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## REPORT ON THE MINERAL DISCOVERIES IN THE NEIGHBOURHOOD OF BELL MOUNT.

*Geological Surveyor's Office, Launceston, 6th November, 1893.*

SIR,

On the 12th October I left Sheffield for the purpose of examining and reporting upon the recent discoveries of gold, tin, and bismuth near Bell Mount. In order to see as much of the country as possible I went out to the field by way of Mount Claude and the Middlesex, or Five-mile Rise Gold-field, noting the mining work in progress on the way, and I also made a short excursion to some gold-bearing ground in the vicinity of Stormont.

The Bell Mount is a small peak, probably 2700 feet or thereabouts in height, on the divide between the Forth and Wilmot Rivers, about W.S.W. from the west end of Mount Claude, and is about 21 miles by road from Sheffield. From the township westward to the Forth Bridge the road is mostly metalled and very good, then going southward through the Parish of Narrawa it is not good, being only formed in places, while other portions have been simply cleared. After passing the furthest out agricultural selections the road becomes a simple bush pack-track which in wet weather becomes almost impracticable. This track continues on through the mineral sections and joins the road from Liena to Middlesex, near the Great Caledonian mine. This road, which is an unformed one and unfit for wheeled traffic, crosses the Forth at the Lorinna Bridge, and on the top of Gad's Hill connects with a track which leads over Mount Claude on to the main road from the Mount Claude mine to Sheffield. It is therefore possible to reach the Bell Mount Field either by way of the upper Forth Bridge or the lower one. For foot traffic there was a cage and wire rope as well across the river between the Mount Claude sections and Bell Mount, but I was informed that it was out of order and not much used.

The route followed by me was that over Mount Claude and Gad's Hill to the Five-mile Rise gold-field and thence back to Sheffield by Bell Mount. Round Sheffield the country is mostly composed of basalt of Tertiary age, which weathers to a rich chocolate-coloured soil: in one place I saw signs that this overlies deposits of sand and clay full of ferruginous bands similar to those usual throughout the Launceston Tertiary Basin. On the road to Railton the old Silurian rocks also are seen, at intervals slates, sandstones, and limestones, but I did not see anything of the Coal Measures, though they are close by at the Dulverton Colliery. Basalt is again found on Gad's Hill and on the watershed between the Wilmot and Forth Rivers, as will be more particularly described later on. As it everywhere covers older formations likely to carry minerals, and often shows indications of having filled up and obliterated old watercourses, it is quite likely that numbers of "deep leads" worth prospecting are concealed under the basaltic covering, even down in the farming districts where mining is not at present thought of. In the Bell Mount Field there is great hope of the finding of payable "wash" below the lava flows.

The older mineral-bearing rocks are well seen in the rugged masses of Mount Roland and Mount Claude, the peaks of Bell Mount and Stormont, and along the slopes of the deep valley of the Forth River. The evidence as to the age of the principal formation is not yet satisfactory, though a few fossils have been found at the Middlesex and Bell Mount gold-fields, but it seems probable that it belongs to the same period as the rocks of the Zeehan and Heazlewood silver-fields, which are doubtfully classed as Upper Silurian. On the tops of Mount Roland, Mount Claude, Bell Mount, and Stormont we find large beds of coarse conglomerate, consisting of pebbles of quartz and quartzite very similar to the conglomerates of Mount Owen and Mount Zeehan. These are interstratified with more or less indurated sandstones, quartzites, grits, slates, and limestones, the whole series lying in much contorted folds. The conglomerates are the highest members of the series, the rocks seen in the deep gullies, though conformable with them, being generally sandstones and slates. On the whole, though each layer is much crumpled into wavelike shape, the general stratification appears to be fairly horizontal, thus explaining the occurrence of the conglomerates on the detached peaks. Nothing was seen of the ancient schist and quartzite formation which forms the country rock in the head of the Forth Valley near Mount Pelion, and it probably lies deep below the one just mentioned. In the Dolcoath T. M. Company's sections and in the bottom of the valley of the Forth opposite them, a granite formation is seen, which appears to be intrusive through the Silurian strata, and to have caused considerable metamorphism of them near the contact. It consists of quartz, reddish felspar, and dark mica, closely resembling the granite found in the Mersey River near Liena and on the top of Gad's Hill, with which it is in all likelihood directly connected. Near the Great Caledonian mine at Middlesex a decomposed granitic rock is seen which probably is also connected with it, and on the Iris T. M. Company's ground there is

another much weathered rock which may prove to be a quartz-porphyry or else a fine-grained marginal portion or dyke of the granite. Near this latter, in the Iris Company's tailrace, a hard blue-black dense rock is found, which weathers to a greenish clay: on the weathered surfaces it is clearly seen to be a conglomerate composed of well-rounded pebbles, but on breaking it across it resembles a crystalline rock. It is clearly a conglomerate which has originally contained much felspathic or argillaceous matter, and has been intensely hardened and rendered sub-crystalline by metamorphism, an effect probably due to the intrusion of granite close by. The principal discoveries of tin ore in the district are not far from the granite, though mostly in the Silurian strata, and it is therefore likely that the occurrence of tin is, as usual, the result of the presence of this rock.

