

country such as occurs at Waimate North and at Kerikeri. The younger basalts occupy the present valleys. Scoria cones, with their attendant basalt-flows, floor the broad valleys at Pakaraka, Ohacawai, Kaikohe, and north of Waitangi. These young basalt-flows have dammed back the local drainage and hence are bordered by swamps and lakelets.

Between Kaikohe and Kaihu lies the Tutamoe Plateau: a huge complex of basic igneous rocks 2,000 ft. or so above sea-level.

The rainfall is highest on the Tutamoe Plateau, where it is over 100 in. per annum, and lowest on the east coast near Kerikeri, where it is less than 50 in. Similarly, temperatures are lower on the western side of the district than on the east owing to the greater height above sea-level and to its being more exposed to the prevailing westerly winds.

### Soils.

The soils of the district show well the relation of the soil profile to (1) the original rock material, (2) the climate, and (3) the vegetation under which the soil developed. A close relation also exists between topography and soil profile, the soils being generally more mature on the easy country.

The soils are classified in four main divisions.

(1) The podsols are best developed on easy country where kauri groves formerly flourished, and, in the area mapped, have formed on clays weathered from sedimentary and acid volcanic rocks. They are characterized by a well-developed grey leached layer below the topsoil with humus and other pans below. In many places the grey layer is itself cemented to form a hard silica pan.

These soils have poor natural drainage, are acid and of low fertility, and generally now support low scrub and rushes. They require large amounts of lime and phosphates before good pastures can be established, and where the clay is well leached from the topsoil responses to potash are to be expected.

(2) *Immature Podsols*.—The immature podsols are developed on sedimentary and acid volcanic rocks under a cover of mixed bush. They are tentatively divided into three types according to the degree of profile development.

In type A a grey leached silt loam layer, 6 in. or so thick, overlies a yellowish clay subsoil. This soil is best developed on rolling to moderately steep country under bush containing kauri and a fair proportion of rimu and allied trees. Like the mature podsols, these soils are naturally acid and infertile, but the grey layer when cultivated forms a good seed bed for clover establishment, and in this respect the type is superior to the other soils of this division, which have sticky clay topsoils.

Type B, developed under a similar forest cover to type A, generally on slightly steeper slopes. The topsoil is a clay and the subsoil is mottled light-brown and grey.

Type C, which has developed under mixed bush containing much taraire and puriri, is naturally more fertile than the two preceding types. The subsoil is brown and generally not mottled.

All the immature podsols respond well to lime and phosphates. For good pasture establishment liming is essential, especially on the more mature soils, which are generally to be found on the easy country.

(3) *Red-brown Soils*.—The red-brown soils are derived from basic igneous rocks. A complete range of types exists from "young" free silt loams to "mature" compact clays. Differences in soil profile are due to differences in (1) the actual age of the parent rock, (2) the topography, and (3) the type of bush cover.

The clay fraction of the red-brown soils is high in sesquioxides, and hence the soils all have low plasticity and a strong granular structure, which makes them friable and easy to work. They also have the power of absorbing and reverting to comparatively insoluble form large quantities of water-soluble phosphates, and it is this property that gives rise to the popular saying that much of the volcanic land is "a sink for manures."

The young soils of this division are fertile and respond well to phosphates, basic phosphates or a mixture of superphosphate and lime being better than superphosphate alone. The more altered soils need additional lime treatment. Slight to moderate responses to potash are to be expected on all of these soils.

The seven soil series recognized in this division are given in order below, the more mature being shown first:—

(a) *The Okaihau clay and stony clay*, which has been mapped over 64 square miles, developed under a bush cover on the flattish to gently rolling surface of the older basalt-flows. Much of the land is at present scrub-covered. The soil, which has been described by Grange (*N.Z. Journal of Science and Technology*, Vol. XVI, pp. 9–18, 1934), is popularly known as "ironstone soil," and is characterized by a layer of ironstone nodules 3 in. to 12 in. thick. The soil is a dull-brown crumbly clay, a typical profile being—

12 in. dark dull-brown clay;  
9 in. compact dull-brown clay with iron nodules;  
7 in. compact dull-brown clay;  
On compact brown clay.

In many places the nodule layer is thin and is 18 in. from the surface, but in other places it is thick and extends to the surface.

Where little or no fertilizer has been applied, the root growth of plants is generally poor, owing probably to the toxic effect of the soluble alumina in the highly acid soil.

(b) *Kerikeri clay and bouldery clay*, which cover 7,000 acres in the neighbourhood of Kerikeri, are closely related to the Okaihau soils but are developed on rolling country, and although small nodules