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Expedition to the West Coast of Otago, New Zealand; With an Account of the Discovery of a Low Pass from Martin's Bay to Lake Wakatipu

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tinuation of fine weather and then only on horseback by men free from giddiness.

Amongst the different Alpine lakes of the province of Canterbury, Lake Pukaki is without doubt the most picturesque. It lies 1746 feet above the sea, is 10 miles long and 4 miles broad, and its formation is one of the most interesting objects which can be presented to the geologist and physical geographer. Nowhere, so far as my knowledge extends, are the proofs so convincing that it has, like similar lakes in other Alpine regions, been formed by the retreat of an enormous glacier. But it may truly be stated that the view from its shores towards its sources will rival in beauty and majesty any known views in the world.

In the centre, Mount Cook, resembling a large white tent, rises above the other ice-clad giants, of which Mount Stokes and Mount Sefton to the south, and Mount Haidinger to the north, are the most conspicuous. The bed of the river Tasman, nearly as wide as the lake itself, continues for 23 miles in a straight line to the base of Mount Cook; here dividing into two branches, of which the eastern one is the broadest and most important. In this main branch, 2 miles above the southern foot of Mount Cook, terminates the great Tasman glacier, the largest of all New Zealand glaciers. On both sides the ranges present us not only with *roches moutonnées*, but also with terraces cut into the rock, sloping down at such an angle that their fall can be accurately measured (from $1\frac{1}{2}$ to 4°).

VII.—*Expedition to the West Coast of Otago, New Zealand; with an Account of the Discovery of a Low Pass from Martin's Bay to Lake Wakatipu.* By JAMES HECTOR, Esq., M.D., Provincial Geologist.* (MAP, p. 56.)

Read, December 12, 1864.

ON the 20th of March, 1863, I represented to his Honour the Superintendent that I was desirous of extending the Geological Survey of this province into the West Coast district during the following winter, and suggested that a small sailing-vessel should be placed at my disposal for that purpose. My proposal was willingly acceded to, and a schooner-rigged yacht called the *Matilda Hayes*, of 20 tons register, was selected for the service. A light whale-boat was also built for the service at Port Chalmers, 21 feet in length, so that it could be taken on the deck of the schooner.

* Abridged from the original Report in the 'Otago Provincial Government Gazette' of November 5, 1863.

On the evening of the 20th May we sailed from Otago Heads, with a fair breeze from the north-east, but it died away during the night, and till the evening of the 24th we drifted slowly along with only light but favourable puffs of wind. The weather during this time was delightful, and there was nothing in the clear warm air, richly tinted sky, and delicate veil of haze that hung over the land, to remind one that it was only a month from the shortest day. At night the sea was rendered brightly phosphorescent, principally by swarms of minute *ciliagrade medusæ*.

A constant current sets up this part of the coast to the northward, and is stated in the 'N. Z. Pilot' at from 1 to $1\frac{1}{4}$ mile per hour. This may be the case close in shore, but as our course lay 7 miles from land, we did not find it to exceed $\frac{1}{2}$ mile per hour. When anchored in the channel within the bar at the Heads, the current was found to run at the rate of $2\frac{1}{4}$ knots per hour alternately with the ebb and flood tides, and the temperature of the ebbing waters to be 1° Fahr. lower than that of the flood, this difference being constant both with day and night tides, the ebb being 50° and the flood 51° . When 6 or 7 miles from land, the temperature was, however, constantly 51° .

During the 24th there were signs of stormy weather brewing in the south, so that we hugged close to the land between the Nuggets and Tautuku Bay. The coast here is picturesque, being precipitous with numerous indentations. The cliffs, which rise to an average height of 270 feet, are composed of stratified rock, dipping to the north-east, with from 12° to 20° inclination to the horizon.

On the 25th I landed in Riverton Harbour, and engaged the services of a native crew to accompany the Expedition in one of their large sealing-yawls. I moreover engaged a native seaman named Henry, who was strongly recommended as being well acquainted with the West Coast. I was detained in Riverton, bargaining with the Maoris and by other delays, until the 11th of June. Riverton Harbour is not suitable for a vessel of more than 100 tons, as the river is too narrow to permit a large craft mooring with the strong currents that set with both the ebb and flood tide. That with the ebb ordinarily runs at 4 knots per hour, and is greatly increased during freshets.

At 9 A.M. on the 12th June we crossed the bar, just at full tide, the depth of water being $7\frac{1}{2}$ feet. On quitting the roadstead, which is that portion of the bay sheltered from the west by Howell's Point, we found it blowing a stiff breeze from the w.s.w. This wind suited us very well, as my object was to reach Port William in Stewart's Island, there to await the first easterly breeze we might have.

The coast of Stewart's Island is bold but not precipitous, and thickly wooded to the water's edge. There are several snug nooks

in which vessels can anchor safely; and in one small bay off a stream, named in the chart Murray River, we saw two large vessels lying in shelter. I remained two days in Port William, sounding, dredging, examining its shores, and getting the data for a more detailed plan of it than is given in the Admiralty chart.

