

their place is taken by the Miocene rocks of the Kuamahanga. The same rocks bound the formation in the Pahaoa Valley.

In the northern area, which is separated from the southern area by the low ground of the Kuamahanga Valley, the south boundary is the beds of the Cretaceous formation, with a westerly trend, which, giving way to the Miocene beds of the Bismarck Creek, change the boundary to a north-easterly direction. The formation keeps strictly to the high rugged country of the two ranges—the Taipos—and that of the Brocken, and occupies them to the exclusion of other rocks. The series consist mainly of a somewhat fine-grained sandstone, the beds of which are at places interstratified with drossy serpentinous shales. The whole does not present any variety. Everywhere they are much shattered, so much so that it is all but impossible to make out any strike and dip in the rocks. At only one place could this be determined with anything like accuracy. Everywhere they have been splintered and contorted in all directions. But in the one or two localities where dip and strike could be ascertained, as on the eastern flank of their exposure, about two miles from the junction of the Te Maire and Kaiwhata Creeks, at a height of 800 ft., it is seen to be at an angle of 40° to the east with a northerly strike. These measurements were approximately confirmed at a point about the same height four miles south of the East Coast Road.

In the Te Maire Creek, interstratified with these rocks, are seen drossy and serpentinous shales. There is a number of bands, all of which are crumpled and contorted. The approximate dip is at high angles, while the strike is in a northerly direction. The thickness of the bands is not great, not more than 1 ft., and at places no more than 2 in.

3. Upper Cretaceous.

(c.) *Lower Division.*—These rocks are the most extensive and important in the district, extending the full length of the district under survey, and occupying in places a width of four miles. This formation bounds (almost as a consequence) all the older and younger deposits. It is divided into two distinct and separated areas. One is a narrow strip occupying the East Coast from the right bank of the Kaiwhata at its mouth to Flat Point. It is not of any great width, being no more than one mile wide. The other and more important area is of extreme irregularity (in its boundary lines); commencing on the western flank of the Maungaraki Range in the Pahaoa Valley, it extends in a narrow strip in an easterly direction, narrowing down as it approaches the East Coast road to about half a mile. It here rises to the summit of the range in this section, and a little further north it extends westerly in a narrow neck to spread to the northward to meet the valley of the Kaiwhata and to the south as far as Whatipu Creek. The western portion continues north, keeping the mountain-tops and the western flanks of the Maungaraki Range. With the exception of a limited exposure of the Middle division of the Upper Cretaceous rocks in the Little Kaiwhata Stream, this part of the series occupies exclusively the western flanks of the Maungaraki Range. At the Kaiwhata it narrows down to about two miles, at which point it makes a northerly turn and trends along the left bank of the Kaiwhata Stream. The eastern branch of this area is very regular, trending in a general north and south direction between alluvial deposits and Miocene rocks on the east, and the Upper division of the Upper Cretaceous rocks on the west. These same rocks also give the western division its regular easterly boundaries, differing from the somewhat tortuous boundary provided by the Miocene and the Middle division of the Upper Cretaceous rocks on the west.

Of these two areas of this division the best exposure of the coal-rocks is in the smaller. It consists almost exclusively of the typical carbonaceous rocks and the associated beds. At the northern end they rise in a precipitous sea-face from 100 ft. to 200 ft. in height. Further south the hills recede. They do not penetrate inland up the Kaiwhata Valley very far before they disappear under the Younger Miocene formation. The rocks are identical with the coal-rocks of Castle Point, concurring with them in the persistency of the strike being due north, and in their westerly dip. The angles at which they disappear vary from 75° from the horizontal to almost vertical. This high dip is not generally attained by the same rocks elsewhere. The texture of the coal-rock is coarse, granular, and gritty. They are in all cases well stratified, occurring in laminations as small as $\frac{1}{8}$ in. to 1 in. in thickness. At places the laminations are wavy. Coaly matter is the predominating feature of the whole, occurring in small veins and pockets.

Invariably associated with these coal-rocks are beds of conglomerate, shales, and mudstones. In this area the inclusions in the conglomerates are small and do not make up such a proportion of the whole as the same beds elsewhere. The contained pebbles are in places small, and occur in many bands. Besides these conglomerates interstratified with the rocks under notice, is a series of fine shales and mudstones having none of the characteristics of the containing beds. They occur in varying thickness from a few inches to a couple of feet and more. In places they show much crumpling. As Flat Point is neared these shales and mudstones become associated with a coarse, gritty sandstone containing plant-remains, which take the place of the coal-rocks described above.

Owing to the cutting down of the face of the sea-cliff being approximately along the strike of the coal-rocks, and to the limited width of this area, no extensive section can be seen. Notwithstanding, the relation of the beds is very important when the general structure of the country is considered. For their whole length on their western boundary, they are overlapped by the Younger Miocene beds stretching southwards from the Kaiwhata, and in conjunction with their easterly beds they form the remnant of an important syncline that once was connected with the beds dipping east, belonging to the Lower and Upper division of the Upper Cretaceous rocks.

In the second and larger area of this formation, these typical coal-rocks occur in two distinct places. They are well seen in the watercourse of the Little Kaiwhata Creek, and in the main creek above the confluence with the smaller stream. These coal-rocks here comprise the usual shales and mudstones with conglomerates, but, due possibly to the larger section shown, they are