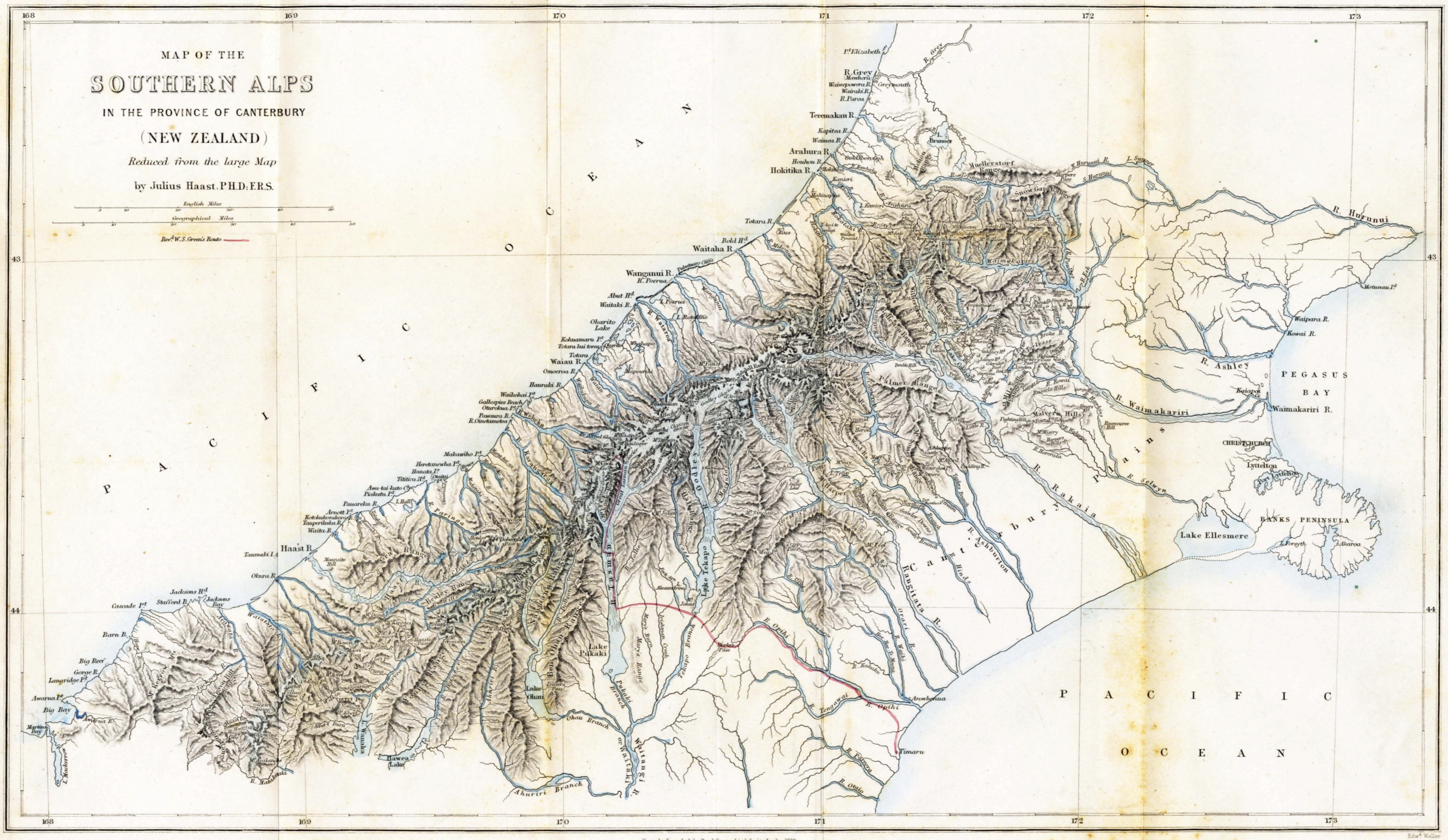

MAP OF THE

SOUTHERN ALPS

IN THE PROVINCE OF CANTERBURY

(NEW ZEALAND)

Reduced from the large Map

by Julius Haast, PH.D. F.R.S.

English Miles

Geographical Miles

Revd W. S. Green's Route

From the Journal of the Royal Geographical Society, London 1870.

