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By His Honor's Command,
THOMAS DICK,
Provincial Secretary.

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GEOLOGICAL EXPEDITION TO THE WEST COAST OF OTAGO, NEW ZEALAND.

REPORT BY JAMES HECTOR, ESQUIRE, M.D., PROVINCIAL GEOLOGIST.

NOTE.—Dr. Hector desires it to be stated that although he considers this Report correct, yet, as it was hastily written, and he had not an opportunity of revising it, some slight inaccuracies may have crept in.

THOMAS DICK,
Provincial Secretary.

Dunedin, 19th October, 1863.

To the Provincial Secretary of the Province of Otago.

SIR—I beg to enclose, for the information of his Honor the Superintendent, a short and hastily prepared narrative of my explorations on the West Coast of the Province during the last four and a half months, from the time of my leaving Dunedin, on the 20th of May, until the 23rd September last. I also beg to enclose a rough chart of the entrance to the Kaduku River, which is mentioned in that narrative, and also a tracing of the first sketch of a map of the North West district, which I have in preparation, in order to assist the explanation of the route by which I have recently crossed from the West Coast to the Wakatipu Lake. Likewise copies of the Meteorological Observations recorded on the West Coast up to the 31st August.

In the month of April last, I made a rapid excursion from the west shore of that lake along with Mr. Von Tunzelmann, nearly to the head of the west branch of the Greenstone River, following the track of Messrs. M'Kellar and Gun, two enterprising runholders, who explored that country, and were undoubtedly the first to obtain a view of the western slope of this Province, although it was quite impossible for them to have seen the sea from the point to which they reached.

Want of time and the occurrence of bad weather prevented my then going as far as I wished, yet the examination of the structure of the country 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 Honor the Superintendent

and to several of my colleagues in the Government service, 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. M'Kellar 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 River;† and further, from the Maories 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 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 under the care of the skipper, at its anchorage at Wart Point, with instructions to return to Gravel Cove, and from there to make an examination of the Waiuna Valley during my absence.

I 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.

Mr Hutchinson is well-known as one of the earliest and most experienced settlers in the Province, and one who has worked hard to develope its resources as lessee both of coal mines and lime stone quarries, and it gives me pleasure to acknowledge, that I have been much indebted to his shrewd and practical remarks respecting the capabilities of the country.

Having learnt from the Maories that they had been up the river in a canoe, and that the cutter's crew (mentioned in the narrative), had also taken a boat up for some distance, I wished to ascertain how far it was navigable, and with this view was accompanied for the first day and a half by the Skipper and another extra hand in the little dingy that we built in Milford Sound. By this arrangement the walking party were relieved of their swags for a good distance, but as the river is full of shallow rapids we did not save very much by it.

The river has a width of from 80 to 100 yards, and winds through a valley which, for the first six 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 Maories, a place that they visit periodically to catch eels. Only the position of this lake is shown in the accompanying map, for as yet I have not ascertained its exact shape.

Up to this point, which is is about seven miles by the windings of the river, there occur nine rapids, at only one of which, however, it was necessary to unload the boat, the others being overcome by dragging it for a short distance over the stones without removing its load. The above distance was accomplished in four hours. The banks of the river are elevated twenty to thirty feet, and consist of stratified beds of clay, sand, and alluvial silt, the latter having often a depth of twelve feet. The flats, which are well timbered, slope gently back to the base of the mountains, where they are slightly swampy in some places; but this is owing, not to the want of sufficient fall for natural drainage, but to the small streams being occasionally blocked by the falling of trees across their channels during floods.

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 forty 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 ten 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. At this place we found a boat's painter left attached to a tree, so that the party of the cutter seem also to have brought their boat thus far.

They appear to have established several large camps along the river, in each of which they had remained for some time, but as I

* Lake M'Kerrow on the official maps.

† Hollyford River.

* Lake Alabaster on the official maps.

observed few holes sunk anywhere, they probably limited their prospecting operations to the beaches along the stream. 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 through steep ravines as low as three thousand 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. Indeed, every circumstance I have observed seems to indicate that there has been an unusually small snow fall on the mountains during the past winter.

Above the boulder rapid just mentioned, the fall of the stream is again comparatively slight for ten or twelve 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 ten feet by floods.

In some parts of the valley the flat land, which is of good quality and above the highest floods, is nearly two miles in width, and as the soil appears principally to be a deposit from a Lake that once extended from side to side, and probably occupied the whole of this valley and its ramifications, it will have a more uniform character than is usual in valleys so closely hemmed by mountains. The forest which covers the flats is very open and free from underwood, and contains some fine timber trees, black birch, iron wood, remu and white pine being the most prevalent. Above the second boulder rapid, the rounded shingle which lower down is confined to the bed of the principal stream and its tributaries, 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.

It is extremely difficult to form any estimate of the extent of available land in the valley, but I do not think it can exceed 10,000 acres. Its quality is however excellent, the soil being generally a light friable loam containing a proportion of vegetable matter. In travelling up the valley we crossed the stream repeatedly, taking advantage of the shingle beaches, over which we could progress more rapidly than through the woods; but if this were impracticable from the flooded state of the river, the best road would be found along its west or left bank.

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 had furnished myself with an accurate mercurial barometer, and also with a small aneroid, and as I have assistants at present taking regular observations on both the east and west shores of the Province, I expected that the accurate section of the Island which I should thus be able to obtain, would prove one of the most interesting results of my journey from sea to sea. I was therefore much disappointed when notwithstanding the greatest care, both instruments became useless early in the journey, so that I am unable for the present to give more than an estimate of the elevations passed over. Another, and I trust a more successful attempt will be made, as I return with fresh instruments. In the meantime, 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'Kellar and Gun obtained their prospect of the western slope, when in search of new pastoral country.

We encamped near the top of the hill, which is over 3,000 feet above the sea level, and at least 1,400 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 northwest, which is half a mile in extent, forming the Pass Creek; while that of the South Lake, which is two 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 Lakest and is the route which has been frequently traversed by the Maories, between the Wakatipu, Kuduku, and Riverton.

The ease of this route may be judged of from the fact, that a woman, I was told, performed this journey alone. As far as I have been able to learn, however, it was not by this Pass, but by the one which leads from the true Awarua to the head of the Wanaka Lake, that the Maories of the North Island used in former times to make their incursions on the natives that lived by the Clutha and Mataura Rivers.

In that valley there are also two lakes, but from my elevated point of view, I could not discover whether the watershed is to the north or the south of them.

Both these valleys, with the lakes that lie in them, were described by Messrs. McKellar and Gun, and from their sketch, were laid down in a map of the Province published by the Chief Surveyor Mr. Thomson, more than two years since, and long prior to the discovery of any gold fields but those of the Lindis and Tuapeka.

The Kakapo River, above the point where we left, or rather from above where it is joined by the stream from the westward of the two low valleys, appears to become a mere mountain torrent taking its rise from several heads that descend from the Darran Mountains, and are separated by lofty "cols" or snow passes from the heads of the various tributaries of the Cleddau River that flows into Milford Sound. Some of the peaks along this range are very prominent, the principal one being Mount Christina, of McKerrow's map, a high conical mountain, very distinctly seen from the sea, off Milford Sound. To the south-east, and rising probably from the head of the Te Anau Lake, are three well marked peaks that I believe can be also observed from one position in Milford Sound when looking up the valley of the Arthur River.

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 Mariroa 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.

The time actually employed in travelling was as follows:—

	Hours.
With the dingy.....	8
Thence to the height of land.....	22
Thence to Wakatipu Lake, to Mr. Von Tunzelmann's	16
Total.....	46

Next day, being 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, whose business engagements prevents his remaining longer absent from town, 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 Honor on the 7th instant.

In the foregoing description of the route I have followed in crossing the mountains, and of the country at its western extremity, as given in the enclosed narrative, I have limited myself to the statement of what I observed and recorded on the spot, and have intentionally avoided expressing an opinion as to whether the present requirements of the Province are such as to make the result of this part of my explorations of immediate practical value. However, I may state that when such requirements do exist, 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.

Since my arrival, information has been given me by the Chief Surveyor, Mr Thomson, respecting the Kakapo Lake, which had been furnished to him by a Captain Alabaster, and from which I immediately recognised that his was the party that the Maoris informed us had visited the Lake with a cutter, and which I believe was the first vessel of any kind that ever entered the Kaduku river. The short verbal account he gave of the country is in every respect clear and trustworthy. Above the point where we left the dingy on the Kakapo River, we observed no tracks of any one, until within a few miles of the Pass Creek, when we saw a camping place about six months old beside a prospect hole; and a little further on we saw the fresh tracks of two men and a small dog,

who seem to have come down the river for a short distance and turned back again, about three days previous to our passing. We stumbled on the same tracks repeatedly as far as the height of land, but there lost them, as the men appear to have kept up on the range to the West, without descending to the Greenstone Valley.

The Secretary of the Gold Fields has also placed in my hands a sketch map of the same country, which in all the main features is very correct, 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.

Until I finally return with the schooner, and have had leisure to examine the collections, I shall refrain from giving any particular account of the Geology of the Western district, but I may mention that the indications are much more favorable for the occurrence of valuable mineral lodes, than in any of the country more to the Eastward; and it is not improbable that a belt of mineral ground similar to that which occurs in the Province of Nelson, may also be found at various points along the Coast. Although the gold-bearing rocks are to be met with at various points, I do not expect that any extensive auriferous deposits will be worked in the district I have examined, as the physical structure of the country is widely different from that of any gold-producing country I am acquainted with. The district, however, which holds out most promise, will be in the neighborhood of the Waiuna Valley, and perhaps for some distance north and south of it, among the lower ranges which lie between the sea coast and the lofty mountains.

During the whole time of the Expedition, meteorological observations have been regularly made, and are still being continued at six-hourly intervals by my assistant, Mr Williams, so that there will exist abundant materials for making a comparison of the climate of the East and West Coast for the period during which we have been out.

So far as they have gone, the following abstract of these observations tends to show that, with nearly the same atmospheric pressure as on the East Coast, the mean temperature on the West is considerably higher and without such an excess of moisture in the air as might reasonably have been expected:—

May to September, 1863.	Dunedin.	West Coast.
Mean atmospheric pressure	29.889 ..	29.879 inches
Mean temperature of air	44.1 ..	49.3 Fah.
Mean amount of moisture - Sat. = 100 ...	68 2 ..	73.7
Mean elastic force of vapour	.232 ..	.238 inches

A large collection has been formed of rock and mineral specimens, birds and marine animals, and of the various kinds and qualities of the timber found on the coast.

The season was unfavorable for making botanical collections; but I now take back with me Mr Buchanan, the botanical collector for the survey, and during the next few spring months, I have no doubt a most valuable and exhaustive gathering will be made.

I have the honor to be,
Sir,
Your obedient servant,
JAMES HECTOR,
Provincial Geologist.

NARRATIVE REFERRED TO.

On the 20th March last, I represented to his Honor the Superintendent, that I was desirous of extending the Geological Survey of this Province, which is in progress 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 the necessary arrangements were placed under the care of the Harbor Master Captain Thomson, and with his approval a schooner-rigged yacht called the Matilda Hayes of 20 tons register was selected for the service. This small craft was chosen in preference to a vessel of larger size, as it would be more manageable in the intricate Sounds on the West Coast, and in case of necessity could be easily towed, or even pulled with sweeps.

The date fixed for the starting of the expedition was the 7th of May, by which time the yacht was thoroughly refitted at Port Chalmers, and her limited accommodation turned to such good account, that she was able to carry without crowding—nine persons with provisions for five or six months.

A light whale boat was also built for the service at Port Chalmers, twenty-one feet in length, so that it could be taken on the deck of the schooner. In order to render this boat more secure, it was fitted up with airtight metallic casings, and a cork stuffed fender around the gunwale, in the same manner as a life-boat.

Various causes delayed the completion of the outfit until Saturday, the 16th day of May

when the skipper, Mr. John Falconer, brought the yacht up to Dunedin with her crew and stores aboard, and on the Monday following the various instruments were placed in her, and in the afternoon of that day she was visited by His Honor the Superintendent and other gentlemen interested in the success of the Expedition, and immediately afterwards left her moorings, but could not drop down the harbor until the morning tide.

May 19th.

Further delays prevented us from starting until this day at noon, when unfortunately we got the flood tide against us, with only a light southerly breeze in our favor, so that it was 5 p.m. when we reached the Heads, where we anchored just within the bar. Captain Thomson piloted us down thus far, in order to assure himself that everything was in proper working order, and we were also accompanied so far by Mr. Mansford, the Resident Magistrate of the Port. We had a pleasant though tedious sail, and when our visitors left us, we fired a parting gun, and exchanged three hearty cheers for the success of the Expedition. The voyage round to the Bluff had few incidents worthy of record. On the evening of the 20th May, we sailed from Otago Heads with a fair breeze from the N.E., but it died away during the night, and till the evening of the 24th we drifted slowly along with only light but favorable 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. The long swell which at all times rolls up from the south caused the only drawback to our enjoyment, as it pitched the little vessel most unmercifully. 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 1¼ miles 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 ¼ mile per hour.

When anchored in the channel within the bar at the Heads, the current was found to run at the rate of 2¼ knots per hour alternately with the ebb and flood tides, and the temperature of the ebbing waters to be 1 deg. Fah. lower than that of the flood, this difference being constant both with day and night tides, the ebb being 50 deg. and the flood 51 deg. When 6 or 7 miles from land the temperature was, however, constantly 51 deg.

On the evening of the 23rd we were off the Molyneux Bay, and during the night we showed lights just in time to escape being run down by the s.s. City of Hobart.

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 Tautawku Bay, ready to take shelter in any of the snug little anchorages that occur along this coast, in the event of the wind drawing through Foveaux Straits from the westward.

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 (greenstones, porphyritic conglomerates, and felspathic sandstones, most probably, judging from previous observations in the interior) dipping to the N.E., with from 12° to 20° inclination to the horizon. At Long Point, however, these strata form a lofty scarp, which is continued westward into the interior and forms the northern boundary of a valley, which is apparently of some extent. And, south-west of this, the coast has a less bold character and presents a greater extent of available land contiguous with the shore.

This district much resembles Moeraki, excepting that the woods, which from the sea look extremely dense and scrubby, everywhere come close down to the beach. Nevertheless, this must ultimately become a valuable portion of the Province, as it is well suited for small settlements situated by the little harbors, which are numerous along the coast, and round which there are generally good sized patches of flat alluvial land.

When off Long Point in the afternoon, and just as we were losing sight of the Nuggets those curious pinnacles of rock became thrown up above the horizon to a considerable altitude by refraction. There was a dull haze over the sea at this time, and the amount of moisture in the air was its usual fine weather average of sixty per cent, so that the refracting medium was probably a local belt of moister air caused by the mixing of the air currents from either side of Stewart's Island. This remarkable mirage, it is remarked in the N.Z. Pilot, usually affects the outline of the islands at the eastern extremity of Foveaux Straits before the setting in of an easterly wind, and it proved to be a sure precursor in this instance, for at midnight a fresh breeze sprung up from that quarter. This was so favorable an opportunity for getting well through the Straits that I abandoned the intention I had of examining Waikawa Harbour and sailed on for Riverton, but when opposite the Bluff, the wind began to change to the S.W, so that we had to run into that harbour, where we anchored at 1 p.m. on the 25th.

As the schooner might perhaps have been delayed here for some days, I at once landed in order to proceed to Riverton without delay by way of Invercargill, that I might lose no time in engaging the services of a native crew to accompany the Expedition in one of their large sealing yawls of about five tons burthen.

Without entering the inner basin of the Bluff Harbour, we had dropt anchor just

within the Pilot Station at Starling Point, where there is the best shelter from westerly winds. From this point it is nearly a mile's pull to the site of the township where there are a couple of Inns, a Court House, and a few Stores.

Putting up for the night at the Eagle Hotel, I met there with Mr Lyel, who had just returned from a fortnight's residence on Dog Island, a rocky islet lying about four miles from the entrance to the harbor, upon which the Government intend to place a lighthouse to assist the navigation of Foveaux Straits. He had been examining the rock of which it is composed, with a view to using it in the construction of the lower part of the tower. From the specimens he showed me, it is a compact greenstone, consisting of an intimate and rarely granular mixture of felspar and hornblende, occasionally with masses of amorphous quartz dispersed through it. The proneness to disintegrate under the action of the weather, and its irregular cleavage, generally render this rock an inferior building material.

26th May.

After an early breakfast on mutton bird, a disagreeable Maori delicacy which I tasted for the first time, I ascended the Bluff Hill, along with several other gentlemen. The rise is over a succession of steps, each of which marks a change in the mineral constitution of the rock. The first step, on a level with the Court House, is composed of highly siliceous felstones of a dark grey color, horny lustre, and splintery fracture forming thick vertical laminæ that trend W. 36°. N. The second step which is covered with flax and low scrub consists of dark greenish grey syenitic gneiss distinctly tabular, the greater cleavage planes being nearly vertical, and having also the above strike or trend. This rock is traversed by veins of crystalline hornblende rock, and also by injected veins of fine grained granite. The third step consists of felspathic gneiss, *i.e.*, containing an excess of felspar of a pale flesh color. The fourth is hornblendic like the second. At the summit the rock is more granitic than elsewhere, and contains a little mica as well as hornblende dispersed through it. It is, however, obscurely laminated in the same direction as the previously mentioned rocks, and must, therefore, be considered as a true gneiss. The height of the Bluff Hill, as given in the Admiralty Chart, is 860 feet, and as it commands a splendid view both of the Straits and the inferior, it is admirably adapted for the signal station which has been placed there. It would form a most desirable Meteorological Station, as the register could be kept by the signal man, and the results could not fail to be of great interest and utility. The wood which clothes the seaward face of the hill is principally manuka when high up, but there is mixed bush towards the water's edge. The low scrub which clothes the open portions is principally a small eurybia, a dwarf manuka or tea tree, that is in full flower, also a low gaulthria, and shrub specimens of the same, both covered with berries, and a low dracophyllum or shrub heath. The general appearance of the vegetation with the huge bunches of Maori grass, reminded me of the faces presented at an altitude of 2,000 feet, in the mountains to the north. Notwithstanding the season, the sand flies are very troublesome, especially at the top of the hill.

At 11, I started with Cobb's coach for Invercargill. The road follows the beach round the head of the bay, sometimes passing through the sea, and is therefore only passable when the tide is nearly half way out. A new road is in an advanced state, however, but as it is cut through heavy bush, and not yet metalled, it is too soft for present use. The strata exposed along the shore are vertical greenstone slates and felstones. At the head of the bay, where the road crosses over a low divide to reach the Mokomoko, the rock is indurated clay stone. To this point, it is proposed to make a railway as the first part of a line to the Bluff, the immediate purpose being to carry road metal up to Invercargill, this being the nearest place to the town where hard rock crops out.

From the Mokomoko, the road follows along the estuary of the Oreti or New River, which has only a narrow channel at low water where extensive mud-flats are exposed along its banks. The beach is very hard and firm, excepting where streamlets cross it, and at these the horses have always heavy work. This road is very dangerous for a driver not well acquainted with it, as after dark, or in foggy weather, and especially if the tide is up, it becomes very difficult to keep in the right direction.

I was informed that, on the arrival of the last English Mail, in April last, it was despatched immediately, though after dark, from the Bluff to Invercargill, but the driver, missing his way when traversing these flats, mired his horses and had to unload on a spot far from the bank of the river. When the tide rose, it scattered the boxes over the mud flats and they were only picked up after great searching, and some of course quite saturated. The terraces along the New River estuary, and I suppose all the low plains to the eastward, are composed of fine quartz gravel and sand. This plain is marked by ridges, which doubtless indicate the successive channels which were formed by the Mataura and Oreti rivers at the time they poured their waters into an extension of the present bay prior to the last elevation of the land.

The lowest land is everywhere very peaty on the surface, as shewn by the deep porter colour of the water in the drains. The roads are very bad at present, being only gravelled

over, a mud foundation, and not macadamised. The drive from the Bluff to Invercargill occupied 4¾ hours, the distance being a little over 20 miles. Horses are changed at the Mokomoko.

At this time the streets of Southland capital quite rival the state of those in Dunedin in its muddiest days of last winter. Previously they were remarkable for their dryness and firmness under foot, but they were mere gravel walks quite unable to carry the increase of traffic which has been suddenly thrown upon them since the discovery of the Wakatip Lake diggings. Being built on a high terrace on a clearing still surrounded by heavy bush, and from having wide rectangular streets, it reminded me greatly of some of the young thriving towns of the Western States of America.

While I remained at Invercargill for the two following days, I had much interesting conversation with the Superintendent, Dr Menzies, and with Mr Heale the Chief Surveyor, respecting the many important public works in prospect, such as tramways to the North, the railway to the Bluff, telegraphs, water and harbor works. Opinion seems much divided as to whether the Bluff or the New River will be most easily converted into a good seaport for large vessels.

It appears that the Bluff has many serious defects which it will be difficult to remedy, otherwise I could hardly conceive how a bar river port could ever compete with it.

