Art. XXXVIII.—*The Alluvial Deposits of Otago.*

By L. O. Beal, sen.

[*Read before the Otago Institute, 11th July, 1888.*]

In April, 1870, in the young days of this Institute, I had the honour of addressing the members on the subject of the "Alluvial Deposits of our Goldfields;"* also since then, some fourteen years back, without, however, writing a paper for publication, on the same subject, especially in reference to a change in the earth's polarity; and I now, with your permission, beg to supplement my remarks.

The "glacial epoch" is so thoroughly recognised as having occurred in the earth's history that I need here but mention it as a fact. It has been alluded to by many authorities. The explanation of the existence of this period I assume to be that the polarity of the earth has, in the course of an extremely long period, changed—*i.e.*, the east and west of to-day were once at north and south, thus allowing the earth's surface to have become gradually and entirely under the influence of the polar climate, and equally so under the influence of the equatorial climate, thus accounting for the remains of tropical flora and short-haired animals near the north pole—the presence of the body of the megatherium mentioned by Lieutenant Nordenskjold in the neighbourhood of the mouths of the rivers Obi and Yennisei, and the large accumulations of ivory tusks at Nova Zembla, being notable illustrations; whilst the appearance of ice on the equator, as noticed by Professor Agassiz, in describing his holiday trip up the Amazon River; and in our own home of New Zealand,—and, though I am not conversant with Australian writings, I feel sure the same features have been observed and described there,—amply bear out the same theory. The subject is well described by Mr. J. T. Campbell in his book "Frost and Fire," as applicable also to the British Isles.

Viewing the physical construction of the earth, as shown in any map, we find its circumference at the poles and the equator to differ by something like twenty-nine miles—a fact of such great moment that we can scarcely embrace its importance, as a very little of so great a difference would account for the altitude necessary to bring about the climatic changes we are considering. The subject of the action of ice at the present day may be read of in any travellers' books, such as Ross's "Antarctic Expedition," Lord Dufferin's "Letters from High Latitudes," E. Whymper's "Scrambles in the Alps," and many others. The enormous time such events would occupy,

* "Trans. N.Z. Inst.," vol. iii., p. 270.

and the large amount of *débris* carried by the ice in this glacial epoch, will well account for the wearing-power we see in the ranges of mountains, in the vast accumulations and the different varieties of rocks and soils that fill our valleys, and in the equally extensive appearance of flowing water that has so fully sorted them during their deposition.

To-day we observe in valleys running east and west very strong evidence of their shady and sunny sides in the difference in the growth of vegetable life; and in the glacial epoch this difference between the shady and sunny sides I imagine to be equally observable. The shady side, facing the south, would be the last home of the glaciers, and thus account for the greater quantity of deposit which we call the terraces of to-day; whilst the sunny side, facing the north, being more under the influence of water caused by the melting snow, has been scoured out, and has thus prevented the *débris* being of equal height on both sides of such valleys. Every valley thus tells its own geological story, a large one like the Clutha or Molyneux Valley having, of course, more to tell us than its smaller companions.

When considering this subject we must bear well in mind the difference between the very gradual melting of snow and the more powerful water-scouring of our present rainfall—sometimes light, sometimes heavy, especially during tropical and thunder storms. The persistent, steady melting of the snow, no matter of what magnitude the snowfalls might be, would give us those regular or almost regular and light bands which we see in the banks of the Molyneux River, my lowest point of observation, and in the photograph which I show of the celebrated Mount Burster Claim, in the Kyeburn Ranges, some 4,000ft. above the level of the sea, which forms my highest point of observation. The deposits at the Blue Spur, Tuapeka, and other large sluicing-claims at lower elevations, tell the same story. The consideration of this subject is necessarily very absorbing to us as dwellers in this land of golden deposits. It indicates and points to the evidence of old channels of rivers, the objects of search to the miner and of possession to the speculator and capitalist; and it will not be denied that wherever the bed-rock in the Silurian formation has been reached large deposits of the precious metal have been found, as at Gabriel's Gully, Tuapeka, Butcher, and Conroy Gullies, adjoining the Manuherikia River, in the Molyneux Valley. Occasionally, also, rich deposits have been found when sinking in the terrace-formation, as at Ross Flat, on the west coast, and in the Cardrona Valley. These two latter may be pictured to our minds by considering the river-features of to-day—say, for instance, in the lower part of the Shag Valley, where the Shag River

closely resembles a letter S; and it will be admitted that, could we take up a slice sufficiently thick, and thus bare to our view this valley at an earlier time, before it had been so much filled up as to-day, we should find this river equally meandering, only that it would have to be described by opposite curves to the letter S of to-day; and in the intermediate depths the same large waterflow would be observable, and thus explain to us the meaning of the following extract from the *Otago Daily Times's* (27th April) mining intelligence from the Arrow: "The gold was found in the stuff taken out in the operations of boring, and several layers of wash were passed through, all showing more or less gold. The bore-hole is now down upwards of 100ft. without striking the bed-rock. The prospects of the field are better than ever before." The bands of wash-dirt, of course, indicate to us the larger water-sorting of the then course of the river.

I must apologize for the brevity and incompleteness of this paper, as I have had no opportunity for travelling for some few years, and beg you will find an excuse for me; but if I have succeeded in drawing attention to this subject, that others who dwell in districts more favourable for observation than Dunedin may profit by it, I shall be content. I need hardly say that all valleys are filled up in the way indicated by the foregoing remarks.

Of the photographs I now exhibit No. 1 is of the Mount Burster Claim, showing the bands I have alluded to; No. 2 is of the Müller Glacier, and brings under our notice the *débris* it is carrying, also at its foot exhibits the water flowing. The glacier is melting on its surface exposed to the rays of the sun, and thus causes the stones with which it is charged to become more apparent than its normal condition would be when nearer the pole.

Art. XXXIX.—*Note on Rock collected by the Rev. W. S. Green from near the Summit of Mount Cook.*

By Professor T. G. Bonney, F.R.S.

Communicated by Professor F. W. Hutton.

[*Read before the Wellington Philosophical Society, 9th January, 1889*]

Under the microscope this rock is found to be composed of —(1) angular fragments of rather clear quartz, commonly less than 0·1in. in diameter, but occasionally as large as 0·15in.: (2) rather earthy-looking fragments of about the same size, which on examination with a high power are found to be crowded with filmy microliths, often faintly tinged with green, giving