Edwd Weller

THE

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A Journey into the Glacier Regions of New Zealand, with an Ascent of Mount Cook by the Rev. W. S. Green.*

THE whole of New Zealand consists of a line of upheaved stratified rocks, modified in the northern portion by recent volcanic activity, and in one or two other places showing traces of more ancient vulcanicity. The axis of elevation runs from S.W. to N.E., and is cut across into the North Island, South Island, and Stewart's Island, by Cook's and Foveaux Straits. In the South Island the mountains attain to their greatest elevation, and for over 100 miles the Southern Alps, as they were named by Captain Cook, raise their peaks far above the snow line; in no place, for the whole of that distance, descending to a col or pass free from eternal snow and ice.

Immense glaciers fill the valleys, and the remains of still more gigantic glaciers are everywhere to be met with. This chain, with its continuation north and south, seems to have been upheaved in Jurassic times, and though it has experienced many vicissitudes of upheaval and depression, it has never since, according to Professor Hutton, been submerged. These mountains are, then, of vastly greater antiquity than their European rivals, and their long exposure to the frosts and storms of ages is abundantly evidenced by the heaps of loose splintered stones to which all except the higher peaks have been reduced.

The mountains lie close to the west coast, their western flanks possess a humid climate (the rain-fall at Hokitika being

* The portion of Mr. Green's narrative published in the present number was read before the Royal Irish Academy on June 26. In following numbers Mr. Green will give a detailed account of his attacks on and successful ascent of Mount Cook, the highest summit of the Southern Alps.

measured at 118 inches) and are clothed with forest and impenetrable scrub. The western glaciers in some places extend to within 705 feet of the sea, and the rivers are short and swift. This low descent of the glaciers, and the mean line of perpetual snow being at about 5,000 feet compared with 8,000 in Switzerland, where also no glacier descends to within 4,000 feet of the sea, is particularly instructive when we consider that these Southern Alps are at about the same distance from the Equator as the Pyrenees and the city of Florence. To the east of the mountains the land drops suddenly to a level of about 2,000 feet above the sea, and then, by gentle slopes and immense flat bare plains, sinks gradually to the coast. The continuity of the plains is broken by ridges of low rounded hills, which, on close examination, often prove to be old moraine accumulations; while many of the plains are the basins of ancient lakes, the old shores being very sharply defined. In the southern and northern portions of the South Island this arrangement of mountain and plain is considerably modified by the splitting up and bifurcation of the main axis of elevation, but flat plains, extending to the very foot of the highest peaks of the main chain, are most characteristic of New Zealand, and distinguish it from other mountainous countries, where ranges of foot-hills have to be ascended and upland valleys traversed before the higher ranges can be reached. In the province of Canterbury, where the mountains attain their greatest height in Mount Cook, or Ao-Rangi as it is called in the Maori tongue, these features are most distinctly observable; the Canterbury plains, followed by the Mackenzie plains, extending up to the very ice, and so flat that Dr. Haast said he would undertake to drive a buggy the whole way from Christ Church to the foot of the Tasman glacier. We tried it with an express waggon and three horses, and nearly accomplished it. The country was level enough, but the boulders, as we drew near to the glacier, proved a little too much for a wheeled vehicle, and the waggon ended its days by being capsized in the Tasman river.

These New Zealand rivers have been a source of much difficulty to colonial development. They are so swift and erratic in their courses that fords are dangerous and bridges difficult to construct. Once the rivers leave the mountains there is nothing to keep them to one channel, as the plains, being composed of loose boulders and sand, are easily eaten away by the swift streams swelled in summer by the melting snow. A river-bed is therefore a broad sheet of gravel, through which a number of small streams wander, and change day by day,

what was a main channel one day being quite a secondary stream in the lapse of a week or so. Much time was often spent in crossing one river, with the delays of searching for fords, &c.; but now that railways run north and south the problem has been solved on the most important route by bridges, some nearly a mile in length.