As we gradually lost sight of Stewart's Island, in departing on our course to the west coast, it became wreathed in dark tempestuous clouds; while before us, over the valley of the Waiau River, the twilight was clear but lurid. Partly sailing and partly towing we passed the white cliffs of Chalky Island, which remind one of the Isle of Wight; and rounding the Garden Islands at 11 A.M., soon after anchored in the capacious and land-locked harbour of Southport.

The south end of the port is named Lee Bay, the shore being exposed to the north-west gales. The beach there is shingly, and rises 50 feet to a level and finely timbered flat, on walking across which for a distance of $1\frac{1}{2}$ mile I came out on the shore of Preservation Inlet. The extent of this level neck of land between the two inlets does not exceed 1000 or 1200 acres in extent. The flats are covered with a fair growth of timber, comprising red, black, and a few white pines, totara, mapau, iron-wood, carmachia, birch, and many other trees of the southern parts of the province. Excepting the supplejacks in a few places, the forest is quite open, and much more easily traversed than I expected. It is the shrub-growth around the shores which is so remarkable for its beauty and diversity. No artificial arrangement could effect the rich and graceful variety of some of the natural groups of shrubs that clothe the little headlands and rocky islands. It is probable that the Garden Islands were so named from their excelling in this respect.

At 3 o'clock in the afternoon of the 22nd of July, we were off the south entrance to Dusky Bay. It was quite dark when we passed Breaksea Sound, the night being mild and fine, with a light southerly breeze. The sea was brilliantly illuminated with large fiery masses, which proved to be compound *polyps*, forming tubular masses sometimes 12 inches in length and 2 in diameter.

The breeze continued favourable until daybreak, when it became calm, the air being deliciously fresh and mild. When off Nancy Sound, at a distance of 7 miles from the shore, we had a panoramic view embracing the whole coast from Milford Sound to Dusky Bay. Its aspect is gloomy and forbidding in the extreme. The black mountains rise abruptly from the water's edge, with a slope rarely less than 25° , and often 50° to 60° , but not forming sheer precipices. The walls of the Sounds are equally abrupt, and it is obvious at the first glance that they cannot have originated as arms of the sea, or be due in any degree to its erosive action;

their most protected angles and nooks having the same abrupt and still outline that characterises the seaward slope. The view from the summit of a range of mountains—when a mantle of clouds conceals their base and wells up into all the valleys and ravines—has been likened to their partial submergence beneath the sea; and to convey a correct impression of the appearance of this coast, I need only reverse the simile, as the hard outlines and profound valleys, which we are accustomed to see only at considerable elevations, have been here reduced to the sea level.

We remained nearly stationary till 1 p.m., when the wind shifted to the north-west, and clouds began to gather on the mountains, warning us to take shelter, so that we put back to Thompson Sound, which was 7 miles to the southward, as it could be most easily entered with the wind from this quarter, and moreover, affords a more secure anchorage than Nancy Sound, to which we were opposite. The wind carried us right into the Sound, but then failed us, so that the boat had to be launched, and the yacht towed up to the anchorage in Deas Cove, a distance of 3 miles. We were hardly anchored when the storm from the north-west broke, and in a few hours acquired great violence—the gusts of wind drawing through the narrow mountain valley having terrific force, and accompanied by torrents of rain. This storm, which continued for 3 days, was the most violent we had had on the coast, the gusts of wind having such strength that though we lay in a land-locked cove, it was found necessary, besides putting down two anchors, to moor the craft to the trees. The rain was incessant and very heavy, as much as 8 inches falling in 48 hours.

On the 28th we took advantage of a moderate breeze to sail up the Sound. The scenery is very remarkable. The mountains have an average height of 2000 feet, and a few peaks rise to 4000 or 5000 feet. For several thousand feet above the water-level, and probably far beneath it, the rock has been smoothed and planed down by the ice action.

On the 5th of August we passed into Doubtful Inlet, after several days' detention in the narrow arms of the Sound, and a favourable breeze soon carried us again to Thompson Sound. On the right side of Doubtful Inlet I found a snug little cove, not particularly marked on the chart, where there is a convenient anchorage for vessels not drawing more than 10 feet water. If we had known of this place it would have saved us several days, as we should not have required to take the schooner up to the head of Crooked Arm, from which we had found it difficult to escape again.

We sailed next morning for Milford Sound, which is distant 40 miles to the north. Until nightfall we made but little progress, but by daybreak next morning we were off the entrance. The scene was magnificent as the sun rose and slowly lighted up the