The useful minerals found in the district comprise gold, tin ore, carbonate and sulphide of bismuth, and argentiferous galena. Wolfram is rather plentiful, accompanying the tin ore in the Iris claim in troublesome quantities, and topazes, often fine clear crystals, are pretty abundant, but it does not seem likely that either of these minerals will be of commercial importance. The tin and bismuth occur, as far as yet seen, only within short distances from the granite, but the gold and galena are more widely distributed, and seem to belong to the Silurian strata. The largest nuggets of gold have come from the new Bell Mount field, and for its extent this has probably proved the richest area of auriferous ground in the district, but the most gold has been taken from the Five-mile Rise or Middlesex portion of it. No reefs of any importance have yet been found from which the gold might have been derived, and I am inclined to think that much of it comes from small veins in the Silurian rock, and possibly also from the direct disintegration of this. The conglomerates often show pebbles of reef quartz in their mass, and as it is therefore evident that the rock from which they were derived contained quartz veins, there is no unlikelihood that gold also was present, and might thus exist in the later rocks formed of the gravel and sand resulting from their erosion. From this aspect we might then regard the conglomerates as simply very ancient alluvial "wash," only that they were marine gravels and not river drift.

The Middlesex and Bell Mount fields are at a considerable altitude, the Great Caledonian mine being some 2600 feet, and the Bell Mount Gold Camp about 1800 feet above sea level. There is a considerable rainfall, and in consequence the vegetation is luxuriant, in the sheltered gullies especially. It is of much the same type as on the West Coast silver-fields, though not quite so dense—myrtle, sassafras, tree ferns, celery pine, and tea-tree being among the commonest forms of vegetable life. The horizontal scrub, so much dreaded by the prospectors of the West Coast, exists, but not to any very troublesome extent, but on some of the higher and more exposed ground a tangled mass of tea-tree, bauera, and cutting-grass is often met with, and is very hard to penetrate. On the plains we find stringy bark, peppermint, and other large timber of the eucalyptus tribe, and this forest is generally very open. The dense vegetation in the valleys, however, is a great bar to prospecting, and it will be only after the bush has been much burnt off that the country can be thoroughly searched for minerals. The discovery of the Bell Mount gold-field is said to have been due to a fire last year, which cleared off the dense bauera scrub and laid the surface open for examination.

The country is much broken by deep ravines, the principal ones being the gorges of the Forth and Wilmot Rivers. The valley of the Forth is very deep, the Lorinna Bridge being only about 700 feet above sea level, and from the river to the mining sections at Middlesex and Bell Mount there is a rise of between 2000 and 1000 feet. Deep gullies run down from the high ground, cutting the slopes into rugged furrows. From Middlesex to the Iris Company's ground there is a flat basaltic plateau on the top of the ridge separating the Iris and Forth Valleys, but this terminates about two miles south of the peak of Bell Mount, and the tin sections are mainly on the broken ground falling away to the valleys on the Forth and Wilmot. Going westward to Stormont there are several deep ravines to cross, and then the ground again falls away into the deep gully of the Falls River. This stream and the Iris River, when united, form the River Wilmot.

While the rugged nature of the country will no doubt make it somewhat difficult to transport machinery and material to the new Bell Mount tin and gold-fields, it has nevertheless the advantage of affording very great facilities for mining operations and for obtaining copious supplies of water for mining purposes. The benefit of these facilities is not at present felt, as the alluvial deposits happen to be almost on the top of the ridge separating the Forth waters from those of the Wilmot, but later on, when lode mining begins, they will be greatly appreciated.

In the following description of the localities visited they are taken in the order in which they came on my route, as it would be inconvenient to deal with the discoveries of the different metals separately, more than one being often found on the same Section.

*Mount Claude.*—The only work now going on in this District is being done by The Kentish Proprietary Silver Mining Company, No Liability, on Section 90-87M, who are continuing the adit begun in 1883 by The Mount Claude Silver-Lead Mining Company; the latter drove it 593 feet and then abandoned it in 1884, after which year it remained untouched till 1891, when The Southern Cross Proprietary Silver Mining Company, No Liability, again took



