

shells flourished, there was no "Oamaru Cape," which now gives a friendly shelter to our coasting fleet; as it is also tolerably plain that a spacious harbour or inlet then existed, where the waters of the Waitangi now traverse an extensive agricultural district.

The following, I think, to a common mind—perhaps not to a trained geological one—seems to bear further testimony to the age of these shells:—

In various parts of this coast the face of an old sea-beach is seen, often elevated considerably above the present one, and supplying the shingle from which the present coast is formed. This is covered by many feet of silt. The inference surely is, that *since* this old beach was formed, we have had at least one considerable depression (to allow of the uniform deposition of such a depth of clay over many miles of surface) and one subsequent elevation.

If, in our day, there is little or no sensible movement going on in this part of New Zealand, we may surely conclude that the two movements, referred to, represent a very lengthened period. Yet the fossil shells in this old beach seem precisely similar to those now living; then, how immensely old, by comparison, must this group of shells be, in which only a few bear any close resemblance to those we now find. As bearing on this, and because we often hear it assumed that the coast is rising, the following may be worthy of note:—

At the mouth of the Awamoa, and, I believe, at various creeks on the coast, we find evidence of old Maori repasts, where moa bones (many of them broken, and the fractures still sharp, not waterworn) are associated with those of the seal, marine shells, such as Maoris still collect for food, chert flakes, etc., in a black soil, apparently a mixture of sand and charcoal. I believe those who have studied the matter consider that it is a long time since Maoris feasted on moa flesh, and that these particular deposits are amongst the earliest records of human life in these islands. Yet while exploring at this place with spade and pick, I was on two occasions "washed out of my diggings" by the sea at spring tide, showing that the deposit is now only slightly above high-water mark, while we may safely assume, that, if lower by only a foot or two, such a friable soil could not long withstand the violence of the sea on an exposed coast. While taking out some egg shells (moa) at this place, I found, at about twelve inches below the surface, a small bit of ivory resembling one half of a long squarish bead, split down the centre longitudinally. I am not aware of any hollow ivory tusk it could be made of, and it is difficult to conceive how the hole could be bored without the use of an iron tool. I shall enclose wax impressions, which may interest Mr. Mantell,—like showing him a nugget from his old diggings.*

ART. XLI.—*Account of a visit to a Hot Spring called "TE PUIA," near Wangape lake, Central Waikato, Auckland; in August, 1868.* By R. GILLIES.

[Read before the Otago Institute, November 2, 1869.]

Most of you are aware that in the North Island of New Zealand a series of natural wonders exists, such as are unequalled in any other part of the known world, in the shape of thousands of hot springs, fumaroles, mud-volcanoes and solfataras. Some of them are of the grandest and most beautiful character, and will yet, when the Maori difficulty is effectually disposed of, draw to our shores crowds of scientific and delighted observers. The district in which these principally occur extends from the active volcano of Tongariro, in the

* See *Mantell*, loc. cit. sup. Also "Trans. N. Z. Inst.," Vol. i., p. 18.—Ed.

Province of Wellington, in a north-easterly direction, along the Upper Waikato, through Lakes Taupo, Rotorua, Rotoiti and Rotomahana, to the White or Sulphur Island, a solitary, but active volcano situated in the Bay of Plenty, many miles at sea. But the spring which I ask you to visit with me to-night is not situated in this zone or belt of active volcanic agency, nor does it possess any of the grand or even beautiful characteristics which belong to the world-renowned "Orakeikorako," "Rotomahana," or "Rotorua" springs. Still it has an interest of its own, especially to Otagonians, to whom a hot spring of any sort is a natural wonder not discovered as yet within their borders, so far as I know.

