

glacier, almost reaching across it; this is slowly travelling down on the top of the ice, or tumbling into crevasses and being carried down as under-ice moraines. According to the rate of the ice-floe this mass of drift will be over the terminal face by next spring, and for a few years to come the snout of the glacier will be disfigured with stones and dirty ice. Now, from its size, I am almost certain this mass of drift will form a terminal moraine of no mean size along the present face of the ice, the duplicate of the one at Δ ; and what I want, and would impress on every one who takes an interest in such matters, is to watch and note the progress of this mass of drift. An immense slip coming down on a glacier, I am certain, has more to do with the formation of moraine in some places and not in others, and has an effect on denudation that as yet has been taken little account of.

If careful notes were taken, and this drift forms a new lateral moraine, or perhaps causes the Δ one to be attacked, I think some data as to the age of the large lateral moraine three miles below the Forks, and another interesting fact, might be obtained. If a moraine is formed, it will be found to be composed principally of rolled schist wash, with very little Torlesse slates in it, and the amount of angular and semi-angular boulders will be small compared with the rolled wash that will be found lying beneath. It will also be totally different from the moraine extending from the mouth of Dolly's Creek to Δ , the highest point of which is at A1; this latter is composed of a mixture of the schist and Torlesse slates, showing that it came from far higher up the glacier, and there are far more larger rocks mixed with it. Now, I believe that in olden time land-slides, compared to which the present big slip is but a speck, came off the face of the peak above point S, and from the cliffs between Unser Fritz and point G, and completely covered the glacier for years. This took place probably when the glacier was on the No. 2 line level.

In my report on the moraines between Cook's River and the Omaroa, which went to Hokitika some five or six years ago, I remarked that the bluff-faces were composed of rolled wash, capped by angular morainic drift. Mr. McKay, the Government Geologist, remarked the same peculiarity up the Hokitika and Arahura Rivers, and he appears to have been puzzled—at any rate he gives no reason why the morainic drift should be dumped on the top of what appears to be river-wash. The process is very simple, and can be seen going on at the Waiho at present, and at the Thermal Glacier, Waiaototo River. The formation and sorting of a moraine depends entirely on the quantity of drift lying on its surface near its terminal face. One like the Strauchon, almost entirely covered with drift, will deposit at its face a moraine composed almost entirely of angular blocks, as the drift which falls direct from it is out of all proportion to that which drops down crevasses and is shoved up at its snout by the ice-pressure as rolled river-wash, abraded by the action of the ice and the water underneath. One like the Franz Josef, before the big slip came down, would send little or no drift over its face, but would send it out as rolled wash in a ground moraine; but, now that the slip drift is approaching the terminal face, the two processes will go on together: the rolled wash will be forced up from underneath, and the angular and semi-angular drift will fall from the ice on the top of it. But, large as this slip is, it will not be so powerful in its results as to form a moraine like that at Δ , where the angular and rolled drift has been in nearly the same quantity. If this is the process by which part of the Gillespie's Bluff, Cook's, Hunt's, and other sea-bluffs, have been made, then they are not, as is supposed, the end of lateral but are in reality terminal moraines. This assertion is not so astounding as at first appears. I have seen maps showing the original size and shape of the old West Coast glaciers, and in every instance they follow what are now the present river-flats, and the long ridges of drift running parallel with them and ending in high sea-bluffs are called their lateral moraines. I have examined every river, from the Arahura to the Hollyford, and in no single instance did I find the ice flow in any direction but north. The Waiho drift is to be looked for not at its mouth, but away north toward the Wataroa River. I believe the whole country was a mass of piled-up drift at one time, and the so-called lateral moraines are simply drift hills, shaped by the various rivers, ages after the ice had anything to do with them. The lateral moraine below the Waiho Forks, the old course of that river and the Totara into Mapourika, are but events of yesterday. I had not time to examine this moraine just mentioned, and will not commit myself and say it is one. It looks like one, certainly; yet it resembles, only on a larger scale, many of those giant bars which so many Westland rivers have formed across their course, and changed their flow into a totally different direction. Examples of such are to be seen on the Teremakau, Waitaki, and Pyke Rivers. It requires to be examined to see if these are not remains of lake beaches along it. It is, of course, ice-drift, but its nature has to be proved first. I cannot get it to fit in with any of the old ice-lines, unless R to the Outlook is the one. Whatever it is, its shape is against its being a terminal moraine, and that peculiar form is more of the bar than anything else.

In valleys containing large glaciers I have always found four tiers of terraces, or old ice-lines, as if there had been four distinct periods. These lines keep a wonderfully regular distance from each other, and their inclination is very uniform, from, say, 4,000ft. to 600ft. or 700ft., where the river valley breaks out of the hills. The longer the valley, the more gentle the slope. The best places to see these lines are up the Haast, near the Eighteen-mile Bluff; and, better still, the wonderful terraces of Mount Caria, up the Arawata, where the old lines can be seen quite distinctly for 4,000ft. up, and running for miles down the valley. In the smaller valleys, two and three terraces are visible, and the smaller ones have none. From this I would conclude that the Franz Josef, although the largest glacier at present, was, during the great ice period, of second, or may be third-rate importance. It must have been far eclipsed by Cook's, and the Karangarua. It is possible that the flat ledge at point L, and a faint trace of another at point G, may be remains of No. 4 line; but they are high above any line I have yet seen, and there is no trace of it lower down. The highest remains of those terraces are at point U, the Outlook, and 1,000ft. above the mouth of Mildred's Creek; and those points decidedly belong to point R, U, and N line (F.B., p. 14). This article is margined surface geology; it treats more of the surface than what is under. The dip and strike of the rocks are the same all over the country, N.N.E. with a dip E. The valley of the Waiho has been entirely eroded across the line of strata, the rocks being schist, gneiss, and