

GEOLOGICAL REPORT ONK. BRODRIBB'S PRODSLEY ESTATE.(1) INTRODUCTION

Following the preliminary report on the above estate it was requested that a more detailed geological examination be made. This work was carried out during the latter end of February, and the accompanying plan shows the distribution of the principal rock types. In some places it was impossible to determine the exact nature of the bedrock owing to the heavy mantle of soil and in such cases the geological map has been left uncoloured. The predominant type of boulders in these undetermined areas has however been indicated on the map.

In preparing the accompanying map a slight departure has been made from the usual method of procedure in as much as the rocks have been subdivided according to their petrological character as well as to their age.

(2) GEOLOGY

The rock types observed have been sub-divided as follows;

Sedimentary.

Permo Carboniferous	(Sandstones and mudstones with (thin beds of limestone. (Limestone.
Triassic	(Sandstones, grits and conglomerates. (Micaceous Sandstones.
Tertiary	Friable sandstones and sandy clays.
Recent	(Gravels, sand and clays (Calcareous Tufa.

Igneous.

Mesozoic	Diabase.
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The Sedimentary Rocks.

Permo Carboniferous. Sandstones, Mudstones etc. - These form the bedrock of more than two thirds of that portion of the estate lying to the northern side of the of the Break o' Day River. The mudstones are the predominant rock type; they are fine grained rocks of a greyish or dirty white colour and generally resemble a fine grained sandstone. Some fairly coarse sandstones occur interbedded with the mudstones. In the bed of a small creek near the deposit of calcareous tufa occurring in the Malahide Estate, immediately north of the big bend in the river, a thin bed of dark grey argillaceous limestone is seen to be interbedded with the mudstones. In this vicinity the

rocks are horizontally bedded.

No limestone beds were observed among the Permo Carboniferous rocks extending eastwards from the large body of diabase.

A composite sample of mudstone, consisting of several pieces of rock taken from several different outcrops, was analysed with the following result:

Analysis of Composite Sample of Mudstone.

<u>Constituents</u>	<u>Per Cent</u>
SiO ₂	86.40
Fe ₂ O ₃	1.15
FeO	0.76
Al ₂ O ₃	4.61
TiO ₂	0.18
CaO	0.20
MnO	0.07
MgO	1.52
Na ₂ O	0.01
K ₂ O	0.67
P ₂ O ₅	0.29
S	0.19
SO ₂	0.03
<u>Ignition Loss</u>	<u>5.12</u>
<u>Total</u>	<u>101.20</u>

Limestones. - About twenty chains south of the road, light brownish to yellowish crystalline limestones outcrop in the creek which traverses the centre of the property. Similar rocks outcrop along the western boundary fence, south of the road, and innumerable limestone boulders were observed in the paddocks in this vicinity. Hence the bedrock of this portion of the estate is probably composed almost entirely of limestone.

To the north of the river, near the north eastern extremity of the diabase mass, crystalline limestones identical with those described above have been exposed in several small pits and trenches. Owing to the limited number of exposures it was impossible to map these rocks with any degree of accuracy but it is probable that they extend over several acres.

These rocks are highly fossiliferous and in no way resemble the greyish argillaceous limestone occurring on the Malahide Estate.

The analysis of a composite sample of the crystalline limestones is shown below.

Analysis of composite sample of limestone.

<u>Constituents</u>	<u>Per Cent.</u>
SiO ₂	13.20
Fe ₂ O ₃	0.51
FeO	0.32
Al ₂ O ₃	1.33
CaO	46.50
BaO	NIL
MnO	0.08
MgO	1.23
Na ₂ O	NIL
K ₂ O	0.19
P ₂ O ₅	0.31
S	0.19
SO ₃	0.07
<u>CO₂ and Ignition Loss</u>	<u>36.92</u>
<u>Total</u>	<u>100.85</u>

Triassic. Sandstone-grits and Conglomerates. - These may be described as coarse sandstones containing pebbles of quartz and schist. In some cases the pebbles are sufficiently numerous for the rock to be called a sandstone-grit and when the pebbles are both large and numerous it becomes a sandstone-conglomerate.

The rocks of this group outcrop on both the northern and southern portions of the estate and appear to fringe the Permo-Carboniferous rocks. To the north they outcrop almost continuously along a narrow strip extending along the most northerly fence and to the south they extend for a short distance up the creek which passes through the south-west corner of the 78 acre paddock.

It is probable that the quartz and schist pebbles of these rocks would not disintegrate readily on weathering and hence these constituents would take no part in the process of soil formation.

Micaceous Sandstones. - Micaceous sandstones outcrop on the hills in the south eastern portion of the estate and innumerable sandstone boulders are scattered about the surface to north of these hills. All of the outcrops observed were quartz sandstones of the Ross series. The chief mineral constituents are quartz and muscovite.

Boulders of micaceous sandstone were observed along the eastern boundary fence south of the road near the small diabase hill adjacent to the road, and also near the 38 $\frac{1}{2}$ mile peg on the railway line.

The chemical composition of the micaceous sandstones is illustrated by the following analysis.

Analysis of composite sample of micaceous sandstone.

<u>Constituents.</u>	<u>Per Cent.</u>
SiO ₂	92.60
Fe ₂ O ₃	0.78
FeO	0.54
Al ₂ O ₃	3.12
TiO ₂	0.20
CaO	Trace
MnO	0.07
MgO	0.86
Na ₂ O	Nil
K ₂ O	0.31
P ₂ O ₅	0.14
Ignition Loss	1.20
S	0.12
SO ₃	0.03
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Total	99.97

Tertiary. Near the railway bridge, friable sandstones and sandy clays outcrop on both sides of the river. These deposits appear to be older than the recent alluvium occurring along the river flats and have therefore been referred to the Tertiary.

