Some New Zealand Volcanoes: Discussion
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near Panui and another patch within the crater, is entirely mountainous. The highest points on the island are Tutaretare (1162 feet) and Opuahau (1274 feet). These guard the southern and western flanks of the great crater occupying the whole central and eastern part of the island. At the lowest part of the crater are two small lakes, one of which is about half a mile in length, joined together by a swampy stream. To the shore of the lake descend on the western slopes gently inclined scoria slopes, covered with a low forest growth. The eastern and southern flanks are for the most part precipitous. A narrow and relatively low ridge separates the crater-basin from the open sea, and near a saddle on this ridge a small stream of water issues from a vertical face of rock.

The coast-line of the island is indented by numerous bays, but most of these are fronted by steep precipices of obsidian, so that the interior of the island is accessible from only a few points where sandy beaches relieve the general steepness of the strand-line. A number of islets lie off the shore, the most extraordinary of these being several tall rectangular stacks of remarkable shape which guard the entrance to the shallow bay of Orongatea. At the northern end of the island some hot springs issue on a sandy beach. These represent the expiring phases of the volcanic upheaval that built the island up from the sea-floor. The island has not been an active volcano for many centuries, as the tall forest which appears in places, and the great amount of denudation in a few localities amply testify. It must, however, have (geologically) recently been in full eruption, since the characteristic volcanic topography is so well maintained.

Major LEONARD DARWIN (before the paper): Dr. Mackintosh Bell, our lecturer to-night, was for six years Director of the Geological Survey of New Zealand. He is a Canadian by birth, and in Canada he had excellent opportunities for studying geology and geography. Dr. Mackintosh Bell made a special study of those remarkably interesting regions—the volcanic regions of New Zealand, and it is with regard to that district he is going to speak to us to-night.

Major DARWIN (after the paper): When we hear of New Zealand and of its great prosperity, I think we are often apt to forget what a comparatively new country it is. Such being the case, I cannot help thinking that the greatest credit should be given to its Government for the way in which it has taken up this question of geological and geographical surveys. I feel certain that its Government will never repent the expenditure it has incurred in sending men like Dr. Mackintosh Bell to make scientific surveys of every region. I am sure we have all been extremely interested to-night, and I have hardly ever seen a lecture better illustrated with photographs. He showed us some views of those vanished white and pink terraces. I had the good luck to visit New Zealand in 1874, and I saw those wonderful places. I think he is right in saying that no photograph can really give an adequate impression of them, partly because of the extraordinary colour of the water. The colour of water in some reservoirs of waterworks—the intense blue you sometimes see, only a little more milky—gives one the best idea of the colour of the water in those terraces, an absolutely intense blue which, contrasted with the pink-and-white walls, made a most glorious effect. These terraces are places the beauty of which one can boast about with the greatest amount of

safety for the following reason. The world is divided into two classes—those who have seen the pink terraces and those who have not seen them. As to those who have not seen them, they will never be in a position to contradict one. As to those who have, they are all ready to join in a little freemasonry of exaggeration of their beauty.

Dr. TEMPEST ANDERSON: I feel quite sure that you will not wish to separate to-night without most cordially thanking our lecturer for the very interesting description he has given of these New Zealand volcanoes. When I went there owing to his influence I was passed on from one friend to another, and had every opportunity given me of seeing and studying all these wonderful volcanic phenomena which he has so well described to you—described so well that I do not intend to attempt to add anything to what he has said.

