REPORT ON THE MINERAL DISTRICTS OF BELL MOUNT, DOVE RIVER, FIVE-MILE RISE, MOUNT PELION AND BARN BLUFF.

Government Geologist's Office,
Launceston, 3rd April, 1901.

SIR,

ACTING on instructions received from Mr. W. H. Twelvetrees, Government Geologist, I left Launceston on the 18th February to examine and report upon the mining districts in the vicinity of (1) Bell Mount, (2) Dove River, (3) Five-Mile Rise, (4) Mount Pelion, and (5) Barn Bluff.

Throughout the journey I was treated with great kindness and hospitality by the various mine managers and others with whom I came in contact. I am also specially indebted to Messrs. A. Stephenson, John M'Namee, Rudolph Wachsmuth, and C. P. Smith, Mine Managers, and also to Messrs. Chas. Adams, E. Anderson, G. Renison Bell, J. Swallow, and H. Andrews, for much valuable information and assistance.

Mount Roland.

When passing through Sheffield, I took advantage of a spare afternoon to visit Mount Roland. This is a fine bold escarpment, about five miles south of Sheffield, and rising some 2500 feet above the surrounding country. The country around Sheffield is overlaid with Tertiary basalt, and this extends south to the foot of Mount Roland. My track passed up the centre of the northern end of the mountain. The surface is here largely covered with *débris* and conglomerate boulders fallen from the top of the mountain, but every now and then the bed rock is exposed *in situ*. It is composed of syenite, considerably decomposed at the surface. Unfortunately, I was unable to determine the extent of this

mass, but it is evidently very considerable. Towards the west a little galena has been known to exist for a great many years, and eastward, at the Minnow River, there are also deposits of silver-lead ores. The syenite extends from the foot of the mountain up to the capping of conglomerate. The latter is the same conglomerate that caps so many of the mountains on the West Coast of Tasmania, and is believed to be of Devonian age, though there has been no evidence of a positive nature in support of this. On Mount Roland the conglomerate is dipping about 20° to 30° to the south, the strike being east and west. Hard red sandstones occur on the top of the mountain, interbedded with finer conglomerates, but at the bottom of the series there is a very thick bed of coarse conglomerate. The southern side of the mountain slopes gradually, and is less steep than the dip of the conglomerates. The mountain is deserving of a more careful examination, and might very possibly yield information concerning these old conglomerates, which would be of much value elsewhere. The same rock is seen two miles north of Sheffield on Badger Hill, and also to the west, on Mount Claude.

The Bell Mount Mining Field.

This field is situated on the divide between the Forth River and one of its western tributaries, the Wilmot River. Bell Mount itself is about seven miles south of the township of Wilmot, and the mining field lies to the south of this again. The total distance by road from Sheffield is 22 miles; of this the first eight, to the Lower Forth Bridge, is in good order, being metalled nearly all the way. The last mile or so passing down to the Forth Bridge was only formed, and not in good condition at the time of my visit, but men were at work putting it in order. From Forth Bridge to Wilmot the distance is three miles—sidecutting and formed—but only about 20 chains metalled. From Wilmot to Shepherd and Murphy, distance eleven miles, formed, and cuttings made twelve feet wide for a distance of four miles, and metalled, perhaps, a hundred chains. The metalling is not continuous, but only here and there, where formerly bad bog-holes existed. From here on to near Bell Mount

the road has been only cleared, and the trees grubbed, the worst bogs being roughly corduroyed with slabs and round myrtle spars. Approaching and passing round Bell Mount, the road has been formed and cuttings made fifteen feet in width, and these continue right through to the Shepherd and Murphy Mine. The road was in a very passable condition at the time of my visit, as there had been a long spell of fine weather, but even then there were some nasty bog-holes to be negotiated. In winter the road must get in a very bad state, and would soon become practically impassable were there any quantity of traffic along it.

Plate I is a geological sketch map of the field. The sedimentary rocks of the district belong to the Silurian period, and where exposed consist, for the most part, of sandstones, containing "fucoid (kelp) stems" in abundance. This is the most characteristic fossil of the district, locally known as "pipestem," from its resemblance to the stem of a clay pipe. Other fossils are met with, but more rarely; a variety of rhynchonella occurs at Bell Mount diggings, also fenestella; and at the Five-Mile Rise Mr. O'Rourke presented me with a fine specimen of trilobite, from the same rock. These fossils are probably of Upper Silurian age. A collection has been sent to R. Etheridge, jun., Curator of the Australian Museum, Sydney, for determination, but I fear that none of the specimens which I was able to send were sufficiently perfect for exact determination. These same Fucoid sandstones occur southward as far as the Five-Mile Rise, and on the other side of the Forth they are met with on Mount Claude, and south as far as the Lemonthyme Hill. Conglomerates of the same age as the sandstone also occur, generally occupying the more elevated positions. Their superior hardness enables them to withstand the processes of denudation longer than the softer sandstones and slates. The prominent position of the conglomerates, and the presence of numerous boulders of the same rock lying along the slopes of the hills, gives one the impression, at first, that they are much more widespread than subsequent examination proves to be the case. Slates and limestones also occur, probably in greater abundance than the conglomerates, but they are not so easily seen, as they

occupy the low-lying parts, and are frequently covered with vegetation or river wash.

To the south-east of the field an extensive belt of quartz porphyry occurs. This rock gradually passes into granite in an easterly direction, and is evidently caused by the marginal cooling of the granite mass. Granite and porphyry are two rocks of the same composition, and differ only in the way in which the mineral constituents have separated and crystallised out. Granite has cooled slowly, and all the mineral constituents of the rock have had ample time to fully crystallise; we find, therefore, no trace of glassy or felsitic matter present. Porphyry, on the other hand, has been cooled comparatively quickly; the quartz and a little of the feldspar have had time to separate themselves from the rest of the magma, but the bulk of the rock has solidified as a micro-crystalline or glassy mass, which latter has subsequently become devitrified. The great width of the porphyry on the surface at the western end of the belt may be explained by assuming that the present surface represents the top of the granite mass, and that the granite itself exists at no great depth from the surface. There is very strong evidence in favour of this view. At the south-east corner of Section 1333-91M, a patch of sandstone still remains overlying the porphyry, and on Section 1420-91M much of the latter contains numerous fragments of sandstone embedded in its mass; so much so, that the weathered surface may readily be mistaken for that of a conglomerate or breccia. This occurrence is at least 25 chains from the nearest sandstone on the present surface, and, therefore, the fragments are evidently derived from overlying sandstone, which has subsequently been removed by denudation. We have further evidence to show that the porphyry extends in a north-westerly direction at no great distance from the surface. The northern contact of the porphyry and sedimentary rocks is just below a long straight ridge of white conglomerate, underneath which the porphyry appears to be passing. On the Shepherd and Murphy Tin Mining Company's Section, 1437-91M, an extremely metamorphic garnet rock is met with, which almost certainly is the result of the metamorphism of limestone through contact with the porphyry.

Although the country about is well exposed, no porphyry has been found on the surface in the vicinity of this rock, and we are, therefore, compelled to assume that the metamorphism has been produced by an underlying mass of porphyry. As will be seen by reference to the geological map, much of the country is overlaid by the Tertiary basalt. This is an unfortunate circumstance from a mining point of view, as it renders prospecting very difficult. Some of the Shepherd and Murphy lodes have been traced under the basalt, and these will, no doubt, be followed. To the west of the basalt there is a large deposit of deep alluvial drift, containing both gold and tin in appreciable quantities. This is said to continue underneath the basalt, though I had no opportunity of verifying the statement. It is, however, very probable that deep leads do exist under the basalt, and their discovery might be of great importance to the prosperity of the field.

About a mile north-west of the Shepherd and Murphy mine, on Crown land, I found a dense green rock, containing a good deal of magnetite, which micro-examination proves to be largely composed of epidote and vesuvianite. This is a metamorphic rock, and is probably also due to the alteration of limestone. It occurs in the sandstone, and is worthy of more thorough examination. Its approximate position will be found on the geological sketch map.

On Bell Mount itself there occurs an extensive belt of schistose porphyrys, chlorite schists, and argillaceous schists. The porphyrys are of a totally different character to those occurring in the south-eastern portion of the field, which constitute the marginal portion of the granite mass. The former, I believe, are interbedded with the clay slates, and represent old rhyolitic lavas of the same age as the argillaceous schists with which they occur. Whether these belong to the same age as the fucoid sandstones (Upper Silurian) or to some older period, I was unable to determine. In any case they are older than the massive porphyry already described. The belt is striking about north-west and south-east. I found a similar schistose porphyry on the Narrawa Section. This may be the western edge of the schistose porphyry belt, but, unfortunately, time did not permit me to decide

this point. The country is apparently favourable to the occurrence of ore deposits, but, with the possible exception of the Narrawa lode, so far, nothing has been found in it.

The Shepherd and Murphy Tin Mining Company, No Liability.

A. Stephenson, Mining Manager. This company holds Sections 1968-93M, 1437-91M, 1456-91M, 2326-93M, each of 80 acres, and 2134-91M, of 78 acres. Most of the mine workings are situated on the south-eastern portion of Section 1437, on the slope of the hill to the south of Bismuth Creek. As will be seen by the geological sketch map (Plate I.), a good deal of the country is covered with basalt, but on the greater part of Sections 1437, 2134, and 1968, as well as a small strip on the north of Section 1456, the Silurian sandstones and slates are exposed. Quartz-porphyry exists on the south-eastern angle of Section 2134, and, as has already been explained, there are strong reasons for believing that this extends through the other sections at no very great depth below the surface, though it is nowhere else exposed to view. About the centre of Section 1437, a lenticular mass of garnet rock occurs. In its normal state, this is a hard yellowish-brown rock of resinous lustre, composed principally of garnet, but also containing epidote, pyroxene, magnetite, and probably zoisite, though the latter is decomposed, and could not be identified with certainty. To the west, this rock becomes black and heavy, owing to the presence of much magnetite, and contains numerous veins of flesh-coloured feldspar running through it. The rock is not an uncommon one, being often met with among old sedimentary rocks and crystalline schists. Its presence is attributed to the metamorphism of limestone through contact with an eruptive rock. In this case there can be no doubt that the metamorphism is due to contact with porphyry. Limestone occurs in the bed of Bismuth Creek, about 30 chains north-west of the garnet rock, and, no doubt, were not the intervening country overlaid with basalt, this could be traced much nearer the garnet rock. Slate, a rock which invariably accompanies limestone in these sedimentary rocks, occurs in the creek just below the outcrop of garnet rock. There can, therefore, be no doubt as to its origin. The most northerly

of the tin lodes known on the section has been driven on into the garnet rock, and, as far as can be judged by the work done, it appears to have a favourable influence on the mineral contents. Mr. W. F. Petterd has discovered the presence of bismuth sulphide in this rock; this may be regarded as a good indication. It is probably due to impregnation from the lode.

On the surface of the hill on which the lodes occur numerous large boulders have been found composed of a sandstone breccia or conglomerate, the parts being held together by a siliceous cement. These boulders contain coarse crystals of tin oxide and topaz distributed through them. They have been evidently derived from some deposit of old cemented wash, and very possibly come from a deep lead underneath the basalt on Section 1465. Near the edge of this basalt, at the north end of the section, a dish was washed from the sub-soil, which yielded a prospect of very similar tin oxide and topaz to that found in the boulders. If such a lead exists here, it could be found by carefully trenching along the edge of the basalt. The work may well be held in abeyance for the present, as the company will have its hands full for some time to come in exploiting its tin lodes; but the occurrence is worth bearing in mind, and should receive some attention as soon as the more pressing work is completed.

The mine has been very carefully described by Mr. J. Harcourt Smith, late Government Geologist in September, 1898, and as there has been very little exploratory work done since his visit, a detailed description of the workings will not be necessary in the present report. A short account, therefore, of the tin-bearing lodes and the principal work done thereon will be all that is attempted here. In all, seven parallel lodes are known to exist on the property. The strike is approximately east and west, and the dip vertical. The lode-matter consists of quartz with tin oxide in coarse crystals, wolframite, sulphide of bismuth, and, in the upper parts of the lodes, carbonate of bismuth; a little topaz and fluorite are also present. The lodes are small but have proved to be regular in their occurrence, both as to size and mineral contents. They have been numbered from south to north as follows; 1, 2 3, 4, 5A, 5 and 6, number 6 lode being

GEOLOGICAL SKETCH PLAN

OF

BELL MOUNT MINING DISTRICT

Scale 10 5 0 10 20 30 40 50 Chains

5 cm

PLATE I

G. A. Waller
Assistant Government Geologist

BELL MOUNT

1961 91M 50

1960 91M 48

WILMOT RIVER

LEA RIVER

BELL CREEK

WEST SPUR

BELL MOUNT DIGGINGS

POVERTY GULLY

MOSQUITO CK.