In the province of Otago rich woods extend right across the island to the east coast, giving place in many districts, however, to immense plains covered with tussock-grass and Spaniard or sword-grass, except where the farmer has come and adorned the landscape with waving fields of wheat. Farther north the great snowy chain seems to form a complete barrier to the moisture and vegetation of the west; the plains, hills, and valleys, are all bare, as if shaven, the short grass being of the one uniform brownish yellow hue. Clumps of flax (*Phormium tenax*) and isolated cabbage trees (*Cordyline australis*) make the desolation appear more desolate. The rainfall is but 25 inches; the air is clear, bright, and exhilarating; and when we do penetrate into the furthest recesses of the mountains, to the very brink of the glaciers, we at last come to a rank vegetation, brought into existence by the rains condensed by the cold ice-peaks.

Acclimatisation has produced wonderful results in New Zealand. On the great grassy plains where the moa once stalked majestically, the skylark is now the commonest of birds, the sparrow threatens to become a plague as the rabbit has done, and English weeds seem determined to establish themselves and attain to a fertility unexampled at home. Clouds of thistle-down fill the air, and sorrel usurps the ground prepared for oats and wheat. Among other interesting points brought out by this invasion of the vegetable kingdom, one at least is worthy of special notice, the failure of red clover, while white clover thrives amazingly. In the neighbouring island of Tasmania red clover grows well, and it is now believed that till the humble bee is introduced to fertilise the flowers, red clover will not propagate itself in New Zealand.

On the 12th of last November I sailed from Plymouth for Melbourne in the Orient steamer 'Garonne,' having arranged with Ulrich Kaufmann and Emil Boss, both of Grindelwald, to follow me in the next ship. Unfortunately, small-pox broke out in my ship, and between a delay at the Cape, and quarantine at Melbourne, I was not able to reach New Zealand and join my men till February 5. Immediately on landing I received a kind telegram from Dr. Hector, and a letter from the Minister for Railways, inclosing free passes on

the New Zealand railways for myself and guides during our stay in the colony. I lost no time in reaching Christ Church, where I spent an afternoon in Dr. Haast's company, he being the great authority on the Southern Alps; and next morning he started in the train for the south. On arriving at Timaru we had a delay of three hours before the train left by a branch line for Albury, and we occupied the time in purchasing provisions for our mountain journey. As we were assured that we could get sheep right up to the snows of Mount Cook, we took with us but a small supply of meat in tins. Flour, meal, bread, and biscuits, formed the bulk of our stores. On reaching Albury by rail we hired a waggon and horses, and on the evening of the next day we got our first view of the great snowy range. The contrast between the brown flattened downs over which we drove, and the purple ice-seamed peaks, was most striking. Next morning we were up betimes, as we did not know how long our journey might be, and our driver was unacquainted with the country beyond this point. Our road soon lost itself in the rolling downs, so we walked on in advance, pioneering the way; and thus before midday we reached the last swell overlooking the Tasman river. We had now to descend about 200 feet, and again came upon the track leading up the river-bed. This river-bed of the Tasman, over two miles wide, is a broad sheet of coarse gravel, through which the river meanders in countless channels, between which are often most dangerous quicksands. We drove along over marshy flats on which numerous seagulls had their nests (one of these young seagulls we afterwards met high up on the glacier, winging its flight over the snowy range to the west coast), then across river channels and over wide tracts of gravel. Right before us, rising abruptly from the river-bed in the point where the valley forked, was the great mass of Mount Cook, its icy peak glittering like a pinnacle of frosted silver against the deep blue sky. On either side the mountains rose from the flat valley with the same abruptness, and the terminal face of the Hooker and Tasman glaciers closed in the end of the two branches into which the valley divided to the right and left of Mount Cook. This flat river-bed, with the mountains rising from it abruptly, and from margins as sharply defined as the shores of a lake, is so typical of all the mountain valleys we saw, that we may ask—'What is the cause of a feature so distinctive?' I believe the low level to which the glaciers descend, and the consequent short incline of the rivers, is a sufficient cause. The terminal face of the Tasman glacier is, according to Dr. Haast, only 2,456 feet above the

sea, while the means of four observations, taken on as many days by myself, make it 100 feet lower, and its river descends to the sea level by a fairly uniform incline of about 25 feet to the mile. If the river had a greater depth to descend before reaching the level country or the sea level, it would erode a deep ravine-shaped bed, like those so common in the European Alps. High up on the mountain slopes on the side of the valley opposite to where we travelled were the most remarkable series of terrace formations I ever saw, their level being quite 500 or 600 feet above the present river, and their edges sharply defined. Dr. Haast considers that they form part of the margin of an ancient lake which was dammed up by a glacier crossing the valley lower down during the last great glacier period.