27th May.—Being very kindly supplied with one of the horses from the Survey Department, I started at 1 p.m. for Riverton, having completed my business in Invercargill. After a few miles the road strikes through the bush, and is only a narrow "corduroy" track in bad repair, forming the very worst bit of made road I ever took a horse along. There is, however, a good road to Riverton, but it involves a circuitous route by Wallace Town. After about four miles, the track emerges on a swampy plain that extends to the Oreti River—successive concentric reaches of very dense thicket bounding it to the Eastward, All this plain may one day be easily drained, and will form very valuable land, equalling that of Inch Clutha.

The Oreti, which is crossed by an incredibly slowly-moving punt, worked with a chain, is a deep sluggish stream in this part of its course, resembling a canal in appearance, and might doubtless be used as one. After passing for a couple of miles over broken sandy hills, the track leads out on a splendid hard beach that extends for ten miles, and ends only at the mouth of Jacob's River.

This beach, which is composed of quartzose and felspathic sand, has a very gentle slope, so that a heavy surf rolls in with the slightest swell.

The remains of three wrecks are on the shore here; but as one of them—a large brig, which has been driven ashore in a very exposed position—has been able to withstand the surf for two years, this would seem to indicate that it has not much power to break her up. On arriving at Riverton, I found the Yacht just entering the harbor, having crossed the bar in the forenoon.

She lay in the Bluff Harbor, where I left her on the 25th, until the morning of the 27th, during which time there were fresh Westerly winds. On that morning she left at 7 a.m., with a light breeze from the N.E., and reached this place in ten hours.

The pilot came on board at once, and remained in charge of her during the night. When she crossed the bar this morning, in 8 feet water, it was quite quiet, the wind being light from the northward.

I lost no time in delivering my credentials to Messrs Surman and Crerar, to whom Captain Thomson had previously written respecting the engaging of a Maori crew. I found that nothing had been done, as all the Natives were away mutton-birding on the Islands in the Straits. The mutton-bird (Tee-te) is a species of puffin that builds in holes in sandbanks on sea-girt islands. They are very fat and rich, and greatly prized as food by the Maoris, who preserve them in great numbers by salting and smoking them, trading any surplus they obtain, beyond what is necessary for their own consumption, to the Natives further to the northwards, in which case they are packed in bags made of kelp. The mutton-bird harvest is therefore of great importance to them, and the first party of Natives here only just returned from it, reporting that they had this year been very unsuccessful, and that the remainder of those belonging to this Kaiyk would arrive in a few days. As this deficient harvest of mutton-birds would render them anxious to proceed to the West Coast for the sake of getting seals, I anticipated no difficulty in getting a crew.

As nothing further could be done for some days, I was able to avail myself of the offer of Mr Francis, of the Te Anau Lake, to accompany me on a visit to the limestone caves on the Waiau River, and having left directions with the skipper regarding the work to be done during my absence, I started with that gentleman in the afternoon of the 28th May. We followed the north road, which is in process of construction to the Wakatip Lake, and which joins that from Invercargill at the elbow of New River. As it rained heavily, the road was soft, but there did not appear to be much traffic upon it at present After passing over twelve miles of fine rolling country, dotted with clumps of bush, and having the extensive forests of the Longwood Range at a short distance to the west, we reached Dr. Hodgkinson's shortly after dark, and remained his guest for the night.

The soil in this district is of a good quality, being formed by the decomposition of basalt and limestone, both of which rocks crop out along the base of the Longwood Range.

The limestone is the same impure sandy deposit which forms the upper member of the older tertiary series in the Oamaru district, to which this country bears a strong resemblance, excepting that it is both better wooded and enjoys a moister climate.

The basalt which overlies the tertiary limestone is of a light bluish grey color, and contains zeolite crystals, and cavities filled with earthy chlorite.

On the 29th we continued to skirt the Longwood Range for nine miles, crossing low irregular spurs, that are terraced towards the valley of the Aparima (Jacob's River), and which appear to consist of dark sandy clays, capped by a stratum of limestone. These strata have often a considerable dip, which varies irregularly in its direction, probably resulting from disturbances during the protrusion of the basalts of the Longwood Range.

We crossed that range of hills by a low saddle, called Raymond's Gap—the highest point passed over being about 270 feet above the level of the sea. The country continues everywhere well adapted for settlement, as the soil is rich, and the hills are clothed with abundance of good timber. We had left the North Road at the Orantau River, a few miles after starting, and since then had followed a very good bridle track, which, however, it would be an expensive work to convert into a dray road, as there are a great many creeks to be bridged.

Soon after, striking a stream that flows to the Waiau River, we reached Mr. Austin's station. After dinner, that gentleman kindly volunteered to guide us to the Waiau River, as there were many bad creeks in the way, the crossing places of which were difficult to find. In the deeply cut channels which traverse this district, the flats are seen to be composed of brown ferrugenous clay shale, like that at Moeraki, covered by a reddish friable loam. After crossing a range of low, smoothly rounded hills, we reached the valley of the Orawea River, which is remarkable for its fine pasturage. At a few miles distance from the north the limestone strata were observed to form a range of hills, scarped towards the Takitimo Mountains, and the strata dipping at a high angle towards the S.W. Between these hills and the higher mountains, I am informed that brown coal has been discovered, so that it is very probable that we here have the same succession of formations as occur from the Kakanui Mountains, N.W., towards the coast of Moeraki. The Limestone Range trends round to the west, so that after rising from the river in that direction, we traversed it in the direction of the strike of the strata in following down the limestone gorge to the Waiau River, where we arrived at sunset. The limestone here dips to N. 25° W. at 20°.

The Waiau is a fine clear mountain stream, bounded by extensive terraced plains of shingle, the records of Lake action at successive levels during the slow erosion by the river by the run of limestone, which at one time crossed the valley, and which now forms a picturesque cliff on each side. Turning to the right for a couple of miles, across a level grassy terrace, on which there remain several clumps of bush, we reached Mr. Cuthbertson's station, where we were hospitably received.

The next day was stormy, with rain, and occasionally showers of snow, so that we could not make our proposed examination of the caves. In the afternoon, a short lull enabled me to examine the terraces that skirt the river, and by a rough measurement and levelling I found, as I conjectured would prove to be the case, that they were formed by the river erosion of a pre-existing deposit, the surface of which had a more regular and gentle slope.

Early on the morning of the 31st, we crossed the Waiau River to Mr. Atkins' station, which is, therefore, in the Province of Otago, as this river forms the western limit of Southland.

The swift current of this river, especially when flooded, renders it necessary to use great caution in crossing; and already, I am told, there has been one fatal accident. There is nothing, however, to prevent a proper skow-punt, running on a strong wire rope, being placed at this place, if it were necessary. Its width is about 130 yards. In the limestone cliffs I found sufficiently distinct fragments of fossils to enable me to identify their strata as being of the same age and relative position as the upper tertiary limestones of Oamaru and Caversham, which is probably a deposit analagous to the white crag of the English tertiaries.

It is an impure sandy deposit, consisting really of fragments and debris of shells, cemented along with a varying proportion of quartzose sand, and sometimes containing a large quantity of argillaceous matter. This rock, in some cases only, sets hard like a mortar upon being exposed to the air as a surface, or to the percolation of water in lines of fissure.

This causes it to weather very unequally, so as to form ruinous cliffs and broken precipices, which, when grouped with dark green foliage, as along the Waiau River, gives rise to the strikingly picturesque scenery peculiar to this formation.

In following up the valley of the river, the limestone was found to be overlaid by a series of marls, ferrugenous sands, and clay, contain-

ing fossils of a decidedly esturine character. Re-crossing the river, a party of six of us, provided with candles and a rope, explored the caves opening from the limestone gorge.

This gorge is about 180 feet deep, and the caves, of which there are five or six, open from the base of the northern slope, and descend with the dip of the strata.

They are mere fissures, but of very ancient date, having been in many cases filled from above by the same shingle that forms the overlying terraces. From one of them we obtained some fine semi-transparent stalactites, composed of crystallized carbonate of lime; but without a more searching examination I saw that there was no chance of discovering any remains of the Moa and its allies; but as these caves resemble in their structure many of the bone-yielding caverns of Europe, and in the fact of their having been filled by the washing in of superficial deposits of late tertiary age, there is every probability that a proper search would be rewarded by interesting discoveries.

Along the limestone ranges which bound the shingle plains, immense rifts in the soil, of unknown depth, are frequently seen by the shepherds, and in which sheep are often lost. These fissures are indeed so frequent as to render it dangerous to ride over the country after stock, though as yet no accidents have occurred.

Starting in the evening, we reached Mr. Aylmer's station, on the Wairaki River, by moonlight. The air was very clear, and sharp frost set in—this sudden change in the weather indicating the upland character of the climate in consequence of the vicinity of the mountains, although its actual elevation can hardly exceed 500 feet above the sea level. Next morning we found it very cold work riding, as the frost was severe. The track crosses a succession of terraced hills, keeping at some distance back from the Waiou River, which here passes through a narrow ravine. The structure of the country is everywhere concealed by heavy deposits of well rounded shingle, principally the debris of syenitic rocks. The edges of the terraces are very steep, and the intervening valleys are occupied by swampy morasses that will give trouble in constructing a road in this direction. This broken country, which is valuable for pasturage, stretches right to the base of the Takitimo Mountains, which lie about five miles to the east of the track.

At noon we reached Mr. Ligar's station, which lies in a valley at the base of a high precipitate scarp of conglomerate, called Cabbage-tree Hill, which rises over 1000 feet above the level of the creek. These conglomerate strata, which probably belong to the lower carbonaceous group of rocks, appear to be highly disturbed, but I did not inspect them closely.

In the stream I found beds of indurated clay shale, with iron-stone; nodules also similarly disturbed, and I was told that a short distance below the station the stream flows over blue slate, with quartz veins, containing iron pyrites, and in the neighborhood of which gold in small quantities has been obtained. From Ligar's the track rises 700 feet up what is called the Big Hill, to the level of a high terrace, indicating that the level of the plains surrounding the Takitimo Mountains has been about 1700 feet lower than now, prior to the denudation of the great valley of the Waiau, during the gradual rise of the land at later tertiary times. This terrace at once recalled the appearance of the high plains which lies between the head of Shag Valley and the Upper Taieri Plains, and which is a similar altitude. In this case, however, the shingle of which the terrace is composed is principally syenitic gneiss, with fragments of hornblendic rock like that which occurs at the Bluff, whereas in the latter case the superficial deposits consist of felspatic clays and subangular shingle, derived from the chloretic and micaceous schists, which there form the predominating formation. From this elevated terrace a full view is obtained of the Te Anau basin, which is bounded by the Greenstone Mountains to the N., by the Eyre Mountains and Takitimo on the E., and by the Okaka Ranges to the W., which latter forms the portion of the Southern Alps which is so cut up by the sounds of the West Coast.

The Te Anau and Manapora Lakes occupy only a small portion of this large basin, which is drained mainly by the Waiou River; but the Oreti, which passes Invercargill, also rises within its north-east corner, as it flows at first in close proximity to the Mariroa River, the principal tributary of the Waiau being separated from it only by a few miles of level straith.

The whole area of the basin is occupied by terraces, the steps of which descend successively towards the Lakes, but every torrent and stream have cut deep ravines into the incoherent materials composing them. In many sections, however, which are thus obtained, the terracing is observed to be merely a superficial form given to stratified deposits of more ancient date, covered by a thin coating of shingle. These deposits consist of blue and chocolate colored clays, with ferrugenous bands and modulated masses, which lie at various angles, and are probably of an early tertiary age. The floor of the basin is of a dark syenitic gneiss, which occasionally appears as the level of the lake as smooth rounded bosses.

The re-descent from the high terrace to the level of the Waiau is as abrupt as the ascent from Ligar's. After following that river for a few miles we again ascended to the higher plains and skirted the flank of Takitimo Mountains, upon which there is good pasture, although of a character that indicates that the climate is dry and resembles that of the plains in the interior and northern part of the Province. On the slope of the mountains there is a good growth of birch forest, but no other kind of bush appears to grow in this district. At Mr. Gillow's station, where we passed the night, I was informed that the winter is often very severe on these plains, and that night frosts in the summer months are so common that the raising of garden crops is precarious. On the 3rd of June we at first skirted the left side of the Mariroa River, on the opposite side of which there are high cliffs of stratified clay capped by a stratum of coarse shingle and large angular blocks of rock. We then crossed over a northern spur of the Takitimo, which is partly composed of a tuffaceous conglomerate enclosing fragments of basalt and dark colored slate. These conglomerates are associated with clay shales, which are finely terminated, and contain regular layers of clay iron-stone from two to six inches in thickness, containing fragments of fossilized vegetable matter and streaks of coal, but no distinct fossils were observed. In some places these strata are traversed by veins of white calcined spar. At the highest part of the saddle, over which the track passes, we left our horses and ascended a spur of Mount Hamilton for 3000 feet, crossing strata of conglomerate and coarse sandstone, which lie at a high angle, and passing under the shales just described, but resting against the blue slates of which the Takitimo Mountains are principally composed. We have, therefore, the same succession of strata occurring as that displayed on the northern flank of the Kakanui Ranges, so that the better qualities of brown coal may be expected to occur in this district towards the base of the conglomerate formation.

From the peak which we reached we had a splendid view of the Manipora and Te Anau Lakes, with their long sinuous arms penetrating far into the recesses of the gloomy looking mountains to the westward. After returning to our horses we followed down a branch of the Oreti to the eastward. The change in the vegetation on this slope is very marked, the fine nutritious grasses that clothe the terraces of Te Anau basin giving place to the coarse red snow grass, which grows in large bunches, leaving the soil bare between them, or only sparsely covered with tufts of the large leaved *celinesia*, or cotton grass, being an indication that the snow water lodges a long time on the surface during the spring months.

I am familiar with the varied aspects of the vegetation throughout the Province on different exposures and different altitudes, but as I have never seen the change so abruptly marked as here, where there is only a slight physical barrier, I am inclined to attribute it mainly to a change in the nature of the soil consequent on the presence of a superficial drift, which covers a great part of the southern extremity of the Island, but has not extended into the inland basins, the formation of which was accomplished at a later date. This drift is well displayed in the sections along the creeks, which have cut deep channels through the terrace plains. It is of a dull red colour, and consists of stiff clay mixed with large boulders of the synite and conglomerate rocks, the clay having been derived from the terminated shales on which it rests. On reaching the Oreti River, which is bounded on the east by a formal terrace 170 feet in height, we learned that some diggers had been washing for gold on the opposite slope, in a gully descending from the Eyre Mountains, but that they had not obtained any large quantity. I have not as yet seen any trace of the foliated and quartziferous schists to the south and west of the Wakatipu Lake, but it is not improbable that they may reappear on the southern flanks of the Eyre Mountains, in which case gold may be expected to occur.

Proceeding southwards from the Oreti we crossed the low hills that bound the plains, in order to reach the valley of the Aparima. These hills consist of the same conglomerate sandstones and shales as at Mount Hamilton, and which still preserve their high dip and W.N.W. strike. Against them, to the south, I believe the limestone strata dip at a low angle and contain abundance of their characteristic fossils. The structure of the country to the south is concealed by heavy superficial deposits of clay and gravel, to understand which would require a minute examination, and would no doubt throw great light on the later tertiary geology of this extremity of the island.

I returned to Riverton early on the 5th June, and finding that the Maoris had arrived on the previous day, with the kind assistance of Captain Howell, succeeded in engaging a crew of eight men to accompany my expedition, on the understanding that they were allowed to go as far north as Jackson's Bay, and there leave two of their number who wished to return to their native district. They were also to be allowed to hunt seals for their own profit at any time when I did not require their services. I moreover engaged a native seaman named Henry, who was strongly recommended as being well acquainted with the West Coast, and from having made several voyages to California and elsewhere in whaling vessels, was able to act as one of the yacht's crew.

I was detained in Riverton, bargaining with the Maoris and by other delays, until the

11th of June, but no time had really been lost, as since the morning that the schooner arrived from the Bluff the wind had remained steadily from the westward, and therefore adverse to our further progress through the Straits. The few days since my return from the side trip to the Manipori district were employed in examining the structure of the Puripurikeeno Valley and that of Howell's Point, which is the first promontory westward from Jacob's River. The Puripurikeeno is a branch of the Aparima, which takes its rise in the Longwood range of hills, and flows through rich rolling country, bordered sometimes by grassy downs and sometimes overhung by dense forests of birch, remu, miro, and other trees.

This stream is deep, and seven miles from its mouth is thirty yards wide; above this point it became blocked by fallen trees. A short distance above its confluence with the Aparima it is confined for three-quarters of a mile to a rocky channel eighty yards in width, through which the tide flows and ebbs with great violence, as above this strait there is a large expanse or tidal lake which is mainly dry at low water. The rock at the Narrows is a felstone and porphyritic conglomerate, the former of which, in some places, is decomposed into a soft yellow clay-stone. The soil derived from these rocks supports a dense growth of large sized manuka. The downs which skirt the river higher up are composed of stiff blue clay, sometimes a notable quantity of iron. This clay deposit forms steep overhanging cliffs 8 to 10 feet in height; just below the series so characterestic of the boulder clay in Scotland. This clay abounds in fossil marine shells, which are, however, badly preserved. They were principally—

Saxicara.
Pecten.
Tapes.
Pectuncules.

Also, fragments of fossilized leaves and carbonaceous matter. It is evidently a very recent tertiary deposit.

These felspathic rocks extend to Howell's Point, where they are well displayed along the sea coast. The ridge to the westward of the Aponeno appears to be wholly composed of this rock, and it is probably an outlier that has survived denudation, of a formation that occupied great extent of surface in pre-tertiary times, and in its classification should be perhaps grouped with the hornblendic gneiss and granites of the Bluff.

As exposed along the coast, the formation presents several marked varieties of rock. There is a compact tabular greenstone, which passes into a conglomerate made up of angular fragments of brown or greenish porphyry, cemented by a matrix of porphyritic greenstone, which contains crystals of hornblende. Also, a smooth-grained rock of a pea green color, with a porcelain-like fracture. There are also both basic and highly silicious felstones, but the prevailing rock is the fine grained greenstone. The same formation was met with at the Nuggets, to the South of the Clutha. The woods along the coast from Howell's Point are infested by immense herds of pigs, some of which are of enormous size; but I am told their flesh is very unsavory, as they feed principally upon seaweed and offal that is cast upon the shore. On the morning of the 11th, we dropped down to the mouth of the river, but finding that the bar was breaking too heavily for us to cross, we anchored just within it. A large three-masted schooner, the Pearl, was lying close to us a sorry plight; jammed hard and fast upon the rocks and full of water to the hatches. She is the first large vessel that has entered the port, and she accomplished it safely, but after being at anchor in the stream, got ashore when they were trying to shift her position.

Riverton Harbor 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. The best way to make the Harbor available, would be to throw a bridge or continue the present jetty across to the opposite side, where there is a deep pool with from 15 to 30 feet, close alongside the rocks where a wharf might be built at small expense, and besides which vessels would lie sheltered from the current. At 9 a.m. on the 12th June we crossed the bar, just at full tide, the depth of water being 7½ feet. It was rather ticklish work, as we had only a very light wind off shore and a heavy swell dead against us.

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 or Stewart's Island, there to await the first easterly breeze we might have, having arranged with the Maoris that they should also seize the first chance of getting to Preservation Inlet, and if first, to await the arrival of the packet. As the tide was on the ebb, the current was setting through the Straits from the eastward, and against the wind, causing a high and dangerous sea way for a small vessel. The schooner, however, behaved admirably; several seas struck her with great force, and broke over her with a crash that seemed to stagger her, drenching all who were on deck, but nothing gave way, and she recovered at once. The wind being right a-beam, we made a good run, although close reefed for most of the way, reaching Saddle Point—which is the N.W. point of Stewart's Island—at 2.40; having crossed Foveaux Straits from Howell's Point, a distance of 23 miles, in less than three hours.

On getting under the lee of Stewart's Island, the wind failed us, so that we crept along very slowly, and at last had to lower the boat and tow into Port William, where we anchored at 6 p.m., and long after dark. However, Henry—the Maori I had engaged at Riverton—took us in without difficulty.

From Saddle Point—which is a remarkable promontory forming the termination of a long spur leading from Mount Anglem, south-east to Port William—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. With daylight next morning, we found that there were five vessels in the harbor, wind-bound, three of them having been there for a long time. One schooner bound for Hobart Town, had left Riverton by the same tide that we entered that port with, and as yet had got no further on her voyage, as ever since the weather had been steadily from the westward.

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. During this time we had a violent storm from the W. and S.W. On the night of the 14th it blew such a gale that, although under the shelter of high land, we had to pay out 60 fathoms of chain in 5 fathoms of water, and lay down a second anchor; while the schooner which lay next to us dragged her anchor for nearly a quarter of a mile.

The Barometer fell steadily during the gale, but not lower than 29·70 inches. Towards its close it became bitterly cold, with showers of hail and sleet, so that we went on shore and lighted a large fire, as also did the crews of the other vessels. At midnight, on the 14th, the wind veered to the south, with a fall of snow, which ended the storm. Port William is a very favorite harbor for vessels waiting for easterly winds, and was at one time a whaling station of some importance. There are also the remains of a Native village, but the place is now quite deserted, and all the spots, which had been cleared in former days, densely overgrown with brushwood.