it in hand and extended it some 60 feet further. This Company then got into difficulties, and the mine fell into the hands of the present owners, who have now extended the adit to 800 feet and are still driving. The tunnel runs S. 22° 16' W. from the Claude Creek, and passes through a series of beds of sandstone and limestone. The strata are much crumpled, the dip changing several times in the course of the driving from northerly to southerly. The first 500 feet were mostly through hard metamorphic sandstone or dark quartzite, after which a great deal of hard blue crystalline limestone has been met with. At 682 feet what may prove to be a slide was cut through, striking N. 70° W. and dipping northward at an angle of about 30°. A strong stream of water comes from this. Near the mouth of the drive several small veins of galena were passed through, generally less than an inch in thickness, and too small to be of any importance, except as showing that the country rock carries ore. Across the creek from the mouth of the adit a little work has been done on Section 2990-87M, on another small and rather irregular vein of galena, and the old Mount Claude Company also drove some short tunnels a short distance further up the creek on some rather similar veins. There appear to be a good many small galena veins in the country rock, giving hope that if a larger lode were found it might contain payable quantities of ore. The main adit has been put in for the purpose of cutting what was believed to be a large lode, which crops out as a mass of gossan on the hillside some 210 feet above the tunnel. Some trenches cut into this outcrop have shown it to contain veins of galena of very fair silver value. The width of the ferruginous outcrop is 105 feet, and it may be traced for some chains in length. Unfortunately it is not easy now to see what has been found, for the ground is very wet, and the trenches have become partially filled up and very much iron-stained. The principal one is about ten or twelve feet deep, and is cut into the northern side of the lode-mass. Along this a shallow drive has been made some 10 feet to the east and 30 feet to the west. As far as can be now seen, the lode-matter consists of broken country rock and quartz, with much oxide of iron in the crevices, but Mr. Hartrick, the manager of the mine, informed me that a vein of galena was worked out here and was left underfoot, dipping to the south at a very flat angle. In a small creek some two chains further west there is much broken country rock, with veins of oxide of iron and occasionally carbonate of iron, and a little galena, blende, and pyrites have been found here. Fair concentrating ore, consisting of galena in a gangue of carbonate of iron and broken country, has been obtained from another hole a short distance east of the first-mentioned trench also. Four bags of picked ore from the flat vein are reported to have been assayed in Melbourne with the result of returning 79 ounces of silver to the ton and 59 per cent. of lead. In Section 644-91M a very similar outcrop of ironstone is found on about the line of strike of the above one, and a shallow tunnel some 85 to 90 feet in length has been driven across it. About half way in this tunnel there is some broken stuff interspersed with veins of carbonate of iron carrying a little blende and galena, and a nice bunch of good ore is said to have been taken out. The country rock is quartzite and limestone, lying in rather flat strata. Further east still on the line of these outcrops it is said that there are more ferruginous masses. Going westward along the course of the supposed lode there is a sort of depression or break in the ground, which is always very wet and swampy, and this break continues to the Forth River, where gossan is again reported to be found upon the line of it. It seems rather probable that this depression in the ground may be the result of a break or fault in the rock below. The appearance of the stuff where the outcrop has been cut into indicates rather a broken line of country than a true lode fissure, and though it is clear, from the galena and other lode minerals found, that a certain amount of deposition of lode-matter has gone on, it seems to me very doubtful if this will be found of sufficient quantity and regularity to be worth working; I should rather expect to find a somewhat wide mass of broken country rock, with veins and bunches of ore scattered irregularly through it. It is quite possible, however, that there may be considerable and well defined ore-bodies. It is very unfortunate that the tunnel was begun when so little had been done to ascertain the nature of the occurrence, not even the direction of underlay of the lode being then known. Even now, all that is known on this head is that there is an apparent underlay to the southward of the wall that has been cut, and that the tunnel has further proved that if the lode exists down to that level it must underlay to the south, otherwise it would have been already met with. It would have been advisable to have driven a shallow tunnel right across the formation before going down to the deep level, so that it could be seen what really was the nature of the lode and how it was lying. Were it not that such a shallow tunnel would be of no use in working the lode, and that the deep one is 800 feet into the hill, it would seem to me desirable even now to explore the surface; but, as things are, it is probably best to continue the main tunnel. The face of this is now 330 feet past the point where the wall of the lode would have been met with had it been vertical, so its underlay must be greater than  $1\frac{1}{2}$  in 1, and even supposing that the southern edge of the iron-stained matter at surface indicates the hanging-wall of the lode, and that we take this instead of the footwall, the underlay to the south must still exceed 1 in 1. The probabilities therefore are that if the lode exists at all at the tunnel-level it will be met with inside another 100 feet, else it will be most unusually flat, and it would be better to spend money on driving this distance at the level, where, if successful, it would afterwards be useful in developing the mine, rather than the same length in a shallow drive that would be useless for working purposes.

Should payable ore be found the facilities for economical working are very good. The Claude Creek would supply water for dressing purposes and motive power with little expense, and for a long time there would be no need to mine below the adit-level, so that winding and drainage

machinery would not be required. The tramway laid by the old Mount Claude Company to the end of the Claude Range has been taken up, but could easily be relaid, and from the end of it into Sheffield and Railton the road is fairly good, and could easily be made an excellent one: the ore could therefore be readily and cheaply sent to market. While the prospects of the mine are not very bright, and a great deal of money has been spent without value being received for it, there is still a chance of success, and a little perseverance now will finally decide whether or not the lode lives downwards.

On the road over the top of Mount Claude, right at the saddle, there is an outcrop of hematite speckled with spots of white kaolin, which has from time to time attracted the attention of prospectors. It appears to be a bedded deposit, lying conformably between the conglomerate strata both in strike and dip, and has probably been originally a bed of brown iron ore deposited at the same time as the conglomerates. It is said to be traceable for miles, and a little gold is reported to have been got in it. The hematite is much like the massive hematite on the outcrop of the Mount Lyell pyrites mass, and it is possible that in depth this also may change to pyrites. The bed is, however, quite small, only  $2\frac{1}{2}$  to 3 feet in thickness, and would no doubt be contorted in accordance with the crumpling of the enclosing strata, which are at this place seen to be much thrown into wavelike folds, so that it is not likely to be worth mining upon.

*Middlesex Goldfield.*—A good deal of gold has been got from this field in past years, and a few men are still working. The country rock is mostly sandstones and slates, much like those of the Zeehan field. The gold obtained has been mostly got from shallow alluvial workings along the beds of the small watercourses which have cut into the hill slopes, the "wash" being mostly sub-angular fragments of the country rock. Some of these little creeks have yielded a good deal of gold, mostly angular and associated with quartz. Though reefs from which the gold has been shed have been persistently looked for for many years, only a few small gold-bearing veins have been found, and it seems more probable that the metal is coming from minute veins in the country rock itself than from definite reefs. A little work has been done on some of the veins that have been found, but nothing of consequence was got. The Thistle Company drove a cross-cut about 45 feet to cut a small lode, and then followed this N.  $50^{\circ}$  W. for 90 feet. It was, as far as can now be seen, only from one to six inches in thickness, and consisted of iron-stained rubbly quartz and sandstone in which there was some gold. A vein of galena is also reported to have been obtained, but I did not see this. The vein has a fairly well-defined wall, but is too small to do anything with. The Union Company sank a small shaft on some gold-bearing veins, and then drove a tunnel about 145 feet to cut them, but do not appear to have been successful in reaching them. The most extensive mine, however, was the Great Caledonian, which has considerable underground workings and a nice 15-head battery. The workings being full of water I could not examine them. On surface the lode appears as a small, rather irregular, vein of ferruginous rubbly quartz and sandstone, not unlike the Thistle one. The stuff raised from the deeper levels also does not appear to have been well defined quartz, but only ironstained, partly silicified, country rock. After one or two disappointing crushings the mine was abandoned. From what I could see of the surface portions of the lode I wonder that it was ever considered worth opening a mine upon it.

