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REPORT ON THE DIAL RANGE AND SOME
OTHER MINERAL DISTRICTS ON THE NORTH-
WEST COAST OF TASMANIA.

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Government Geologist's Office,
19th December, 1903.

SIR,

I HAVE the honour to submit to you the following Report on these districts, which, in accordance with your instructions, I visited in April last, and again in October.

The North-West Coast, famous for its excellent agricultural land, consisting of soil derived from sheets of Tertiary basalt, has for its foundation highly-inclined strata of foliated and convoluted schists, quartzites, and sandstones, which prolong themselves seawards, giving the geologist a clue to the nature of the massive sub-stratum which may be expected to form the floor of the massive highlands and ranges of the interior.

Here, on the sea-coast, these ancient underlying strata thrust themselves out for inspection. They are mostly in a highly metamorphosed condition, and their varieties are numerous. Their folding and alterations often mask them, and make identification of their character and sequence extremely difficult. Their strike is generally east of north, but the direction of dip varies.

At the mouth of the Blythe, and at Parsonage Point, Burnie, and at the bay to the east of Cooee Creek, a green, tough gabbroid rock occurs, intrusive in the Silurian slates and sandstones; but this is the only eruptive rock, of an age prior to the granite, which I have noticed along the beaches. At the Forth River, there is some serpentine a little inland, besides ancient crystalline schists of undetermined age.

The factor in the deposition of the minerals (silver-lead, arsenical, iron and copper pyrites) which are found at various points over the area (from, say, Ulverstone on the east to Stowport on the west), was the intrusion or consolidation of underlying granitic rock. This granitic rock has not attracted much attention, but it is plainly visible on the road to Dial Creek (soon after passing Whisky Creek) as a soft coarse granite. Descending to the former creek, it is quite decomposed, and I could not obtain a single speci-

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men of fresh rock. It is impossible, with the naked eye, to determine its nature; a microscopical examination shows it to be felspar porphyry.* The same rock is found at Keddie's Mine. At the iron-copper pyrites deposit of the Dial P.A., the rock is quartz-porphry, which has been shattered, and forms a breccia along the line of lode, simulating a tuff in appearance. Further south, east of Mt. Duncan, and south-west of W. Russell's 104 acres, Hardstaff's copper pyrites lode is in granite rock. At the north-east of Russell's land is a granite dyke traversing blue slate, only a few feet wide, on the west bank of the Leven. South-west of this, on the southern boundary of Riana Township, I saw the coarse red mica granite which extends thence, west, to the River Blythe. This is the same kind of granite as is found, in the form of transported blocks, in the glacial conglomerate at Wynyard.

The porphyries east of the Dial Range are dykes or other prolongations of the main mass; and the quartz veins at the Neptune and Penguin mines undoubtedly proceed from the same source.

The older slates, during the process of shrinkage and foliation, have parted under the intense strains, and the granite molten reservoir below, the pressure relieved, has injected its contents into the spaces thus created. With diminishing pressure and heat, the siliceous fluid probably dropped its metallic contents, and formed mineral lodges. At a later date, and at sea-level, the piles of conglomerate and breccia, which now cap the Dial Range, were formed. These were the shingle of the sea-beach at that time, and are widespread throughout the north-west and west of Tasmania, covering many of the summits of the mountains. The West Coast Devonian conglomerates, however, are usually heavier, carrying larger and looser quartz pebbles; whereas the Dial conglomerate is, as a rule, tighter, and more apt to turn to a deposit of stones more or less angular. No quartz veins penetrate the conglomerate, and the granite leaves it untouched. The veins of lead and copper are not formed in it, the only economic mineral which it encloses being hematite iron ore, this occasionally occurring in the form of large masses of transmuted conglomerate. I believe nothing but the merest traces of gold have been found in the Dial conglomerate. Comparisons have been made between it and the auriferous "banket" of the Witwatersrand beds, near Johannesburg, in South Africa. These are,

* A variety of quartz-porphry, in which the porphyritic crystals are felspar instead of quartz.

however, beside the mark, as the mineralisation of the South African pebble beds, which are often intersected by quartz veins, and contain iron pyrites (commonly galena, copper pyrites, and blende rarely), took place subsequently to the deposition of the sand and quartz pebbles; while any gold carried by the Dial conglomerates must be detrital gold, derived from the waste of reefs in more ancient rocks. There may, however, be localised belts of auriferous sand in one part or another of this formation, assuming the existence of gold-bearing reefs in the underlying or adjacent slates; but such belts have not yet been found. There is nothing geologically against the possibility of their existence, and a discovery of gold-bearing drift would not be surprising. As our granites and their accompanying quartz reefs, were already in existence when these conglomerates were laid down, gold quartz reefs must not be sought in this formation. Older Tertiary gravels and sands cover the slates in places at the Penguin, as they do also at intervals all along the Coast. Gold has been found in these drifts, and more still might be obtained but for the fact that exploration is hindered by a widespread sheet of basaltic lava, which extends inland behind the Penguin to Riana, 9 miles from the sea, and behind Ulverstone to double that distance, producing by its disintegration, the rich agricultural chocolate soil for which the Coast is famous. The basalt covering is nowhere very thick; often the deep red soil is the only surviving remnant of the volcanic sheet, the underlying slates and quartzites cropping out to view as the bedrock.

After the basalt had covered the land, and filled up the then existing creeks, the coastal country slowly rose, the present rivulets carving out their courses in the rising land. This elevatory movement seems to have continued to quite recent times, for raised beaches are seen all along the coast, not very high above the tide mark, and containing recent marine shells.

PENGUIN AND DIAL RANGE DISTRICT.

Deposits of Copper and Silver Ores.—These are copper and iron pyritic ores; some of them at sea-level on the beach, others inland, at the base of the Dial Range.