inequalities of coastward slope, and so threw back the mountains in their true proportions and full grandeur. At dawn they had looked rather insignificant, their sharp serrated crests seeming merely to form a summit of a dark wall rising close to the water's edge. These mountains have a different aspect from those further to the south, for instead of solid cubical masses bounded by mural cliffs, they form groups of peaks joined by narrow ridges, and throw off sloping spurs towards the sea. The highest mountains almost overhang the sound on either side—Pembroke Peak on the north having a rounded summit covered with perpetual snow, and the Llawrenny Peaks to the south being also snow-clad. It was 11 o'clock before we passed Fox Point, which is the south headland, as at that time in fine weather the breeze commences to blow up the Sound from the seaward. Three miles from the entrance of the Sound it becomes contracted to the width of $\frac{1}{2}$ mile, and its sides rise perpendicularly from the water's edge, sometimes for 2000 feet, and then slope at a high angle to the peaks that are covered with perpetual snow. The scenery is quite equal to the finest that can be enjoyed by the most difficult and toilsome journeys into the Alps of the interior, and the effect is greatly enhanced as well as the access made more easy by the incursion of the sea as it were into their alpine solitudes. The sea, in fact, now occupies a chasm that was in past ages ploughed by an immense glacier, and it is through the natural progress of events by which the mountain mass has been reduced in altitude that the ice-stream has been replaced by the waters of the ocean. The evidence of this change may be seen at a glance. The lateral valleys join the main one at various elevations, but are all sharply cut off by the precipitous wall of the Sound, the erosion of which was no doubt continued by a great central glacier long after the subordinate and tributary glaciers had ceased to exist. The precipices exhibit the marks of ice-action with great distinctness, and descend quite abruptly to a depth of 800 to 1200 feet below the water-level. Towards its head, the Sound becomes more expanded, and receives several large valleys that preserve the same character, but radiate in different directions into the highest ranges. At the time that these valleys were filled with glaciers a great "Ice Lake" must have existed in the upper and expanded portion of the Sound, from which the only outlet would be through the chasm which forms its lower part. Two hours' sail brought us into a fresh-water basin, where we anchored. Two streams of considerable size enter the head of Milford Sound, the Cleddau River from the s.s.e., and the Arthur River from the south-west. A well timbered flat about a mile in extent lies between them, which has been principally formed by the materials brought down by the first-mentioned stream, consisting of shingle and stratified sands. It is evidently a river-

valley deposit, and its surface slopes up the valley of the Cleddau River, forming benches 4 to 6 feet above the highest floods. This flat (and a few hundred acres on islands in the lower part of the Arthur River) is the only land at the head of Milford Sound that could possibly be made available for any purpose.

Below the narrow part of the Sound around Anita Bay there is another small portion of level land, but it is a mere strip by the water's edge along the base of steep ranges of hills. Fresh-Water Basin, in which we were moored, is an expansion of the main channel of the Cleddau River lying between the before-mentioned flat and a vertical precipice of rock, but closed in from the up-Sound winds by Cemetery Point. We lay within a few hundred yards of the foot of a cascade 540 feet in vertical height. The grand scale of the surrounding scenery detracts, however, from the imposing effect which this fall would have in any other situation. The volume of water is very considerable, especially after heavy rains, forming a stream for 100 yards between the foot of the fall and the edge of the sea 40 feet in width, and, judging from the flood-mark, sometimes 18 to 20 feet in depth. The occasional flooding and the continued dashing of wind and spray from the falling water have prevented the growth of scrub on a small plot of about an acre in extent, which from a distance presents the pleasant, because unusual, sight on this coast, of a grassy knoll. The surface of this plot is covered with hummocks, not unlike graves, which doubtless has suggested the name Cemetery.

On the 10th August the weather promising well in the forenoon, I started on an exploratory journey up the valley of the Cleddau River; but in the afternoon it began to snow heavily, so that I had to return after getting about 5 miles from the mouth. The valley has a very rapid fall, but it is crossed by no ledges of rock or other obstacles than the large boulders derived from ancient moraines with which the valley is partially blocked up. The floor of the valley is composed of the detrital matter, the rock only showing at the sides, where it forms steeply-inclined slopes grooved and scratched like those of the Sound. Three valleys join to form the main valley of the Cleddau River, but they all seem to originate among precipitous mountains, and give no hope of an easy passage to the eastern side.

On the 17th August, there having been several days of fine weather, with south-east wind, I made another attempt to examine the Cleddau River, taking with me three men, a tent, and provisions for some days. The woods were very dry and pleasant, and the stream so much lower than during the previous week, that we were able to skirt it in many places where I had previously to wade across it.

Following up the middle of the three branches, by evening we

had made about 8 miles—the latter part of the journey being very rough work on account of the great size of the boulders which block the channel, and over which we had to scramble at the risk of slipping into the torrent; this did happen to two of the party, but fortunately with no worse result than a thorough drenching in the icy water. The fall of the river is very great; and the bed of the stream is everywhere composed of glacier *detritus*, sometimes rudely stratified, and filling the valley to the height of 1500 feet above the sea level, the immediate river-valley being excavated between this accumulation and the steep, smooth wall of rock against which it rests.

Next day we followed up one of the branches to its source. The upper part of its valley is cut, to the depth of 540 feet, through a true moraine consisting of earthy clay, and containing regular blocks of rock of all sizes up to 30 and even 40 feet in diameter. The stream ends quite abruptly against a glacialised surface of rock, which slopes to a height of 3000 feet, at an angle of from 30° to 40°. The snow which falls from the mountains is unable to lie on this polished surface, and, sliding down, wedges in at the back of the moraine, forming a miniature glacier, though without the true ice structure, at an elevation of only 1000 feet above the sea-level. The depth of the groove, which has been cut by this snow-bank between the rock and the moraine, is not less than 400 feet.