Some 15 chains or so south of the Great Caledonian mine there are two small shafts sunk on what is known as Johnson's Reef, which is a vein 4 to 12 inches in width of iron pyrites, said to be gold-bearing. The outcrop is largely composed of dense hematite. The vein seems somewhat irregular, and very little has been done beyond cutting it in the two small shafts. It might be worth following a little way to see if it becomes any more promising. This lode must be near the contact of the granite and sandstone formations, the country rock enclosing it being a somewhat decomposed greenish granite. This is said to have been met with also at the deepest level of the Great Caledonian mine.

Another mine in this district, but close to the Forth River, on which a good deal of work has been done—namely, the Campbell's Reward mine—was not visited on this occasion by me, as it was out of the way, and said also to be now inaccessible on account of fallen rock and timber. As seen from the above, I only examined this field cursorily in passing, there being no work of consequence now in progress. From the amount of gold which has been taken from it, it will no doubt continue to be prospected, and likely enough good reefs will yet be discovered.

*Stormont Goldfield.*—A short visit was made to some sections held under Prospectors' Protection Orders, situated about half a mile north of Stormont, on the divide between the head of the Stormont Creek (a tributary of the Iris) and the Falls River. A little work has been done in the Stormont Creek lower down, but was not payable as far as I could learn. No one was at work on the field at the time I saw it, and I was only able to get information at first hand about one claim, that held by Messrs. Moon and Cates. In this there is a considerable area, over an acre probably, of gravel, forming a terrace between the main branch of the Stormont Creek and a small watercourse which joins it. A tailrace has been opened up the latter, and a little sluicing has been done. The wash in the small face that has been worked is from 4 to 6 feet deep, and is mainly sub-angular quartz and quartzite, together with well-rounded gravel from the disintegration of the old



conglomerates. The gold is fine and not much waterworn, but is very hard to save in ground-slucing, as the bedrock is a hard hackly-jointed quartzite or hard sandstone, very full of joints and fractures, which retain the gold, and cannot be satisfactorily cleaned out. About 3 ounces of gold have been got from the small amount of gravel as yet sluiced, which is a fairly good return. In the tailrace there is a false bottom of dark clay, with angular pieces of quartz and quartzite in it; what is below this is not yet known. A small race brings in a little water from the Stormont Creek, and in winter a fair supply could generally be got, but in dry weather there would be but little obtainable. This promises to be a fairly payable claim for a party of men who would work it themselves, after getting all the available water into a race and providing themselves with a short line of pipes for hydraulic working. By opening the terrace at the junction of the two creeks and working upwards the whole of the wash could be systematically sluiced. The terrace requires further testing by means of a few holes before much labour is spent on it, but, judging by present appearances, the ground is quite worth the attention of a working party. I do not think that a company employing men on wages would be likely to make any profit from it.

On the hill above the terrace several veins of quartz have been found, but as yet no defined reefs; the locality is well worth further trial.

On the slope to the Falls River, across the divide from Moon and Cates's claim, there is another claim (Aylett's) which has somewhat similar angular wash and a little gold, but, as the owners were not on the ground, I could not learn what success had attended their working.

The country rock in these claims is very similar to that at the Middlesex Field, only that there is much conglomerate on the higher ground, the peak of Stormont being all conglomerate. Between this field and the Bell Mount one the country is very much covered with basalt, and it is only at intervals that the older rocks are visible. At the Iris crossing there is a good deal of limestone and quartzite, and it is said that a garnet rock also exists, but I was unable to find it. There is also limestone further to the east, and a small creek disappears entirely into a cavern in this formation. In the deep creeks the basalt is often cut through, and in one or two places "wash" has been found under it, and it is likely that careful and intelligent search round the margins of the basaltic cappings would be rewarded by the discovery of buried gravel deposits or "deep leads" emerging from under them. As these would belong to a time previous to the outflow of the basalts, and when the whole of the surface of the country exposed to the wearing down action of rains and streams was composed of the auriferous formation, they are much more likely to contain gold than the recent watercourses which have cut their valleys through the non-auriferous basalt. The largest flows of basalt seem to be between the Iris River and the Bell Mount tin-field, the westernmost sections of which are largely covered with it. At the time of the volcanic outbursts it seems pretty evident that the main ridges and valleys of the district were much the same as at the present day, and that the lava flows poured over the slopes therefore ran somewhat parallel to the now existing surface, but nevertheless the smaller gullies and watercourses were not in quite the same positions as those in which the streams now run. The scorix and ashes and the flows of liquid lava would naturally accumulate most in the gullies and fill them up, forming an entirely fresh surface, which has since been cut into its present shape by the action of running water. Where the basalt flows are largest it is probable that there was formerly low ground. It is a very common feature in leads covered with this rock to find the old gutters right under the crowns of high ridges of it, the explanation being that the main streams of molten matter ran down into the lowest ground and formed the thickest masses of hard rock right in the bottoms of the gullies over the gravels; then, when the running waters again began to cut into the surface they had little effect on the hard volcanic rock, and cut into the softer stuff on each side of it, wearing it down until the basalt remained as a ridge. Consequently in prospecting it is advisable to trace the course and find the terminations of the lava ridges, and then search for deep ground round the ends of each old flow. Where practicable, shafts may also be sunk in the ridges through the rock capping. The main hope of the district seems to me to depend on the discovery of alluvial gutters beneath the basalt, as they are much more likely to be important than the comparatively small quantities of "wash" in the modern watercourses.

