

JR 1954/112-120

In anticipation of the despatch of a Departmental water boring plant to the Hamilton Municipality, a visit has just been made there. This was not only for the purpose of conducting a geological survey of the area but also in order to interview farmers and others interested in having bores put down on their properties. In 1946, Carey and Henderson made a geological map of the Lawrenny Estate and its environs, and this has been more or less incorporated in the present map.

This map will be rather an odd shape, because the area examined is largely that occupied by settled land particularly where enquiries have been made by the owners for boring details. The mapping extends from the junction of the Bothwell Road with the Lyell Highway near Gretna in the south, to Osterley in the north, a distance of twenty-four miles, and varies in width from two to eight miles, such natural boundaries as the Derwent and Ouse Rivers being utilised.

Most of the country consists of open rolling hills and plateaux, with sometimes deeply dissected valleys, but covered with little or no vegetation but grass and occasional trees. It is, therefore, very easy to traverse and map. A detailed Lands Department map of the old Lawrenny Estate and a complete coverage by aerial photographs further assisted the mapping.

Outside the Lawrenny Estate, heights were taken by aneroid barometer, and in this part of the mapping, the form lines are not as accurate as the contours of the Lands Department section.

#### LOCATION AND ACCESS

The centre of the Municipality, Hamilton, is a small town situated on the Clyde River and the Lyell Highway at 46 miles from Hobart. The Highway at this time is sealed for most of the way from Hobart to Hamilton except for two stretches, one of four miles north of Gretna and the other for three miles south of Hamilton. Beyond Hamilton, except for the first two miles and through Ouse it is unsealed.

The other main township of the Municipality, Ouse, is nine miles beyond Hamilton. Osterley, on the Lyell Highway 21 miles from Hamilton and Hollow Tree 7 miles are much smaller and the other towns and villages of the municipality are outside the mapped area.

Roads are not plentiful. From the Lyell Highway between Gretna and Hamilton, are three roads leading east and more or less converging and then continuing on to Bothwell and Broadmarsh. Opposite the centre one of these, a road leads west from the Highway, meanders across the Hamilton Plains, an area laid out in town blocks and drops steeply down the hill to Hamilton. Between Hamilton and Ouse, the Ellendale Road branches to the west from the Highway, crosses the Derwent at the Dunrobin Bridge and runs south to Ellendale and beyond to Westerway. At Ouse itself, the alternative route to the West Coast, through Tarraleah, branches west from the Highway.

Much of the country is so open that in summer, at any rate, vehicles can be driven over a large part of it.

### TOPOGRAPHY

The dominant topographical feature of this district is the Derwent River, which, with its tributaries the Ouse, Dee and Clyde, has cut deep into the surrounding country-side. The Derwent itself is rapidly approaching a state of maturity here and though more than fifty miles from the sea is only between two and three hundred feet above it. Its tributaries, on the other hand, except near their mouths are still in a semi-youthful state and are characterised by deep gorges and rapid-flowing water.

The different topographic expression of the various rock types is most noticeable. The basalt is usually marked by high rolling plateaux of about one thousand feet above sea-level. Dolerite, because of its resistance to erosion, forms most of the higher hills and the sandstone and shale a lower, flatter terrain. However, although the land does reach a maximum of over 1,800 feet above sea-level, there are no really outstanding mountains and few high hills. Sometimes the sandstone suffers rapid erosion and forms spectacular cliffs as along the Ouse River. Faulting too has had some effect on the topography, although fault scarps are not common.

### RAINFALL

The central and southern portion of the mapped area has one of the lowest rainfalls in Tasmania and the annual average is under twenty inches. As the north and west are approached, however, the rainfall increases rapidly until at Osterley it is twenty nine inches and at Cleveland (just outside the mapped area) thirty two inches.