The entrance of the harbor, lying between the East and West Heads, is one mile and a-half wide; but within, it is divided into two capacious bays, separated by an obtuse promontory. It was in the north-west of these bays that we anchored, as there the best shelter is obtained, and in it a small vessel can get into a perfectly land-locked position. Round the shore the scrub is almost impenetrable, but the hill sides—which rise steeply—are clothed with a more open forest growth, consisting principally of remu or red pine, iron wood and carmalie. The scrub close to the water's edge is principally of a remarkable shrub, which I have only previously seen on Howell's Point, but is abundant on the West Coast, called by the Maoris Some of its leaves, which are bright polished green on the upper side, and covered with white down on the lower, and have a tough leathery texture, measure 7 x 5½ inches.

At the northern extremity of the harbor (where the whaling station was situated), there is small extent of level land, and also by the old Maori village, on the western side of the Bay, there is a sandy beach and small boat harbor, with a few hundred acres of bush land in a narrow valley. A similar, though smaller, patch of land also occurs towards the south end of the harbor; but elsewhere the shores are rocky and precipitous.

The rock is a coarse grained red or grey granite, which being traversed by veins of granite of more recent date and a lighter color, and afterwards pierced and shattered by dykes and injected veins of hornblendic trap or greenstone. Most interesting sections abound, clearly displaying the facility with which the trap rock has penetrated the granite in all directions, most probably however, only following and expanding previously existing lines of fissure.

No minerals of interest or value were observed, although several might reasonably be expected to occur in this formation under the above conditions.

On the beach of one small cove that is surrounded by lofty cliffs and situated in the north bay of the Harbor, the sand is almost wholly of magnetic oxide of iron, in a very minute state of division, but neither gold nor tin was associated with it. The hollows between the ridges and bosses of granite are filled up with an unstratified deposit of stiff yellow clay, containing sub-angular boulders of large size.

The dredging was very unsuccessful, as the bottom of the harbor is everywhere sandy, or covered with sea-grass and kelp, so that the many casts which were made in from 4 to 14 fathoms soundings were only rewarded with a species of spider and hermit crabs, the latter inhabiting the white shells of small species of mollusk of the genus Triton.

There being nothing further to be seen at Port William, we sailed round on the the 15th to Paterson's Inlet with a light N.W. breeze; feeling confident that this additional distance to the S.E., of 8 or 10 miles, would make very little difference in the time of our run to Preservation Inlet, if we only had a fine breeze from that quarter. Before reaching Paterson's Inlet, we passed Horse Shoe and Half Moon Bays; both snug and beautiful spots. On the south side of the latter bay, close to Aker's Point, there is a small group of houses, which is the fish-curing establishment of Mr. Hoslett, I am informed. To the seaward,

there is a cluster of small wooded islands; on one of which I also observed a few houses.

We entered the Inlet at 4 p.m., but owing to the absence of wind and a slight tide against us, it was after sunset before we reached the anchorage in Glory Cove. No one on board had ever been in the place before; but we groped our way, even after dark, without difficulty, by the aid of the Admiralty Chart.

As the sky, on the morning of the 16th, at last gave promise of an easterly wind, I landed early to examine the shores of the beautiful little harbor in which we lay, and which, according to the New Zealand Pilot, is the most snug and accessible of the many five harbors contained within Paterson's Inlet.

It is completely land-locked, and on one side has a sandy beach, with deep water and fine mud bottom a short distance from the shore; while on the opposite side, low rocky banks overhang 16 to 20 feet depth of water, forming almost a natural wharf. The rock is everywhere a coarse grained red granite, which decomposes easily and forms a rough sandy clay or *laterite*.

This granite is singular for containing nodules of a compact fine grained variety of granite, so that at a distance it resembles a mechanically-formed rock.

I observed no traces of the greenstone and hornblendic dykes which so abounded at Port William, so that the line of these volcanic rocks is probably limited to the chain of islands that run from that place towards Ruapuke Island.

The hills surrounding the harbor appear, from the water, to be steep and lofty, but this appearance is deceptive, owing to the low scrub which grows next the shore, passing gradually back into the forest growth containing trees of good height. Generally, on scrambling through the first belt of scrub, a sharp rise of 60 feet, brings one on to a comparatively level tract of open forest land. Although I should have liked to examine more of Paterson's Inlet, I was constrained to take advantage of the fine easterly breeze which sprung up early in the afternoon, so that we at once weighed anchor and sailed for Preservation Inlet. Before leaving the harbor, a boat visited us from the Saw Mills, which are situated about five miles up Paterson's Inlet. There are two different establishments, and altogether a little community, comprising nearly a hundred persons. Besides these there are several fishing stations at various parts of the Inlet; and on the Peninsula, that closes it from the eastward there are 16 to 20 houses and a good deal of tilled land, so that there may be altogether a population of about 200 persons in this district.

There is said to be abundance of fine timber, but of the woods I have seen, the greater part consists of red pine and iron wood, the birch or *Fagus* appear to be altogether absent, which is a very remarkable circumstance, as this genus forms the bulk of all the primitive forest on the south and western part of the Middle Island. As we cleared the harbour we sighted the schooner "Wild Wave," from Invercargill, which greatly delighted our visitors, as the population in the Mills had been anxiously expecting her arrival with provisions for a long time, and, indeed, for many days past been reduced to a diet of cockles and wood-hens. When outside we had a fresh breeze from the S.E., before which we sailed along the coast at a great rate, logging eight and a-half knots. On coming abreast of Saddle Point at 3 p.m., the skipper put over the patent log, and took his course for Windsor Point, which is the headland eastward from Preservation Inlet. Before dark we passed the rugged rocks which form the north-west cape of Stewart's Island. These pinnacles of granite rock, rising abruptly from the sea, afford most striking evidence of the tremendous energy with which the waves of the South Seas expend their force on the shore line, levelling mountains and strewing the *debris* over a large submarine area.

As we gradually lost sight of Stewart's Island, it become wreathed in dark tempestuous clouds; while before us, over the valley of the Waiau River, the twilight was clear but lurid. The breeze was rapidly increasing to a gale, and the sea which it raised against the S.W. rollers getting rather too heavy for us. The water was brilliantly illuminated by phosphorescent masses, but we were going too rapidly through the water to attempt to capture any with the tow net in order to examine their nature. At 8 p.m. we had made 42 miles from Saddle Point, and as this left only 26 miles further to run to Windsor Point, at 10·30 the schooner was "hove to" with her head in shore under close reef mainsail, being then, the skipper considered, about 4 miles S.E. of Windsor Point. At dawn on the 17th, after a terrible night of pitching and tossing, the Skipper called me with the disagreeable news that we had drifted during the night further than was anticipated, and that he fancied we were now to the leeward of Preservation Inlet. Moreover, as there was a tremendous sea running, he doubted if we were able to recover the distance we had lost by beating. When daylight came in, this proved to be correct, and we found that we were 11 miles S.W. of the point of land between Chalky and Preservation Inlets. As it would never do to be blown out into the South Seas, the yacht was steered under close reefed canvas as near to the proper course as possible. She behaved well, and rose so lightly on the high waves, that it seemed almost as if they would overwhelm her; the Skipper hauled her closer and closer to

the wind so that we were able at last to enter Chalky Inlet by the south passage after passing between Table Rock and the Balleny Reef, both of which dangers are quite conspicuous in daylight, and form good guides for determining the exact position of a vessel entering either of the two great sounds. When within Gulche's Head, which divides Preservation from Chalky Inlet, we were sheltered from the sea, and only got the wind in flaws. 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 harbor of Southport. As we lay in shore the anchorage, the lead gave 15, 13, 9, 7, fathoms, and then the word "let go" was hardly given, when we were nearly aground in 6ft. water, with a soft mud bottom—having got on to a bank deposited by some small streams which enter the Bay at this place.

The gale continued from the S.E. for several days after this date, but we only saw it as a dense bank of cloud, hurrying rapidly through Foveaux Straits to the westward, while we were enjoying most delightful weather, having clear sunshine during the day, followed by cold bracing nights. In the woods on the north of the ports we found traces of an encampment of not more than a few months' date, where six or eight persons had pitched their tent for several days. They must have been on their return from a long trip, I should think, as they had left old clothes and worn-out boots behind them; likewise a small bag of duck shot, which we appropriated. On the opposite side of the Bay we also found some very old tracks, and the initials P.R. cut on a tree, and at a short distance found carved on a tree, "Ladybird, March, 1862," near which a number of trees had been felled for firewood. Southport, which is so named in contradistinction to Northport, which is on the opposite side of the Inlet, is one and a half miles long, and half a mile wide. It communicates with Chalky Inlet by two channels, one of which is narrow and only suited for boats. The main channel is 200 yards wide, but contains several sunken rocks, and turns off from the Inlet at such an awkward angle that it would be difficult for a large sailing vessel to get into Southport, although, if once in, she could not find a better and more suitable anchorage—the best place being just within the entrance, on the left hand side.

The south end of the port is named Lee Bay, the shore being exposed to the N.W. 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 one and a half miles, I came out on the shore of Preservation Inlet. From here I got Henry to point out the place on Coal Island where the other Maoris would be encamped with their boat, but could receive no indication of their having arrived at the rendezvous. The extent of this level neck of land between the two inlets does not exceed 1000 or 1200 acres in extent; but there is a great deal of the surrounding country that is neither too steep nor too elevated to be turned to account. 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. Two days were spent in examining Southport and the rocky promontory that divides it from the main inlet, and in taking astronomical and magnetic observations. On the 20th June (which, by the way, despite all the delays, was just one month from the time we left Otago Heads,) I started for the examination of the upper part of Chalky Inlet, in the whale boat, taking with me three men and about one week's provisions. Those left in the yacht built a raft for the purpose of communicating with the shore while I had the boat away, but it answered so badly that I determined to have a dingy built the first opportunity that offered. The pull up the Sound was enchanting, the sea being as smooth as glass, the mountain tops sharp and clear, and the afternoon warm as a summer's day. I kept close along the eastern shore, touching whenever a rocky exposure demanded my attention, till I reached Cunaris Sound, which is the eastern of the two arms into which Chalky Inlet is divided at a distance of ten miles from its entrance. I then struck across for the other arm, which is named in the chart Edwardson's Sound. Although the coast is for the most part rock-bound, there are little shingly bays at intervals, on which in fine weather a boat can be hauled up for the night. Between Southport and Cunaris Sound, a distance of six miles, a low range of hills rises from the shore, separated by the valley of the stream which enters Southport from the high mountains that lie between Chalky and Preservation Inlets. The forest which densely covers these hills is principally of black birch, with a sprinkling of remu or red pine, excepting close to the water's edge, where there is an immense variety of evergreen shrubs. The tops of the distant mountains above, and altitude of 3000 feet are, however, quite free from trees, and covered with grass. Further up the Sound, where the mountains are over 5000 feet in

height, and have abrupt and rugged summits, sprinkled with snow, the forest appears to extend to a slightly greater altitude as viewed from the east side of the inlet. The large islands which lie to the east side of the opposite shore, namely Chalky, Passage, and Great Islands, between the latter of which and the main land lies Northport, appear to have gently undulating surfaces elevated from 300 to 600 feet, and of such character that they may ultimately become available for settlement. At three o'clock the sun had set behind the mountains just as we reached the headlands between Cunaris and Edwardson's Sound, and from the precipitous look of both shores, I was beginning to fear that we should require to push on to the head of the Inlet to camp, when I espied a small patch of shingle beach. It was only about twenty yards long, and contained in a nook in the rocks where a stream leaps down from the mountains and deposits of rock torn off in its course. The beach thus formed is very steep, owing no doubt to the tremendous surf which at times breaks on this headland, as it is exposed to the swell which rolls up the Sound from the S.W., so that it was only with great exertion that we managed to haul the boat above tide-mark. The depth of the Sound, close to the shore, is 100 fathoms, and the fact that this heap of shingle, which rises to a vertical height of 30 feet, with a slope of 12 deg., can continue to rest on the brink of such a submarine precipice, shows how feeble is the drawback of the surf to carry and disperse it. Were the land here to be elevated so as to expose the floor of the great valley now occupied by the sea, in order to account for the little terraced heaps of shingle which would then appear to rest on ledges elevated 600 feet, we might be led to suppose that they were the remnants of a deposit which at one time filled the valley from side to side. The true nature, however, of many deposits in the valleys of the interior, resting in similar anomalous positions, was at once made evident to me by this instance. We found an excellent camping place here under an overhanging precipice shrouded with tangled evergreens, that produced a fine effect when lighted up by the glare of our fire. Next morning was clear, sharp, and frosty. As the tide was unusually low, I took the opportunity of searching for the few marine animals that can live on this surf beaten point of rock. Unlike a coast line which is truly exposed to the Ocean, the rocks are rarely encrusted by barnacles, until about half tide-mark, owing (as I afterwards found) to the quantity of fresh water which floats on the surface of the salt water of these Sounds, especially after wet weather. A few of the crisped leaved seaweeds and pink mallipores encrust the pools between tide-marks. But the true kelp is hardly laid bare at all even at lowest tide. An immense limpet, two inches across, a few whelks, chitons, and very minute mussels were all the mollusca that I obtained, and two species of actinia or sea anemone, two species of star fish and a sea urchin, completed the list of marine life. I was particular in observing, because most of the tertiary deposits of the East Coast of the Province must have been formed in rock-bound basins like these Sounds, and I was curious to learn what class of fossils might be expected to occur under such conditions. Coasting along the east side of the sound, the mountains again become lower as we approached its head, and we passed several narrow benches of flat land with shingle beaches, one of which was nearly half a mile long.

The lower part of the Sound is from one and a-half to two miles in width, but it narrows to three-quarters of a mile in the upper part, with the shores sloping to the depth of 60 to 80 fathoms, even where they are not at all high or precipitous above the water line, excepting in a few sheltered bays, where eight or ten fathoms soundings were got. The sea is beautifully clear, and covered by a film of fresh water that gives the surface an oily appearance when mixed with the underlying salt water by the dipping of the oars. At six and even ten fathoms small objects could be seen distinctly, and when fishing at that depth the sport was greater than the mere bobbing of a baited line, as the manœuvering nibbles of the finny dupes could be distinctly seen and taken advantage of. We could also watch an occasional shark, five to six feet in length, swimming about quite unheeded by the more agile fishes, but only waiting till one of them got into trouble, to pounce and secure it for his own especial benefit, and at the expense of our hooks in several instances. Fish of fine quality are very abundant everywhere near the shores of these Sounds, most of them taking the bait readily. They are nearly all of the family of spiny fishes, the sea perch (the cod fish of Dunedin market), the sea bream or snapper, and the trumpeter or kowihowi of the Natives, being the most plentiful. The Sound penetrates quite into the recesses of the mountains, and it is curious that the vegetation assumes a more alpine character, although of course the sea level is preserved. Many of the shrubs that are plentiful lower down the Sound disappear, and the remu is rarely seen on the mountain slopes, which are covered only by sombre birch; however, at the extreme head of the Sound, two rivers enter through a secluded lake, or fresh water basin, and on the banks of these rivers many of the lost shrubs reappear; and strangely enough, some of them, especially the veronicas, were even at this season in flower. Moreover, the red pines along the banks of these rivers excel in healthiness of growth, straightness and length of trunk available for timber, than any of those seen lower down the Sound. Full-grown

trees 60 to 80 feet in height rise to a perfect taper like young plants without a twist in the stem or gnarled branch toindicate rough usage from stormy weather, showing the perfect shelter afforded by this deep mountain valley. Both these rivers reach the sea level by cascades, to the foot of which we easily got in the boat. The river to the north is deep and placid for nearly a mile above its mouth to where it issues from a narrow and gloomy rent in the rocks, through which there was barely room to push the boat against the rapid current to the foot of the cascade, which is 25 feet. The walls of this remarkable chasm are about 200 feet high, and the narrow pool, as near as we ventured to the foot of the fall, was 36 feet deep.

The fall upon the other stream, which enters the basin from the east, is only a few feet in height, but it falls at once into a pool, bounded by precipices that have even a greater depth than the above.

The flats along the lower part of these streams are true valley deposits, such as may be seen in any mountain valley formed by the gradual change of the water-course from side to side; and as I did not discover any remains above high water mark of the brackish water deposit with esturine shells, which is now slowly filling up the basin, or any trace of terraces round the mouths of the rivers, I conclude that the land at the head of this Sound, unlike most parts of the New Zealand coast, is not rising; and the consideration of the nature of the falls almost demonstrates that it is, on the other hand, an area that is being submerged.

The examination of the walls of the chasm, through which the first-mentioned river falls, convinced me that it has been cut by the action of the falling water, which may have followed a pre-existing fissure. The rock is a granular quartzite, compact and close grained in texture, but still such a rock that can be slowly worn away by the mechanical action of running water. The depth of the rocky chasm below the fall must, therefore, of itself prove that the fall was once higher, and as it now falls to the sea level as a necessary consequence, it follows that the land must then have been more elevated.

At night we encamped between two streams that enter the Sound from rugged valleys in the Kakapo Mountains, a range along the west side of the Sound, which has been named after the kakapo or nocturnal ground parrot, an interesting bird, now almost peculiar to the S.W. corner of this Island. On a flat round the edge of high water mark we found abundant traces of that bird, as they come out of the woods during the night to feed on the grass, chewing it into pellets, which they spit out after extracting the juice. During the night we heard all round us their harsh croaking cry, and also the screaming whistle of the kiwis.

The morning of the 22nd of June was close, with drizzling rain, and though the tops of the mountains were clear, the sky was obscured by heavy masses of vapor, and Henry said that although it was dead calm at the head of the Sound, yet it must be blowing a heavy gale from the N.W. outside. During the forenoon I continued to skirt along the western side of Edwardson Sound, and found a marked change in its geological character from that of the eastern side. Upon the latter side the prevailing formation is a fine grained gneiss, the foliation and bedding of which trends north and south, and below Cunaris Sound to Southport the formation is an interesting group of silicious felstones, greenstones, glossy clay slates, and mica schists, the extent and relations of which I shall hereafter describe in detail.

Continuing on the same side of the Sound, Garden Island to Gulche's Head, the formation is coarse crystalline red granite, apparently in direct contact with the last-mentioned group of rocks. I now found that the west side of the Sound is composed of grey granite, of hard uniform texture and large tabular structure, so that immense blocks could easily be removed. It would form a splendid building material, and might be quarried close to where the largest shipping might lie in perfect safety. There is to be sure no anchorage ground, owing to the great depth of water, but the shore here forms a natural wharf, quite equal to the best that could be artificially formed. The situation best adapted for a quarry is about two miles from the head of the Sound, where there is a low range of hills, between the water's edge and the higher mountains. Lower down there is a small Bay, with fair anchorage ground, but exposed to the swell that comes up the Sound even thus far. The gneiss rocks prevail here for a short distance, but the granite again reappears and forms the shore right down to Northport. The mountains slope steeply to a great height, and sometimes present a sheer precipice for the first few hundred feet; but at one point where the average slope was continued to the water's edge, and appeared to the eye very highly inclined, I found that the top of a peak 3300 feet high, and in view at ten yards from the shore, was elevated 30 degrees. Although a slope having such an average inclination is practically useless and even inaccessable, it is interesting to find that the walls of these Sounds are those of true valleys, and not those of fissures formed of paroxysmal forces. I obtained abundant proof of the true nature of their origin by the erosion of glaciers, but the discussion of these I shall defer until I can compare the observations regarding the subject made on other parts of the Coast.

On reaching the main part of Chalky Inlet, I next struck up Cunaris Sound, keeping along the north shore, which is composed of gneiss and clay slate dipping at 20 degrees to the E. by N., the stratification being unusually distinct. Towards the head of Cunaris Sound there is a small extent of flat, though of course thickly wooded land between the base of the mountains in the north and the water's edge, there being about 15,000 acres that may be adapted for cultivation. Cunaris Sound terminates in two heads separated by a sloping rocky promontory. A river thirty yards wide falls into the northmost of these, and it is evidently subjected to great floods, as the shoal off its mouth is strewn with drifted trees of large size. Grey teal, and the blue mountain or rapid duck, were very plentiful here; there were also large flocks of the red bill or oyster catcher, feeding on the cockles and small mussles that are laid bare at low water. Woodhens were very numerous here as elsewhere round the shores. There appear to be two varieties of them: one large and of a reddish brown color, is the same as that on the east coast, and is found in the woods principally. The other is considerably smaller and of a dark brown, or almost black color, and is generally seen feeding round the sea margin. We encamped on the east side of the river, but pitched our tents some distance back in the woods to escape the sand-flies, which had been more than usually troublesome all day—a sure precursor of bad weather. During the night the kakapos and both the small and large kiwis were calling close round our fire, but all my attempts to get a shot at them were ineffectual, as it is necessary to have a good dog to capture them.

Heavy rain commenced to fall during the night, and continued all next day, the wind coming in violent gusts from the westward, but at the same time blowing up the Sound steadily. The wind near the entrance of the Sound, I afterwards heard, having been at this time from the south-east.