Accepting in part this interpretation of the phenomena, several interesting questions follow which we shall try to answer. What river or rivers fed this lake? Was it the Tasman? The present source of the Tasman, being about 200 feet lower than the terraces, would be below the level of the ancient lake, so it could not have been the feeder, unless the lake existed in an inter-glacier period, when the climate was milder, the ice-cap smaller than at present, and the source of the Tasman higher up the valley. Supposing it was not filled by the Tasman river, it seems to follow that at the time of the existence of the lake the great trunk glacier formed by the junction of the Hooker and Tasman must have filled up the centre of the valley, and, extending far away down to beyond the terraces, formed the dam which banked up the drainage of the hills above the terraces, and thus formed a lake similar to the Merjelen-See, in Switzerland. At the same time the main drainage of the great glacier passed along at a lower level, and issued from its ice-cave miles lower down, as the stream of the great Aletsch does at the present day.

That the Tasman glacier has been down the present valley at almost its present level, past the foot of the slopes on which the terraces occur, is proved by the existence of several little mounds of old terminal moraine which the river has failed to remove.

The heat as we journeyed up the river-bed was intense, dark masses of rain-clouds blocked up the Hooker valley, while the Tasman remained clear except for a passing shower. Along the course of the river small whirlwinds followed each other at regular intervals, making themselves visible by the cloud of minute sand which they whirled upwards to a height of from 50 to 100 feet. The track we followed was only

made by bullock-waggons on their yearly journey for the wool of the two sheep-stations near the head of the valley; and the ruts were so deep that more than once our waggon was nearly upset, and only by dint of slashing, hauling, and shoving, did we surmount some of the difficulties. At two o'clock, after fording a broad stream coming down from the right, we arrived at Mount Cook station, and were hospitably received by the proprietor, Mr. Burnett, and his good lady, who busied herself to provide us with a meal, while Mr. Burnett found one of his shepherds to pilot us over the Tasman. It was now three o'clock, and late to proceed, but my whole object was to push ahead as fast as possible, so, in spite of the protestations of the driver, we started, to get past what we expected would prove the greatest difficulty of our journey. For a short distance the horses were able to gallop over a grassy flat, the shepherd riding on in front, and every now and then startling a small flock of Paradise ducks. On reaching the shingle of the river we had to go on foot, only getting into the waggon when a channel of ice-cold water deeper than usual had to be crossed. After fording about a dozen such streams we reached the larger channels; here our pilot rode up and down, testing the fords, and when the main channel was reached we got into the waggon. The water surged and gurgled over the wheels, the horses got frightened, and just as we were in mid-stream a splinter bar gave way and the horses became hopelessly mixed. The wheels were settling down, the river welling into the bottom of our trap, and the weight of baggage alone kept it from floating. There was no time to lose; so, fastening a rope to the fore carriage, we ran along the pole, and from the neck of the leader dropped into the river, where it was no more than knee deep, and then, hauling on the rope, we got the waggon into shallow water, and spliced the broken harness. Cold blasts now swept down from the glaciers, and heavy masses of clouds obscured the sky. As our clothes were well wet, we splashed recklessly along through the river channels, and at dusk reached the grassy slopes of the farther shore. Here our pilot turned back, and we saw him galloping along the shingle flats till he became a tiny black speck, and then vanished in the gloom. We were now close to Birch Hill sheep-station, the last human habitation toward the glacier world. Its wool-shed (a building of galvanised iron) afforded us shelter; and, after a cup of good tea, administered to us by Mr. Southerland, the young shepherd in charge, and a change of clothes, we slept soundly on the wool bales, only occasionally aroused by the growling of the thunder, and the rattle of heavy rain on the iron roof.

Next day, February 13, we packed our horses, and, assisted by Mr. Southerland as guide, and two young gentlemen who had ridden up from Timaru to see the glaciers, we got across the rapid torrent from the Hooker glacier, and at 1 P.M. reached a patch of scrub about two miles from the face of the Tasman glacier, and, unloading the horses, pitched camp. We sent the horses back from here, with orders to return for us on March 7.

