

neath. The boulders in all three of the cataracts coming into Cassell's Flat are of immense proportions.

Judging from the general appearance and formation of this part of the country, I believe that in the remote past an immense ice-field existed south of Mount Sefton, and discharged itself in three main streams seawards. The low saddle between the McKerrow Glacier and the Twain Basin, even now only 50ft. or so above the glacier, would form no obstacle to the junction of the ice-fields off Sefton and those south. The northernmost stream of ice flowed down the Twain Valley, and over the depression behind the conical hill facing Cassell's Flat, and joining, or being joined by, the smaller glacier from VII.5 flowed through Regina Gorge into the main glacier, or the middle stream from the great central ice-field, which came over the Karangaroa Saddle and down that valley, till, uniting with the northern stream, it filled the whole basin of Cassell's Flat, and was again augmented by the large ice-flow from Mount Cook, which probably then found its way west over Baker's Saddle. This glacier must have been of enormous thickness, as on the spur of Mount McDonald, by Point R and Cairn XXI., there is what I believe to be distinct evidence of the ice overflowing that ridge, by depressions in the direct line of the flow, and going down the Mana-kai-au Valley to the low country, as well as the main Karangaroa Valley. Another piece of evidence which makes me inclined to put forward this theory is that while going up Ryan's Peak I noticed two lines of boulders lying on the east side of the lower peak, more than 4,000ft. above the river, which had every appearance of an old lateral moraine, left there by a stream of ice which came down the valley from the east.

There are signs of rapid, and possibly sudden, retreat in both valleys, which would easily be accounted for if these conclusions are correct. These great ice-streams from the central field had to come over Baker's Saddle, 6,300ft., and the Karangaroa Saddle, of about 5,000ft. in height, and on the gradual shrinking of the central ice-field they would suddenly be cut off at these points, notably at the Karangaroa Saddle, where one of the main streams would suddenly lose its connection with its source of supply, and, owing to its having no high peaks near it, would consequently fail to send down a sufficient body of ice, thus causing a sudden and rapid retreat.

The idea of a stream of ice coming off Mount Cook, over Baker's Saddle, is supported by the finding of boulders in the Copland Valley of the same formation as the Mount Cook Range, but, as I found also some of the same rock on the top of the main range west of FitzGerald Pass, it is possible that these stones came from Stokes or Ruareka, neither of which peaks have been closely examined. However, such a very low depression as Baker's Saddle must, I think, have been an outlet for the ice of the central ice-field lying near the Mount Cook of that day.

Of the fact that a glacier at some remote period came over the Karangaroa Saddle there is no doubt, as the rock is ice-worn, and strewn with immense erratic boulders; also, there is distinct evidence in the three very marked terraces on the left-hand side of the valley, between the saddle and Troyte River. The third stream from the supposed ice-field went down the Landsborough, helped by offshoots from the Hooker Range and the present dividing-range, but whether it discharged its waters eastwards or westwards I will not presume to give an opinion, as there seem to be good reasons for supposing that the Hooker Range is the older of the two, and formed at one time the watershed. Of this third stream, the McKerrow, Spence, and Le Blanc Glaciers are the only remains; while the principal remnant of the old ice-field and glacier is to be found up the Twain, in the Horace Walker, Douglas, and FitzGerald Glaciers.

In the course of this summer's work I had to fix stations on the ridge between Mount McDonald and the low country, at the head of the Mana-kai-au River, and took advantage of Mr. Scott going on to his hill to muster sheep. A week or so prior to this Dan Koeti, a Maori helping in a muster, went back along the ridge further than any one had hitherto been, and discovered two alpine lakes, which he reported to me. Hearing of these I went back towards Mount McDonald, and found that these two lakes were situated over 4,000ft. above sea-level, and draining into Jacob's River. The larger lake, Roto te Koeti (named after the finder), is half a mile long by 15 chains broad; the smaller one, almost circular, 10 chains in diameter. The larger is a good specimen of the real alpine tarn, formed or left by a glacier of considerable depth, and surrounded by ice-worn precipices and slopes which extend below the water's edge. Unfortunately, the avalanche *débris* and water from Mount McDonald is gradually filling it up.

Some time later in the summer, after coming down the Copland River, R. Fiddian and I, according to instructions, ascended Ryan's Peak (6,400ft.), with the object of obtaining bearings and photographs, and also to fix "The Spike," a peculiar rock seen from the Karangaroa Valley. The view from the summit of the Peak is one of the most extensive I have yet seen from a low hill on this coast, including (as will be seen by the panoramic photograph sent in) nearly all the great peaks of the dividing-range, a portion of Mount Cook, and the whole Hooker Range. The La Perouse Glacier, lying at the head of Cook River, is visible from *névé* to snout over the Copland Range, and the low country is seen to great advantage.

We bivouacked near "The Spike," which lies at the Karangaroa end of Ryan's Range, just above the bush-line, in the mountain scrub. It is a solitary column of rock which has become detached from the rocky spur behind its present portion, and, falling outwards, is now poised over the precipice into the Copland Valley, having the appearance of a great gun mounted to command the Regina Creek Valley and slightly elevated to drop a shell over the intervening range. This rock has a clear reach of 58ft. overhanging the precipice, and is about 15ft. thick by a little more in breadth, and is a distinctly striking feature in the view from just above the forks of the Copland and Karangaroa. The photograph I send herewith will give a good idea of the rock, the figure on the end giving some notion of comparative size.

While speaking of the transinsular route, I ought to have mentioned that I now know the whole dividing-range from the head of the Murchison Glacier to south of Mount Sefton on the east coast, and from the head of the Waiho River to the Haast Pass on the west coast, and am still of