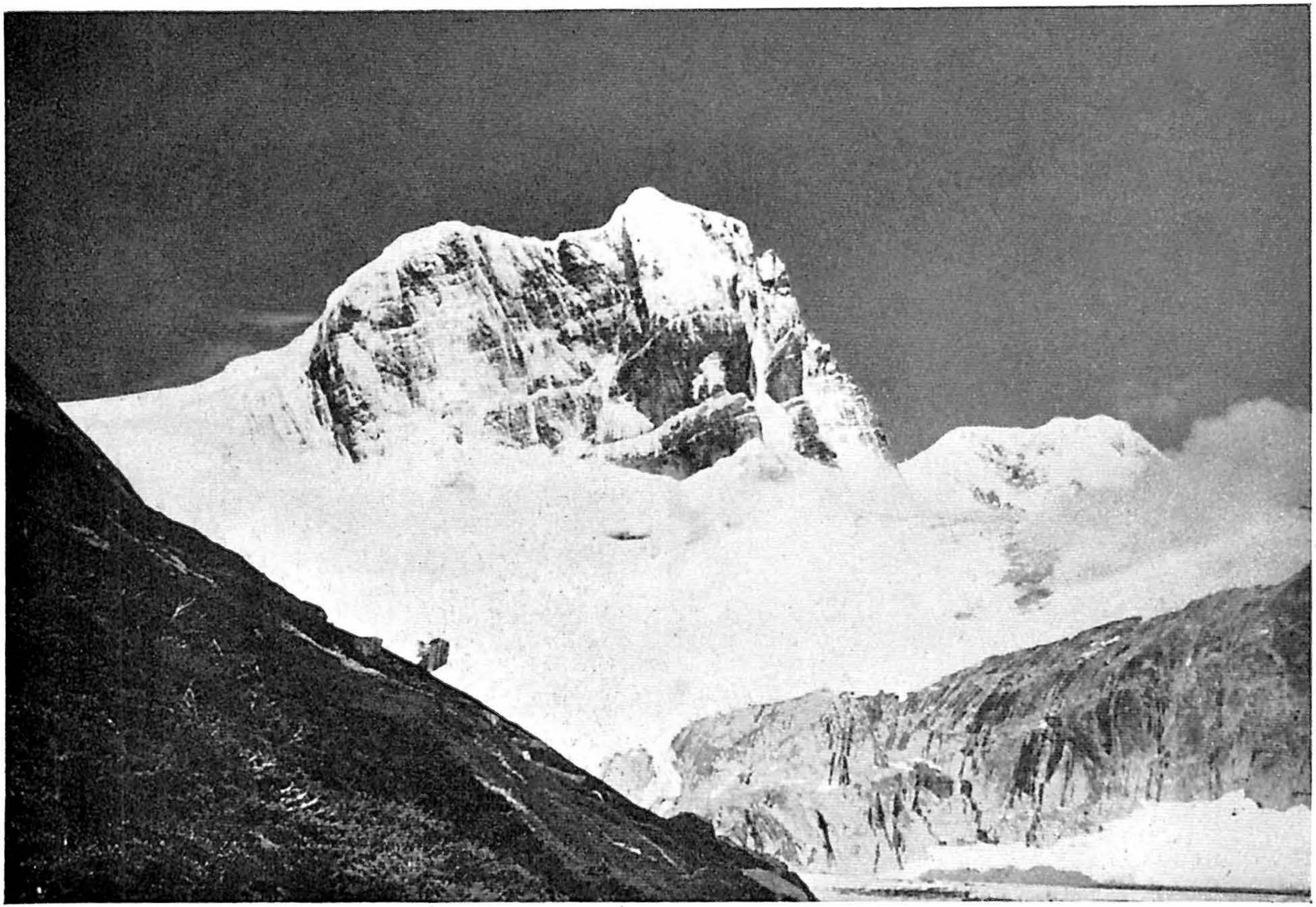
The objects of the small expedition which I took to Patagonia in the southern summer of 1958–9 were to make botanical and zoological collections and some glaciological observations in the country west of the great lakes. But my own motive for launching it was not, alas, scientific. It was to satisfy a desire, of many years' standing, to make the acquaintance of this strange region; an acquaintance which I hoped might in time ripen into terms of intimacy. For, like Tilman, I had long been intrigued by its remarkable geography, the labyrinth of fjords which split the Chilean coast, forming an archipelago a thousand miles long, and bite deep into the mainland; the curiously similar pattern of lakes on the opposite side; the innumerable glaciers which radiate from the central ice-caps and thrust their massive fronts into the intricate system of waterways surrounding them. That so much of the region remains unexplored is due almost entirely to its physical difficulties. Most parts of the main range even on the eastern side, can only be reached by amphibious operations which are liable to be rendered hazardous by the violent storms which prevail. The glaciers in their lower reaches are often so broken that it is impossible to travel on them; lateral moraines rarely offer an easy line of approach, and the forest, which covers all but the steepest slopes and extends to an altitude of about 3,000 ft., is usually dense, trackless and difficult to negotiate. Except on parts of the ice-caps where sledges could be used, back-packing is the only means of transport and no porters can be hired locally to help with this. But the chief problem is presented by the prolonged periods of rain, the rarity and brevity of spells of fine weather and, above all, the savage wind-storms which sometimes continue for weeks at a stretch, with gusts said to reach a velocity of 130 m.p.h.

