

Skirting the Mataura and Whakaea Rivers are well-preserved and extensive terraces at heights of 100 ft. and 25 ft. to 30 ft. as well as minor remnants of terraces at 150 ft. The main streams are entrenched to a depth of 4 ft. to 6 ft. in their flood-plains and appear to be actively engaged in down-cutting.

STRUCTURE.

The two units distinguished in the above section similarly show totally different structural features. From a few chains west of Trig. I at Knapdale a fault with down-throw to the south-east trends in a north-easterly direction through Chatton and passes north of Waikaka to Greenvale, where it terminates against a fault striking north and south. This fault separates marine beds to the north-west from lignite-bearing strata to the south-east. These latter, which near the fault are disposed at fairly high angles, form an asymmetrical syncline the axis of which passes a mile south of Waikaka, whence south-east they rise gradually to the surface, but for the most part are veneered by weathered gravels. The presence of basalt, elsewhere usually associated with faulting movements, about a mile south-west of Maitland suggests that the structure may be complicated by minor faulting. Along a fault passing from a point half a mile south of Trig. F to a point a quarter of a mile south of Trig. K, west of Waikaka, Tertiary strata are faulted down against the older greywacke, metamorphics, and igneous rocks to the north-west.

The Upper Waikaka and Otama-Wendon Valleys have somewhat similar structure, each being fault-angle depressions along major faults trending north and south and with down-throw to the west. In each the structure is complicated by minor sub-parallel and transverse faults. The elevated blocks, besides being tilted to the east, have also a slight tilt downwards towards the south, where they are truncated by the faults mentioned above. Tertiary sediments are preserved in strips along the eastern margins of the depressions, and in the Otama Valley, as also possibly in the Waikaka Valley, are bounded on the west by faults parallel to the main fractures but of relatively small throw. West of Mount Wendon two minor transverse faults trend away for some distance to the south-west, defining a small upthrust wedge one mile wide which truncates obliquely the Tertiary strata occupying the Upper Waikaka Valley. A similar fault-bounded wedge is found in the depression to the west, immediately east of the Wendon Stream; the faults are sub-parallel to the main fracture and die out towards the head of that stream. The western of these two faults, with down-throw to the west, can be traced with increasing throw southwards to the Pyramid Bridge. There appear to be minor transverse faults in the Wendon Creek-Stony Creek depression.

Another important fracture along which Tertiary sediments are down-thrown and preserved on the west follows the eastern side of the Whakaea Valley from Wendon to Wakaia. A subsidiary parallel fault with similar, but considerably less, throw lies about a quarter to half a mile west.

The amount of throw along the main north-south faults can be measured in thousands of feet; the fault planes dip to the east towards the up-throw side, showing the movements to have been caused by thrust from the south-east. Toward the north the fracture-lines bend round slightly towards the east. In the King Solomon Mine, near the confluence of Stony Creek and Winding Creek, the schist can be seen to override the Maori Bottom gravels. All evidence indicates that the movements extended over a fairly lengthy period, with two major phases of dislocation. Faulting probably commenced in the late or late-middle Tertiary, as a thick series of shales, lignites, and conglomerates were deposited on marine beds of Otataran age before disruption commenced; and Maori Bottom gravels, deposited subsequent to the first displacement, have been involved in later movements.

STRATIGRAPHY.

Tuapeka Series.—Rocks of this group from the basement of the district and comprise quartzites, fine conglomerates, argillites, and greywackes, which towards the north grade into schists, semi-schists, and phyllites. Folding has been generally along east and west lines, though local variations in strike and dip are common. There is no direct evidence of their age, but they occur between unmetamorphosed beds of probable Mesozoic age to the south and the Otago schists to the north, and are probably Palæozoic.

Clinton Series.—Macpherson found fragments of fibrous shell resembling *Inoceramus* or *Maitaia* in boulders approximately a mile and a quarter south of Pyramid Bridge, but the writer saw no similar rocks in place.

Mesozoic (?) Beds.—Near Knapdale and Chatton in Okapua Creek valley and stretching north-west to Chatton are unaltered, well-compacted mudstones and sandstones, generally striking east and west and dipping at high angles to the north. In Okapua Creek valley they are overlain unconformably by fossiliferous marine strata of the Chatton Series. Their contact with the greywackes and argillites to the north is obscured by the Otama intrusive and associated metamorphics, but their unaltered condition separates them lithologically from the rocks of the Tuapeka Series. As they contain no fossils their age is problematical, but they closely resemble rocks of the Hokanui Series outcropping farther south near Gore, and they are tentatively assigned to the Mesozoic.

Welshman Series.—South of Wakaia are shales, white sands, quartz-conglomerates, and grits, with lignite seams underlying the marine sandstones of the Chatton Series. They are missing in the Okapua Creek area, but are found again near Waikaka and farther north in the upper Waikaka Valley. A small patch of the fine quartz-conglomerate occurs a mile south-east of the Pyramid, and here, as also near the head of Otama Stream and seven miles north of Waikaka, residual blocks are found cemented by limonite into a compact rock.

They are apparently terrestrial beds and underlie Otataran marine strata, which places their age as early Tertiary or Upper Cretaceous. Macpherson has correlated them tentatively with the quartz conglomerates of Otago Central, making them the equivalents of Williamson's Hogburn Series.