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## Raised Beaches in Teviotdale District, North Canterbury.

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IN view of Dr. Henderson's recent paper on the post-Tertiary coastal features of New Zealand (*Trans. N.Z. Inst.*, vol. 55, pp. 580-99, 1924), the following note on raised beaches is compiled from observations of the coast between the Motunau and Waipara Rivers. The terraces here are so well defined that they may often be seen distinctly from the Port Hills across Pegasus Bay, and they have previously been briefly described by Professor Speight in his paper on the Lower Waipara Gorge (*Trans. N.Z. Inst.*, vol. 44, pp. 221-33, 1912). Though intermittent uplift is clearly indicated along this coast, erosion has been so rapid as to cut away much of the original seaward extension of the lower terraces. For this reason it is very difficult to get any definite correlation between the river-terraces and the remnants of wave-levelled coastal platforms in the same district. The object of this paper is to record the heights and distribution of those platforms which are of marine origin.

### THE DOVEDALE AREA.

The coastal marine terraces are divided into two groups by the Limestone Range, which reaches the coast about midway between the mouths of the Waipara and Motunau Rivers. This range, capped by a tilted and faulted block of Weka Pass limestone, extends from a point about three miles south-east of the Waipara Railway-station to the sea, through Montserrat, whence the limestone swings inland, continuing past Vulcan Hill to the north of the Motunau River.

To the north of the bluff, where the limestone forms a steep white cliff, the perfect shore-platform of the Motunau widens out rapidly; but the present paper is concerned only with the series of platforms to the south of the bluff. These are most clearly defined in the Dovedale area, where an extensive shelf, capped everywhere by marine shell-bearing gravels, resting unconformably on slightly tilted marls and sands, has the shape of a segment of a circle. It widens out southward from the limestone bluff, reaching its maximum width near the mouth of the Dovedale Stream, and then tapers to a point towards the mouth of the Waipara. Whereas in the south it is deeply dissected by a series of parallel juvenile consequents, most of the drainage in the north is tributary to the Dovedale Stream. This results in the preservation of a remarkably uniform line of coastal cliff, and such a decrease of height inland as to allow the accumulation of water in three permanent lagoons on the portion known as Bob's Flat.

The coastal cliff increases in height from 180 ft. (the actual height of a superimposed stream-terrace) at the mouth of the Dovedale Stream to 370 ft. where the shore-platform tapers out against the limestone bluff of Montserrat. Since all the terraces of the area rise inland, this remarkable increase in the height of the cliff and the narrowing of the platform behind it suggest that to the north the platform was once very much wider, but has been cut back by the sea.

Immediately above Bob's Flat a remarkably well preserved and uniformly high remnant of a marine cliff runs almost parallel to the present shoreline. This shows a height in front of 650 ft., and is no doubt the former seaward edge of a raised beach extending back to the stripped dip-slopes of the Limestone Range. This older terrace is notably more dissected than those at a lower level, but, owing to the drainage being again tributary to the Dovedale stream, the seaward scarp is very uniform and not dissected by stream-channels to any considerable extent. At Amuri Bluff McKay has recorded the occurrence of marine platforms with Recent marine shells at a height of 500 ft. (*Rep. Geol. Explor., 1874-76*, p. 177), so if this terrace be a true marine platform its height is greater than any hitherto recorded on this part of the coast. At a point above Trig. D north of the mouth of the Waipara a doubtful platform-remnant preserved by a cap of hard conglomerate rises from 650 ft. to 700 ft.

#### THE MOUTH OF THE WAIPARA.

In this locality Professor Speight has described a wide coastal plain extending southward several miles (*Trans. N.Z. Inst.*, vol. 44, map, p. 223). At the river-mouth this is at least a mile and a half in width, rising in this distance to a height of 35 ft. at the base of the old sea-cliff on the south bank of the river. In places occupied by swamp this plain is little above sea-level, and its very recent emergence is suggested by the occurrence of patches of well-preserved mussel-shells. On the south bank of the river the top of the old sea-cliff is 85 ft. above the juvenile coastal plain, or 120 ft. above sea-level. From here a wave-cut bench rises inland 165 ft. at a point on the Teviotdale Road. The highest part of the inner edge of the platform is slightly higher than this. At the trig. station north of the river the sea-cliff is still 120 ft. above sea-level, but rises northward in stages to 150 ft. and 210 ft., which is approximately the height of some of the lower remnants along the coast.