*Bell Mount Tin and Gold Field.*—The sections taken up for tin-mining in the vicinity of Bell Mount are situated a little more than two miles south of the peak, and the gold sections just at the foot of it on its south-western slope. A discovery of silver-lead ore has also been made to the north of the auriferous ground on the west side of the Mount.

*Iris Tin Mining Company, No Liability.*—This Company hold seven sections, comprising 551 acres (Nos. 1405-91M, 1406-91M, 1421-91M, 1403-91M, 1404-91M, 1420-91M, and 1407-91M), situated on high-lying flattish ground, right on the watershed between the Forth and Iris Rivers. The basaltic plateau lying on the watershed and extending from Middlesex terminates about the south side of the property, but there is still a considerable amount of basalt to the north west of the end of the plateau covering the slopes of the hills. The greater part of section 1403-91M is covered by it, as are also the south-west corners of 1404 and 1405. The main workings are in section 1404, where at the time of my visit a party of tributors were ground-slucing along the

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course of a small creek running into the River Forth. In the tailrace the bedrock seemed to be all the hard blue conglomerate above described, weathering to greenish clay. Further to the north-west, however, a decomposed granitic-looking rock is seen, which may prove to be a quartz-porphry, but which I cannot name with certainty till I have seen it in its undecomposed condition. This contains occasional veins of quartz and mica, very small, but likely to yield tin, and I am disposed to regard it as the rock from which the ore is derived. The tin ore is crystalline, and hardly at all waterworn, and sometimes has a little quartz adhering to it. The wash is distributed over a considerable area, but is, as a rule, shallow and rather poor, and, as the ground is covered with thick forest, there is considerable expense in clearing it. The water-supply also is poor, being dependent on rains, the creeks being small and soon dried up so high on the divide. A dam has been made to impound as much water as possible, but it has not much capacity, and a large part of the tin-bearing ground is not commanded by it. Along the north boundary of sections 1403 and 1404 a number of prospecting holes have been sunk, bottoming at depths of from three to six feet, in which more or less tin ore has been found, but I doubt very much if there is enough to make the ground pay. It might give wages to a working party, but unless something better than has yet been seen is found, there seems to me to be no chance of profit for a non-resident owner or company. The low price of tin, owing to the large amount of wolfram contained in the ore, is to be reckoned with, as well as the expense of working the ground. The principal inducement for the present company to continue working is the possibility of finding lodes from which the alluvial tin has been derived. In the middle of the holding, where the granitic rock above-mentioned (the doubtful quartz-porphry) crops out, there is greater probability of finding ore than elsewhere, though the experience of the adjoining Shepherd and Murphy's claim shows that the tin veins also exist in the Silurian formation. The surest way of discovering the lodes is by working the alluvial covering off the bed-rock, and as this progresses it is likely that tin-bearing veins will be laid bare. The alluvial working will be necessarily slow and intermittent, depending on rains for water for washing, but it is very doubtful if it would be of any use for the owners to go to the expense of bringing in a water supply from a distance to allow of regular work. If several of the owners of sections were to band together to bring in a water supply for the whole field, it might, perhaps, be made successful commercially, but I fear such concerted action is very far in the future.

Section 1403-91M has the best water supply of any of the Iris Company's sections, the so-called Seven-mile Creek running through it, but is mostly covered with basalt. Some prospecting might be done in this for a deep lead. In the north-west angle of section 1405 some work has been done on a lode containing topaz, sulphide of bismuth, and carbonate of bismuth, which seems to be an extension of the bismuth lode worked in Shepherd's section 1437 adjoining, but it is very small, much broken up into strings, and in hard quartzite country, so it does not seem possible that it could be worked with profit. A little metallic bismuth has been found in the gravels of the creek below where this lode crosses it.

*Dolcoath Company* (not registered).—This Company holds Sections 1333-91M, 1334-91M, 1336-91M, 1337-91M, and 1366-91M, comprising 365 acres. Mining operations are confined to Section 1333, where a tin-bearing rock has been discovered on the west side of the Forth River Valley on steeply sloping ground some 600 feet lower than the Iris Company's workings, and probably 1000 feet above the Forth River. The south-eastern half of Section 1333 and the greater part of Sections 1334 and 1336 are on granite country, but in the north-west portion of 1333 and in 1366 the bedrock is quartzite and conglomerate. The stanniferous rock must be nearly on the contact between the two formations, and is probably a marginal portion of the granite which has been altered and impregnated with tin by hydrothermal action along the contact. It is rather of the character of a stockwork than a contact lode, being composed of numerous varieties of granite more or less impregnated with tin ore. We find in it portions consisting mostly of glassy quartz and large weathered crystals of felspar, others in which the rock is mainly granular quartz with a little mica through it, others again carrying much green talc and soft kaolin, while at times bunches of topaz crystals and stone composed of quartz and topaz make their appearance. The most common rock contains a good deal of kaolinised felspar cementing together quartz granules, and often carries much iron arsenical and copper pyrites. A little molybdenite also is found. In many respects the stanniferous rock resembles the stuff in the stockworks of the Blue Tier district, but contains a great deal more topaz than is usual in these, being in parts quite a topaz rock. The tin ore is in bunches through the stuff, appearing to accompany the topaz-bearing parts most of all, and is generally in somewhat large crystals, though also at times found finely impregnated. The whole occurrence is similar to the Roy's Hill deposit in the St. Paul's River Valley, except that the latter does not show topaz rock, both being marginal masses of granite at the contact of granitic intrusions with quartzites, which have undergone chemical alteration and rearrangement of the constituent minerals. The stanniferous mass in the Dolcoath property has been proved to be over 100 feet in width by surface trenching, and a tunnel is now being driven through it at a depth of 50 feet below the highest part of the outcrop to test it more thoroughly. This tunnel has an approach of about 24 feet in length cut through the stockwork rock, and has been driven 15 or 16 feet into it. Both in the surface trenches and in the tunnel a good many bunches of tin ore have been found, and excellent specimens can be obtained, but on the whole the stuff yet met with is poor. After crushing and washing off several samples carefully taken so as to



