slighest approach of sickness, they would resign themselves to death, and that would be the invariable result. This may be accounted for simply by a dream, and the effect of an excited imagination upon a weak, untutored mind.

I do not apologize for the fragmentary nature of the notes which I have thus put together, but I may express a hope that some of those who have had opportunities of inquiry into the same subject, will, as early as possible, place on record the results of their observations.

Appended to this paper are drawings of the private marks on *Karaka* trees, and the Mori-ori and Maori names of some of the indigenous birds and plants.

ART. III.—*Notes on the Influence of Atmospheric Changes on the Hot Springs and Geysers in the Rotorua District.* By Capt. GILBERT MAIR.

[*Read before the Wellington Philosophical Society, 28th Oct., 1876.*]

FOR many years past, partly from my own observations, and partly from conversations held with intelligent natives, I have been led to believe that some of the hot springs and geysers in the Rotorua and Taupo districts are affected to a remarkable degree by changes in the wind. Latterly I have carefully noted down these changes, and hope at a future time to reduce such observations to some system. But in the hope of drawing attention to this very remarkable phenomenon, I will now give a few instances as they occur to my mind.

Close to my residence at Tekautu, Ohinemutu, there is a large steaming pool 30 by 50 feet wide, and about 60 feet deep, named Tapui. It is situated on a grassy mound, about a hundred yards from Rotorua Lake, and some fifteen or twenty feet above its ordinary level. I have been in the habit of bathing here for some years past, and generally found the water about blood heat.

Since October, 1874, I have observed that immediately the north and east winds (which blow directly across the lake) set in, Tapui fills up four or five feet, a strong outflow takes place, and the temperature rises from 100° to 190° This continues till the wind shifts round to south, south-west, or west, when Tapui resumes its ordinary level and temperature.

In 1875, from January to September, sea breezes or winds from north to east, set in, generally about 9.30, and at noon Tapui would be full and running over, and nearly at boiling point. In the evening, as the wind from the sea died away about six o'clock, the water began to recede, the

temperature to lower, and at eight o'clock the water became cool enough for bathing.

This year, however, the prevailing winds have continued to blow from the sea, and Tapui has seldom been fit to bathe in. For many years the natives living at Koutu have observed the rise and fall of this spring, which circumstance has passed into a proverb,—"*Tapui tohu hau*"—(Tapui the wind pointer). They tell me that they have never known it to remain hot for so long a time previously.

At Whakarewarewa, two miles and three quarters from Ohinemutu, there are several hundred mud baths and boiling springs. There are also several fine geysers, which become very active during south-west and westerly winds, frequently throwing water 40 to 60 feet. The principal ones are named Pohutu and Te Horu. They are rarely active in the middle of the day, but generally between seven and nine in the morning, and from three to five in the evening, while Whakaha Rua, or the "Bashful Geyser," is only in a state of violent ebullition after dark.

Perhaps the most singular instance of atmospheric influence is in the case of Te Tarata, the White Terrace, at Rotomahana. The great crater, which is about 90 feet in diameter, is usually full of deep azure blue colored water, occasionally boiling up ten or fifteen feet; but when the keen south wind, or *tonga*, blows, the water recedes, and you can descend 30 feet into the beautifully encrusted crater, which remains empty till the wind changes, when it commences to refill at the rate of three or four feet per hour, boiling and roaring like a mighty engine. When the crater is almost full, grand snow-white columns of water 20 feet in diameter are hurled 60 feet into the air. Blue waves of boiling water surge over the shell-like lips of the crater, and fall in a thousand cascades over the alabaster terraces.

There are many other springs (for example, Ohaki, near Taupo, Whakapoapoa, at Orakeikorako) which, according to Maori legends, are influenced by changes in the wind. There is a great spring called Ketetahi, situated on the western slope of Tongariro, and 1800 feet above the level of Rotoaira Lake, which is only active during westerly winds.

About three miles north of the Waikato River at Niho-o-te-Kiore, and in the middle of Hinemara Plain, are two fine springs, named Waimahana. These pools are circular, each about 25 feet in diameter, and 30 or 40 yards apart. They are situated on a spur which slopes down to the Whangapua River, 180 feet below, on the sides of which the outflow has formed pretty white silica terraces. The northernmost pool slowly bubbles, and the temperature throughout the year ranges from 190° to 200°. In March or April the water in the other pool recedes to ten or fifteen feet below the

surface, and remains at blood heat until December, when it fills up, a strong outflow takes place, and the temperature is increased to 204°.

I carefully noted these springs during the years 1870 to 1874 without detecting any deviation from what I have already stated.

In writing these notes I have had to trust entirely to memory: they are therefore not so accurate as might be desired. But I think sufficient evidence has been adduced to justify us in assuming that the coincidence of these changes in the Hot Springs is not merely accidental, but must be attributed to some unexplained cause. Before any correct theory can be arrived at as to the supposed effect of the wind on the Hot Springs, it will be necessary to obtain careful observations extending over a considerable time.

Can it be that the singular phenomena I have alluded to are caused by contraction or expansion of the earth's crust? or are they attributable to barometric pressure? It seems difficult to realize the possibility of their being due to the latter cause, as the orifices of some of the springs I have instanced vary in width from 90 feet to nine inches.

Were these geysers situated at a lower level than the lake, atmospheric pressure, extending over a large water surface, might readily be assumed as a cause; but Te Tarata, and several of the springs I have mentioned, are at a considerable elevation above any water.

Before concluding, I may mention that volcanic action in the Hot Lake District is fast dying out. Many of the finest geysers have dried up during the last twelve years, including the once famous Waikite, at Ohinemutu—so graphically described in Mr. Meade's book—Waikite, at Whakarewarewa, and Te Koingo, or the "Sigh," at Rotomahana; while few new ones ever burst out.

ART. IV.—*On the Draining of Towns.* By W. D. CAMPBELL, Assoc. Inst. C.E., F.G.S.

[*Read before the Wellington Philosophical Society, 4th November*, 1876.]

THE subject of drainage comes before us, in almost every town, either as a question of system or of clarification at the outfall; in England, both of these aspects of sanitary work have of late received a great deal of attention, and many of even the most lethargic towns have been stirred into action by injunctions served upon them by River Conservancy Boards.

The consideration thus bestowed upon drainage has necessarily caused a more methodical grappling with the subject; and the author having been actively engaged for several years upon drainage works, submits to the