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PRELIMINARY REPORT ON THE DEEP LEAD OR INFRA-BASALTIC STANNIFEROUS GRAVELS OF THE RINGAROOMA VALLEY NEAR DERBY.

Government Geologist's Office,  
Launceston, 26th February, 1900.

SIR,

PURSUANT to your instructions, I proceeded to Derby on the 23rd January, and now have the honour to submit this Report of a twelve days' inspection of the country between Derby and Mount Cameron, and more especially of the high basaltic plateau to the north of the township, which is supposed to conceal large deposits of tin-bearing gravel accumulated in an ancient bed of the Ringarooma River. I was accompanied on my journey by Mr. S. Hawkes, of Scottsdale, who was appointed by the Government to facilitate my inspection of the ground, and to aid me with the local information which he has collected during many years. By guiding me directly to the various outcrops noticed, and in some cases discovered by himself, and in placing at my disposal the fund of information which he undoubtedly possesses, Mr. Hawkes rendered valuable service in this geological traverse. Mr. M. J. Griffin, of Gladstone, Inspector of Mines for the Eastern and North-Eastern Districts, joined us on the plateau near the Pioneer, and I have to thank him too for assistance and useful information readily given.

The geology of this district has been dealt with so often by former Government Geologists that I need not go over old ground, and repeat what has already been described. It will be enough if I indicate geological considerations as I proceed.

The Ringarooma River takes its rise in the high land between Ben Nevis and Mount Saddleback, whence it flows north to near Branxholm, thence meandering N.E., E., N., and finally N.W. to Bass Straits, into which it falls at the Port of Boobyalla. During the lower and principal part of its course, it either runs in stanniferous granite or receives tributaries, which feed it with the detritus of stanniferous granite country. Consequently it is not at all surprising that tin-bearing wash has accumulated in its bed. What is surprising is that from Branxholm downwards the modern river does not keep to its ancient bed, but has struck out a new course and carved a new channel for itself. It is not at first glance apparent that this is so. It is not until we become aware that a belt of deep alluvial drift exists outside the banks of the present river, and much deeper than its present bed, and diverging greatly from its present direction, that we recognise that the present channel is not the ancient one. The questions which now suggest themselves are, how long has the river flowed in its present bed, and what caused it to change its course? There is a well-known physical phenomenon which comes to our aid, for in places it marks off the times of the old channel from those of the new one. I allude to a sheet of basalt which has largely protected the subjacent gravels from waste and destruction. This basalt has not overflowed the country here, burying hill and dale under a widespread lava sheet, but has apparently confined itself to the ancient river valleys, filling them up, and concealing the river gravels beneath a stony covering. There seem to have been intermissions and repetitions of this flow, as may be seen in the faces of the wash at Derby. The fact that the lower sheet of basalt is

covered again by wash denotes that the first flow had not completely filled up the river valley, but that, even as late as the final eruption, the valley continued to exist as a stream channel. The extreme thickness of the lava cap still surviving is, perhaps, 100 feet, or even more, but in many places it is now only a thin skin, and has often wasted quite away, leaving only the red soil and decaying kernels of rock to indicate its former presence. In the Derby mines we see the weathering and disintegration of basalt characteristically exemplified in the undecomposed kernels of hard lava which have survived the process of decomposition. The remainder has been converted into the red and brown clays, which are the ultimate stage of decay *in situ*. Microscopical examinations of specimens from the lower basalt mass at the Brothers' Home show the rock to be an olivine basalt, in which the felspar is mostly porphyritic, and the groundmass largely consists of small brownish-violet tinted crystals of augite. A slice from the upper sheet shows the same groundmass, but the porphyritic mineral is olivine, which is very plentiful. Notwithstanding the difference in the larger crystals, the identity of the groundmass leads to the inference that the two lava sheets issued, though at different intervals, from the same geographical source. Where was this source? Various centres suggest themselves. Mount Horror, for instance, the lava of which has a coarse doleritic texture like that of an old volcanic plug. But the lava of the Briseis and Brothers' Home mines evidently obeyed the law of gravitation, and descended the channel of the Cascade. The drainage of the Cascade country gravitated then to the N.W., as it does now, and the lava stream must have flowed in that direction. Bullman's Bluff, near Branxholm, was mentioned to me as an extinct volcano, and a likely source. I had no time to ascend it and ascertain its nature, but if it is really a volcanic pipe, and not a capping, it may have supplied the lava which covers the wash at the Arba mine. But I am somewhat suspicious of extinct craters in Tasmania. Up to now we do not know of any. The cinder cones of such as may have existed have long since been removed by denudation, and the tops planed down to a uniform level with the surrounding country. They may have been fairly numerous at one time, for Tertiary basalt of nearly every variety known to petrographical science is found almost all over Tasmania. For the present, it may be conceded that we are unable to locate the foci whence the Ringarooma lavas emanated.

While the ancient valleys were being gradually filled with their gravel deposits the land was slowly subsiding. This sinking movement, though gradual, helped to impede the scour of the streams, and allowed the tin-bearing wash to settle and accumulate. Towards, and at the close of this period of subsidence, the basalt volcanoes emitted their lava, and slowly filled up the water-courses. That active vulcanism was spread over a long period may be deduced from the intermission of activity which admitted of the deposit of intermediate beds of river wash.