fairly represent the bulk of the rock, I could come to no other conclusion than that it was far too poor to pay for working. Since my visit I believe that some better stuff has been cut, but whether this is the beginning of a general improvement or only a patch of ore remains to be seen. As the unaltered granite is seen in a small creek passing the mouth of the tunnel only a short way to the east, it is evident that the tunnel has been begun towards the eastern side of the stockwork, and as the likelihood is that the mineralising solutions found passage most freely along its western side on the actual contact with the quartzite formation there is reason for hoping that better ore will be obtained as the tunnel is extended westward. In the Roy's Hill deposit the best ore has been found right on the contact, and in the case now under consideration it would be advisable to push the tunnel through to the quartzite wall. The formation is so large and carries so much tin that, even though not payable at present, it deserves thorough prospecting. Should payable ore be found in quantity the ground is very suitable for working either by open quarrying or by tunnelling, and is so steep that the stone could be easily and cheaply sent down by a self-acting tramway to the Forth River, where an unlimited supply of water for driving machinery and dressing ore is always available. From the machinery site there would probably be no great difficulty in crossing the river and connecting with the road from Sheffield to Mount Claude, so that transport of machinery and ore would be fairly cheap. With these facilities, a very small percentage of tin, one per cent. or even less, could be profitably worked if a very large bulk of rock were available without picking. Very large quantities of stuff would have to be crushed and dressed, the problem being just the same as in the case of the large low-grade stockworks of the Blue Tier.—(See Report on the Tin Mines at the Blue Tier, County of Dorset, 19th January, 1893.) In the Dolcoath mine it may turn out that it will pay to pick out the rich ore, but I do not think that this will be so, and believe that reduction of the ore in bulk as it is mined will be the only chance of success. Lest I should be misunderstood, I would again repeat that at present the rock found is not in my judgment payable under any circumstances, but there is great hope that further exploration will yet lay bare richer rock, and it is only when such richer rock is obtained that the above remarks as to working will apply. The formation requires to be penetrated by the tunnel to its western side; and while this work is in progress surface trenching across the lode should also be carried on, cuts being made from side to side of the stanniferous rock at frequent intervals along its course. Similar stuff has been picked up a long distance away from the workings, and it is rather likely that the whole length of the contact between the granite and silurian formations will be found to be at intervals tin-bearing, so a great deal of prospecting has yet to be done. The presence of tin ore in the surface soil will probably here, as at the Blue Tier, afford an indication of the quality of the bedrock below. The property of the Dolcoath Company cannot yet be said to be a valuable one, but is one on which valuable discoveries are very likely to be made, so its exploration can be recommended as a genuine and promising prospecting enterprise.

*The Shepherd and Murphy Tin Mining Company, No Liability*—(Sections 1437-91m and 1456-91m, 158 acres in all).—This Company's ground has been more thoroughly prospected and better opened up than any other in the district, and can now show alluvial tin ore and gold and lodes containing tin oxide and carbonate and sulphide of bismuth. The work is practically confined to Section 1437, next to nothing having been yet done on 1456, which is mainly covered with basalt. This rock also comes in strongly on the western side of Section 1437, but the eastern portion is pretty free of it, and is composed of slate and sandstone country. The principal workings are on a small creek running a little west of north through the section, and joining the Seven-mile Creek near the northern boundary. Another small creek runs pretty parallel to the last near the eastern boundary, and on the spur separating the two very fair prospects of tin can be obtained in various places. The tin ore is crystalline and angular, and is probably derived from a set of lodes which have been found running east and west through the holding; one of these has been stripped and cut into along the outcrop in the slope to the eastern small creek above mentioned: it is small, being only from six to ten inches in thickness, and consists of quartz and carbonate of bismuth with a little tin ore and some wolfram. A good deal of tin was got by stripping the surface here, very much mixed with carbonate of bismuth, which, owing to its high specific gravity, cannot be separated from the tin by washing. The specific gravity of tinstone, according to Dana, is from 6.4 to 7.1, and of bismutite (carbonate of bismuth) is from 6.86 to 6.909, so that the two substances are as nearly as possible the same weight. Parts of the lode are very rich in bismuth, and if equally good ore continues downwards the vein might be profitably worked; it is seen again further to the west, still containing a little bismuth, but is small and much broken, and, as already said, it has been traced into the Iris Company's section. The lode being small and not very rich, except in one part, I am not sanguine as to its being successfully worked, especially as the enclosing country is pretty hard at the spot where the best ore is seen, but it deserves to have some work done upon it to test it lower down. In depth the carbonate will no doubt be replaced by sulphide of bismuth and metallic bismuth. The value of bismuth ore is rather hard to arrive at, the price depending very much on the stock in the market. The world's consumption of the metal is quite small, and a shipment of 50 tons of it would probably have difficulty in being disposed of. The retail value of the pure metal is high, the latest quotation I have seen (*Engineering and Mining Journal*, September 16, 1893) being \$6.25 per kilogramme, or at the rate of, say, £1270 per ton. The price got by the producer is, however, much less, and would probably not exceed £700 a ton.