Penguin Silver Mine (Section 2385-93M, 15 acres).—The old shaft on the beach, half a mile east of the Penguin township, was sunk to 70 or 80 feet between thirty and forty years ago, and some driving done in different directions,

the northern drive being under the sea; notwithstanding this, there was no trouble with the water. At the surface, it is difficult to see exactly what was driven upon. A band of siliceous dolomite, charged with iron pyrites, goes out to sea northwards from the shaft. Parallel with this, another north and south outcrop, of the same nature, but copper-stained, is seen about 100 feet east of the shaft. A shallow shaft has been sunk to prospect this, and some pyritic ore obtained, containing small quantities of gold, copper, and silver. This is about 20 feet deep, and filled with water. There is an outcrop, 70 feet east-south-east from the main shaft, showing copper pyrites, pieces of which I took; they were found to contain, by assay, $1\frac{1}{2}$ oz. silver per ton. The ore from the shallow prospecting shaft just mentioned assayed, in the Government laboratories, 8 dwts. silver per ton; and from the outcrop close by, 12 dwts. silver per ton, a trace of gold, and 1 per cent. of copper. The outcrop north of the main shaft assayed 4 ozs. of silver per ton; and another sample, from one of the eastern outcrops contained only a trace of copper. Joints and veins are seen crossing the country from east to west, so that we have an area of silicified rock, traversed by a more or less rectangular grating of veins. It is probable that at shallow depths this arrangement of veins will prevail, and there will be no well-defined lode to work upon; but it is equally likely that some junctions will be made at a greater depth. The chances, too, are that richer mineral will be found at an increased depth, for with the constant percolation of water from the sea, a good deal of leaching must have taken place. It will be of no use driving from the shaft at the level of the present drives, for there is sure to be little or no change at 70 feet down; but at several hundred feet down some alteration, both in the vein-formation and the mineral, may be expected. Some of the numerous veins apparently carry rich concentrations of fahl ore, for Mr. Montgomery, in his 1895 report, refers to alleged assays of 230 ozs. silver per ton. I did not succeed in getting samples of this rich ore, although I have been shown assay notes giving high figures. In accepting such figures, the authenticity of the samples is a matter of prime importance, and with respect to this I have no information of which I can make use. Mr. Montgomery's samples, which were assayed by Mr. W. F. Ward, returned—gold, 1 dwt. 15 grs. per ton; silver, 27 ozs. 15 dwts. 8 grs. per ton; copper, 3.4 per cent.; nickel, 2.5 per cent.; cobalt, 0.8 per cent.; lead, 10.8 per cent. Evidently the ore

varies considerably in richness, and if the richer varieties could be discovered in any quantity, work would be profitable; but, as indicated above, the only reasonable way of ascertaining the value of the deposit is to sink 300 or 400 feet, and open out at that depth. It will then be seen whether there is any lower zone of enrichment resulting from the leaching of the metals from the upper part of the formation; and whether the numerous veins in the shallow zone make into a definite lode at that depth.

The shallow meandering drives which have been put in answer practically no purpose, as they are not more than 60 feet below a surface covered with water twice in the twenty-four hours. They only show that, at that short distance below the outcrop, the condition of the veins is practically identical with the appearances at surface; and they indicate that the prospects are unfavourable for further expenditure on shallow works.

I am disposed to interpret the strata which enclose the veins as belonging to the older Silurian, favourable therefore, under the influence of the granitic solutions emanating from some undefined depth below, to the deposition of metals.

Sullock's Mine.—Ten or 15 chains west from the Penguin Mine there is also an irregular mineralised formation of the same character, as the Penguin deposit. Several years ago I saw the shallow shaft put down upon it, between tide marks, by the late Mr. Thos. Sullock. The country was siliceous and dolomitic rock, impregnated with iron pyrites, slightly auriferous and argentiferous. The outcrop showed quartz and magnetic iron oxide. It has been abandoned without much trial; the place selected for testing it is about the worst that could have been chosen, being below high-water mark, but the assay results and the general appearance of the formation at surface, contra-indicate merely shallow work. The remarks made under the head of the Penguin Mine apply to this as well.

Mr. Hall, who has bought Hardy's farm, is driving a tunnel south into the hill, a few chains west of Hardy's old drive, upon the line of this fractured stockwork belt. It is impossible to follow any of the veins persistently for any length, but the vein belt as a whole, no doubt, passes south into the hill range.

Neptune Mine (Section 3596).—The old main shaft is half a mile east of the Penguin Silver Mine, and is situate on the shore above high-water mark. As at the neigh-

boring mine, the section extends north from the railway, under the sea. I am told that the shaft is 100 feet deep; and that two levels were driven from it, one at 50 feet, and a bottom one at 100 feet. The bottom level did not reach the lode, and seven years ago Mr. Ellis took up the work and extended the level; but I am informed that no lode was got, only a vein $1\frac{1}{2}$ in. wide. Mr. Jno. Ellis has kindly furnished me with a note of some assays which he made at the time. He says:—

	Silver.	Lead.
	ozs.	per cent.
Galena and cerussite.....	36	66
Galena (upper level).....	24	67
Galena (lower level).....	28	69
Lode matter (green siliceous).....	5 $\frac{1}{2}$	a few.
Bag of galena from beach.....	24	60

The above samples contained merest traces of gold.

The galena and cerussite was obtained from the lower level two or three days before the last inrush of water; the mine has not been unwatered or worked since."