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We do not possess in Tasmania the alternations of sedimentation which would warrant us in adopting the time-honoured triad, Eocene, Miocene, Pliocene, as divisions of our Tertiary beds. Excepting the isolated occurrence of beds at Table Cape, now definitely established (by Prof. Ralph Tate) as Eocene, we are unable to divide our Tertiaries, with any degree of confidence, into more than early and later Tertiary—Palæogene and Neogene of Mr. R. M. Johnston—and the period of basalt eruptions may be taken as the dividing line. Practically, our divisions of Tertiary time are pre-basaltic and post-basaltic. The fact that our pre-basaltic Tertiary estuarine and freshwater sediments may be of any date from Eocene to Miocene, is of itself sufficient reason for excluding the European scheme of classification. We find that all through Australia basaltic eruptions have taken place at the end of the Palæogene period. I have had an opportunity of consulting a series of fossil fruits in Mr. W. F. Petter's collection, named by the late Prof. M'Coy from the Miocene auriferous drifts of Haddon goldfield, near Ballarat, and of comparing them with fruits found in the Beaconsfield auriferous lead and the Flinders' Island tin-drifts: some of these are evidently identical, viz.—fruits named *Plesiocapparis* and *Celyphina M'Coyi*, found in the auriferous deep leads of Victoria. But when we begin to distinguish our pre-basaltic beds from Eocene on the one hand, or Pliocene on the other, we find ourselves involved in difficulties, which convince us that we cannot confidently classify the Tasmanian Tertiaries otherwise than by a dual division. Mr. R. M. Johnston's most recent classification of these beds is so little known, that I reproduce it here:—

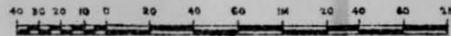
Stratigraphic Rock Divisions.	Local Characteristics.
<p><b>NEOGENE (PLIOCENE).</b></p> <ol style="list-style-type: none"> <li>1. Later lignites and contorted clay and sand-drifts of the Henty River.</li> <li>2. Older terrace pebble-drifts of the older Pluvial period.</li> <li>3. Glacier moraines of sub-alpine regions.</li> </ol>	<p>Pebble terrace-drifts on the plateau or upper undisturbed slopes of the main valleys contain fossil woods of the older rocks as well as of the older Tertiary period</p> <p>Moraines and erratics of the subalpine valleys and plains of the western highlands, as at Mount Tyndall, Murchison River, Lake Dixon, Mount Pelion.</p> <p>Contorted clays and sandstone formation, with intercalated lignites, containing remains of fagus, acacia, eucryphia, and phebalium, hardly separable from existing species.</p>
<p><b>PALÆOGENE (EOCENE TO MIOCENE).</b></p> <ol style="list-style-type: none"> <li>1. Basalt sheets (olivine), tuffs, and breccias.</li> <li>2. Fluvial and lacustrine deposits.</li> <li>3. Marine formation of Table Cape, Flinders Island, Montagu, and Cape Grim—(Eocene).</li> </ol>	<p>Basaltic sheets and tuffs intruding and spreading over Tertiary marine deposits at Table Cape, and generally found capping the Tertiary lacustrine deposits, as at Table Cape, Magnet Range, Mount Biscoff, Breadalbane, Geilston, Cornelian Bay, Glenora, One-tree Point.</p> <p>Lacustrine deposits, often of great thickness and extent, composed of sands, clays, lignites, travertines, and sometimes including rich auriferous and stanniferous drifts. Contains the remains of a flora, rich, varied, now extinct. Examples:—Launceston, Derwent, Macquarie Harbour Tertiary formations.</p> <p>Marine beds, composed of alternating bands of shelly limestone, calcareous sandstones, coral rag, ferruginous, gritty, and pebbly sands, replete with fossil shells, corals, foraminifera, echinoderms, sharks' teeth, bones of marsupials, and sometimes stray leaf impressions, some of which are identical with those in the purely lacustrine areas. Only from 1 to 2 per cent. of the shells are identical with living species.</p>

When the volcanic forces had declined in energy, and the eruptions were coming to an end, or thereabouts, the subsidence of the land in this part of Tasmania seems to have ceased also, and an upward movement began. This elevation continued down to a very recent period, and, for all we know, may be in progress at the present day. The raised sea-beaches above high-water mark all along our northern coast point to very recent movements.

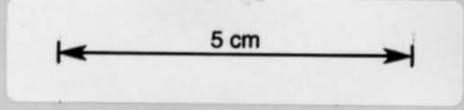
Ever since the out-pouring of the lavas, the Ringarooma River has flowed in a fresh channel. It is reasonable to infer that when the old channels were choked with basalt the streams would be diverted to fresh courses. The general trend of their flow towards the sea would, doubtless, not be very different from what it is now, but the water would of course follow any new natural line of flow created by the surface features of the land. Such a line would be found along the edge of the invading lava sheet. This line would give the stream its new initial direction, and its subsequent course would be determined by the configuration of the country. This is just what we observe in the Ringarooma River, above Derby. Between A. H. Boyd's 198 acres and the township, the land on the north bank is all capped with basalt, as is also Kirkland's Hill on the south side, and there is every appearance of the modern river having worked its way downwards and northwards from the contact line of the basalt with the granite, cutting down through the sandstones, and eventually excavating a bed in the solid granite itself. Close to and above the bridge at Derby the granite rock is seen descending into the stream, and the large bosses of granite above the township have every sign of wear by water, when the river flowed at a higher elevation. The river continues to flow in solid granite, interrupted only by the main creek lead, but resuming its granite channel down to Gladstone and beyond. Just to the west of the township of Derby, where there is a small dam thrown across the Ringarooma, we find evidence that the old and new channels cannot have been other than two very different lines of flow. A mile higher up the river, at the old Ringarooma Valley Company's works, the ancient bed has been bored through 106 feet down to soft granite, on the north side of the road. But that bed could not possibly have extended to where Derby is now, because lower down at the dam just alluded to, the river runs in hard slate and sandstone rock. These yellow and light-coloured sandstones with iron stains belong to the Silurian system. They are vertical, and strike across the river N. 5° E. I was told by Mr. M. J. Griffin, Inspector of Mines, that they reappear to the north of the Brothers' Home Extended mine. On the south bank the sandstone of the river bed is covered by about 3 feet of sand with large sandstone pebbles, forming a recent shingle bed, and this again by 4 feet of soil. Higher up the hill on this side the soil is besprinkled with white granitic detritus, concealing the sandstones beneath, which mount to about 80 feet above the river, when the granite protrudes and forms the remainder of the mountain range.

