

About half a mile to the south of the creek, on the coast, another small and local disturbance occurs, differing from the one just mentioned as having crumpled the strata very much; causing a displacement of from 2 ft. to 10 ft. without altering or shattering the beds themselves. This displacement can be traced not more than about 20 ft., and the beds beyond continue as before in the regularity of their strike and dip, till in the south, on approaching the Otahome Creek, they give way to the overlying soft sandstones and shales, which, in their turn, disappear under the blown sands.

To the north of the Ngakauau Creek and on the coast the same occurs again. The regularity of the strike and dip is broken by a succession of local faults and disturbances. On the left bank of the Ngakauau, in consequence of these disturbances, the beds strike due east and dip south at an angle of  $15^\circ$ . Passing this fault, which occupies approximately about 200 ft., the beds assume their normal strike and dip, the strike being  $20^\circ$  east of north, while the dip is at an angle of  $60^\circ$  and to the west.

At a point about half-a-mile north of the creek the strike alters to due north with a dip of  $45^\circ$  to the west, while further on the beds become quite flat and the interstratified shales become thinner. As Castle Rock is approached the coal in the coal-rocks becomes more abundant, occurring in places in pockets 2 in. and 3 in. thick, while the interbedded shales assume a more indurated and slaty character, and, as Castle Rock is neared, occur without the presence of the coal or the coal-rock. As mentioned before, the coal-rocks to the south disappear under a development of soft sandstones and shales, which rocks again are soon covered by the blown sands near the Otahome Creek.

About two miles and a half to three miles up the Ngakauau, and in the heart of the Trooper Range, the typical coal-rocks again appear, the strike being due north and the dip  $45^\circ$  west. Here they consist of gritty rock with coal. The rock is very soft and friable. The coal is distributed in thin veins and laminæ and is of good quality. Associated with the beds are the usual shales and mudstones, and conglomerates, the former being thin-bedded.

(a.) *Middle Division*.—Second in importance is the Middle division of the Upper Cretaceous system, occupying two separated areas. The southern area is bounded on the south by the Whareama River, on the east by the Pacific Ocean, on the west by the limits of the survey, and on the north by the foothills of the Trooper Range. The northern area of the same division is bounded by the Whakataki Creek, in the north by the ocean and the Miocene rocks of Castle Point, on the west by the limits of the survey, and on the south by a line drawn in a general westerly direction from Castle Rock. There are no strong physical features to mark the boundary between the Lower division and the Middle division, excepting perhaps that the Lower division does not rise to any height on either the northern or southern boundaries. The division consists of a series of sandstones of various grades of coarseness and thickness, and of glauconitic rocks, associated with finely bedded shales.

On the left bank of the Whareama is seen a grey-coloured sandstone, interstratified with a grit of a similar colour, containing lime, the strike of which is  $50^\circ$  west of north, and the dip westerly, at an angle of  $45^\circ$ . Continuing north, this strike of the beds is changed to due north, while the dip has altered till, at places, it is seen to be quite vertical. Further on, the beds assume their normal direction and measurement, which are at no variance with the underlying rocks of the Lower division, in consequence of which the beds strike in a general northerly direction, with a westerly dip at  $45^\circ$ . At a distance of about one mile from the coast, and at a height of 600 ft. above sea-level, an outcrop of glauconitic rocks appear. They are of the usual green colour, with veins of glauconite passing through. The rock is coarse, and at places weathers to a grey colour. The strike and dip of these glauconitic rocks are never very distinct, but, as well as could be determined, differ in no way from the beds of the same division on the coast. In the valley of the Otahome, where the underlying rocks of the Lower division appear, a series of shales and sandstones are exposed. These are thin-bedded, and are associated with the glauconitic rock. They are well stratified, the strike being  $20^\circ$  west of north, and the dip at  $65^\circ$  to the west. The northern area consists of grey sandstones of a fine-grained character, together with shales and mudstones.

At a point about a mile and a half up the Whakataki Creek, from its mouth, the beds are composed of shales and sandstones, having a strike of  $40^\circ$  east of north, and a dip of  $50^\circ$  to west. These beds disappear under the alluvial of the creek. At the mouth of the Whakataki, small outcrops of a grey-coloured sandstone appear within the tide-way, and continue south to the head of Castle Bay, where they are seen to overlay a series of soft friable shales of a grey colour, upon which rest the Miocene rocks of Castle Rock.

At a point about due west from Castle Rock, at a height of 500 ft. above sea-level, is a sandstone, presumably a greensand oxidised to a deep-brown colour. Its strike is  $40^\circ$  west of north, dipping west at  $45^\circ$ . It is composed of gritty grains of quartz, cemented by iron-oxide. The whole beds as exposed are decomposed, but, if the decomposed zone of the rock could be passed through, the rock would be seen to be glauconitic sandstone, in no way differing from the glauconitic rock in the southern area. The sandstone immediately overlying it has a strike of  $60^\circ$  east of north, and dips east at  $45^\circ$ , while the beds upon which this decomposed glauconite rests strike  $40^\circ$  west of north, and dip west  $45^\circ$ .

## 2. *Upper Miocene.*

There is a very small but prominent exposure of the Miocene rocks. It forms the precipitous rock and adjoining reef known as Castle Point, trending in a north-east direction, having a width of about 500 ft. In Castle Rock it rises to a height of 400 ft. in vertical walls, being a very prominent landmark, while the reef itself, with vertical sea-walls, rises to 150 ft. or more. It is composed exclusively of a shelly limestone, which is seen in three or four different beds containing shells which are in different stages of conversion into a sub-crystalline limestone. In the uppermost beds the shells have dropped out from their calcareous matrix, and