Details of monthly averages for four stations are as follows:

MONTH	HAMILTON	OUSE (CAWOOD)	OSTERLEY	CLEVELAND
January	165	157	194	196
February	124	159	183	198
March	140	147	216	199
April	155	149	242	237
May	144	171	217	242
June	173	197	235	266
July	163	205	256	292
August	155	188	247	308
September	181	205	289	322
October	208	233	307	340
November	165	182	265	289
December	181	190	267	271
Year	1,954	2,183	2,918	3,170

### GEOLOGY

The principal rock types outcropping in this district are the sandstones and shales of Triassic age, and the whole sequence amounting to many hundreds of feet occurs in one part or another. The base of these rocks and a small area of underlying Permian mudstones can be seen at one place. Associated with these sediments are all manner of dolerite intrusions both large and small, transverse and concordant of Jurassic age. These must not be confused with the lavas and occasional dolerites of Tertiary age which cover wide areas of mainly plateau country. Large beds of alluvia, Tertiary clays and recent river deposits are concentrated near and round the present Derwent River.

Permian: Only one small occurrence of Permian rocks outcrop in the mapped area. This is round about "Allenvale" homestead on the Gretna-Bothwell Road, where faulting has brought to the surface grey mottled mudstones. These are very hard and siliceous, weather to a white-coloured rock and are apparently not fossiliferous. On lithological evidence and because they underlie the base of the Triassic, they have been assigned to the Ferntree Mudstone horizon.

Triassic: Sandstones and to a lesser degree shales and grits of this age are very common and representatives of beds right from the base to the top may be studied. There has always been some doubt as to the sub-division of these Triassic (and possibly Jurassic) sediments in Tasmania. Up till recent years, the Geological Survey had recognized two main divisions, the lower series, the Ross Sandstones and shales, and the upper, or Felspathic Sandstones, including the coal measures. Carey and others, have in the Lawrenny mapping in 1946 and again in the Geology of Tasmania, prepared for the Hobart A.N.Z.A.A.S. Meeting in 1949, divided the Triassic into four parts:-

Felspathic Sandstones

New Town Coal Measures

Knocklofty Sandstones and Shales

Ross Sandstones.

Later writers seem to have discarded the Ross Series and placed all the lower sandstone and shale beds in the Knocklofty. Lithologically, the Ross and Knocklofty beds appear very similar, although shales appear much commoner in the latter; but this may be merely a facies variation from place to place and the time factor may be the same. Felspathic sandstone beds occur both above and below the coal measures and so it is difficult to divide the upper beds into two series. Hence in this mapping, the original subdivisions of the Triassic as adopted by Nye in his Underground Water Supply Papers have been adhered to and the two main series of Ross and Felspathic have been retained. In the adaption of Carey's mapping of the Lawrenny Estate, his "Felspathic Sandstones" and "Langlosh Coal Measures" have been included in the "Felspathic Sandstones"; and his "Knocklofty Sandstones and Shales" and "Ross Sandstones" in the Ross Sandstones.

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In the field, these two divisions can be easily recognised. The felspathic sandstones with their white flecks of felspar present a characteristic speckled appearance. Some writers regard them as (in part at least) of tuffaceous origin. Included in the sandstones are beds of clay and shale containing various coal seams some of which are worked at Langloh. These however, were not found on the outcrop and information about them is confined to workings and various bores. It is not proposed, in this report, to discuss the coal measures as that would be outside the scope of this investigation. Fossils are fairly plentiful, particularly in the clays and consist of various fern fragments as well as roots, stems and branches of conifers.

The principal rock type of the Ross Series is a fairly coarse, iron-stained sandstone, whose siliceous grains shine in the sun. Mica is a common constituent of this rock and sometimes felspars may be seen. Near the numerous dolerite intrusions, the sandstone often becomes baked to a quartzite, but this effect is not noticeable for more than a foot or so away. A bed of coarse grit, with infrequent pebbles and boulders, occurs in these sandstones near Hollow Tree; and the base of the series, also a grit, may be seen conformably overlying the Permian mudstones to the east of the road near "Allenvale". Shales are quite common in this series and these like the sandstones often contain abundant mica. Near the Dunrobin Bridge some are crammed with fossil fragments.

