

- (4) The sinking of new bores and the consequent tapping of more and more artesian water must inevitably more or less affect the available artesian pressure.

Reference may be made to the following paper by Mr. Henry Hill: "Water-conservation and Hawke's Bay Artesian Systems," (Trans. N.Z. Inst., vol. 54, pp. 134-47; 1923). On pages 140, 142, and 143 Hill discusses the effect that the draining or lowering of Lake Poukawa would have on artesian water-pressure, &c.

It needs little knowledge of human nature to predict that if the Poukawa Swamp is drained any subsequent falling-away in the artesian water-supplies will be attributed by many persons to the drainage operations, yet the true causes will be those mentioned above.

In conclusion, I can but repeat the opinion expressed above, that the draining of the Poukawa Swamp will not affect the artesian water-supplies of the Heretaunga Plain to any appreciable extent.

10. WHITE ISLAND.

(By L. I. GRANGE.)

On the 29th March I left Opotiki for White Island, and returned to the mainland on the 9th April. I received assistance from Mr. M. Paul, Inspector of Mines, Waihi, and Messrs. H. Welsh (general manager) and E. Kennedy (engineer), of White Island Products, a company formed in 1926 to develop the mineral resources of the island.

White Island volcano, with an area above sea-level of nearly one square mile, is formed of andesitic tuffs, agglomerates, lava-flows, and dykes, the fragmental rocks predominating. The crater is about 60 chains long, and on an average nearly 20 chains wide. Its eastern end has been breached by the sea at three places. It may be divided into three parts—an eastern flat area (25 acres) rising from sea-level inland to 43 ft. above high tide; a middle area (43 acres), the site of the lake that was infilled in 1914; and a western area (35 acres) of coarse landslip material of irregular surface, the greatest height of which is 260 ft.

Sections exposed on the cliffs below the gannet-rookeries on the south side of the island show that during the latest of the eruptions that were strong enough to throw fragmental material out of the crater andesitic ash was ejected. The two uppermost showers, 6 in. and 2 ft. from the surface, contain fragments of charred wood and thermally altered rocks from the crater-floor. The present vegetation* on the island, consisting mainly of pohutukawa (*Metrosideros tomentosa*), many of which reach a diameter of between 9 in. and 12 in., appears to have established itself after the last of these eruptions.

The landslip of September, 1914, came from the western wall, and, moving over the crater-floor, by blocking blowholes and the vents of the hot lake, caused small eruptions. The material, amounting to several million tons, helped forward by the eruptions, reached the sea at each of the three bays, but chiefly by way of Crater Bay. In the crater sand, mud, and hummocks of partly decomposed andesite were left.

Where cuts have been made on the south-eastern end of the flat the sand and mud is seen to have a minimum thickness of 3 ft. Over the site of the lake, the floor of which was in most parts less than 5 ft. above high tide, the debris reaches from 30 ft. on the seaward end to 65 ft. above high tide on the western end. The hummocks are numerous on the southern half of the crater, being about 15 ft. high on the flat and more than 40 ft. on the lake-site.

At the present time there are eleven fumaroles of considerable size, in addition to many small vents, most of which were formed after the 1914 disaster. The Donald Blowhole, one of the few vents of any size that are some distance from the inner edge of the crater, is the strongest. The vents of this terrific blowhole, which lies at the bottom of a small depression, some 30 ft. deep, emit with a deafening roar clouds of smoke-blue gas, which seems to consist of sulphur dioxide, hydrochloric acid, and only a small amount of steam. Surrounding the vents is an incrustation of hæmatite, with a thin covering of a bright-yellow salt, probably ferric chloride. A weighted thermometer was suspended over one of the vents, but the blast was too strong to allow it to remain in the vent, so that it swung in and out and knocked against the walls. The reading, 173° C., was probably too low; and this appeared to be confirmed by the melting of solder on a tin held 3 ft. above the vent. At a few points in the bottom of the depression are small boiling pools of yellow and green water. One of the samples of water taken from here attacks zinc vigorously. The Little Donald, another dry fumarole on the southern margin of the crater, burst out on the 3rd February, 1926, coating the floor of the crater with a thin layer of ash. The gas appears to be similar to that of the Donald. Occasionally the gas from both blowholes is darkened with ash.

The other fumaroles emit clouds of steam and sulphurous gases under pressure. Some have built beautiful cones of sulphur up to 9 ft. in height. One of the fumaroles in the group north of the Donald Blowhole has a temperature of 102° C. at a depth of 6 ft., and another—the farthest up the slope—a temperature of 200° C. at the lip. An inclined vent a few yards from Lot's Wife (7 chains north-west of Donald Blowhole) has a temperature of 129° C., and contains molten sulphur. A neighbouring fumarole with a cone of sulphur 9 ft. high has a temperature of 118° C., 8 ft. below the rim. Samples of gas were taken from three vents. A rill of hot yellow water close to Lot's Wife is strongly acid; a strip of zinc thrown into it was violently attacked and soon disappeared. There are many other steam-vents and a few boiling pools, most of which are on the margin of the crater.

The work done on the fumaroles and springs on this visit is regarded as preliminary only. Frequent observations, including accurate measurement of temperature of the dry fumaroles, are needed. Undoubtedly the gases of these fumaroles are emitted from liquid or extremely hot rock at no great depth.

* See W. R. B. Oliver: "The Vegetation of White Island, New Zealand" (Jour. Lin. Soc., Botany, vol. 43, pp. 41-47; 1915). Oliver found only twelve species of plants on the island.