other places they are twisted, contorted, and broken off in all manners of ways; in fact they resemble in this the laminated rhyolites so common about Lake Taupo. The specific gravity is about 2·53. I have only prepared thin sections of one specimen, as they are extremely hard, and more are not necessary for my present purpose, which is merely to draw attention to the existence of these rocks. This specimen is one of those with pink laminæ, and it shows under the microscope the ordinary felstone structure, with a mosaic between crossed nicols, which vanishes when the nicols are oblique. The pink bands are due to minute specs of ferric oxide in a more opaque base. I should judge that the original lava contained two *magmas* differing in their amount of iron oxide, and that in the more ferriferous laminæ some of the iron has segregated into minute globules.

There can be no doubt but that all these rocks are devitrified rhyolitic lava streams.

ART. XXXV.—*On a* Leucophyre *from the Selwyn Gorge.*

By Professor F. W. HUTTON, F.G.S., and G. GRAY, F.C.S., Lecturer on Chemistry at the School of Agriculture, Lincoln.

[*Read before the Philosophical Institute of Canterbury, 6th October,* 1887.]

THIS rock was first noticed by Sir James Hector, as greenstone (diabase ?) occurring in the gorge of the Wakaepa (or Selwyn) in the Malvern Hills,* and is shown on his section (*l.c.*, iv. *c.*) as interbedded with slate rocks, and forming an anticlinal. Sir Julius von Haast, in his "Report on the Geology of the Malvern Hills," mentions them under the name of diabasic rocks,† associated with chertsose rocks and marble. Also in his "Geology of Canterbury and Westland," (p. 271) as diabase ash-beds. In "Reports of Geological Explorations for 1883," p. 29, Mr. S. H. Cox mentions these diabases, and says that he agrees with Mr. A. McKay that they are the same as the diabase ash-beds and cherts of Okuku which he had found to contain triassic fossils ‡ Mr. A. McKay in "Geological Reports, 1884," (Bulletin of Geological Survey, No. 1,) p. 7, describes them as diabasic rocks with jasperoid rocks, either slates or resembling tufaceous sandstone, grey or reddish limestone, crystalline or compact at different horizons in the diabasic beds, with grey cherts and manganese

* "Rep. Geol. Expl." 1870-71, p. 49.

† "Rep. Geol. Expl." 1871, p. 136; and 1871-72, p. 10

‡ "Rep. Geol. Expl." 1879-80, p. 99.

ore. He considers that this series rests unconformably on the 'Annelid beds,' which latter he thinks form the upper part of the Maitai series.

Last summer one of us examined these rocks in the field, and agreed with former observers that they were volcanic ashes and lava streams contemporaneous with the sandstones and mudstones among which they are found. In places, near their margins, considerable decomposition has gone on, and the green rock is penetrated by bright red siliceous veins, coloured by ferric oxide, forming the so-called red cherts and jasperoid rocks. Calcite veins are often associated with these jasperoid portions, giving further evidence of decomposition, and in places the calcite forms segregation masses from 20 to 25 feet thick, which have been called marble, or even limestone. However, their irregular and lenticular shape, as well as their intimate junction with the greenstone along the line of junction, as well as the mineralogical character of the calcite, which does not resemble limestone but vein calcite, all go to prove their real nature. Small quantities of copper and manganese have been found associated with these rocks; and rocks from Okuku, said to be lithologically similar, called ferruginous cherts, contain a small percentage of gold.*

The undecomposed igneous rock is compact, of very fine grain and of a darkish-green colour, too fine-grained to call a diabase and too light-coloured to call melaphyre; it answers better to the old name of aphanite. The hardness is about 4·5 or 5, and the specific gravity varies between 2·96 and 3·05. On the points it has a greasy lustre like serpentine, but not so well marked.

With an inch objective and ordinary light the rock looks granular, numerous small colourless or pale olive-brown, much cracked, crystalline grains in a translucent mesh-work of ground-mass which is milky or cloudy with occasional whitish patches of leucoxene, and rarely black specks of iron ore. With reflected light the ground-mass is very pale-green, and the crystallized mineral is colourless. The iron ores are pyrites and a brownish-black oxide, no doubt ilmenite; the pyrites is rare. With crossed nicols the crystallized mineral shows brilliant polarization colours. Crystalline faces are rare, the mineral being generally in coarse granules, which look as if they had been broken apart; but on revolving the stage, it is seen that the grains have generally independent orientation, although sometimes two grains separated by ground-mass extinguish together. But there are no large single crystalline masses. These grains are mostly of a pale yellowish-green colour, but some are darker and of a brownish-green. None are pleochroic. Occasionally pale-green

* "Rep. Geol. Expl." 1879-80, p. 105.

chloritic particles occur, which are very faintly, if at all, pleochroic.

With a quarter-inch objective the crystallized mineral looks much like olivine, as it is irregularly cracked and has a roughish surface; but the grains are sometimes cleaved in one direction which is oblique to the positions of extinction; the surface is not so rough as that of olivine, and they show no trace of decomposition on the cracks. Probably, therefore, they are augite, although they show no twinning, and this supposition is confirmed by the chemical analysis. These crystalline grains contain numerous minute irregularly shaped, but generally angular, bright particles, generally of a greenish hue; and sometimes short dark lines, curved or straight. Minute liquid-cavities, occasionally with a bubble, can be found, but are rare.

The ground-mass is a finely granular crypto-crystalline mass, of low polarization colours, colourless or very pale greenish, and consists of a water-clear colourless glass with numerous short rods and minute irregularly-shaped particles. In fact, it is saussurite.

The chemical composition of the rock is as follows:—

Percentage Composition.

Hygroscopic moisture	·30
Loss on ignition	2·81
Silicic anhydride	47·41
Aluminic acid	12·66
Ferric oxide	10·88
Ferrous oxide	2·52
Manganous oxide	·73
Calcic oxide	11·21
Magnesic oxide	7·42
Potassic oxide	·22
Sodic oxide	2·92
Carbonic anhydride	·26
Loss, and undetermined	·66
	100·00

Specific gravity 3·048.

This analysis shows that there is little or no olivine in the rock, but that it is composed roughly of about two-thirds of a lime-magnesia augite* and one-third labradorite with some iron ore; while microscopical examination shows that the iron ore is ilmenite, and that the labradorite has been converted into saussurite. The rock, then, consists of a pale-green augite (diopside?) in a more or less abundant base of saussurite,

* Of approximately the same composition as that from the Whin Sill, described by Mr. Teall in "Quar. Jour. Geol. Soc.," vol. xl., p. 648, but with less iron.

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."

---

* "British Petrography," p. 135