By a slightly-dangerous climb we got up the glacialised surface of the rock, and on to the top of the great moraine which is heaped up against it. The frequent landslips which take place from the face of the moraine-cliff do great havoc among the trees that grow on top, leaving their roots bare, so that they die, and are easily thrown over. The forest is very open, and some of the trees are of good size. The principal trees which I observed at an altitude of 1800 feet were the black-birch, the iron-wood or batta, the remu, totara-cedar (a second species of *Podocarpus*), broad leaf, New Zealand holly (*Eurybia dentata*), moka, and several others.

At this altitude, on westerly exposures, there are few lichens or mosses, as the woods are well aired and the soil dry. We were now in the third great longitudinal valley, which runs north and south, crossing the main valley, which is continuous with that of the Sound. As these valleys conform to the trend of the strata, they probably indicate lines of softer rock along which the erosion was more easily effected by the descending glaciers. In these valleys the moraine matter is heaped principally on the eastern side, being opposite to that upon which the greatest accumulation of ice must always have taken place.

Although the mountains rise so precipitously from the valleys,

they are not so steep towards their summits, where there is generally a large area presenting slopes on which snow could rest under circumstances favourable for its accumulation, and form the source of glaciers which would descend into the lower valleys. Pembroke Peak (6623 feet) is covered with perpetual snow, which on its south-east face extends as low as 4000 feet, with a slope of 20° to 30° , and there terminates in a cliff of true glacial ice, judging by its intense blue tint compared with that of the surrounding snow; and did it not overhang a precipice, this ice would doubtless descend as a glacier to a very low altitude. Now the average height of the mountain-ridges is nearly 6000 feet, and with the present conditions of climate, an elevation of the land equal to 2000 feet would, according to the best estimate I can form, raise about six-tenths of the area of this mountain district to that altitude, which is certainly considerably above the snow-line in the strict sense; that is the line above which the snow never disappears during the summer, unless by gravitation after assuming the glacier form by regelation.

It is a mistake to estimate the size of glaciers generated from a mountain-range merely by its altitude, as it is truly the area which in the district is elevated above the snow-line that determines their extent. If this be the case, the area must always be diminishing rapidly from the eroding action of the descending ice, and therefore the extent of the glaciers must also diminish. Judging from the structure of the sounds on the west side of the mountains, and that of the lake district on the east side, I am inclined to think that the opposite sides of this mountain-range have undergone repeated and alternate oscillations to the extent of at least 1000 feet in either direction from a nominal point; and that the western district being at present near to the period of greatest depression, the re-elevation of the land to the other extreme would be almost sufficient to extend the glaciers to their ancient limits, for the residual excess of cold to effect this could easily be accounted for by the necessary alterations in the physical geography of the country which would accompany such re-elevation. The immense lapse of time and the number of secular returns of these conditions is well shown by the remains of the high-level valleys, which were the wide channels for glaciers of earlier date, but are now represented as fringing shelves along the sides of more profound valleys, just like the terraces skirting the valley of a river which is changing its course from side to side of a gradually deepening channel.

From the altitude we had attained I could see that there was no hope of finding a saddle at the head of this valley, whereby communication could be had with the inhabited districts on the east side. All further progress appeared to be barred by precipitous

mountains 5000 feet in height, with detached snowy peaks several thousand feet higher. As the weather was very threatening, we made our way back to the camp of the previous night, and regained the schooner next day during a violent storm, with rain from the south-west.

On the 24th August I left the head of Milford Sound, and dropped down to Anita Bay, where we anchored at dark; and next morning, at 4 A.M., taking advantage of the land-breeze, sailed to the northwards to the Awarua River, which is laid down on the chart 18 miles further up the coast. After making 6 miles, the wind died away when we were off Yates' Point, which is the first promontory to the north of Milford Sound.

As the yacht lay becalmed, with too heavy a swell running to allow of our towing, and as it was necessary that the Awarua should be carefully examined before we attempted to enter it with the craft, I went on in advance with three hands in the whale-boat. Keeping close in-shore, I had a good view of the coast, and satisfied myself that it would be quite possible to get along it from Milford Sound northwards. The coast-line forms a succession of bold headlands, which generally have a group of sharp rocks, or a long reef extending from them to the seaward. Between these headlands are shallow bays, with steep sandy or shingly beaches, on which the surf breaks with tremendous violence. Three of these bays are of large size, each having a large valley extending from it into the interior in a southerly direction; and it is as flowing into the most northerly of these that the Awarua of the Admiralty Surveyor is laid down on the chart. The proper Awarua of the Maoris, according to all the information that I am able to collect, is, however, a large river that falls into Jackson's Bay to the north of that river, which I named the Jackson last summer, but which I have since learnt is known to the Maoris as the Terrehwatta.

