edge of Rotoma Survey District. A hypersthene andesite outcropping close to the Manawahe Road north of Rotorua appears to be younger than the hard rhyolite tuff.

7. The source of the showers of pumice in the Taupo district older than the Rotokawau basic andesite has not been found. According to analysis, the pumice of the Rotorua shower is a dacite.

8. The Recent basic-andesite eruptions from vents south of Rotoiti were somewhat like the Tarawera type of eruption. Four craters—Roto Atua, Roto Ngata, Deadman's Gulch, and Rotokawau—are in line, and at least three of them erupted basic-andesite lapilli identical with that blown from Tarawera craters. The basic andesite of Rotokawau contains small phenocrysts of labradorite and augite in a groundmass of feldspar laths, augite, and some doubtful olivine. The silica content is 51·16 per cent. and the lime 11·41 per cent.

9. The latest showers of pumice at Taupo were probably ejected by the Karangahape volcano. Around the lake the fragmental material is coarse, boulders of banded rhyolite in it being up to 4 ft. in greatest diameter. It can be traced northward to Tokoroa and nearly as far as Hemo Gorge.

The history of volcanic eruptions is fairly complex. There were many outbursts, and the intervals of rest seem to have been comparatively short. The Tarawera eruption of 1886 was not isolated; it was one of a series caused by the rising of basic magma along fissures. Similar eruptions in the past have alternated with those due to rhyolitic magmas. So in the future not only may comparatively mild eruptions of the Tarawera type occur, but also the far more devastating pumice explosions.

Hot Springs.

Special attention was paid to the hot springs. Large-scale maps showing accurately the position, temperature, reaction, &c., of the springs of the different localities were made. Mr. Thomas Esdaile, A.O.S.M., under the writer's direction, has been carefully recording the temperatures of forty-one springs near Rotorua.

The Wairakei Valley springs, which are located on a fault along the valley-bottom, are at or close to boiling-point. An open fracture crosses the Champagne Pool, and another joins several of the springs near the Prince of Wales Feathers. Several geysers play regularly at intervals of a few minutes to a height of 10 ft. to 20 ft. With the exception of a few muddy springs, they are alkaline or neutral, and have a salty taste. No sulphur is being deposited.

The springs in the Waiora Valley, a few miles south of Wairakei, which are also along a fault, are acid, and some reach the boiling-point. At the head of the valley a number of small fumaroles are depositing sulphur. The cliffs of rhyolite tuff near the head of the valley are in parts being opalized and pyritized.

The alkaline springs in the valley-bottom behind the Terrace Hotel at Taupo are probably fed by subsurface streams of hot water derived from springs near Tauhara Mountain. Several dry washouts from the foot of Tauhara converge at the springs.

Several clear alkaline boiling springs rise on the east bank of the Waikato near the Spa Hotel. One of them, the Crow's Nest Geyser, is surrounded by a mound of sinter 7 ft. high and 11 ft. across. Back from the river is an area of boiling mud-pots.

There is considerable thermal activity at Rotokaua, north of Taupo, where the ground is altered over an area 90 chains by 60 chains. Many small steam-vents, collapse-holes, small patches of sulphur, and hot pools are to be seen. The springs, a number of which lie at the bottom of collapse-holes 20 ft. to 30 ft. deep, are, with few exceptions, strongly acid. The area is remarkable for the amount of gas that is bubbling up in the water; more gas comes up here than in any other part except Tikitere.

Thermal activity is spread over a wide area at Orakei Korako, on the Waikato River, nine miles south-east of Atiamuri. On the west bank of the river are several clear hot alkaline pools, one of which plays when soaped, and two boiling mud-pots. Across the river from the geyser numerous steam-vents warm the ground for two miles up-stream. All the springs except that in the Alum Cave are neutral or alkaline. The Terrace Geyser boils continuously, throwing water to a height of about 12 ft. in the same manner as Papakura Geyser at Whakarewarewa. Alongside the Terrace Geyser is a beautiful terrace of grey sinter 15 ft. high. Small springs on the bank of the Waikato have an edging of fretted snow-white sinter, and their overflow has formed white terraces.

The hot springs on either side of the Orakonui Stream are alkaline or neutral, and deposit snow-white sinter.

In a branch of the Waipapa Stream north-west of Oruanui Siding are hot alkaline and acid pools and boiling mud-pots. A fault follows the Waipapa from the junction of this branch to its mouth, and at two points along it hot, weakly mineralized water depositing white sinter issues close to the stream.

Water from a spring near Tikitere contains 1,638 parts of sulphate radicle per 100,000. The other mineral waters of the subdivision that have been analysed range in total solids from 22 to 324 parts per 100,000.* The mineral contents are principally alkaline chlorides, aluminium and alkaline sulphates, and silica. The sulphate radicle is the most abundant. The waters of Frying-pan Flat and Inferno lakes in the Waimangu Valley, two springs at Waiotapu, and one on the flank of Maunga-ongaonga contain free hydrochloric acid. Several have appreciable amounts of boric acid. In general, it may be said that the alkaline springs are much weaker in mineral content than the acid. Most of the alkaline springs have fairly strong overflows, and rise apparently in well-defined underground channels.

The samples of gas analysed were similar in composition to those examined last year. They consisted mainly of carbon dioxide, with smaller amounts of carburetted hydrogen, sulphuretted hydrogen, nitrogen, and oxygen. The gas from Hinemoa's Bath, on Mokoia Island, is extraordinary in that it contains 88·30 per cent. of nitrogen and only 2·75 per cent. of oxygen.

* All the summaries of and partial analyses mentioned in this report are from complete analyses made by the Dominion Analyst and his staff.