"Te Puia," as the Maoris call it, is situated about forty-five miles, as the crow flies, south of Auckland city, on the banks of the "Mira," a stream flowing from the west into the Wangape lake, in the Central Waikato basin. A drive in the coach of about thirty-two miles along the main south road, brings us to Point Russell, an incipient township on the banks of the noble Waikato, just past Koheroa, the scene of the fight of 17th July, 1863. Taking steamer here, and proceeding about thirteen miles up the beautiful river, often with the branches of peach trees, which grow luxuriantly on its banks, brushing the paddle-boxes of the steamer as she follows the windings of the deeper channels, we pass "Meremere," another spot memorable in the 1863 war, alike for the strength of its position, and the ludicrous incident which accompanied its evacuation by the Maoris, and disembark at the mouth of the Wangape creek, just below Rangiriri, the bloodiest of all the battle-fields in the Waikato campaign. With the assistance of a Pakeha-Maori friend who accompanied us (I say "us," for my wife accompanied me, and was the first white woman who ever visited "Te Puia"), we here engaged a Maori canoe and crew to take us up the Wangape creek and lake, to within about five or six miles of the spring. This part of the journey was something enchanting, the smooth easy motion of the canoe, the beautiful scenery of the lake (whose name I was told denotes "a large sheet of water"), and the measured cadence of the paddles, as they dipped simultaneously to the musical "Tupari, Tupari" of the Maoris, interrupted occasionally, as we passed native settlements, by the peculiarly shrill Maori cry of welcome, "haere mai," or of enquiry as to who we were: all gave an interest and pleasure not often met with in New Zealand travelling, just in the least degree marred, in our case, when we remembered that we were going into a part of the country which, though perfectly safe, had not been often visited by Europeans. At sunset we landed at the head of the lake, and were accommodated in a nice raupo whare, for the three days during which we made this our head-quarters—our Maori hostess dispensing her hospitality with a kind and liberal hand. From this place, a journey of two hours, on foot, the last half mile through a low-lying swampy Kahikatea forest, brought us to "Te Puia."

This name "Te Puia," though given by the Maoris living in the vicinity specially to the spring now under consideration, appears to have a more general application as well, and to be the generic term for a certain description or class of hot springs, as will appear from the few following remarks of Dr. Hochstetter, which I take the liberty of reading, as I am aware there are not many copies of his work on New Zealand, in Otago. (Page 391.)

"The phenomena are similar to those upon Iceland, and as the Icelanders distinguish their hot springs as Hverjar, Namur and Laugar, so also the Maoris make a similar distinction, although not quite so marked, between Puia, Ngawha, and Waiariki. The Hverjar upon Iceland are either permanent fountains, whose boiling water is continually in a state of ebullition; or intermittent ones, whose water shows a vehement ebullition only at certain periods, when it reaches the boiling point, while during the intervals it is in a

state of calm repose, its temperature often falling considerably. To the Hverjar belong, for example, the celebrated springs of Haukadál, the great Geyser and Strokkur, and with these the Puias of New Zealand correspond. The word Puia is especially used in the Taupo country, to designate the intermittent, geyser-like fountains of Tokanu, of Orakeikorako on the Waikato, and of Whakarewarewa on Lake Rotorua. Puia has, moreover, the more general meaning of crater or volcano, and is applied to active as well as extinct volcanoes. Namur, upon Iceland, are the non-intermittent springs, such as the solfataras of Krisuvik and Reykjahlid, having no periodical eruptions; and the same are in New Zealand the Ngawhas, a term specially used for non-intermittent springs, for the solfataras and sulphurous hot-springs on the Rotomahana, Rotorua, and Rotoiti. Finally, the springs suited to bathing purposes, the water of which never reaches the boiling point, and all naturally warm baths are called 'Waiariki,' corresponding to the Laugar of Iceland."

From this it will be seen that "Te Puias" are intermittent springs, whose temperature varies considerably at different times; a phenomenon which seems to be characteristic of this individual spring, as will appear from certain considerations to be mentioned further on. This is an incident worthy of note, as corroborative of the correctness of Hochstetter's general observations and deductions, and illustrative of the general prevalence, amongst the Maoris, of certain terms for certain classes of phenomena. Hochstetter never visited this spring, was never any nearer to it than the Waikato, and yet, here we find the same term applied amongst one tribe, which he found prevailing amongst other and totally different tribes, at least one hundred miles from this.