A gravelly flat extends up the valley of this stream for the distance of a mile, but the land is poor and stony, and subject to inundation. It is, however, covered with an evergreen thicket of veronicas, eurylias, and other shrubs, some of which were in flower. The gravel is principally of fragments of gneiss and silicious slate, containing only a small admixture of quartz pebbles, and, from its appearance, gives no promise of being auriferous. It would be, however, impossible to reach the bottom of the deposit on account of its slight elevation above the tide-mark.

Passing round a headland composed of fine grained hornblendic gneiss specked with grains of dark granite, I followed up Cliff Cove, the eastern arm of Cunaris Sound, which is narrow, winding among rocky islands and terminating in a chain of tidal basins over a mile in length, which are not laid down on the chart, the entrance to them having escaped observation. It was low water, and besides ducks and sea fowl there were a number of the dark colored woodhens on the mud flats feeding on shell fish.

From the head of these basins a walk of 400 yards through the woods brought me out on the shore of Preservation Inlet in Last Cove, about seven miles from its upper extremity. This neck of land is quite low, but bounded on both sides by lofty and precipitous mountains.

The torrents which descend from these flow into Preservation Inlet, and accordingly add to the eastern side of the isthmus by the quantity of sub-angular fragments of rock which they bring down. The dense growth of the forest which covers the rocky slopes, even when nearly perpendicular, tends to break up the rock very rapidly, as the roots have rarely any other hold than by inserting themselves into the crevices; and as they increase in growth, they break off fragments of all sizes, and form accumulations in the bottoms of the valleys that might be mistaken sometimes for moraines.

The absence of the characteristic terraces which mark the existence of a "col," or ancient strait, was a further proof that the coast line here is not rising, as in a situation like this they could hardly fail to be procured.

We tried to pull down the Sound in the afternoon, hoping to reach the Southport that night, the distance being 14 miles; but the wind and sea against us were too violent, so that we crossed to the west shore of the Sound, where we encamped for the night. The rain had been incessant all day, so that we were quite wet through, but it did not feel very cold, and the men were remarking how differently they would feel if similarly exposed on the East Coast of the Province.

The storm continued during the night, but lulled at daylight, so that, starting at once, we got back to the yacht at noon on the 24th.

With a strongly manned boat, on the 25th, I again attempted to examine the Red Head Cliffs, as there appeared to be less swell on the sea than previously. I, however, only succeeded in landing at one place and found the rock, which there forms a breastwork on the most exposed part of the island, to be dense granite, containing large crystals of felspar of a beautiful flesh-red color. There being a light north-west breeze and fine weather on the 26th, we sailed round to Preservation Inlet. Notwithstanding the light wind, the swell was running very high, and the Balleny Reef was marked by towering wreaths of spray. We had a fine view of the cliffs of Chalky Island, which are composed of soft sandy strata that dips to the S.W. at a low angle. They are very ruinous, being rapidly undermined by the sea. The surface of the

island, which has an extent of about two or three square miles, is undulating, and rises to an elevation of 850 feet towards its northern extremity. After entering Preservation Inlet we sailed close under the bold cliffs of Coal Island, which are also composed of a newer sedimentary formation, consisting of sandstones, conglomerates, and shales dipping to the westward at a low angle, excepting at one place where they have been "faulted up" at an angle of 50°. We anchored close to its north extremity under Steepto Island, hauling up and making fast the stem of the craft to the rocks, the water being very deep close in shore.

There has once been an extensive whaling station here, where a small patch of bush has been cleared, as we found the beach strewn with whale bones, broken iron pots, fire bricks, and other relics of a temporary try-work.

Steepto Island and the west end of Coal Island are composed of the blue clay slate and silicious slates. The former are cleared in the north and south direction, and some of the beds being fissile enough for quarrying as roofing slate. The passage between the two islands is very shallow, a very unusual circumstance in these Sounds. At low tide there is here only from six to eight feet over a gravelly bottom, which is a favorite feeding ground for the large cray fish (Palinuris), so that, on a subsequent occasion, with a slender pole sharpened at one end and used as a spear, we captured a large number with great ease.

Steepto Island is the place where the Maoris generally encamp with the boats when in Preservation Inlet, as there are several fine caves in the slate rocks which afford a comfortable shelter.

Many of these caves are of considerable size, and have evidently been formed by the erosion of the sea; and as the entrance to them is often elevated 10 to 20 feet above the tide-mark, they would seem to indicate that the land is on the rise, and to contradict what I observed at the head of the Chalky Inlet, unless we assume an unequal motion of the earth's crust, in the short distance of from 15 to 20 miles, and the central and loftier portions of a mountain range to be sinking while its flanks are rising. Stormy weather commenced on the 28th, and finding that the yacht lay in too exposed a place, we sailed across the Sound on the morning of the 29th, and anchored in Cattle Cove, in seven fathoms water, well sheltered, and with plenty of room to swing.

This is the only good anchorage ground in Preservation Inlet, and although excellent, it is by no means equal to Southport.

The schooner was at anchor for 16 days, until the 14th July, of which a few days were lost, owing to bad weather. There is a well sheltered shingle beach, and abundance of firewood and water here; and it has evidently been at one time a favorite place with whalers. We found some recent cuttings in the woods here, that were probably not more than a few months old. The view up the Sound from Cuttle Cove is very beautiful, sharp snowy peaks being visible over a succession of forest ranges, with groups of rocky and wooded islets in the foreground. These islands are composed of the slates and silicious felstones which are sometimes traversed by felstone dykes and quartz veins. The main shore also presents the same formation; and at Cavern Head, which lies opposite to Cove Island, so named from being pierced by a tunnel-like cave, the like clay slate is traversed by large veins of quartz that generally travel north and south. Although I frequently made the attempt, I never succeeded in landing on this headland, on which there is always a heavy surf breaking, and it is quite inaccessible from the shore; but from fragments of the rock cast up on the beach to the westward, I found these quartz veins to be the white opaque and ferrugenous variety that is generally considered to be auriferous, but I observed no trace of gold.

The 28th June was spent in examining the bay to the west of Cavern Head, and the Cording Islands in the centre of the inlet. To land in this bay, which has a sandy shore, we required to beach the boat in a heavy surf, which was by no means an easy or safe undertaking. I found that the slates here were procured by a wide dyke of light grey porphyry or granite, the casing of which contained calcined and altered fragments of the contiguous rocks.

The blue slates are less perfectly cleared near this dyke than elsewhere, and the original lines of stratification more distinct. They are mottled with iron stains, and contain streaks and blotches of iron pyrites, among which I searched narrowly, but in vain, for traces of organic remains.

The Cording Islands consist of the same silicious slates, that, so far as I have yet ascertained, immediately overlie the clay slates, as I shall hereafter show when describing more particularly the geology of this district.

The Islands are of small size, but there are several good boat harbours among them. The shores are covered in places with immense erratic boulders of granite, of a variety that is only to be found further up the Inlet.

The weather at this time was very fine, the 30th being quite equal to a summer day, clear, bright, and almost too warm. It was spent on Coal Island.

This Island, which has an extent of 4 square miles, is bounded by cliffs 200 to 300 feet in height on all sides. There are, however, several landing-places from which there is no

difficulty in ascending them to the rolling and hilly surface. It is formed of coarse grit sandstones and conglomerates, interstratified with indurated clay shale containing small seams of coaly matter, and also obvious impressions of fossil plants. The sandstone sometimes contains nodules that are evidently the remains of shells, all the characters of which have been lost.

The strata appear to have been much disturbed near the boundary of the slates, which form the eastern angle of the Island, but towards the west they are well exposed in cliffs, and they appear to be nearly horizontal. They displayed the same character and order of succession of the different strata on both sides of the Island.

On the mainland to the south of the Narrow Strait, named in chart, Otago's Retreat, they were also observed, but much disturbed. It is, however, probable that this formation extends over a considerable area of land through elevated country which stretches to the south-east of Preservation Inlet to the landward of Windsor Point.

The thickness of this series of strata is not less than 1,500 feet. They are almost identical in character with the carbonaceous series of Victoria, as displayed at Griffith's Point, and to the conglomorates of the Horse Ranges and Shag Point in the eastern part of this Province. The sandstone near the junction with the slates is composed of granitic sand, so finely re-cemented, that at first glance it appears to have been the character and fracture of a true granite. The surface of the Island is covered with fine timber that is very open, being rarely choked with thicket.

The prevailing trees are ironwood, remu, and birch. The stems of the trees and surface of the ground are covered with a profusion of small ferns and immense lichens. The former are principally various species of the delicate hymenophyli. On the morning of the first July the Maories at last arrived, having been waiting at Pahia, the native village west of Riverton, since the 22nd of June for a fair wind to bring them round.

Next day I proceeded up Preservation Inlet in the Maori boat, which was large and commodious as compared with our own small whale boat. I had a crew of six Maories and one of my own men. Above Cording Islands the inlet is narrowed to less than half a mile in width by the jutting out of a promontory from its western shores. On the right hand of this long narrow passage thus formed, the mountains rise very abruptly from 2000 to 3000 feet, and are composed to their full height of granite, which contains the prevailing formation, till near the top of the Sound, excepting at a few points, where there are patches of the slates, and one place to the south of Last Cove where there is a lofty vertical cliff of syenitic gneiss like that of the Bluff. At the upper end of the Sound the formation is mica schist, felspathic gneiss, and quartzite. A strong current flows out through the Narrow with the ebb tide, but owing to the quantity of fresh water poured into the head of the Sound, the influence of the flood tide is hardly felt. There are several wooded flats of limited extent, and almost level with the water opposite to the mouths of streams descending from valleys in the mountains.

Excepting these flats, there is hardly standing room to be found any where along the sides of the Sound above the Narrows until reaching its upper extremity.

On one of the flats we went ashore for dinner; it was about five acres in extent, and at a distance of 100 feet from the shore, the water suddenly deepens to 60 or 70 fathoms. The gentle slope out to the edge of this bank is nearly dry at low water, and is covered with cockles and large mussels, on which numbers of sea fowl were feeding when we arrived. The abundance and large size of the mussels on the shores of this Sound, and even on a sandy or gravelly bottom, which is usually repugnant to them, seemed very remarkable, as there were few, if any, seen in Chalky Inlet, excepting minute specimens studding the rocks between tide-marks.

I followed up the stream which enters the Sound at this point, climbing over large boulders that obstructed its channel for half a mile, till I reached Fine Cascade, 120 feet in height. Nothing but the *debris* of granite rocks was met with in the bed of this stream.

As we coasted along, the Maories caught a number of wood hens, going ashore when they saw them among the rocks, and securing them with a flax noose on the end of a wand. We encamped at the mouth of a stream about four miles from the bed of the Sound. Among the fragments brought down by the stream were some masses of reef quartz, along with gneiss and hard silicious slates. The rock *in situ* is the same granite as previously. We had omitted to bring a tent, and slept in the boat, which was moored a little distance on the shore; while the Maories camped in the bush, making a shelter from the rain, which had now commenced, with the boat sail; but they very stupidly had their camp on a level with high water, and being spring tide, the sea rose in the night and flowed right over where they were lying, so that they had to take refuge in the roots of some dead trees, and remain perched there till morning.

Next day, the boat being exposed to a high wind which had sprung up from the west, we were obliged to decamp in spite of the drenching rain. We did not go far, however, as the Maories found an overhanging precipice that afforded protection from wind and rain. It was a singular camping place, the cliff being about 100 feet high, with a narrow ledge of fallen stones twenty feet long and eighteen

feet wide, which was not covered when the tide rose. On this ledge we managed to establish ourselves, removing the most angular of the blocks of rock with levers, in order to find room to lie down.

We had deep water on the one side and a more than vertical precipice on the other, so that there was not much room for exercise, and all our firewood and water had to be fetched with the boat.

We spent three days and nights imprisoned on the rock, during which the storm continued with unabated violence, with thunder and lightning, and a heavy snow storm on the mountains. At first the Maoris caught plenty of fish close to the rock, but they soon began to get scarce, so that on the morning of the 6th, although it was still wet, we pushed on to the head of the Sound.

I regretted that the mountains were so covered with clouds, as, judging from the partial peep obtained, the scenery must be very fine. The mountains are very lofty, and rise steeply from the limit of the woods, which at this season is the same as the snow line, but there are lower and broken ridges that skirt the valley, which relieve the scenery of the bald appearance usual in these Sounds.

Several streams enter the head of the Sound, and on the principal one there is a splendid waterfall, 80 or 100 feet in height, over which an immense body of water was pouring in consequence of the floods.

Above this fall I understand there is a large lake, but the bad weather prevented my visiting it. There are shingle flats at the head of the Sound, but though heavily timbered they are barely elevated above flood mark. The Maoris could not snare woodhens on account of the stormy weather, and my gun was of little service from the same cause —although there were plenty of ducks of various kinds. As there was no dry place to camp, we returned again to our rocky ledge, where we passed a fourth night. On the way down, the Maoris caught eleven of the large fish called Harbuka, or Groper, of about 30lbs each. These fish are generally plentiful near the shores at the head of the different Sounds. By next day the storm had abated, so that we started early on our return down the Sound, and reached Cuttle Cove in the afternoon.

Next day, I consented, though with some reluctance, to the Maoris again leaving us, as Murphy wished to camp on Chalky Island, both on account of its being a good fishing and sealing place; and also because it was more conveniently situated for starting with the first Southerly breeze for Dusky Bay. I now begin to perceive that it will be a loss of time to try to examine the coast working northwards, as the winds from the S. and E. are very rare—the prevailing winds being from west to north-west. As we had at this time low tides during the day, I was able to make a better examination of the carbonaceous strata in Coal Island. The only seam of coal I found is from 4 to 9 inches in thickness, and dips at an angle of 15° to the east. It, however, again crops out, with an opposite dip, a few hundred yards nearer the junction of the series with the underlying slates. It is only exposed at very low tides; but, once seen, it was easily traced back to the brow of the hill, which rises steeply from the shore at this place; but is so obscured by fallen *debris* and dense scrub that a further search in that direction would be an expensive and tedious operation.

The following is the section of the strata, which lies at right angles to the shore and forms rocky ledges jutting into the sea, and covered with kelp:—

Massive coarse-grained sandstone, composed of granitic sand, and resting on the edges of the slates	100 ft.
Argillaceous sandstone in the flags with obvious plant impressions and straits of coal	250 ft.
Coarse grit passing into conglomerate, the pebbles being principally rounded fragments of slate	30 ft.
Laminated sandstone	10 ft.
Coal	4 to 9 in.
Pipe clay	6 inches
Blue clay shale...	4 ft.
Sandstone	6 ft.
Blue clay shale.....	6 ft.
Grit	20 ft.

These strata are the same as those displayed on the south side of the island, where they have the same trend and general order of distribution, so that it is probable that they pass right through and form the mass of high land in the interior of the island. Immediately to the west of where the coal was found, the strata are suddenly thrown up at an angle of 35deg., and the lower flaggy sandstones attain a much greater development than that given above, and from the whole thickness of the cliffs exposed along the sea-coast, so that the above seam of coal, if it occurs at all, must be at an elevation of 200 to 300 feet above the level of the sea, and on the tops of thickly wooded table land. It is, however, extremely improbable that such a seam will prove persistent over a large area; but, while it may suddenly thin out altogether, it is just as liable to expand into a thick and valuable seam of fuel; such is the irregularity of deposits like this, which have been formed in a very limited basin, subject to sudden changes in the nature of the sediment with which it was gradually filled up. We mined about a ton of the coal, and though taken from the outcrop, where exposed alternately to the sea and the atmosphere, we found it of excellent quality—quite equal to the Sydney coal which we had on board, to which it bears a great resemblance

both in appearance and its manner of burning. I also found the same strata upon the mainland to the north, forming the hills between Southport and Gulche's Head, encircling the little Bay called in the chart Price's Beach, in which vessels can find temporary anchorage during the N.W. winds. The strata here are much the same as in Coal Island, excepting that the sandstones pass more frequently into coarse conglomerates. The position of the coal is relatively the same, as it occurs in the upper part of the series associated with grits and indurated clay shales. There, also, only one seam is discovered 6 to 14 inches in thickness, but of inferior quality to that on Coal Island, as it contains a larger proportion of earthy matter and sulphur. At this time we lost the greatest part of several days, as the weather was wet and stormy, with thunderstorms nearly every night. I however dredged the more sheltered parts of the Sound among the islands, but did not find much variety, the channels, which vary from 20 to 40 fathoms in depth, being characterised by extreme poverty of marine life. The most interesting shell obtained was a large Terebratula, which is very similar, if not identical, with the most characteristic and plentiful fossil in the Oamaru limestone. As I was anxious to get round the West Cape, which lies between Chalky Inlet and Dusky Bay, by the first opportunity, I deferred further examination of the coal strata till our return, when we will probably be detained here for some time. There being an easterly breeze on the 14th July, we made an attempt to get round to the north, but the wind failed us when opposite Gulche's Head, so that we had to put into Price's Beach. There we lay at anchor two days, until we were forced again to take refuge in Cuttle Cove owing to the occurrence of stormy weather from the north-west. On the 18th instant the weather was again promising, so that we started with a light N.E. breeze, which carried us out of the Sound and past Gulche's Head, but failed us in trying to beat into Chalky Inlet, when it became calm, but with a heavy sea running from the westward. Owing to the strong outset from Chalky Inlet and the tidal current setting down the coast from the north, we got into rather an awkward position, for, in spite of having the boat towing ahead and also using the sweeps, we began to drift rapidly towards the Balleny Reef, which was breaking with great violence about a mile to our leeward, so that we had to drop a kedge in thirty fathoms water.

We dreaded having to pass the night in this dangerous position, but a light breeze from the south-east sprung up by good fortune just before dark, of which we lost no time in taking advantage of. The yacht rolled heavily, and in making sail the main boom broke loose by accident and knocked two of us down, and unfortunately dislocated my left shoulder joint. However, with the aid of one of the seamen, who had been treated for a similar mishap himself, I managed to reduce it and have the necessary bandages applied. The wind had hardly strength to carry us up to Chalky Inlet against the strong outsetting current, in consequence doubtless of the late heavy rains, but with the boat ahead towing we got into Northport about two hours after dark. We had not been long at anchor when another violent thunderstorm broke from the N.W., so that we had great reason to be thankful for the temporary south-east breeze which enabled us to escape in time from our perilous position on the weather side of the Balleny reef. The next day was bright and fine, but with no wind. A party sent in search of the Maoris, found them encamped in Landing Bay, which is on the south side of the Inlet, close to its entrance. Since they had left us they had killed four seals, and also captured a live kakapo, which they sent to me. It is rather larger than the common kaka from which, however, it greatly differs in every respect, especially in the form of its bill, which is short and thick. It is of a light green color, with dusky markings; and from having slight whiskers, like those of a cat, and a depressed circlet of feathers round the eyes, it somewhat resembles an owl. It seemed very uncomfortable when exposed to daylight, but after dusk it became quite lively, climbing about everywhere, displaying all the forward manners of other parrots. He was very ill-tempered and obstinate when interfered with in any of his foraging expeditions, screaming most discordantly and biting furiously. He was rapidly becoming tame, but a fortnight after this date he was killed by a woodhen, which was foolishly shut up with him in the locker of the boat, where he was domiciled.

Northport is by far the best harbour we have been in up to this time. It is quite landlocked, but opens so immediately from the wide part of the Inlet, that a large vessel could make right into it without difficulty. On the north it is surrounded by low granite hills; but Great Island, which lies to the south of it, presents a rolling wooded surface elevated only a few hundred feet above the level of the sea. On the 20th it blew freshly from the south-west, and as the Maoris had promised on the previous day that they would lose no opportunity of getting on at once to Milford Sound, we were anxious to take advantage of this wind, which would be favorable for us if once out of the Sound. We accordingly tried to beat down against it, but when opposite Passage Island, the wind shifted, so that we had to anchor in a small bay in its eastern shore in seven fathoms water. Passage Island appears to be formed of granite, which probably, from its being near the junction of the overlying carbonaceous strata, is traversed

by veins of carbonate of lime. The wind still continued adverse next day, and as we were exposed where we lay to a heavy swell, though sheltered from the wind, we stood across the Sound to our old anchorage in South Port. The beauty of its shores appeared to me to be even more charming than on our first entering this harbour, since which time more than a month had elapsed. In the afternoon, when re-examining the western side of the bay, I recognised the conglomerate beds which I had previously observed as belonging to the upper part of the carbonaceous formation of Preservation Inlet, so that it is not improbable that coal may be found contiguous to this fine harbour. The following is a rough classification of the land in the neighborhood of Chalky and Preservation Inlets, which, though only estimated by the eye, with the aid of the Admiralty chart, will, I believe, be rather under than over the truth.

First, under 200 feet elevation and nearly flat, around South Port and Price's Beach	2000	acres.
Curran's Sound	1500	,,
From 200 to 1200 feet elevation, but moderately level and of good quality, on account of the nature of the subsoil	1500	,,
Coal Island (an elevation 500 feet), Great Island, Passage and Chalky Islands (an elevation of 500 feet)	2000	,,
Between Chalky and Preservation Inlets (inferior quality, average elevation 1000 feet)	5000	,,
South of Preservation and towards Windsor Point	15,000	,,
Between Chalky and Dusky Sounds ...	20,000	,,

In this district there is therefore about 3500 acres of the best quality of land, and 43,500 acres which is higher and less available. The whole of this land, like nearly every spot on the coast which is not absolutely precipitous and below 3000 feet, is densely wooded.