**Tertiary:** Large areas near Ouse are covered with great depths of Tertiary Clays containing sparse narrow sand beds. Bore E quoted in the Coal Resources shows over six hundred feet of clay beds interspersed with narrow beds of sand and lignite. Lignite may also be seen outcropping in the banks of the Ouse River. These Tertiary clays are overlain by basalts. During the Tertiary considerable deposits of bauxite were laid down in two or more areas. Again a discussion of these deposits is outside the scope of this report.

**Igneous:** Some confusion in the nomenclature and differentiation of the basalt and dolerite may be expected in an area of this size. Basically a dolerite is distinguished from a basalt by its mode of formation, that is a dolerite is the result of the injection of a dyke or a sill and basalt is the result of a lava flow. This further pre-supposes that a dolerite should be more coarsely crystalline than a basalt. In the geological map accompanying this report, the distinction is made according to the age of the formation and Jurassic rocks are called dolerite and Tertiary, basalt. The coarse grained rock of almost a gabbro in crystal size, which can be seen in a quarry near "Glenelg" is mapped as a Tertiary Basalt, although it is of much coarser texture than the narrow dyke rock traversing "Ashton", which is Jurassic in Age.

No description need be given here of the dolerite which is typical of that over so much of Tasmania and which has been described in so many reports. It varies greatly in crystal size according to the size of the intrusion and the distance from the chilled margin. Definite dykes and sills may be seen but many of the intrusions are quite irregular. An interesting dyke

can be seen on the air photographs and followed on the ground; for nearly five miles. It is like a metalled road of dolerite pieces, in typical sandstone country, sometimes disappearing, varying in width from ten to fifty feet, and sometimes being displaced by faulting as much as seventy-five feet. Because of its narrow width, the rock is very finely crystalline, resembling a basalt though somewhat lighter in colour. A perfect sill junction between sandstone and dolerite may be seen in a cliff face in the east bank of the Ouse River.

**Basalt:** Varies considerably in appearance from place to place and in accordance with its position on the flow. Near the top it is very scoraceous and vesicular but lower down it sometimes appears quite massive. It is an olivine basalt. There appear to have been more than one flow and on the road from Hamilton up to the plains may be seen, in a road cutting about 10 feet of baked Tertiary sandstone separating the flows. A curious differentiate of the normal basalt appears in a quarry nearly opposite Glenelg. It is very coarse in texture having the appearance of a gabbro in hand specimen and under the microscope is seen to contain some quartz. The only place it may be seen in the field is in this quarry which is near road level at the base of the flow and the evidence suggests that it may be a basalt rock which has become contaminated with the sandstone through which it forced its way upwards.

#### STRUCTURE

These Mesozoic sandstones and shales, and the Upper Palaeozoic mudstones beneath them, have not suffered the intense folding and strain of the older rocks of Tasmania. Indeed they are not really folded at all, but only gently warped and any dips of more than a few degrees are either due to faulting or to false or current bedding. This latter is fairly common but only small in extent.

Faulting, on the other hand, is quite common and its evidence may be seen either directly as in the Ouse cliffs or by the juxtaposition of sediments of different ages. There are two great periods of faulting represented here, that of the Jurassic when the great injections of dolerite were taking place and again during the Tertiary when the great Derwent Fault System occurred. Examples of these two may be seen in the narrow dyke which crosses Ashton. The dyke itself which trends roughly north and south is the filling of a Jurassic fault in the sandstones and at two places a displacement of about 75 feet in an East-West direction represents movement which probably occurred during the Tertiary.

#### SOURCES OF WATER

In this district, the main sources of water for irrigation, watering stock and domestic purposes are, of course, the rivers; but many properties are too far away to utilise these and have to depend on springs, small, often impermanent streams, dams and tanks. Wells are very infrequent and, as far as I know, no drilling for water has been undertaken. It is rather strange that so little well sinking has been tried especially on the dry basalt plateaux.

