

upper horizon the mudstones contain calcareous bands. These become more and more frequent, and finally predominate. Hence there is no distinct division-line between the mudstones and the beds of the next division.

Cobden Beds.—The strata comprising the Cobden Beds (often called the Cobden Limestone) are well seen in the quarries at Greymouth and Cobden. Here they consist of a succession of argillaceous and arenaceous layers, with a varying proportion of carbonate of lime. Inland the beds seem to thin out and become more calcareous, so that they form a limestone of fair quality. The bores at Kotuku have proved the presence in that district of a bed of good limestone 110 ft. to 120 ft. thick. This probably is to be correlated with the Cobden Beds.

Blue Bottom.—The beds classed as belonging to the Blue Bottom have a maximum thickness certainly exceeding 1,000 ft. They are well exposed in the southern part of the Grey Subdivision, where, as is shown by the outcrops, Blue Bottom underlies the whole area from the Hohonu Range to the coast. Northward, beds of Blue Bottom age underlie the morainic *débris* near Lake Brunner, and probably the lake itself, as well as the Kotuku district and much of the Grey Valley. In general, the Blue Bottom beds consist of the tough blue clay or mudstone that has given it its name, but towards the base of the Hohonu Range, and in the Kotuku and Notown districts, the visible outcrops show a bluish or yellowish-brown sandstone, containing in its upper portions interbedded layers of gravel or conglomerate. Much of the material penetrated by the oil-prospecting bores at Kotuku is arenaceous mudstone rather than sandstone. In the same district layers of impure lignite were seen in a shallow shaft, and again in sandstone some distance above Deep Creek Gorge.

PLIOCENE, PLEISTOCENE, AND RECENT.—After the deposition of the Blue Bottom there was considerable elevation of the land, accompanied by marked folding of the pre-existing Tertiary strata. The Southern Alps now rose to great heights, and gave rise to permanent snowfields, from which glaciers ultimately descended into the lowlands. Denudation of the higher lands was intense, and, in consequence, an abundance of *débris* was carried first by the rivers and at a later date by the glaciers into the lowland country. When the ice rivers finally retreated to the mountains the greater part of Westland was covered by a thick deposit of morainic and fluvio-glacial gravels. Portions of these have since been reassorted by the modern streams, and, with fresh material brought down from the mountains, have formed the more modern fluvial and marine gravels. The modern coastal plain is still being built slowly seaward by the material brought down by the rivers. During the past forty years *débris* from the sluicing claims has formed a considerable portion of the stony burden borne seaward by the rivers.

During Late Pleistocene and Recent times some uplift of the land has taken place, for marine gravels and sands are found at elevations approaching 200 ft. in various places. Very noticeable is a raised beach of sea-worn sand in the neighbourhood of Paroa. This beach indicates recent elevation to the extent of 20 ft. to 25 ft.

Economic Geology.

The economic geology of the Greymouth Subdivision, so far as yet investigated, may be described under the headings of (1) Alluvial Gold, (2) Auriferous Quartz veins, (3) Antimony, (4) Coal, (5) Petroleum, (6) Building-stone, and materials for Lime, Cement, Brick, &c.

(1) *ALLUVIAL GOLD.*—The first discovery of payable gold in Westland was made by a prospector named Albert Hunt in 1864. The locality of Hunt's find was Maori Point, a bend of the Big Hohonu or Greenstone River. During the next few years richly auriferous gravels were found at many places within the subdivision. Among these may be noted Stafford, Goldsborough, and other localities in the Waimea watershed, Callaghan's, Marsden, Cameron's, Rutherglen, Maori Creek (Dunganville), Maori Gully (south side of Arnold River), Candlelight, Notown, Red Jack's, Moonlight (famous for its big nuggets), the Lamplough Lead near Chesterfield, and the Auckland Lead on the coast north of the Waimea Creek. The Kumara Goldfield, however, perhaps the most important of all, was not discovered until 1876.

At the present time the richer surface deposits are nearly all worked out, and the population of the goldfields is steadily diminishing. There are, however, still very large quantities of unworked gravel believed to be payably auriferous if only an abundant and cheap supply of water could be obtained for sluicing. In addition, there are certain areas that are rendered unprofitable owing to the lack of fall for tailings or because the upkeep of the great length of sluice-boxes required to carry the tailings away is too expensive. In some of these cases high-pressure water might profitably be employed in hydraulic elevators, or for furnishing motive power to drive bucket elevators, as is done in the Wheel of Fortune Sluicing Claim near Stafford.

Among the areas in which unworked auriferous gravels are expected to afford payable results if an adequate water-supply were obtained may be mentioned Cape and Hayes Terraces near Kumara, the neighbourhood of Notown, Red Jack's, and Kangaroo Creek.

There are several localities where deep leads are supposed to exist. One of these is the old stream-valley between Kumara and Dillmanstown, where on a false bottom the bulk of the Kumara gold has been obtained. There is much reason for believing that on the Blue Bottom a rich layer exists; but prospecting shafts, though sunk to a depth of 140 ft., have failed to bottom, and efforts to sink deeper have been frustrated by water. Probably this ground could be prospected by means of a Keystone Driller or similar machine. A low-level tunnel which would tap the ground at 180 ft. or more below the surface could be driven from the Teremakau River, and, it is not at all improbable, would be at a sufficiently low level to test the ground. There is apparently no reason why the water difficulty, of which there seems to be much unnecessary dread, should not be overcome by a moderate expenditure on pumping machinery. Taking all factors into consideration, the probabilities are so much in favour of payable gold as to justify the outlay necessary to prospect the deep ground beneath the Kumara Flat.