At surface, a lode, or lode formation, runs out seaward to the north-west, but is much obscured by beach deposits; it looks like a 9-foot band of mineralised dolomite, with a seam of galena on each wall. The first shaft which was sunk was Peart's shaft, from which a drive is said to have been put in to this lode, and some good galena obtained about thirty years ago. With the covering of sea-shingle, it is extremely difficult to make out the geological relations of the surrounding strata, but I believe the country-rock is Silurian. The massive angular breccia forming the headland, and apparently encasing the lode formation, has a resemblance to a fine-grained variety of the Dial conglomerates; and, if it belonged to these, would be a capping only; but I am disposed to assign it to the Silurian series, of which it would be an interbedded member, partaking lithologically of the nature of a greywacke. This breccia goes up the hill a chain above Mr. Cameron's house, south of the railway, and is then overlaid by basaltic soil. Mr. Cameron showed me several samples of bright galena from the Neptune Mine; a little copper pyrites was noticeable in some of it. The silver ratio to the lead unit is not high in this ore, but so little is really known of the deposit, that it is not safe to generalise. It would not require much driving to intersect the lode in the bottom level, and see what it is; but, even then, I believe deeper work will be necessary to prove the deposit below the zone of these narrow seams and veinlets. The phenomena all along this

beach are similar. The country-rock is traversed by small fractures, which, filled with mineral, form the numerous veinlets which have encouraged mining, but which are not sufficiently important to work profitably. The aim should be to get below this horizon of ramifying veins, into a zone of larger fissuring, where there is a better chance of meeting with ore in payable quantities. So much has been said of the Penguin beach mines, and so disappointing have been the results of work that for a long time they have been looked upon as hopeless, and the little that can now be seen of them is not very inspiring; but a little consideration suffices to show that the work done has been altogether insufficient to prove them either one way or the other, and that actually, as mining risks go, their claims are equal to those of other shows which have received far more attention.

Penguin East Beach.—Some Tertiary manganese oxide is on this beach, half concealed by the sand, on the Section 1690-93M, 20 acres. The outcrop is only partly visible, but shows fairly pure ore. Some bulk tests were made some years ago, but while pure ore can be got in places, the average quality, as tested, was not good enough to leave any profit on exports.

Dial Range (East Side).—The route to these mines follows the Iron Cliff Road out of the township, soon turning off along the South Road, and leaving the latter for the Dial Track. The basaltic soil continues until, approaching Mt. Montgomery, it is replaced by the waste of the conglomerate forming that mountain. At Revell's farm, at the base of the mountain, the track attains its highest level, 500 feet above sea. The track is cut in the clay derived from the range, and no bed-rock is visible until Whisky Creek is reached, where a spring of pure water falls over a ledge of black slate by the roadside. On rounding the curve of the road south of this, the granite country is entered, and the road passes over it from here to the Dial Creek, where the variety of the granitic rock is felspar porphyry.

Keddie's Mine.—These tunnels, driven on the south side of Dial Creek, are flooded, and I could not enter them; but I examined the country-rock, and the ore-tip, from which I was able to see that the workings are in felspar porphyry, sometimes brecciated.

I hardly think that the brecciated rock is volcanic ash, but rather that it consists of the shattered porphyry. This

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is most apparent in the tunnel nearest the bridge. The lower tunnel, further down the creek, is in more solid porphyry. The mine is evidently at the contact of the porphyry with the Silurian slates and sandstones. The latter adit was being driven to intersect a lode cut in an upper tunnel, and has apparently done so, for iron pyrites is on the tip outside. Very little copper pyrites can be detected in the ore. The samples obtained by the late Mr. J. Harcourt Smith assayed no silver nor copper, and 1 dwt. 15 grs. of gold per ton. The specimens of iron pyrites which I took, when tested in the Government laboratories, gave a trace of gold, but no silver. There is so much iron pyrites in this contact country, that it is difficult to believe that it is not associated with some metal of value. There is reason to believe that the copper carries the gold and silver contents; hence, the aim in all these explorations should be to discover the shoots of copper ore, which here and there accompany the pyrite.

Dial Mine.—The Dial Range Prospecting Association carried on some work, a few years ago, on the sections south of Keddie's, which are now charted as an extended prospecting claim, 320 acres, in the name of P. H. W. Sams. The mine is at the central angles of the four Sections, 3191, 3190, 3188, 3189-93M, an adit driven south being in the south-east angle of 3191, and one north in the south-west angle of 3190.

On Section 3190, a tunnel, bearing north-west, changing to north, has been driven from the creek for about 70 feet on the lode and lode-formation, which is a crush breccia, or zone of fractured rock (quartz porphyry), the interstices of which are filled with, and the fragments often replaced by, iron pyrites. The pyrites is occasionally enveloped in a film of black copper oxide (malaconite), and sometimes associated with copper pyrites, gold, and silver. Encrusting sulphates of copper (blue) and iron (green) occur from decomposition of the pyritic ores. The tunnel has been driven about 80 feet in breccia; the ore-body seems to have been left just beyond a shaft a little way in, which has been sunk on the lode for 13 feet, or 30 feet from surface. A crosscut east has been put in at end of tunnel for 22 feet, but it only shows clayey, brecciated country, without mineral. At the shaft, the lode is exposed for a width of 6 or 7 feet clearly; it is said to be 13 or 14 feet wide at this point, but the full width is obscured by timbering. It consists, at the level of the tunnel, of loosely aggregated iron pyrites, merging into jointed, massive

quartz porphyry rock on the west side, without any parting or wall. The boundary on the east side of the lode is not accessible. The shaft was being unwatered during my visit, but the pump was defective, and the bottom was drained only a few minutes, just time enough to secure samples. These, assayed in the Government laboratories, by Mr. W. F. Ward, returned 1.6 per cent. copper, and 15 dwts. silver per ton; only traces of gold were found. The iron pyrites at the tunnel level contained, by assay, neither gold nor silver. A picked specimen of copper ore, alleged to have come from the shaft, was given to me, which I identified as belonging to the same or a similar formation, but, as I did not take it myself, I only give its assay for what it is worth, viz., 8.2 per cent. copper, 3 dwts. gold, and 68 ozs. silver.

