

or less closely, and the legends of the Native race contain references which show clearly that they recognised the linear arrangement of the vents and their common origin. Activity is more pronounced now at the northern end of this line, perhaps owing to the fact that another earth-fissure crosses it, running west-north-west and east-south-east—*i.e.*, approximately at right angles to the Maori line. The great volcano of Savaii, in Samoa, is placed at their intersection, and hence its continuous activity for the past few years.

The Hawaiian line is parallel to the Samoan line, and the Maori line when prolonged intersects it at the centre of its greatest activity. There are thus two intersecting sets of telluric cracks crossing the Pacific Ocean.

Returning to the Maori line, we find that submarine eruptions have been reported south-west of Tonga, and probably the marked deep-sea shoalings which lie in the same direction are further manifestations of volcanic activity. Great movements of elevation and depression also occur in the neighbourhood of Tonga, caused by either great faults or earth-folds—probably by both, as explained by Jensen (34)—and these volcanoes are probably connected with this disturbance. The faulting which has gone on near Tonga develops gradually into the gentle arching-up of the crest which has taken place in the New Zealand area in recent times. Volcanic activity is a frequent attendant of a folding of this kind. Its centre of maximum disturbance will doubtless shift backwards and forwards along this line, but the periods will be of long duration.

Thus it is likely that Ruapehu will be active again—perhaps not in the near future, but almost certainly after a long space of time. Its general form, the character of its lavas, though not in themselves absolutely sufficient to warrant the prediction as certain, yet suggest that Ruapehu has not passed through all the phases of its life-history.

#### (B.) GENERAL DETAILS AS TO THE VOLCANOES.

##### (1.) RUAPEHU. (Photo. No. 31.)

Ruapehu is a great cone rising from the central plateau to a height of over 9,000 ft. It has been built up by successive flows of andesitic lava and showers of scoria, and shows the beautiful mathematical profile that characterizes such mountains. The sides have been deeply scored by mountain-torrents rising in its glaciers and snowfields. These torrents have had a marked effect on the country surrounding the mountain. They have swept from this latter the loose scoriaceous materials, and also the products of rock-disintegration, till now these have accumulated in the form of great alluvial fans around the base of the cone and prolong its slope in conformity with that which is dependent on the regular succession of lava-flows and beds of scoria. This has the effect of extending the base of the mountain.

The summit of the cone is occupied by a large crater, nearly a mile across, and filled with ice. It was no doubt formed originally by a powerful explosion which tore away the top of the mountain. The only present signs of activity exist in a small subsidiary crater occupied by the hot lake. The southern portion of the mountain seems to have been formed from another vent or pipe, the lavas from the two overlapping. It is therefore a twin cone, like Etna, produced by the coalescence of the peaks formed from two adjacent and more or less connected vents. The southern peak belongs to one which has been long extinct.

The most remarkable feature of the summit of Ruapehu is the hot lake (Photo. No. 6) which lies near the eastern side of the great crater. It is about two hundred yards across, nearly circular in shape, and depressed beneath the level of the ice about 150 ft. Its walls are partly of volcanic rock, and partly of glacier ice, which is rapidly melted by the heat of the water as the ice moves down to it. Small icebergs continually break away, but they are, of course, soon destroyed. There is evidence that the lake boils frequently (11, 15, 16, 39), and on the 22nd March, 1906, it ejected quantities of mud over the surrounding snow. It is usually quiet, however, but it emits a strong sulphurous smell, and is of a dirty colour. No doubt it is largely formed from the melting of the ice by steam issuing from a crack or fissure in the mountain. It is highly likely that the water percolates through the porous walls of scoriaceous rock on the eastern side, and perhaps forms the true source of the Wangaehu River.

The lower slopes of the mountain are distinguished by the immense amount of disintegrated matter. Through it rises at times the solid rock, usually of a dark colour, in most weird and fantastic forms. As you ascend the cone the solid rock becomes more and more pronounced. The colour of the lava varies greatly. Sometimes it is almost black, with a resinous surface, frequently fissured by cracks produced by shrinkage on cooling; sometimes it is red, and contains prominent hornblendes; but usually it is of varying shades of grey.

Small glaciers hang in the hollows on the flanks near the summit, and stretch down sometimes over 2,000 ft. before they melt. As a rule, the amphitheatre at the head of a valley is the place where snow accumulates before it turns into glacier ice, but here the crater itself is the collecting-ground. This crater glacier is nearly circular in shape, about a mile across, and some three hundred acres in area. Its depth probably does not average more than 200 ft. The pressure of continual falls has consolidated the snow into ice, and the excess of what falls over that which is evaporated flows over the lower portions of the lip of the crater and down the sides of the mountain. The middle of the field is solid and not crevassed, but as it approaches the top of the outward slope it breaks into regular crescentic crevasses. When the outflow of the ice is impeded by the rocks of the crater-ring, it is broken up by the irregular crevasses that one sees in a valley glacier when its regular flow is obstructed. This type of collecting-ground is worthy of special notice. On the ice there are occasionally blocks of stone that have fallen from the surrounding cliffs, forming at times true glacier tables, and at one place near the lake there is a ridge which somewhat resembles a moraine in structure. I think that this must have been formed of stones thrown out by an explosion from the lake, though it is just possible that it may be the remains of a ridge which once divided the crater.