Underground Water: There are four main types of rock in this district, sandstone, dolerite, basalt and Tertiary clays and they may be considered from their water carrying possibilities as follows:-

Sandstones These are among the best of water-bearing rocks and, particularly where they occur in large basins, are well suited for obtaining supplies of underground water by drilling. Of the two types of sandstone occurring here, the felspathic is the more favourable. Nye, in his Underground Water Supply Papers, quotes the percentage porosity by volume of the felspathic sandstone as 26 and that of the Ross as 14. In the Ross sandstones are beds of shales, usually of the order of 10 to 20 feet in thickness which act as impermeable beds, either above or below a permanent water table. The Ross sandstones were deposited under rather arid conditions and all contain a certain percentage of salts, particularly common salt or sodium chloride. Consequently, underground water obtainable in these sandstones is liable, particularly if it is enclosed in a basin with no outlet, to contain varying percentages of this and other salts. Fortunately the larger basins in the area all seem to be open and not contained in enclosing dolerite hills. The felspathic sandstones seem to have a much lower salt content than the Ross.

Dolerite On the other hand, is a most unsuitable rock in which to obtain underground water, as no water at all is carried by the rock itself. Small supplies may be obtained in joints, faults and sometimes, if the soil cover is deep, above the rock. None of these possible sources, however, would warrant a drilled hole.

Basalt although not itself a permeable rock, is usually so thinly jointed and broken that water finds its way through it and is usually contained in sands and gravels, often found beneath the basalt flows. On the North-West Coast of Tasmania, many good wells are sunk in basalt country, and this is often the best way of obtaining water supplies at shallow depths. However, if the basalt is not too thick it is often worth drilling through it to obtain the water at its base. In this country the basalt usually occurs on fairly high plateaux and varies in thickness from a few feet to about 300 feet. Its base, particularly where it overlies dolerite or Tertiary clays, is marked by a series of springs, showing that the water seeps through the basalt and when it reaches the impermeable material below, comes out at the surface. Very little water seems to run off the basalt country but seeps into the soil and then probably through the jointed rock.

Water obtainable from both basalt and dolerite rocks, will not have the sodium chloride content of the sandstone water. On the other hand, it will contain larger quantities of calcium carbonate and some water may be classed as "hard".

Tertiary Beds There are large areas of this material to the west and south-west of Ouse and some of the settlers have farms covering part of these. If the Tertiary deposits have appreciable sand or gravel beds, then quite large amounts of underground water may be obtained from them. However, bores put down (for coal) in these deposits show over 600 feet of clay with but narrow, very intermittent sand beds and so it is not recommended that any boring should be done in these Tertiary clays.

Surface Water Many of the farmers have had small dams constructed on their properties; these usually being dug out rather than constructed across creeks. The soils from the various rock types show great variation in their water holding capabilities. Dolerite soil is the best as this rock weathers to a very clayey material. Surprisingly enough, many fair-holding dams have been constructed in sandstone country. This is because the shale beds, included in the sandstones, partially weather to clays and this material is often washed down gullies and water courses and tends to seal the dams, even if they are dug in completely sandy soil. Thus a sandy site for a dam should not be condemned out of hand, without examining the possibility of clayey soil higher up. Basalt soil, on the other hand, is completely useless for dam construction. Although basalt has much the same chemical composition as dolerite, it breaks down into a totally different soil, a light porous soil which never holds water. The Tertiary clays are ideal for dam construction but in this district, they are often covered by several feet of wind blown sand, so that any dam should be put down to at least the level of the clay.

#### INDIVIDUAL PROSPECTS

A list of eighteen names of property owners, stated to be interested in obtaining the services of a drilling plant, was supplied by the Council Clerk of the Hamilton Municipality. On interviewing these gentlemen, it was found that, of them, six had either never been very interested or had in the meantime made arrangements for alternative sources of water; one had preferred to adopt a wait and see policy, while eleven were definitely interested in having holes put down.

