contact of the Weka Pass stone and the overlying Grey Marl* wherever seen appeared to be perfectly conformable. Evidence of an unconformity at the base of the Mount Brown beds was also noted, and some scanty all-too-incomplete data concerning the faults traversing the area examined were obtained. The general geology of the Waipara and Waikari districts is described in the last annual report of the Geological Survey (26, pp. 90–93), and in the publications there cited, so that no summary need be given on the present occasion.

Unconformities.

(1.) *Amuri Limestone and Weka Pass Stone Contact.*—Near Weka Pass and Waikari this contact is everywhere of the same character as that described in the last annual report of the Geological Survey (26, pp. 90–93)—that is, it is marked by an eroded surface of Amuri limestone, upon which rests a thin, calcareous glauconitic sandstone containing limestone pebbles which passes gradually into the Weka Pass stone. One or two observations may be added to those made last year. In various places small tubular passages in the Amuri limestone now filled with glauconitic sandstone are undoubtedly worm-borings, whilst between Waikari and the middle gorge of the Waipara River "fucoid" casts are abundant in the lower part of the glauconitic sandstone. Small externally black pebbles, which look like greywacke but are really phosphatized limestone, occur in the glauconitic sandstone to a height of 4 ft. above the Amuri-limestone surface. One or two small quartz pebbles occur near the contact in the railway-cutting, and in one locality a single flint pebble, 1½ in. by 1 in. by 1 in., was observed 1 ft. above the contact. The following part analyses of calcareous phosphatic pebbles collected from the horizon last December may here be quoted:—

	(1.) Per Cent.	(2.) Per Cent.
Insoluble in acids	4·34	7·30
Calcium carbonate ($CaCO_3$)	24·11	48·09
Phosphoric anhydride (P_2O_5)	22·56	13·65

The phosphoric anhydride in (1) is equivalent to 49·29 per cent. of tricalcic phosphate ($Ca_3P_2O_8$); that in (2) to 29·96 per cent.

No. 1 sample consisted of pebbles with dark exterior, and No. 2 of light-coloured pebbles. Both were collected on the west side of the road some distance south of Weka Pass Saddle and of the railway viaduct. They are similar in composition to the "phosphatic nodules" collected in the same horizon by McKay many years ago (14, p. 84), but differ from the calcareous pebbles collected by the present writer in March, 1915 (26, p. 92, analysis No. 4) near the railway viaduct.

As the contact is followed southward from Weka Creek valley towards the second gorge of the Waipara River it gradually changes in appearance. The pebbles of limestone marking the contact become fewer, and about a mile from the Waipara River disappear. Not only so, but the water-worn aspect of the upper surface of the Amuri limestone also gradually becomes indistinct, whilst the overlying glauconitic sandstone becomes less glauconitic and more calcareous, so that the contact is marked only by a slight change of lithological character, by the presence of numerous "fucoid" casts, and by small oval grey patches, apparently more sandy than the enclosing rock, some of which are surrounded by a ring of iron oxide. Thus at the second gorge of the Waipara River there is no visible evidence of physical unconformity, but since numerous similar contacts in other parts of the world are regarded by competent geologists as unconformable, and in some cases without dispute, it is still possible to accept the Amuri limestone and Weka Pass stone contact as representing a stratigraphical break.

The Weka Pass stone generally overhangs the Amuri limestone contact owing to its lowest layer being softer and more easily eroded than the rock above or below, and thus a shelf appears at the junction. In the middle Waipara Gorge a shelf, marked by shrubs, is formed at the expense of the uppermost layer of Amuri limestone, here softer than the overlying rock.

The only recognizable fossils seen by the writer near the junction, other than "fucoid" casts and the crustacean(?) mentioned below, were two specimens of *Epitonium* (probably *E. rugulosum lyratum* (Zitt.)) in very sandy Weka Pass stone 4 ft. or 5 ft. above the Amuri limestone. The locality is just to the south of the watershed between Weka Creek and the Waipara River (north-west of Mount Dean). A little farther south a loose block of Weka Pass stone was observed to contain what seemed to be the remains of some crustacean. Thomson and Cotton found somewhat numerous specimens of *Pecten huttoni* (Park) in the same horizon (22, p. 8), and Mr. Alex. McKay has personally informed the writer that in a locality south of the Waipara River whale bones are abundant close to the junction of Weka Pass stone and Amuri limestone. This is probably the bone horizon mentioned by him in an early report (5, p. 38).

(2.) *Contact of Grey Marl and Mount Brown Beds.*—In many places the contact of the Grey Marl with the overlying (Mount Brown) beds is obscured by soil and debris. A clear junction, however, is visible in a small gorge of Weka Creek, about half a mile west of the road through Weka Pass, and affords very satisfactory proof of the unconformity maintained by Hector and McKay (12, pp. xi–xii; 18, p. 102, &c.) as present between Grey Marl and Mount Brown beds. In this locality the upper surface of the Grey Marl (here a fine-grained calcareous argillaceous sandstone) is irregularly eroded, and succeeded by layers of calcareous shelly greywacke and current-bedded sandstone containing pebbly beds or lenses composed largely of Grey Marl fragments. At one spot the first few inches of the soft sandstone immediately above the Grey Marl

* McKay's correlation of the bluish-grey mudstone or fine-grained sandstone overlying the Weka Pass stone with the Grey Marl is here provisionally accepted. For a discussion of this point see Thomson in the Sixth Annual Report of the Geological Survey (22, p. 9).