The subsoil of the low land is mostly shingly or sandy where derived from the carbonaceous strata, but is always covered by at least one foot of dense vegetable mould. On much of the higher land the rock is very close to the surface, but even where barest there is often a growth of large trees which cling to their places by inserting their roots deeply into the fissures and rents of the rock. The amount of disintegration of the mountain slopes caused by this simple agency is very considerable, and, as I have previously remarked, appears quite sufficient to account for the piles of large angular fragments with which they are often strewn. Early in the morning of the 22nd, we got a south-east wind, by which, with the aid of the current down the Inlet, we were able to weather Passage Island, and get out to sea through the channel that lies between it and Chalky Island. I have not, as yet, had an opportunity of landing on Chalky Island, although I have passed close to it at various times. It appears to present abrupt and ruinous cliffs to the sea on all sides, excepting at its N.E. angle, where there is a comparatively low and level promontory, upon which, Henry says there were at one time a few white men, who lived there and cultivated gardens. They were probably a party of sealers or whalers. This promontory appears to be of granite overlaid by conglomorates and coarse sandstones, and again by clay and light-colored chalky looking beds; the whole dipping to the S.W. but rising again towards the opposite or seaward side of the Island. Its N.W. angle is formed of rugged pinnacles of conglomerate, that form dangerous reefs, upon which we found the sea breaking furiously. The wind continued fresh, so that we had no difficulty in weathering the formidable reef which runs out for more than a mile from Providence Head, which forms the northern boundary of Chalky Inlet.

It occupied 2 hours from the time we left Southport till we had this reef between us and the land, after which we began to think that we were at last fairly out of these Sounds, in which we had spent the last five weeks. Excepting a few days after our first arrival, there has been no weather until this date; by which, if we had wished, we could have got out to the northwards. The S.W. swell rolls right into these inlets, and as the only wind blowing out of them is from the N. or N.W., there is always a great difficulty in getting out with any wind from the opposite direction. In making an offing of 4 miles, and opening up the West Cape and the entrance to Dusky Bay, the course was changed to N., leaving the wind, which moderated as the day advanced, right behind us. Coasting along at the above distance, I got a good view of the coast—although the distant mountains were quite enveloped in clouds. The country is more level than I expected: the shore is bounded by rocky cliffs, a few hundred feet in height, from the summit of which there is a gentle slope for a distance of six miles to an elevation of about 1500 feet, backed by smooth wooded ridges—the summits of which are 3000 feet above the sea. This slope extends from Chalky Inlet to Dusky Sound, but is divided by the valley of a stream that enters the sea at the West Cape, which has its rise apparently from the West side of Stopper—a lofty mountain at the head of Edwardson's Sound. The dark woods which cover this slope are occasionally broken by patches of yellow, where there are open grassy spots, and its uniformity is broken by a few sharp cones—not unlike those on the seaward slope of Saddle Hill. I have no doubt, however, that a close inspection would prove this surface of the country to be far more rugged than its appearance from the seaward indicates. At 3 o'clock in the afternoon, we were off the south entrance to Dusky Bay, where the Maoris had doubtless arrived by this time, as we observed they had left their camp when we passed it in the morning; but I was so desirous of getting up

the Coast with this favorable wind, that we pushed on, trusting to their joining us at Milford Sound, according to their promise. The mountains behind Dusky Bay appear to be high, judging from the extent of them covered by snow. The Peninsula that forms the seaward part of Resolution Island and ends in Five Fingers Point, is low. It has the same gentle slope as the land to the south of Dusky Bay, but we were too far from shore to make it out clearly. It was quite dark when we passed Breaksea Sound, the night being mild, and fine, with a light southerly breeze, forming a delightful contrast to the disagreeable weather we had had of late. 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. There was also a great variety of Medusa; and a few specimens of the curious little Clio were obtained.

The breeze continued favorable until daybreak, when it became calm, the air being deliciously fresh and mild. We were then off Nancy Sound, at a distance of 7 miles from the shore, and 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, having been here reduced to the sea level. We remained nearly stationary till 1 p.m., when the wind shifted to the N.W., and clouds began to gather on the mountains, warning us to take shelter, so that we put back to Thompson's 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. We now passed closer in shore, so that I was able to observe the formation to be slate or schist, traversed by large veins of quartz. 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 three miles. The sea was quite calm, and there was hardly any swell in at the entrance, so that we got in without difficulty. The sides of Thompson's Sound are precipitous, the appearance immediately on entering it resembling that presented only by the upper portions of Chalky and Preservation Inlets. We were hardly anchored when the storm from the N.W. 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. It was very fortunate that we turned back, as we had had no warning of the coming of this storm, except from the gathering of the clouds on the mountains, the barometer having maintained steadily the high reading of 30.35. This storm, which continued for three days, was the most violent we have 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. The barometer fell to 29.43, but not until the worst of the storm passed—on the 27th—when the weather began to moderate though still continued blustering and showery. Deas' Cove is a very small anchorage opening to the south or up the Sound, being closed from the opposite quarter by a low and partially swampy neck of land, about a square mile in extent, and bounded on the one side by a low rocky ridge, and on the other by lofty mountains. The rock is a granitic gneiss, the hard surface of which has faithfully preserved the groves and polished surfaces caused by ancient glaciers. Excepting the small flat above mentioned, there is no level ground in this neighborhood, and indeed, it would be difficult to find standing room on much of the Coast.

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 to 5000 feet. They are mere shapeless masses of rock, covered only with a low straggling scrub, excepting in a few gullies where alone there are trees of any size. For several thousand feet above the water level, and probably from far beneath it, the rock has been smoothed and planed down by the ice action. There are very few ravines for the drainage of these mountains, the rain running off in precipitous torrents, which scour paths down their sides from 60 to 80 yards in width. One of the most remarkable of these torrents occurs on Secretary Island, where a large body of water leaps from the top of a precipice about 2000 ft. in height, almost to the sea level.

The appearance of this Sound recalled to mind the descriptions I have read of the Straits of Magellan, excepting that the glaciers which there descend to the sea are here wanting; but there is abundant evidence of their having existed in these valleys at one time, most probably when these mountains were elevated several thousand feet above their present relative level,—a conclusion founded on observations which I will not attempt for the present to give in detail. Secretary Island is composed of granitic gneiss and other highly altered rocks, inclined towards the west at a low angle. On the opposite side of the Sound the lines of stratification dip in the opposite direction, so that the valley occurs on the ridge of an anticlinal fold, and forms the only instance I have seen of the apparent conformity of one of these valleys to a line of dislocation. Passing behind Secretary Island, we reached Doubtful Inlet, still sailing to the southward, and led by the wind, followed up Crookedstone, which is a narrow and tortuous branch of the Sound about 6 miles in length. The following day the N.W. wind gave way to fine southerly weather, the change—as is usual—having given a slight coating of snow to the mountains as low as 1600 feet above the sea. The valley of Crookedstone is extremely precipitous, but opens out towards its head where it divides into three branches, the central of which leads across a level flat for about a mile, to the head of Dagg's Sound.

Round the head of the Bay extensive mud flats are exposed at low water, on which there are plenty of ducks and other water fowl. The bush which covers the flat is very dense, consisting chiefly of a thicket of fuschia trees, but on the moderate slopes, birch, remu, and tree-ferns reach a larger size than in other parts of this Sound. There are also a number of cabbage trees of a species not found on the East Coast—known to the natives as the Towe. The New Zealand holly (*Eurybradentate*) is also very common along the shore, where it grows to a considerable size. We enjoyed a few days of magnificent weather at this time, with sharp frosts towards daybreak, so that everything was covered with a thick hoar frost; and on the 30th, the surface of the water from side to side of the Sound was covered with ice about one-eighth of an inch in thickness. This arises from the film of fresh water having frozen on the surface of the salt, exactly as if it had been contained in a shallow pool, the temperature of the salt water a few inches below the ice being 48°. A few hours of frost of slight intensity, was thus able to freeze up the yacht, although she was floating in salt water 6 fathoms in depth.

Leaving this secluded valley on the 31st, we dropped down slowly with the tide—towed by the boat—but did not reach more than half-way down the arm by dark, when we anchored opposite the entrance of a large valley, on the right hand side of the Sound, which presents a greater extent of level ground than is usual in this Sound. This valley appears to curve towards the south and west, so that its upper extremity was shut out from view. On its eastern side it is bounded by a precipitous cliff, surmounted by little peaks, from which we named this place Rampart Cove. It is not a good anchorage, as it is exposed to the north-west winds, and from the edge of the mud flats which were laid bare at low water the bank descends suddenly, and the water deepens forty to fifty fathoms. Next day we continued our slow progress down the Sound, but after making about three miles the wind sprung up from the north, so that we had to seek shelter in a bay on the left hand of the arm, which was named Waipero Cove, where we anchored on the edge of a steep bank in ten fathoms water. During the night it blew a gale down the valley in which we lay, so that our anchor dragged, and we drifted off the bank into deep water, and at 2 a.m. all hands had to be called, and being high tide we ran the schooner right into the mouth of the creek, and tied her up to the trees in eight feet water, and where it was nearly dry at low tide. We were detained here for three days, during which time I made a careful survey of this cove in order to obtain its exact form, both above and below water, in order to test the theory of the glacier formation of these valleys. The average depth of water is 90 to 100 fathoms, to which depth the rocky sides of the valley descend at an angle of 35°, where there is a level mud bottom from side to side which slopes gradually towards the main body of the Sound. The bank which bars across the Valley and forms the head of the Bay, is a true moraine, its upper part consisting of angular blocks of rock of every variety found in the mountains, but in front this moraine is marked by a bank which has been formed of the finer materials, brought down by the streams and shot into deep water.

It is however impossible to convey a correct idea of the form of these valleys without the accompanying plans and sections.

Among the fragments in the head of the moraine at the head of the cove there were small blocks of crystalline marble of pure white color and white grain, and sometimes speckled with brown and lead colored mica; but this interesting and valuable rock was not found *in situ*.

On the 5th of August we again got out into Doubtful Inlet, and a favorable breeze soon carried us to Thompson's 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 ten feet water. If we had known of this place it

would have saved us several days, as we would not have required to take the schooner up to the head of Crooked Arm, from which we found it so difficult to escape again. In Thompson's Sound we had again to resort to towing, but the water here being perfectly salt, the craft was less sluggish than in the upper part of the Inlet, so that we made good progress and reached Deas' Cove early in the afternoon.

During the fine weather which we had at this time, the barometer continued very low, remaining steadily at 29·50. When examining a swampy flat at the head of Deas' Cove, besides the traces of kakapos, I believe I also saw those of the Moho, or Tuckahed of the natives, or the *Notornis* of naturalists, a large species of swamp hen that was coeval with the gigantic Moa, and of which only one specimen, shot in Dusky Bay, and procured by Mr. Mantle, has yet been seen by naturalists. A second specimen was however shot in this very swamp by a party of whalers, of whom Henry was one; and I heard from the Maoris that these birds are yet tolerably plentiful on the west side of the Te Anau Lake. It is not improbable, therefore, that if the tracks of any large birds have been seen by the diggers in the neighborhood of the Wakatipu Lake, it has been this bird that has been mistaken for the Moa. It is about two feet in height, and has the largest foot of any bird in the country, so that its track, especially if in snow, would be sure to attract attention. When feeding, it is in the habit of cutting the grass into short lengths, and laying it in a heap, but does not chew it into a pellet after the manner of the kakapo.

The weather being favorable we sailed next morning for Milford Sound, which is distant forty miles to the north. After getting outside we had fair wind and clear sky, although there were a succession of snow storms on the mountains. Until nightfall we made but little progress, but by daybreak next morning we were off the entrance of Milford Sound. 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. We anchored for a short time in Anita Bay while I landed to examine the beach from which the Maoris procured the jade or greenstone for the manufacture of their ornaments and weapons. It is from among the shingle that this stone is obtained, occurring as rounded pebbles along with fragments of hornblendic gneiss and felstone. Although I found plenty of these pebbles, I did not discover the source from whence they are derived, but a large felstone dyke crops out behind the beach, in contact with a green hornblendic rock and serpentine; and as the felstone near the sides of the dyke contain small green specks, which are of the nature of this mineral, it is probable that it has been formed along the line of junction as nodules and irregular masses. Proceeding up the Sound, three miles from the entrance, it becomes contracted to the width of half a mile, and its sides rise perpendicularly from the water's edge, sometimes for 2,000 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 being 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 1,200 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, and next day, as I intended to remain here sometime, a large tent was put up on shore and everything in the yacht was taken out and overhauled. The carpenter also commenced to build the dingy, the tim-

ber for which had been cut and sawn while we lay in Cuttle Cove, in Preservation Inlet. 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 S.W. A well timbered flat about a mile in extent lies between them, but 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 four to six 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 Anila 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 a hundred 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 an 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.

For several days after our arrival in Milford Sound we had continued bad weather, with thunder and snow storms on the mountains, so that little could be done beyond examining the shores of the Sound. On the 10th August, however, the weather promised well in the forenoon, so that I started 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 five miles from the mouth. It was rough and cold work, as the channel is blocked by large boulders, so that it was necessary to cross and re-cross the river very frequently. 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 morains, 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. Of course it would be quite useless to search for gold in a valley having this character, even where excavated in an auriferous formation, which it is not, as the detritus has undergone no assortment in the true rocky floor to which it would be necessary to sink, may be many hundred feet beneath the surface. 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. Four miles up the river, on a tributary from the south-east, I found the recent camping-place of a party of diggers. They had laboriously cut a track through the thicket along the side of the river, so that I infer that it had been flooded at the time of their visit, and that they could not follow its channel as I had done. Both the Cleddau and the Arthur River appear to be liable to tremendous floods, as the line of river-drift can be traced back in the woods to the height of 20 feet above their usual level. During these floods the valley would be quite impassable, as the tributary streams could not be flooded. Next day, when examining Deep Water Basin, which lies between the mouth of Arthur River and the wooded flat, we found another camping-place, at which there was—"Nugget, 5th June, 1863, R. D. K," carved on a tree, probably by the same party of men that were up the river; also in Harrison Cove, which is the entrance to the valley that leads to Pembroke Peak, we found another of their camping places of still later date.

The geological structure of the mountains around Milford Sound is more complicated than in any other part of the West Coast that I have examined. The prevailing rock is syenitic gneiss, associated with mica schist greenstone porphyry, and felspathic schist, succeeded towards the lower part of the Sound by fine grained gneiss of newer age, felstones, quartzites, and clay slates. No metallic ores were observed, but several might be expected to occur among the last-mentioned group of strata, if a locality were found to have been traversed by fissures in which vein-stone could form. When sailing about the Sound, we frequently saw large shoals of the cow fish, which is an immense Porpoise ten to twelve feet in length. They swim with great speed, raising their large back fin out of the water every few minutes; and sometimes leaping several feet clear of the surface. I shot one, but having no harpoon could not secure him before he sunk. Several seals were also seen about the mouth of the Sound, but, though easily shot, it was impossible to secure them, the water being so deep close to the shore, as they also sink when dead. Fish are not so abundant in Milford Sound as they

are to the south; but we got a few trumpeter and sea perch of excellent quality; and also several small species of fish, which I have not seen elsewhere on the coast. On the 17th August, there having been several days of fine weather with S. E. 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 which join to form this river, 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, 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 grove, 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 does 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 *Potocarpus*), broad leaf, New Zealand holly (*Eurybria 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.

The study of the deposits which fill these valleys possesses great practical interest from their intimate relation to the gold drifts on the eastern side of the mountains.

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 favorable 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, of from where 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 in 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 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, which appears to be surrounded 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, giving up all hopes of the arrival of the Maoris—of whom we heard nothing since we were in Chalky Inlet—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 whaleboat.

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 appearance of the country is considerably altered from that to the south of Milford Sound, as the high snowy mountains trend to the E.N.E. from Pembroke Peak, and retire behind lower wooded hills, which, however, are too steep to be of any value, unless the bush could be replaced by pasturage.

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 shingle 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 Terrewhatta.

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 Dwarud River, when Henry, 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 recognized the long and dangerous reefs that lay before us. On making towards the north end of the sandy beach, which extends for three 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 two 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 ten 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 S.W., 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.

While we were tending the signal fire on the sandspit after dark, the Maoris we had seen on the beach on the previous day joined us. There is only one family of them, consisting of a very old man, his wife and two daughters. They have lived here for five years, having previously resided in Jackson's Bay. Through Henry, I learnt from them that a vessel, which from their description we supposed to be a cutter, had called here some months ago and landed two men, who proceeded up the river in a small boat, but returned in a short time in a starving condition, having lost their tent, gun, and provisions by a sudden freshet of the river which swept them away during the night. The Maoris supported these men for a long time until their vessel called back for them. On her second visit she entered the river and sailed up it for a long distance, and, as far as we could make out, they were here at the time of the great storm which we experienced in Thompson's Sound, which commenced on the 25th July.

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, as, if a nor'wester had sprung up, he never could have beat out against it. As the weather looked very threatening in that direction, the skipper was afraid that unless he got into the river with this tide he would have to run back to Milford Sound, and therefore we determined to try it at once, even though the best time was already past before she was able to beat up to the entrance. However, I did not anticipate that the ebb current would acquire such velocity in such a short time, as we afterwards found that it did, or the attempt would never have been made. When within a cable's length of the entrance the anchor was dropped in five fathoms water, while the first kedge and line was run out. This brought her right abreast the point of the sandspit, and in the worst part of the channel, having a group of sharp rocks within a few yards of her stern. The second kedge did not take her out of danger, for the current had now acquired the velocity of five or six knots an hour, so that we could hardly stem it with the boat to lay kedges. The sea had also increased, and made it wild and dangerous work, as immense rollers were breaking twenty feet to our left, the break just ceasing at the edge of the deep water in the channel. Twice the boat was nearly swamped in attempting to fetch back the line from the next kedge. At this time a part of the windlass gave way, owing to the violent jerking on the chain—for the anchor had to be dropped each time the kedges were shifted—so that the position of the craft became very critical, and if any of the kedging lines had snapped, nothing could have saved her. However, thanks to the judgment and care exercised by Captain Thomson before our starting, all our gear was of first-rate quality, and the next kedge brought her behind the shelter of the sandspit, where she was tolerably safe. It was more than two hours' hard work to get her in so far—a distance of barely 500 yards—during which all hands were taxed to the utmost, and I cannot praise too highly the skill and coolness displayed by the skipper and crew on this trying occasion. When the tide slackened a little the yacht was tracked up for a short distance farther, and moored in a very snug place behind a rocky islet, on the right side of the river.

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 four miles we were surprised and delighted to find that it flows out of a lake, one to two miles in width, and extending in a southerly direction for ten or twelve 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 six to ten 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 five 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 thicket of the tutu, fuschia, and other shrubs, where we found tracks of wild pigs—the progeny, Henry learned from the old Maori, of a pair that had been turned loose a few years since. After finding the only safe mooring place near the head of the lake, which is a little projecting headland on the east shore, which will afford shelter from the N.W. gales, we returned next day to the schooner. For some time after this we had stormy and changeable weather, which caused some loss of time, and nearly a fortnight elapsed before I had completed the survey and examination of the lower part of the river and coast, and was able to proceed up to the lake with the schooner. 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.

The Maoris describe this stream as of very small size; and further, that it is impossible to land with a boat at its mouth, or indeed in any other part of that bay, which I may mention is known to the whalers as the Big Bay.

Martin's Bay, into which the the Kaduku River flows, is 4 miles across, between the two headlands, and rather less than a mile in depth. As the headlands are partly composed of the same grits, sandstones and conglomerates, that occur on Coal Island in Preservation Inlet, it is very probable that the beds of coal may also occur along with these strata, although, as yet, I have discovered no trace of it. The strata of the South Head is as follows: proceeding southwards from the sandy beach, the shore is strewn for half a mile with large boulders, principally of syenite, greenstone, and gneiss. The first rock exposed *in situ* beyond the boulders is a soft chlorite schist, passing into clay slate, and containing large intruded veins of white quartz, and occasional beds of silicious felstone.

The schists have a remarkable resemblance to the Waitahuna and Tuapeka. They trend to the N.E. and dip at a high angle to the seaward; they are succeeded by a stratum 40 feet in thickness, of cream-colored crystaline limestone, apparently of excellent quality. Overlying this limestone, and still pursuing the same strike and dip, are the conglomerates and grits of the carbonaceous strata, but in which I could not detect any stratum of coal or other traces of vegetable matter.

This conglomerate is remarkable for having the pebbles which are of small size and well rounded, very irregularly dispersed through it, frequently without touching one another. The matrix is a fine grained sandstone of a purplish grey tint. The pebbles are fragments of granite, syenite, quartz, silicious felstone, basic felstone, porphyritic conglomerate and diorite.

