

about a quarter of a mile. It is bounded on the north by the alluvial of the creek and the limits of the survey, on the south and east by the coal-rocks, and on the west by the limestone of the Upper division of the same rocks. In this area the division is made up of a glauconitic sandstone, grey sandstone, shales and mudstones, and micaceous sandstone, all of which are here seen standing at high angles, and when not vertical the dip is invariably to the eastward.

The lowest rock of the division is a decomposed glauconitic sandstone in the bed of the stream, with a strike of 45° east of north, and a dip to the west at an angle of 60° . Above this, is a series of beds of glauconitic sandstone interstratified with fine-grained shales and sandstones, the latter having plant-remains. These strike 15° west of north, and the dip is almost if not quite vertical. Overlying is a blue micaceous sandstone similar to the beds in the Kuamahanga, having the same fine texture. The interstratified grey sandstones are very thick-bedded, at places being 10 ft., without any apparent cleavage or line of deposit being seen. The associated sandstones and shales all conform with the glauconitic rock in the matter of their high dips and strike. Throughout the whole series calcite is in quantity, occurring as minute stringers or veins up to 2 in. in thickness.

Towards the eastward, down the valley of the Kaiwhata, where the glauconitic rocks have been separated from the main body by the encroachment of the alluvial, the rock is seen to be very much decomposed, which has given them various colours, ranging from bright yellow, red, blue, and a rich sooty black. The relation of these beds to the underlying rocks of the Lower division is not well seen. In the west they are separated from them (the coal-rocks of the coast) by the alluvial, and on the west the junction with shales and sandstones is, for the same reason, not visible.

(a.) *Upper Division*.—This important branch of the Upper Cretaceous rocks is broken up into two separate areas. The larger of the two commences at Glenburn in the extreme south, with a width of about four miles, extending over the Maungaraki Range into the valley of the Pahaoa. The eastern boundary for about two miles follows the coast-line till abreast of Whatipu Creek, and about one mile south of the East Coast Road, when, due to the conformation of the coast-line, it trends inland. The boundary of the formation is still due north, having on its east the coal-rocks. On the western side the boundary is first in an easterly direction, which quickly narrows the formation, till abreast of Whatipu it is no more than two miles in width. With both boundaries in a general north-east trend the divisions get less and less in width, till on coming to the East Coast road, they are only half a mile in width. Thus it is seen that the area is triangular in shape. The division for the most part keeps the main range of the Maungaraki, occupying both flanks in the south, and rising to the highest peaks. But passing Whatipu the beds keep to the eastern flanks, and at high elevations gradually rising from the low ground till the lowest beds are 800 ft. in height. The second area of these rocks is a long strip stretching from the Kaiwhata, where it cuts the coast range to a point within two miles of the northern extremity of the southern portion. The trend of the Kaiwhata area conforms with the southern portion, its eastern and western boundary having a general north-easterly direction. Its greatest width is about one mile. It occupies the eastern flanks of the Maungaraki, and to the north of the Kaiwhata rises to form the highest peaks, while it also descends to the creek-bed in the gorge of the river. As it proceeds south it gradually narrows, and runs out a little to the north of the East Coast Road. The boundaries of this division are made up, for much the greater part, of the underlying coal rocks, while in the Kaiwhata area the eastern boundary is for a very small distance the Middle division. In the south the Recent deposits form its eastern boundary. The limestone which exclusively composes the division in both areas is for the most part fine-grained and white, but in places is of a bluish colour, and at others, of an incoherent nature. In the gorge of the Kaiwhata the strike is 30° west of north, which carries it to form the highest peak above the gorge. The dip is 45° , and to the east, in places, calcite has been deposited in thin veins, forming a complete network, spoiling what would otherwise probably be an excellent lithographic stone. This refers particularly to the limestone in the vicinity of Glenburn, in the south. On the East Coast Road the beds are seen to be dipping 40° to the east, with a strike of 20° west of north.

2. Lower Miocene.

This formation has a considerable development in the district, and in all it occupies four distinct and separate localities. One is located in the valley of the Pahaoa in the south, another occupies the Bismarck Creek and Kaiwhata River, a third the Kuamahanga Stream, and a fourth is an area extending from Flat Point northwards.

Commencing with the largest and most important development of the formation, the first is the Pahaoa area. It occupies almost exclusively the whole valley of the same name. As a rule, the beds confine themselves to the low ground. This also refers to the whole formation throughout the district. An exception to this is in the Pahaoa area under consideration, which at places rises to heights of 800 ft. In its boundaries it is limited by the surrounding Cretaceous rocks on the north-east and the south, while the Secondary rocks, rocks of the Taipo Ranges, bound them on the west. The trend of the whole is in a south-east direction, narrowing in width as it proceeds. In the north-west it attains its greatest width along the coast-road, varying from three miles to three miles and a half, while lower down the stream, by the encroachment of Maungaraki Range from the eastward, they contract to a width of two miles. The beds are not found any distance away from the right bank of the Pahaoa, nor do they occupy any portion of the foot-hills of the adjoining Taipos, thereby differing from the same rocks on the eastern and southern boundary. On the western flanks of the Maungaraki (the coast-range), as mentioned elsewhere, the beds reach a height of 800 ft., and, although this elevation is attained and kept for almost the whole length from Wainuioru southwards, yet the tops of the ranges are never occupied by these rocks.

At places, as on the low saddle by which the East Coast Road crosses to the coast, the rocks rise to within 200 ft. of the water-parting. The high elevations which these Miocene beds