A journey along the road to the west, towards Branxholm, discloses certain facts bearing on the river course. The flat below the road on E. G. Clarke's 49 acres has not been bored, and is probably shallow. Just opposite, on the north side of the river, we see what is called Gunton's Gap, but it has the appearance of being a depression or wearing down of the front range rather than a real gap, as there is higher ground at the back. On E. G. Clarke's 40 acres, and E. Button's land adjoining, to the E. of the road, there is a high spur of wash capped with basalt. By boring

# SKETCH MAP OF DERBY DEEP LEADS

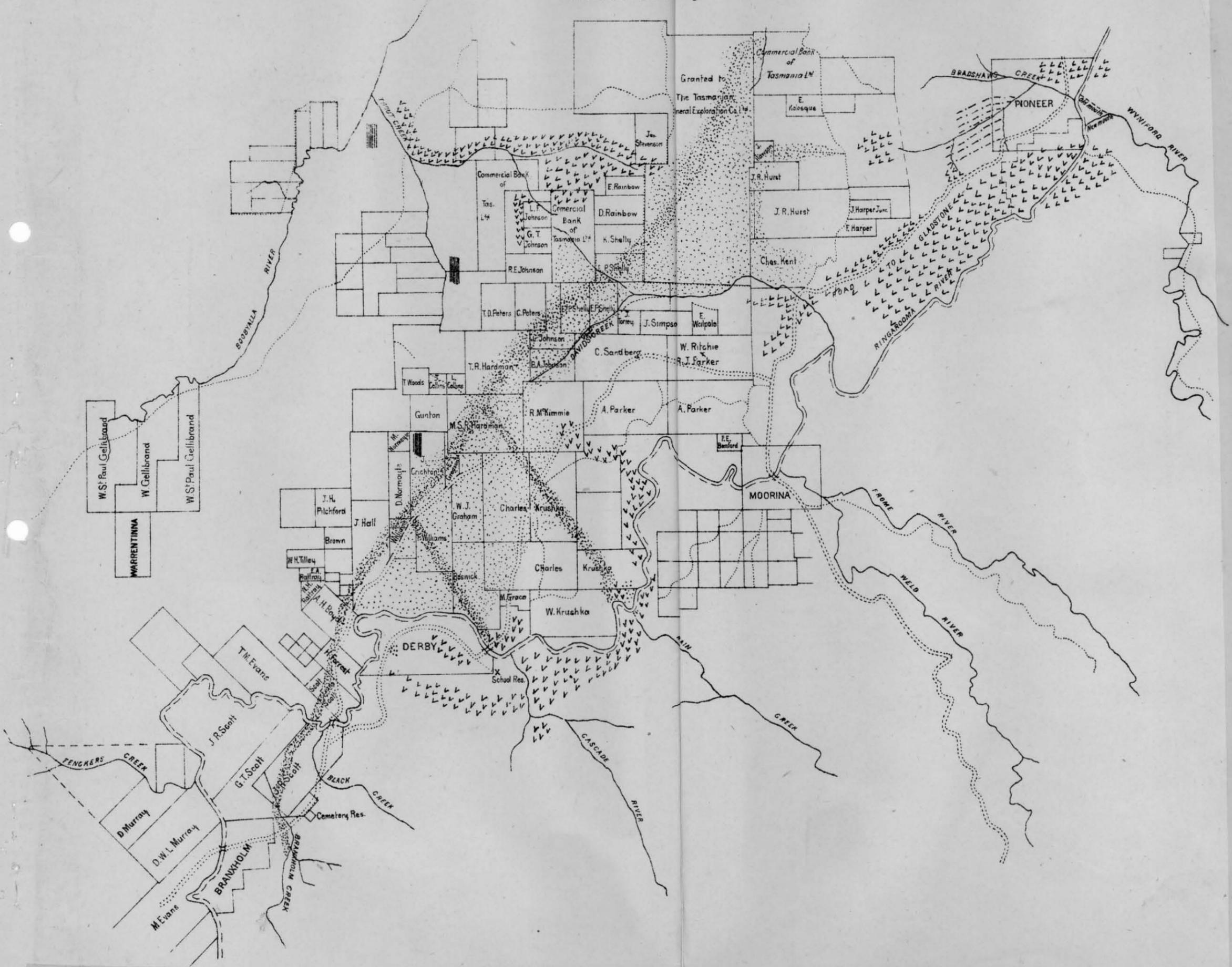


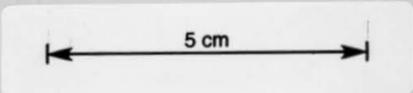
Scale of Chains



- INDICATES Slate and Sadstone
- Lead not under Basalt
- Granite
- Basalt (the closely dotted shows probable course of Lead)

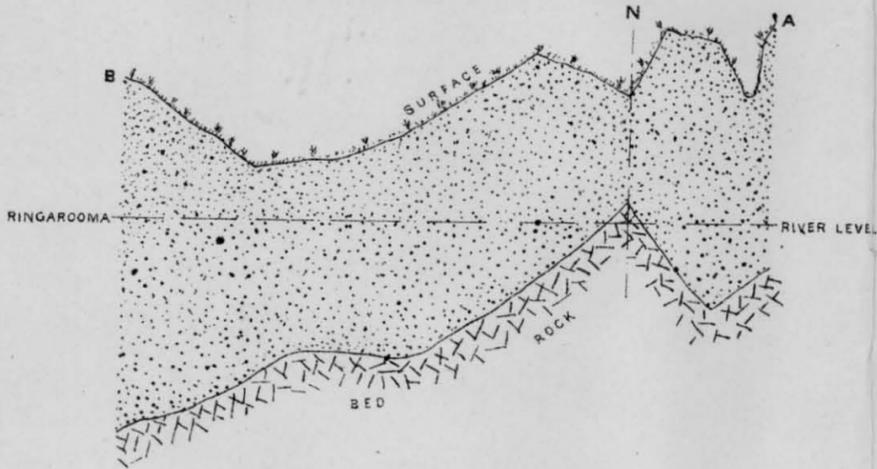
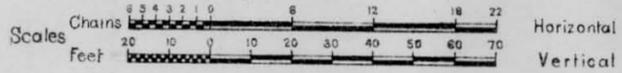
W.H. Trevelyan — Government Geologist