BASALT CREEK

SOUTH SPUR

DEEP ALLUVIAL WASH

BISMUTH CK.

ROAD TO WILMOT

4M.

5M.

6M.

7M.

NARRAWA CK.

BRAMPTONS CREEK

WATER RACE

SHEPHERD AND MURPHY TIN M.C.

4726 93M 80 T.F. GURR

1437 91M 80

1968 80 93M

4030 93M 78 R. ATKINSON

2134 91M 78

4909 93M 78 H.P. MITCHELL

1456 91M 80

2326 93M 80

1403 91M 80

4474 93M 80 A.J. RITCHIE

1420 91M 80

1421 91M

5184 93M. 10

36 93G 20

35 93G 20

NARRAWA PROS. ASS

5183 93M 10

370 93G 10 C. PACKETT & W. GIBSON

3715 93M 79 J.U. FLETCHER

1336 91M 79

3714 93M 79 J.W. PEASE

RIDGE WHITE CONGLOMERATE

SCHISTOSE PORPHYRY AND SCHISTS

SILURIAN STRATA

ALLUVIAL WASH

BASALT

PORPHYRY

GRANITE

GARNET ROCK

Ep EPIDOTE ROCK

Sl. SLATE

L. LIMESTONE

the furthest north. Between the outcrops of numbers 5 and 6, No. 1 adit has been driven nearly due south, cutting lodes Nos. 5 to 1; and 140 feet below this No. 2 adit, was put in, cutting No. 6 lode 50 feet from the entrance. A third tunnel is now being driven about 120 feet below No 2, with which it is intended to cut all the known lodes. This is to be used as a permanent working adit for the mine. At the time of my visit this tunnel had been driven 290 feet, and had still 80 feet to go in order to cut No. 6 lode, provided it preserves its course of east and west. On the surface however, the course appears to be altering a little to the north of west, and in that case the lode may be cut 30 or 40 feet sooner. The other lodes should, if they continue their present course, be cut by this tunnel at approximately the following distances:—No. 5 at 880 feet; No. 5A, at 892 feet; No. 4, at 967 feet; No. 3, at 1060 feet; No 2, at 1110 feet; and No. 1, at 1200 feet.

In No. 1 adit, lodes Nos. 2 and 4 are the most promising. No. 2 is about 15 inches wide, and has been driven on for about 25 feet. A rise has been put up to the surface (86 feet), and is said to be in payable ore all the way. This lode is richer in bismuth than the others. A good bunch, from which 15 bags of bismuth sulphide were obtained, was cut in driving from the adit. No. 4 lode has been driven on a total distance of 115 feet, and varies in width from 18 inches to two feet. It carries a fair percentage of tin oxide throughout, as well as a good deal of wolframite, and some bismuth sulphide. No. 6 is also a very promising little lode. From No. 2 adit it has been driven on a total distance of 320 feet, and varies in width from 15 inches up to 2 feet. Towards the west it enters the garnet rock, and the tin appears to show an improvement, which is a most hopeful sign. No. 3 adit will intersect this lode some 620 feet west, and 110 feet below No. 2. The event is looked forward to with some anxiety, as it is of course quite possible that the adit may strike the lode in a poor spot. Should this be the case, there is no need for despondency. There are poor as well as rich patches in every lode, and at that distance the poor patch is as likely to be struck as the rich one. In either case the lode should be driven on both east and west in order to prove it as quickly as possible.

Since Mr. Harcourt Smith's visit to the mine the stamp battery and concentrating mill have been completed, and during the last winter 400 tons of stone were treated. The stone came from the various lodes in the following proportion :—

20 tons from No. 2 lode.
80 tons from No. 4 lode.
300 tons from No. 6 lode.

The parcel yielded 14 tons, or 3½ per. cent of concentrates, as well as about 4½ cwts. of hand-picked bismuth sulphide, but of the 400 tons put through, 90 tons had been previously hand-picked for bismuth, and in the course of mining a patch of bismuth ore was struck which alone yielded 15 bags of sulphide.

The concentrates are not pure tin ore, but contain also wolframite and bismuth sulphide, and are of too complex a nature to be treated at the local smelting works. The parcel has been shipped to Europe, where there are several buyers who profess to pay for all the valuable constituents of the ore. The success of the mine will no doubt largely depend upon the price obtainable for the concentrates ; should this prove satisfactory, there is no reason why the mine should not become a very payable concern. It is true the lodes are small, but as far as they have been proved, are consistent, and this is a very important point in mining. The facilities for economically mining and handling the ore are excellent. No pumping or winding machinery will be required for some years, and I do not think the mine will ever be troubled with much water. No. 3 adit is being driven on the same level as the battery hopper, so that the ore can be delivered straight into the mill, without further handling. As soon as the mine has been opened up from this level, the aërial tramway which at present connects No. 1 and No. 2 adits with the mill may be dispensed with, and the sooner the better. It does not work well, and is a constant source of annoyance and delay.

The battery and concentrating mill is a nice compact little plant. The ore is dumped into a hopper, which delivers into a Blake crusher with 9″ by 16″ jaw opening, and crushes to about 1½-inch cube. From the crusher the stone passes to a two-compartment conical trommel, which separates three classes : Class I., above 1 inch

diameter; Class II., between 1 inch and ½ inch diameter; and Class III., below ½ inch diameter. Class I. passes directly on to the stamp battery. Classes II. and III. go to two two-compartment plunger jigs, the tailings from these being fed into the battery. The stamp battery is of 10 heads, 950 lbs. stamps, with a 7-inch drop. The battery screens contain 14 holes to the inch. The battery is fed by a pair of Challenge automatic ore feeders. The pulp from each battery of 5 heads passes through a series of two Rittinger Spitzlutten of excellent design, 18 inches in width, giving two sorts or classes of sands. These are treated on two pairs of jigs, the tailings from which go to waste. The overflow from the Spitzlutten passes on to a Spitzkasten, 12 feet long, 2 feet 6 inches wide at small end, and 5 feet wide at large end. This separates two sorts of slimes, which are treated on a couple of Frue Vanners.

The respective specific gravities of the minerals present in the ore as as follow :—

Wolframite (tungstate of iron and manganese) ...	7·2–7·5
Cassiterite (oxide of tin)	6·8–7·1
Bismutite (carbonate of bismuth).....	6·86–6·9
Bismuthmite (sulphide of bismuth)	6·4–6·5
Iron pyrites	4·95–5·1
Topaz	3·4–3·6
Quartz.....	2·65

It will be evident from the above, that it is impossible to separate the first four minerals in the list by mechanical means. The concentrates will, therefore, consist of a mixture of these minerals. The object to be aimed at is, of course, to obtain as pure a tin ore as possible, though the wolframite, and especially the bismuth, are well worth saving, but are much more valuable if they can be separated from the accompanying minerals. The only way in which this can be effected is by hand-picking. This should be practised not only in the mill but in the working places of the mine itself. When the mine has been more fully opened up it will probably be possible to do a good deal of sorting of the ore before it is brought into the battery. Thus it will probably be found that the tin ore, wolfram, and bismuth occur more or less in separate patches. If this is the case it would be a mistake to mix the ores in the battery hopper only to endeavour to separate them again mechanically.

Advantage should, as far as possible, be taken of the natural concentration, and the ore which is rich in wolfram should not be treated with that which is rich in tin. Bags should always be kept handy in the stopes for the reception of any bismuth ore which it may be possible to separate by hand.

The cleavage of minerals is a factor of the greatest importance in ore concentration. Tin oxide has, luckily, no cleavage, and, in consequence, it has very little tendency to form slime. Moreover, in the ore under consideration the tin occurs in coarse crystals, so that there is no necessity for fine crushing. Under these circumstances the loss of tin in concentration should be very small. Wolfram has a perfect cleavage, and, therefore has some tendency to slime. On this account it will be found that the concentrates from the vanners will contain more wolfram than the coarser product from the jigs. There will also be a greater loss of wolfram than tin Sulphide of bismuth, which, next to tin ore, is looked upon as the most valuable component of the ore, has a very perfect cleavage, and, in addition, is a very soft and brittle mineral. For this reason it will slime very much in the battery, and the loss in concentration will be great. The only remedy is careful handpicking. Fortunately, the high price of bismuth will enable handpicking to be carried out to a much greater extent than is the case with a less valuable ore.

The plant is driven by two Pelton wheels, one of which drives the battery, and the other the concentrating plant. Unfortunately, at the time of my visit, and for some time previous thereto, the battery had been at a standstill, owing to want of water. The water supply is at present taken from Brampton's Creek, which is sufficient during the winter months, but during the dry weather does not contain enough water to drive the mill. It is intended to bring in water from the Weaning Paddock Creek, where an ample supply can be obtained, and the survey of the race has been already made.

The Bell Mount Gold Diggings.

This is a small but fairly productive alluvial gold field, from which, during the past nine years some 5000 ounces, of gold have been won. It was originally discovered by

Malcolm Campbell in 1892, and during that and the following year quite a rush set in, upwards of eighty men being at work on the field. Since then the field has been in a semi-abandoned condition, though a few men have always been able to make a living, either by re-washing the ground passed over rapidly in the first instance, or by treating the wash on the terraces, a lot of which has proved to be well worth working. During the last few months the Bell Mount Hydraulic Gold Mining Company, Limited, has started operations, and is bringing in water from the Iris River by means of a race five miles in length. This company proposes to work the deposit on a large scale, taking out all the wash which proved too poor to be worked by hand.

The deposit of alluvial wash is situated directly south of A. J. Lyall's Blocks 1001 and 1002-97G, and will be found marked on the geological chart (Plate I) appended to this report. To the south and west of the field are two narrow spurs of hard sandstone separated by the steep and almost semi-circular gorge through which the Bell Creek flows. To the north the ground rises to the foot of Bell Mount, and to the east is an undulating plain covered for the most part by loose sandy drift, and gently rising till Hall's Track is reached, falls sharply away to the Forth River.

Several creeks flow through the deposit; the largest of these, Bell Creek, flows through the western portion. To the east of this is Poverty Creek, and still further east, Mosquito Creek, while Basalt Creek flows through the southern end of the deposit. The Bell, Poverty, and Mosquito Creeks are separated by large mounds of wash up to 60 feet in height, and the wash extends at least as high as this up the slopes of the South and West Spurs, and also for a considerable distance in an easterly direction. It appears pretty evident that the wash originally extended across the gullies, and has since been sluiced away by the present creeks, the gold becoming concentrated in their beds.

The western portion of the field proved to be much the richest. In the Bell Creek both the wash and the gold are coarser than elsewhere, and on the terraces on the western spur the gold is mostly coarse, and occurs from the surface down; indeed, the coarsest and best gold is

found within two feet of the surface. In Poverty Creek both gold and wash are finer, and, as one would judge from its name, by no means so rich as in Bell Creek. Mosquito Creek has only been worked within the last couple of years; the gold is of the same nature as that found in Poverty Creek. Speaking generally, the greater part of the gold won has been coarse. The largest nugget found weighed 22 ounces, and was sold for £83. Several nuggets from 10 to 16 ounces, and many others of smaller weights, are recorded; the nuggets are described as being all of the same nature, flat in shape, with one side smooth and the other jagged. Most of the gold is augular, and contains a good deal of quartz, though some water-worn gold has been got from pot-holes. The wash is for the most part composed of angular fragments of sandstone with a little schistose porphyry and schist, the latter generally more or less waterworn. Boulders of conglomerate also occur, especially in the mound between Bell and Poverty Creeks, and on the slope of West Spur. Below the wash, there is often a false bottom consisting of black pug, and containing vegetable remains; this is evidently an old surface soil. It has been bottomed in several places, but no gold has been found underneath it. In Poverty Creek, the wash, which is very fine, has been sunk in for a depth of 35 feet without reaching bottom; it is said to contain fine gold all through. This would bring the bottom at this point below the present outlet of the Bell Creek. I think, however, that this depth is quite local, as in several other places close at hand the sandstone bottom has been reached at much shallower depths.