After pulling 10 miles, and when opposite to the south end of the second bay, or Martin's Bay of the chart, we observed a smoke on the shore; and, on standing in for it, found it to be a party of Maoris, who made signs for us to land; but as the sea was breaking nearly a quarter of a mile from the shore, I dared not take the boat even within hail. Guided by the Admiralty chart, which hitherto I had found faithfully correct, I was making to the next bay to the north in search of the Awarua River, when our guide, who had been along this coast sealing, though he knew nothing of that river, thought that I was going too far, and that the mouth of the only large river he had ever heard of on the coast, into which there was a chance of taking a yacht, was at the northern extremity of Martin's Bay, as he recognised the long and dangerous reefs that lay before us. On making towards the north end of the sandy

beach, which extends for 3 miles, we found a strong current against us, which quite confirmed this opinion. Still, however, when close in shore, we could see no appearance of an entrance, the surf seeming to break with increased violence where the sandy beach meets the rocks. Proceeding cautiously, and keeping a few boats' lengths from the rocks, we however found that this appearance was deceptive, and that there was really a pretty-wide channel lying between the rocks and the point of the sandspit; and pulling up against a current of two or three knots, a few hundred yards brought us into comparatively still water, when we found that we were in a large river about a quarter of a mile in width, the first reach of which extends for nearly 2 miles parallel with the sea-shore, and separated from it only by a narrow sandspit. After landing on a gravelly point, where there was an old Maori hut and a camping-place where tents had been pitched very recently, I lost no time in examining and making a rough plan of the entrance of the river; and having sounded carefully, set up guide-marks by which to bring in the schooner at once with next morning's tide should she arrive in the offing during the night. The channel is quite deep enough for much larger vessels, as there is 10 feet of water in the shallowest part of the bar; but it is very narrow, and there are five or six awkward sunken rocks on that side on to which the current would naturally tend to sweep a vessel. However, I anticipated no difficulty in getting the yacht in if we could only hit the proper time of the tide. Next morning, as we could see nothing of her in the offing, we pulled up the river against the ebb for a few miles, and were greatly pleased with the alluvial land, and the fine quality of the forest growth with which it is covered. Being afraid that the schooner might arrive in time for the evening tide, I did not go far up the river; and on returning to the sandspit at 1 P.M., we saw her at a distance of 8 miles to the south-west, but further from the land than where we had left her on the previous day. After lighting a large fire as a signal, it being then low tide, I was able to improve my plan of the entrance to the river, and fill in the rocks and channel more accurately than previously. The current was flowing out with great velocity, the clear channel at the turn of the tide being contracted to a width of 110 feet.

Next morning (the 27th August) there was a fine southerly breeze, and we were on the look-out for the schooner, but she was not in sight. However, at 8 A.M. we heard her gun fire round the point to the north, and immediately put out across the bar, it being then almost the turn of high-water. When they picked us up, after a pull of a couple of miles from the land, I learnt that the skipper, misled by the chart, had been sweeping the northmost bay all the morning in search of the entrance of the Awarua River, where he

expected to communicate with me. He describes the bay as being very deep, with a bold boulder-beach, without any appearance of a river, and complained of the great risk he had run in being led to sweep so close in-shore in search of the river through the error of the chart, for, if a nor'wester had sprung up, he never could have beat out against it.

Early on the morning of the 28th I proceeded up the river, accompanied by the skipper, to see how far up it would be advisable to take the yacht. We had the advantage of the flood-tide, which carried us rapidly up; and, after a distance of 4 miles, we were surprised and delighted to find that it flows out of a lake 1 to 2 miles in width, and extending in a southerly direction for 10 or 12 miles. We had a fair wind up this lake, so that by noon we reached its upper extremity, where a considerable stream enters it from the s.s.e., and up which we were able to take the boat for nearly a mile. The lower part of this lake is comparatively shallow, varying from 6 to 10 fathoms, and surrounded by a large extent of level land, which is continuous with the flat through which the river winds, and is bounded on either hand by low sloping hills.

About 5 miles from its lower end it, however, acquires all the characters of one of the Sounds, being bounded by steep mountains that rise out of deep water. At the head of the lake there is a large flat, covered with thickets of the tutu, fuchsia, and other shrubs. This river is called by the Maoris the Wakatipu-kaduku, or the river that leads up to the Wakatipu Lake; by which they mean, not the Wakatipu Lake of the east side of the mountains, but the lake I had just discovered, and which, in order to avoid confusion, I propose to name the Kakapo Lake, in order to preserve the name of that rare and interesting bird which will, in all probability, soon become extinct; and preserving part of the Maori name, I would name the river Kaduku.*

Martin's Bay, into which the Kaduku River flows, is 4 miles across, between the two headlands, and rather less than a mile in depth. The best weather for entering the Kaduku River is after a few days of light N.N.E. or south-east winds, or with a light south-west wind if there has not been previously a gale from that quarter, as in that case there is sure to be a heavy swell, especially if the barometer is low. The most severe gales on the coast are from between N.N.E. and N.N.W., and not often from north-west, as is the case farther south, and on the whole these were the prevailing winds during the month's experience we had of the place. As the bay is open and the current sets strongly off shore to the south-

* The lake is called "M'Kerrow" on the official maps, and the river at the head of the lake "Hollyford."

ward, there would be little danger in a vessel anchoring in it for a short time in fine weather, to wait the proper time in taking the bar, as, if a northerly gale sprang up, she could easily reach Milford Sound with the first of it.