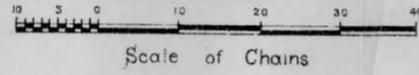


### PIONEER MINE

Section along line A-B North West-South East  
Showing fall of bed rock to West

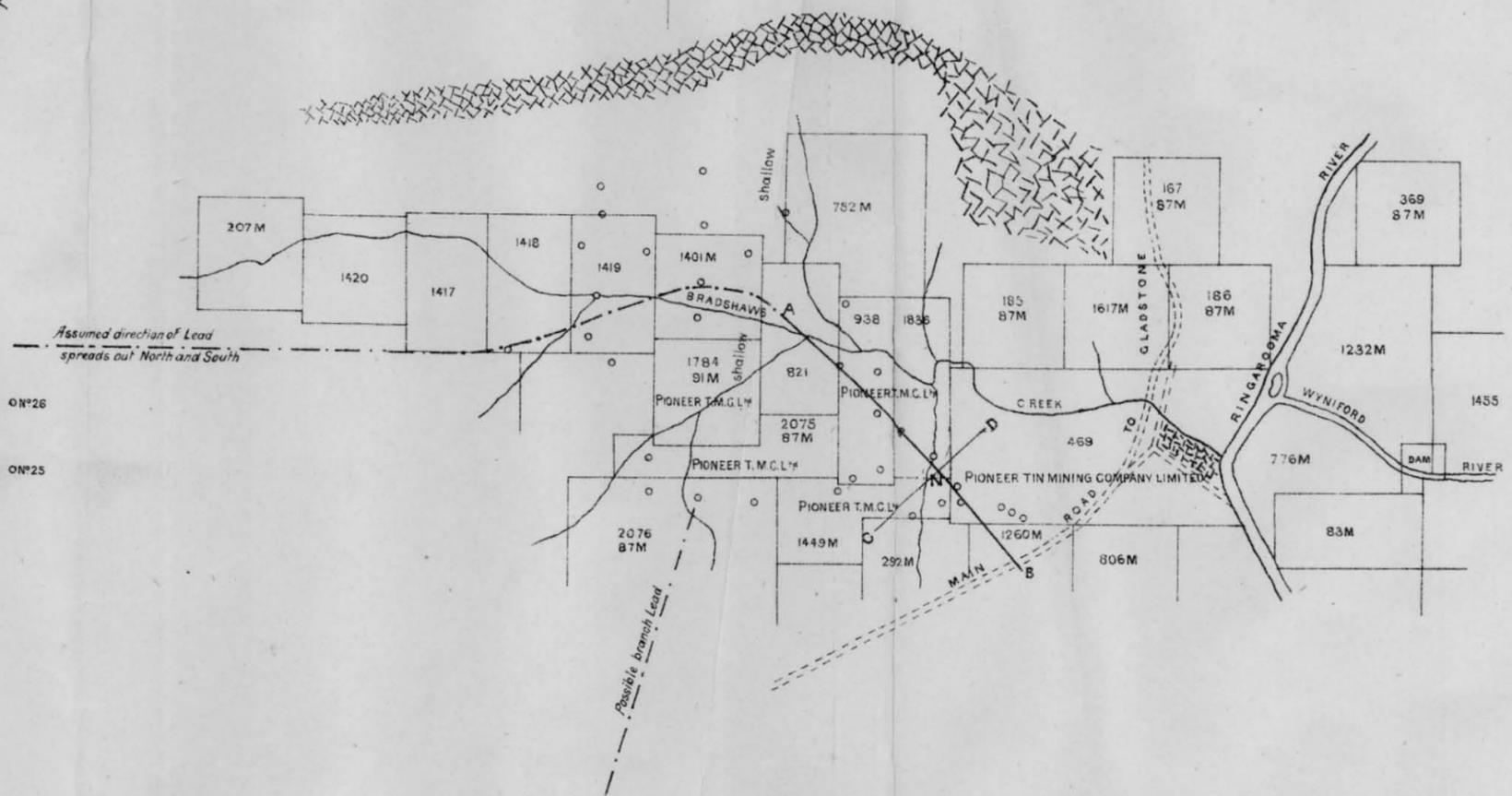


### THE PIONEER LEAD

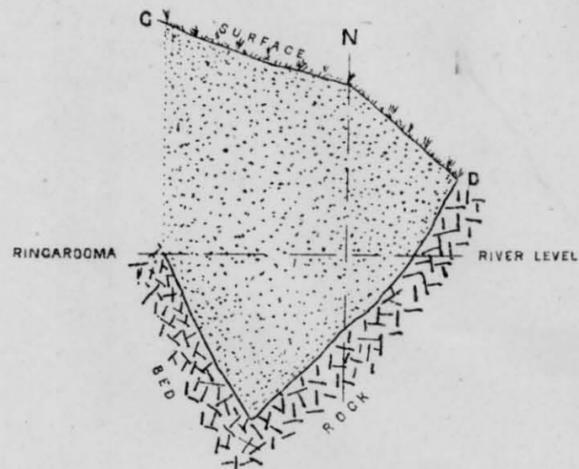


W. H. Trevellick Government Geologist

INDICATES Granite  
Bores



Cross Section of Lead at N - along line CD



and tunnelling it has been proved to contain a little tin ore. It is a ferruginous quartz wash, resembling that at the Briseis and Brothers' Home mines. The formation comes right down to the road and below it, showing in its face false bedding, the signs of former eddies and changing currents. This is O'Doherty's land. A tunnel has been put into the wash below the road, and prospects obtained. On this land the granite comes down to the road again, and looking at the wash it seems to occupy the embayment thus formed by the rim rock. Opposite Bryant's land a spur of granite descends N.W. towards the river. The road bank here is all granite. Just south is the alluvial deposit of the old Ringarooma Valley Company, which is a tongue of deep stanniferous ground running up the hill E. We know the ground is deep on the N. side of the road, for it has been bored through 10 feet of modern wash, and 96 feet of ancient drift, into soft decayed granite. In the east end of the workings a section is seen of the shingly modern wash lying on the top of the ancient alluvial. About 400 tons of tin ore are said to have been taken out of these workings, as well as a little gold. Three or four chains up the gully beyond the end of the workings the wash runs out, and there is not a vestige of it further up, but as it descends in the flats towards the Ringarooma it widens out. The granite rock is very steep to the west of the deposit, and bounds the drift on that side with an abrupt fall. This spur of granite descends to the road, and would seem to have thrown the river off to the north. As the old channel could not have been on the south side of the present river, the Valley Company's deposit must have fed the main lead.