The conglomerate is succeeded by several hundred feet in thickness of calcareous shale, containing cherty nodules, not unlike flints. The above strata form ledges that are exposed at low water.

The cliff behind is composed of a very recent formation, consisting of a breccia of angular fragments of the underlying rocks, imbedded in moist yellow clay. At the base of the deposit, which is at least 350 feet in thickness, rests a stratum of blue clay and gravel. This deposit contains no fossils of any kind, to throw light on its origin. The hills behind are principally composed of the first-mentioned schists with quartz veins, which is a formation of much earlier date than the succeeding strata from the limestone upwards.

The same conglomerates are also met with on the North Headland, and there give rise to very remarkable coast scenery, but their relations are not so clearly displayed.

The best weather for entering the Kaduku River is after a few days of light N.N.E. or S.E. winds, or with a light S.W. 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 N.W, 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 offshore to the southward, 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 harbors on the coast; the only defect of which arises from its great depth of water and small extent of available land on its shores.

The distance from the Kaduku River to Milford Sound is only 18 miles, and the intervening country, though rough and hilly, is yet traversed by valleys which could doubtless be taken advantage of in the construction of a road; but having only seen this country from mountain tops and from the seaward, I cannot speak positively on this point. The best anchorage ground, which is at the head of Milford Sound, could not, however, be reached by a road, as some parts of the shores of the Sound are absolutely precipitous; while Anita Bay, which is the only other anchorage, and situated on the south side, and close to its entrance, is not only on the wrong side, but is also too much exposed to N.W. gales, so that it would be difficult to find a good site for unloading. However, just within Dale Point, which could easily be reached by land, and where there would be perfect shelter, I believe, by blasting and quarrying, a sufficient extent of wharf frontage might be obtained where vessels might be safely moored, although the water is too deep for anchorage.

Milford Sound is one of the most easily entered of all the Inlets on the coast, for, although surrounded by high mountains, the wind draws through it very steadily, and in moderate weather there is a marked land breeze during the forenoon, and a sea breeze in the afternoon, while the influence of the tide is not at all felt.

The Kaduku River makes three reaches between where it leaves the lake and enters the sea. The lowest, or Kaiyk Reach, is a mile and a half in length, and is only separated from the sea by the sandspit, which is 100 yards in width and 50 to 70 feet in height. This part of the river averages a quarter of a mile in width, and has a wide channel with no where less than 10 feet of water. A sunken reef of rock, however, extends nearly half-way across it from the split rocks which lie on its eastern side, and again at the upper end of the reach opposite to an old Maori kaiyk, a bank formed of snags buried in gravel nearly crosses the river, and is almost dry at low water; but along its eastern side, however, there is a channel 30 fathoms in width, in which there is not less than 11 feet at high water. From the bend of the river a narrow creek navigable for boats extends for half a mile farther along the back of the sandspit, penetrating through dense scrubby thickets, and flowing from a small lake near which the Natives have their present kaiyk and potatoe garden.

Above the Kaiyk Reach the River narrows considerably, its average width being 180 yards. It is deep from side to side, but out of the line of swiftest current there are a few snags, which narrows the channel to some extent. The proper channel varies from twelve to twenty-five feet, and above the bank at the Kaiyk there are no obstacles of any kind to its navigation. The land is elevated considerably above the highest floods, excepting in a few places, where there are swampy recesses extending back into the woods. The banks consist of stratified gravel and sand, with a stratum of clay, full of marine shells of the same species as those inhabiting the present mud flats, but elevated thirty feet above the sea level, the whole being covered with a thick deposit of loam. This deposit proves that there has been an elevation of the land at least to that extent, and that the Kakapo Lake is, in its nature, the same as the upper part of one of the Sounds farther south, but only being cut off from direct communication with the sea by the elevation of the shallow bar which formerly extended across its entrance.

There is at least 4000 acres of alluvial land bordering the river and the lower part of the Kakapo Lake. It is covered with timber of finer quality and of greater variety than I have seen elsewhere on the West Coast, comprising white, red, and black pines, totara, miro, ironwood, moka, birch, ghoa, and others—all of luxuriant and healthy growth. At the angle between the two upper reaches, named White Pine Reach and Lake Reach, are the Alleys, which are two small coves that have an average depth of 18 feet, and form snug little harbours, secure from all winds and currents.

Excepting at the entrance of the river, where the channel that is free from dangers is only 110 feet wide, and at the two obstructions which I have mentioned as lying opposite to the kaiyk and the spit-rocks, the river has a clear channel for navigation from the lake to the sea that is not less than 40 fathoms in width, and 12 feet in average depth of water. The proper time for taking the bar is after three-quarters flood, when, unless there be a freshet in the river, the current generally ceases to flow out. At half-flood the average soundings are from 15 to 20 feet, and only in one place on the bar 10 feet, which was probably on the top of a rock. Besides

the group of sharp rocks at the entrance, about a cable's length within the bar there is a dangerous rock nearly in mid-channel, and generally a wash at high water; but the water being quite smooth around it, it can easily be avoided.

With regard to the currents and tides within the river, they vary so much, according to the state of the weather, that it would require a few months' experience of the river before a correct account could be given of them.

From what has been observed, however, it appears that after a few days' rain the current runs out very strongly, and the effect of flood-tides is hardly at all felt, so that there is a constant outset. After fine weather the current in the river does not run stronger than between Dunedin and the Heads, which is from two to two and a half knots per hour during the ebb tide. The influence of the flood in ordinary weather is felt within the river about an hour and a half before, and half an hour after, it is high water outside. But after a few days' fine weather and southerly winds, when the level of the lake becomes lowered, the flood tide commences to run up the river fully two and a half hours before high water, at the rate of nearly two knots an hour. On the bar, however, the current never makes stronger than at the rate of one knot an hour. Within the entrance of the river the rise and fall of the tide is from four to eight feet, being full tide at the change of the moon at 11.40. The range, however, decreases on ascending the river, and in the lake it certainly does not exceed six inches. By keeping in line the marks which I put up to guide the yacht over the bar, and which I intend to place in a permanent form before I leave the river, a vessel will pass safely between the point of the spit and the sunken rocks; but after opening up the bend of the river she must keep close to the back of the sandspit, where there is the deepest water within a couple of fathoms from the edge of the bank, the exact position of which can always be easily known by the tide-rip, which the rollers give rise to on breaking over the spit into deep water. In the present state of the entrance no vessel drawing more than seven feet should attempt to enter this river, and then only under very favorable circumstances, with a high barometer and light S.E. wind.

For a quarter of a mile within the lake the water is shallow, excepting in the proper channel, which lies to the eastern shore, in which there is from two to five fathoms; but when over this bank there is everywhere from 10 to 20 fathoms, with steep gravelly shores, and further up the lake, where the shores become mountainous, the depth increases to 70 fathoms. When the lake is very low the water is slightly brackish just within the entrance, but elsewhere it is at all times perfectly fresh. In the lower part of the river the water is fresh only during the latter half of the flood tide, but then only on the surface.

On the 10th of September we left our moorings at the Split Rocks, at 6·30 a.m., just as the tide was beginning to run up the river. We got on very well as far as the Kaiyk Rapid, where the bank I have mentioned crosses the river, but there a gust of wind off the eastern shore caused the schooner to take the ground, and before she was got off, the up-current was nearly spent. However, she was kedged up during the day against the current, and in the afternoon was anchored in Gravel Cove, which is a pretty little bay on the east side of the lake, with six fathoms water, and so steep a beach that the stern of the yacht was hauled in and made fast to the trees without touching the ground, so that we could jump ashore.

The gravel beach which surrounds the lake rises to 6½ feet above the ordinary water level, which indicates the extent to which it is occasionally flooded, and it was delightful to have such a pleasant promenade after the bold and rocky shore we had been accustomed to on the other parts of the coast.

The Maori family had accompanied us, and had established a picturesque camp in the woods close to the mooring place. For the next few days we had splendid weather, so that I was able to ascend several of the mountains. Towards the Sara Hills, which lie to the N.W. of the Lake, the land slopes gently back for three quarters of a mile, forming a succession of terraces rising to a height of 270 feet, and covered with fine open woods of noble growth. At the base of the hills these terraces become broken and cut up by gullies, but there is no rock exposed, as they appear to consist, to a height of 400 feet of imperfectly stratified clay and sub-angular shingle. It is in this broken ground that the Maoris catch the Kiwis and Kakapoes, but although they accompanied us one day for that purpose they procured none, as their dogs were too shy to hunt before strangers. They are always able to catch them when they are alone, however. Only the small Kiwi is to be found here, the larger species, or Takawika, being found only in the Sounds further south.

The slopes of the hills are very steep, but still are covered with trees of large size; some of the iron-wood trees, (Rata), at an elevation of 2,000 feet having a girt of from 20 to 30 feet.

South of Gravel Cove a considerable stream enters the lake from the eastward, which the Natives call the Hokuri, and south of which the high mountains commenced to bound the lake. From Cairn Hill, one of the low peaks

on Skipper's Range, which lies along the east side of the lake, a splendid view of the mountains and surrounding country was obtained from a height of 4,000 feet.

The ascent was very steep but not difficult; no view was obtained until we were clear of the woods, which ceased at 3,400 feet, at which elevation they have their upper limit, as all the mountains in this district.

As they give way to the open grassy top of the hill, the birch, which is always the highest tree, becomes scrubby and stunted, and covered with dry crisp lichen. Shrubs not seen lower down also appear, some of which I had only previously remarked on the Pigeon Hill on Jackson's River. The bush is replaced by coarse grass and large tussocks, with scattered bushes of stunted shrub heath (Dracophyllum), several species of Calmisia, and other sub-alpine plants.

The sky being without a cloud the view from the summit was magnificent.

To the westward the sea bounded the horizon from below Milford Sound to the north of the Awarua Bay, but the shore line was concealed by low wooded ranges, so that its form could not be observed excepting at a few points. The Awarua Valley was very distinctly seen at a distance of 6 miles trending to the S.E., and from 2 to 4 miles in width. It has a level bottom partly occupied by a lake, and partly open and grassy; but there it is probably swampy. No large river could be seen, but a considerable quantity of water must, I should think, be discharged through the valley from the snowy mountains, where it originates. This lake, I afterwards learned, is known to the Maoris as the Waihuna Lake, and the stream flowing from it to the sea, the Awarua of the chart, by the same name; the only Awarua which they know being, as I have previously mentioned, a river flowing into the north end of Jackson's Bay.

From the Waihuna Lake a valley two miles in width, tolerably level and not elevated more than a few hundred feet, leads through to the Kakapo Lake, so that the two larger valleys are connected by a tract of available land.

Turning towards the interior, the large groups of snowy mountains could be distinguished, separated by the great valley which runs to the S.S.E., and is partly occupied by the Kakapo Lake.

The Darran Mountains, which are the group to the west of this valley, are those that cluster round Milford Sound, of which Pembroke Peak is the most remarkable from the seaward. It is not, however, the highest, as Tutoko Peak, which is a lofty conical mountain, having a shape similar to Mount Aspiring, and occupying a central position between Milford Sound and Kakapo Lake, is higher by probably 1,000 feet.

These mountains extend to the south for at least 20 miles, bounding the valley of the Kakapo Lake by a straight abrupt slope which, however, is not precipitous.

The Bryneira mountains, to the east of the valley of the lake, constitute a much larger group, extending as far as the sources of the Jackson River, Matakitaki, which flows to the Wanaka Lake and the Dart River, which flows to the Wakatipu. Two ranges belonging to these mountains, both of them at this season covered with snow, lie between the Awarua Valley and the Kakapo Lake, from between which the Hokuri stream flows to the north, and separated by a low saddle from a third large lake which as yet I only know of by report, and termed by the Maoris the Wawaihiwuk Lake, the drainage of which is effected through the Kakapo river that flows into the upper extremity of the Kakapo Lake.

Before leaving the summit of the mountains, we put up a pile of stones for the purpose of afterwards ascertaining its exact position. The lower part of the mountain bordering the lake, is composed of porphyritic greenstone, like that at Milford Sound, but overlaid by granitic gneiss, consisting of laminæ of felspar and quartz, with flakes of pearly mica irregularly dispersed. The rock sometimes passes into a rose-tinted or white quartzite, with layers of mica and felspar arranged in very fine laminæ. They are the same rocks as are met with on Black Peak, near the Wanaka Lake.

On the 18th we sailed to the upper end of the lake and made the schooner fast in Warp Cove. The upper end of the lake is in latitude 44° 31′ 41″; that of Gravel Cove, where we were last anchored, 44° 23′ 40″, and the lake is about 10½ miles in length.

About the 15th the barometer fell as low as 29·08, but without any remarkable change in the weather following. In the course of a few days it rose to 30 inches, when a violent storm set in on the night of the 18th, accompanied by a rainfall of 6 inches in the thirty-six hours that succeeded, but during which time the barometer continued to rise steadily. The frequence with which this anomaly occurred shows how little the indications of the barometer are to be trusted in these deep mountain valleys.

JAMES HECTOR,
Provincial Geologist.

Dunedin, 19th Oct., 1863.

HOLIDAY.

BIRTHDAY OF HIS ROYAL HIGHNESS THE PRINCE OF WALES.

HIS Honor the Superintendent directs it to be notified that on Monday, the 9th day of November current, being the birthday of His Royal Highness the Prince of Wales, the Provincial Government Offices will not be opened.

THOMAS DICK,
Provincial Secretary.

METEOROLOGICAL OBSERVATIONS TAKEN ON THE WEST COAST OF OTAGO.

GEOLOGICAL SURVEY EXPEDITION, "MATILDA HAYES."

Day.	Moon's age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
May.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
21	3	9.30 a m	30.229	30.35	.225	47	69.8	50	Calm	...	Clear and fine, with haze towards E.; half-ebb runs 2½ knots in bar channel
,,		3.30 p m	30.269	30.32	.224	54.5	52.7	51	N E	Light breeze	Clear; half-flood 2¼ knots
,,		9.30 p m	30.233	30.32	.234	50	64.6	50	N W	Gentle do	Clear; half-ebb. Clearing the Heads at this time
22	4	3.30 a m	30 109	30.19	.258	50	71.6	51	N W	Gentle do	Clear, with very light haze
,,		9 30 a m	30.073	30.18	.206	54	49.3	51	S E	Light air	Stratus 10. Very pleasant weather
,,		3 30 p m	29.999	30.12	.282	52	72.7	51	N E	Light breeze	Stratus 10
,,		9.30 p m	29.987	30.08	.270	51	72.2	51	S	Light air	Overcast and hazy
23	5	3.30 a m	29.963	30 04	.257	52	66	51	W	Moderate brêeze	Overcast and hazy
,,		9.30 a m	29.925	30.03	.268	57	57 7	51	N	Light do	Cumulus stratus cirrus 6
,,		3.30 p m	29.933	29.98	.255	56	56.9	51	N	Light air	Stratus 6
,,		9.30 p m	29.967	29.98	.295	55	68.1	51	N	Light breeze	Clear, with light haze
24	6	3.30 a m	29.893	29.93	.282	52	72.7	51	W	Light do	Clear, with light haze; wind dropped after 4 a m
,,		9.30 a m	29.891	29.93	.322	57	69.2	51	W	Light air	Partially overcast
,,		3.30 p m	29.788	29 82	.282	58	58.4	51	N	Light do	Partially overcast
,,		9.30 p m	29.774	29 76	.296	59	59.2	51	Calm	...	Densely overcast; at sunset heavy clouds to W, then became overcast
25	☾	3 30 a m	29.627	29.59	.308	54	73.8	51	N E	Gentle breeze	Rain since 11 p m; rather heavy sea
,,		9.30 a m	29.394	29.36	.295	55	68.1	53	E	Gentle do	Overcast; clearing to N.; rained until 8 a m; sea more calm
,,		3.30 p m	29.534	29.57	.321	55	74.3	52	W	Strong do	Overcast; heavy squalls. Bluff Harbor
,,		9.30 p m	29.863	29.86	.308	54	73.8	52	W	Moderate gale	Clear overhead; heavy cloud to the West
26	8	3.30 a m	29 963	29.98	.282	52	72.7	52	W	Strong breeze	Heavy clouds to the W. and S. W.
,,		9.30 a m	30.031	30.06	.255	56	56.9	52	W	Light do	Stratus 3, N. E. to N.W.
,,		3.30 p m	30.012	30.04	.256	54	61 3	52	E	Gentle do	Heavy clouds to the S. and S E; stratus 2, N.W.
,,		9.30 p m	30.008	30 03	.244	53	60.6	52	N	Light do	Clear; heavy swell; strong breeze from N. from 5 to 8 p m
27	9	3.30 a m	30.005	30.03	.232	52	59.8	52	N	Light do	Partially overcast; clearing Bluff Harbor
,,		9.30 a m	30.004	30.08	.244	53	60 6	52	N	Light do	Overcast, clouds hanging along the coast
,,		3.30 p m	29.895	30.01	.282	49	67.4	51	E	Gentle do	Densely overcast
,,		9.30 p m	29.921	30.00	.170	53	42 8	50	N	Light do	Densely overcast; slight rain at 8 p m; Riverton Harbor
28	10	3.30 a m	29.915	29.99	.175	49	50.5	52	N W	Light do	Overcast
,,		9.30 a m	29.937	30.02	.258	50	71.6	52	N W	Light do	Overcast; mouth of Jacob's River
,,		3.30 p m	29.919	30.00	.323	59	64.7	50	W	Gentle do	Stratus 4; ebb tide
,,		9.30 p m	29 917	30.00	.234	50	64.6	47	E	Light do	Heavy clouds round the horizon; Riverton
29	11	3.30 a m	29.969	29.99	.271	49	78.1	48	W	Light do	Clear overhead; heavy clouds round the horizon
,,		9.30 a m	29.951	29.94	.321	51	85.9	49.5	W	Light do	Stratus 3 to the east; 1st, 2nd ebb

Day	Moon's age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degrees of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
May.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
,,		3.30 p m	29.873	29 91	.295	53	73.3	46	N W	Gentle do	Partially overcast; ebb tide
,,		9.30 p m	29.866	29.98	.297	46	92.3	48	W	Strong do	Overcast; flood tide; rained from 4.30 until 8 p m
30	12	3.30 a m	29.921	29.95	.265	48.5	60.2	45.5	W	Strong do	Partially overcast; very strong gusts at intervals
,,		9.30 a m	29.891	29.93	.199	49	57.2	48.5	W	Moderate do	Partially overcast; heavy clouds to North; strong gusts, with slight rain
,,		3 30 p m	29.791	29.85	.196	51	52.5	45.5	W	Strong do	Partially overcast; clearing to N.E.
,,		9.30 p m	29.801	29.85	.190	51.5	49.8	48	W	Strong do	Overcast; showery
31	13	3.30 a m	29.821	29.88	.202	47	62.4	...	W	Strong do	Overcast; showers of rain and hail
,,		9.30 a m	30.045	30 08	.118	46.5	37.2	...	S	Strong do	Overcast; heavy squalls; clearing to N.E.
,,		3.30 p m	30.033	30.22	.142	43	51.1	...	S	Light do	Cumulus 6; at 6 p m nearly clear sky, then became overcast
,,		9.30 p m	30.246	30.33	.140	46.5	44.1	...	W	Light air	Overcast; a still cloudy night
June											
1	○	3.30 a m	30.271	30.34	.169	46	54	...	W	Light do	Overcast; a slight shower of rain.
,,		9.30 a m	30.289	30 36	.198	45.5	65	...	W	Light breeze	Overcast. [4 knots
,,		3.30 p m	30.281	30.34	.232	52	59.8	...	W	Light do	Overcast; temp. of sea at 2 p.m. in 5 fathoms of water (half-ebb) 45°; current
,,		9.30 p m	30 257	30.38	.236	48	70.5	...	W	Light air	Overcast; commencing to rain; rise and fall of tide at jetty 7 feet 9 inches
2	15	3.30 a m	30.282	30.34	.162	50	45	...	W	Light do	Overcast.
,,		9.30 a m	30 255	30.33	.209	50	58	...	N W	Light breeze	Clear, with banks round the horizon.
,,		3.30 p m	30.200	30.25	.192	55	44.5	...	N W	Light do	Clear
,,		9.30 p m	30.173	30 26	.162	50	45	...	Calm	..	Partially overcast
3	16	3.30 a m	30.172	30 25	.169	46	54.5	...	W	Light do	Cumulus stratus 6
,,		9 30 a m	30 227	30.27	.220	51	59	...	Calm	...	Cumulus stratus 4
,,		3.30 p m	30.220	30.30	.192	55	44.5	...	W	Light do	Cumulus 4; heavy clouds to the N.W.; slight showers since 10.30
,,		9.30 p m	30.245	30.33	.209	50	58	...	W	Light do	Clear over head; banks round the horizon
4	17	3.30 a m	30 207	30.23	.169	46	54.5	...	N W	Light do	Overcast
,,		9.30 a m	30.188	30.29	.282	52	72.5	...	W	Strong gale	Slightly overcast
,,		3.30 p m	30.322	30.36	.230	56	51	..	W	Strong breeze	Overcast
,,		9.30 p m	30.300	30.36	.192	55	44.5	...	W	Light do	Stratus 3, to N.E.
5	18	3 30 a m	30.325	30.35	.269	53	66.5	..	W	Strong gale	Partially overcast; heavy sea
,,		9.30 a m	30.312	30.46	.269	55	62	..	W	Strong breeze	Overcast; a slight shower at 9 a.m.
,,		3 30 p m	30 382	30.45	.282	56	62.5	...	W	Strong do	Clear.
,,		9 30 p m	30.368	30.46	.244	53	60.5	...	W	Light do	Clear overhead; banks to E. and N. At 10.25 a smart concussional earthquake
6	19	3.30 a m	30 328	30.42	.195	44	67.5	...	N W	Light air	Clear and hazy [brought all the men out of their bunks on
,,		9 30 a m	30.277	30.38	.182	45	60 5	...	Calm	...	Cirri 8 [deck, the vessel lying then aground.
,,		3.30 p m	30.131	30.24	.255	58	53	..	N W	Strong breeze	Stratus 3, and hazy overhead; heavy stratus to the north
,,		9.30 p m	30.198	30.18	.229	58	47.5	...	N W	Light do	Stratus 4, principally to the north
7	20	3.30 a m	30.188	30.08	.255	58	53	...	N W	Strong gale	Overcast.
,,		9.30 a m	29.970	30.04	.269	59	53.5	...	N W	Gentle breeze	Cumulus-cirrus 4; heavy stratus to the north
,,		3.30 p m	29.814	29.87	.312	62	56	...	N W	Moderate do	Clear, gusty, excessively warm; flood tide 52°, river 46°, 5 miles up
,,		9.30 p m	29.660	29.70	.285	64	48	...	N W	Strong gale	Clear; hot winds; bush fires all around
8	☾	3.30 a m	29.719	29.79	.282	56	62 5	...	W	Strong breeze	Very heavy rain through the night; estimate 1 inch
,,		9.30 a m	29.777	29 83	.349	55	80.5	...	S W	Light do	Overcast
,,		3.30 p m	29.718	29.73	.295	55	68	...	Calm	...	Overcast; thick haze