For some distance before reaching the spring, the heavy air of the swampy forest is impregnated with a sulphurous odour, occasionally to the extent of being very offensive, and about ten chains from our journey's end, the bush track, which we followed, brought us to the stream which flows from the spring. Speaking from memory, this stream was from two to three feet wide, of a similar depth, and running with a considerable current. It was clear, with a bright but dark-green deposit, or, as I at first thought, with fungus plants growing in the bottom. Steam was rising all along its course, and it was so hot that you could not hold your hand in the water. The creek was about four feet below the general level of the flat, and the bank sloped easily down to the edge of the water. On this bank no herbage of any sort was growing, but whether the red unclad soil was the result of anything peculiar in the water, or of recent floodings of the creek itself, I cannot pretend to say; I rather think of the latter, however, as evidences were not wanting of recent inundations. Following up the creek, and scrambling through some thick undergrowth in the otherwise open Kahikatea bush, all of a sudden we come upon "Te Puia."

I confess I felt disappointed on seeing it. From what I had read of hot springs, I expected to have seen a nice circular basin, with its sides encircled by silica or lime; a clean and graceful punch bowl on a gigantic scale, with a funnel or tube descending from the centre, from whence proceeded all the "hubble-bubble, boil and bubble," with which our ideas of subterranean igneous action are generally associated. I might then have let my imagination loose for a time, and pictured to you fairy nymphs with angelic forms laving their graceful limbs in the enchanted bath, whilst sylvan satyrs kept watch and ward in the dark recesses of the forest around. But alas, nothing could be more prosaic than this ugly dub of water, more like a duck or horse-pond than anything else. Along one side and one end, the bush came close to the pond's edge. On the other side and end, the bush was cleared for a space of about ten feet, on the average, as shown in the sketch. There was no hollow, or head of a gully, or anything of that sort, to indicate that water might

be expected there ; and any one approaching the spring from the side on which the bush grows thick, and close to the water, might, just as likely as not, plump headlong into the hottest of the water before being aware of its existence.

“Te Puia” is simply a sudden pool in the flat forest land, with the water about two feet below the general level around, and with a perpendicular clay bank forming its margin all round. The pool is somewhat the shape of a kidney potatoe, and measures along its greatest length, between perpendiculars from each end, sixty-eight feet, and in the same manner across, twenty-one feet. The depth of the pool I could not measure, as the Maoris have wisely filled it in, to within about three feet of the surface of the water with branches of trees, so as to afford any poor beggar, who might accidentally tumble in, a chance of getting out again before being parboiled. A log is placed across the pool, just above the surface of the water, to enable the natives visiting it to take advantage of the hottest part for cooking their potatoes, eggs, or “kai” generally. At the only part where it is at all possible to bear the heat of the water logs are also placed, coincident with the surface of the water, for the convenience of bathers. Nor let it be supposed that these rude appliances were at all unnecessary. I can assure you that it would take more nerve than I am possessed of, to have induced me to walk out on the log at the hottest part. I am not much afraid of water, but to run the risk of being boiled alive is quite another thing, and would make most men pause before risking it uselessly. In order to get the temperature of this part of the spring, I adopted another plan than that provided by the Maoris. I cut a long pole in the bush, and tied my thermometer by a string to the end of it, and thus dipped it into the hottest part. However, I found the logs at the other part of the spring of the greatest service, when I had prepared myself for a bath, and when, of course, the lady portion of the party had satisfied their curiosity and retired. At first I could only stand on the log, and dip the tips of my toes in the water, and gradually, inch by inch, descended deeper, till I was able to introduce my whole body up to the chin. Whilst thus immersed, my sensations were too hot to be pleasant. Every moment I felt as if the crown of my head was coming off, I was however determined to *do* the hot spring thoroughly, and knew that assistance was at hand to take me out at once had I fainted. To move much in the water, or bathe, in the ordinary acceptation of the term, was too painful to be endured.