Where the modern river parts company with the old channel can be guessed at approximately. The old stream, with a gutter 100 feet below the level of the present river, could not have flowed to where Derby is now, because that direction was blocked by the sandstone and granite. The granite also prevented it from turning south, which would have been contrary to the fall of the land. There was thus no opening for it but to the N.E., and, accordingly, in this direction we find plenty of evidence of deep ground under a basaltic covering.

I have not investigated the country above Branxholm, and cannot describe the exact point where the present river first diverges from the ancient bed, but for the present purpose it is enough to know that near Branxholm the two courses are separate. The ancient one seems to correspond with a part of Branxholm Creek, south of the road, and its deep ground can be traced north into the Arba Company's property. I believe it to pass, as laid down in Mr. Thureau's map (Sept. 1884), across the Ringarooma at the east end of the Arba tailings area, and to preserve a N.E. direction parallel with the present river through A. H. Boyd's 198 acres, when it begins to form the basalt-covered plateau, which extends for some 12 or 13 miles N. and N.E. of Derby, with an average width of about a mile. This sheet of basalt, though now maintaining an average height of 300 feet above the bed of the Ringarooma, conceals a deep river valley filled (under the basalt) with wash down to the gutter, which must be at least 100 feet below the present river. The rise of the land has elevated this plateau to its present height above the sea (700 feet according to aneroids), and aided the Ringarooma in cutting its way down from that level to its present rocky channel, far below. If we reflect a moment, we see that this basalt mass marks out for us the direction and width of the valley which it inundated, and by tracing the trend of the slates and granites which bound its margins we

are able to guess the course of the ancient river deposit, the deep lead of the Ringarooma.

From Boyd's land the basalt passes N.E. through Crichton's farm, and the river valley was apparently kept N.E. by the rim-rock of slate which hems it in from the Boobyalla basin on the N.W. corner of that farm. Further north, it is still blocked off on the N.W. by slates to the N. and W. of T. D. Peters' land, while it cannot rejoin the Ringarooma between Main Creek and Moorina on account of a granite barrier which is exposed on M'Kimmie and Sandberg's lands. The granite in the S.E. part of R. M'Kimmie's farm crops out at a level of about 230 feet above the Ringarooma, and a couple of hundred yards north of the homestead. It is the usual coarse, porphyritic, dark mica granite (= granitite), and is connected by a nearly N. and S. line with Sandberg's (O'Reilly's) granite a mile further north. Back to the S.E., a few hundred yards from the house, and at about the same level as the exposure just mentioned, there is another outcrop, which seems to be connected with the bedrock falling away down to the Ringarooma. Paddy's mine is a little below this, where some tin ore has been found in shallow drift. The surface soil at M'Kimmie's house is basaltic, and a little to the W. a shaft was sunk 30 feet in basalt without reaching any underlying drift. This was in the flat to the W. of road, and was suspended on account of water. A little further north, beyond M'Kimmie's house, on the west side of the road, decomposed granite is found under six feet of granitic drift, which has been used for blinding the road. This line of granite plainly forms the rim rock to the east of the lead, and confines the old stream to its north-easterly course through Hardman's, Johnson's, Peters', and Shelley's sections. On Alf. Collins' farm, 220 feet above Derby, basaltic soil prevails, but it is rimmed by granite and slates forming the higher ground to the N.W. There is a granite ridge here running N. and S. along the west boundary of G. T. Johnson's land. The creek at the eastern base of the ridge has cut its bed down to a level of only 80 feet above the bridge over the Ringarooma, at Derby. Higher up, on the flank of the hill, we found granite *in situ*. Nothing has been done on this ground in the way of boring. The ground being so low suggested a suspicion whether there was any outlet for the lead in a north-westerly direction from Alf. Collins' farm. The drift would have to be much lower than the granite bottom of the creek referred to, but, from the fall of the creek, I dare say we could have found a granite exposure a good deal lower. Such an outlet would divert the lead into the Boobyalla country, *via* the Trout Creek line. It would be well to devote some attention to this run of country, and if a few lines of levels were run across this plateau by the Survey Department, they would be helpful: however, I do not think this gap was the outlet. Certainly we are here on the west side of the watershed down to the Boobyalla, but though the Trout Creek, which flows into that river, has some alluvial at its junction, it is bounded by slate on the S. and granite on the N. in its lower reaches, while, higher up and further E., that creek and its forks flow over granite, which continues into the Commercial Bank's 317 acres and the country to the north of it. The southern portion of the Commercial Bank's land is all basalt; the northern portion, all granite. This granite country completely bars the lead due north, and, consequently, if the latter does not turn west to the Boobyalla, which is improbable, it keeps on its north-easterly course, in a distinctly widening channel, into the Tasmanian Mineral Exploration Com-