Recent. Typical black river alluvium is extensively developed near the big bend in the Break o' Day River and similar material extends along the larger creeks on both the northern and southern portions of the estate. To the north west of the house the black alluvial soil is underlain by yellowish to bluish-grey clays. These persist to a depth of five feet.

The black alluvial soils extending along the creeks to the north and south of the river are usually underlain by clays and coarse rubbly gravels. In the extreme north western corner of the estate, sands are sometimes associated with the clays and gravels.

Calcareous Tuff. This occurs on the northern side of the river in the Malahide Estate and along the western boundary fence of Frodsley. It forms small mounds and has been deposited from springs exuding from the Permo-Carboniferous mudstones and limestones. The material is soft and friable and could be used for agricultural purposes but the amount available is very small.

An analysis of this material gave a result of 41.4% lime (CaO).

Igneous Rocks.

Diabase. This is a medium grained basic igneous rock consisting mainly of soda-lime feldspars and augite. Most of the diabase on the estate has a peculiar flakey jointing and when broken it splits into thin slabs varying in thickness from a quarter of an inch to an inch.

A large intrusive mass of diabase outcrops along the railway line between the 39½ and 40¼ mile pegs and extends northward for a distance of approximately one mile. Diabase boulders and soil are also exposed in a small cutting on the north eastern side of the river. It is possible that this small area may be connected beneath the mantle of soil with the main mass immediately to the east but it may also represent an accumulation of diabase detritus derived from that mass.

Another fairly extensive area of diabase occurs in the hills in the south east corner of the Estate.

A thin strip of land covered with diabase soil and boulders extends from the vicinity of the 38¾ mile peg on the railway to the west boundary fence. Diabase also outcrops on a small hillock immediately south of the road; this may possible represent the remains of a former sill or plug.

In addition to the above, numerous large and small diabase boulders occur scattered over various portions of the estate, notably along the northern side of the river east of the railway line, around the homestead and the dairy, near the 39 mile peg, and along the eastern boundary fence south of the road. The boulders near the 39 mile peg and those south of the road are generally small and probably represent material shed from the adjoining hills. In the other localities however, i.e. near the dairy and to the north of the river, many of the diabase boulders are from three to eight feet or more in length and have the same flakey jointing as the outcrops in the main mass north of the railway line; it is possible that these boulders have been derived from an underlying mass of diabase.

The analysis of a composite sample of diabase from the estate is shown below.

Analysis of Composite Sample of Diabase.

<u>Constituents</u>	<u>Per Cent</u>	<u>Constituents</u>	<u>Per Cent</u>
SiO ₂	52.40	MnO	0.17
Fe ₂ O ₃	2.56	MgO	6.25
F ₂ O	6.91	Na ₂ O	1.34
Al ₂ O ₃	18.49	K ₂ O	0.84
TiO ₂	0.60	P ₂ O ₅	0.55
CaO	10.15	S	0.13
BaO	NIL-----	SO ₃	0.07
		Total	100.46

The rock analyses contained in this report represent fair average samples of each particular rock type. Thus any one sample consisted of several pieces of a particular rock type from different outcrops in various portions of the estate. It was considered that by doing this a more accurate idea of the average chemical composition would be obtained than by taking a sample from a single outcrop.

(3) SURFACE WATERS.

The estate is traversed by the Break o'Day River and several small creeks. Generally the smaller creeks may be said to supply sufficient water to those portions of the estate which cannot be served from the river.

Three analyses of the surface waters are shown below. The locations from which these were obtained are indicated on the plan.

Analyses of Surface Water

Constituents	Parts per million		
	A	B	C
Total Solids	: 101.60	: 848.00	: 780.00
Chlorine	: 26.40	: 250.3	: 185.00
Sulphate	: 6.17	: 24.70	: 57.60
Carbonate	: 18.50	: 118.00	: 140.50
Silica	: 9.60	: 18.40	: 28.00
Iron & Alumina	: Minute Trace	: Minute Trace	: Minute Trace
Calcium	: 15.40	: 125.70	: 139.30
Magnesium	: 5.24	: 16.60	: 17.50
Sodium	: 7.20	: 88.00	: 62.50
Volatile solids	: 13.60	: 207.20	: 150.00

- A Break o'Day River near punt.
- B South flowing creek near road.
- C North flowing creek north of river.

(4) UNDERGROUND WATER.

Underground water should be available at shallow depths in the Recent and Tertiary formations but these are located in such a way that better and larger supplies of water can be obtained from the adjoining creeks and from the river.

The Triassic rocks in the extreme northern and southern portions of the estate would probably yield a supply of water at a depth of 100 feet or more, but the cost of boring and the installation of a windmill would be in the vicinity of £200.

It is uncertain as to whether the Permo-Carboniferous rocks and the diabase would yield supplies of underground water.

On the whole it would be cheaper to utilise the existing streams for purposes of water supply than to sink wells or to put down drill holes. In some of the smaller creeks a permanent supply could probably be maintained by putting in small dams.

(5) CONCLUSIONS.

In this report no mention has been made of the various soil types occurring on the estate, as the work of soil investigation has now been taken in hand by Mr. Stephens, a soil research officer attached to the Waite Institute. Hence it has been unnecessary for me to carry out the work of investigating the soils along the lines suggested in the preliminary report.

The preliminary report, a copy of this report and a copy of the accompanying map are being submitted to Mr. Stephens for use in conjunction with his work.

(Signed K.J. Finucane)
FIELD GEOLOGIST.

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