

For this series I propose the name of "Putataka Beds," from the Maori name for Waikato Heads, at which place they are best seen.

These beds contain two or three seams of impure shaly coal, not more than six inches thick, and of no value as fuel. They exist at a short distance below the sea-level, from Waikato Heads to Kawhia, showing above the surface at Otehe Point, and perhaps in Whaingaroa Harbour and other places; the extent of surface covered by them is, however, insignificant.

On the west side of Te Kapamahanga I saw traces of micaceous sandstone, probably belonging to this series, but I could obtain no section of them *in situ*, and I admit them into my map at this place chiefly in deference to the views of Dr. Hochstetter.

TERTIARY ROCKS—BROWN COAL FORMATION.

The oldest of the tertiary rocks in this district is the brown coal formation, which is here always seen resting directly on the primary slates.

The following is the section at Kupakupa, drawn up chiefly from information obtained from Mr. W. Rowe, the intelligent manager of the coal mines:—

- (a). Light yellow clay, with nodules of clay ironstone, 230 feet.
- (b). Upper fireclay, dark blue, 12 to 14 feet.
- (c). Dark blue shale, 4 feet, containing leaves of dicotyledonous plants, similar to those of Drury and Nelson.
- (d). Brown coal, 6 to 18 feet.
- (e). Lower fireclay, very pure and heavy, 20 feet.
- (f). Light-coloured clays, with stains of oxide of iron and bands of clay ironstone, 100 feet.
- (g). Primary slate-clays, about 30 feet above the level of the river.

Both the coal and the shale above it contain lumps of the fossil gum called "ambrist."

In appearance this coal is much like Cannel coal, having a lustrous pitch-black colour, with brown films in places. It does not soil the fingers. Its fracture is conchoidal, shining, and hard, and it does not fall to pieces easily. Both the streak and powder are black and glistening.

It is easily ignited, and burns with a bright clear flame, throwing out an intense heat, and falling into a light grey ash, easily blown away, and without any appearance of caking.

It is burnt with much satisfaction on board all the steamers plying on the Waikato, and I would recommend that samples be sent to the laboratory of the New Zealand Geological Survey at Wellington for analysis, as I am of opinion that it will be found equal, if not superior, to any of the hydrous coals of New Zealand.

On the east bank of the river the coal is again seen. No complete section has been made of it here, but it appears to be 8 or 10 feet thick, but accompanied with a good deal of shale.

Further eastward the coal field is continued in small detached blocks, each occupying the centre of a spur running from the higher slate ridge, all the coal between these detached portions having been washed away by denudation.

South-west of the present mine the coal field expands into much larger dimensions, although here, too, it is divided into several detached blocks, each, as a general rule, getting larger as you recede from the river, until it is cut off and overlaid by the Whaingaroa clay and Aotea sandstone.

Near the head of the Awaroa River I obtained a pretty fair section of the coal seam, and considered it to be 12 or 15 feet thick. It is, therefore, probable that it obtains an average thickness of at least 12 feet throughout this district.

It is of course impossible as yet to estimate, even approximately, the area over which the coal extends; but as some idea, however rough, may be thought desirable, I may say that, in my opinion, the area of the coal fields on the eastern side of the river is about 300 acres, and that they contain about 2,800,000 tons of coal; and that the coal fields on the western side of the river cover an area of 7360 acres, and contain about 137 millions of tons of coal.* The whole of this can be got without pumping, or any mechanical means for raising the coal to the surface.

The largest mass of coal in a continuous block appears to be south-west of the source of the Awaroa River, and I would suggest to any company proposing to work this part of the field that the best way would probably be to make a tramway down the valley of the Mangaohei River, and so deliver the coal on the Waipa, opposite to Ngauwahia.

The seam at the present coal mines, and on the opposite side of the Waikato, is 150 feet above the river, or about 220 feet above the sea-level. At the source of the Awaroa River it is about 50 feet higher. Whether it rises gradually from the river to this level, or whether it is thrown up by one or more faults, I cannot say, but think that the latter is probably the case, as a fault is seen in the present working running in a nearly east and west (true) direction, with a trend of 50° north, and throwing up the south portion about 7 feet.

The clays of this formation, being derived from the decay of the slate rocks on which they rest, are exceedingly like the recently decomposed primary rocks, and, as they contain no fossils, it is often very difficult, in places, indeed, almost impossible, to distinguish between the two, the ironstone nodules being the chief characteristic of the coal formation.

On the east slope of Kapamahunga Range a series of banded light yellow and red sandy clays occur, about 400 feet in thickness. From their position I presume that these are of the same age as the brown coal formation, but they differ very much in appearance from it, and I observed no sign of coal. Dr. Hochstetter, however, says that he was informed that coal had been found in the neighbourhood.

PAPAKURA LIMESTONE.

It appears probable that the limestone which is seen resting on the secondary rocks, south of the Waikato Heads, and the one in the Kapamahunga Range, are extensions of the same bed that is found at Papakura, and I have therefore taken Dr. Hochstetter's name for them.

* Therefore it may be roughly said that the Lower Waikato coal fields contain about 140 millions of tons of coal.