pany's block, where the basaltic plateau is about 550 feet above sea-level. Half way up this block we have the farms of Messrs. J. Harrison, Jno. Simpson, and Wagner, from east to west, all on fine basaltic soil, and enjoying a favourable climate for agriculture. The farmers complain bitterly that the Government does not connect the block by a good road with the road to Bradshaw's Creek. Mr. Simpson has a well on his farm sunk in basalt to 80 feet. To the N.W. of Mr. Wagner's homestead is a knob or hill of basalt, which extends as a ridge for a mile northwards. Going west from Wagner's into Stevenson's land and beyond, we find the head of the north branch of Trout Creek flowing through a yellow, clayey soil, with granitic detritus. There is a small shaft sunk here, on Wagner's land, in white, angular granite detritus. This betokens that granite cannot be far off; and a little lower down the creek, first, huge granite boulders occur, and then granite rock *in situ*. Mr. Wagner has sunk a 34-ft. well in his orchard. It first passed through 28 feet soil and soft basalt, then through 6 feet yellow pug, finally entering the drift. The basaltic sheet is evidently thinner here than on Mr. Simpson's part of the estate. Following up the trend of the basalt and its boundaries in this simple but convincing way, we see that it certainly comes through this large block of land. Standing on this plateau, a break is visible in the country northwards, and though this has no necessary connection with the ancient drainage, it seems to be the direction of the lead. To get behind the Mineral Exploration Company's block to the north, we examined the country along the road running by Hurst's and Kolosque's land. Eastwards from Kolosque's, the country is granitic, but westwards and south, basaltic, probably the edge of the lead. Following the road due north, we have yellow, slightly-bedded quartz sand, until She-oak Hill is reached, where there is white, apparently marine, sand and quartz grit, cemented with oxide of iron, often nodular. Looking westward, slightly S.W. from this hill, the low gap in the country alluded to on the Mineral Exploration Company's block is seen. To the N. is Mt. Cameron, a bold granite mountain, 1800 feet above sea-level, thrusting its underground prolongation of bedrock southwards. All this granite country to the N. and E. effectually disposes of any idea that the former course of the river was to the east of Mt. Cameron. Just past the She-oak Hill there is granite *in situ*, about a chain west of the road, as also on the hill to the W., running south. At the west end of Mt. Cameron the granite comes down to the road, which may be 30 or 40 feet above the eastern branch of the Boobyalla. The granite along this N. and S. line may be taken as the eastern boundary rock, which the old river could not break through.

The further tracing of the lead north of the Tasmanian Mineral Exploration Company's block could not be undertaken on this journey, and as the basalt thins out in that direction, and the country expands into low plains, the delimitation of the old river-course will most likely be attended with some difficulty. All that can be said at present is, that the lead debouches from the northern part of the Exploration Company's block into the catchment basin of the eastern branch of the Boobyalla River, and runs towards the sea, west of Mt. Cameron. This sketch of its course, as roughly defined by its rim-rocks, is as much as I am able to submit for the present: the detailed delineation of its boundaries can only be accomplished by the expenditure of more time than that at my disposal, and, of course, with the goodwill of the occupiers

of the farms. Those whom I had the pleasure of meeting were most obliging and hospitable.

That the main lead of itself is stanniferous is proved by the Arba and other works higher up its course, but its value is greatly enhanced by its receiving the tributary leads of the Cascade, Main (Weld and Frome?), and Wyniford rivers. These have flowed for ages from the south-east, washing down granite sand and tin from the high ranges in which they have their source. The Ringarooma River, from Derby downwards, has cut across their course. The principal tributary lead is that of the Cascade, at Derby, where it is worked by the Krushka Bros. (Brothers' Home), New Brothers' Home No. 1, and Briseis mines on the south side of the Ringarooma, and the Brothers' Home Extended on the north side. The Briseis originally worked along the bed of the Cascade before they found their deep ground. The wash there was a modern one, and not more than 10 feet deep. Between the Cascade River and the deep ground of the Briseis Mine the ridge is granite, and this falls rather abruptly into the Briseis drift. The granite range rises to the south of the Briseis workings, so that the old lead runs up between granite walls towards higher ground, and feathers out in the Company's most southeasterly section. The basaltic overburden forms a capping of varying thickness, but attaining a depth of from 60 to 100 feet, under which, on the face opposite Derby, a vertical filling of 200 feet of wash, extending across the Krushkas' and Briseis mines, is exposed between granite sides down to the bottom works. I was told the bottom of the gutter had not been reached at the base of this face, but judging from the small distance between the granite sides at the bottom, it cannot be more than 30 feet or so deeper. Consequently, at this point the vertical thickness of the wash must be about 230 feet. The low horizons are, as might be expected, the richest in tin. I saw some parts forming a gravel of small quartz pebbles, which seemed to be highly stanniferous. Layers of tin ore may be seen concentrated at different horizons in the wash, and these often run some distance and then thin out, after the manner of stream deposits. Some silicified wood is found embedded in the drift, but its nature has not yet been determined. I was informed that some shells (bivalves) had been found once in the old Triangle workings, but this is the only occurrence of shells which I heard of throughout this journey. The basalt is much decomposed: much of it was columnar. Fragments of rudely-formed hexagonal columns are plentiful in the *debris* heaps. The horizontal line of demarcation between the reddish brown basalt cap and the white quartz wash below is very plain. A layer of pug is often found, sometimes just below the basalt, sometimes lower down in the drift, from 2 to 6 feet thick. Boulders of decomposed granite are found in the wash, but they have fallen from the adjacent ranges, and owe their present position, to gravitation; at least, I see no reason for ascribing their occurrence to ice-transport, of which there is no evidence whatever in this district. The occurrence of decayed granite floaters associated with basalt kernels in white quartz-drift at the west end of the workings admits of an obvious explanation. The idea of solid granite overlying drift, as was mentioned to me on the spot, is an impossible one.

On the hill to the S.E. of the Briseis, there is some deep ground lying to the W. of the Cascade and its granite margin. In this ground there are a couple of old shafts, one of which struck the granite after passing through 26 feet of drift. The other is in 56 feet of

drift and no bottom. East of this is only granite, which bounds the lead in that direction. Some have supposed deep ground to exist eastwards from the Briseis towards Main Creek, but, so far as I know, this has not been proved.

Looking across to the Brothers' Home Extended and Triangle works, we see that those deposits are a continuation of the Briseis and Brothers' Home wash: in other words, it is the Cascade lead or drift laid down in the old channel of the Cascade River. The modern Cascade communicates with the modern Ringarooma River by a granite channel to the E. of the old lead. The granite which is seen in the eastern part of Brothers' Home Extended is the continuation westwards of the ridge of granite which separates the modern Cascade stream and the Briseis workings. The granite bottom is seen dipping into the Extended N.W. at the entrance to the workings, and the drift dips that way too, as might be expected. The face of wash exposed is about 100 feet high, with a capping of 50 to 80 feet of basalt. The wash between these works and the river east of bridge goes down to a good depth below the present river. This is apparently along the line of the Triangle workings, and the deepest ground has run along that line parallel with the present river. Mr. M. J. Griffin formerly put a bore (No. 1) down here, which bottomed at 101 feet, and went six inches into hard granite, the brace of bore being 26 feet above river. In No. 2 tunnel on Beswick's freehold, 8 feet above river level, just opposite the *Dorset Hotel*, a bore was put in to 60 feet below the floor of the tunnel. The tunnel was in drift, and the bore got into a boulder wash. This bore would have to go 22 feet 6 inches more to reach bottom of lead at level of No. 1 bore, mentioned above. Coarse bands of shingle occur in the wash at different levels, in which pebbles of sandstone are numerous. It looks as if the ancient river had cut through the Silurian sandstone which once covered the granite round Derby. Light-coloured pug is noticeable in layers in the wash: this indicates tranquil sedimentations. Various bores have been put down ahead of the works, disclosing tin-bearing wash, but the trials do not seem to have been conducted systematically, and do not furnish much useful information. Further, W. Weir and party bored on the ridge above race on north side of the Ringarooma, and are said to have gone down in wash below the river without bottoming. The drift was tin-bearing, but poor.