In 1900, a parcel of 6 cwts. crude ore was sent from here to the Smelting Company of Australia, and, from their ore-purchase statement, I notice that its assay value was 4 dwts. gold per ton, and 9.1 per cent. copper; no silver. Samples assayed at Broken Hill in 1899, from the then bottom of the winze, gave 23.6 per cent. copper, and 2 ozs. silver per ton. The assay note of Mr. F. E. A. Stone, Analyst to the Mines Department, Melbourne, in 1898, of samples from this mine, has been shown to me, and I reproduce the results given:—

Assays per Ton of Sample.

	Gold.	Silver.			Copper.
		ozs.	dwts.	grns.	
					per cent.
Iron & copper pyrites	Trace	1	6	9	8.5
	Nil	2	8	23	14.3
	"	1	12	16	8.7
	"	2	14	21	12.6
	"	3	0	17	18.6
	"	1	14	15	11.3
	"	1	18	13	11.3
	"	2	13	13	16.9
	"	2	9	0	17.6

Mr. W. F. Ward, Government Analyst, made an assay of the ore for Sir Edward Braddon, 18th April, 1900, which returned 4.9 per cent. copper, a minute trace of gold, and no silver. Another assay made by Mr. Ward, for Mr. F. S. Denney, 16th May, 1900, gave 7.2 per cent. copper, 1 oz. silver per ton, and a trace of gold. The silver and gold con-

tents evidently vary greatly, and any productive mining would have to be accompanied by continuous assays. Taking the parcel sent to the Smelting Company of Australia as a basis, such ore, with the present price of copper, would be worth from £4 15s. to £5 per ton at the mine; but, with the repeated assay returns of no gold, or only traces, present, the continuance of the gold contents is highly uncertain. Apparently, there are patches of the ore-deposit fairly rich, while other parts are practically barren. The brilliant crystalline iron pyrites, which is so abundant, seems to be worthless; but the copper collects more or less silver and gold, though by no means in uniform proportions. It must be remembered that a little black oxide of copper augments the copper percentage considerably, and that the ore in this form will, owing to the loose nature of the lode, be found existing to a good depth.

Owing to the class of lode (contact), the extension of the ore-body will probably be very irregular, following the fractures at the edge of the quartz porphyry rock; and the deposit of metal may be expected to be bunched. The bunch of ore at the shaft does not continue in the tunnel further than a foot or two north of the shaft, but whether this is due to its bunched nature, or to its having crossed the tunnel, cannot be seen without another crosscut west; this might be put in opposite the crosscut east. At surface, there are indications of the lode extending a good distance both north and south.

On the south side of the creek a tunnel has been driven about 170 feet, in a direction a little east of south, in a similar crush breccia carrying iron and copper pyrites. The object of this adit is said to have been to cut a lode about 200 feet below a gossan outcrop higher up the hill, but it has been driven continuously in the mineralised contact formation. A few feet in, a shallow winze (18 feet) has been sunk, which, I was told, went down on a copper ore deposit, one specimen of which (black oxide) assayed 18 per cent. copper. At first the pyrites appears on the west wall of the adit, but towards the end of it, on the opposite side, and the soft country is followed. There is a good deal of kaolin and softened clayey country in the adit; the kaolin has been assayed, but contains no valuable metal. A crosscut west has been put in to prove the width of the pyrites belt, which seems here to be about 30 inches; at the end, a crosscut has been driven in soft clayey rock. There is a seam of crystalline pyrites on the east side, at the end of the main tunnel.

At surface, $2\frac{1}{2}$ chains to the west, slate comes in, so that here the contact would appear to be one of quartz porphyry and slate. It is the same line of contact which goes right through the property northwards, and the zone of fracturing may be rather a broad one, which adds to the difficulty of prospecting it, as it is difficult to say in which part of it the payable ore is located. The proper plan seems to be to sink on the body disclosed in the shaft on the north side of the creek, and after going down a fair depth, say 100 feet, open out on it, and crosscut. After this is done, the owners will be in a position to see whether the prospects warrant work on a more extensive scale. I would not advise any other expenditure at present than this necessary cost of development. With the chances of getting down on a payable body of copper ore, the deposit is, I think, worth testing. The distance from Penguin is nearly 6 miles, and the Leven River is a little over a quarter of a mile to the east; a wagon-track from Penguin passes within a quarter of a mile of the mine.

Sykes and Robt. Revell.—This is south-east from Keddie's in the Dial Creek Valley. A formation, impregnated with iron pyrites, has been partly uncovered, but requires thoroughly stripping before anything definite can be said about it. It has also been worked a little on the Dial side of the creek. No exposure of fresh rock is to be seen, but the country appears to be granite rock to the east, and slate on the west. This seems to be one of the numerous contact formations of the district; whether it carries any copper pyrites can only be ascertained after more work.

Hardstaff and Rogers.—This mine is on a 320-acres extended prospecting claim, south and west of Russell's 104 acres, half a mile south of the Dial P.A. Mine. A lode outcrop has been traced for a considerable distance in a hard granite (dyke) rock,* in a north-east to south-west direction, dipping north-west at an angle of about 50 degrees. The lode is a fissure one, about $1\frac{1}{2}$ feet wide, banded with carbonate of iron, and arsenical iron and copper pyrites. It carries at the outcrop, where a cut has been made into it, a 2-in. vein of solid copper pyrites, with some copper glance, a sample of which has been assayed by the Government Analyst, returning 40.7 per cent. copper, and 2 ozs. silver per ton. I took a sample, also, of the iron pyrites from the lode, and this assayed 1 dwt. gold, and 4 ozs. silver per ton. I was told at the mine that assays had been made,

* Augite granite.

