

A coarse sandstone occurring on the spurs in the vicinity of Atarau Peak, and forming the crest of a portion of the Tutamoe Ridge (slightly north of the subdivision), is probably the closing bed of the series.

[] *Structure of the Series.*—The necessity that geological work in the petroliferous area of Poverty Bay should be done with the utmost detail is clearly evidenced by the result of mapping the strikes and dips of the formations examined in the subdivision. The structure, as indicated by this mapping, is one of considerable complexity. The rocks have been folded into a series of very irregular folds—in places wide and open; again, much compressed.

[] Two main well-defined anticlines running approximately parallel to one another have been located. The first of these lies in the eastern portion of the subdivision, and, running in a general N.N.E. direction from about the Village of Te Karaka, passes through Toromiro Hill, and crosses the valleys of the Makahakaha Ngarara and Parariki streams. This anticline is crossed by a shorter one with a general N.E.—S.W. direction, the intersection giving rise to a dome at a point about a mile and a half north of Hokoroa Homestead. Near the northern boundary of the subdivision are two short subsidiary anticlines to the east of and approximately parallel to this main one. The second main anticline is that passing through Waitangi Hill. From this point its strike is about due north to the northern limits of the subdivision, and slightly south of west to a point about one mile west of the confluence of the Mangamaia Stream and the Mangatu River. At the last-named point a dome is formed by its conjunction with an anticline with a general north and south direction. The main anticline continues, from this dome, about one mile in a southerly direction, and then bifurcates—one branch running about north-west between Mangahaumia and Big Slip, the other branch running first south, then west across the Urukomo Stream and up the valley of the Wheao Stream. At Waitangi Hill a dome is formed by the crossing of a short anticline running in a N.W.—S.E. direction.

In the extreme eastern portion of the subdivision there is evidence of an anticlinal arrangement of strata near the confluence of the Makahakaha and Whakauranga streams.

From the above description it will be seen that the rock-folding in the area is very irregular, and that it is unsafe to assume that any fold will continue in the same direction for even a few miles. Hence, to know definitely the structure of the interesting localities of the occurrence of the petroleum indications at the head of the Totangi Stream, and the mud and gas springs at Waimata, both of which are situated about five miles without the southern boundary of the subdivision, an extension of the detailed geological work will be necessary.

The frequent occurrence of creeps, and slumps or landslides, has obliterated to a large extent the surface indications of major faults. The petroleum indications at Waitangi Hill are probably on a line of fault extending thence in a W.S.W. direction to the Waipaoa River, a distance of five miles. From the occurrence of outcrops of the older group of the Whatatutu Series on the north side, and of the younger group on the south side of this supposed fault-line, it may be inferred that the downthrow of the fault is to the north.

The disturbed state of the strata in the Weraroa Stream and the occurrence of gas springs on the spur to the north seem to indicate the presence of a fault running in a general east-and-west direction in this vicinity.

Minor faults are of frequent occurrence, and are very well shown in cliff-faces and in river-beds.

(b.) *WAIPAOA BEDS.*—The Waipaoa Beds are sandy pumiceous deposits, the material of which is probably derived from an area outside the subdivision. They occur mainly in the Waipaoa Valley between the Puha and Whatatutu villages, where they show in cuttings and cliff-faces underlying the terrace gravels and overlying unconformably the claystone rock of the locality. Outcrops not covered by gravels occur on the low spurs on the right and left banks of the river, and the presence of this formation is easily detected by the sparseness of the vegetation it supports. Small outcrops were also noted in the Waikohu River bed; on the spur to the north of Tawa Stream; and in a right branch of the Makahakaha Stream (branch of the Whakauranga).

(c.) *RIVER AND TERRACE GRAVELS.*—The valleys of the larger streams show high- and low-level terraces of some considerable extent, the surfaces of which are covered to a depth of 10 ft. or more with loosely consolidated debris, consisting of water-worn material derived from the more resistant strata occurring in the area.

Economic Geology.

PETROLEUM.—The mineral of chief interest within the subdivision is petroleum. The existence of surface indications of this mineral at Waitangi Hill—a description of which has appeared in a former report*—has been known since 1873. Various petroleum companies have operated within the subdivision since that date, but all were unsuccessful in obtaining oil in payable quantities. It is extremely unfortunate, from a geological as well as from an economic point of view, that so little information is on record concerning the actual results obtained during these operations.

Of nine holes bored within the subdivision, the majority were sunk at or in the immediate vicinity of the surface indications at Waitangi Hill, and these reached depths ranging to 500 ft. The South Pacific and Minerva holes are, however, located some distance away.

The South Pacific borehole is situated about a mile and a quarter (air-line) due south of Waitangi Hill (Trigonometrical Station 138). It was commenced on the 11th December, 1884, and in December, 1887, had attained a depth of 1,321 ft. It is said that at this depth oil was struck, causing a “blow-out.” The oil became ignited, burned down the derrick, and generally wrecked the machinery. A new plant was erected, and another 15 ft. bored without any oil being obtained. The hole was then abandoned. That this borehole should manifest such strong evidence of the presence of petroleum, and then prove

* Second Annual Report, N.Z. Geol. Survey, 1908, p. 33.