It may be taken as demonstrated that the Cascade lead runs parallel with the Ringarooma through T. Beswick's land N.W., illustrating in a striking way the difference of the drainage at this point now and then, for the Ringarooma River is now running in exactly the opposite direction. The Cascade lead, prolonging its course on the same line, must inevitably fall into the old lead of the Ringarooma, and, as far as we could see, it would do this on F. Williams' 202 acres.

The present fall of the Ringarooma is 9 to 10 feet in a mile, assuming, for the sake of getting an approximate idea, the ancient river to have had the same rate of fall, and the clay in the wash seems to show that sometimes, at least, it was not greater, then, by the time the main lead arrived at where F. Williams' land is now, the bottom would be 110 feet (minimum) below the present river bed opposite the old valley workings, and the Cascade lead would fall into it at that depth. I am aware that we cannot be certain that the old leads ran in direct lines; they were probably sinuous to some extent, and possibly meandered a good deal in the lower parts of

their course. The effect of any great deviation would transfer the junction of the two leads to W. J. Graham's land further north.

The main lead receives further tributaries during its course towards the sea. The first after the Cascade is that of the Main Creek, which apparently goes through C. Krushka's land under the basalt, and falls into the main lead in Hardman's 312 acres. The next is the Frome and Weld lead, which has originated the deep ground at Moorina. Up the valley to the S.E. there are still patches of basalt on ancient wash. There is an opinion to the effect that this lead bends northwards, and connects with the deep ground further north at David's Creek, but we did not trace its course on this visit, and I merely mention it for the sake of completing our view of the ancient system of leads. The last lead going northwards is the important one of the Pioneer, at Bradshaw's Creek, opposite where the Wyniford River falls into the Ringarooma. This lead is not protected by a covering of basalt, and the upper parts of it may not be quite so ancient as the others, but it plainly began to form in the old pre-basaltic times when the fall of the country was setting towards the Ringarooma main lead. Mr. Cecil Ryan, the engineer in charge of the Pioneer Tin Mining Company's works, has lately established this very clearly. The dip of the old lead is conclusively demonstrated by the numerous bores which he has put down with the view of proving the true direction and depth of the channel. The whole series of bores put down here from time to time number 52, of which Mr. Ryan has sunk 30. In the eastern part of the workings bare rock is exposed; westwards the ground deepens first to 33 feet, then to 88 feet, and bores more to the west bottomed at 104 ft. and 108 ft. Bores nearly two miles west still show deep ground, thus: No. 25, not completed, is down to 104 feet, still in wash containing much black pug, with organic matter, sticks, leaves, &c. The sand carries quantities of fine iron pyrite. No. 26 is 114 feet deep, and bored 3 feet into a close-grained granite, not the ordinary country granite. Between here and the township, the lead seems to turn towards the south, but the exact continuation is unknown. It is a matter for speculation whether the alluvial to the south is a feeder or a part of the main gutter. At all events, the Pioneer lead cannot now be affirmed to be a marginal part of the Ringarooma lead. It is clearly a tributary of it, and, I imagine, must join it somewhere in the Mineral Exploration Company's block. Mr. Ryan's work has done more to elucidate its position and direction than any previous work here. He was good enough to give me some interesting information respecting his work. All the bores have been put down in 3-ft. sections, so as to form a reliable idea of the ground passed through. The gutter has been proved for  $\frac{3}{4}$  mile down the lead. As long as the gutter is kept to, gravelly wash prevails, but away from it fine sand is met with. A long way off the gutter some rotten wood and small pieces of lignite have been found. The shingle is coarser near the Wyniford River, and grows finer going west. No shells have been found in the Pioneer wash, but since my return, Mr. Ryan informs me that two obsidian bombs have been discovered. These interesting and mysterious objects will doubtless turn up more frequently now that they are attracting closer attention. The tin in this lead is coarser on the bottom, but nowhere really coarse, being, all through, fine ore well rolled. Tiny topaz stones occur, but very few sapphires. In the Wyniford tin sapphires are plentiful, and topaz is found there also. The ore is evenly distributed in

veinlets and layers. The hardest ground in this deposit is a three-foot cake of cement at the top. There is no basalt to be stripped off, but tin is found at the grass roots.

The top of the Pioneer workings are only 300 feet above sea-level now, and there is no doubt, that subsequently to the filling of the gutter in early Tertiary times, the sea has flowed over this surface, re-arranging and distributing drift some distance away from the true channel of the stream. This conclusion is confirmed by an examination of the country round Gladstone and Mt. Cameron, which presents the features of a plain of marine denudation. The absence of marine shells is puzzling, but loses much of its apparent force by being merely a negative argument which the discovery of a single shell might overthrow.