February 14 was devoted to strengthening and doubling our tents against the weather, and throwing a bridge over the stream that flowed near our camp, and between us and the glacier. Early on the 15th we started from the camp, taking with us some slight poles for observation on the motion of the glacier, my photographic apparatus, our ice-axes, and provisions for the day. Crossing the bridge, an hour's smart walking over grass-covered flats brought us to the terminal moraine which rises up here in grassy knolls to a height of 200 feet, and which, assuming a more recent appearance to the eastward, extends right across the valley, a distance of about two miles in a straight line. Nowhere is ice visible except near the farther shore where the river breaks forth. The truncated form of this termination of the glacier shows, I think, that it cannot be retreating very rapidly if it is retreating at all. As the absence of any heaps of terminal moraine on the flat plains near to its face proves that the river outlet must have changed many times along the present terminal face to have so completely swept the valley of all outliers except one small heap which has been protected by boulders of unusual dimensions. It may be stationary, but from consideration of the appearance of the terminal face, and from observations on the relations of the present lateral moraine to more ancient ones to which I shall allude further on, I would conclude that the glacier is at present advancing; or if it is not doing so at the present moment it has done so since its last retreat, as there is good evidence to prove that at a period not very remote the glacier was smaller than it now is.

We ascended the outer line of grass-covered moraine, and, passing a little blue lake lying in a deep hollow in which we discovered numerous small fish about four inches long, we ascended heaps of newer moraine composed of immense loose angular boulders, and finding our progress over it most fatiguing and slow, we turned off to the left in hopes that the lateral moraine might prove more practicable, but finding it just as bad, and no level ice being in sight, we descended to the hollow between the lateral moraine and the mountain side.

Here we were entangled in almost impenetrable scrub, composed of Wild Irishman (*Discaria toumatou*), and sword-grass (*Aciphylla Colensoi*), which cut us so cruelly that I quickly returned to the boulders, and soon got far in advance of my companions, who tumbled about in the scrub. Occasionally we got a more open bit for a change, but nowhere could we feel ourselves safe from the chance of a broken leg or sprained ankle. After five hours of this sort of thing we again surmounted the lateral moraine, and, striking right across the glacier, in one hour reached the white ice. The cool air of the ice was most refreshing after toiling over the heated boulders under bright sunshine and sheltered from any wind. We walked briskly ahead until 2 o'clock, when we reached a point from which we had a splendid view of the great cliffs of Mount Cook and the grand amphitheatre of peaks which swept round from left to right. This view I consider quite equal, if not superior, to anything in Switzerland, and the glacier beneath our feet had an area half again as great as that of the great Aletsch, the largest glacier of the European Alps. Tributary glaciers poured in with graceful curves from the mountain sides, and long lines of moraine, from thirty distinct ice-streams which were in sight from this point, brought their tale of boulders to add to the great rampart which had given us such trouble to surmount. We scanned the great ice ridges of Mount Cook with anxious eyes; all its approaches seemed most difficult; the only point which was quite clear was that our present camp would not do, and that, in spite of the roughness of the road, we must shift it up to where we now were. As it was getting well on for 3 P.M. we decided we could at present go no farther, so, selecting a mark on the hillsides, I set up a row of stakes across the glacier, and, having secured a photograph, we started back for camp, which we reached at 8 P.M. On our way we deposited our ice-axes, the stand of my camera, and some photographic plates beneath a boulder, so as to have the less to carry on our journey up the glacier.

February 15 was spent in selecting the necessaries for our journey, and in cutting the flesh off the bones of the sheep, and making all arrangements for an early start. Mr. Southerland who rode up to see how we got on, kindly took a good-sized pack made up in our small tent, across the front of his saddle, and, riding up to the moraine as far as his horse could go, deposited it in some scrub, hung up a flag to mark the spot, and promised that whenever he should see our fire burning again he would come up to see if we wanted anything. At this lower camp the heat during the day was very great, the

temperature being often 82° in the shade; the air was clear, with barometer ranging from 27·60 to 27·70.

