

geological position is in the Cretaceo-tertiary series of the New Zealand Geological Survey. The surface of the specimen, which is one of innumerable equally well-marked samples which might have been chosen, is scored in more than one direction by grooves or striæ, which vary much in depth, the maximum being about $\frac{1}{16}$ in.; and were it not that some of these are curved they would present no features distinct from true glacial striæ.

The slip occurred on a surface of the coal-measures dipping at 25° , and was caused by the accumulation of surface-water in a deposit of soil and vegetable growth, the cohesion of which had been destroyed by fires. After proceeding for some distance the direction of the moving mass was changed to about 40° from the straight line by an outstanding mass of quartzose grit, and at this point the whole body plunged over a vertical cliff about 20ft. in height, forming a veritable cascade of mud, and stones, and tree-roots. In the lower portion the angle of slope was reduced to 10° , and at this point a cottage was carried away and destroyed, unfortunately not without loss of life, for an infant member of the family was left behind in the confusion, and the mother perished in a heroic but unsuccessful effort to save her child.

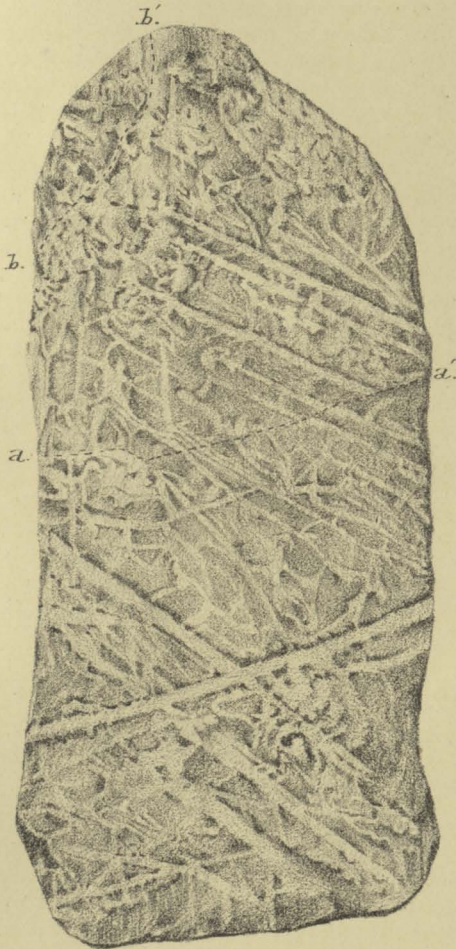
The surface bared in the upper portion of the slip is fire-clay, rendered very slippery by the presence of water, while the part which came away consists, below the soil, of about 8ft. of fireclay and quartz grit, the hard fragments of the latter causing the striation of the remaining rock, which at the time of my visit was covered with numbers of well-defined grooves.

ART. XLI.—*On the Neighbourhood of Te Aoroa, Northern Wairoa.*

By JOHN HARDING, of Mount Vernon.

[*Read before the Hawke's Bay Philosophical Institute, 13th Aug., 1888.*]

TE AOROA is situated on the west bank of the Northern Wairoa, between Aratapu and Dargaville. This, together with a long stretch of country to its north and south, is classed as "drift" on our geological map. This would apply to the high lands, but about one-fourth is rich alluvial flat and swamp, the hills soft sandstone, varying in colour from snow-white to black. The coast-hills differ much from those farther inland, the latter having a large quantity of bog-iron mixed with the surface-soil, in many parts rendering it impervious to water, and so almost useless for agriculture or grazing. All this hill-