Before disturbing the pool, the water was clear, and of a faint-blue tint ; the branches, etc., forming the artificial bottom, being covered with the same bright malachite-green deposit, I have mentioned before as characterising the stream which flows from it. What this beautiful green deposit is I cannot say. On disturbing the water, however, it disappeared immediately, and the whole pool became of a white milky colour.

At the hottest part the water was *not* boiling, but effervescing like ginger beer, and vapour occasionally rose from it. Here I found the temperature, by an ordinary tin thermometer, to be 168° Fah., a foot below the surface. At the place where I bathed the temperature was 113° Fah. The temperature of the air at the same time being 68°. The Maoris said that the spring was not so hot at that time as it sometimes is, and that they often cook their potatoes and other kai, quite easily in it. At the above temperature (168°) they could not do this, and I was inclined then to view this and other stories which I heard of scalding pigs, boiling eggs, etc., to be myths rather than actual facts, till Dr. Hector suggested to me the likelihood of its being an intermittent spring ; and since perusing the remarks of Hochstetter, which I have read to you, upon the name “Te Puia” being applied, in general, to all intermittent springs whose temperature varies ; and also some remarks of Captain Hutton

upon this same spring, recorded in the "Transactions of the New Zealand Institute," Vol. i. p. 71. I think it is very likely that my unbelief was more at fault than the Maoris' facts.

Before disturbing the water, I filled two square gin bottles, which I had brought with me for the purpose, from the hottest part of the spring, and sealed them up at once to prevent the escape of gases. One of these bottles of water was afterwards forwarded, through my brother, to Dr. Hector, and is the bottle of water the analysis of which is given on page 71 "Transactions N. Z. Institute," Vol. i. The other bottle had a more inglorious, and somewhat ludicrous, end. The excess of my care of both bottles caused me to place them on a shelf in the raupo hut where we were entertained during our stay, and one day some "old hands" (surveyors' men) were having dinner in the hut, I was outside, making a sketch of the beautiful Whangape lake, when one of the Maoris came rushing out in a very excited state, gesticulating for me to come at once. I saw something was wrong, and on going in, found one of my bottles, which I had strictly charged the Maoris to take great care of, in the hands of one of these civilized white men, with the top part of the bottle broken off, and only a very little water left in the bottom. "Oh Sir," says the fellow, "please Sir, it busted." I suspected at once that it was not any peculiarity of the water that had caused the "busting," as in that case the whole of the water would have been gone, and the shelf, on which the bottles were lying on their sides, would have been wet. I said nothing, however, and after they were gone I found my conjectures correct, and that these men, in their insatiable love of drink, had jumped to the conclusion that the bottles contained gin, took one of them down and gave it a friendly tap on the head. The Maoris interfered too late to save it from their lawless greed, but the explanation that it was water from "Te Puia," suggested at once the excuse that it "busted." I drank some of this water and found it tasteless.

With reference to the medicinal properties of the spring, I may state, that a surveyor in the district informed me that on one occasion he was very ill with rheumatism, and that he camped close to "Te Puia," and by repeated bathings in the water for a fortnight, taking care to cover himself well with blankets after each immersion, he was thoroughly cured, and has had no return of the malady since.

"Te Puia" also forms a very good barometer for those living within sight of the valley, as, before the advent of rain a column of vapour is invariably seen rising from the spring.

There are several other hot springs in the same valley in which "Te Puia" is situated, but I was told they were all smaller.

The valley of the Mira is a deep precipitous glen, but from its being densely wooded, I can say nothing about its geological character, except that a bold white cliff which I observed on the opposite face of the glen, from where I descended into it, was said to be limestone.

As to the origin of these hot springs I should have liked to have read another extract from Hochstetter's "New Zealand," but I have detained you too long already, and must just conclude by referring you to page 432 of that able and deeply interesting work, which I regret to find is not so well known in Otago, as it deserves to be.