I chose the section of the range embraced by the western arms of Lago Argentino for much the same reason that a beginner usually chooses one of the better-known centres for his first Alpine season. There is a government launch on Lago Argentino which greatly facilitates the approach to the high mountains, while the presence of the small shanty-town of El Calafate on the southern shore of the lake goes far towards solving the problem of supply. There were five of us in the

party. Geoff. Bratt shared with me the initiative and the organisation and undertook various glaciological tasks; John Mercer, who had been to the area twice before, was mainly concerned with a study of the forests bordering the glaciers, designed to determine the dates of successive glacial advances; Peter James of the British Museum filled twenty-five packing cases with four thousand specimens of plants and lichens; Peter Miles, who joined us in Argentina, made a collection of birds and insects, besides being largely responsible for getting us to our field of operations. We had no rigid plan, but we hoped by working from several successive bases at the heads of the various fjords, to cover as wide an area as possible in the three months we had allowed for the field work. We also hoped to visit the glaciers west of Lago Viedma.

We reached Lago Argentino early in December, and after spending a week or so in the lovely valley of La Cristina as guests of Mr. and Mrs. Masters, we went up the north-west arm of the lake. This is a wide fjord and the scenery surrounding it is most spectacular. Along the western shore, the forested slopes climb steeply to a magnificent array of ice peaks which stretch far away to the main ice-cap which forms the northern horizon. From this, the Upsala Glacier descends in a majestic sweep to meet the head of the fjord on a three-mile front. Bratt and Mercer spent a fortnight working on the Upsala and its lower tributaries, and then came to join Miles and me on Lago Onelli, which is separated from the main lake by a narrow strip of heavily forested land. Meanwhile we had established a dump of supplies at the western end of this lake. For this we used a small rubber boat, powered by a 'Seagull 40' outboard motor, which we had brought from England. Unfortunately, on the return voyage I steered too close to an iceberg and struck a submerged ledge of ice, with the result that the outboard was torn from the boat and sank to the bottom.

A few days later my ineptitude in this form of travel nearly caused a much more serious loss. The others were making their way along the shore of the lake while I took the equipment in the boat. There was one place where some vertical cliffs stopped them; so I landed at a point beyond these, unloaded the equipment on to some rocks a few feet above the water, and returned to fetch the others across in relays. While I was rowing Mercer around the impassable section, we heard an avalanche fall from a glacier across the lake, some two miles away. Five minutes later we reached the place where I had landed and found that a heavy swell was beating against the rocks and all but washing our precious equipment away. We had to stand well off the shore or the boat would have been ripped on submerged rocks now revealed by the backlash of the waves. At length the swell subsided and we were able to land and carry the loads to a safe place in the forest above. But we were lucky to escape the consequences of my carelessness, for when the



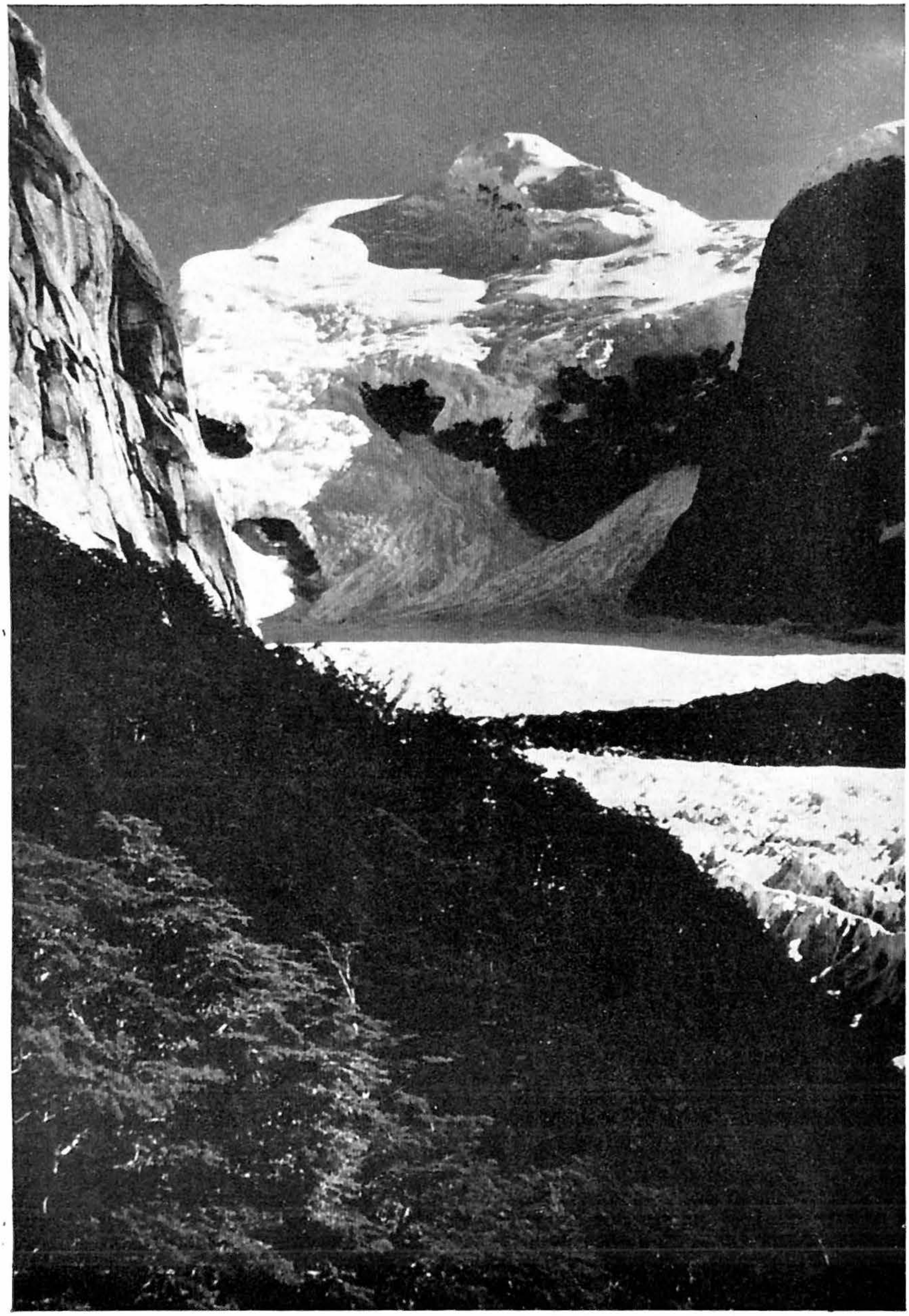
UNNAMED PEAK ON THE MAIN DIVIDE ABOVE SENO MAYO.