The dangers, however, which are incurred in entering the Kaduku River, are very great in its present condition, arising from the narrowness of the channel, the strength of the outsetting current (excepting at high water), and the exposed nature of the coast, on which there is nearly always a heavy swell rolling. Still, however, I believe it could be greatly improved, and would form at least quite as good a port as many which are freely entered by sailing vessels and steamers of small size on other parts of the New Zealand coast. If, however, an easy line of route be discovered to the interior of the Province from this point, this district—which is in itself of great interest—will obviously acquire a still higher importance, from its being the nearest part of New Zealand to the Australian and Tasmanian ports, so that in future times it may not improbably be a terminus of mail and telegraphic communication. In that case, for the convenience of large vessels, it would be necessary to have communication with Milford Sound, either by a system of lighterage, or overland, by road or railway, and thus render useful one of the most excellent harbours on the coast; the only defect of which arises from its great depth of water and small extent of available land on its shores.

A previous examination of the structure of the country between Kaduku River and Lake Wakatipu, left no doubt on my mind that the Southern Alps were traversed in this longitude by a depressed valley, similar in all probability to that recently described by Dr. Haast as leading from the head of the Wanaka Lake, and through which I might certainly expect to find an easy route between the east and west slopes of the island. This impression I communicated verbally at the time to his Honour the Superintendent, my only doubt being as to the exact place at which such a route would terminate on the coast. A statement, which I had heard, that Messrs. McKellar and Gun had seen the waters of Milford Sound, inclined me, though it was rather against my own theoretical views, to expect it to lead towards that point; but my examination of the valley of the Cleddau River, at the head of Milford Sound, had quite precluded any hope of a low pass in that direction. However, the view I had from Skipper's Range, above the east shore of Kakapo Lake, enabled me at once to recognise the proper line of route as lying up the valley of the Kakapo (or Hollyford) River; and further, from the Maoris we met on the coast, I learnt that, by travelling in that direction, several parties of natives had in former days migrated to the

settlements on the southern part of the island. I therefore at once made arrangements for crossing the mountains and proceeding to Dunedin for the purpose of communicating with the Government, according to my promise, before the expiry of five months from the time the Expedition started. Accordingly, on the 23rd September, I left the yacht in the Kaduku under the care of the skipper, and took three men across the mountains with me, one of whom was Mr. Hutchinson, the owner of the yacht, and whose great desire to see the West Coast had induced him to ship as one of the hands.

The river has a width of from 80 to 100 yards, and winds through a valley which, for the first 6 miles, averages one mile in width and trends s.s.e. from the lake. At that distance from its mouth, it receives a branch 60 yards in width that forms the outlet of the Wawaihiwuk Lake* of the Maoris, a place that they visit periodically to catch eels.

The upper part of the Kakapo River, and its tributary the Wawaihiwuk meet from almost opposite directions, the former draining the southern and the latter the northern extremity, of a longitudinal valley which extends for about 40 miles with a general direction from north to south, having the Bryneira Mountains on the east and the Darran Mountains and Skipper's Range on the west; the drainage being effected between the two latter mountain groups through the Kakapo Lake. The shallows become more frequent and formidable above the junction of the two streams, and the valley is for a short distance narrowed by a range of low hills which project from the mountains on the south as if it were the remains of a barrier that had at one time closed the present outlet of the large valley. These hills, however, cause no obstruction, the river passing through them with an even channel, unbroken by falls or rocky ledges, and having flats or sloping banks on either side. At a distance, in a straight line, of 10 miles from the mouth of the river, where we arrived early on the second day, the channel was obstructed by the immense boulders of an ancient moraine, causing a violent rapid about half-a-mile in length, so that from this point I sent back the dingy. The Darran Mountains, which encircle the head of Milford Sound and form the west side of Kakapo Valley, have a striking appearance from this point, although from the profundity of the valley the higher peaks are completely shut out from view.

There is only one place where there is the slightest appearance of a gap in this range, but even there the saddle cannot be lower than 3000 feet. The high slopes above 5500 feet seem to be covered with perpetual snow, with glaciers of small size descending

* "Lake Alabaster" on the official maps.

through steep ravines as low as 3000 feet above the sea-level, but from the extent of bare rock from their lower extremity and the position of their terminal moraines, I am inclined to think that in some seasons they must descend about 500 feet lower.

Above the boulder-rapid just mentioned, the fall of the stream is again comparatively slight for 10 or 12 miles, at which place the valley is crossed by a second moraine, but in this part of its course, besides the frequent occurrence of shallows, its channel is much obstructed by drift wood, which is frequently piled to a height of 10 feet by floods. In some parts of the valley the flat land, which is of good quality and above the highest floods, is nearly 2 miles in width. The forest which covers the flats is very open and free from underwood, and contains some fine timber-trees. Above the second boulder-rapid, the rounded shingle fills the valley from side to side, so that the useful land may be considered to terminate at that point, or about 18 miles from the south extremity of the Kakapo Lake.