The source of the gold in the Bell Mount field is a question of considerable importance to prospectors in the district, and some discussion on the question will not be out of place in the present report. It has been suggested that the gold may have come from a deep lead under the basalt, but I think this is very unlikely, because, apart from Basalt Creek, the wash is quite free from particles of this rock. Moreover, the only basalt in the vicinity of the deposit lies at a lower level than the greater part of the payable wash. The angular character of both the wash and gold, and the presence of quartz in the gold, makes it more probable that the gold has been

derived from reefs or veins in the country-rock, and in seeking these we must endeavour to find out from which direction the wash has come. The wash is bounded on the south and west by narrow spurs of sandstone too small to afford such a mass of alluvial as we have here, and making it impossible for the wash to have come from either of these directions. To the east the country is low-lying, and is largely covered by basalt. We are, therefore, compelled to assume that the wash has come from the north, and probably followed the general course of the Bell Creek. A somewhat hurried examination of the country went far to confirm this view. In several places along the creeks I noticed deposits of similar wash to that contained in the Bell Mount diggings. The country is composed almost entirely of sandstone, until far up near the source of the creek, where a belt of conglomerate occurs. Beyond this, porphyry and schist country is met with. All these rocks are found in the Bell Mount alluvial, the porphyry, schist, and conglomerate, however, being, as one might expect, greatly subordinate to the sandstone. I think, therefore, that the most probable source of the gold is to be found on the southern and south-western slopes of Bell Mount, more probably in the sandstone than in the schists. When discovered, the reefs or veins will probably be, like others known in the district, small, rich, and patchy, but considering the large amount of gold derived from their disintegration they are surely worth looking for, and when found should be worthy of systematic exploitation.

The Bell Mount Hydraulic Gold Mining Company, Limited.

Rudolph Wachsmuth, manager. This Company has been at work since August, last year, bringing in water from the Iris River with the object of treating the wash in the Bell Mount diggings by the process of hydraulic mining. The race, which is about five miles in length, is nearly completed for the first four miles, but the last mile, which passes through the most difficult country, has yet to be cut. There is still a nasty cliff to be negotiated, but, fortunately, the race comes for the most part just along the base of the cliff, leaving only a chain

or so of high fluming, so that the difficulty is not insuperable. The sectional area of the race is 4½ square feet, with a fall of 1¼ inches to the chain. This should be capable of delivering 150,000 gallons per hour on to the workings. The fluming is being constructed of greater sectional area and a greater fall than the race, so that the size of the race can be increased, if it is found to be necessary, without very great expense. The pressure-tank is 130 feet above the sluice-box, and considering the loose and sandy nature of the greater part of the wash, should prove to be sufficient. The get-away for the tailings is along the Bell Creek gorge, where there is a good fall for half a mile, until the latter joins the Wilmot River. At the top of the gorge there was a sandstone bar, which had to be shot away in order to enable the whole of the ground to be worked. Thus the first two conditions for successful working, namely, sufficient quantity and pressure of water, and sufficient get-away for the tailings, may be said to be fulfilled ; the third and last condition, namely, the presence of a large quantity of gold-bearing wash, will, I think, also prove to be satisfactory. Along West Spur there is a large amount of wash, parts of which have been worked with very good results. The gold here is coarse and patchy, but when worked in bulk should yield a good return. At the north-western end of the field the ground was very difficult to work by hand, owing to the difficulty of draining it, but just here one of the best claims on the field was located. The richest ground has, of course, been worked out, but, owing to the difficulty of draining, it is probable that much good ground still remains. It is very likely that an elevator will have to be used to work this end of the field. The mound between the Bell and Poverty Creeks has never been much prospected It certainly contains some gold, but whether it will prove payable or not is a question which will be best proved by the nozzle. There is always a chance of striking a good lead in places like this. Further east, there is a large quantity of wash, which may also prove to be payable. Mosquito Creek, which has cut its way through this, has managed to collect enough gold in its bed to pay for sluicing, though whether the wash will be payable in bulk is not determined. On the whole there seems to be

every prospect of the venture turning out a profitable one.

Section 1960-93M. *W. T. York.*

A little prospecting has been done on this section on some small veins of galena that occur on the side of the gorge to the east of the Iris river. The galena occurs in small veins and stringers running through the country. In one place I noticed a small bunch of mixed ore about 9 inches wide, but this is exceptional. Near the south-west angle of the section a short drive has been put in on the side of the hill, following a vein of galena about 2 inches in width. This, however, soon died away, though other small veins are still showing in the face. The country is not unfavourable for the occurrence of galena lodes, being composed of slates and limestones, but I hardly think it worth while to spend more money in tracing up these small stringers. It is not at all likely that a payable deposit would exist below the surface without giving some more decided evidence of its presence than we have here. The ground is worth further prospecting on the surface, but unless some stronger evidence of a defined formation is met with, it is quite useless to spend money in sinking or driving.

Section 2114-91M.

This section was floated last year under the name of the "Tasmanian United Wolfram Company Limited," with the object of working a run of alluvial ground which passes through the northern portion of the section. When the company was floated the price of wolfram stood at £70 per ton. Since then, it has fallen as low as £30, and at the present time it is worth about £50 per ton. The section, which is one of those formerly held by the Iris Tin Mining Company, is situated to the south-east of the Shepherd and Murphy mine, on a high flat saddle between the watersheds of the Forth and Wilmot rivers. The country is for the most part porphyry, much decomposed on the surface, with a strip of sandstone to the west. The southern portion of the section is overlaid with basalt. Mr. R. Dryden, who has been prospecting the section for the Company, has sunk a number of holes in the wash, and demonstrated that the

run goes right through the section, the width varying from one chain up to seven. The metal-bearing wash is shallow, varying from a few inches up to a couple of feet. Mr. Dryden estimates the wash to contain an average of 9 ounces to the dish of mixed tin and wolfram. The deepest ground has been already worked by tributors under the old Iris Company. These workings are situated on the eastern portion of the run. The ground was worked principally for tin, the wolfram being picked out by hand. I understand that most of the latter has since been removed and sold. The rest of the ground was left, principally on account of the difficulty of getting water on to it. This is, I fear, a serious difficulty, on account of the highly elevated position of the section, and will have to be carefully gone into. Mr. Dryden thinks that water can be got from the Bull Plains Creek by means of a race five or six miles in length, but I am told that the Shepherd and Murphy Company failed to get water from this source into its pressure tank, which is 200 feet below the general level of this section. If this is the case, the Wolfram Company will probably encounter the same difficulties in bringing in water on to this ground. It is, however, probable that at least a winter supply can be got by damming small creeks in the vicinity. The whole of the section is covered with heavy timber, which will greatly increase the cost of mining. On the whole, I fear the Company will hardly find it profitable to work the ground themselves. If water can be got on the ground at reasonable cost, it would, probably, pay tributors to work it, and the Company would, besides obtaining a fair royalty, stand a good chance of tin-bearing lodes being discovered. The country is very favourable for tin lodes, the junction of the porphyry and sandstone occurring on the western portion of the section, and it is probably from lodes occurring in this vicinity that the tin and wolfram which is found in the wash has been derived.

The Dove River District.

Leaving the Shepherd and Murphy camp on March 1st, I proceeded to the Devon Mine, where I was most hospitably entertained by Mr. John M'Namee, the

mining manager. The first few miles of the track from the Shepherd and Murphy mine is in an extremely bad condition. For some distance after leaving the mine the old track has been abandoned as impassable, owing to fallen timber, and the present one has been merely beaten out of the bush by the mailman's horses, no attempt having been made to cut it out. When the old track is reached it is not in a very much better condition, and frequent detours have to be made into the bush in order to avoid fallen timber. In one place there is a very bad bog-hole, half concealed by floating cords, which is most dangerous to cross on horseback. Considering that the mail and all the supplies for the prospectors and others at the Dove River and the Five-Mile Rise pass along this track, something should be done at once to make it more fit for traffic. If left in its present state it will become quite impassable next winter.

Leaving the old V.D.L. track about half-way down the Five-Mile Rise, the track to the Devon Mine takes a south-westerly course into the Dove River. It was, at the time of my visit, in good order, but would no doubt be very muddy in wet weather. The last mile is very steep, falling an average of 1 in 4 for 70 chains, and in places it must be much steeper than this. When we consider that all the ore from the Devon Mine has to be packed up this track, some idea can be formed of the difficulties with which this pioneer mine has had to contend. The country passed through for the first half-mile after leaving the old V.D.L. track is the same fucoid sandstone already met with at Bell Mount. After this the country is overlaid with basalt for perhaps another mile, and then granite is entered, which continues down to the Dove River, a distance of about another mile and a half. The Dove River is a tributary on the west side of the Forth. It is a fine stream of water flowing through a very steep gorge, at least 1200 feet in depth. The precipitous nature of the country makes a thorough geological examination a lengthy and arduous undertaking, but a general idea of the geological features can be obtained by examining the rocks which outcrop in the bed or on the banks of the river. I followed the latter down for about a mile below the Devon Mine, and went up stream as far as the Sirdar

Prospecting Association's Section, a distance of about five and a half miles, returning over a steep spur, around the northern end of which the Dove River winds. The course of the river is most tortuous, a remarkable feature considering the depth and precipitous nature of the gorge through which it flows. At the Devon Mine a massive belt of granite crosses the country roughly in an east and westerly direction, and from this granite and porphyry dykes break out into the country in many places. The porphyry is often seen to be the margin of the granite, but it also occurs in separate dykes. North of the granite the country is composed chiefly of hard quartzites, probably of the same age as the fucoid sandstones of Bell Mount and the Five-Mile Rise districts, but hardened and altered through contact with the granite. To the south of the granite belt we have finely laminated crystalline mica schists or gneisses of the uniform character characteristic of Archæan rocks. These are met with in the Dove River below (south of) the Devon Mine, and also about four miles higher up stream, about due west from this point. Among these schists I found a fine-grained massive rock, which is probably an old diorite, or some allied rock. This occurs in the Dove River, about half a mile to the south of the Devon Mine.

The Devon Mine.

John McNamee, Mining Manager. This company holds Sections 1831-93M and 1021-93M, each of 40 acres. The contact of the porphyry and the quartzite is seen in the Dove River, a little north of the centre of Section 1831. The porphyry is a marginal portion of the granite, and in it, on the western bank of the river, the Devon silver lode occurs. The course of this lode is a little east of north, whereas that of the river at this point is due north and south; consequently, towards the north the amount of backs decrease, and towards the south they increase. The dip is about 80° to the east. The lode has been opened up by means of an adit, put in about 25 feet above the river. It was cut at 50 feet from the entrance, and the adit continued for another 30 feet with the object of cutting any parallel lodes, but so far, without success. A small parallel vein was, how-

ever, cut in the mouth of the adit, carrying three inches of galena. This was dipping to the west, and evidently junctions with the other lode at no great depth. From the adit the lode has been driven on north for a distance of 154 feet, and south for a distance of 83 feet. Both north and south shoots of metal were met with, and these have now been nearly stoped out over the drive. The width of the lode-channel is from two to three feet, and is filled with galena, country-rock, and a little quartz. The upper portion of the lode is much oxidised, and contains a good deal of carbonate of lead. The gossan is of fair quality, but not sufficiently rich to pay for the very high cost of packing to Sheffield, in addition to other freight and smelting charges. The galena is of excellent quality, and occurs in bands, the width varying from a few inches up to over two feet. The Manager informs me that good metal is showing in the floor of the drive for nearly the whole distance driven, and he estimates the average width of galena at 15 inches, though in places it goes up to over two feet. About 100 feet north of No. 1 adit a second is being put in just above the flood-level of the river, with the object of working out this metal. Unfortunately, it will be only about 18 feet below the first adit, but as the distance to be driven is only about 30 feet, this appears to be the best thing to be done under the circumstances. The northern end of the drive, which was not very far from the surface, was principally in oxidised ore, but at the lower level it is probable that the galena will continue further north. The mine has been more than paying its way for some time, but it is very much to be regretted that absolutely no prospecting or development work is being attempted. No. 1 adit should certainly be continued for another 150 feet or so, with the object of finding other parallel lodes, and the drive should be continued south with the object of discovering other shoots of metal, of which there are encouraging indications on the surface. The problem of sinking, too, is one which the company will be forced to face before very long. Pumping machinery will have to be erected, but I am not of opinion that very large quantities of water will have to be dealt with, provided that adequate means are adopted to prevent the surface-water from draining into the mine. There is, of

course, a risk of the river giving trouble, but I hardly think that likely. Ample water-power for driving the machinery exists in the Dove River, but that is a question that will have to be very carefully gone into. The sides of the gorge are so steep that the race would have to be flumed through a large part of its course.

The mine has been sending out regular shipments of ore since May, 1899. In all, 172 tons have been shipped, realising the sum of £2153 11*s.* 11*d.*, excluding cost of packing, &c. The average assay value of the ore has been as follows:—Gold, 5 dwts. 4 grs. per ton; silver, 85 ozs. 10 dwts. per ton; lead, 55·9 per cent. This gives an average of 2 grains of gold and 1·53 ounces of silver per unit of lead. The galena is therefore of high grade. The gold contents are exceptional for Tasmanian galenas.