last man had been brought across, and while we were reloading the equipment into the boat, we heard a prolonged roar from across the lake and watched a long line of séracs collapse one after the other as though under an artillery bombardment, and crash into the water. We hastily unloaded the boat again and carried it and the kit well clear of the lake. Five minutes later the waves came, this time many times larger than before, and completely submerged the rocks where I had originally dumped the loads.

While Miles was collecting at the head of Lake Onelli, Bratt, Mercer and I set out to climb one of the main peaks above the head of the valley which we hoped would give us a view across the continental divide. Fortunately, we had a spell of fine weather. We made our way westward up a wide glacier flanked by tall *nothofagus* forest. One of the curiosities which never quite lost its strangeness for me was the sight of flocks of parrots flying over these glaciers, uttering the same raucous cries that hitherto I had associated only with tropical jungles. Another unlikely inhabitant of these forests, though less common, is the humming-bird. We left the glacier just before reaching its upper basin and climbed the steep forested slopes above. This was very strenuous work, particularly higher up where the twisted boughs and stems of dwarf *nothofagus*, far too tough to break, were closely intertwined, and it was 8 o'clock by the time we had reached the upper limit of the scrub and had found a suitable ledge on which to pass the night. According to our aneroid, the altitude was 2,800 ft., which seemed a paltry height to have reached after a long day's toil. But our bivouac commanded a wonderful view, and with three hours' daylight still in hand, we had ample leisure to enjoy the sunset colours spreading over a vast expanse of glacier, lake and sky.

We started at 7 o' clock the next morning, climbed up easy slopes for 1,400 ft., and at 8 o'clock we reached the first steep buttress of the ridge. Mercer had injured his arm a few days before and decided to turn back, while Bratt and I roped up and continued. For the next 2,000 ft. the ridge was steep and narrow, but though the rock was far from sound, it did not present much difficulty. To our left we looked into a great ice amphitheatre forming the head of the Onelli Glacier. In the centre of this there was a broad glacier saddle about 7,000 ft. high, which evidently lay on the main watershed. To our right was a sheer drop to a tributary glacier fed entirely by ice avalanches falling from the mountain. At a height of about 6,500 ft. our ridge ran out into a snow slope. Though not particularly steep its surface was most unstable. It was composed of balls of ice about the size of large glass marbles which slipped like scree beneath our feet and threatened to carry us down with it over the precipice below. At first, we could make nothing of it, but soon we found that we could cause the first few layers to avalanche and

74°
73°
72°
Miles
5 0 10 20 30
Heights in feet
R. Pascua
B. Norte Occidente
B. Norte Oriente
ARGENTINA
CHILE
B. Oeste
Co. O'Higgins 9097
L. O'Higgins
L. San Martin
Gl. O'Higgins
Cordon Gaea
B. Sur
49°
Co. Lautaro 11,090
Cordon Pio XI
Co. Piramide
Fiordo Maipú
Est. la Condor
Mt. FitzRoy 11,066
R. de la Viedma
Vulcan Viedma
R. Tunnel
Mariano Moreno
Lago Viedma
Gl. Upsala
Est. la Cristina
50°
L. Onelli
Lago Argentino
Seno Mayo
Pta. Bandera
El Calafate
L. Rico
L. Roca
Gl. Moreno
Fiordo Calvo
Brazo Sur
L. Frio
74°
73°
72°



HEAD OF THE MAYO GLACIER.

Martin. For sixteen days they were confined to their tents on the edge of the plateau by violent storms, and by the time these had abated their supplies were nearly exhausted. However, they pressed on westwards and reached a point near the main divide. Visibility was still bad, but when they were at about their farthest point it cleared for about a quarter of an hour and they saw, close at hand, a 'volcanic cone', some 3,000 m. high, from which clouds of steam were issuing. For some reason Reichert's discovery did not receive the recognition it deserved, and in the subsequent speculation about the existence and whereabouts of the volcano it seems to have been largely ignored. His route to the ice-cap had been followed twice, in 1957 and in 1958, by parties led by Hugo Corbela, but no fresh evidence had emerged.