A brisk breeze, occasionally blowing in sudden strong squalls from S.W. or N.W., prevailed in the valley, while on the mountain ridges a steady, fierce wind seemed to blow continuously from the W. The wood-hens or wekas (*Ocydromus australis*) were a source of constant amusement; they seemed to know no fear, and would come picking and examining every article in our camp, and were always ready to bolt off with any small object left on the ground. They cared little for the stones we threw at them, and all night they kept up a constant whistling accompanied by a kind of grunting noise On the stream hard by we had an inexhaustible supply of blue ducks (*Hymenolaimus malacorhynchus*); there were never many to be seen at a time, but when we shot three or four one day a couple of brace more would occupy the same part of the stream next morning. They were not wild, so in order to save cartridges we generally pelted stones to get them close together, and then tumbled two or three in the one shot. Far more wild, though quite as numerous, were the paradise ducks (*Casarca variegata*). These were splendid birds; in habits, mode of flight, and note, resembling geese rather than ducks; and the male, with his white head, kept such a good look-out that various stratagems had to be adopted ere we secured one for the pot. There were a few mosquitos and sandflies, but the large blowfly was the greatest source of annoyance. A coat or a blanket could never be laid on the ground for half an hour with impunity; even my mackintosh was considered a good receptacle for their eggs; but we kept them from our cold mutton and ducks with a few yards of mosquito net; and, after all, having your coat full of maggots does you no harm so long as they do not, like the larvæ of moths, feed on the material.

We were astir at the dawn of February 16, and, as soon as we had our packs ready and the tent secured against all wekas and other possible invaders during our absence, we started for the glacier. On reaching the little red flag that marked our pack at the foot of the moraine we re-arranged our loads, Kaufmann and Boss dividing all they had to carry into four loads, while my swag consisted of my knapsack, a plaid, a mackintosh cape, a sack containing my camera and plates, another sack full of cartridges, and the guns. It was quite as much as I could manage over the rough ground. My men adopted the plan of carrying one load each for an hour or so and then setting it down, scrambling back again for the

others, thus making the whole journey twice. In this manner I arrived first at the camping-ground we had chosen near the shore of a little blue lake, where the whole drainage of the valley that found its way beneath the boulders bubbled forth to the surface; and I had the camp pitched when my men arrived at dusk. The lake was embosomed in dense scrub which here clothed the high moraine and the mountain sides. This scrub was composed of dwarf pines, birch, or more correctly beech (*Fagus*), veronicas, sixty species of which are indigenous to New Zealand; and shrubs of podocarpus, coprosma, dracophyllum, &c. As we came along, we could not resist eating the sweet red berries of *Podocarpus nivalis*, though at the time we were not sure what ill effects might ensue. Of smaller plants, the fine white *Ranunculus Lyal ii* was everywhere abundant; it goes by the name of Mount Cook Lily among the colonists, and we found its large succulent leaves most useful in our hats as a protection against the fierce rays of the mid-day sun. A little white violet became common from this camp upwards, and ferns nestled under the shade of every damp rock. Keas, or Mount Cook parrots, now made their appearance and came screaming close to the tent. Kaufmann shot a couple, and soon had them picked and in the soup-kettle, while Boss added a brace of ducks to the larder. Parrot soup proved so good that from this day forward we were never without some in the kettle. Since sheep were introduced into New Zealand, these parrots have acquired a taste for kidney fat, and, perching on the poor unresisting animals, eat through their flesh in order to obtain this delicacy. Further up the glacier these birds were so tame that I knocked one on the head with a stick which I had in my hand. As night closed in, heavy drops of rain fell, and soon it began to blow a gale; but, ensconced in our felt sleeping-bags, we at first defied the elements, and slept well. After midnight, however, the weather became so terrible that sleep was impossible. The tent could not blow away, as it was made on Mr. Whymper's plan, the sides and floor being all in one, but I felt sure it must soon split; it fluttered and banged, and the torrents of rain never ceased lashing its sides. Thunder crashed round the mountain peaks, and when morning came there was no improvement. So far the tent resisted the rain, but now Kaufmann's sleeping-bag was getting wet from soaking the damp through the tent walls; then a pool formed in our opossum rug, and it was no longer possible to keep dry. There was no chance of lighting a fire, so we sat in the tent shivering until mid-day; and at three o'clock, seeing that it promised