There is a large heap of seconds at the mouth of the tunnel. It consists principally of gossan and country rock, and some of it contains a good deal of carbonate of lead. This ore could not be concentrated mechanically, but might pay to handpick as soon as the means of getting the ore to market are more favourable. Galena seconds have been mixed with the gossan; this is a mistake. They should be kept separate, as the company may erect concentrators later on, when the latter would become valuable.

The mine has been worked under the greatest difficulties. The cost of packing the ore into Sheffield alone is £5 per ton, and all mine supplies have to be obtained at even a higher rate. With the present means of access it would be quite impossible to bring in machinery. That under these circumstances the mine has been able to do a little more than pay its way is most encouraging, but of course the future prospects of the mine depend upon the behaviour of the lode in depth. Should it prove to be as rich or nearly as rich in depth as it has already been shown to be near the surface, there will be no doubt at all about it. I can see little reason for evil forebodings. The valley of the Dove River has been excavated at a comparatively recent period, certainly long after the metal was deposited in the Devon lode. We may regard the valley as a tremendous costean, 1200 feet in depth, in the bottom of which the Devon lode is exposed. It is

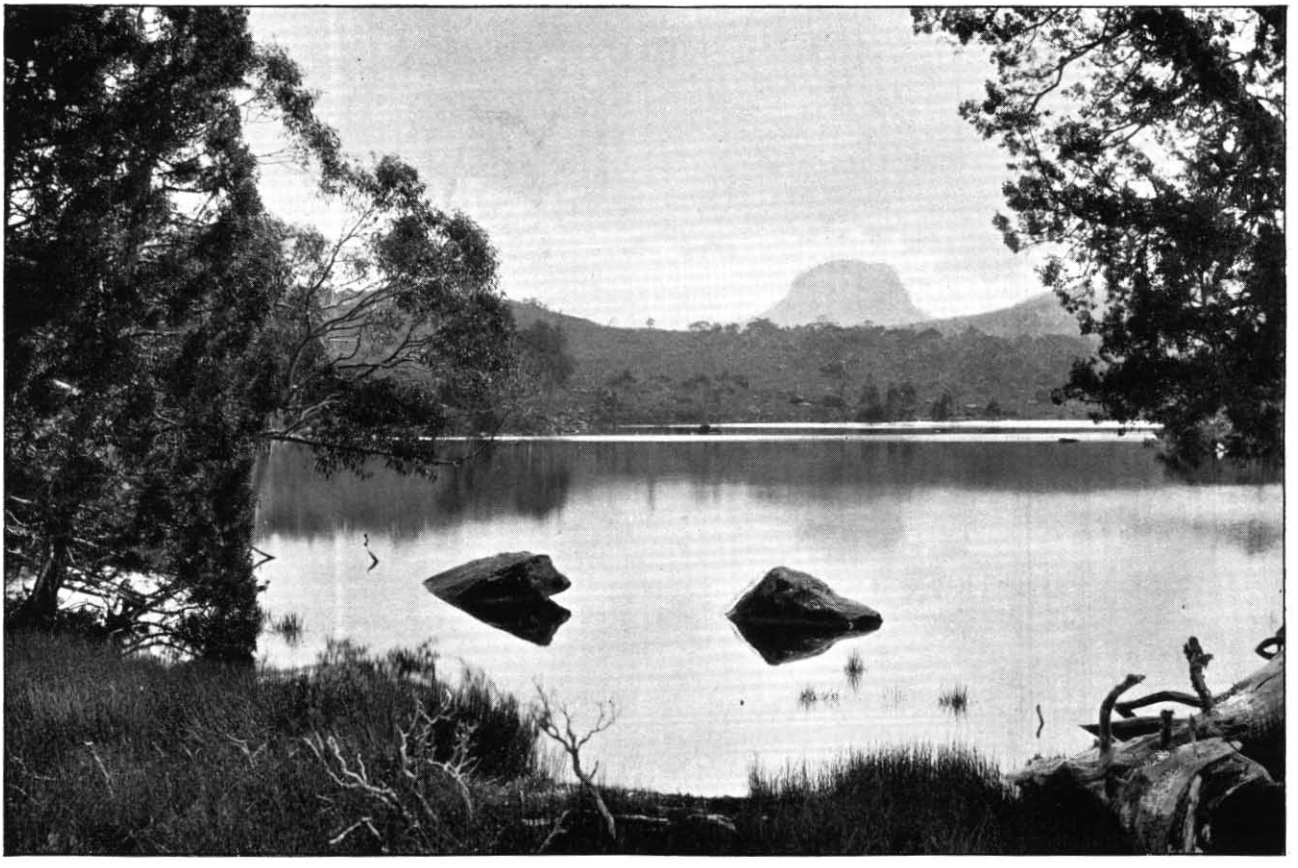
plain that, unless we have a case of enrichment by surface waters, the present surface of the ground can have had nothing do with the presence of galena in the lode, for when the galena was deposited the surface was many hundreds, and possibly thousands, of feet higher than it is at present. I could see no evidence in favour of surface enrichment. The lode, except quite near the surface, was undecomposed. The gangue is either country-rock or crystalline quartz, and there is no soluble mineral present, the removal of which might have caused an enrichment. There is only one possibility, and that is the re-precipitation and concentration of the galena from down-going solutions carrying sulphate of lead. This is a question which has recently been brought into prominence by several American geologists. From a chemical standpoint the reactions have been proved to be possible; but to how great an extent these reactions take place in nature is a question in which there is room for much further investigation.

Other Sections.

The Devon is the only mine in the district which is at work at the present time. And, indeed, very little work of any kind has been done on any other section. T. Davy has a show about a mile and a half below the Devon, on which he tells me there is a lode carrying galena and carbonate of lead, but as he was not in the district at the time of my visit, I was not able to see it. On Section 4665-93M, south and adjoining the Devon, there is also said to be a lode carrying galena, and it may possibly be a continuation of the Devon lode. I was unable to visit it, and I understand very little has, as yet, been done with it. On my way up the river I noticed a small vein of galena crossing the bed of the stream, on Section 1978–93M. This occurs just to the west of a dyke of porphyry, and, though itself valueless, is an indication of the presence of the metal. The contact of the porphyry and quartzite should be prospected here, as this is the most likely place for payable deposits of ore to occur. But the porphyry itself should not be neglected, for we have already the example of the Devon lode which occurs right in the porphyry, though near its contact with the quartzite. Somewhat similar veins of

galena occur on Sections 3287 and 3288–93M, but, as far as I could find out, no defined lode has been discovered. Section 3855–93M, known as the Sirdar Prospecting Association, stands by itself about a mile and a half to the south-west of the Devon mine. The country here appears to be all composed of finely crystalline and laminated mica schist. No eruptive rock occurs on the section: a little work has been done on some small veins of galena, but nothing payable has been discovered. One of these veins has been driven on for about 12 feet, and about 60 lbs. of galena taken out, but it has almost disappeared in the face. I consider it quite useless to spend money in opening up these small veins; they are not the least likely to open up into payable lodes, and are only of value as indicating the presence of the metal. There may be a payable lode in the vicinity or there may not, but certainly where these veins occur is the most likely place to look for lodes. Take the Devon Mine as an example. Here a small vein of metal occurs in the rock, and may very possibly have been the first indication of galena discovered on that property. Had the prospector expended his time and exhausted his resources by sinking or driving on this, it is probable that he would never have discovered the real lode. Fortunately, however, he expended his time on the surface, and uncovered the gossanous capping of the present Devon Mine. Galena lodes of any size are almost always capped with gossan, and the country about is stained with oxide of iron. These are, therefore, the indications which must be looked for, and until they are found the less time and money that is spent in driving or sinking, the better. On the north side of the river, on the Sirdar property, there is a gossan formation which ought to be trenched across, and, if the indications are favourable, should be followed up along its strike. This may possibly be the outcrop of a defined lode, though at present it would be impossible to say.

I consider the field is worthy of much more attention from prospectors than it has yet received. These very old mica schists are mineral-bearing in a great many countries of the world, and in this district there is every reason to believe that good permanent fissure lodes will be discovered. The country is broken through in several



BARN BLUFF, FROM LAKE WINDERMERE.

places by dykes of porphyry and masses of granite, and the tendency of modern geological research is to ascribe more and more importance to these old acid rocks. They are believed to be the principal source of the metals on the West Coast of Tasmania, and that they are metal-bearing in this field is proved by the Devon lode itself, and the numerous veins and stringers of galena which occur in or near them throughout the district.

As regards access to the field, the present track was constructed by the Devon Mining Company (assisted by the Government to the extent of £100) in order to get its ore to market. The grade, as has already been remarked, is very steep, even for a pack-track. A fair grade for a road, or even a tramway, might be got by sidling down the valley of the Dove and Forth Rivers, and this is certainly the only practicable outlet for the Devon Mine and sections in the vicinity. Its construction would stand a good chance of opening up other mines lower down the river. Emerging from the Dove River gorge there are three routes available to obtain railway connection, each of which is strongly advocated by interested parties. The first of these which I will consider is to connect with Mole Creek, *via* Lorinna and Lienna. The distance from the Devon to Lorinna would be about five miles, and, as I have already stated, a good grade is to be had. From Lorinna to Lienna, Gad's Hill has to be crossed. A couple of years back a road was formed between these two townships, but, unfortunately, it was never laid out by a competent surveyor, and it passes over almost the highest point in Gad's Hill. It is useless for cart traffic, the grade being altogether too steep. Mr. Burrows, authorised surveyor, acting on behalf of the Devon Mining Company, has nearly completed a survey of another route. This crosses Gad's Hill about two miles further north at a low saddle, and according to Mr. Burrows report to the Devon Company, besides shortening the distance by half a mile, secures a workable grade all through, the steepest part being 1 in 10, and that only for a few chains. The distance from Lorinna to Lienna would be, by this road, about 7½ miles. From Lienna to Mole Creek the distance is 12 miles over a good macadamised road. It is stated that this road

would have the advantage of opening up about a thousand acres of agricultural land on the western fall of Gad's Hill. Mr. J. C. M'Michael, legal manager of the Devon Mining Company, informs me that the company has offered to pay £300 towards the construction of this road.

The second proposed route would be to connect the Devon Mine with the road already formed to the Shepherd and Murphy Mine. The distance would be about 14 miles, and I think a good grade could be obtained. The objections are that it would involve unnecessary climbing. The road from the Devon Mine will start from near the bottom of the Forth gorge, and this route would involve ascending to Shepherd and Murphy's (about 1000 feet), only to come down again on the same side of the river. The other side of the Forth gorge has then to be climbed in order to reach Railton. The total distance to Railton by this route would be 43 miles, as against 25 to Mole Creek.

The third suggested route is to connect with the proposed railway to be constructed from Railton to Wilmot at its crossing of the Forth River. The distance in this case would be only 12 miles from Lorinna, or say 17 miles from the Devon Mine, but considering that this line will probably not be completed for some years, I think it would hardly be fair to the district to postpone almost all means of access for that length of time. Moreover, Mr. W. R. Reynolds, the engineer in charge of the survey of the Railton-Wilmot Railway, tells me that there are engineering difficulties in the way which would make the construction of this road very expensive.

I am, therefore, of opinion that the first route mentioned, namely, that to Mole Creek, *viâ* Lorinna and Lienna would be cheaper, and serve the district better than any other.

Five Mile Rise Gold Field.

