

Unconformably overlying the rocks already described are beds usually referred to the Pleistocene. A great thickness of vesicular rhyolitic fragmental material ("pumice"), for the most part evidently laid down in water, and ranging in grain from silt to fine conglomerate, occupies the lowlands. These deposits are undoubtedly derived from tuff and breccia ejected by volcanoes in the Taupo zone. Some of the beds in the south-east corner of the district may be of subaerial origin. The cross-bedded and wind-blown sands of the coastal region are considered to be of the same age. They contain much ironsand, and in places pumiceous material.

The Recent deposits of the district consist of beach-sands, harbour-muds, fluvial and marine gravels, and, most important of all, the water-borne pumiceous sands and silts of the Waikato Valley, together with the overlying peaty deposits.

ECONOMIC GEOLOGY.

The coal-measures of the district occur at the base of the Tertiary series, but over large areas are absent, and the overlying beds rest on the basal rock. Again, the Tertiary strata are much broken by faults and have been greatly eroded: thus the coal of the subdivision is confined to patches that are small when compared with the whole area examined. As stated in a former paragraph, the Tertiary patches occur most abundantly along either flank of the uplands, and only south of Mount Pirongia are small remnants of the Tertiary sheet left still undenuded on the crest of the range. Along the western flank of the uplifted mass coal-bearing strata are scantily present, and seams of workable thickness do not occur. On the other hand, along the eastern side patches of coal are found in a more or less continuous belt from the northern boundary to Mount Pirongia. Immediately north of the mountain is a large block of Tertiary strata, of which the base is nowhere exposed. East of the uplands south of Pirongia coal is again exposed. Westward, remnants of coal-measures on the crest of the southern uplands extend along the ridge-tops to the head of Kawhia Harbour. Outcrops of coal were examined at many points in this district, but although much coal still remains, the bulk of it has been removed by denudation. Northward, as the Kawhia depression is approached, the Tertiary beds are more continuous, and in this direction, as well as in the adjacent basins of the Okupata and Oparau streams, a large area of coal-bearing country may exist. The base of the Tertiaries, however, is below drainage level in this area, and much of it is concealed beneath volcanic breccia, so that the amount of coal it contains can be determined only by boring.

Refractory clays (fireclays) are found associated with the coal-seams only in small amount, and appear not to be of such good quality as those of the Huntly district. Massive claystones of Tertiary and Mesozoic age occur in vast quantity.

High-grade limestone occurs in the Tertiary beds at many points on or near the western uplands. A small plant which crushes limestone for agricultural purposes is situated at the foot of the uplands at a point sixteen miles by road south-west from Frankton. Large amounts of first-class limestone outcrop on the shores of Raglan and Kawhia harbours at points close to channels navigable by coastal steamers.

The beach and dune sands of the district, the latter occurring in large quantity, contain a considerable proportion of ironsand. In places wind and wave action have produced small deposits of almost pure blacksand. The average sand, no doubt, would yield a concentrate with a high iron-content.

Good roadmaking material is abundant throughout the western uplands. The hardest and most resistant rock is obtained from the basaltic flows and agglomerates and from some bands of greywacke.

In the lowlands good roadmaking material is scarce except near the southern border of the district. Some of the roads are formed of broken rock obtained from the Te Aroha or Te Kuiti districts. The grits and fine gravels deposited by the Waikato and Puniu rivers form an excellent surface, but a road made entirely of this material will not stand heavy traffic.

2. WHANGAREI AND BAY OF ISLANDS SUBDIVISION.

(By H. T. FERRAR, Geologist, and W. H. CROPP, Assistant Geologist.)

FIELD-WORK AND AREA SURVEYED.

As shown by last year's report, the geological survey of the Whangarei and Bay of Islands Subdivision was still in progress in the month of May. This field-work was continued until the 9th July, when the winter rains rendered the roads impassable. The senior writer reassembled his party on the 30th September, and was continuously in the field until the end of May of this year. Mr. W. H. Cropp, A.O.S.M., joined the party as Assistant Geologist on the 23rd November.

During the past season the following survey districts were mapped in the order given: Kawakawa, Kerikeri, Whakarara, Bay of Islands, Russell, Whangaruru, and Purua, an area of some 608 square miles. In 1907-8 Dr. J. M. Bell and Mr. E. de C. Clarke made a systematic survey of the Whangaroa Subdivision, and the present survey has linked itself to their work along the eastern boundaries of the Whangaroa, Kaero, and Omapere survey districts. Including the area mapped subsequent to the writing of last year's report, and portions of the Tangihua and Ruakaka survey districts on the shores of Whangarei Harbour, the total area surveyed during the calendar year was 754 square miles.

In addition a short excursion was made into the Waipu district in order to trace the relationship between the Whangarei coal-bearing series and the underlying formations. During December, 1920,