for a similar night and all our things were wet, we determined to secure the tent and provisions as best we could, and retreat to our lower camp. The wet scrub drenched us as we pushed our way through it, but on reaching our camp we were soon into dry clothes. The weather cleared for an hour or so about sunset, allowing us to get our supper in comfort; but as it began to blow and rain as night came on, we made ourselves snug in our hammocks, and slept in spite of the banging of the tent walls and beating of the rain. As next day was stormy, wet, and cold, we remained in bed till noon, the highest temperature being only 42°. After our mid-day meal we set off in our waterproofs to try and reach the Hooker glacier; but, finding we should have to mount the steep slopes of the spur of Mount Cook through dripping ferns, we relinquished the attempt, and amused ourselves by running after and catching some young wekas. The old birds came from all points to remonstrate, and, forming a wide circle, squealed and grunted forth their indignation; and as we returned their young ones unharmed, they were, I am sure, quite satisfied that their interference had a most important influence over our actions.

It cleared a little about sunset, showing the mountains glistening with fresh-fallen snow, and then settled in again for a bad night, the wind still blowing a gale from the N.W. At midnight we were aroused by the most awful torrent of rain; there seemed to be no wind with it, and in the morning when we awoke in bright sunshine, and looked out of the tent, we found the whole landscape, down almost to the foot of the glacier and surrounding hills covered with a robe of freshly fallen snow. These lower hills are, of course, covered with snow in winter, but it seldom lies on the flat valley for more than 24 hours at a time. We were much surprised at learning this from the shepherds, as for a long distance the valley may be considered to be at the same level as the termination of the glacier; and land in such proximity in Switzerland would be covered all through the winter with many feet of snow. The wind was now from the S., the sky blue, and, as the snow was rapidly melting, I determined to start by myself for the camp at the Blue Lake, spread all the things to dry, and leave the men to follow when they had our lower camp dried and secure. I took the gun with me in hopes of meeting some ducks, but, finding none, I deposited it and some cartridges at the bridge for Boss to bring along, and went on up the glacier moraine. On reaching the little lake in the moraine I took a swim in the deep clear water, and then

scrambled on to the camp. Everything was *in statu quo*, except that the wekas had been making free with our ducks. The snow was nearly gone, so I collected plenty of dry wood from an old avalanche slope, and, lighting a big fire, soon had the sleeping-bags steaming away, and as the sun shone down with great power I had everything dry when the men arrived in the evening. Boss proved the best sportsman; he had shot no less than eight fine ducks, and with those already in our larder, and a few parrots, we were now well provisioned. It rained again a little at night, but next day was fine enough to continue our journey, which we did as usual, my men going over all the ground twice, and while they went back for the last stage I pitched the tent and cut twigs for our bedding; coprosma and veronica scrub being still in abundance. I shall not go into all the details of our troublesome journey; suffice it to say that our fourth camp was pitched on the moraine abreast of the stakes I had erected on the glacier. On visiting them, however, I found them all lying prostrate, and blown to some distance from the holes in which they had stood. The sunshine and storm of the past seven days had so altered the surface of the glacier that we had some little difficulty in finding the holes we had made. When we set the sticks up again and I ran my eye along them to the mountain's side, I found that they were still in an almost perfect right line, showing that in that time no motion of any importance had taken place. This was, however, what might have been expected owing to the flatness of the lower portion of the glacier, the incline being about one hundred feet to the mile. We returned to camp over piles of angular rocks, alternating with gravel heaps, coming now and then upon a yawning chasm with sides of dirty ice, and inclosing deep blue pools of ice-water. The new moraine near the margin of the glacier overtopped a rampart of ancient moraine, showing that the glacier, at a period not very remote, was smaller than it is at present. Not only there, but on various other parts of our route, I made similar observations. The old moraine was consolidated by the disintegration of the rocks composing it, and afforded soil for numerous tufts of sword-grass and other smaller plants. Here, for the first time, we found the New Zealand edelweiss (*Gnaphalium grandiceps*), and my men seemed to take fresh heart after all their fagging work, when we had our hatbands adorned with the familiar little felt-like flowers. After a good night's rest on a bed of *Veronica Hectori*, we continued our 'swagging,' and on the next afternoon, February 23, we reached our fifth and final camp. We

