through which is scattered some ilmenite, and occasionally a chloritic mineral. A second brownish-green augite is also present. This answers very closely to Gümbel's definition of leucophyre, as quoted by Teall,* except that in our rock the augite is in very considerable quantity.

This, therefore, may be taken as the name of the rock. It differs from dolerite in the subordinate position of the felspar and in the green augite; it is, in fact, an augite rock with some plagioclase and iron oxide; sometimes, however, the saussurite appears to be as abundant as the augite. That it is an altered rock is undoubted, and it may perhaps be an altered dolerite. Its granulitic texture shows that it consolidated during movement, and its association with beds of volcanic ash shows that it is an old lava stream, probably of Triassic age.

Art. XXXVI.—*On the Oxford Chalk Deposit, Canterbury, New Zealand.*

By Henry Wilson, B.A.

[*Read before the Philosophical Institute of Canterbury, 2nd June*, 1887.]

Plate XV.

The Ashley County seems peculiarly rich in interesting geological formations, but to none does more interest attach itself than to the small patch of chalk near Oxford. This chalk was reported on as far back as 1881 (*vide* Geological Reports), by Mr. McKay, of the Geological Department. Mr. McKay's report of the bed is so accurate that my description must in part traverse his. There are, however, some interesting particulars with regard to the fossils contained in the chalk that have been passed over in his report, and to these I shall have the pleasure of calling your attention. Besides the question of fossils, there is the interesting question of the distance from land at which a chalk, almost as free from impurities as English chalk, may be formed.

This chalk, then, is situated in and almost wholly composes one small hill: this hill forming, in one direction, the extremity of the bush-clad hills lying around the base of Mount Oxford.

As will be seen by a reference to the accompanying diagram (Plate XV.), the hill is skirted on three sides by streams; while on the fourth there is a valley, so that the chalk hill is, to use a Scotticism, "self-contained."

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* "British Petrography," p. 135

The dip of the chalk cannot be absolutely made out, as it is so much obscured by bush and alluvium; but from observations I made upon the greensand by which it is underlain, there can, I think, be little doubt but that its dip is about 27° to the south-east. This, too, is the conclusion Mr. McKay comes to. Beneath the chalk, as I have just noticed, is a bed of greensand; above it is a layer of basaltic rocks, whose decomposition appears to have given rise to the soil bearing the bush covering the whole hill. At the point marked *L* in the accompanying diagram, and within a few yards of the chalk section, what appears to be a dyke of this basalt has assumed a columnar form in cooling.

Mr. McKay, from his report, seems to have had some doubt as to whether the chalk (?) outcropping at *L* was the exact equivalent of that at *M*. Until the bush is further cleared, exposing other sections, this of course cannot be absolutely determined. I was, however, fortunate enough to obtain specimens of *Pecten williamsoni** from each section.

P. williamsoni, I may remind you, is found at Aotea and Raglan, North Island; Kaipuke and Tata Cliffs, Nelson; Black Birch Creek, north side of Hurunui Plains; and from the Curiosity Shop, on the Rakaia. The other fossils from each section, so far as my investigations have carried me, differ considerably from each other.

At *L* I obtained (2nd) *P. fischeri.*† This fossil was originally described from Papakura, near Auckland. Since then it has been found at Port Waikato, Oamaru, and Weka Pass.

3rd. *Cristellaria* (*Robulina*) *cultrata*, D'Orb., var. *antipodum*, Stache.‡ Hitherto only found at Raglan.

4th. Several varieties of *Pecten* hitherto undescribed. The presence of these fossils, so characteristic of the Oamaru System, leaves no doubt as to the age of the chalk.

At *M*, where the chalk is much freer from silica, I found it composed very largely of Foraminifera. A section ground thin and placed under the microscope exhibited many coccoliths. The only large fossil, however, that I have been able to discover at this outcrop, in addition to *Pecten williamsoni*, is a rather abundant brachiopod, hitherto undescribed, but apparently allied to *Terebratulina lenticularis*, Tate.

The presence of the Foraminifera and coccoliths at once point to the conclusion that the deposit is a true chalk, and not a mere limestone; but the following comparison between its chemical composition and that of the English chalk leaves no doubt upon the subject:—

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* "Voy. Novara," plate ix., fig. 11, p. 50.

† Zittel, plate ix., figs. 1 and 2, p. 53.

‡ Palæontology of "Novara Expedition," plate xxiii., fig. 30.

From Colonial Laboratory Reports, Wellington, 1879–81.
(*Mr. W. Skey, Analyst.*)

	New Zealand Chalk.*			English Chalk (Average).
	A	*B*	*C*	
Carbonate of lime ..	82·26	82·26	66 82	94·59
Carbonate of magnesia..	1·84	..	..	2·01
Alumina	..	1·84	0·92	Trace
Iron oxide	Traces	Traces	Traces	Trace
Silica and insoluble silicates	15·69	15·69	32·10	3·16
Water	·21	·21	·16	·24
	100·00	100·00	100·00	100·00

A, *B*, and *C*.—From section at *M*; but *C* from a lower level than *A* and *B*.