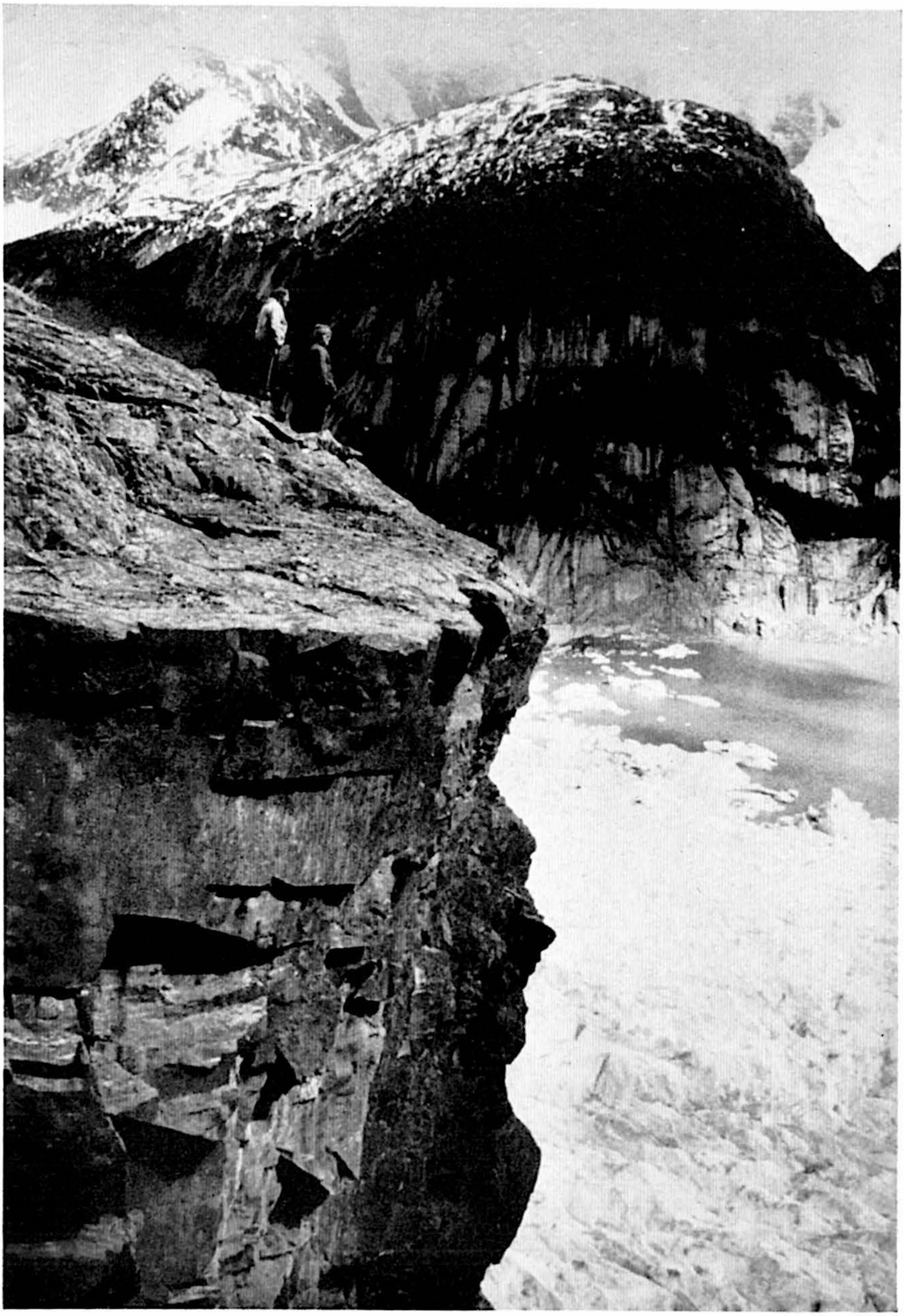
In 1944–5 the American Air Force made a series of survey flights over the range; examining the photographs taken on these, Professor Keller of the University of Chile and Dr. L. Lliboutry found what they thought to be an active vent on a large rock outcrop in the accumulation area of Viedma Glacier. In 1952 observations made by Lliboutry on another flight seemed to confirm this belief, and the outcrop came to be known as 'Vulcan Viedma'.

The first object of our journey to the Viedma area in January 1959 (mentioned above) was to reach this 'Vulcan Viedma' to obtain definite proof of the existence of the active vent. We made our way up the valley of the Rio Tunel and reached a pass at its head. From there the Viedma Glacier appears as a vast sheet of ice descending gently from the huge plateau of the 'Hielo Continental', of which it forms a kind of lobe. It penetrates the eastern rim of the plateau as an ice stream nearly ten miles wide, contracts rapidly and reaches Lago Viedma, twelve miles to the east with a front of two miles. The general altitude of the plateau is about 6,000 ft., but it is intersected by a number of ranges of which the Cordon Mariano Moreno, stretching some fifteen miles from north to south and containing peaks up to 11,600 ft. is one of the most prominent. We had no difficulty in identifying the 'Vulcan Viedma' lying close under the eastern flanks of this range. On our way across the ice we came to a place where pumice was scattered over a wide area. We reached our objective and stayed there for four days in appalling weather, which did not however prevent us from making a thorough investigation of the 'Vulcan'. We found that it was in fact an ordinary nunatak, $3\frac{1}{2}$ miles long and perhaps a mile wide, composed mostly of sedimentary and metamorphic rocks. Near the middle there was a large lake-basin partly enclosed by an ice barrier, which was obviously the 'crater' mentioned by Lliboutry. We found no evidence whatever of any volcanic or thermal activity, present, recent or ancient. Nor was there in the vicinity of the nunatak, any sign of the pumice we had found on the journey over, so that wherever this had come from it was not from there.

James and Miles. But we found it impossible to reach the glacier from there, so on the following day I ferried the rest of the party with equipment and two weeks' food over to the northern side, an operation rendered so complicated by a powerful westerly wind that it took us most of the day. The wind was extraordinarily warm, which caused very rapid melting of all the ice surfaces. These warm winds were invariably the harbingers of storm, and during the next few days the weather was very rough; indeed, during the four weeks that we were in the Seno Mayo there were only five days when it did not rain, and calm spells were rare. We were lucky enough to find a very large overhang under the northern precipice, and in this we made a comfortable base, completely protected from both wind and rain.

The barrier formed by the end of the Mayo Glacier, though less than two miles wide, was much more formidable than we had expected; everywhere the ice was broken into a chaotic labyrinth of sharp ridges and spires intersected by deep crevasses. We made two attempts to find a way across, but our progress was so slow that each was abandoned before we had reached the middle. I was laid up for two days with influenza after which, on one of our few fine days, Dickinson, Bratt and I climbed to a prominent spur running down from Cerro Mayo. From there we looked down a vertical precipice of some 2,000 ft. to the lake beyond the ice barrier. We had a clear view of the southern section of the basin and of a fairly low gap leading westward to the Pacific. Southward we saw to the head of the Mayo Glacier where a curious sheet of black moraine lay right across the upper basin. We took two sets of angles from the ends of a base, to determine the position of this moraine and the level of the inner lake. Recent shore lines extended some 200 ft. above the surface of the water.