After losing four days by continued rain, which I was surprised to find only caused a rise of a few feet in the river, we reached a stream which descends from the saddle at the source of the Greenstone River on the morning of the 1st October, being then a distance of 25 miles from the Kakapo Lake, although by the route we had come, following all the bends of the river, we must have travelled 40 miles, as it occupied us eighteen hours exclusive of all delays.

I may state that the rise of the valley to this point I estimate at 400 feet, and thus far there would be no heavy gradients to be overcome in the construction of a road. After following up the Pass Creek for a short distance, and with an easy climb of two hours, we reached the top of a bald hill on the west side of the Greenstone Valley, being, I have no doubt, the same from which Messrs. M^rKellar and Gun obtained their prospect of the western slope, when in search of new pastoral country. We encamped near to the top of the hill, which is over 3000 feet above the sea-level, and at least 1400 feet above the highest point of the Greenstone Valley, or, in other words, just so much higher than it was necessary for us to rise in order to strike the waters that flow to the East. The bed of the stream which descends to the westward from the saddle is very precipitous, but on both sides of it there are spurs which lead easily down to the Kakapo Valley. Two lakes occupy the bottom of the valley where the water turns, separated by a mossy flat; the water from the north-west, which is half a mile in extent, forming the Pass Creek, while that of the South Lake, which is 2 miles long and half a mile wide, forms the Greenstone River that flows to the Wakatipu Lake. From the top of the hill I obtained a view of a second and even deeper

valley, which I suspect leads through to the Mavora Lakes and is the route which has been frequently traversed by the Maoris, between the Wakatipu, Kaduku, and Riverton.

After two hours' walk along the ridge next morning in a south-east direction, we descended into the Greenstone Valley and reached my furthest camp of last April, and by nightfall got several miles below the point where we, on that occasion, left our horses. The descent of the valley of the west, or McKellar's branch of the Greenstone River, is very gentle and uniform, and the total fall from the McKellar Lake at the summit level to the Wakatipu Lake, a distance of about 22 miles, cannot exceed 400 feet.

As the lower part of the Greenstone River, for a few miles above where it receives the eastern or Caples branch, is obstructed by bush, I again followed McKellar and Gun's track by the Mararoa River, and next day reached the out-hut of Mr. Von Tunzelmann, situated on the Riverton track, 10 miles south-west of the Wakatipu Lake. The total distance from the Kakapo Lake to the Wakatipu Lake by the route I followed is 90 miles. But if we had followed straight up the Kakapo Valley, and followed down the Greenstone River to where it enters the Lake, which would be the proper line to cut a track, the distance would be less than 50 miles.

On the 4th October, I reached Queenstown, and from there sent back two men to clear the track I had "blazed" to the Kakapo Lake, and then return to the height of land and there await my arrival from Dunedin. Accompanied by Mr. Hutchinson I then proceeded by the ordinary route to the Dunstan, and thence by coach to this place, and had the pleasure of reporting my arrival to his Honour on the 7th instant.

I may state in conclusion that there will be no difficulty in constructing a road at a moderate expense between the Wakatipu and Kakapo Lakes that will pass over a summit-level of the mountains that does not involve a rise of more than 400 feet above the Wakatipu Lake, which, being elevated 1000 feet above the sea, consequently makes the western descent equal to 1400 feet, 400 of which may be accomplished with an imperceptible gradient.

NOTE.—The Secretary of the Gold Fields has placed in my hands a sketch-map of the country between the Kakapo and Wakatipu Lakes, which in all the main features is very correct, made by a miner named Caples, who states that he reached the sea at Martin's Bay in March last. From the statement which accompanies this sketch, Mr. Caples appears to have kept on the mountain-ridges, and to have followed routes that were unnecessarily difficult, and never to have entertained the idea that an easily practicable one existed; he, however, displayed extraordinary

energy and perseverance to accomplish what he did, and I take the liberty of referring to these circumstances, as I think that every credit is due to him, for being the first to give any account of this previously unknown district. By comparing his sketch I recognise his McKerrow Lake as being the Kakapo Lake, and his Hollyford River and Pike's Creek as corresponding respectively to the Kakapo River and the Wawaihiwuk Creek mentioned in the foregoing narrative.

VIII.—*Observations made in Central, Eastern, and Southern Arabia during a Journey through that Country in 1862 and 1863.*
By W. G. PALGRAVE, Esq.

Read, February 22, 1864.

A LINE of route which led me across the Arabian Peninsula from Gaza to Maskat, thus traversing the country in its greatest breadth, could not but afford special opportunities for observation both of the land and of its inhabitants. A few notes, the result of such observation, may not be unacceptable, while they contribute to fill up the blanks in our view of Arabia.