Bismuth and bismuth ores frequently contain both gold and silver, but as far as I can learn no tests have yet been made of the ore from this claim to ascertain if it contains the precious metals. As both gold and silver are found in the vicinity, there is much likelihood of their being associated with the bismuth, and assays should be made for them.

Near the lodes the alluvial tin is mixed with a good deal of carbonate of bismuth, and there will be some difficulty in smelting to avoid making an alloy of the two metals. By careful firing at a temperature sufficient to reduce the bismuth to the metallic state, but not high enough to smelt the tin ore, it will be possible to eliquate a good deal of the former, but I doubt very much if it can be completely separated. The mixed ore will therefore probably require to be sent to Europe for sale, instead of being sold and smelted locally as usual.

In the creek which runs through the middle of the section a lot of clearing and sluicing have been done, and there appears to be a very considerable quantity of alluvial stuff worth sluicing. Towards the north side of the section the creek runs over a bottom mainly composed of basaltic *débris*, and at the junction with the Seven-mile Creek there is evidently a considerable thickness of this, for though deeply cut into it is not cut through. The true bottom, or bedrock, is therefore not yet reached in this part of the ground. To the west of the creek a long trench has been cut in loose surface stuff, largely derived from the basalt formation, which, nevertheless, gives good prospects of tin and a little fine gold. Ironstone containing tin ore was also found here, and it is possible that there is another lode to be laid bare. A little higher up the hill than these workings a shaft has been sunk on a spur in alluvial ground to a depth of 15 or 18 feet without reaching the bedrock. The wash in this is mostly sandstone, quartz, and quartzite, a good deal waterworn, and gives prospects of gold and a little tin. This wash probably belongs to one of the old buried channels, and a strong effort should be made to find the old gutter by sinking a number of shafts to bedrock across the spur. In the alluvial workings in the creek the gravel, which is largely of basaltic origin, often lies in beds which are plainly dipping to the west and even south-west, showing that when they were laid down the ground sloped towards what is now the spur west of the creek. In the face which was at work at the time of my visit the wash was getting deeper and the bottom dipping downwards going westward, so that everything points to deep ground in that direction, and probably as work proceeds the wash will be followed right under the basalt.

The highest face in the little creek when I saw the claim was just on the outcrop of a small tin-bearing lode, four to eight inches wide, consisting of quartz carrying tin ore, often in rich bunches, and a little carbonate of bismuth. All along the outcrop of this little lode good prospects of tin are obtainable. Parts of it are seen to be very rich, and though it is probably too small to be worked, it will be well to prospect it by laying it bare still further. This is an east-and-west vein, parallel to the above described bismuth lode, which is itself found again about  $2\frac{1}{2}$  chains further down the creek, and has been bared by sluicing. Two small quartz veins are here seen carrying tin and a little bismuth ore, and lying parallel to each other a few yards apart. Very fair tin was got here from the surface, and nice specimens may be picked out of the veins. About four chains further down the creek there is another parallel lode, better looking and larger than any of the above. It consists of two quartz veins six to ten inches thick, with a "horse" of sandstone about two feet thick between them. There is a soft clayey "dig" on one side of the main vein, and, counting the quartz and this, the lode-matter is probably from 2 feet to  $2\frac{1}{2}$  feet in thickness. Very good tin was got in the surface soil, and rich specimens are to be seen sticking in the lode still unbroken. This lode might pay to work, and is certainly worth trying.

Between the north and south boundaries of the section there is a fall of over 380 feet, so there is a good opportunity for sluicing to advantage. A small race brings water from the Seven-mile Creek to the north side of Section 1456; this should be enlarged, and a line of pipes laid from it so as to get the assistance of the pressure of the water in sluicing the lower ground. There is a good deal of water in winter in the Seven-mile Creek, and, with attention to conservation, it could be made to furnish a very fair supply for the greater part of the year.

Close to the south boundary of Section 1437 a little work has been done, which again goes to show that there is deeper ground under the basalt to the westward: some gold is got in the wash here obtained.

The tin ore in this claim when cleaned up seems generally to contain a little gold, and when the work goes further west it is probable that the gold will be worth separating. The easiest method of doing this appears to be to stream the dressed tin over blankets laid on the floor of an inclined sluice-box. Grading of the tin ore into sizes by means of sieves would probably make the operation somewhat easier. It will be noted that in this property the principal minerals are tin ore and bismuth, and that gold is of subordinate value; but I am not at all sure that this relation will continue, and have considerable hope that in the deep ground the gold will be the most valuable constituent.