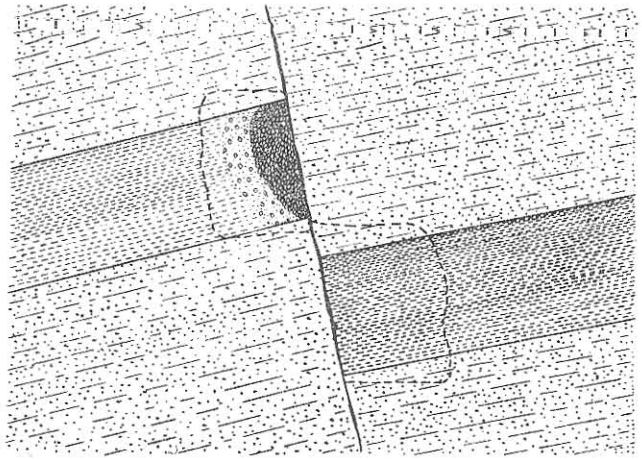
Leaving the Devon Mine on March 4, I made Lorinna my head-quarters for the Five-Mile Rise District. The latter is situated on the western slope of the Forth River Gorge, about 8 miles from Bell Mount. The old V.D.L. track from Sheffield to Surrey Hills passes across the Upper Forth Bridge at Lorinna, and thence up the

Five-Mile Rise to the Caledonian Mine. The geology of the district is very simple. The sedimentary rocks are composed of fucoid sandstone, with thin layers of shale and slate, striking about north-east and south-west, and dipping about 10° to 20° to the north-east. Often the dip of the strata follows the slope of the hill for considerable distances, and, following up some of the creeks, one can trace the same bed of shale for over half a mile, though its thickness does not exceed one or two feet. On the eastern side of the Forth River, we come across limestones and slates conformable with the fucoid sandstones, and overlying them. Above these the sandstones appear again. Granite occurs to the south of the field on the Golden Cliff Mine, this being a portion of the granite belt which runs from the Mersey over Gad's Hill to the Devon Mine. Higher up the Hill the country to the north and south of the rise is overlaid with Tertiary basalt. There has been a considerable quantity of alluvial gold got from the field in past years from the beds of small creeks flowing down into the Forth River; but, at the time of my visit, there was no work going on at all, even O'Rourke's Hydraulic being closed down for want of water. There have been a number of small gold-bearing veins or reefs discovered on the Five-Mile Rise, and many of them contained very rich patches of gold-bearing stone, the richest gold being found in a whitish sandy pug. Some of this is described as being almost yellow with fine gold, but, unfortunately, the amount available has been very small. Quite a number of these reefs have been floated from time to time, and work started with great hopes of success, but not one of them has been able to hold its own. It cannot, however, be said that any of these shows have really had a fair trial. The shoot of gold which was first discovered has been sunk on and soon found to give out, but very little effort has been made to discover others of a similar nature in the same reef. As no one was at work on the field at the time of my visit, I was unable to see as much of the field as I should have liked.

The Golden Hill Mine.

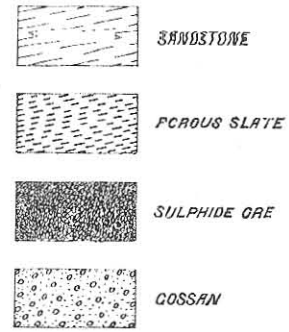
Sections 1476-93G, 1477-93G, 1478-93G, 1475-93G, each of 10 acres, chartered in the name of L. J. Bryant.

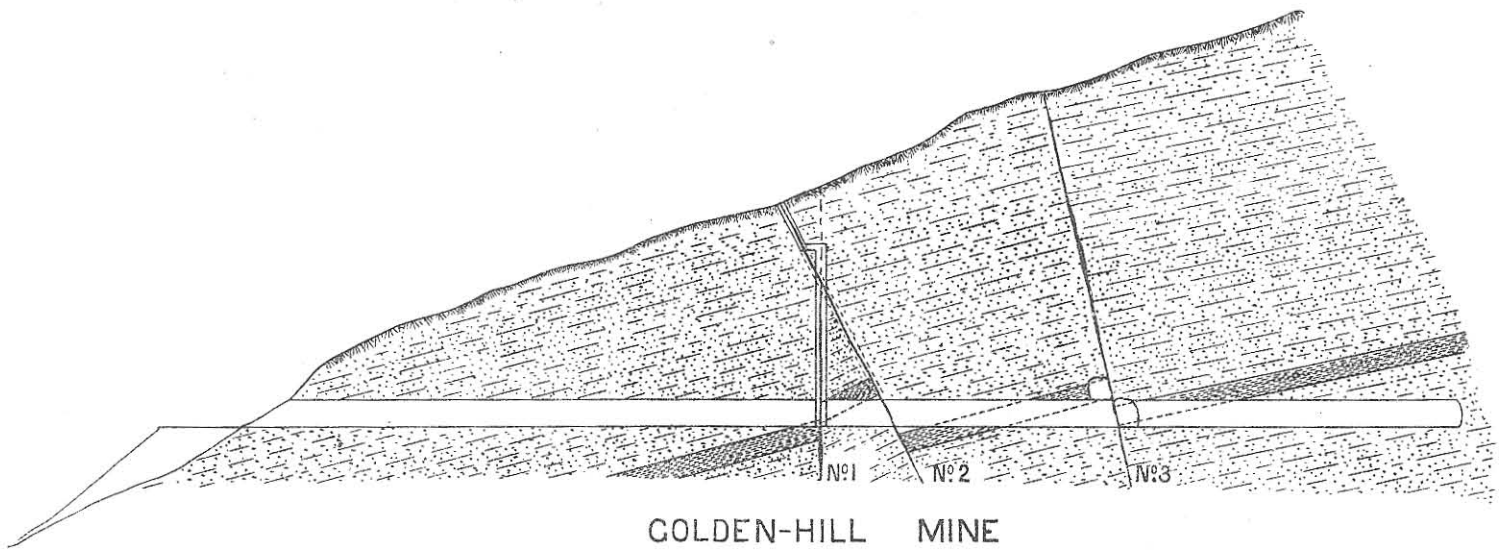
This mine is situated about half a mile south-west of the Forth Bridge, and is connected by means of a tramway, with a 15-head stamp battery, erected on a machinery site on the western bank of the Forth River. The battery was formerly driven by steam-power, but the engine and boiler have lately been removed. The country is similar to that occurring elsewhere on the Five-Mile Rise, and consists of flat-lying fucoid sandstones, with thin seams of shale and slate. The latter have evidently played an important part in the deposition of the mineral matter. I walked up a creek to the north of the mine for some distance. The dip of the strata follows the fall of the hill nearly the whole way, and the water in the creek flows over flat smooth slabs formed by the stratification of the sandstone. On the banks of the creek there is a seam of shale about 15 inches in thickness, which can be traced on either bank of the creek for a long distance. In quite a number of places I noticed that a stream of iron-stained water trickled down from this seam, and in several places small cuts had been put in, revealing the presence of pyrites, and in one place I noticed a little yellow pyromorphite. The mineral in each case was confined to the seam of shale, and often occurred on both sides of the creek. It is evident that this mineral is due to small fissures traversing the country. The shale was favourable to the deposition of mineral sulphides, and became impregnated with the latter from mineral-bearing solutions traversing the fissures. This fact throws considerable light upon the occurrence of sulphide ore in the Golden Hill Mine. Plate II. gives a sectional sketch of the formation and mine workings. A tunnel has been put into the side of the hill, cutting three small veins or fault fissures numbered 1, 2, and 3. These fissures are apparently nearly parallel as to strike, the latter being about north-east and south-west, and dip as shown in the sketch. The throw of the faults is very prettily show by tracing out the position of a seam of porous sandy shale, about 4½ feet in thickness, which occurs in the sandstone. Going into the workings, this seam is first seen in the bottom of the tunnel, dipping underfoot, and striking at right angles to the course of the tunnel. It is faulted upwards by No. 1, and on the other side of the fissure appears in the roof. Going on to No.



ENLARGED SECTION ON FORMATION Nº3

NOT TO SCALE





GOLDEN-HILL MINE

SECTIONAL SKETCH OF COUNTRY AND MINE-WORKINGS

PLATE 2.

Scale 10 5 0 10 20 30 40 50 60 70 80 90 Feet

G. O. Wallis
Assistant Government Geologist.

5 cm

2, the shale gradually disappears overhead, but reappears in the floor of the tunnel as soon as the fissure is passed. No. 2 is, therefore, a down-throw fault. The seam again gradually rises in the tunnel until No. 3 is reached, when it is again faulted downwards; after this it finally disappears overhead. All this may be readily seen by consulting the sectional sketch on Plate II. Where cut in the tunnel, these three veins or fissures are very small, not more than two or three inches in width, and filled with sandy pug and a little reef quartz. No. 1 has been risen on for about 40 feet, but no further work has been done upon it. No. 2 vein has widened out very considerably towards the surface, and has been underhand stoped for, perhaps, 150 feet. The stopes are now mostly full of water, and I could form very little idea of the nature of the reef; there are apparently two well defined walls about 18 inches apart. Mr. L. J. Bryant tells me that two crushings were taken out, which gave an average return of 7 dwts. of gold per ton. An underlay shaft was also put down on the vein, but as this was full of water, I could not examine it. A sample of gossan from the end of the stopes, assayed by Mr. W. F. Ward, Government Analyst, gave a return of 18 dwts. 19 grs. of gold and 1 oz. 19 dwts. 5 grs. silver per ton. The vein was about six inches in width at this point.

No. 3 vein has been driven on for a distance of 75 feet from the tunnel, the drive following the seam of sandy shale all the way. The latter has been faulted by the vein, and appears again on the left-hand side just above the drive. One stope has been taken out along this seam, and in the end of the stope about 2 feet of solid sulphide ore, composed of zincblende and iron pyrites, is showing. An enlarged section of the formation at this point is given in Plate II. The sulphide ore is confined to the seam of porous shale which runs horizontally with the stope, and, therefore, forms a horizonal shoot. To the left of the sulphide body there is a foot or so of nice-looking gossan, and for 10 or 15 feet further the shale is much iron-stained. The gossan is evidently caused by the oxidation of the sulphide body by surface waters travelling along the bed of shale.

Four samples were taken from this formation, and were assayed by Mr. W. F. Ward, Government Analyst, with the following results :—

	Gold per ton.		Silver per ton.		
	dwts.	grs.	ozs.	dwts.	grs.
No. 1.—Bulk sample of sulphide ore	4	2	1	4	2
No. 2.—Bulk sample gossan from end of stope next sulphide ore	1	6	0	19	15
No. 3.—Bulk sample gossan and iron-stained shale from side of stope...	Trace		0	2	11
No. 4.—Bulk sample quartz and pug from No. 3 vein	15	12	5	19	5

The results are disappointing, and not as high as the whole of the ore token out of the stope is said to have bulked when treated in the battery. Mr. L. J. Bryant tells me that two crushings were made, the first of which yielded 12 dwts. per ton, and the second 7 dwts. The difference may probably be accounted for by the presence of rich patches, which have raised the average contents of the ore to the figures stated The gossan is said to have been extremely rich in places,

The occurrence of the sulphide ore in the bed of shale is an interesting case of the influence of the country-rock in the deposition of minerals in lodes. It is evident that the fissure vein has acted as the channel through which mineral-bearing solutions circulated. The shale was of a favourable nature, and became replaced by mineral sulphides, which, probably owing to the insoluble and dense character of the sandstone, and also possibly to the absence of a precipitating agent, were not precipitated in this rock. It need hardly be said that the sulphide body cannot be expected to live down; its presence in the vein is entirely dependent on the seam of shale whose strike is approximately the same as that of the fissure vein; but it is quite possible for other similar shoots to be met with in depth. In all probability, other parallel seams of shale occur which have a similarly favourable influence on the mineral contents, but I cannot regard the prospects of the mine as at all encouraging. Were such seams abundant, they would be more noticeable on the surface than is the case, and unless they are abundant the shoots of ore would never pay to mine. It is true free gold occurs in the veins where the shale is absent, but, as far as I have seen

them, they are too small to work. The rich gold is described as occurring in soft sandy pug, and we do not know how much this has been enriched by mechanical concentration. Where the gold occurs in the quartz it is not very rich, and the veins are very small.

The Golden Cliff Mine.

This mine is now held under prospecting licence by Mr. E. O'Rourke. It is situated about a mile south of Lorinna. A cliff of hard sandstone rises from the valley of a small creek, and forms the northern wall of the granite belt which crosses the country from the Mersey to the Devon Mine. In this cliff a small reef or vein of quartz occurs, carrying very fair gold. The width of the vein, where exposed, is only 2 or 3 inches. Mr. O'Rourke is putting in a tunnel below the cliff in broken country, in which he finds fragmentary pieces of quartz, carrying gold. A sample from these pieces, assayed by Mr. Ward, gave a return of 1 oz. 7 dwts. 11 grs. gold per ton. The tunnel is being driven, approximately, on the course of the reef, and when the unsettled country has been passed through there should not be much difficulty in finding it. The country, where settled, is very hard, and I doubt very much if the reef will be found to be payable.

The Glynn Mine.

This mine was deserted at the time of my visit, and I could obtain no information as to the results obtained. The mine workings were left in a very bad state, a lot of the ground having fallen in, making a thorough examination impossible. A five-stamp battery has been erected, and, apparently, several crushings made. The stopes have been taken out very wide—over six feet in places—and the western wall is well defined, but at the ends of the stope the reef appeared to be only about six inches wide. It was filled with a sandy pug, containing some quartz. The country is composed of a soft, shaly sandstone, rather more favourable, I should say, than that which I have observed elsewhere in this district.