———— *Natural Scale.* ————

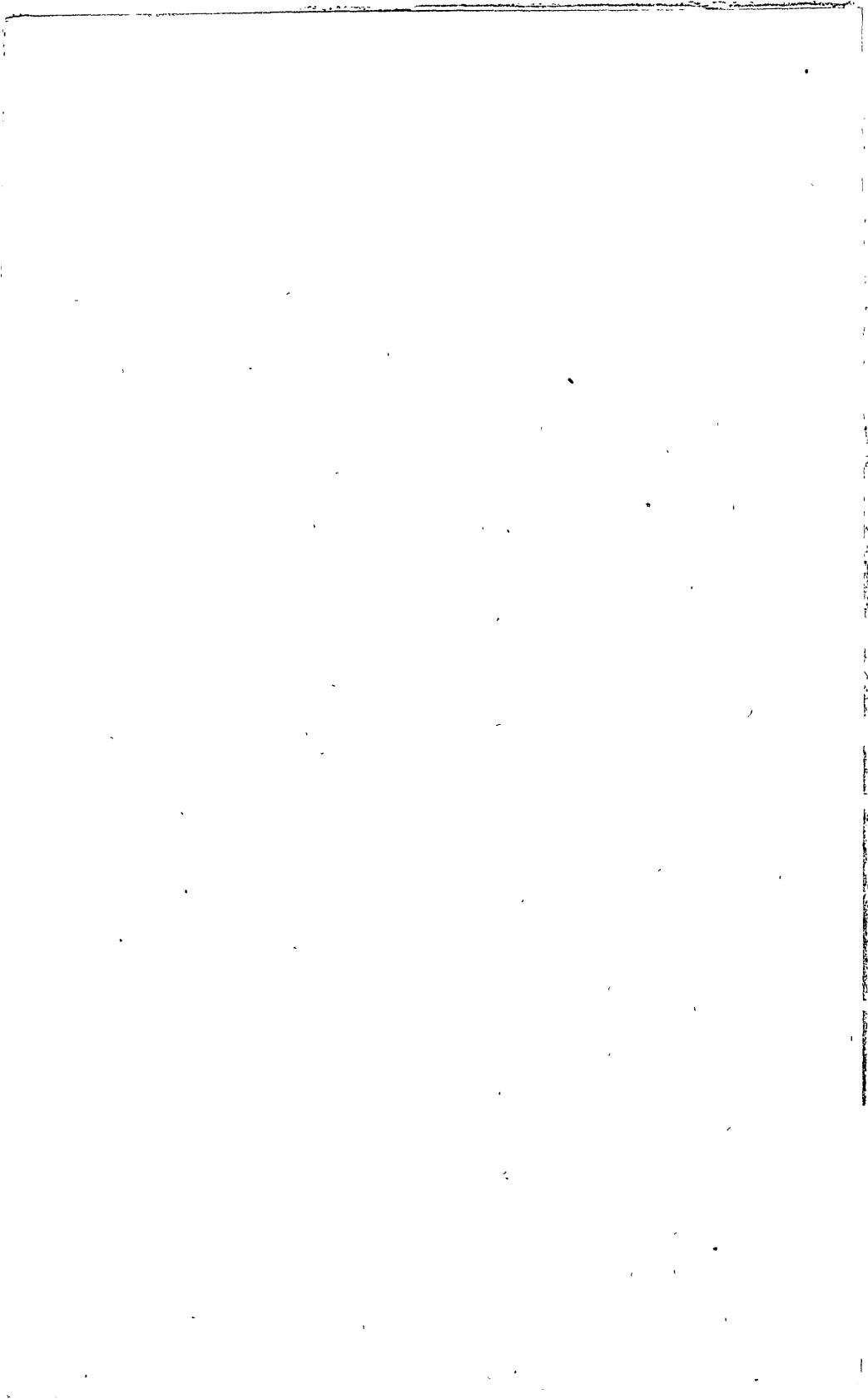
a. a.' and b. b.' are lines of fracture in the specimen.

———— *A STRIATED ROCK SURFACE.* ————

From Boatman's Reef, N.Z.

G. J. E. delt

C. H. P. lith.



land was once grand kauri forest : this is proved by the quantity of kauri-gum found on it. It has been worked as a gum-field—sometimes as many as two hundred men digging on it at one time—for the last thirty years (so I have been told by old residents), and yet it still yields a good quantity.