The ground beyond the bluff looked so precipitous that we decided to attempt a high-level route into the upper valley basin only as a last resort. The following day Bratt and I made another attempt to cross the glacier. We kept close to the rock wall against which the glacier front was pressing. Sometimes we were able to use rock ledges, and at one place we made a valuable advance of 200 yds. by passing through a tunnel under the ice. At length we reached a narrow inlet from the lake beyond, which lay between a mass of impassable ice cliffs and a sheer rock wall. The only chance of making further progress was by using the boat. But the inlet was so closely packed with small icebergs that we were very doubtful whether we could force a way through. However, we decided to make the attempt and the next day we returned with Dickinson, carrying our food and equipment and the boat. It was less than 300 yds. to the opposite shore of the inlet, but it took us four hours of very hard work to get there. Our main worry was that the boat would be punctured on some jagged edge of ice as we heaved



2000 FT. CLIFF AT THE ENTRANCE OF THE UPPER BASIN OF THE SENO MAYO.

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the icebergs apart to make a channel, and chipped at submerged ledges with our ice-axes. It was late in the evening when we landed and just had time before dark to fill the boat with rocks to prevent it from being blown away by the wind and to scramble up into the shelter of the steep forest where we spent the night.

We had hoped to complete the journey to the head of the main valley mostly by boat, so as to avoid crossing the numerous steep ridges and cliffs along the shore. But the force of the wind and the roughness of the lake made this impossible, and we were obliged to make slow and very laborious progress by land. While in the forest, of course, we did not feel the wind, but the noise it made was most impressive: the individual gusts swept down the valley with a roar like that of a major ice avalanche. But on the night of February 10 there was a lull and the next morning dawned calm. We had already abandoned the idea of attempting to cross the gap to the Pacific, and we now decided to seize the opportunity of the calm spell to make a long march to the head of the main valley and back without our loads. The main reason for this decision was that there was one section of the route where the use of the boat was unavoidable. This was the neck of the big lagoon into which the glaciers on the northern side of the basin flowed. Even if it had been possible to cross these glaciers, which we could see it was not, the detour involved would have taken several days.

We rowed quickly along the shore and reached the mouth of the lagoon by 9 o'clock. But by that time the wind had started to blow again, so that I could not manage the boat with all three of us in it. Dickinson remained behind while Bratt and I went on together. We left the boat filled with rocks on the western shore of the lagoon and pressed on as fast as we could to the head of the valley. We found that here the vegetation was much more luxuriant and the trees much larger than any we had seen elsewhere; presumably this was because of the greater rainfall in the western part of the range. When we returned to the lagoon in the late afternoon the wind was blowing with great force and we had considerable difficulty in launching the boat. As soon as we removed the boulders holding it down, it was swept up like a kite dragging us along with it. Once on the water there was no need to row for we were swept over the waves like a leaf with no control over our direction. Violent gusts came alternately down the lagoon and down the main valley. Swirling spirals of spindrift warned us of their approach and as a rule we managed to turn the boat so that they hit us astern. One blast however caught us broadside on and we very nearly capsized. We narrowly escaped being swept into a bay packed with floating ice from which it would have been very difficult to extricate ourselves. There was a heavy swell beating against the eastern shore of the lagoon, and when we reached it we were hurled unceremoniously



CERRO NORTE STANDING AT THE HEAD OF THE VALLEY OF LA CRISTINA.

74° 72° 70° 68° 66°

L. Buenos Aires

Rio Deseado

Gulf of Penas

Puerto Deseado

L. San Martin

Rio Chico

San Julian

Mt. FitzRoy

L. Viedma

Hielo Continental

Santa Cruz

L. Argentino

Can. Conception

Hanover I.

Rio Gallegos

Strait of Magellan

Cape Virgins

Evangelists Is.

Cape Pilar

Punta Arenas

TIERRA DEL FUEGO

Miles

50 0 50 100

Glaciers and icefields

Cape Horn

76° 74° 72° 70° 68° 66°

48° 50° 52° 54° 56°

ARGENTINA

CHILE

PACIFIC OCEAN

ATLANTIC OCEAN

onto the rocks. Meanwhile Dickinson had found an alternative route back to our camp, which saved us many hours of toil and further aquatic adventures. Reluctant to repeat the passage of the ice-filled bay we decided to attempt a high-level route back. Fortunately during the critical phases of this the weather was calm. But on the last day the wind was as violent as ever, and we had to move roped together even on easy slopes. At one point Dickinson was blown over, and, in falling, injured his back. On the 14th we reached the Mayo base where we found James and Miles hard at work on their collections. James had reaped a rich harvest and was now approaching his total of four thousand specimens of lichens and flowering plants.

On the 15th Bratt and I set out to reach the head of the Mayo Glacier. Once again we plunged into the maze of séracs and ice ravines. It was exasperating work; hours of strenuous acrobatics resulted in little apparent advance, and it was impossible to choose a route for more than a few yards ahead. Fortunately the day was fairly calm, though this gave us cause to wonder what the return journey might be like in really bad conditions. It was late in the evening when at last we broke through to relatively smooth ice, and at 9.30, very tired, we reached an isolated patch of forest at the side of the glacier. For the next thirty-six hours it rained heavily and without stopping. The ground on which we had camped became the bed of a stream and our tent was flooded. Then, on the morning of the 17th, the weather suddenly cleared completely and for the next three days there was not a breath of wind and scarcely a cloud in the sky. First we went up to the head of the glacier to examine the strange transverse moraine we had seen there. We concluded that it had been formed by a colossal landslide from one of the neighbouring mountains. Then we discovered an easy pass to the head of the Ameghino Glacier, and climbed to the summit of a small peak above it, where for three hours we sat and gazed at a magnificent panorama of nameless mountains. . . .