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
June	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
„		9.30 p m	29.636	29.77	.223	49	64	...	Variable	and light	Clear
9	22	3.30 a m	29.657	29.70	.269	52	50	...	W	Strong breeze	Overcast
„		9.30 a m	22.719	29.78	.196	51	52.5	...	W	Strong do	Clear overhead ; heavy banks round the horizon
„		3.30 p m	29.692	29.76	.209	50	58	...	S W	Light airs	Cumulus stratus 4 ; heavy stratus to the north
„		9.30 p m	29.807	29.82	.192	46	61.5	...	W	Heavy squalls	Overcast ; showery from 6 p m ; violent squalls with hail
10	23	3.30 a m	29.812	29.95	.125	46	40	...	W	Strong breeze	Heavy stratus to the north ; hazy ; heavy showers through the night
„		9.30 a m	30.064	30.14	.149	51	40	...	W	Heavy squalls	Cumulus 6 ; heavy showers
„		3.30 p m	30.096	30.25	.151	44	52	...	W	Light breeze	Clear overhead, banks round the horizon
„		9.30 p m	30.244	30.35	.177	42	66	...	S W	Light do	Clear ; showery
11	24	3.30 a m	30.253	30.35	.177	42	66	..	Calm	..	Overcast
„		9.30 a m	30.264	30.35	.147	46	47	...	N W	Light do	Light cumulus 5
„		3.30 p m	30.209	33.28	.173	51	46	...	N W	Light air	Clear overhead ; a heavy cloud to S.E.
„		9.30 p m	30.035	30.29	.134	42	50	...	N W	Light do	Clear
12	25	3.30 a m	30.032	30.13	.139	40	55.5	...	N W	Light do	Clear overhead ; heavy clouds to N.E. [W. thrown up by mirage
„		9.30 a m	30.017	30.09	.177	42	66	...	N E	Light breeze	Clearing from eastward ; squally S.W. ; breeze changing from W. to N.E. Land to
„		3.30 p m	29.964	30.03	.236	48	70.5	52	S W	Light do	Slightly overcast ; very strong W. wind ; very heavy sea ; a few slight showers.
„		9.30 p m	29.941	30.08	.254	43	91.5	52	S W	Light do	Clear, with haze ; slight rain [Crossing from Riverton to Port William
13	26	3.30 a m	29.957	30.03	.228	45	76	52	Calm	...	Heavy clouds round the horizon
„		9.30 a m	29.917	30.02	.225	47	70	52	Calm	...	Heavy clouds round the horizon ; showery
„		3.30 p m	29.932	29.86	.249	47	77	52	N W	Slight do	Cumulus 6 ; heavy clouds round the horizon ; showery
„		9.30 p m	29.787	29.77	.260	48	77.5	52	S W	Strong do	Clear, with haze overhead ; heavy cloud to the east ; rain
14	27	3.30 a m	29.614	29.64	.249	47	77	52	W	Very heavy gale	Clear overhead ; heavy cloud to the south ; showery
„		9.30 a m	29.617	29.65	.260	48	77.5	52	W	Very heavy gale	Light cumulus 5 ; very heavy squalls
„		3.30 p m	29.683	29.71	.221	42	83	52	S W	A gale	Overcast ; rain ; gale irregular ; squally
„		9.30 p m	29.813	29.92	.160	40	64.5	52	S W	Strong breeze	Clear, with light haze
15	28	3.30 a m	29.935	30.05	.221	42	83	52	Calm	...	Overcast ; wind changed to south, with snow, at 11 p m
„		9.30 a m	29.989	30.13	.208	43	75	52	W	Light air	Overcast
„		3.30 p m	30.022	30.14	.271	46	78	52	N W	Light do	Clear overhead ; heavy stratus round the horizon
„		9.30 p m	30.035	30.18	.194	39	81.5	48	S	Light breeze	Clear ; tide ¼ to ½ flood ; temp. 48°, being 4° lower than at Port William
16	●	3.30 a m	30.083	30.15	.170	36	80	48	S	Light air	Clear
„		9.30 a m	30.037	30.15	.205	45	68.5	48	N E	Gentle breeze	Light stratus 2
„		3.30 p m	29.919	30.03	.249	47	77	53	E	Strong do	Cumulus 6, stratus 2
„		9.30 p m	29.881	29.98	.262	46	84.5	54	E	Strong do	Clear overhead ; heavy clouds round the horizon
17	1	3.30 a m	29.821	29.92	.262	46	84.5	54	E	Strong gale	Very thick haze ; very heavy swell [squalls outside
„		9.30 a m	29.797	29.90	.251	45	84	53.5	S E	Strong breeze	Overcast ; heavy banks round the horizon on entering Chalky Inlet. Heavy
„		3.30 p m	29.773	29.86	.236	48	70.5	53	S E	Strong do	Cumulus 6 ; South Port Chalky Inlet ; gale still continues outside the Heads
„		9.30 p m	29.833	29.95	.225	47	70	54	S E	Strong do	Light cumulus ; thick haze, easterly wind ; strong gale outside
18	2	3.30 a m	29.929	30.03	.238	46	76.5	52	S E	Strong do	Cumulus 4, with thick haze
„		9.30 a m	30.079	30.15	.236	48	70.5	54	S E	Gentle breeze	Overcast ; in shallow water temperature was 54°, in deep water 55°
„		3.30 p m	30.049	30.19	.249	47	77	54	S E	Gentle do	Heavy stratus to north ; light cirri to S.E., heavy cumulus round the horizon
„		9.30 p m	30.150	30.29	.218	44	75.5	54.5	S E	Light air	Clear

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
June	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
19	3	3.30 a m	30.167	30.33	.191	36	90	54	N E	Light breeze	Clear
„		9.30 a m	30.211	30.38	.221	42	90	55	Calm	..	Very light cirri
„		3.30 p m	30.297	30.37	.241	44	83.5	55	Calm	...	Clear, with very light cirri
„		9.30 p m	30.338	30.41	.177	42	66	54	N E	Light air	Clear, with light passing clouds
20	4	3.30 a m	30.311	30.40	.203	40	82	53	E	Gentle breeze	Partially overcast; thick haze
„		9.30 a m	30.303	30.42	.215	46	69	54	Calm	..	Cirri 3
„		3.30 p m	30.235	30.36	.251	45	84	53	N E	Light air	Clear
„		9.30 p m	30.222	30.36	.221	42	83	53	N E	Light do	Clear
21	5	3.30 a m	30.244	30.29	.186	38	81	52	N E	Light breeze	Clear
„		9.30 a m	30.135	30.24	.203	40	82	53	N E	Light do	Clear
„		3.30 p m	30.006	30.10	.273	47	84.5	53.5	Calm	..	Clear
„		9.30 p m	29.952	30.03	.236	48	70.5	52	Calm	..	Very thick haze
22	6	3.30 a m	29.797	29.87	.238	46	76.5	52	Calm	..	Slightly overcast
„		9.30 a m	29.747	29.83	.236	48	70.5	52	Calm	..	Overcast
„		3.30 p	29.605	29.65	.310	48	92.5	52	Calm	...	Overcast
„		9.30 p m	29.509	29.50	.334	52	86	52	Calm	...	Overcast; commenced raining heavily at 10 p m
23	7	3.30 a m	29.354	29.36	.321	51	86	53	Calm	...	Overcast; heavy rain
„		9.30 a m	29.339	29.39	.361	52	93	54	Calm	...	Overcast; heavy rain
„		3.30 p m	29.655	29.75	.321	53	80	52	S E	Strong do	Densely overcast; heavy rain; heavy squalls commenced at 11 a m
„		9.30 p m	29.758	29.86	.286	46	92	52.5	S E	Light do	Dark clouds passing; clearing to the north; showers at intervals
24	8	3.30 a m	29.917	30.02	.262	46	84.5	52	S	Strong breeze	Dark passing clouds; hazy
„		9.30 a m	30.009	30.16	.245	51	65.5	54	Calm	...	Cumulus 6
„		3.30 p m	30.064	30.17	.251	45	84	54	N	Light do	Cumulus 4; heavy clouds passing
„		9.30 p m	30.064	30.18	.260	48	77.5	54	N W	Strong do	Overcast; rain commenced at 6 p m
25	9	3.30 a m	30.135	30.20	.322	49	92.5	54	N W	Light do	Overcast; heavy showers
„		9.30 a m	30.237	30.32	.355	50	92.5	52.5	S	Light do	Overcast; rain
„		3.30 p m	30.304	30.40	.273	47	84.5	53	N E	Light do	Stratus 2, to W. and S.W.; cumulus 1, to S.
„		9.30 p m	30 396	30.45	.249	47	77	53.5	N	Light do	Clear; heavy dew
26	10	3.30 a m	30 336	30.43	.309	50	85.5	54	N	Light do	Overcast; hazy
„		9.30 a m	30.360	30.43	.321	53	80	53	N	Gentle do	Overcast; leaving Chalky Inlet
„		3.30 p m	30.296	30.35	.322	49	92.5	53	N W	Gentle do	Overcast; rain
„		9.30 p m	30.192	30.29	.348	53	86.5	53	N W	Moderate do	Overcast; hazy; rain
27	11	3.30 a m	30.103	30.30	.334	52	86	54	N W	Moderate do	Overcast; hazy; heavy showers
„		9.30 a m	29.905	30.02	.309	50	85.5	54	N W	Strong do	Overcast; showery
„		3.30 p m	29.798	29.87	.348	51	93	54	N W	Strong do	Overcast; heavy rain
„		9.30 p m	29.834	29 87	.322	49	92.5	52.5	N W	Light air	Overcast; heavy rain
28	12	3.30 a m	29.878	29.92	.264	44	92	52	E	Moderate breeze	Overcast; very heavy rain
„		9.30 a m	29.961	30.09	.245	46	80.5	52	E	Moderate do	Heavy cumulus 6; showery
„		3.30 p m	30.001	30.12	.229	49	67	52	E	Moderate do	Cumulus 4
„		9.30 p m	30.017	30.12	.284	48	85	51	E	Light air	Clear
29	13	3.30 a m	30.007	30.10	.231	43	83.5	51	E	Light do	Clear
„		9.30 a m	30.007	30.11	.231	43	83.5	51.5	Calm	...	Cirri 1, to N.E.
„		3.30 p m	29.969	30.05	.221	42	83	51.5	S E	Light do	Clear
„		9.30 p m	30.008	30.09	.297	49	85.5	52	N E	Light do	Clear
30	○	3.30 a m	29.986	30.05	.186	43	67	52	S W	Light do	Clear
„		9.30 a m	29.981	30.05	.257	52	66	52.5	Calm	..	Clear

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
June	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
"		3.30 p m	29.922	29.97	.284	48	85	52	Calm	...	Clear; lying under shelter of hills
"		9.30 p m	29.876	29.95	.232	52	70	52.5	W	Light do	Clear; wind very light and variable
July											
1	15	3.30 a m	29.856	29.93	.238	46	76.5	52	S	Light breeze	Clear; wind irregular and light
"		9.30 a m	29.861	29.93	.247	49	71	52	Calm	..	Cirri N.W.; stratus E.; fog clouds
"		3.30 p m	29.771	29.83	.321	51	86	52.5	N W	Light air	Overcast
"		9.30 p m	29.704	29.74	.258	50	76	52	N E	Light breeze	Overcast
2	16	3.30 a m	29.582	29.60	.238	46	76.5	52	Calm	...	Overcast
"		9.30 a m	29.540	29.58	.249	47	77	52	Calm	...	Cirri 2, W. and S.W.; low fog clouds to south
"		3.30 p m	29.445	29.47	.296	51	79	54	W	Light air	Overcast; commencing to rain
"		9.30 p m	29.401	29.42	.275	45	92	54	N W	Light breeze	Overcast; slight rain
3	17	3.30 a m	29.277	29.26	.264	44	92	54	N W	Light do	Light cumuls-stratus-cirris to S.W.; heavy cumulus to east; unsteady wind
"		9.30 a m	29.242	29.30	.284	48	85	54	N W	Light do	Overcast; unsteady wind; heavy showers through the night
"		3.30 p m	29.287	29.34	.310	48	92.5	54	N W	Light do	Overcast; heavy rain; wind very irregular
"		9.30 p m	29.521	29.55	.309	50	86	54	N W	Variable	Cumulus 6, clearing to N.W.; showery
4	18	3.30 a m	29.392	29.38	.286	46	92	54	N W	Variable	Overcast; rain
"		9.30 a m	29.252	29.27	.361	52	93	54.5	N W	Variable	Overcast; heavy rain; heavy squalls; heavy rain through the night
"		3.30 p m	29.020	29.03	.361	52	93	54	S W	Variable	Overcast; heavy rain; heavy squalls
"		9.30 p m	29.143	29.19	.322	49	92.5	54	N W	Strong gusts	Overcast; showery
5	19	3.30 a m	29.168	29.20	.275	45	92	53.5	N W	Irregular gusts	Overcast; heavy showers
"		9.30 a m	29.186	29.27	.262	46	84.5	54	N W	Moderate breeze	Overcast; heavy showers of rain and hail; rainfall for 24 hours previously .5 inch
"		3.30 p m	29.194	29.30	.238	46	76.5	54	N W	Strong gusts	Overcast; heavy showers; heavy squalls
"		9.30 p m	29.312	29.40	.236	48	70.5	52.5	N W	Strong do	Overcast; heavy showers of rain and hail
6	20	3.30 a m	29.397	29.49	.228	45	76	53	N W	Light breeze	Overcast; heavy squalls
"		9.30 a m	29.493	29.60	.236	48	70.5	52.5	N W	Squally	Overcast; heavy showers of rain and hail; thunder at 5 a m; rainfall .25 inch
"		3.30 p m	29.540	29.64	.264	44	92	54	N W	Squally	Overcast; rain
"		9.30 p m	29.622	29.70	.254	43	91.5	52	N W	Squally	Overcast: rain
7	☽	3.30 a m	29.727	29.81	.254	43	91.5	52	N W	Light breeze	Overcast; rain
"		9.30 a m	29.819	29.95	.286	46	92	52	Calm	...	Cumulus-stratus 8; rainfall .65 inch, ceased raining at daybreak
"		3.30 p m	29.872	29.98	.262	46	84.5	51.5	S E	Gentle do	Overcast
"		9.30 p m	29.920	30.03	.235	41	91	50	S E	Light do	Clear
8	22	3.30 a m	30.009	30.03	.228	45	76	50.5	S E	Light do	Clear, with thick haze to S. and S.E.
"		9.30 a m	30.029	30.03	.249	47	77	51	S E	Light air	Cumulus-stratus 5; cirri 3
"		3.30 p m	29.651	29.76	.309	50	85.5	52	S W	Light do	Overcast; heavy rain since 2.30
"		9.30 p m	29.427	29.46	.361	52	93	51	N W	Light breeze	Heavy rain; wind variable
9	23	3.30 a m	29.255	29.34	.389	54	93.5	52	N W	Squally	Heavy rain
"		9.30 a m	29.266	29.28	.295	55	68	52	N W	Light breeze	Cumulus-stratus 6; rain; rainfall .5 inch
"		3.30 p m	29.115	29.14	.308	54	74	53	N W	Gentle do	Cumulus 6; slight showers and squalls in forenoon
"		9.30 p m	29.084	29.13	.362	54	86.5	52	N W	Light air	Overcast; slight rain
10	24	3.30 a m	29.442	29.52	.283	50	78.5	52	N W	Moderate breeze	Overcast; rain
"		9.30 a m	29.739	29.82	.296	51	79	53	N W	Squally	Overcast; showery; rainfall .5 inch
"		3.30 p m	29.851	29.96	.297	47	92.5	53	N W	Moderate breeze	Overcast; rain; showery through the forenoon
"		9.30 p m	29.904	30.02	.322	49	92.5	53	N W	Squally	Overcast; heavy showers; wind variable
11	25	3.30 a m	29.978	30.04	.271	49	78	53	N W	Heavy squalls	Nimbus 3; showery; dry N. wind in heavy gusts towards daylight
"		9.30 a m	29.953	30.06	.296	51	79	54	N W	Heavy do	Overcast; showery; rainfall .4 inch
"		3.30 p m	29.941	30.05	.334	52	86	54.5	N W	Heavy do	Overcast; heavy showers

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July.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
„		9.30 p m	29.993	30.08	.335	54	80	54	N W	Heavy do	Overcast ; showery ; thunderstorm from Southward
12	26	3.30 a m	29.910	29.99	.335	50	92.5	54	N W	Heavy do	Overcast ; heavy rain ; a heavy thunderstorm at 4 a m
„		9.30 a m	29.906	29.95	.389	54	93.5	53	N W	Squally	Overcast ; showery ; rainfall .65 inch
„		3.30 p m	29.700	29.80	.334	52	86	53	N W	Squally	Overcast ; showery
„		9.30 p m	29.605	29.65	.348	51	93	53	N W	Squally	Overcast ; showery
13	27	3.30 a m	29.677	29.76	.238	46	76.5	53	N	Gentle breeze	Overcast ; heavy thunder at 2 a m
„		9.30 a m	29.764	29.85	.241	44	83.5	52	W	Light do	Cumulus 5 ; clearing to S.W.; rainfall .35 inch
„		3.30 p m	29.839	29.93	.262	46	84.5	51.5	S W	Light do	Cumulus 6 ; occasional shower of rain and hail
„		9.30 p m	29.874	29.98	.262	46	84.5	50.5	N W	Light do	Partially overcast ; showery
14	28	3.30 a m	29.901	30.00	.241	44	83.5	55	N W	Light do	Partially overcast ; showery
„		9.30 a m	29.901	30.05	.214	48	85	52	N W	Light do	Overcast ; heavy rain ; rainfall .25 inch
„		3.30 p m	29.931	33.00	.297	47	92.5	51.5	N W	Light do	Overcast ; rain
„		9.30 p m	29.876	29.95	.297	47	92.5	51	N W	Moderate breeze	Partially overcast ; slight drizzling rain
15	29	3.30 a m	29.720	29.81	.251	45	84	52	N W	Strong do	Clear, with haze ; heavy banks round the horizon
„		9.30 a m	29.664	29.73	.249	47	77	53	N W	Light do	Overcast ; slight rain commencing ; rainfall .5 inch
„		3.30 p m	29.467	29.53	.275	45	92	52.5	N W	Moderate do	Overcast ; showery ; heavy shower of hail from W.
„		9.30 p m	29.524	29.59	.238	46	76.5	53	S W	Moderate do	Clear, with passing clouds
16	●	3.30 a m	29.562	29.62	.213	44	75.5	53	N W	Moderate do	Cle r, with light nimbus
„		9.30 a m	29.524	29.60	.283	50	78.5	54	N W	Moderate do	Partially overcast ; showery ; rainfall .25 inch
„		3.30 p m	29.524	29.60	.308	52	79.5	52	N W	Moderate do	Overcast ; heavy showers during the day
„		9.30 p m	29.525	29.60	.334	52	86	52.5	N W	Moderate do	Clear, with passing clouds ; showery
17	1	3.30 a m	29.536	29.58	.286	46	92	52.5	N W	Moderate do	Overcast; heavy rain and hail; thunder early in the morning
„		9.30 a m	29.574	29.65	.310	48	92.5	50.5	N W	Light do	Overcast; heavy rain; rainfall for 24 hours 1 inch
„		3.30 p m	29.432	29.48	.260	48	77.5	52	N W	Light do	Overcast; showery
„		9.30 p m	29.490	29.58	.308	54	74	52	N W	Light do	Overcast; slight showers
18	2	3.30 a m	29.569	29.53	.236	48	70.5	50	N W	Light do	Partially overcast
„		9.30 a m	29.597	29.68	.212	48	63	51.5	N W	Light do	Overcast; slight showers; rainfall .5 inch
„		3.30 p m	29.680	29.77	.234	50	64.5	52	S E	Light air	Cumulus stratus-cirrus 4; heavy cumulus round the horizon; wind changing to S.E.
„		9.30 p m	29.870	29.97	.251	45	84	51	S	Light breeze	Clear; North Port, Chalky Inlet
19	3	3.30 a m	29.913	30.02	.249	47	77	50	E	Light air	Clear
„		9.30 a m	29.934	30.05	.225	47	70	50	E	Light do	Clear
„		3.30 p m	29.897	29.97	.231	43	83.5	51	Calm	..	Clear, with light stratus
„		9.30 p m	29.814	29.90	.260	48	77.5	52	N E	Light do	Clear; darkening to the east; slight rain commencing
20	4	3.30 a m	29.733	29.93	.223	49	64	52	S W	Light do	Nimbus 4
„		9.30 a m	29.927	30.00	.208	46	65.5	52	S	A gale	Cumulus 4 to north; rainfall during the night .25 inch
„		3.30 p m	30.009	30.00	.215	46	69	54	S W	Squally	Overcast; heavy showers
„		9.30 p m	30.053	30.16	.189	48	56.5	54	S W	Moderate breeze	Overcast
21	5	3.30 a m	30.080	30.15	.209	50	58	54	S W	Light do	Partially overcast; showery
„		9.30 a m	30.121	30.20	.232	52	60	54	S W	Light do	Cumulus 8; rainfall .15 inch
„		3.30 p m	30.123	30.22	.234	50	64.5	52	S W	Light do	Overcast; slight showers
„		9.30 p m	30.096	30.24	.212	48	63	52	W	Light do	Overcast; slight showers
22	6	3.30 a m	30.081	30.21	.209	50	58	52	S W	Moderate do	Overcast; showery
„		9.30 a m	30.198	30.31	.262	46	84.5	54	S E	Light do	Overcast; showery; rainfall .15 inch
„		3.30 p m	30.226	30.33	.189	48	56.5	56	S E	Light do	Overcast; fleecy
„		9.30 p m	30.295	30.40	.189	48	56.5	56	S	Light do	Overcast
23	☾	3.30 a m	30.319	30.41	.199	49	57	54	S	Light air	Stratus 2, N.E.