The width of the main Ringarooma lead at surface, as indicated by the basaltic sheet, is from 1 to  $1\frac{1}{4}$  miles in the southern half of the table-land, increasing to  $1\frac{1}{2}$  miles and upwards in the northern part. This surface breadth will increase the difficulty of locating the trend of the gutter through this area. The only way of locating it is to put down lines of bores from N.W. to S.E. a hundred feet apart, in a straight line right across the basalt capping. The cores will not prove the value of the wash, and we must not be led astray by thinking that they will. We know from other parts of the lead that the tin ore is distributed through the drift irregularly in nests and layers and veins, and that portions are nearly barren. If, therefore, barren cores are brought up, they need not shake our confidence in the existence of large accumulations of ore in the deeper parts of the buried lead. That payable drift exists in the tributary leads is an absolute fact, and these tributaries must have contributed their quota to the main lead, which ought to be richest just at or below the junctions. The course of the Cascade lead from the bridge at Derby to where it joins the Ringarooma lead, is within two miles in length, and it is difficult to believe that all the tin had been exhausted before the junction was reached. At that spot a concentration would take place, the impact of two streams of different velocities inevitably causing the deposition of material held in suspension. The first line of bores might be put down across the farms of F. Williams and Jas. Crichton, to determine the gutter there. The next line would be across M.S.R. or Thos. Hardman's farm. The height of the plateau here is 750 ft. above the sea, and the gutter would, I think, be struck between 450 and 500 feet from surface. The next line would be across the farms on the Tasmanian Mineral Exploration Company's block, where the land falls, and the gutter might possibly be found at 400 feet. Somewhere between this and the previous parallel another line might be put down, and these four lines might be expected to locate the underground lead and gutter fairly well. They would also demonstrate the angle of dip of the containing rim-rock, which is an important thing to know before setting out plans for shaft-sinking or tunnelling. If the gutter is anywhere near a steep rim-rock, then the shafts must be sunk in the solid, and drives put in under the lead, for there is reason to believe the lead holds a good deal of water, and sinking straight into it before draining would throw an enormous strain on the shafts. I am afraid the body of wash is too great for the use of ordinary iron boxes and screwjacks with rectangular shafts. The safest way in the end would be to resort to the somewhat expensive system of circular shafts lined with segmented cast-iron cylinders. Brick-lined shafts are apt to get out of

plumb. A pumping station would be best established towards the lower end of the main lead in the Exploration Company's block, and the whole lead drained if the work is to be conducted on a scale corresponding with the extent of ground. When the water which has collected in the drift from the Ringarooma River (the gutter, be it remembered, is below the bed of that river) and from the surface catchment of the plateau, is once pumped out, the chief part of the trouble would be over, and it ought not to be difficult then to cope with the current supply. Another difficulty which needs consideration is to find water on the plateau for sluicing. There are only David's Creek, several small temporary creeks, and a few which are all but temporary, so that the water question requires very careful examination as a first and important preliminary. In a few places, perhaps, the stuff might be brought up to the mouth of the shaft and conveyed down to the nearest water, but the plateau is so large that this plan would be inconvenient as a rule, and extremely expensive; and when we see that the gutter necessarily lies at least 400 feet below the general level of the plateau, it is impossible not to recognise that mining this lead must be attended with heavy expense. Large stores of tin brought down from the stanniferous granite ranges undoubtedly are distributed through the mass of the wash, deposited not only by the parent stream, but also by the tributaries which fed it. The practical question, however, after all our examinations and hopes and wishes, is whether the deposit is rich enough to reward work after reimbursement of expenses. Of course it is impossible to forecast the tin contents of the lead with anything approaching accuracy. I have made numerous inquiries as to estimates made of the richness of the drift in existing and past mines on the lead and its tributaries. Though some of these I believe to be perfectly reliable, I am afraid they are not altogether systematic enough to be very useful. I am credibly informed that a large quantity of drift handled at one of the mines on the Cascade lead averaged 4 lbs. to the cubic yard, or one-sixth per cent. Mr. J. B. Mackenzie, C.E., estimated the whole drift above a 20-ft. deposit next to the bedrock in the New Brothers' Home No. 1 mine at  $3\frac{1}{2}$  lbs. per cubic yard = about one-seventh per cent. For the 20-ft. layer next the bedrock he adopted the estimate of 12 lbs. per cubic yard = about one-half per cent. Mr. Lewis had previously estimated the average value of the wash in that mine at one-half per cent. In the Cascade lead, it must be remembered that the top 30 or 40 feet of drift is very poor, while the wash resting on the gutter is proportionately rich. There is reason to believe that the tributary leads are richer than the higher part of the main lead. I should not be surprised if the average of the latter, prior to receiving its feeders, does not exceed one-eighth per cent. By excluding successively higher horizons of the drift from the calculations, successively higher percentages may be obtained, but, even taking the lower or bottom half of the lead only, I think the average contents of tin may be safely assumed as below one-half per cent. It is true that, with hydraulicking, even one-twentieth per cent. and less will pay, but it has yet to be proved that with underground mining, such as is necessary on this plateau, drift averaging less than one-half per cent. can be considered as payable.

Some further examination of the basaltic plateau is desirable, and the country to the north of it requires special investigation. I shall be glad if any information or hints conveyed in this Report will result in leading

those resident in the district to devote time to the collection of reliable information and data bearing on the plateau and its buried lead. I shall always be pleased to receive communications from those interested in the matter, for the outlines sketched in this Report are sufficient to show that the subject is not yet exhausted.

It is clear, however, that the exploitation of the lead on a proper scale is a work hardly likely to be undertaken by individuals. Its magnitude leads the inhabitants of the district to invoke the aid of the national resources. I am well aware of the expectations of many who wish to see the birth of a new industry in this part of the Island, and I remember, too, that tin is a quasi-precious metal, which can bear high mining costs. I have endeavoured to take a just, sober-minded view of the deposits. I am ready to affirm that every geological consideration points to the existence of large quantities of tin ore being held in the concealed drifts. At the same time I am of opinion that the expense of draining and working these on private land, with the gutter at a great depth, and with a scarcity of water on the spot, introduces an element of risk considerable enough to lead the Government to pause before undertaking the work. If, however, individual associations care to select spots (approved by the Department) with the view of doing what they can to prove the value of the deposit, and are able to establish satisfactorily their bona fides and financial strength, then, in view of the desirability of a practical test, and of the great benefit to the East Coast and to the Colony which would result from success, I think the Government might be fairly considered justified in encouraging individual enterprise and granting some aid to the undertaking.

I have the honour to be,  
Sir,

Your obedient Servant,

W. H. Twelvetrees,

Government Geologist.

W. H. Wallace Esq.,  
Secretary for Mines,  
HOBART.