GEOLOGICAL NOTES ON THE COUNTRY TRAVERSED BY THE DERWENT VALLEY RAILWAY EXTENSION.

(PLATE XIII.)

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The great basaltic sheet, once continuous from Macquarie Plains to Glenora, ends somewhat abruptly on the Northern slope of the valley of the River Styx. Whether it originally extended farther is uncertain, but the probability is that its advance was barred by thick-bedded tertiary sands and clays corresponding to those exposed in the bed of the Derwent near Macquarie Plains, and covered in pre-basaltic times by a great accumulation of drift gravels, the greater part of the whole formation being subsequently removed by denudation. Half a mile from the Glenora station the new line passes through solid basalt, the continuity of which is broken by an irregular band, the determination of the character of which will require a more careful examination than is practicable on a flying visit. It is loosely compacted, and some of it has the appearance of volcanic tuff. But the interesting feature is that, scattered through the formation are crystalline patches of opal varying in colour from pure white to dark brown. There are also faint but unmistakable traces of fossil wood. It was from this same sheet of basalt that the fossil tree was unearthed near Macquarie Plains, which was described by Sir Joseph Hooker some seventy years ago, and is now a conspicuous object in the Natural History branch of the British Museum. It has been identified by Mr. Newell Arber as a species of Cupressinoxylon*.

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*Cupressinoxylon Hookeri. sp. nov., a silicified tree from Tasmania. By E. A. Newell Arber, M.A., F.L.S., F.G.S. Geological Magazine, January, 1904.

The origin of the specimens of agate, carnelian, and various forms of chalcedony, which are often found in gravels of the Derwent basin, or ploughed up in basaltic soils, has always been something of a mystery, but the occurrence of these opals in situ points to our Tertiary basalt as one of the sources from which they have been derived.

The basaltic country which has been described abuts against a rather lofty rise of deep bedded gravels with quartzite boulders up to about eight or ten inches in diameter. The summit of the hill is, by aneroid, about 440 feet above sea level. These gravel beds show no sign of local glaciation, but may be moraine matter brought down by post-glacial erosion. Before any definite conclusion can be formed respecting the history of these gravels and boulders, it will be necessary to investigate the history of similar deposits in other parts of the Derwent basin. On the slopes of the eroded sandstones between Glenora and Hamilton, some 200 feet above the present river level, are lines of travelled shingle and waterworn boulders, and a similar deposit lies high up on the ridge between Hamilton and Upper Broadmarsh. These may be regarded as the remains of terraces on the margin of ancient lakes long since drained by erosion of the river bed. But it is to be noted that none of these deposits are of local origin. All the material consists of quartzites, schists, and indurated sandstones, which have come from the far distant Western country, and their distribution is suggestive of some form of glacial transport.

Approaching Fenton Forest the line passes through a small rise of sand and fine gravel. On the right are the hop grounds and paddocks occupying what was the bed of one of the numerous lakes of the Derwent Valley before the river cut its way through the barrier of basalt near Macquarie Plains. So far there was no formidable obstacle to the construction of the railway; but from near the Forest gate the cuttings for a distance of nearly two miles are through massive diabase of an unusually refractory character. At two and a half miles from Glenora was the maximum difficulty of the whole line. The diabase of Eastern Tasmania is notoriously one of the hardest and toughest of rocks, but here there was not only the difficulty of getting in the drills deep enough for effective blasting, but the rock is so unusually hard and splintery that there was no avoidance of serious damage to face and hands in the subsequent breaking up with the hammer. The depth of the cutting at this point is about 14 feet. The diabase is rudely columnar, and resting upon it is a band of altered sandstone (Plate XIII.), the section showing more conclusive evidence of the presence of an intrusive sill than I have seen elsewhere inland, though similar sections are common enough on the shores of Tasman's Peninsula, Bruni Island, and the Channel. Towards the western end of this cutting the sandstone is much dislocated by the lifting agency of the intrusive rock. About half a mile farther on is a long cutting through altered mudstone, the diabase only showing here and there. The general dip is about E.S.E., and in this direction it will pass under a neighbouring lofty hill of sandstone, which is normally the next member in the ascending series. The differences in level and the changes in the direction of dip of the sedimentary rocks along the whole route show that they have been much disturbed and faulted by the intrusive diabase, which everywhere underlies them at a greater or less depth in the form of sills or laccolites.

