

At present it is somewhat doubtful whether the glauconitic sandstones alternate with the chalky limestones or not.

(2.) *Coralline Limestone*.—Coralline limestone containing Foraminifera occurs near the junction of the Mangataikapua Stream with the Waipaoa River. According to Mr. McKay the coralline limestone has a considerable development near Maungapohatu, where it is underlain by calcareous greensands.

(3.) *Claystones with Calcareous Concretions, and Argillaceous Limestones*.—Claystones with calcareous concretions occur mainly in the valleys of the Waingaromia River and its branches. The claystones themselves are gray in colour, finely textured, and fairly impervious. The calcareous concretions consist of hard, finely textured material, pinkish-white in colour, probably containing a large percentage of lime. The concretions occur sometimes as cylindrical masses up to 6 in. in diameter and 4 ft. in length, again as concretionary boulders of various shapes, often five or six feet in diameter.

The argillaceous limestone shows two varieties—one a dark well-compacted limestone with few fossils, the other a highly fossiliferous rock with shells cemented by an argillaceous matrix.

(4.) *Claystones and Fine Sandstones with Rare Concretionary Bands, Coarse Conglomerates, Fine Shelly Conglomerates, and Coarse Sandstones*.—Claystones passing through argillaceous sandstones into fine sandstones cover a considerable portion of the area examined. The sandstones are of greenish-brown tint, generally finely textured, and loosely compacted. The argillaceous sandstones and claystones are dark-gray to black in colour, and in general show small shell-fragments scattered throughout, and occasionally contain bands consisting almost entirely of shells. Associated with these rocks occur harder concretionary bands with or without shells, and fine conglomerate bands consisting mainly of shells, shell-fragments, and pebbles of sandstone up to half an inch in diameter.

The coarse conglomerates consist of an arenaceous or argillaceous matrix and pebbles of igneous rocks, which are generally basic, but are in places possibly somewhat acidic. The exact petrological character of these rocks has not yet been made out, but they apparently consist of diorites, gabbros, amygdaloids, and possibly basic syenites. The conglomerate is well exposed in the valley of the Waipaoa just opposite Waipaoa Station, and appears as a layer conformably interbedded with claystones. The occurrence of fragments of igneous rocks in Mangataikapua Stream suggests that the conglomerates occur in that locality also.

So far as the present examination has gone, no igneous rocks of any kind have been observed *in situ* within the subdivision.

The closing member of the Whatatutu Series is apparently a band of brownish sandstone of coarse texture, which occurs for the most part on the higher elevations—that is, on the spurs separating the heads of the various streams.

Structure of Series.—The mapping of the strikes and dips, which throughout the area have been observed with the greatest care, indicates a structure of considerable complexity. The rocks have been folded into a series of very irregular folds—in places wide and open, again much compressed. Faulting on an extensive scale has apparently greatly increased the complication. From the vicinity of Waitangi Hill north-westward to the Waipaoa River, the prevailing strike is north-west to south-east; a short distance beyond this river, however, the prevailing strikes are in directions nearly transverse to that mentioned—a feature which may imply a great fault-line approximately parallel to the general course of the river.

(b.) *Waipaoa Beds*.—The Waipaoa Beds are sandy pumiceous deposits, the material of which is probably derived from an area far outside the subdivision. They occur overlying the sandstone, which, as already remarked, seems to represent the highest formation of the Whatatutu Series, on the ridge to the north of Tawa Creek. Boulders of a similar character also occur on the left bank of the Waingaromia River, about three miles above Waitangi Homestead.

(c.) *Pleistocene and Recent*.—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 by loosely consolidated débris, consisting of water-worn material derived from the more resistant strata occurring in the area. In the Waipaoa River this detritus also contains pebbles of igneous rocks derived from the conglomerates previously noted as occurring in the Whatatutu Series.

Economic Geology.

Petroleum.—The mineral of chief interest occurring within the area examined is petroleum, surface indications of which are well shown in the vicinity of Waitangi Hill, at the head of Te Hau-o-te-Atua Stream (see accompanying plan). A very small branch of this stream, named Petroleum Creek, exhibits oil indications on the surface of the water contained in natural springs, seepage-holes and test-pits occurring at intervals for a total distance of about 16 chains.

The natural springs are pools containing water, through which gas rises in bubbles and leaves a thin coating of oil on its surface. The seepage-holes are shallow surface depressions, with numerous minor holes which contain water showing a thin coating of oil: the soil in and around these seepage-holes is saturated with oil. The test-pits sunk by the various oil companies which from time to time have operated in this locality have depths ranging to 20 ft. At present they contain water, and, as in the case of the natural springs, sometimes show a bubbling of gas through the water with a thin coating of oil on its surface. In all, counting test-pits, springs, and seepage-holes, fifteen points showing petroleum were noted in the 16 chains.

Two samples of oil collected from the main oil-springs were submitted for analysis. No. 1 sample was collected at the end of January after some weeks of dry weather, when the pool contained much charred manuka scrub, and appeared to have been burnt off a short time before.