Mr. A. E. KITSON: The interesting lecture so well and graphically given by Dr. Bell, and illustrated by so many beautiful views, recalls to me incidents that happened during a bicycle tour through New Zealand some years ago. One is almost dumb with surprise on observing the marked evidences of volcanic action in the North island. The great faulting and differential subsidence that have taken place, the huge amount and diversified character of the volcanic material thrown out, the numerous groups of geysers, mud "volcanoes" and hot springs, all fill one with astonishment. Lake Taupo, in a sunken area, is an interesting study. On part of the western side stand the great Karangahape cliffs, 1000 feet high, while on the east are the old lake terraces, now 100 feet above the level of the lake, but which formed the shore before the Waikato river cut its way through the northern rim. The volcanic zone shows examples of deeply sunken areas, as Lakes Taupo and Waikaremoana; those of moderate sinking, as the main portions of the volcanic plains, and of block mountains, as Paeroa and Tarawera, which have remained at about their old altitudes. All who are drawn to the study of natural phenomena owe a great debt of gratitude to the grand old pioneer geologists, Dr. F. von Hochstetter, Dr. Julius von Haast, Sir James Hector, Captain Hutton, and Mr. Alex. McKay, who have unfolded to us the extraordinary beauty and fascinating history of New Zealand geography and geology. To geologists later in the field, as Prof. Gregory, Prof. Park, Prof. Cox, Dr. Marshall, Dr. Bell, Mr. Cussen, and others, we are greatly indebted for extending our knowledge of the region, with its almost unique volcanic features. The terrible and peculiar volcanic eruption of Tarawera can be understood by adopting the suggestion of Prof. Gregory, that though the eruption of lava and ash was probably through a fissure, yet the tremendous explosion, which destroyed the pink and white terraces, was caused by the sudden flashing into steam of water from the bottom of Lake Rotomahana getting into contact with a body of lava beneath the lake. The formation of sinter around the springs, formerly regarded as wholly caused by deposition of the silica on the cooling of the water, is now held to be largely due to low forms of plant life (*algæ*), which are able to live in the boiling water and secrete silica from it, the silica being deposited on the death of the plants. A visit to the wonderful Wairakei valley gives one a fine appreciation of the energy of even the waning phases of vulcanicity. The geysers playing at various regular intervals, the hot springs, the boiling cauldrons, the steam and gas vents, all have their peculiar features. Nor should one omit the worthy guide, Robert Ingle, who takes a keen and intelligent interest in each phenomenon in the valley, knowing its characteristics, and who holds a supreme contempt for the less naturally attractive hot springs of Rotorua. Taking a sack, he blocks the outflow from a hot pool, and with fine scorn remarks, "At Rotorua they decorate a tiny geyser and hot springs with shady seats and white gravel paths, but here at Wairakei we make geysers." Then,

lifting the sack from the rim of the pool, he proves his statement by a practical demonstration.

Mr. E. O. THIELE: I think so much has been said already this evening on New Zealand that there is little left for me to say, except to express my very great pleasure at being here to enjoy again seeing many of those scenes which bring back pleasure to me. There is one thing which I regret, and that is that Dr. Bell has been unable to show you the wonderful colouring effects which he mentioned in his lecture. They were also referred to by the chairman. These colour effects must be seen to be appreciated. There are so many points in connection with the volcanic phenomena of New Zealand that there is room for quite a number of lectures, and Dr. Bell touched the keynote of the whole of New Zealand geography when he said that it is brimful of studies of very great interest. That fact is forced upon even the most casual observer, and although Dr. Bell simply dealt to-night with volcanic action of recent times, there are many other geographical problems of great interest which take us back to earlier times. Associated with the volcanic phenomena we have had numerous Earth-movements of various kinds, such as those of a sudden nature resulting in fracture and faulting, and a slower movement which has affected the river-systems, the coast-line, and the whole country generally, introducing a great field for geographical study. At this late hour I do not think I will make any more remarks, but simply again express my pleasure at being here this evening to enjoy these wonderful views and Dr. Bell's remarks.

Major DARWIN: In the name of every one here present, I am sure I may give a hearty vote of thanks to Dr. Mackintosh Bell for his extremely interesting lecture.

NOTES ON THE TROAD.*

By WALTER LEAF, M.A., Litt.D.

THOUGH the Troad is the nearest and most accessible part of Asia, and the plain of Troy one of the most famous areas on the surface of the globe, the interior of the country is very little known. It has been visited by a good many archæologists, but they have mostly confined themselves to their special subjects, and have rarely given much geographical information. The principal authorities are (1) P. Barker Webb, who visited the district in 1819, and gave the first scientific account of it. His work, by a curious fate, though composed in English, has appeared only in translations—Italian (in 'Biblioteca Acerbi,' Milan, 1821); German (translated from the Italian by Dr. H. Hase; Weimar, 1822); and French (under the author's supervision, as 'Topographie de la Troade ancienne et moderne;' Paris, 1844). (2) Virchow, "Beiträge zur Landeskunde der Troas," in *Abhandl. d. k. pr. Akad. d. Wiss.* (Berlin, 1879), scientific work of the first order, but confined to the plain of Troy and its immediate neighbourhood. (3) "Report on the Investigations at Assos," in *Papers of the Archæological*

* Map, p. 128. In deference to Mr. Leaf's wishes, certain names have been spelled in his paper and map with modified German vowels, ä, ö, ü, although not in accordance with the Society's rules for orthography. The point will be definitely considered at the next revision of the Rules.