At 3¼ miles, at a sharp bend in the Russell Falls River, is a fine section showing columnar diabase underlying altered and much jointed mudstone.

The diabase shows itself here and there for the next mile, but is mostly hidden by sand and gravel, and the waste of the mudstone which is the bed rock of this part of the district. At 5¼ miles a cutting was taken through mudstone of normal character, but with a change of dip to S.W. The next cutting is through mudstone at first in regular bedding, but towards the Western end large loose angular blocks of the same rock were met with, together with rounded boulders of quartzite and other ancient rocks, and occasionally of diabase. One weathered block of the last named measured 3 feet by 2 feet, with a thickness of about 7 inches. The next cutting is through soft sandstone lying conformably to the mudstone. This is the last appearance of the sedimentary rocks, and the terminus of the line stands on sandy clays and gravel thinly covering massive diabase.

The character of the country from this point may be briefly described. To the West and South-West are lofty ridges of diabase, which is continuous for about three miles on both sides of the gorge occupied by Russell Falls River. The first change is shown in outcrops of thick bedded mudstone and sandstone, and these are succeeded by Permo-Carboniferous marine beds brought into view by strong faults. The same broken and faulted country continues up to the head of the valley, where these marine beds crop out on the Southern flanks of Mt. Field at an elevation of over 2,000 feet. To the east at a lower level are great bands of Ordovician limestone with a northerly strike, and to the west are rugged ridges of quartzite and conglomerate, with bands of limestone, and traces of the Cambrian sandstone which I have elsewhere mentioned as occurring at the head of the Florentine Valley. The discussion of the mutual relations of these rocks is, however, outside the limits of this paper. It may, however, be noted that, as was pointed out in a paper read before this Society in 1896,* that the valley of the Russell Falls River is the first stage of the only practicable route for communication by road or railway between Hobart and the West Coast, whether it be in the near or the far distant future.

In concluding these somewhat fragmentary notes, it only remains to consider whether this district supplies any proof of glaciation in past ages, and it must be admitted that the evidence is not very clear. The typical mudstone, which is one of the most widely distributed of South-Eastern sediments, is an upper member of the Permo-Carboniferous marine series. It is noticeable for the number of erratics of large size that are contained in it, and is almost certainly of glacial origin. The stupendous intrusion of diabase, which now caps all the mountains and most of the hills of Eastern Tasmania, is mostly stripped of its original covering of sediments, the remnants of which are seen in isolated patches, or abutting against the flanks of the mountains, where they have been protected from erosion by accumulations of talus. It is hard to conceive any agency but

*Land routes for exploration of the Western Country. By T. Stephens, M.A., F.G.S. Read 10th August, 1896.

that of an ice sheet which could affect such extensive denudation. Its occurrence would probably be towards the close of that Mesozoic period of which we have so little accurate knowledge, and there seems to be no other way of accounting for the rounded character of all the lower diabase-capped hills, resembling gigantic roches moutonnées. It has been established that there was a further glaciation in the Western Country in Tertiary or post-Tertiary times, and, assuming that similar conditions prevailed on the Southern mountain ranges, one might safely conclude that the main features of this district were roughly shaped by moraine-bearing glaciers descending from the Mt. Field range, the existing configuration of the country being due to post-glacial erosion under high pluvial conditions. So far there is little positive evidence in support of this theory beyond the presence of a few erratics, and the steep slightly terraced slopes of the Permo-Carboniferous beds where they bound the valleys, a contour widely different from that of rocks eroded by running water. In such a district as this it is futile to expect to find the evidence of polished rock surfaces, or striated pebbles and boulders, for none of the rocks over which the glacier would pass are hard enough to offer any resistance with the sole exception of the diabase, and that would be broken up rather than smoothed.

DIABASE, WITH OVERLYING SANDSTONE.