were now 3,750 feet above the sea, having gained by a week's labour only 1,450 feet of actual elevation, and Mount Cook still towered 9,000 feet above us. Our advance was here checked by the ice of the much broken Ball glacier coming down from our left, and though we carried our swags on to its surface in hopes of camping farther up, the absence of scrub on the further spurs, of sufficient size to promise a supply of firewood, made us retrace our steps and pitch our tents on a gravel slope close to the mountain side, in the angle formed by the Ball and Tasman glaciers. Here a glacier stream provided us with water, and the vicinity of our camp was strewn with dead wood brought down by landslips and avalanches from the steep slopes above. Whilst looking for a suitable nook for our tent, Boss came upon a little square patch of dwarf gnarled coprosma exactly the square of our tent. It grew by itself on the gravel in a snug corner, and seemed as if prepared so specially for our use that we did not wish to decline the hospitality of nature. Filling up, therefore, the centre of the square with some cut bushes we pitched our tent on it. Never was a bed more comfortable; its spring was perfect, we never sank to within less than 5 or 6 inches of the ground; and so long as the wekas contented themselves with squeaking and grunting, and not pecking upwards, we did not wish to deny them the comfortable lodging beneath us, which they seemed to appreciate. From this camp we made a long day's excursion up the main glacier and completed our reconnaissance of the ridges of Mount Cook; and from a point on the medial moraine I took a circle of angles with a view to making my map, and secured a couple of negatives of the Hochstetter ice-fall. But the light was so brilliant, there not being a cloud in the sky, that over exposure of my plates was almost unavoidable.

On this day we spent some time sounding crevasses; into one moulin I lowered a stone with 320 feet of cord, but, as the cord was found to have tangled, the observation could not be relied on. We then timed the fall of large stones, and on several occasions measured five seconds by my watch before the first crash was heard, giving a depth of 300 feet; and then, as a series of bangs followed for as long again, these crevasses must at the lowest computation be 500 feet deep. The glacier which I have named the Ball glacier, after John Ball, M.R.I.A., one of the founders of Alpine exploration, close to our camp, had some points of special interest. Flowing from the S.W. it met the current of the main glacier coming from the N., and, failing to stem it, was pushed aside down the valley, its

lower portion thus making an acute angle with its former course. As our tent was in this angle, I had abundant opportunity for watching its great slabs of ice, which stood up high above the moraine, and by observation I found the ice moved past at the rate of one foot per day. At one point the pressure had been sufficient to push down the moraine as a great wall might have been tumbled over; while immediately in front of our camp the glacier was building up the rampart by a constant dropping of angular stones. Even in the stillness of night these sounds evidenced its icy life; and one night we heard a bang as of a cannon-shot when some new crevasses sprang into existence.

The blocks of the moraine were all either sandstone or slate of the newer palæozoic formation, of which Mount Cook and all this range is composed, with occasional fragments of quartz and blocks of a kind of volcanic breccia, which, according to Professor Valentine Ball, who kindly examined a piece which I brought home, consists of fragments of pyroxene and felspar, the latter being much decomposed. I failed to find this rock *in situ*, though it must occur somewhere on the west side of the glacier.

Scrambles in the Eastern Graians.

By George Yeld.

THAT to have been defeated on the easy side of a mountain is an excellent reason for trying a more difficult route to its summit will be granted by all mountaineers. A dismal retreat from the Val Savaranche side of the Grand Paradis in 1878 was the cause of my arrival at Cogne with Alphonse Payot, of Chamonix, on August 3, 1879, with the intention of traversing the monarch of the Graians from the Valnontey to Ceresole.

As we strolled into the village on a lovely evening we were so much taken by the views of the splendid cirque of ice, snow, and rock which closes the southern end of the Valnontey, that I decided on making the Pointe de Ceresole or Pic de la Lune the object of our first expedition.

Accordingly on the following afternoon, taking with us Léon Guichardaz as porter, we started for a châlet on the cliffs above the Valnontey. We had hardly crossed the Cogne meadows when we were compelled to take shelter from a thunderstorm which came up from Noasca, and with its black clouds caused the snows of the Grancrou to assume an un-