The cliffs on the coast show the same drift-sand nature down to sea-level. They also show that many great changes have taken place, and that the late kauri forest was not the first, for in the cliffs are several beds of good lignite, divided from each other by thick beds of drift-sand. This lignite contains many kauri-trees and fossil gum (ambricit).

The higher hills all have remains of old pa on the tops, and you can learn the history of them from the Maoris ; but since my sons have had the place the remains of a very large old pa have come to light, of which the oldest natives say they have never heard. There are indications that the whole has been covered with forest, though not kauri, for kauri does not appear to have grown on the present coast-hills since the days of that pa.

When I bought the property this part was covered with a dense growth of fern, tutu, and scrub. This was burnt off, exposing the surface to the west winds, which removed the surface vegetable soil, then the sand, thus exposing bit by bit the ground-plan of a pa. It is on a large flat, and the process of uncovering is still going on. After a heavy gale my sons often find stone axes and pieces of stone, a kind of flint ; but I have not seen any remains of wooden articles.

At one place, known as Mount Wesley (an old Wesleyan mission-station), the sandstone hills reach from the coast to the bank of the Wairoa, and one seam of the lignite crops out and forms a small reef in the river near the bank.

One strange feature of the country is the presence of a layer of blue clay or mud in a liquid state at varying depths. This mud was first found by my son in sinking a hole for a strainer-post. He hit the seam, and it ran over the top of the hole ; and, though that is some nine years ago, it still runs at times, and has formed a quagmire about the place in which he has had many sheep smothered till he fenced it round. Recently a country road was cut through the hill at Mount Wesley. As the work proceeded one of my sons told the contractor that he was getting very near this mud, and cautioned him to alter his line slightly. The contractor laughed, and asked where mud was to come from on a hill ; but a few more strokes of the pick hit the seam, and out flowed the mud, and the place had to be sheet-piled, and that only partly stopped the outflow. It was running along the side of the road when I was there a few weeks since. This mud or clay is just like what the early Wellington settlers used to call earthquake

mud or clay, because it always ran out of cracks and holes in the ground at the time of an earthquake.

About the centre of the property there are a number of caves. The only known way of entering is to be lowered down by a rope. When inside there is a slight glimmer of light from somewhere; but, as Paddy said when lost in a large building, you cannot find the entrance out. I think these caves were formed as follows: The entrance-hole is in the centre of a slight hollow. Here, of course, the rain-water would accumulate, and percolate through the sandstone to the layer of mud, thence out at the bottom of the inland cliffs to the swamp below, taking the mud and soft sandstone with it. Possibly when the swamps are fully drained entrance to the caves may be found at the foot of the cliffs.

I can see no difference in the stone axes and adzes found at the exposed pa. However, I can only think that its origin must date back to a time far beyond what we give for the arrival of the Maoris—possibly to a previous race of people. This view is strengthened by the fact that in draining parts of the large swamp to which I have referred my sons came upon ancient draining-works, showing that these swamps had been drained ages ago, at the cost of much labour and skill. Large ditches have been dug, running from one mile to one and a half miles long, and as straight as an arrow, from the river back to the foot of the hills.

Now, so far as my experience goes, the Maoris rather prefer to make a swamp than drain one. They will build eel-pas across streams, thus damming back the water, flood the surrounding country, and so create a swamp. A large proportion of the swamps at the Thames and the Waikato are said to have been made by eel-pas, and there is evidence that some of the Te Aroa swamp has been thus made; so I think the old pa and the old drainage-works are the work of a race which lived here before the Maoris.

ART. XLII.—*Notes on the Geology of Tongariro and the Taupo District.*

By Professor A. P. W. THOMAS, M.A., F.L.S., F.G.S.

[*Read before the Auckland Institute, 30th July, 1888.*]

PLATES XXVI.—XXXII.

WE owe our first accurate knowledge of the geology of the Taupo volcanic zone to von Hochstetter. Although he spent a comparatively short time in the district, his great geological insight