floods in the Wangaehu, Waikato, and Wanganui Rivers, probably attended with serious consequences to the town of Wanganui. The great boulders in the Whakapa and Wanganui Rivers, some of them weighing over 50 tons, would seem to have been carried down by such floods in the past. That the atmospheric conditions affect the state of the thermal springs and fumaroles in the Tongariro group appears very evident. I had not sufficient opportunity of noting the state and conditions of the steam-vents, under various atmospheric conditions, to make any definite statement on the subject, but I noticed that the discharge of steam was greater in the early morning with southerly winds and frosts; and the Natives always look for bad weather when the steam hangs low on Ngauruhoe in the morning.

Art. XLVII.—*Phenomena connected with the Tarawera Eruption of 10th June, 1886, as observed at Gisborne.*

By Archdeacon W. L. Williams.

[*Read before the Auckland Institute, 26th July*, 1886.]

About 2h. 30m. a.m. on the morning of the 10th June, 1886, most of the inhabitants of Gisborne were roused from their slumbers by the rumble of distant explosions, following one another in quick succession, accompanied by an extraordinary agitation in the atmosphere, (there being no wind to speak of,) which kept the doors and windows rattling in their frames, as though from the effect of a discharge of heavy artillery in the neighbourhood. The first probable cause that suggested itself was thunder; but, on looking out, it was seen that the sky was perfectly clear and the stars shining most brilliantly. Then, if it was not thunder, might it be the forewarning of a violent earthquake? But the atmospheric disturbance showed that it could not be a mere earth-rumble; and so the conclusion was forced upon one that it must be a distant volcanic eruption, probably from Tongariro.

A further survey of the horizon, however, showed a cloud low down in a W.N.W. direction, in or near which there was something unusual going on; flashes of light illuminating the whole cloud; then linear flashes darting in various directions, or round balls of light. As the view of the cloud was somewhat obstructed by trees, we could only see the upper part; and concluded that, wherever the eruption might be, there was a thunderstorm of an unusual character raging in that direction in the far distance. Other people, who had an unobstructed

view of the W.N.W. horizon, saw much more of the fiery display than I did. Accounts given by different people vary somewhat; but this is probably owing to the difference of time at which the observations were made. Those who had an early view, about 2h. 30m. a.m., describe the cloud as shaped somewhat like a mushroom, the lower portion forming a distinct column, while the upper part spread itself out on all sides. The flashes, or incandescent objects, also were seen to be projected from below into the upper part of the cloud, and some of them to fall again, and others apparently to explode, many of them presenting decidedly the appearance of balls. After a time the cloud became more diffused, and no longer maintained the mushroom shape. Between 3 and 4 a.m., a south-west squall came up, with heavy rain, which effectually put a stop for some time to further observations. A number of slight shocks of earthquake were experienced at intervals, some persons having counted as many as twelve between 3 o'clock and noon.

Towards morning it was observed that there was an unusual darkness, though there was a low comparatively bright arch in the south-west horizon. At 7 a.m., when it should have been broad daylight, it was still exceedingly dark, but near objects on the north-east side were dimly lighted up by a weird reflection from the south-west horizon, the light taking a very peculiar colour from the cloud overhead. It was evident now that we were under the edge of a dense cloud of volcanic dust, which shut off the sunlight very effectually, with the exception of what came to us in a roundabout way by the south-west. Under the influence of the south-west gale, which had now set in decidedly, the dense dust-cloud gradually moved off to the north-east, and by 10 a.m. we were able to dispense with artificial light.

There were frequent squalls and showers from the south-west during the day; but nothing further was seen of the eruption, though the rumble of the explosions continued to be heard from time to time during the day, and for several days afterwards.

On the evening of Sunday, 13th June, the horizon being clear, there was visible a distinct column of vapour or smoke in the W.N.W., which formed a diffused cloud above.

There has been no fall of dust or ashes in Gisborne, though there was a sprinkling at places about fifteen miles off in a north-westerly direction, and, of course, more further on. The southern limit of the deposit on the coast is Anaura. At Waipiro, in Open Bay, dust came down from about 4 a.m. to about 10h. 30m., causing the most intense darkness, until it was gradually driven off by the south-west wind about 11 o'clock. The deposit there is about 1 inch thick on an average.

According to the best available maps, the distance in a direct

line from Gisborne to Tarawera is just 90 miles; the height, therefore, of the cloud of vapour and dust which was visible here at the time of the eruption must have been very great. An object at that distance, to be visible at all on the horizon, must be at least one mile in height above the level of the sea. It is not possible to obtain an absolutely correct measurement of the height of the cloud above the horizon, but a close approximation can be arrived at by the aid of other objects with which it could be compared. In this way it appears that the angular measurement of the height of the cloud, as seen from Gisborne, was from 3½ to 4 degrees, corresponding to a height above the plane of the horizon of from 5·5 to 6·3 miles. For the full height, we must add to this the distance between the plane of the horizon and the top of the mountain, which will bring the whole height, at the lowest computation, to a little over 6 miles from the top of the mountain.

Art. XLVIII.—*Notes on the Eruption of Tarawera, as observed at Opotiki.*

By E. P. Dumerque.

[*Read before the Auckland Institute*, 21*st July*, 1886.]

On 10th June, 1886, at about 2 a.m., people were aroused by violent noises as of peals of thunder, and volcanic rumblings, and towards the south-west the sky was illumined with strong light, from the midst of which at intervals shot forth balls and forks of fire.

From about 2 till 9 a.m. there was a succession of shocks of earthquake of moderate force, accompanied by a peculiar floating or rolling, as it were, of the earth.

At about 3 a.m., the sky at the time being perfectly clear and starlight, an inky-black cloud rose in the south-west and drifted towards the north-east, and gradually quite overspread the heavens; and a rain of fine ash, and subsequently dust, commenced, which lasted till noon, and covered the Opotiki district to a depth of about 1½ inches. The air was unusually cold. It was pitch dark till 10.20 a.m., at which hour the fall became slighter and daylight gradually appeared, and the rest of the day was twilight.

Animals were greatly distressed, and cattle gave vent to constant bellowings. Many small birds died, and insect life suffered severely.

No tidal disturbance was noted.