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
July.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
„		9.30 a m	30.405	30.46	.186	53	51.5	55	S W	Light do	Cumulus-stratus 6
„		3.30 p m	30.312	30.43	.234	50	64.5	56	N	Gentle breeze	Overcast; commencing to rain
„		9.30 p m	30.267	30.42	.251	45	84	51	N W	Moderate do	Overcast; heavy rain; Deas Cove, Thompson's Sound
24	8	3.30 a m	30.181	30.30	.209	50	58	56	N	Gale	Overcast; very heavy rain
„		9.30 a m	30.148	30.25	.271	49	78	56.5	N	Gale	Overcast; very heavy rain; rainfall during the night .15 inch
„		3.30 p m	29.951	30.05	.297	49	85.5	56	N	Gale	Overcast; very heavy rain [A sudden change of weather, without any warning
„		9.30 p m	29.888	30.03	.334	52	86	56	N	Gale	Overcast; very heavy rain from the barometers, which fall very slowly, and
25	9	3.30 a m	29.934	30.04	.335	54	80	56	N	Gale	Overcast are still high
„		9.30 a m	29.837	29.92	.335	54	89	56	N	Gale	Overcast; very heavy rain; rainfall for 24 hours 4 inches
„		3.30 p m	29.671	29.70	.362	54	86.5	56	N	Gale	Overcast; very heavy rain
„		9.30 p m	29.485	29.53	.376	55	87	56	N	Gale	Overcast; very heavy rain
26	10	3.30 a m	29.441	29.48	.335	54	80	56	N	Gale	Overcast; showery
„		9.30 a m	29.336	29.37	.348	53	86.5	56	N	Gale	Overcast; showery; rainfall 3 inches
„		3.30 p m	29.459	29.50	.362	54	86.5	56	N	Squally	Overcast; heavy rain; wind changed at 4 p.m. to south
„		9.30 p m	29.769	29.81	.282	52	72.5	54	S W	Light breeze	Overcast; showery
27	11	3.30 a m	29.875	29.94	.258	50	71.5	52	S	Light air	Overcast; drizzling rain
„		9.30 a m	29.931	30.03	.258	50	71.5	51	N E	Light breeze	Overcast; rain
„		3.30 p m	29.919	29.95	.258	50	71.5	51	N	Gentle breeze	Overcast; rain; showery
„		9.30 p m	29.849	29.88	.245	51	65.5	52	N	Heavy squalls	Heavy cumulus 6
28	12	3.30 a m	29.713	29.73	.220	51	59	55	N	Heavy do	Partially overcast
„		9.30 a m	29.572	29.60	.219	53	54.5	55	N	Strong breeze	Cumulus 6
„		3.30 p m	29.417	29.45	.296	51	79	50	N W	Light do	Overcast; rain; Crooked Arm
„		9.30 p m	29.501	29.57	.236	48	70.5	48.5	S	Light do	Overcast; slight rain; Haulashore Cove; the water here is fresh
29	13	3.30 a m	29.597	29.68	.215	46	69	48	Calm	..	Clear over head; heavy cumulus round the horizon
„		9.30 a m	29.690	29.79	.205	45	68.5	48	S W	Light do	Slight cumulus 6; rainfall .75 inch
„		3.30 p m	29.752	29.80	.186	50	51.5	...	S	Light do	Cumulus 4; vessel aground
„		9.30 p m	30.015	30.01	.173	44	59.5	49.5	Calm	...	Clear; probably south wind outside; cloudless and beautifully still
30	○	3.30 a m	29.985	30.05	.173	39	72.5	49	Calm	..	Clear
„		9.30 a m	29.998	30.09	.151	33	80	47	N	Light air	Light cirri N.W.
„		3.30 p m	29.967	30.04	.234	44.5	80	50	S W	Light do	Cirri 2; clear, sharp, and pleasant
„		9.30 p m	30.015	30.10	.162	35	79.5	47	S W	Light do	Overcast; a still night; thick fog down the channel
31	15	3.30 a m	30 052	30.13	.170	36	80	50	W	Light do	Overcast
„		9.30 a m	30.057	30.15	.173	39	72.5	47	N	Light do	Clear; fog over the water; a slight shower at 4 a.m.
„		3.30 p m	29.997	30.10	.231	43	83.5	50	N W	Light breeze	Overcast; a few drops of rain
„		9.30 p m	30.082	30.14	.241	44	83.5	51	Calm	...	Overcast; slight rain; wind probably N.W. outside
Aug.											
1	16	3.30 a m	30.101	30.14	.100	42	74.5	50	N E	Light air	Partially overcast
„		9.30 a m	30.069	30.15	.103	40	82	52	N W	Light do	Cumulus 4
„		3.30 p m	29.931	29.97	.234	50	64.5	53	N W	Gentle breeze	Very light stratus
„		9.30 p m	29.780	29.84	.218	44	75.5	52	N E	Gentle breeze	Clear
2	17	3.30 a m	29.617	29.66	.186	50	51.5	...	N W	Moderate breeze	Light cumulus
„		9.30 a m	29.500	29.58	.260	58	77.5	52	N W	Moderate do	Overcast; slight rain
„		3.30 p m	29.502	29.56	.297	49	85.5	52	N W	Light do	Overcast
„		9.30 p m	29.540	29.58	.260	48	77.5	52	N W	Gentle do	Overcast; rain
3	18	3.30 a m	29.516	29.57	.262	46	84.5	...	N W	Gentle do	Overcast; rain
„		9.30 a m	29.532	29.58	.258	50	71.5	51	N W	Light do	Cumulus 8; clearing to the east; rainfall .5 inch
„		3.30 p m	29.406	29.47	.309	50	85.5	52	Calm	...	Overcast
„		9.30 p m	29.430	29.49	.273	47	84.5	50	N W	Light air	Clear

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
Aug.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
4	19	3.30 a m	29.356	29.41	.177	42	66	52	N W	Light breeze	Slightly overcast
„		9.30 a m	29.334	29.38	.228	45	76	52	Calm	..	Overcast; rainfall .25 inch
„		3.30 p m	29.256	29.27	.260	48	77.5	52	N W	Light air	Overcast
„		9.30 p m	29.253	29.28	.238	46	76.5	52	N W	Light breeze	Slightly overcast; drizzling rain
5	20	3.30 a m	29.276	29.26	.248	47	77	52	N W	Light air	Clear, with haze
„		9.30 a m	29.327	29.37	.273	47	84.5	50	E	Light breeze	Cumulus stratus; cirris 6
„		3.30 p m	29.327	29.37	.349	55	79.5	54	Calm	..	Light cumulus; cirris; entering Deas Cove
„		9.30 p m	29.401	29.44	.260	48	77.5	54	Calm	..	Clear, with light stray clouds
6	☾	3.30 a m	29.414	29.44	.249	47	77.5	54	S E	Light air	Overcast
„		9.30 a m	29.450	29.49	.242	46	84.5	52.5	S E	Light do	Overcast
„		3.30 p m	29.412	29.46	.308	52	79.5	54.5	S W	Gentle breeze	Overcast
„		9.30 p m	29.499	29.51	.273	47	84.5	54	S	Light air	Clear
7	22	3.30 a m	29.497	29.54	.273	47	84.5	54	S	Light breeze	Clear over head; cumulus round the horizon
„		9.30 a m	29.577	29.64	.238	46	76.5	54	N E	Light air	Clear, with stratus round the horizon
„		3.30 p m	29.590	29.64	.236	48	70.5	53	S W	Gentle breeze	Light cumulus; Milford Sound
„		9.30 p m	29.668	29.72	.231	47	83.5	53	Calm	..	Clear, with haze
8	23	3.30 a m	29.681	29.75	.221	42	83	53	Calm	..	Overcast; slight rain
„		9.30 a m	29.744	29.82	.221	42	83	53	S E	Light air	Light cumulus-cirri 3; thick fog on the mountains
„		3.30 p m	29.679	29.75	.231	43	83.5	54	S E	Light breeze	Overcast; heavy rain and thunder
„		9.30 p m	29.634	29.74	.231	43	83.5	53	S E	Light air	Overcast; rain
9	24	3.30 a m	29.560	29.58	.284	48	85	46	E	Squally	Overcast; heavy rain; distant thunder
„		9.30 a m	29.560	29.62	.284	48	85	46	N W	Squally	Overcast; rain; rainfall since noon 2 inches
„		3.30 p m	29.580	29.65	.231	43	83.5	46	W	Light breeze	Overcast; showery
„		9.30 p m	29.700	29.74	.212	41	82.5	48	W	Light do	Overcast; rain
10	25	3.30 a m	29.665	29.71	.186	38	81	46	W	Squally	Overcast; rain
„		9.30 a m	29.767	29.88	.203	40	82	50	S W	Light breeze	Light cumulus 4; rainfall .5 inch
„		3.30 p m	29.805	29.90	.221	42	83	51	N E	Light do	Overcast; snowing since 2 p m
„		9.30 p m	29.808	29.90	.225	40	91	49	N E	Light air	Overcast; snowing
11	26	3.30 a m	29.787	29.87	.191	36	90	46	N E	Light do	Clear and hazy; snow on deck 1½ inches thick
„		9.30 a m	29.795	29.88	.203	40	82	50	S W	Light breeze	Cumulus 5; rainguage showed 1 inch for 24 hours
„		3.30 p m	29.787	29.84	.190	41	74	50	S W	Light do	Cumulus 6
„		9.30 p m	29.817	29.88	.162	35	79.5	50	Calm	...	Clear
12	27	3.30 a m	29.763	29.84	.157	37	71	48	S W	Light do	Clear, with haze
„		9.30 a m	29.735	29.73	.186	38	81	52	W	Light air	Overcast; rain; commenced raining at 8 a m
„		3.30 p m	29.498	29.57	.221	42	83	46	W	Light breeze	Overcast; ceased raining at 2 p m
„		9.30 p m	29.577	29.60	.170	36	80	50	W	Light do	Clear
13	28	3.30 a m	29.463	29.63	.155	31	89.5	49	W	Light do	Clear
„		9.30 a m	29.654	29.74	.157	37	71	50	S E	Gentle do	Cumulus 6
„		3.30 p m	29.638	29.73	.177	42	66	52	W	Squally	Cumulus 8
„		9.30 p m	29.634	29.73	.160	40	64.5	54	W	Squally	Clear
14	●	3.30 a m	29.667	29.71	.205	45	68.5	52	N E	Strong breeze	Clear, with haze
„		9.30 a m	29.731	29.82	.139	50	38.5	54	S E	Strong do	Cumulus 6
„		3.30 p m	29.763	29.89	.173	51	46	54	S E	Moderate do	Cumulus 6
„		9.30 p m	29.906	30.02	.202	47	62.5	54	S E	Squally	Clear

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
Aug.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
15	1	3.30 a m	29.961	30.10	.208	43	75	52	S E	Squally	Clear
„		9.30 a m	30.012	30.12	.241	44	83.5	54	S E	Light breeze	Cumulus 4
„		3.30 p m	29.994	30.13	.283	50	78.5	52	S E	Light do	Clear
„		9.30 p m	30.141	30.22	.236	48	70.5	52	S E	Light air	Clear
16	2	3.30 a m	30.122	30.25	.173	39	72.5	50	S E	Light do	Clear
„		9.30 a m	30.157	30.30	.215	46	69	53	S E	Light do	Cumulus 8; fleecy
„		3.30 p m	30.124	30.25	.308	54	74	52	S E	Light do	Cumulus 6; fleecy
„		9.30 p m	30.199	30.33	.186	43	67	54	S E	Light do	Clear
17	3	3.30 a m	30.225	30.37	.157	37	71	50	S E	Light do	Clear
„		9.30 a m	30.278	30.40	.181	40	73	53	S E	Light do	Clear
„		3.30 p m	30.253	30.38	.296	51	79	52	E	Light do	Clear
„		9.30 p m	30.341	30.48	.181	40	73	54	S E	Light do	Clear
18	4	3.30 a m	30.349	30.49	.165	38	72	54	S W	Light do	Clear
„		9.30 a m	30.362	30.51	.231	43	83.5	53	N	Light do	Cumulus 6
„		3.30 p m	30.278	30.37	.407	57	87.5	51	N	Light do	Overcast
„		9.30 p m	30.249	30.30	.270	51	72	50	N	Light do	Overcast
19	5	3.30 a m	30.174	30.24	.284	48	85	52	E	Gentle breeze	Overcast; rain
„		9.30 a m	30.072	30.14	.309	50	85.5	53	E	Moderate do	Overcast; slight rain; rainfall .25 inch
„		3.30 p m	29.957	30.03	.375	53	93	54	E	Light do	Overcast; steady rain
„		9.30 p m	29.814	29.85	.334	52	86	52	N W	Squally	Overcast; rain
20	6	3.30 a m	29.805	29.90	.375	53	93	45	N W	Light breeze	Overcast; rain
„		9.30 a m	29.816	29.95	.362	54	86.5	45	N W	Squally	Overcast; slight rain; rainfall 1 inch
„		3.30 p m	29.881	29.94	.407	57	87.5	48	N W	Light breeze	Overcast
„		9.30 p m	29.848	29.88	.348	51	93	49	N W	Light do	Cumulus 6; clearing to the east
21	7	3.30 a m	29.808	29.90	.335	54	80	48	Calm	...	Overcast
„		9.30 a m	29.776	29.84	.334	52	86	48	S E	Light air	Cumulus-stratus-cirrus 6; rainfall .5 inch
„		3.30 p m	29.604	29.62	.378	57	81	50	N W	Gentle breeze	Light cirri
„		9.30 p m	29.496	29.55	.309	50	85.5	50	N W	Squally	Clear and hazy
22	☽	3.30 a m	29.520	29.53	.238	46	76.5	50	N W	Light air	Clear
„		9.30 a m	29.552	29.65	.309	50	85.5	52	N W	Light do	Overcast; slight rain; commenced raining at 8 a m
„		3.30 p m	29.567	29.63	.334	52	86	48	N W	Light breeze	Overcast; slight rain
„		9.30 p m	29.601	29.69	.348	51	93	48	N W	Light do	Overcast; showery; showery all day
23	9	3.30 a m	29.632	29.68	.334	52	78.5	50	Calm	..	Clear and hazy
„		9.30 a m	29.640	29.70	.283	50	80.5	50	E	Light air	Clear; fog on the mountains; rainfall .5 inch
„		3.30 p m	29.601	29.66	.349	55	76	50	N E	Light do	Cumulus 2
„		9.30 p m	29.694	29.80	.228	45	70.5	48	E	Light do	Clear
24	10	3.30 a m	29.744	29.88	.236	48	76.5	50	E	Light do	Clear
„		9.30 a m	29.898	29.98	.238	46	76.5	50	S W	Light do	Clear
„		3.30 p m	29.881	30.00	.308	52	79.5	48	S W	Fresh breeze	Clear
„		9.30 p m	30.006	30.10	.258	50	71.5	54	S W	Gentle do	Clear
25	11	3.30 a m	30.059	30.15	.218	44	75.5	52	S W	Light do	Clear
„		9.30 a m	30.081	30.20	.321	53	80	54	S	Light air	Clear overhead; cumulus round the horizon
„		3.30 p m	30.031	30.17	.321	55	74.5	56	Calm	..	Cumulus-stratus 4, round the horizon
„		9.30 p m	30.081	30.19	.321	53	80	54	S E	Light do	Clear; a beautifully fine night
26	12	3.30 a m	30.010	30.15	.284	48	85	55	S E	Light do	Clear
„		9.30 a m	29.981	30.12	.308	54	74	54	Calm	...	Cumulus-stratus-cirrus 8
„		3.30 p m	29.861	29.97	.282	54	67.5	56	Calm	...	Cumulus-stratus-cirrus 4
„		9.30 p m	29.813	29.91	.258	50	71.5	54	E	Light breeze	Clear, with light stratus

METEOROLOGICAL OBSERVATIONS—*continued.*

Day.	Moon's Age.	Hour.	Barometer corrected and reduced to 32°	Aneroid Barometer.	Elastic Force of Vapour.	Temperature of Air.	Degree of Moisture.	Temperature of Sea.	Direction of Wind.	Force of Wind.	Sky, Clouds, Remarks on Weather, &c.
Aug.	Days		Inches.	Inches.	Inches.	Degrees.	0=100.	Degrees.			
27	13	3.30 a m	29.716	29.81	.258	50	71.5	56	E	Gentle do	Cumulus-stratus 8
„		9.30 a m	29.657	29.74	.245	51	65.5	54	E	Gentle do	Overcast
„		3.30 p m	29.559	29.62	.335	56	74.5	48	W	Light do	Overcast
„		9.30 p m	29.548	29.63	.334	52	86	...	N	Light do	Overcast; slight rain ; commenced raining at 6 p m
28	○	3.30 a m	29.535	29.62	.348	53	86.5	...	N	Light do	Overcast; showery
„		9.30 a m	29.596	29.69	.391	56	87	...	N	Squally	Overcast
„		3.30 p m	29.612	29.69	.396	60	76.5	...	N	Light breeze	Clearing to southward
„		9.30 p m	29.489	29.54	.362	54	86.5	..	S W	Squally	Overcast; rain
29	15	3.30 a m	29.527	29.63	.348	51	93	...	W	Squally	Overcast; rain
„		9.30 a m	29.766	29.86	.404	55	93.5	...	S W	Squally	Overcast ; showery
„		3.30 p m	29.831	29.98	.393	58	81.5	...	W	Light breeze	Overcast ; occasional shower
„		9.30 p m	29.912	30.00	.396	60	76.5	...	N	Strong do	Overcast ; occasional shower
30	16	3.30 a m	29.828	29.91	.375	53	93	...	N	Strong do	Overcast ; rain
„		9.30 a m	29.758	29.80	.375	53	93	...	N	Strong do	Overcast ; rain
„		3.30 p m	29.601	29.64	.422	58	87.5	..	N	Strong do	Overcast ; rain
„		9.30 p m	29.483	29.46	.404	55	93.5	...	N	Strong do	Overcast ; heavy rain
31	17	3.30 a m	29.364	29.38	.348	51	93	...	N	A gale	Overcast ; heavy rain
„		3.30 p m	29.407	29.48	.308	52	79.5	...	S W	A gale	Cumulus 2, south
„		9.30 p m	29.578	29.64	.269	53	66.5	...	W	Strong breeze	Cumulus 4, round the horizon.

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