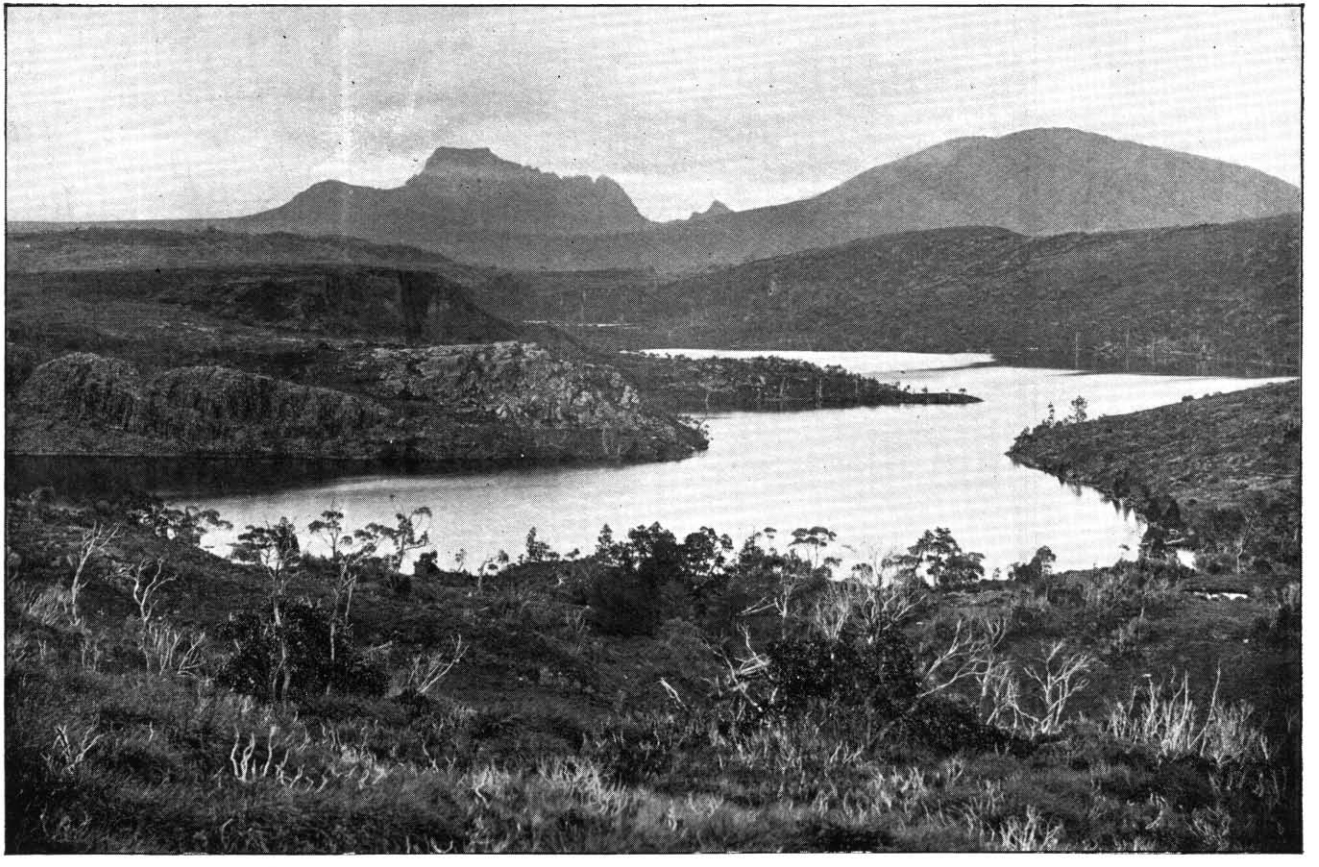
O'Rourke's Hydraulic.

This is a small mine which has been successfully worked by the owner for the last six or seven years,

whenever the water supply permitted. The mine is situated to the north of the V.D.L. track, just opposite the turn-off to the Devon Mine, on what is known as Sunday Creek. The water supply, which is only available in wet weather, is taken from another creek to the north. A small dam has been constructed just above the run of wash, and from this the pressure main comes down along the deposit. The run of wash is, perhaps, 500ft. in length by two or three chains in width, and up to 10 or 12 feet in depth. It is composed, for the most part, of angular sandstone wash, the bottom portion of which is firmly cemented together, and has to be shot out. The gold is generally coarser than that found elsewhere on the Five-Mile Rise. It often contains quartz, and is quite angular, and sometimes flaky. Angular pieces of lode quartz are also met with in the wash, in some of which visible gold is present. The central gutter has been worked up to within a chain or so of the dam, but Mr. O'Rourke tells me that the greater part of the remaining wash is payable, his object in working up the gutter being to locate the source of the gold, which he thinks will prove to be a payable quartz reef. In this there should be no great difficulty, as the gold has, evidently, not travelled far.

Other Sections.

There have been several other mines in the district, all possessing essentially the same general characters as those already described. The Caledonian Mine is situated at the top of the Five-Mile Rise. This mine started on a rich vein of gold-bearing pug, which soon changed into a small quartz reef. A fifteen-head battery was erected (subsequently removed to the Golden Hill Mine), and a crushing of 200 tons put through. This is said to have yielded 12 dwts. to the ton, but, on account of the narrowness of the reef, it did not pay for the mining. The old Union Mine, a little west of the Golden Hill, and Campbell's Reward, about three miles north of Lorinna, were of the same character. On the whole, I cannot think the country is likely to contain any large and payable reefs. The creeks have all been well prospected for alluvial, and although this is widely distributed, it occurs nowhere in very large quantities. Where it has been worked it has



LAKE AGNEW AND CRADLE MOUNTAIN.

usually led up to some small reef similar to those which have been described, and I think it is probable that these will account for all the gold that has been shed.

Forth Bridge to Barn Bluff, via Mount Pelion.

On March 6th, I left the Forth Bridge for the Barn Bluff. The only route at present available is along Innes' Track from Lienna to Rosebery. The track is most circuitous. From Lienna it ascends on to the divide between the Mersey and the Forth rivers, and follows this in a southerly direction for about 20 miles, until the eastern end of Mount Oakley is crossed. Then it descends in a westerly direction to Lake Ayr, at the foot of East Pelion, passes round north end of West Pelion, and then runs in a north-westerly direction to the Barn Bluff. Along the track, the distance from Lienna to the Barn Bluff Copper Mine is about 46 miles, but as the crow flies it is not more than 16 or 17. Besides being very circuitous, the track has many other disadvantages. The divide between the Mersey and Forth rivers is at an elevation of from 2500 to 3250 feet above sea-level, and in winter a large part of this is covered with snow, absolutely prohibiting all traffic. Much of the track is also very boggy, and, after Mount Pelion is passed, traverses button-grass swamps for several miles. Very little traffic passed along this track until the Barn Bluff Company started operations, some four months ago, and even now the pack-horses only go along the track about once a week; but this has been sufficient to make the track quite dangerous in parts. The greater portion of the track has only been pegged out, and much of it passes over swampy ground, which is only covered by a thin crust of vegetable matter. This soon becomes broken through, and a dangerous bog-hole is produced.

The northern end of the divide between the Mersey and the Forth is known as Gad's Hill. Here the country is all overlaid with basalt, with the exception of a belt of granite passing across the northern end of the hill, and which has already been referred to. Gad's Hill is about ten miles in length. South of this, the track enters fucoid sandstone country for about four miles (Lemonthyme Hill), until the Berriedale Plains are

reached, when the country is again overlaid with basalt. This continues for, perhaps, another couple of miles, and for the remainder of the divide, a distance of 12 miles, the country is composed of dolerite. This rock is also a capping, the Forth and Mersey gorges on either side being cut into sandstone or schist. Descending from the plateau to Lake Ayr, we enter the horizontal strata of the lower coal measures.

The geology of the country in the vicinity of Lake Ayr and Mount Pelion is very interesting. Plate III. gives a sketch map (for which I am indebted to the kindness of Mr. G. R. Bell) with a rough geological section of the Pelion Group of Mountains. As will be seen, there are in this group six good-sized mountains, separated by high saddles, only two of which have received separate names. The un-named mountains I have numbered 1 to 4, in order to facilitate reference. The geology of all the mountains in this part of the State presents essentially the same features. The lowest rocks are highly-inclined schists of, probably, Archæan age. Above these come horizontally-stratified conglomerates, sandstones, and shales belonging to the Lower Carboniferous period. The thickness of these strata at Mount Pelion I estimate at from 1200 to 1500 feet. Above these again, and forming the capping of all the mountains in the district, is a layer of columnar greenstone (dolerite) from 500 to over 1000 feet in thickness. In the Pelion group, the saddles between the separate mountains are in carboniferous strata. Mount Pillinger and Ragged Mountain, to the east of Mount Pelion, The Du Cane and Eldon Ranges to the south, Mount Oakley, Barn Bluff, Brown Mountain, and Cradle Mountain, to the north, all present essentially the same geological features. Viewing the country from the top of one of these mountains, the deduction is almost irresistible that these now isolated masses of dolerite once formed part of an enormous sheet covering the country in all directions. If this view is correct, the area of the sheet must have measured at least some hundreds of square miles, and its depth from 800 to over 1000 feet. According to the latest theory as to the origin of the dolerite, it is supposed to have been inserted between horizontal layers of sedimentary rocks in the form of great laccolites, or sills. However well this theory may

hold for other parts of the State, I am not of opinion that it is tenable in this. A laccolite having an area of hundreds of square miles is, of course, impossible, and I cannot believe that each of these mountains represents a separate sill, connected with an internal reservoir by means of a separate volcanic neck. Were such the case, dykes, or fissures, or some decided evidence of disturbance, would be noticeable along the well-exposed slopes of the Pelion Group; but such is not the case. The coal measures are singularly undisturbed, and are not broken through by any eruptive rocks. Wherever the eruption of dolerite took place, it must have been at some distance from any of the Pelion group of mountains. I shall not discuss this question further in the present report. It is to be brought forward at the next meeting of the Australasian Association for the Advancement of Science, to be held in Hobart in January next, and then, no doubt, many more facts concerning this interesting rock will be brought to light.

Coal at Mount Pelion.

Two seams of coal have been discovered in the Pelion Group of Mountains. The first one which I examined was exposed in several trenches on the eastern slope of West Pelion, and in one place a tunnel, 20 feet in length, has been put in on the seam. The latter is, apparently, horizontal, and about 17 inches in thickness. It is composed of a bright firm black coal, containing, unfortunately, considerable quantities of pyrites. A bulk sample taken down the face of the seam, and analysed by Mr. W. F. Ward, Government Analyst, gave the following result :—

Fixed Carbon, Ash — Coke		52·0 per cent.
		17·1 „
Gases, &c., lost at red heat		19·6 „
Sulphur		10·5 „
Moisture lost at 212° F.		0·8 „
		100·0

The unusually high percentage of sulphur would probably render the coal useless for economic purposes.

The second seam has been found outcropping on the northern slope of No. 3, Mount Pelion. On the north-western end of this mountain a tunnel has been put in on the seam for a distance of 50 feet. The seam is split into

two parts at this point, separated by about 4 inches of carbonaceous shale, the upper portion being about 5 inches in thickness, and that of the lower 21 inches, excluding a few inches of very poor coal on the floor of the seam. This makes a total of 26 inches of coal. A bulk sample taken at this point gave, on analysis, the following result :—

Fixed Carbon } Coke ..... }	54·6	per cent.
Ash }	20·2	„
Gases, &c., lost at red heat	22·5	„
Sulphur	0·6	„
Moisture lost at 212° F.	2·1	„
	100·0	

I was surprised at the large percentage of ash present, as the coal had the appearance of being singularly pure and homogeneous. I am inclined to think it must be in part due to the accidental inclusion of some of the carbonaceous shale in the sample. This, of course, might be eliminated during the process of mining. In other respects the result is very satisfactory. About 20 chains to the east of the above tunnel another opening has been made 20 feet in length into the same seam. It is not split into two parts at this point, one seam 22 inches in thickness being seen. The floor of the seam is composed of shale, and the roof of firm sandstone. The same seam has been traced, by means of small trenches, round the slope of the mountain to the west side of East Pelion. Here it is said to be about 18 inches in thickness, though I did not examine it at that point. The seam is 900 feet above the one found on West Pelion, and, in all probability, might also be picked up on that mountain. The seam is too small to be payable at present, even if the ash contents proved to be satisfactory, but if a local demand sprang up through the development of metal-mining in the district or at Barn Bluff, it is probable that the seam would then become payable.