(2) The Elusive Volcano

Since the discovery of the great lakes of Southern Patagonia there have been many reports of volcanic activity somewhere in the vicinity of the southern of the two main ice-caps. For example, nearly fifty years ago some travellers have described showers of volcanic ash falling near the western end of Lake Viedma; deposits of volcanic *ejecta* had been observed on the Glacier O'Higgins, the Glacier Chico and elsewhere in that area; according to de Agostini and others, settlers near the shores of Lago San Martin had talked of seeing on several occasions great columns of smoke rising from the ice-cap to the west.

In 1933 a party led by Dr. Reichert reached the ice-cap by ascending the O'Higgins Glacier from the south-western branch of Lago San

Martin. For sixteen days they were confined to their tents on the edge of the plateau by violent storms, and by the time these had abated their supplies were nearly exhausted. However, they pressed on westwards and reached a point near the main divide. Visibility was still bad, but when they were at about their farthest point it cleared for about a quarter of an hour and they saw, close at hand, a 'volcanic cone', some 3,000 m. high, from which clouds of steam were issuing. For some reason Reichert's discovery did not receive the recognition it deserved, and in the subsequent speculation about the existence and whereabouts of the volcano it seems to have been largely ignored. His route to the ice-cap had been followed twice, in 1957 and in 1958, by parties led by Hugo Corbela, but no fresh evidence had emerged.

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I found the problem of the elusive volcano very intriguing, and I decided to return the following season to try to locate it. Meanwhile I visited Dr. Lliboutry in Grenoble to discuss the matter with him. From a study of the available evidence he was inclined to believe that the vent was in the nature of a fissure volcano which erupted periodically and was covered by snow and ice during its intervening periods of quiescence. He suggested that its probable location might be about lat. 48° 50′ S., long. 73° 40′ W., and somewhere in the middle of the unexplored northern part of the ice-cap. My original plan, therefore, was to investigate this area, attempting to reach it from the head of the Brazo Oeste of Lago San Martin. No one had penetrated to the ice-cap from this direction, but several valleys drain into this fjord from the west and I hoped that at least one of them would afford access to the plateau. A good deal of time and effort would no doubt be needed to find a way, but as the main obstacle to the exploration of any part of the ice-cap is the violent wind that prevails, this route would have the advantage of involving the shortest distance to be travelled on the plateau, exposed to its full force. It is not possible to reach the Brazo Oeste overland, and it appeared that the only boat available on Lago San Martin was extremely unreliable. However I was fortunate enough to obtain from the War Office the loan of a large inflatable boat, a replica of that used by Dr. Bombard for his voyage across the Atlantic, manufactured by R.F.D. Co. Ltd. Also the Seagull Company very kindly lent us two 4-horsepower outboard motors.

I invited Peter Miles to accompany me again. Though not a mountaineer, I had found that he was a very useful man to have on an expedition of this kind, and I hoped that besides helping with the carrying of loads to the ice-cap, he would be able to continue the zoological work he had done during the previous season. He had recently got married and I agreed to his request that his wife, Martha, should accompany him. I also invited W. Ellery Anderson to come with me, and he helped me to collect the necessary equipment in England and to arrange for its transport to Buenos Aires. Jack Ewer, of the University of Chile and Peter Bruchhausen of the Antarctic Institute of Argentina completed the party, which assembled in Buenos Aires in the middle of December 1959. We travelled from there to Comodoro Rivadavia in a tanker, arriving at that port on the 26th.

Once again the Shell Company of Argentina gave us generous and invaluable help which solved our difficult problem of reaching Lago San Martin. Mr. de Wit, the Company's Manager in Comodoro Rivadavia, entertained us there and provided us with three vehicles for the onward journey of some 600 miles. We started this at 6.30 a.m. on the 27th and, driving by way of San Julian and Tres Lagos, reached the shore of the Maipu Fjord of Lago San Martin, at 3 p.m. on the 29th. The last

forty miles of the journey was over an extremely rough track. At the end of this, there was a small estancia, 'El Condor', whose owner Senor Fernandes, received us with the same open-handed hospitality that one finds everywhere in Patagonia.

Before leaving Santiago, Ewer, with the co-operation of the Instituto Geographico Militar, had made an exhaustive study of the air photographs of the ice-cap taken by the American Air Force. He had found among them two pictures which had evidently escaped the notice of Professor Keller and Dr. Lliboutry, for they showed definite evidence of volcanic activity near the summit of the highest peak of a range named by de Agostini 'Cordon Pio XI'. This peak, which was called 'Lautaro' by Lliboutry, lies almost in the centre of the ice-cap just south of the 49th Parallel, a position corresponding much more closely to the 'volcanic cone' seen by Reichert's party. In view of Ewer's discovery I had decided to approach the ice-cap from the Brazo Sur, following Reichert's route. This change of plan altered the whole character of our task, for instead of finding a new route on to the ice-cap and searching over a wide area of its untrodden northern part, we would be approaching by ways already traversed and aiming at a definite objective.