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varying from 1 to 4 dwts. of gold, and silver as much as 12, 16, and 20 ozs. per ton. I noticed also a little galena in the lode. West of Salmon Creek, an adit is being driven north-west to intersect the lode 70 or 80 feet below its outcrop. The country being extremely hard, slow progress was being made. The lode is a well-defined one, and fully merits the trial work now in hand. Further north, Russell's old tunnel, if extended, would cut the lode-line at a good depth, but it would have to be driven a few hundred feet further. Further south, too, I saw an exposure of what I took to be the same lode; so that it probably maintains its course for between $\frac{1}{2}$ and $\frac{3}{4}$ mile. There is a likelihood of the band of good copper ore varying in width in different parts of the lode, upper and lower, and it may possibly increase to a payable width. The value of the mine is prospective, and the prospects are encouraging.

Robt. Hutton's Outcrop.—A couple of miles south-west of Hardstaff and Rogers', an exposure of slate in a deep creek occurs, where a small quartz vein, carrying a little galena, has impregnated and altered the country for about half a foot on its footwall side. It runs very regularly between the laminae of the blue banded slate; about 60 feet higher up a 3-in. vein of quartz, which is said to have shown a little galena, also occurs in a similar way, bearing N. 10° E. This occurrence is worthless in itself, and the indications are against the vein widening at all in depth; but it is useful as stimulating search for better outcrops, and as showing that mineral country extends a good deal further south than the known Dial deposits. This slate country, of which Mt. Duncan, at the south end of the Dial Range, also largely consists, is an area in which gold quartz reefs might be expected. About 3 miles due south is Applebee's Copper Show, on Walloa Creek, north of Gunn's Plains, and the intervening country has been poorly prospected, if, indeed, it has been examined at all. From the Penguin to Walloa Creek the distance is 10 miles, and all along this belt, between the Dial Range and the River Leven, the ore phenomena have one and the same origin, connected with the consolidation of the underlying granite. The wide distribution of copper ore in association with the iron sulphide, though very irregular, is an inducement for renewed prospecting. Without such work, discoveries of payable ore will never be made, and the Dial district will remain, as it is to-day, an undeveloped field with promising indications. But with adequate and judicious prospecting, eventually,

I doubt not, some of these indications will be found to improve into payable deposits, and this extensive mineral area be seen responding to the hopes which have been long entertained.

NORTH AND WEST DIAL RANGE.

Devon Consols.—About $\frac{1}{4}$ mile from the coast, on Section 1660-93M (formerly 2624-87M), at the north end of the range, are the Devon Consol's workings, which have been idle for some years. The ore is iron pyrites, with which a little copper pyrites is said to have been associated; but, as far as such of the assays as are reliable go, no metal of a payable character has been found. Mr. Montgomery's average samples were 1 oz. 1 dwt. 5 grs. silver per ton, with traces of gold and copper. The lode has been thought to be in the Dial Range conglomerates, but I could not satisfy myself as to this; and I believe all these copper-bearing lodes will be found to be in the older (Silurian) strata. The hematite on the surface above the mine may belong to the conglomerates; Mr. J. C. Ellis shipped 300 tons from here. His last shipment was 66 $\frac{1}{2}$ per cent. iron, and only 2 $\frac{1}{2}$ per cent. silica, but, as a rule, there was too much earth to handle.

Badger's Mine.—This is on Section 707-M (formerly 4849-93M), just outside the south boundary of A. Hutton's and J. Revell's Section 340-M. Mr. Hall was the discoverer of the lode, and Messrs. Badger and Hall worked it. It is now charted in the names of Messrs. McKenna and Rogers. The country-rock is difficult of identification, but the level which is driven south-east begins in a decomposed quartz-felspar porphyry, not easy to distinguish from sandstone, and cuts a small vein ($\frac{1}{2}$ inch to 2 inches) of bright galena, dipping south-west. This vein is seen a few yards further in the tunnel, on the south-west side, widening and contracting in short bulges, only the facing, however, left now on the hanging-wall; then slate country comes in, and the lode is in the slate. At 55 feet, short crosscuts were put in both ways; a little native copper was found in the north cuddy. There are three small stopes over the back of the level, and from first to last about 3 tons of galena were, I am told, sent away, containing $\frac{1}{2}$ oz. of silver to the unit of lead. A small shaft is being sunk on ore, now down 24 feet, and carrying small veins of galena. A tunnel, 50 or 60 feet lower down, has been driven about 400 feet, and drains the creek, but has not cut the lode. The ore in this lode has

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some admixture of zinc blende, with a little copper pyrites in addition to iron pyrites, and will require careful dressing. A sample assayed by Mr. Ward, returned 44 per cent. lead, and 13 ozs. silver per ton.

Not much is known of the extension of the lode, as it has not been trenched upon north or south. It ought to be traced at surface, as it may widen out at some part of its course, when a profitable mine might result. It owes its existence to the intrusion of the quartz porphyry, and is a contact result. There is some probability of it becoming a copper lode in depth. The width is not very encouraging, but the shaft will give the means of proving it below the level, and its outcrop line at surface should indicate any improvement on its course.

Iron Cliffs and Lady Braddon Mine.—The Iron Cliff comprises a huge outcrop of limonite (brown hematite), about 150 feet wide, on Section 340-m. A. Hutton and J. Revell, inside and along the eastern side-line. It runs south down the hill to McBride's Creek, in bold cliffs, with as much as 40 feet vertical face, showing in parts fibrous, botryoidal, and stalactitic forms of structure. Northwards, it passes through Anderson's 60 acres, covered by basaltic soil, except where exposed in a creek; and into Barnes' 23 acres, which it traverses. The ore on the latter land has a good deal of quartz mixed with it, as well as baryta, and is sometimes manganeseiferous. A sample which I took from the outcrop here, assayed by Mr. Ward, Government Analyst, contained 59 per cent. iron, 5 per cent. silica, traces of phosphorus and sulphur. Samples taken from the blow or large outcrop on Hutton and Revell's section, assayed in the Government laboratories, returned—(1) 48 per cent. iron, 18.4 per cent. silica, 0.15 per cent. sulphur, trace phosphorus, no gold or silver; (2) 57 per cent. iron, 7.2 per cent. silica, traces of sulphur and phosphorus. I think there is no doubt about this being a lode outcrop, and not a bedded deposit. It contains vein-minerals, and the last shade of doubt which existed in my mind, owing to its being assigned to the Dial formation, has been removed by noticing Silurian quartzite on its east side, and quartzite and slate on its west wall, in the Lady Braddon tunnel; but I should not be surprised if this large lode turns out to be connected with the contact of the quartz porphyry of Badger's Mine. Some of the iron from this lode has been shipped by Mr. Ellis, but it was found to be too siliceous.