Mount Pelion Copper Mines.

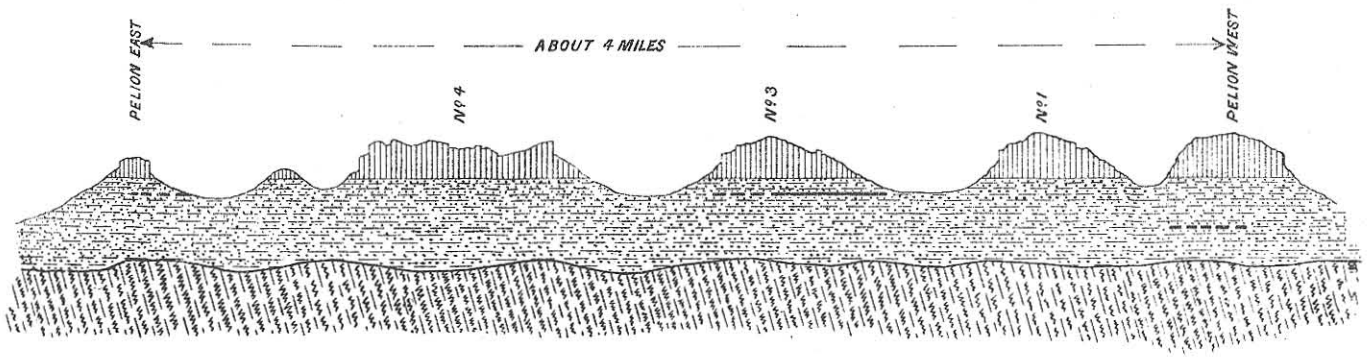
These mines, which I believe have been shut down for some years, are situated in a belt of schist country between East Pelion and Mount Oakley. Time did not permit me to locate the shows on the different sections. Several veins, carrying copper pyrites, were examined on the south

GENERAL SKETCH OF THE PELION GROUP OF MOUNTAINS

PLATE 3

G. A. Waller
Assistant Government Geologist

5 cm



IDEAL SECTION PELION GROUP OF MOUNTAINS

COLUMNAR GREENSTONE (DOLERITE)

CARBONIFEROUS STRATA
CONGLOMERATES
SHALES & SANDSTONES

SCHISTS

COAL SEAMS

side of the creek which flows from Lake Ayr into the Forth River. These have been trenched across, and sunk on for short distances in several places, but as the holes were all full of water at the time of my visit, I could only examine their outcrops on the surface. They seem all to consist of small veins and bunches of iron and copper pyrites, pyrrhotite, zinc blende, and quartz. The most easterly of these veins is the largest. On this a shaft has been sunk, from which a good many tons of ore have been obtained. It consists mainly of iron pyrites, zinc blende and hematite, with a little copper pyrites. The strike is north and south, and on the surface the vein is from 1 to 2½ feet in width. The eastern wall of the vein is well defined, but I could see no western wall, and think the metal is due to the replacement of the country-rock on this side. About 30 chains north of these veins another lode, or probably, a continuation of one of those already described, has been discovered. The formation has more of the appearance of a true lode than any of the others. It also strikes north and south, the dip being 60° to the west. A small open cut has been made upon it, and in the centre of this a shaft (now full of water) has been sunk. On the surface the lode is about 5 feet wide, and consists, for the most part, of quartz, with bands of zinc blende and iron pyrites up to 18 inches in thickness. The country is low-lying, and could only be tested by sinking. Under these circumstances, and considering the by no means encouraging results which have so far been obtained, I doubt if it will be worth while to spend more money upon it. There is, however, every possibility of payable lodes existing in the locality, as the country is of a favourable nature, and the failure of these should not be allowed to discourage prospecting in the locality.

The Barn Bluff Mining Field.

This field has been brought under prominent notice during the last few months by the discovery of several large deposits of copper-bearing pyrites. The field is situated to the east of the Barn Bluff, between that mountain and the Forth River. The country consists mainly of finely laminated schists, striking for the most part about 80° west of north, and sometimes due east and

west. The dip is variable, and it is probable that a careful survey would disclose a series of anticlines and synclines. The whole country shows very marked evidence of prolonged glacial action, large areas being covered with glacial *débris* and erratic boulders of greenstone (dolerite) being met in all directions. *Roches moutonnèes* are not uncommon, and lakes varying in size from an acre or two to several hundred acres are very abundant. Superficially the country strongly resembles the Lake Dora district.

The rock most frequently met with is a strongly foliated quartz schist. This consists principally of quartz, but contains a good deal of hydro-mica, the flat particles of which are arranged in parallel layers, giving to the rock its foliated structure. The fine laminæ are very prominent on the weathered surface of the rock, but are by no means so distinct on the fresh fracture. I think that quartz schist is a more appropriate name for the rock than quartzite, the term by which the rock is locally known, as it lays more emphasis on the schistose character. The rock occurs in long bare ridges all over the country, the intervening flats and hollows being covered with button-grass or scrub, or being occupied by small lakes. This causes the rock to appear in greater abundance than is really the case. I think it will be found that the softer schists are really in greater abundance than the quartz schists, but these being softer have been worn away by the erosive action of the glaciers, and, therefore, are now hidden from view beneath the button grass and glacial *débris* of the low-lying ground. Crystalline mica schists, hydro-mica schists, and argillaceous schists are all represented. I also noticed a nodular schist containing very numerous siliceous nodules about the size of a walnut. The latter stand out on the weathered surface of the rock, giving it a very striking appearance.

I believe these schists are of archæan age, and that the same line of country extends in a northerly direction as far as the Devon Mine. The Mount Pelion schists are also of the same age. It may be worth recording, in this place, that at the 29-mile peg on Innes' Track, a boulder is to be seen consisting of coarsely crystalline gneiss. The latter has evidently been transported by ice, but must have come from somewhere in the district. Its occurrence may be an additional proof of the ancient character of the rocks in the district.

The Barn Bluff Gold, Silver, and Copper Mining Company, No Liability.

C. P. Smith, Mining Manager. This company holds Sections 4920-93M and 4921-93M, each of 80 acres. They are situated about 4½ miles south-east of Barn Bluff, and the mine workings are in the valley of Commonwealth Creek, a tributary on the west side of the Forth River. The mine was discovered by H. Andrews and J. Swallow about two years ago, but, with the exception of some surface trenching, no work was done until the present company took over the property.

Plate IV. gives a geological sketch map of Section 4920. I wish to lay particular stress on the fact that this is only a *sketch* map as far as the geological features are concerned. The mine workings are plotted approximately correctly, but it was impossible for me to locate, with much accuracy, the lines of contact of the different rocks. The ground is largely covered with button-grass, scrub, and detrital matter, and often it happens that where one most wishes to find an exposure, there the rock is most effectually concealed. The strike of the country is approximately shown by the lines or dots representing the various rocks. But as this varies considerably, especially in that belt of country which is shown running diagonally across the section, an accurate representation could not be made by this means. In all essential particulars, however, as far as the present report goes, the chart will be found to represent the geological features of the mine with sufficient accuracy. It will be seen that two creeks flow through the section—Cook's Creek flowing along the northern boundary, and Commonwealth Creek about 10 chains to the south. It is on the spur between these creeks that the mine workings are situated. To the south of Commonwealth Creek the ground rises steeply for over 500 feet, the highest point being known as the Big Knob. The greater part of the section is composed of quartz and other schists, striking from 80° to 90° to the west, and dipping either vertically or steeply to the north. The rock is frequently traversed by veins of white quartz striking north-east and south-west, and a few chains north of the section a small dyke of basalt, 4 feet in width, is beautifully exposed in the bottom of a creek, striking in the

same direction as the quartz veins. A microscopical examination of this basalt proves it to be very fresh olivine basalt, and evidently of Tertiary age. Crossing the section diagonally from the north-west corner to the south-east, is a very remarkable belt of country striking approximately 45° west of north. Along the south-western wall or boundary of this formation there is a band of chlorite schist, perhaps two chains in width, which can be traced in a straight line right across the section. To the north-east of this band, in the vicinity of the mine workings, a hard, dense, dark green rock occurs, also containing chlorite, and strongly impregnated with crystalline iron pyrites, and also containing copper pyrites. This occurs in bands running parallel to the chlorite schist. North-west of this again we find a greyish-green rock, easily scratched with the knife, and probably containing both chlorite and stealite. I think that both these rocks are of the same nature, and propose the provisional name of chlorite rock until their precise character has been determined. Actinolite rock also occurs in some of the trenches in this belt. Further south along the belt I did not notice the chlorite rock, though it is quite possibly present. The Big Knob is composed of highly foliated quartz schist, very strongly crumpled, and striking in all directions. On four different places along the south-western wall of the chlorite belt, outcrops of white quartz are noticed. They consist of a mass of thick veins of quartz, containing numerous druses of crystals. They are approximately in a straight line, and occupy the same geological position in relation to the chlorite belt, and are evidently connected therewith. As will be seen by the chart, more than half of the mine openings have been made to the east of this chloritic belt. Here the country is composed of alternate bands of quartzite, or quartz schist and actinolite rock. The latter, when free from the presence of pyrites, is composed of fine fibres of actinolite, malted and felted together in a very compact manner, making the rock extremely tough and difficult to break with the hammer, though it is easily scratched with the knife. Both these rocks are often very heavily charged with mineral, dense bands of pyrrhotite, iron pyrites, or micaceous iron and iron pyrites, all containing a little copper pyrites, and sometimes the latter in considerable quantities, occur over the whole area which

has been opened up. The dense pyrrhotite occurs more frequently in the quartzite than in the actinolite, and has the appearance of having replaced the latter metasomatically, there being no definite line of contact between them, but rather a gradual passing over from the quartzite into pyrrhotite, the intervening rock being composed of quartzite, more or less heavily charged with pyrrhotite. The pyrrhotite generally contains a little copper pyrites distributed through it in fine strings, and sometimes in considerable quantities. The actinolite rock appears to be richer in copper than the quartzite, and to be more generally associated with iron pyrites than with pyrrhotite though bands of the latter also occur in the actinolite rock. In several places I thought I detected the fine fibres of actinolite all through the otherwise dense whitish iron pyrites, or mixture of iron pyrites and micaceous iron. This might be taken as pointing to the replacement of actinolite rock with pyrites. This also contains a little copper.

The eastern portion of the chloritic belt is also very heavily charged with pyrites and micaceous iron, and usually, though not always, the dense metal is associated with actinolite, the latter often occurring in long bundles of radiating fibres. Altogether, the deposit exhibits some novel and most interesting phenomena, and it will not be till much more work has been done that any adequate theory of its origin can be put forward.

The Barn Bluff Company started work on the formation on the 12th of January last, and immediately commenced vigorously opening it up by means of a series of open cuts and trenches, with the object of ascertaining the nature and extent of the formation. Considering the very short time that the company has been at work (at the time of my visit, a little over 2½ months), the amount of work done is most creditable, but, as yet, the extent of the formation is merely a matter of conjecture. The open cuts and trenches extend over an area, the extreme dimensions of which are 9 chains long by 7 chains wide. In all of these the country is more or less mineralised. There has, however, been nothing done, as yet, to show how far the deposit extends to the south and west of these workings. In both these directions the metal appears to be going just as strong and massive as anywhere else. The principal

openings are charted on the map, and, to facilitate reference, I have lettered them with capitals. Openings A to L are situated east of the chloritic belt, whereas M to T are situated either in this belt, or near its margin.

Open cut A discloses a seam of pyrrhotite, containing a good deal of copper pyrites and some arsenical pyrites, about 2 feet wide. Copper contents improve in the bottom of the cut, which is about 7 feet in depth. Strike is east and west, and dip vertical; north and south walls are quartzite. The Manager tells me that a sample from this cut, assayed by Mr. Ward, Government Analyst, yielded 9½ per cent. of copper, as well as some gold and silver.

Open cut B.—About 12 feet wide. The face is mostly composed of solid pyrrhotite, with copper and arsenical pyrites distributed through it, also a good deal of quartzite and actinolite rock, the latter containing copper pyrites in bunches. Strike of formation east and west.

Open Cut C.—About 10 feet wide in solid actinolite rock, with iron and copper pyrites in bunches. A little talc and stealite also present.

Open Cut D.—Very solid metal is exposed here. It consists of whitish iron pyrites apparently replacing actinolite. It is poor in copper.

Open Cut E.—Subsoil is deep here; from the bottom of the cut a good deal of solid iron pyrites and a little copper pyrites has been obtained.

