

## GEOLOGY.

The Kotuku Oilfield is about fifteen miles south-east from Greymouth (twenty-one miles by rail) and lies in the wide lowlands which, stretching through North Westland, extend north between the Paparoa Mountains and the eastern highlands to beyond Reefton. Kotuku is about nine miles from the south end of the Paparoa Mountains and about five miles east of Bell Hill which here forms the edge of the highlands to the east. Fluvatile fluvio-glacial and morainic deposits of Recent and Pleistocene age cover the lowlands, except along some of the stream valleys in which narrow discontinuous strips of underlying Tertiary beds are exposed. A great piedmont glacier at one time covered the eastern part of the lowlands where Kotuku is situated and outcrops of Tertiary strata are much too few to allow the sequence and structure of the beds to be determined. The lower part of the Tertiary beds, however, are well exposed along the lower valley of the Grey where that stream cuts across the wide anticline that forms the southern continuation of the Paparoa Mountains.

These highlands consist of ancient sedimentary rocks and intrusive granites. The old greywackes and argillites appear in the core of the great anticline a mile west of Stillwater; they also form Bell Hill, east of Kotuku, and the country of the auriferous lodes of Mount Greenland, near Ross, and of Reefton. The rocks are generally greenish coloured and are everywhere strongly folded, often shattered and, near granite intrusions, altered to hornfels and schists. They contain no internal evidence of their age, and different writers assign them to periods ranging from the Carboniferous to the Ordovician.

The main eastern highlands, the continuation of the Southern Alps, are separated from the lowlands by a range of lower hills cut into a series of isolated masses by the streams crossing them from the more elevated country. The Alpine rocks are chiefly quartzite, grey-coloured greywackes, and dark argillites. In other districts late Triassic fossils are found in some bands, and the whole vast series is probably of early Mesozoic and late Palæozoic age. The lower hills east of them consist chiefly of granite, as Mounts Smart, French and Te Kinga at the back of Lake Brunner; Bell Hill, north of these, is formed, as already stated, of the early Palæozoic greywackes intruded to the east by granite. Between the granite and the Alpine greywackes is a broad band of gneisses, schists, and other intensely altered rocks.

As in other parts of the world, the schists and gneisses, the strongly folded and shattered greywackes slates and argillites, and the granites that intrude them do not contain oil in commercial quantity. Rocks quite as old as the greywackes of the Alps or of the Paparoas may contain oil in large amount, but the alteration due to heat and pressure the older rocks of the West Coast have undergone forced out what petroleum they may have originally contained or destroyed its source in the rocks. These old rocks now form the platform or base on which rest the younger strata which are potentially, and in places actually, petroliferous.

The gravels and morainic deposits of the lowlands so effectively conceal the younger rocks near Kotuku that their sequence in the district can only be observed in the uplands and hills north-east, east, and south-east of Greymouth. The sequence of the strata taken with but slight modification from New Zealand Geological Survey Bulletin No. 13 is as follows:—

Formation.	Content and Thickness.	Age.
Old Man Bottom .. ..	Gravels consolidated; 600 ft. .. ..	Late Pliocene.
Blue Bottom .. ..	Gravels, shales with lignite, blue sandstones, and clays grading down to calcareous claystones and limestone; 1,200 ft.	Pliocene and Miocene.
Cobden limestone and Point Elizabeth beds .. ..	Limestone, calcareous sandstone and claystone; 1,000 ft.	} Oligocene.
Omotumotu beds. . . .	Mudstone, calcareous claystone, sandstone, grit and conglomerate	
Kaiata mudstone. . . .	Dark calcareous mudstone; 3,000 ft. ..	} Eocene.
Island sandstone .. ..	Sandstone with minor shales; 500 ft. ..	
Brunner beds .. ..	Sandstone, grit, pebble beds, minor shales, and coal seams; 500 ft.	
Paparoa beds .. ..	Sandstone, shale, and coal seams; 2,000 ft. ..	} Upper Cretaceous.
	Basal conglomerate; 1,000 ft. .. ..	

These strata record the history of this part of New Zealand after the great mountain-building movements of the late Jurassic or early Cretaceous. The thick Paparoa beds are probably the deposits in the lower valley and estuary of a considerable stream. The Brunner beds, which in part rest on the Paparoa beds and in part overlap on the old rocks, are deposits of similar origin laid down after land movements of some kind, though these seem to have been insufficient materially to alter the composition and texture of the Brunner beds as compared with the upper part of the Paparoa Series. The overlying Island sandstone and Kaiata mudstone are marine beds likely to be more uniform in texture and to have a wider distribution than the strata of the two preceding series.