

grauwackes, passing in places into cherts. Over considerable areas on the coast south of Whangaroa Heads these rocks are reddened by iron-oxide and impregnated with small seams of manganese-ore, and in places they are intruded and altered by intermediate igneous rocks. Occasionally notable developments of acidic agglomerates and tuffs occur. The beds forming the Kiriwha Series are apparently arranged in an anticlinorium, the axis of which runs west-north-west and east-south-east.

(2.) *The Waipapa Series.*—A series of rocks of probably younger age than the Kiriwha Series is exposed in the south-western portion of the Kaero Survey District in the watershed of the Waipapa River. This series consists of greenish argillites and grauwackes, which rarely, if ever, show any trace of bedding-planes, but are traversed by several systems of joints, and in places contain seams of manganese-ore. No signs of contemporaneous volcanic activity or of alteration by intrusives have been found in these strata.

A Primary age has been tentatively assigned to the rocks of the Kiriwha and Waipapa Series, but it is quite possible that the age of one or of both of the series just described may ultimately prove to be Early Secondary rather than Primary, as in the case of the Manaia Hill Series of the Coromandel Subdivision.*

(3.) *The Kaero Series.*—The rocks assigned to the Kaero Series occupy the southern part of the Whangaroa and the northern part of the Kaero Survey District—that is, the area separating the two older series of sedimentaries—and also almost all that part of the Omapere Survey District which has so far been examined.

The lowest beds of the Kaero Series are exposed around the shores of Whangaroa Harbour, and consist of green sandy argillites, with thin inconstant beds of very fine conglomerate. Apparently overlying these beds conformably near the head of Whangaroa Harbour is a concretionary sandstone containing ammonites not yet identified. Superposed on the concretionary sandstones are green sandstones, mudstones, and shales, which are extensively developed in the central portion of the Kaero Survey District. Limestones are found associated with these beds near Kaero, and, further south, in the Omapere Survey District.

The green sandstones near Kaero yield poorly preserved fossils of Tertiary character, so it is possible that they are unconformable to the concretionary sandstones, but this has not yet been established.

The copper-deposits near the head of Whangaroa Harbour occur in calcareous shales and mudstones belonging to this series.

(4.) *Tertiary Volcanics.*—In the northern part of the subdivision these volcanics are represented mainly by agglomerates, which attain a thickness of 400 ft. or more around the north-western shores of Whangaroa Harbour, but thin out rather rapidly to the south and east. The older lava-flows of the eastern and southern portions of the subdivision are provisionally assigned to the same period.

Acidic rocks are represented in the volcanics only near the settlement of Pungaere by scattered fragments of obsidian (too numerous to have been brought by Maoris), and by two outcrops of a rock which has been doubtfully identified as a rhyolite.

(5.) *Post-Tertiary Rocks.*—To the Post-Tertiary period are assigned several well-preserved puyas to the east and south of Lake Omapere, and the comparatively fresh basic lava which has flowed from them. Acidic rocks are represented only by the hummock-shaped hill of Putahi, on the south shore of Lake Omapere.

Under alluvial deposits are placed the extensive mangrove swamps at the head of Whangaroa Harbour and the river-deposits, generally of small extent, which occur in the valleys of the larger streams.

Economic Geology.

The economic possibilities of the subdivision may be considered under the following headings:—

- (1.) Copper-ore.
- (2.) Manganese-ore.
- (3.) Iron-ore.
- (4.) Petroleum-shales.
- (5.) Gold.

(1.) *Copper-ore.*—Some years ago large boulders, consisting mainly of pyrite and chalcopyrite, were found in a small stream at the head of Whangaroa Harbour. A considerable amount of prospecting-work has since been carried out in this neighbourhood, resulting in the location of mineralised rocks in several places. In one case a lode, yielding, it is said, 10 per cent. of metallic copper, was found. The Whangaroa Amalgamated Copper Company, on whose claim this discovery was made, are now sinking a shaft to ascertain whether the ore persists to any depth. No where else has a definite lode been discovered, though zones of rock, more or less impregnated with chalcopyrite, have been encountered, and large boulders of iron gossan are rather widely distributed.

(2.) *Manganese-ore.*—Stringers of impure pyrolusite and psilomelane are fairly frequent in the primary rocks, more especially in the upper part of the Waipapa River in the rocks of the Waipapa Series, but none are sufficiently large to be commercially valuable.

(3.) *Iron-ore.*—Small deposits of bog-iron ore of good quality occur in several places on the Kerikeri Plains. The extent of the largest of these, situated about three miles from Okaihau, on the Okaihau-Kerikeri Road, is now being ascertained by means of boreholes. The average thick-

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