Open Cut F.—This cut exposes a solid mass of pyrrhotite and copper pyrites about 4 feet in thickness. The country is much disturbed here, and it is probable that this, as well as Cuts D. and E., are very near the eastern margin of the chloritic belt. In none of them could the strike be determined with certainty.

Open Cut G.—About 23 feet wide. Face up to 10 feet high. The centre of the face is taken up with a band of quartzite about 12 feet wide, running east and west. To the north of this there is a band of good copper-bearing rock 2 to 4 feet wide, and consisting of decomposed actinolite rock, with a good deal of micaceous iron and copper pyrites. The copper appears to be improving in the bottom of the cut. To the south of the band of quartzite there is another band of mineral-bearing rock of similar nature to the other, but not so rich in copper. A few tons

of good oxidised copper ore has also been got from the cut. It consists of malachite, azurite, micaceous iron, and limonite, with, probably, some cuprite distributed through the decomposed actinolite rock.

Open Cut H.—About 20 feet wide. Depth of face 15 feet. In the centre of the face there is a band of very dense pyrrhotite, with a little copper. Also contains whitish iron pyrites which tarnishes yellow. This appears to be due to the replacement of quartzite. Its width is about 4 feet. To the north of this is a finely malted actinolite rock, carrying small bunches of copper pyrites and micaceous iron. The two minerals appear to be closely associated, the latter forming the margin, and the former the centre, of the bunch. This band extends into cut G., making the total width about 20 feet; but the copper contents decrease towards the northern wall. Here also the copper contents improve in the bottom of the cut.

Open Cut K.—This is a small cut about 4ft. in width, and exposes a band of whitish pyrites the full width of the cut. The mineral here appears to be replacing actinolite rock.

Open Cut L.—Seven feet wide; subsoil deep. In bottom of cut, quartzite and greenish black rock carrying nice copper pyrites, showing.

Open Cut M.—Exposes actinolite rock heavily charged with iron pyrites. The strike is 40° west of north.

Open Cut N.—Country consists of a hard dark green rock (chlorite rock), with a little actinolite, carrying a good deal of iron pyrites and micaceous iron, with a little copper. The strike is probably west of north.

Open Cut O.—In dark greenish black rock (chlorite rock), a good deal iron-stained, much of it being strongly impregnated with micaceous iron and a little iron and copper pyrites.

Open Cut P.—Trench on top of hill in dark green rock, a good deal decomposed, and exposing in the bottom a good deal of iron and a little copper pyrites.

Open Cut Q.—Hard greenish black rock (chlorite rock), carrying pyrites distributed through it freely in cubical crystals. A lot of dense, whitish iron pyrites is also present, but very little copper; also, dense pyrrhotite and micaceous iron.

Open Cut R.—A shot or two has been put in here, exposing dense whitish iron pyrites and micaceous iron, accompanied by a little decomposed actinolite rock; there is very little, if any, copper present, but the cut is quite superficial.

Open Cut S.—A couple of shots have been put into the edge of the creek at this point, and expose a massive body of stone, consisting of whitish iron pyrites and micaceous iron, replacing actinolite or chlorite rock. A little copper is also present.

Open Cut T.—Here a few shots have been put in, in the bottom of the creek, exposing similar stone to that found in S. The pyrites occurs in strings and bunches all through the rock. The groundmass appears to be composed of actinolite fibres and chlorite, there is also some micaceous iron present, and a little copper.

The above description includes all the most important openings which have been made in the deposit, but between these there have been a number of smaller openings made, and with results similar to those described. Speaking of the deposit as a whole, it may be described as an immense deposit of pyrrhotite, iron pyrites, and micaceous iron, occurring in massive bands in the country rock, all containing a little copper pyrites, and in places the latter mineral is exposed in payable quantities. The bulk of the deposit, however, as far as the present very shallow openings have shown, is very poor. In many of the cuts the copper contents are better in the bottom of the cut than on the surface, and I hold the opinion that there will be a further improvement as greater depth is gained. The mine is well worth vigorous prospecting. This can only be done effectually by tunnelling. The spur on which the present cuts are located should be driven under at as great a depth as possible, and another tunnel should be put into the hill to the south of Commonwealth Creek. The deposit is shown to be crossing the creek strongly in cuts S. and T. How far it extends cannot at present be estimated, and it cannot be economically ascertained by trenching, owing to the heavy overburden of detrital matter that has fallen from the "Big Knob." More trenching, however, is required to the east of the present cuts to determine how far the deposit extends down the spur between Commonwealth and Cook's creeks.

As far as the chloritic belt running diagonally across the strata of the country, and the actinolite rock occurring in this belt, and also apparently forming spurs from it parallel to the strata are concerned, I have endeavoured to describe their occurrence as accurately as possible. It is probable that before their geological relations can be determined we must wait until the processes of mining enable us to examine their occurrence more fully, and until a more accurate and complete survey is made than was possible during my visit. I cannot, however, refrain from expressing the opinion that both these rocks are derived from some old eruptive rock. There appears to me to be no other explanation of the comparatively narrow band of chlorite schist running across the general strike of the country. The rock has, of course, undergone intense alteration. Chlorite is a secondary mineral derived from other ferro-magnesian minerals such as actinolite, hornblende, olivine, &c., of which many basic eruptives are almost entirely composed. Rosenbusch, the great authority on petrology, ascribes the origin of chlorite schist and actinolite rock to the alteration of such eruptives. The position of the actinolite rock apparently forming spurs from the chlorite belt as well as occurring in that belt itself is very difficult to explain, and, certainly, it would be premature to enter into any speculative details as to how it came into the position it now occupies.

Whatever may have been the origin of the chlorite and actinolite rocks, one thing is certain, namely, that the deposit of copper-bearing minerals is intimately connected with them. This is proved by the fact that on the only two other mines which I was able to visit in the district on which copper ores had been discovered, the same rocks were associated with the same minerals, and in each case the occurrence is of a very similar character. In the whole of the district the direction of fissuring is consistently north-west and south-east. This is not only shown by the belts of chloritic rock, but is also evidenced by the occurrence of very numerous veins of white quartz crossing the strata in the same direction, and also by the small dyke of Tertiary basalt, whose strike is approximately the same as that of the chlorite belt. Both the white quartz and the Tertiary basalt occur as the filling of fissures, and the latter goes to show that the direction of

fissuring was preserved until a comparatively recent geological period.

The North Barn Bluff Mine.

T. Cook, Mining Manager. This company holds Section 4954-93M, north-west and adjoining the Barn Bluff Mine. The belt of chloritic rock which crosses the Barn Bluff Company's northern section, continues into this section, and the quartz formation, already alluded to as being connected with the chloritic belt, also occurs here, as shown on the sketch map (*Plate IV.*). I could not, however, find the continuation of the band of chloritic schist which runs so continuously through the section to the south, though it may quite possibly be here, as much of the rock is covered with button-grass. The chloritic rock is hard, and dark green in colour, similar to that found in open cut 2 in the Barn Bluff Mine. It is strongly impregnated with iron pyrites, and a little copper pyrites also occurs. Several cuts have been put in to the sides of the hill to the east of Cook's Creek, cutting bands of iron pyrites in this rock. Quartzite is also met with in this creek. It is now proposed to test the formation at a greater depth by means of a tunnel from the creek.

Section 4669-93M.

Charted in the name of Lord, Swallow, and Erickson. This section is situated about a mile and a half south-west of the Barn Bluff Mine. The general geological features are essentially the same as the latter, the general strike of the country being 80° east of north. On the eastern side of a good-sized creek flowing through the section a small vein of copper pyrites has been discovered, and traced by means of trenches for five or six chains along its course. The width of the vein varies from three inches up to about nine inches, and the strike is about north-east and south-west. The western wall of this vein is composed of a chloritic rock of a similar nature to that found on the Barn Bluff Mine, and striking in the same direction. On the hillside to the east of the vein of copper pyrites there are numerous boulders of porous limonite, or bog-iron, and a few shallow trenches have been

sunk with the object of testing the ground, but none of these have bottomed the subsoil, which in this place is rather deep. The section is well worth prospecting, as we have here evidently another belt of chloritic rock of the same nature as that occurring on the Barn Bluff Mine. That it is also associated with copper is shown by the vein of copper pyrites already found. It is very probable that the boulders of bog-iron on the hill above may have been formed by the decomposition of a body of pyrites. The hill should be well trenched, and if the results are favourable a tunnel should be put in from the creek. About 200 feet of backs are readily obtainable.

North of this section, on the other side of the creek, I was very pleased to see the actinolite rock occurring. It is exposed in a small open cut, but the country is so disturbed that I could not determine the strike at this point. Since my visit the ground has been taken up. It is well worth prospecting.

Sections 4818–93M *and* 4819–93M. *Swallow and Madden.*

These sections are situated a little over a mile to the west of Lord, Swallow, and Erickson's Section. Several shallow trenches and open cuts have been made, exposing a very similar formation to that already described on the Barn Bluff Company's property.

In the first trench examined, which was situated to the west of a small lake, the country was much broken up, making it impossible to determine the strike. Dense pyrrhotite occurred here, associated with actinolite rock, and containing copper pyrites. About six chains to the south of this a trench has exposed a good section of the country. This consists of quartz schist and finely-laminated crystalline mica schists, highly inclined, and striking 80° east of north. In the northern end of the trench a dense body of pyrrhotite has been uncovered: this carries copper pyrites all through it, and in places it is fairly rich: the width of the band is 10 or 12 feet. About 30 feet south of this another band occurs in the same trench. This has not been broken into, but is evidently of the same nature as the other. Passing up the hill to the west several other bands are exposed. All these are striking with the country. The trenches

are all quite shallow, and it is probable that the copper contents will be found to increase in depth. I think it very probable that here also the copper will be found to be associated with a band of chloritic rock. In prospecting the section this should first be located and followed up. Actinolite rock occurs in the northern trench, though here its position could not be determined, owing to the disturbed nature of the country. The show is a very promising one.

Proposed Track to the Barn Bluff District.

It has been already pointed out that the present track to the Barn Bluff, *viâ* Mount Pelion, is not only extremely circuitous, but passes for nearly 20 miles over high-lying ground which, in winter, is covered with snow, and becomes impassable. A great part of the rest passes over swampy ground which certainly could not be made fit for constant traffic without a large amount of expenditure in cording. The question of another route is, therefore, of great importance to the district. After very careful inquiry into this question from a number of prospectors and others who are well acquainted with the country, and after examining the lay of the country as carefully as possible without actually going over the ground, I am quite satisfied that a route can be got which, while avoiding all the worst of the high ground on the divide between the Mersey and the Forth, would shorten the journey from Lienna to the Barn Bluff Copper Mine by from 15 to 20 miles, and the journey from Lienna to Rosebery by from 10 to 15 miles. The proposed route would leave Innes' track at the south end of Gad's Hill, pass for a few miles along the top end of the Forth Valley, and thence gradually descend to the Forth River. There are then two routes possible, and it will require a survey to be made in order to determine which would be most advantageous. One route would bring the track up through the Barn Bluff Company's Section. The Forth gorge would, in this case, have to be climbed by a zig-zag up the spur to the south of the Commonwealth Creek. The second route would join Innes' track in the vicinity of Swallow's Section, and would come a good deal further south than the first, but could probably be made with a better grade. It would

5 cm

GEOLOGICAL SKETCH MAP

OF SECTION 4920
93 M

BARN BLUFF G.S.&C.M.Coy N.L.

Scale 2 1 0 2 4 6 Chains

G.A. Waller
Assistant Government Geologist.

PLATE IV

NORTH BARN BLUFF G.C.&S.M.Co N.L.
4954
93M
80 ac.

WHITE QUARTZ

COOKS CREEK

BASALT DYKE

COMMONWEALTH CREEK

QUARTZ & OTHER SCHISTS

CHLORITE SCHIST & CHLORITE ROCK

BANDS OF QUARTZITE & ACTINOLITE ROCK

BARN BLUFF G.S. & C.M.Co N.L.
4920
93M 80ac.

HIGHLY CONTORTED SCHISTS

BIG KNOB

WHITE QUARTZ

follow the Forth River up to nearly opposite Mount Oakley, and then turn to the west along the northern side of Swallow's Creek. Either of these routes would be in solid country nearly the whole way, and, passing up the schist country in the Forth Valley, would be opening up a possible mineral country which the old track, by passing along the greenstone capping of the divide, avoids. I am of opinion that the prospects of the district fully warrant the construction of this track.

I have the honour to be,
Sir,
Your obedient Servant,
GEORGE A. WALLER,
Assistant Government Geologist.

W. H. WALLACE, *Esq.*,
Secretary for Mines, Hobart.