*Gold Claims.*—Between the Seven-mile Creek and the gold workings the country is mostly covered with basalt, but sandstone and conglomerate make their appearance as we approach the claims



from the south. The workings are on the head of a small creek running into the Wilmot River, and taking its rise on the southern slopes of Bell Mount. On the south side of the creek Sykes and party are working some ground which appears to run away from the present creek as it is followed. The wash contains large, heavy, well waterworn boulders of conglomerate, which may be traced south up the slopes of the hill, and probably indicate the course of an old stream previous to the basaltic outbursts. The wash varies much in depth, the bottom being very uneven. The bed-rock is slate and sandstone, containing quartz veins: it is rather ragged and difficult to clean up. The gold is not greatly waterworn, and is accompanied by a little tin ore. This claim, as work proceeds, will probably yield much useful information as to the older system of watercourses which carried the large boulders. These themselves are likely to be a good indication of the best wash-dirt, and though difficult to handle, should be persistently followed. In the creek itself north of Sykes' claim another party was at work, having cut away a rocky bar that had previously formed a sort of dam. This bar is just below the junction of two small creeks on which the principal claims are situated: these ran through somewhat flat-lying swampy ground, and do not carry very much water. Between them there is a small hill, but going northwards this is found not to be connected by a ridge with the main peak of Bell Mount, but to be cut off from it by swampy flat land. It would seem that the waters from this swampy flat may have at various times drained away through either branch of the creek. The whole of the flats have been taken up by diggers, some 80 men being at work on the field at the time of my visit. The drift consists of pretty well waterworn gravel, and would average from three to eight feet in depth in the lower parts of the leads, but gets deeper towards the north. The only part of it found to be worth saving is about six inches on the bottom, the top drift being of no value. The bottom is not true bottom but a false one, consisting of black clayey matter, in which in parts the remains of vegetation that has grown in it are at times plainly seen: it is evidently, therefore, an old surface soil. It seems to be an earthy swamp deposit, and is likely to be some little thickness. Two holes have been sunk in it by Betts and party in the eastern branch of the lead, one of which did not reach bedrock at about 16 feet, but had to be abandoned, while the other, at about the same depth, struck blue limestone bottom, dipping westward. No wash was found in these holes under the black pug, but it does not seem likely that the gutter was reached. More work should be done to find if there is any wash and gold on the true bedrock: there is a considerable probability of their existence, but no certainty. In the flat at the head of the lead the amount of stripping to be taken off is so considerable that the work becomes very expensive, and in some of the claims it is already contemplated to begin driving out the bottom wash without removing the overburden. Water is very scarce except in wet weather, and the want of this essential, together with the heavy stripping, are much against successful working. It seems to me rather doubtful if a good water supply could be obtained from any of the available creeks without an expense which the prospects of the claims would not justify, and probably therefore the whole of the field will have to be worked with storm-water as available. In the flat at the head of the leads there is still a good deal of ground to be worked, but the lower parts where the valleys are narrow and the gold might be expected to be most concentrated, are getting pretty well worked out, and another wet season or two would see them exhausted unless fresh wash is found under the pug bottom. The value of the flats higher up is as yet but little known.

The quantity of gold obtained from these diggings is not accurately known, but some 500 ounces can be accounted for. Several fairly large nuggets have been obtained, the heaviest being a trifle under 16 ounces in weight. Some of the parties have been fairly successful, others very indifferently so, but on the whole the field seems to have been as yet a fairly payable one.

It should be mentioned that the fall of the black pug false bottom is much the same as that of the existing creeks, so that it would seem that these have deposited the auriferous gravels. The source of the gold is as yet quite a mystery, but light will probably be thrown on it as work progresses. It would seem to come from the slopes of Bell Mount, but it may also possibly be derived from the re-washing of older gravels belonging to the river system obliterated by the basaltic flows. Much work will be required to solve the problem. On Section 990-87G there is an outcrop of ferruginous gossan which requires prospecting. It can be traced some distance on a line running N. 30° W. or thereabouts, and crosses the head of the leads, and has been suspected of being the lode from which the gold is derived. While I do not think this is the case, I should nevertheless advise that some shafts be sunk along this outcrop to ascertain what sort of a lode it is. As the scrub gets burnt off other lodes may be found, and in the dry weather when alluvial work is stopped the search for these might be more systematically carried on. The amount of gold obtained from the small area worked quite warrants strenuous efforts being made to discover the source from which it has come.

*Silver-Lead Discovery.*—On the west side of the peak of Bell Mount, which here slopes precipitously down the Wilmot River, some veins of argentiferous galena have been found. The principal one is probably quite 400 feet above the river, on a very steep rocky sideling. The lode lies very flat, underlaying about 2½ in 1, and strikes about N.W. and S.E. A small tunnel driven some 15 feet into the hill shows it to be from 2 to 2½ feet in thickness, consisting mostly of quartz with some broken country rock, and carrying spots and small veins of galena and pyrites. The

vein appears to be rather irregular, and as it shows at present is quite too poor to work. The clean galena from it is of fair quality, some pieces taken by me and assayed by the Government Analyst yielding 73 per cent. of lead, traces of gold, and 57 ounces 3 dwts. 8 grains of silver to the ton. The other veins found lower down the hill and further to the south are very small and poor. The country rock is blue slate and sandstone.

While the silver-bearing lodes yet found are not of much consequence themselves, they show that the country rock is favourable for the existence of galena veins, and indicate that prospecting for them may be carried on with reasonable hopes of success.

Reviewing the whole district examined on this occasion, it will be seen that gold has been found almost everywhere where the Silurian slates and sandstones occur, at Middlesex, Stormont, and Bell Mount; that argentiferous galena occurs in the same formation at Mount Claude, in small quantities at the Five-mile Rise, and at Bell Mount; and that tin ore and bismuth are associated with the intrusive mass of granite of the Bell Mount Tin-field. Taking into account the large area of ground over which the covering of basalt conceals the mineral-bearing formations, and the dense bush which also hinders prospecting, the number of discoveries already made should indicate that the district must be more than ordinarily rich in minerals, and therefore well worth attention from prospectors and mining adventurers.

I have the honor to be,

Sir,

Your obedient Servant,

A. MONTGOMERY, M.A.,

Geological Surveyor.

*The Secretary of Mines, Hobart.*