R. G. Downie: Mr. Downie and Mr. H.C. Walch are the two gentlemen most anxious for the drilling plant to come to the Hamilton District, and it is they who have done most agitating for it at Council meetings &c. The site selected on Mr. Downie's property is near the new house recently built for his son on the east of the Lyell Highway. This appears to be a site with excellent prospects of obtaining underground water, as the underlying rocks are sandstones, fringed to the east by dolerite hills and falling gently to the south. To the west is the Derwent River some six hundred feet below, but it is over two miles distant, and this distance should allow the water table to rise sufficiently to allow underground water to be tapped at no great depth.

H.C. Walch: Like Mr. Downie, Mr. Walch is very anxious to have at least one bore put down. Unfortunately the likelihood of obtaining water at the site selected is not as favourable. At the same time it is not sufficiently hopeless to discourage boring. This site is in a depression on the basalt plateau to the north-west of his homestead. Below the basalt is sandstone. Little boring has been done in basalt by Departmental Percussion Drills, but it should not prove nearly as difficult to bore as dolerite. The basalt, although hard, is generally porous and friable, especially where it is weathered. The flows have occurred over an uneven surface, sloping generally from east to west.

The thickness of the basalt thus varies from a few feet near the Lyell Highway, to three hundred feet near the Derwent. Where Mr. Walch proposes the bore the thickness should not greatly exceed one hundred feet. There are three possible sources of underground water in these rocks.

1. In the weathered soil above the basalt. quite often the rock outcrops to surface, but in some places and particularly in depressions, an appreciable depth of soil is possible and as it is very porous it may hold limited water supplies.
2. In joint planes and cracks in the rock itself. Although the basalt is full of cavities, these unlike those in sandstones are not all intercommunicating so that the rock is not itself permeable. However, because of the numerous joints, water is able to seep through the rock and small supplies may be intersected by a bore.
3. Beneath the basalt. Springs round the edge of basalt flows, indicate that water is often contained in beds of alluvium, ancient soils &c., below the basalt. Here, sandstones probably occur beneath the basalt, so that the water table may be lower than the base of the basalt.

A.M. Webberley, A.J. Hanlow and W. Bowerman: All own small properties on Hamilton Plains, an elevated basalt plateau to the south of Hamilton township. These people are very badly off for water and although the same remarks apply as in the previous instance, it is considered that boring should be attempted. Underlying the basalt here is dolerite, an impervious rock, and the top of this is indicated round the edge of the Plains by a series of springs.

L. Ashton-Jones owns a large property, Ashton, between Ouse and Osterley. Except for one or two small intrusions of dolerite and a small patch of basalt, the property is all occupied by Ross sandstones and should prove very suitable for obtaining supplies of underground water by drilling. Mr. Ashton-Jones probably wants more than one hole and the depths to water will depend on the exact situation of these.

P.H. Mason has one of the Lawrenny Closer Settlement farms and is interested in obtaining a water supply on portion of the basalt plateau. The thickness of basalt should not greatly exceed one hundred feet at the site selected and water should be obtainable either in the rock, or below it and on top of the dolerite which probably underlies it.

D.J. Nickolls has also a property largely contained in the basalt plateau. It is in the basalt that he desires one or two holes. Again the basalt is underlain by dolerite and water should be obtainable at the base of the former rock.

E.N. Milne has also a Lawrenny farm. Where he requires the water is close to the boundary between the felspathic sandstones and Tertiary clays. It is impossible owing to the absence of outcrop to determine the exact position of the boundary, so I have advised Mr. Milne to go farther south-east than where he actually wants the water, so that

the hole can be put down in the felspathic sandstone, a good aquifer.

V. G. Manning has another settler's farm and is desirous of obtaining water supplies near his house. Unfortunately all round this area are Tertiary deposits and although there are surface areas of wind blown sand, below this are hundreds of feet of dry clay beds. I have advised Mr. Manning to abandon the idea of obtaining water by drilling and to concentrate on some method of damming the surface water.

D. G. Rice has a property on the old Dunrobin Estate across the Derwent River from Lawrenny. The site where he desires to obtain water by boring is about 250 feet above the Derwent River but as it is nearly half a mile in distance from the River, the water table should be less than that footage from the surface. The rock here is Ross Sandstone.

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