Unlike the Brazo Oeste, the Brazo Sur is accessible overland, so that our boat was no longer essential. However as, after a long series of storms, the weather had improved, and our hosts predicted a few calm days, and as sufficient pack animals were not available, we decided that Anderson, Bruchhausen and I should attempt the fifty-mile voyage taking with us the bulk of our baggage, while the others went overland. Having spent the 30th sorting and repacking our stores and equipment and in assembling and testing the boat and engines, we left 'El Condor' on the morning of the 31st. The day was clear and still, and in this we were very lucky, for such weather is exceedingly rare in that part of the world. Instead of the long, cold struggle against powerful head-winds and drenching spray that we had anticipated, we found ourselves gliding over smooth water under a warm sun. In three hours we had cleared the network of narrow channels at the exit of the Maipu Fjord and entered the main lake. Gradually the panorama of ice mountains opened to the westward, clear except for some small white clouds that clung to the higher peaks. At about 4 o'clock we rounded a headland to the south-west and were confronted by a magnificent view of the O'Higgins Glacier sweeping up from its broad front of calving ice cliffs to its source in the Hielo Continental. Far away in the background we saw a mountain, which from its direction and distance we identified as Lautaro. It also had its white cloud, which at first appeared similar to the others; but watching it carefully we noticed that, instead of floating idly about the summit, it was in a state of some agitation and several times before we lost sight of it, mounted swiftly to form a great

mushroom-topped column. Could it be that our volcano had chosen this season to resume its activity ?

There are two small farms at the narrow entrance to the Brazo Sur, and the arrival that evening of our tiny craft caused something of a sensation. The settlers in this remote corner of Patagonia came there from Puerto Natales on the coast of southern Chile nearly fifty years ago, making the long track to their unknown destination by way of Calafate and Tres Lagos. They were obviously delighted to have visitors and received us with great kindness. A long ridge, well forested to a height of 3,300 ft., separates the valley of the O'Higgins Glacier from that of the Brazo Sur; with the aid of pack ponies hired from one of the farms we carried our baggage across this, and when the others arrived on January 4 we went up again to camp on a shelf overlooking the glacier, about five miles above its front. We had with us enough supplies to last us for about eight weeks. From here Anderson left us and returned overland to 'El Condor'.

The O'Higgins Glacier is one of the largest flowing from the ice-cap. Opposite the site of our first camp, it is about $2\frac{1}{2}$ miles wide. But it is in a state of rapid decline. It now flows through a moraine trench (the top of which forms the shelf on which we had our first camp), between 800 and 1,000 ft. deep. The sides of this trench are completely devoid of vegetation, which shows that they have not long been exposed. One of the original settlers, who accompanied us to our first camp, told us that when he first came there in 1914 the surface of the glacier was almost level with the shelf. If this is true it means that the surface of the ice has sunk at least 700 ft. in the last fifty years. Mrs. von Rensell Atkinson, who accompanied Dr. Reichert in 1933, has told me that then the descent from the ledge to the glacier was not more than 60 m., say 200 ft. This suggests that the shrinkage has been far more rapid during the last twenty-seven years, than during the previous twenty. Since 1933 the front of the glacier has retreated nearly five miles. No other glacier that I have seen in Patagonia (or elsewhere for that matter) shows anything like this rate of decline. This exceptional shrinkage of the O'Higgins Glacier is as difficult to explain as the fact that the Moreno Glacier has evidently not diminished appreciably during the last two hundred years, while its neighbours have suffered a considerable net recession over the same period. Lliboutry suggests that this latter phenomenon might be explained by the shape of Moreno's basin which allows the unrestricted passage of the ice from the upper to the lower parts of the glacier. He admits that this explanation should also apply to the condition of the Viedma Glacier, whose basin is quite as open, but which has retreated considerably. He suggests, however, that this apparent anomaly might be accounted for by the melting of the ice by thermal activity centred around his 'Vulcan Viedma'. The evidence for the existence of such

activity has now been refuted, but the suggestion might be worth considering as an explanation of the phenomenal recession of the O'Higgins Glacier, though this would presumably imply that the present phase of volcanic activity centred around 'Lautaro' began not much more than fifty years ago.

From our first camp onwards we had to carry everything ourselves. We aimed at getting enough supplies to the ice-cap to last us for a month; and this, together with our equipment, necessitated three relays between each succeeding camp. First, we had to descend 800 ft. from the shelf into a curious bay of 'dead' ice formed by a gap through which, a few decades ago, a portion of the O'Higgins Glacier had flowed to join a tributary of the Chico Glacier. This minor ice-stream is now making a vigorous thrust over the 'dead' ice to form instead a tributary of the O'Higgins Glacier. Beyond our second camp, on the other side of the bay, we were able to follow along the edge of the glacier for a mile or so, until we reached the entrance of a side-valley. Formerly this had been occupied by a small tributary glacier flowing off the Gaya Range, but we found that its place had been taken by a lake. With a good deal of difficulty we found a way round this obstacle, through a labyrinth of séracs and narrow ice ridges. It was in this section that the rapid degeneration of the glacier was most in evidence. Day by day changes were noticeable, new crevasses opening, ridges and pinnacles disintegrating and after a fortnight it became obvious that a large part of the ice over which our original route lay was about to collapse into the lake.

On January 14 we reached the site of our third camp in the upper basin of the O'Higgins Glacier, and from there, on the 15th, we were able to reconnoitre forward to the edge of the ice-cap. Returning from this task I fell into a hidden crevasse and dislocated my shoulder. Fortunately, while Bruchhausen was holding me on the rope, Ewer was able to reach down, grasp my arm and pull the joint back into place, after which I was able to help my companions to extricate me. I rested for three days while the others continued the work of relaying loads. Since leaving our first camp we had been working continuously regardless of the weather, which for the most part was bad. Wind and soaking rain were our daily portion, but while on the glacier we were sheltered from the full force of the westerly gales, which we could see blowing over the ice-cap, and though conditions were often unpleasant, they were not bad enough to stop us.