I am, indeed, aware that this very appreciation must be often imperfect, and on some points absolutely defective. This is mainly owing to the circumstances under which I undertook and carried out my investigations. For if, on one hand, my journey was conducted in a manner affording me ample leisure and great liberty for observation, whether personal or by means of inquiry from trustworthy sources; on the other hand, it was deficient in many conditions requisite for minute accuracy and absolute precision. Thus the medical disguise which I had assumed, for the greater facilitation of my project, succeeded indeed to the full in preventing or allaying native suspicion, and enabled me to visit undisturbed and at my ease many localities of special interest, and to stay in or near them so long as might be necessary for my purpose. It furnished me also with many convenient opportunities for asking questions and collecting knowledge about regions lying out of my immediate reach and off my path, without too much risk of thereby awaking the habitual distrust of the inhabitants, or displaying a dangerous appearance of over-curiosity. But this same disguise unavoidably deprived me of the means of taking with me any mathematical or geodesical instruments, indispensable to accurate observations, and no less of the freedom requisite for sketching or photographing, nay, often of even taking down on the spot notes however useful; while, at times, prudence rendered my interrogations and researches less precise and less frequent than I

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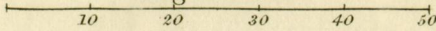
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Map of the Provinces
of
CANTERBURY AND OTAGO
(NEW ZEALAND)

to Illustrate the Papers of

M^r. James M^r. Kerrow, D^r. J. Haast & D^r. Hector.

English Miles



D^r. Haast's Journeys.....

D^r. Hector's Journey 1863.....

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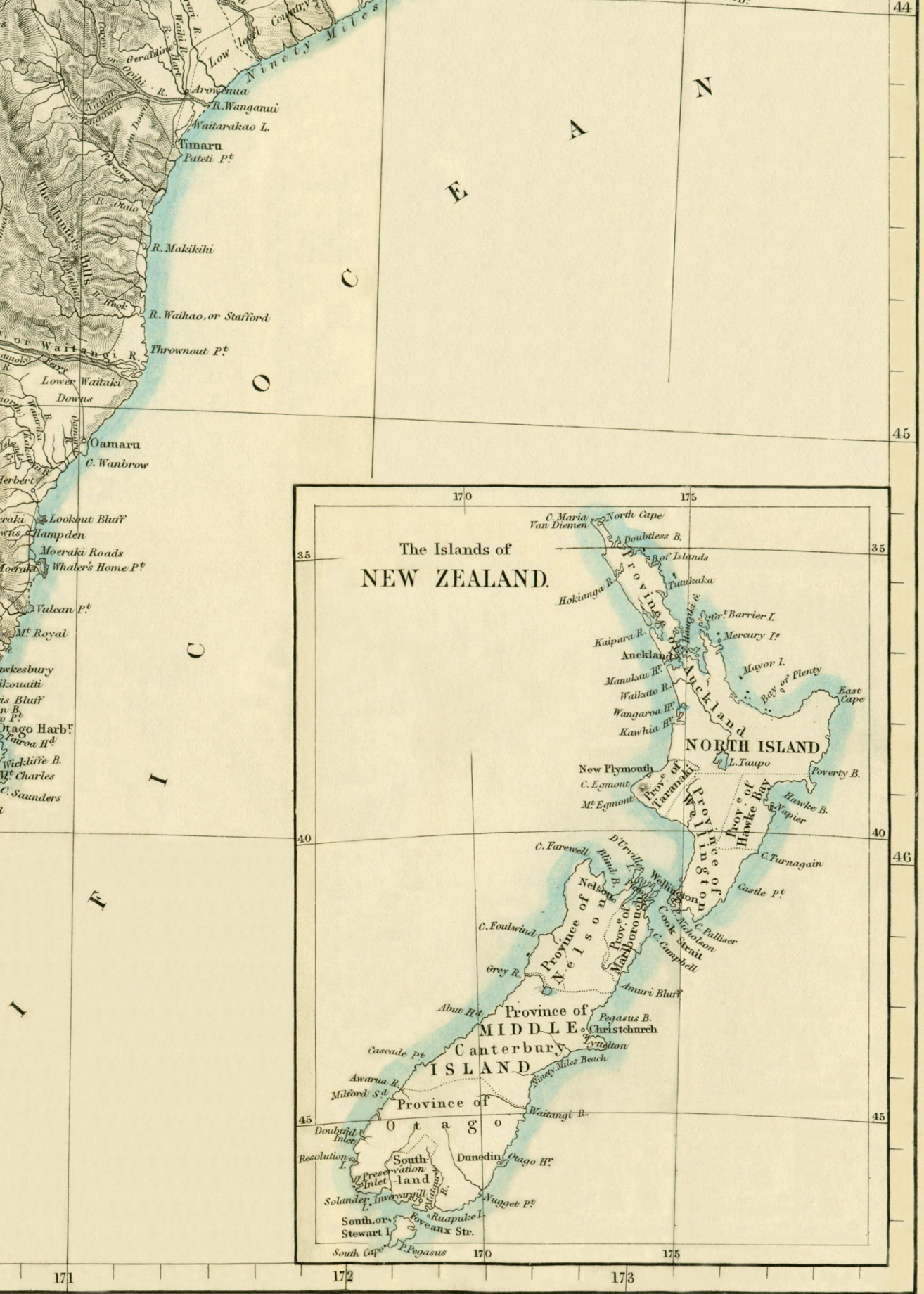


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Edw^d Waller.