Mr. Ellis did some work in a tunnel driven into the lode, which failed to bear out the promise of the first assays, from which a high gold return had been obtained. A new low tunnel was started by the Lady Braddon Company, who ceased work a couple of years ago. Messrs. Hutton and Revell have now taken it up, and extended the Lady Braddon tunnel 90 feet. This tunnel is now in 290 feet from the creek, and has cut into the lode for 37 feet, which leaves about 100 feet more to drive across it. The tunnel has been driven north-east, at as low a level as could be got (about 450 feet below the blow), and passes first through soft slates, followed by sandstone and clay, with a band of dark quartzite and clay, or slaty country, dipping north-east into the hill. Some bands of ironstone cross the level before the lode is reached. The last 37 feet of driving is in a clay ironstone gossan, with blebs and veinlets of silica. I was told that Mr. Ward's assay of it returned 16 grs. gold per ton, with good traces of silver and copper. Samplings which I took on two visits were assayed in the Government laboratories, as follows:—(1) No gold, traces of silver; (2) 57 per cent. iron, 7.2 per cent. silica, traces of phosphorus and sulphur.

To all appearances the end of the tunnel is now below the outcrop on the slope of the hill, without allowing for any underlay. The lode must be wider than shown in the outcrop, or the formation struck in the tunnel must be a parallel band of ore. I should recommend continuing the drive to the hanging-wall of the lode, and then sink. In a large lode like this, metalliferous veins are often found following the walls. A good deal of speculation is rife as to what kind of a lode this is likely to be in depth. The hydrated ferric oxide, which forms the part of the lode accessible to us, is most likely the result of the oxidation of some metallic sulphide, and its dense solid nature indicates that it is derived from iron pyrites, though copper pyrites is not excluded as an associate. The sulphides have disappeared; any copper present has been removed in a soluble form, and redeposited in the lode below the drainage level of the locality. It would seem that there was never much gold or silver in the ore, or, in consequence of their insolubility, they would have remained to enrich the gossan. It is uncertain how deep it would be necessary to sink to reach the ground water-level and the zone of secondary deposition, but it is quite certain that sinking will have to be resorted to to prove the lode. Though I do not think much of its prospects for gold and silver, it may carry a hidden deposit of copper ore of economic value.

Tasmanian Iron Mines.—These comprise the hematite deposits along the course of the Penguin Creek, at about 3 miles from its mouth, which are being worked by Mr. J. C. Ellis, of the Penguin. A horse-tram, two-thirds of it steel, and the remainder wood with steel strips, has been laid down from the quarries to the wharf, a distance of 3½ miles along the creek, which it crosses and recrosses by means of at least 25 bridges in that distance. Thirty tons a day are at present being carried in two trips, and the ore loaded into lighters for transshipment at Devonport to New South Wales' boats. The Cockle Creek Smelting Works are taking the ore for smelting purposes.

The ore sent away is a very pure red hematite, containing 66 to 68 per cent. iron, and 2 to 3 per cent. silica. A recent shipment returned 68·9 per cent. iron, and 1·2 per cent. silica. Samples which I took from the various quarries were assayed in the Government laboratories, with the following results:—

	Iron. per cent.	Silica. per cent.	Sulphur.	Phosphorus.
1. Surface work side of tramway	69	0·4	trace	trace
2. Hudson's quarry	68	0·6	—	—
3. Good's cutting, above road..	68·5	0·6	—	—

These assays and the shipments show the ore to be singularly pure, when it is borne in mind that the theoretical maximum of metal in the sesquioxide is 70 per cent. It is remarkably free from the impurities which are a drawback in metallurgical processes, viz., sulphur and phosphorus, and its silica contents are low. Undoubtedly, the very best iron and steel could be made from this ore. Plainly, the nearness of the deposits to the seaboard, and the ease with which they can be worked, invest them with particular interest at the present time. It is where the creek passes through the properties of Messrs. Hudson, Crawford, and Good that the deposits have been worked, the present workings being at the north end and on the west side of the creek; faces being opened in Hudson's Nos. 1, 2, and 3 quarries in the side of the tableland, which stretches away westward. At my visits, the output was coming principally from the first two quarries. No. 1 had a face of 18 feet of iron ore, below a surface overburden of 6 to 10 feet of yellow clay. The ore consists of large, rounded, and angular lumps and stones of hematite, with some limonite. The boulders attain a great size, and have always a rounded form. One large boulder of ore was taken out weighing 3 tons; boulders have been found in some of the quarries weighing as much as 25 tons. These

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boulders of dense ore lie in softer parts of the deposit, which are often clayey, and not pure enough for shipment under present conditions. The present plan of working is to open out quarries at selected points, where the ore is most clean and solid. No. 2 quarry is a few fathoms north of No. 1, and is in good ore. When I was there, the main supply of ore was being furnished by these two quarries. A little further north, No. 3 was just being opened. On the opposite side of the creek are the old workings, which were started for Mr. Ellis six years ago, and which have yielded between 15,000 and 20,000 tons of ore. To illustrate the irregular occurrence of the best hard ore, from a cut south of No. 1 quarry, only just below the soil, half a dozen large boulders yielded 100 tons of ore. Further up the creek, too, on the east side, about 500 tons of ore were taken out of the surface soil, boulders of 5 and 10 tons first-class hematite being very common.

