

APPENDIX No. 4.

REPORT ON THE GLACIERS OF MOUNT COOK, BY MR. T. N. BRODRICK, ASSISTANT SURVEYOR.

Timaru, 3rd August, 1889.

Under separate cover I send you the plans of the Mueller and Cook districts, showing the Mueller and Hooker Glaciers, and also the terminal face of the Tasman Glacier. Acting under your instructions, I painted the numbers from 1 to 10, in white, on the largest and most conspicuous rocks situated in different positions on the Mueller Glacier (shown on the plan by small red circles), and have accurately fixed their positions by trigonometrical observations. A plan showing the calculations of them will follow.

The rocks were well marked in very large characters and on all sides, so that there is every reason to expect that they will not be lost sight of until they are finally discharged from the glacier. Apparently, after leaving the ice and getting on to the river-bed, the action of the water, by washing the loose gravel from underneath them, gradually buries them. This is especially noticeable at the terminal face of the Tasman Glacier, where huge rocks in great numbers may be seen, the more recently discharged ones just beginning to sink, and so on, until at fifty yards from the glacier there is not a large rock to be seen. The circle marked 11 was not painted: it is a singular conical hillock of ice, covered with gravel. Mr. Huddleston tells me it has kept the same form ever since he went to live at the Hermitage. As there were no conspicuous rocks on that side of the moraine, I fixed its position instead. We carried a traverse by chain and theodolite along the southern side of the Mueller Glacier, on the line shown on the map, until the crevasses were passed; and from thence, by the same method, along the centre of the glacier right up to its head and on to Barron's Saddle, 6,672ft. high, from which point we could see down the valley of the Dobson to Lake Ohau. We also followed the track shown along the northern side of the glacier, with great difficulty and loss of time, to the point marked "camp," where we spent the night on the moraine.

There is a very fine face of ice, 190ft. thick, at an altitude of 7,619ft. on the Moorhouse Range, a little south-west of Mount Sefton. From this face the fall of ice was continuous, and, as it fell into a kind of rocky amphitheatre, the noise, intensified by the echoes, was very great. While standing on the clear ice, near the above place, we had the pleasure of seeing a crevasse commenced: the ice cracked in a long straight line, with a report like a pistol-shot, and immediately absorbed all the water which was standing in pools along its course.

From the camp to the head of the glacier we encountered no difficulties. The ice was smooth, and covered to a depth of about a foot with dry snow; and, except for the extreme regularity of the small medial moraines leading from the two tributary glaciers on the south, which I have shown on the plan, I did not see anything specially worthy of remark. The scenery, of course, is striking and grand, but the same remark applies to all the glaciers. A fine view is also obtained of the three peaks of Mount Cook. As you are aware, only the two lowest are visible from the Hermitage. There is nothing except the fatigue of such a journey to prevent tourists from going, *via* our southern track, to the head of the Mueller at any time. We started at 6.30 a.m. from the camp on the moraine, and measured up on to the saddle; returned, and then swagged the camp back to the Hermitage, getting there at 3 p.m. the same day. I carried a rough ray trace survey up the Hooker Glacier, in the manner shown on the plan, and determined the altitudes of the peaks on the Mount Cook Range, of several places of interest, the three peaks of Mount Cook, and of the Hooker Saddle.

I regret to say we could not get any further than the rocky point between the Noeline and Empress Glaciers. Beyond that the ice was broken up into sharp peaks with huge crevasses between them, and was utterly impassable for us with the appliances we had for mountain climbing. It was not possible to get any further than we did without the assistance of a long ladder to span the numerous chasms. The scenery was exceedingly grand and wild, and would well repay any one for the trouble of getting there.

You will see from the plan that the point we reached is not very much further than the one you and I reached in January; but, by stopping when we did, we missed the best part of the scenery. On the 4th April, at 12 a.m., taking a fixed point on the other side of the glacier, I ranged a line across it on a bearing of $101^{\circ} 43'$ from peg F, setting the rods at fairly regular distances apart in the ice; and again on the 7th April, at 8 a.m., reranged the same line, and found the rods had travelled the distances set down below. The rods are numbered from 1 to 5, counting from the west to the east.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
3ft. 3in.	8ft. 2in.	12ft.	15ft. 4in.	12ft. 8in.

Thus showing that, although the centre moves the fastest, the eastern side travels more quickly than the west.

The old lateral moraine on the east side of the glacier, on which is placed peg E, is very distinctly marked between the shingle slips, as are also the ones between it and the present one now being formed.

This seems to show that, after occupying one position for a long time, the glacier had melted away, and then remained stationary for ages before melting again, and so on until, at the present time, it is 235ft. below the position it occupied at E.

The corresponding old moraine-lines on the west side, although not so distinct, can still be traced: the reason they are not so plain is to be accounted for by the fact that such a quantity of snow accumulates on the Moorhouse Range that avalanches and slips are more numerous, and have swept them away.