is either due to faulting bringing blocks of unconformable beds into juxtaposition and parallel attitudes, or is a conformity between the conglomerate and beds much younger than the Grey Marl, but lithologically similar.

Unconformity above Amuri Limestone.

On the rock-shelf a short distance south of Amuri Bluff a contact between Amuri limestone and a thin upper limestone is very clearly shown, and is of exactly the same character as at Kaikoura Peninsula. The irregular upper surface of the Amuri limestone is penetrated by numerous small cavities and tubular passages (worm-borings) filled with calcareous glauconitic sandstone. On this surface rests 6 in. of conglomerate, composed of phosphatized pebbles of limestone,* set in a small amount of calcareous greensand matrix. This is followed by 2 ft. or 3 ft. of calcareous greensand, containing numerous pebbles of limestone, some 2 in. or more in diameter. Many of these weather to a black colour, and are no doubt phosphatic. Above the greensand is 10 ft. to 15 ft. of limestone, followed with apparent conformity by grey calcareous sandstone passing upward into a more argillaceous rock (Grey Marl). The phosphatic conglomerate may be seen for some distance on the rock-shelf, and also in the cliff to a point near the natural tunnel at the outermost portion of the Amuri Bluff. It is described by von Haast as a greensand conglomerate (2, p. 43), by Hector as a layer of brecciated fragments of calcareous greensands (3, p. xi), and in 1877 by McKay as a greensand conglomerate, which is, he says, a most peculiar bed, consisting of nodules of a calcareous greensand in a matrix of greensand, and, although apparently incoherent, is often of extreme hardness" (6, p. 179). He also states that it contains fossil bones, including those of a penguin (8, pp. 584, 585), and an oyster (13, p. 77). Years later the last-named writer speaks of it as a "bed of phosphatic nodules in a matrix of rather loose greensands" (16, p. 164). In the meantime the presence of phosphatic nodules in a corresponding horizon at Weka Pass had been determined, but there is no record of any analysis of the Amuri Bluff conglomerate having been made. Be this as it may, McKay's statement, though probably merely a shrewd guess, is correct, as is shown by the following analysis of a sample selected near the most southern outcrop on the foreshore: Calcium carbonate ($CaCO_3$), 45·86 per cent.; phosphoric anhydride (P_2O_5), 19·91 per cent. The phosphoric anhydride is equivalent to 43·46 per cent. of tricalcic phosphate.

The next locality where the unconformable contact of Amuri limestone with the overlying rock may be observed is some distance north of Mikonui (Mikinui) Creek. Here there is a peculiar section, which may be described as follows:—

Grey Marl (calcareous sandstone), underlain by —
- 12 ft. to 15 ft. of calcareous rock, the lower part with many pebbles of limestone, reaching 1 in. to 2 in. in diameter.
- 5 in. to 14 in. calcareous phosphatic conglomerate, with a greensand matrix.
- Several feet of limestone, much eroded on its upper surface, with cavities extending to some depth, and filled with calcareous sandstone containing many small dark pebbles (probably phosphatized limestone).
- 2½ ft. to 3 ft. of calcareous sandstone with many pebbles (of limestone probably), which in a few feet both to the north and the south passes gradually into slightly glauconitic limestone.

The phosphatic conglomerate can be traced in the cliff-face for some distance to the north until it is cut off by a fault with downthrow to the northward. The Amuri limestone reappears a short distance farther north, but the conglomerate was not observed by the writer. Not very far to the west or north-west, however, a limestone cliff capped by Grey Marl may be seen on the east side of the main road up the Oaro Valley. Here, opposite a small clump of bush where a Public Works camp was situated in December, 1915, calcareous and presumably phosphatic conglomerate 6 in. thick is exposed for a length of 6 ft. a little above the road-level. At one end debris hides the outcrop, and at the other it is terminated by a fault. Calcareous strata overlie for 40 ft. or 50 ft., and above these comes the Grey Marl proper.

Economic Geology.

The remarks made on a previous page with respect to the phosphatic conglomerate at Kaikoura apply equally well to that in the Amuri Bluff district. Many years ago the limestone at Amuri Bluff was quarried as a building-stone and for the manufacture of quicklime (1, p. 39; 2, p. 38), but the enterprise has long been abandoned. Much of the limestone appears to be of good quality, and suitable for both the purposes mentioned. The lower horizons, however, contain numerous flinty concretions and are of little value, except that they are the source of large quantities of flint pebbles which have accumulated on the shore not far north of Amuri Bluff. Though the majority of these are flattened by erosion, and therefore narrowly ellipical in cross-section, like most shingle pebbles, yet a portion of them may be suitable for use in tube mills, and in days to come may find other uses.

WAIPARA, WEKA PASS, AND WAIKARI DISTRICTS.

Several days spent in the Waipara and adjoining districts were largely devoted to examining the contact between the Amuri limestone and Weka Pass stone. The observations made on the whole support Hutton's view that the contact is unconformable. On the other hand, the

*The assumption that the phosphate of lime replaces the carbonate of lime in limestone pebbles is made owing to the analogy with Weka Pass. It has not been strictly proved.