On the 19th we carried the last relay of loads to the edge of the ice-cap, where we established our fourth camp on a comfortable ledge on a large rock outcrop. It commanded a superb view, and as by a lucky chance the weather had cleared, we enjoyed that evening the first fruits of our toil. Northward across the wide basin of the O'Higgins Glacier, the massive range of Cerro O'Higgins was delicately coloured in the golden

twilight, looking with its remote summits, its armoury of hanging glaciers, as impressive as any Himalayan giant. To the north-west a vast sweep of level ice stretched away to some unexplored ranges, and to a gently curved saddle, rimmed with a line of deep blue which gave us the impression that we were looking over to the Pacific. But, for us, the most exciting sector of the view was to the west, where the 'Cordon Pio XI' rose steeply above the plateau to a long line of peaks, silhouetted against a gaudy sunset sky. About 300 ft. below the summit of the highest of them ('Lautaro') the ice slope on the northern side was gashed by a black fissure, from which there flowed a steady stream of vapour, mounting vertically for several hundred feet, then to be carried away by a southerly air-current.

The next day we set off on skis westward across the plateau to lay a dump of three weeks' supplies. Soon after we had started we saw an eruption of ash from the volcano which blackened the snow over a large area of the mountain side. The weather held and we made excellent progress, reaching a point more than half-way across the plateau to the foot of the volcano, where we laid the dump; but we were all very tired when we arrived back at camp late in the evening. The following morning was again clear, though there were distinct signs that the fine spell was about to end. I was most anxious that we should carry our camp forward to the dump without delay, because I was afraid that a heavy fall of snow or drift might bury the dump, and although we had done our best to fix its position by compass bearings, it would, in any case, be very difficult to find it in thick weather. Also we had left ourselves rather short of food at our present camp. However, though we prepared for an early start, it was obvious that most of the party were badly in need of a rest, particularly Bruchhausen who had lately developed a bad foot, which was becoming increasingly painful. So I decided to take a chance on the weather and give the party its first off-day.

That night the weather broke and for the next four days the violence of the wind and driving sleet made it impossible to venture out onto the plateau. On the fifth day the storm abated somewhat, and we struck camp and set off in the afternoon, hoping to reach the dump by nightfall. But Bruchhausen found that, despite the enforced rest, his foot was worse; skiing caused him such acute pain that it was soon clear that it was useless for him to attempt to come any further. Reluctantly we decided that the wisest course was to send him back, so, that evening, Ewer and I started to escort him down the glacier. We accompanied him as far as our first camp in the forest, where there was plenty of food, and from there he made his way slowly back to the settlement on the Brazo Sur. His departure was very sad both for us and for him, particularly as he had taken his full share of the toil of the past few weeks. It was a bad blow to our prospects on the ice-cap, for the mountaineering

strength of the party, already depleted, was now seriously weakened. It had never been intended that Peter and Martha Miles should play a major part in the work on the ice-cap; indeed it was only the radical change of plan made at the outset, and their keen desire to get there which led to their taking a full share in the work of reaching it, a task they bore with admirable fortitude. But they were not mountaineers, and though this fact made their performance still more remarkable, it now meant that our plans would have to be curtailed.

After some forced marches, Ewer and I rejoined them at the fourth camp and were just in time to take advantage of another brief spell of clear weather. In this we made our way across the plateau to a nunatak at the foot of the volcano where, with supplies relayed forward from the dump, we established a well-stocked base, about half-way between Lago San Martin and the Eyre Fjord on the Pacific coast. For the next fortnight the weather was very bad; heavy rain, some snow-storms and incessant wind, with occasional gusts of extreme violence. In one of these, two pairs of skis were blown away and not seen again. The Camp was protected by a rock cliff from the full force of the wind, though this had the minor disadvantage that when it snowed the tents were buried in drift. One night a pond, two feet deep, formed on the hollow platform occupied by the Miles's tent. Nothing could be done to drain it, so they brought their sodden sleeping bags into our tent (designed for two), where we remained tightly packed until, thirty-six hours later, a lull in the weather enabled us to extricate their flooded tent and construct another platform for it. But three nights later they were in trouble again. A violent gust from an unexpected quarter tore their tent from its moorings, snapped most of the guy ropes and broke one of its poles. Once again they were forced to accept our meagre hospitality for two nights until the damage could be repaired. Meanwhile we were experiencing trouble with our two pressure stoves. The fuel pipes became blocked, partly by volcanic ash and partly by lead in the petrol, and because of a faulty design in the stoves, we could not free them. At length they ceased to function altogether, and thereafter we had to subsist on uncooked food and cold drinks. Fortunately we did not have to rely upon melting snow for water, for there was an ample supply of this on the nunatak.

Besides the short ski tours which we did in the vicinity of the volcano, we had hoped to make a longer journey from our nunatak base into the unexplored northern part of the ice-cap. But it seemed that in the circumstances such an expedition would be beyond our capacity, and I decided to limit our objective to making a collection of rocks from such outcrops on the mountain as we could reach. In this we were helped by one brief spell of fine weather.

Despite a few minor mishaps, our journey back was uneventful and

increasingly pleasant, and we reached El Condor (again by boat) towards the end of February. From there we went on to the coast where I parted from my companions, who were homeward bound, and went on to renew my acquaintance with the glaciers of Lago Argentino.

The achievements of the expedition had fallen somewhat short of my hopes. True, we had established beyond all doubt the existence and position of the mysterious volcano, thanks largely to the timely circumstance of its renewed activity; and we had collected enough material to learn something of its structure. But with less miscalculation and a little more luck, we should have made much better use of a month's supplies carried to the ice-cap with so much toil. There is still a great deal to discover about this strange region and there is much to learn about the peculiar problems of travel that it presents. It is one of the most fascinating regions I know, though it certainly demands of its votaries some measure of stoicism.