You will please observe the differences in the analyses of *A* and *B*, and *C*, with regard to the percentages of silica in each. Now at the section marked *L* in diagram the percentage of silica is about 50. In the lowest part of the chalk exposed at *M* the percentage is 32·10, decreasing in the upper part of the bed to 15·69.

The dip, as shown in accompanying diagram, is towards the south-east—that is, towards *M*. Now, taking all these facts into consideration—the presence of *P. williamsoni* in both; the decrease of silica as we ascend in the chalk at *M*., and the dip of the bed, there can, I think, be no reasonable doubt but that the marl at *L* and the chalk at *M* are one and the same bed, the marl being the lower and the chalk the upper deposit.

At the time of the deposition of the bed, Mount Oxford (4,392 feet high), distant about five miles, must have existed as an island, whence disintegrated rock would be borne to the sea. The high percentage of silica in the lower beds points to comparatively shallow water. Gradually the coast sank; less and less silica was deposited among the chalk; and, finally, the water became pure enough to admit of the growth of a coral reef, teeming with Foraminifera.

But the elevatory agencies reassert themselves; the coast rises. Volcanic disturbance follows long ages of tranquillity: basaltic lava streams flow, where formerly the quiet lagoon existed; but although they may have obliterated the beauty of the scene at the time, yet to them we owe the preservation of this exceedingly interesting record of a portion of the past history of our island.

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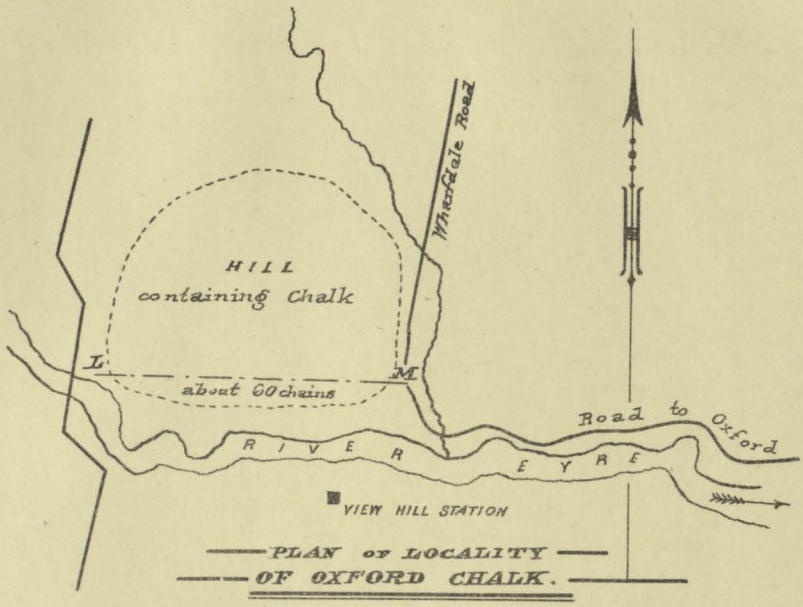
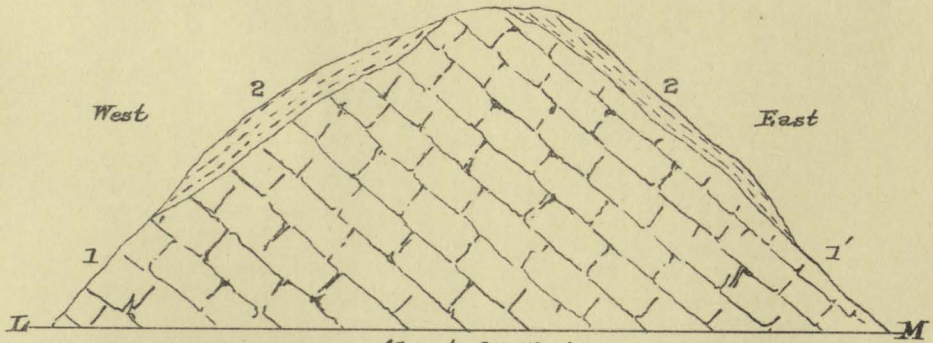
* Specimens collected by Mr. John Ingram, Lab. Nos. 2597 and 2819.



PLAN OF LOCALITY
OF OXFORD CHALK.



SECTION ON LINE L M.

REFERENCE.

1. Marl. — containing
P. Williamsoni.
P. Fischeri.
Cristellaria &c.

1' Chalk. — containing
P. Williamsoni
Terebratula (undescribed)
Foraminifera &c

2. Soil — bearing Vegetation (Trees &c).

H.W. del. To illustrate Paper by H. Wilson. B.A. C.H.P. lith