Mr. H. J. Ellis took me up the creek to the various cuts and other openings into the iron deposits, all showing similar occurrences. There is a long stretch of it for about $1\frac{1}{4}$ mile along the creek; it is naturally of varying quality, much of it earthy and siliceous, and associated with limonite. Associated with the iron is a white friable saccharoidal sandstone, here and there converted into quartzite. I was told that a kernel of this had been found in a boulder of ore. I saw, myself, indications of the conversion of sandstone into the ore of the deposit, and the nodular form in which the ore occurs suggests an original pebbly sandstone or conglomerate. This leads to the belief that the deposits are transmuted beds of the Dial Range formation, and have no relation with the Iron Cliff lode, although the prolonged strike of the latter would bring it somewhere near the north quarries.

The assignment of the sandstones and quartzites to the Dial beds is the key to a proper understanding of the deposit, and, if this be correct, we are able in a measure to forecast the nature of future work. There are no grounds for supposing the Dial beds to be very thick. Examination of the mountain shows that they form a capping, not more than a few hundred feet, which reposes on the edges of the underlying Silurian slates and quartzites, which mount to within 200 feet of the summit. The scanty beds of Dial sandstone and conglomerate which are found at the base of the range, are probably only a thin skin, barely covering the ancient rocks, being a little thicker, perhaps, in the hollows of the old denuded surfaces of these. The iron deposits

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may, perhaps, fill such a hollow, and in that case would be worked out to the east and west when the rim-rock is reached; and vertically when the Silurian floor is met with. I do not anticipate, therefore, that they will be found to descend to any great depths, but they may extend westwards for some distance below the basalt before feathering out; or, on the other hand, the western edge may be close at hand. They will not go further west than the survivals of the original conglomerates. It is evident, therefore, that the Penguin Creek iron is not related in any way to the ore deposit on the River Blythe, although the latter is only 4 miles to the west. The nature of the two ores is also different, the Penguin ores containing only traces of phosphorus. This little seat of industry is a pleasing sight. Since Mr. Ellis embarked in the venture, over 20,000 tons of ore have been shipped altogether, and the work which is being carried on now may be continued on the same, or even an increased scale for a good many years to come, with advantage both to the mine owner and the Penguin District.

Dial Iron Deposits (Denney and Jones).—Section 5088-93m, 50 acres, W. Jones; Section 5089-93m, 50 acres, F. S. Denney. These are iron reward sections at the south end of the Dial Range, on its western flank, within 150 to 200 feet of the crest, and about 6 miles south of Penguin. A good road over the basalt plateau runs south, on the west side of the Penguin Creek, skirting the Dial Range. The buggy is left at Stone's farm (L. Biggins, 100 acres, 33-7), 800 feet above sea-level, the Penguin Creek crossed 50 feet below the road, and the ascent of the Dial begun. After 700 feet of climbing, the ore deposits are reached.

W. Jones' Section (No. 1 Cutting).—This is an excavation into a body of hematite, exposing a small face from 6 to 12 feet in height. On the steep slope of the hill, capping the deposit, are large ironstone boulders. The ore-body is bedded conglomerate, with the pebbles converted into iron ore; nodular iron pebbles showing prominently on the face. Some of the ore is very pure; in other parts, the siliceous conglomerate has been preserved. Samples which I took from the ore were assayed by Mr. W. F. Ward, the Government Analyst, and gave the following satisfactory return:—Iron, 68 per cent.; silica, 0.5 per cent.; phosphorus and sulphur, traces.

This band of ironstone passes northwards right through the section, extending beyond the north boundary. A creek exists north of No. 1 cutting, and on the upper part of the

opposite slope massive boulders of nodular iron ore show in the soil, and projecting from it. The character of ore is the same throughout, except that possibly it is a little more siliceous on the whole than in the cutting. This is a broad and massive formation. Nothing has been done yet in the way of opening it up and ascertaining its extent. There is, no doubt, enough ore to work this section independently, but the juxtaposition of Denney's section suggests that both would be better taken in hand conjointly.

F. S. Denney's Section.—This is south of and adjoining the previous property. I saw three cuttings opened in the conglomerate hematite, which is the same deposit as that on W. Jones' section.

No. 2 cutting is just inside the north boundary, and the ore has an apparent width of 2 or 3 chains. Massive ironstone crops out in huge flat boulders, with nodular surfaces. The pebbles here, too, have been replaced by iron oxide. The deposit is a good looking one, the ore being rather solid, and not quite so siliceous in appearance as at No. 1 cutting, from which it is distant 4 or 5 chains. The samples assayed in the Government laboratories returned:—Iron, 66 per cent.; silica, 1.6 per cent.; sulphur and phosphorus, traces. The ore here could be worked from the west, where, a few hundred yards away, the ground falls rapidly.

No. 3 cutting is further south 7 chains from No. 1. A trench has been dug in boulders of singularly pure and dense hematite; the ore is occasionally crystalline. The trench is not quite deep enough to be thoroughly sure that the solid deposit has been reached; but the boulders in the trench and at the surface belong to the ore-belt, which seems to maintain a width of 2 or 3 chains. There are still indications of ironstone pebbles, but the ore is, on the whole, more dense and massive than in the other cuttings. Samples assayed as above-mentioned gave:—Iron, 69 per cent.; silica, 0.8 per cent.; sulphur, 0.15 per cent.; phosphorus, traces.

No. 4 cutting is 2 chains further south, and 1 chain inside the west side-line. In their excavation, boulders of nodular hematite are cut at 4 feet from the surface. Between and below them is soil, but below the water in the trench solid rock is again struck. The samples which I took here proved to be more siliceous than the others, though the ore appears pure:—Iron, 58 per cent.; silica, 6.8 per cent.; sulphur and phosphorus, traces.

In the soil between the various cuttings, siliceous boulders of ironstone occur, so that the quality is not uniform throughout; but in the ore-belt there certainly appear to be several points where the ore is of good quality. With the small amount of work which has been done, it is impossible to form any estimate of the quantities of ore available. The country-rock is impregnated with iron for a quarter of a mile to the east, and, even on the top of the mountain, the ore, to some extent, is present in the conglomerate.

The sole impurity in the ore on these two sections is silica, and in working the deposit favourable places in it would have to be selected. The faces would be connected with a horizontal tramway, and a wire rope would convey the ore to the basalt plateau, whence the outlet, probably, would be *via* Sulphur Creek, if the Penguin Creek route is considered too rough. If, however, connection were made with Mr. Ellis' tramway, the latter would necessarily be the route. When the iron industry becomes established, these deposits, though not very favourably situated, may be expected to receive attention.

In concluding these remarks upon the Penguin, and the district lying behind it, I may add that, while there is no paucity of indications of mineral, very little has been done in the way of proving the mineral ground, excepting in the case of the much despised iron ore, which, however, is, so far, the only mineral which is being shipped. There are no ready-made mines, but there are signs of minerals scattered over an extensive area, and while it is impossible to point to any particular spot as one which is certain to be profitable, it is possible to say that within this area there are places where, in all probability, profitable discoveries could be made.

BLYTHE AND STOWPORT DISTRICTS.

These are districts which derive their chief importance from their agricultural industries, nourished by the rich chocolate soil which covers the basaltic plateau stretching inland for miles, at an elevation of about 500 feet above the sea; but below this covering of decomposed basalt are the older slates, sandstones, and quartzites of Silurian (probably Lower Silurian) age, which are the receptacles of mineral deposits all over our island. The northern termination of this bed-rock faces the sea on the coast road, where fertile farms, on the top of the cliffs here and there, show how thin

is the basaltic mantle. The deep valley of the Blythe has cut its channel through the basalt into the more ancient bed-rock, and sometimes heights are reached which the basaltic sheet either failed to overwhelm, or from which it has since been denuded. We have, in this way, a highly favoured area, which may be both agricultural and mineral. It is true that there are not many exposures of intrusive igneous rocks; a few exist along the coast line.

At the mouth of the Blythe River, at Parsonage Point, Burnie, and in the bay between there and Coosee Creek, a tough, greenish rock has intruded itself into the sedimentary strata along the beach; but this rock (a gabbro) is probably older than our granites, and does not appear to be associated with mineral deposits. But at no great distance south of the great iron deposit (2 or 3 miles, perhaps), granite makes its appearance in the valley of the Blythe, an extension of the granite mass near Riana and higher up the Blythe River; and wherever on this coast, from the Leven to the Blythe, granitic rocks make their appearance, or make their influence felt, there indications of copper ore deposits appear also.

The land in the Stowport Parish being closely settled, it is perhaps natural that search for minerals has not been very persistent or systematic, for agriculture must necessarily occupy the chief place in the minds of the inhabitants. It is, however, noteworthy that one or two have given a little attention to the sister industry, and have explored on adjacent Crown lands. The result of this so far is, that there are at present before the public two small mines, which it is hoped may develop into properties which will benefit the district, and be the forerunners of other discoveries; these are the Rutherford Prospecting Association and the Blythe Prospecting Association, both formed in Burnie, and having their head quarters there.

Rutherford P. A.—This mine is partly on Crown land (on the 60 acres 4496-93M, W. and T. S. Rutherford), and partly (30 acres) on private property, with the right to purchase, situate west of and adjoining the Chasm Creek Road, 2 miles south-west of the Blythe Iron Mines, and 6½ miles south of Wivenhoe.

Messrs. Rutherford first discovered ore here four years ago, and spent a good deal of money prospecting. A tunnel was afterwards driven west into the hill; at about 10 feet in, a small seam of iron gossan was intersected, carrying some black oxide of copper. From this gossan some good assays were got (8 per cent. copper). A winze was sunk in

the approach, with the intention of opening out at 30 feet, and driving to the gossan vein; but increase of water frustrated this intention, and the drive was put in at 14 feet only. At the time of my visit, this winze was full of water, but I was told that the lode had widened to 2 feet 6 inches, and I was shown about half a ton of copper ore broken from the lode, and stored at Mr. Rutherford's farm. This is in siliceous and black oxidised lumps, containing a good deal of pyrites. I took samples from the different bags, and these, assayed by Mr. W. F. Ward, Government Analyst, gave the following yield:—Copper, 9·2 per cent.; silver, 5 dwts. per ton; gold, trace. Assays made by the late Mr. Latta of samples sent to him were as follows:—

	Copper. per cent.	Silver, per ton. ozs. dwts.	Gold.
1. December 17, 1900.....	13·8	5 2	traces
2. February 14, 1901.....	15·7	3 7	"
3. May 20, 1901—(1).....	20·8	7 3	1 dwt. 12 grs. per ton
" (2).....	0·7	2 9	traces.
" (3).....	1·2	3 2	"
" (4).....	—	1 6	—

The tunnel, a shallow one, was extended 150 feet beyond the lode in slate country, at first a black clay slate, changing half-way in to a light-coloured harder variety, but without cutting any other vein. About 20 feet south a shallow shaft has been sunk 20 feet on the continuation of the gossan lode, which here looks like a flat seam resting on copper-stained clay. Further south, a hole has been sunk 8 feet, showing clay slate on the east side, associated with a limonite gossan at surface, and quartz, looking favourable for both copper and gold. On the top of the hill, to the west, a lot of boulders of good hematite are scattered about, and there must be a solid ironstone formation somewhere near. A 40-foot shaft has been sunk through the loose iron into slate. Samples which I took of this iron ore have been assayed in the Government laboratories, and returned 58 per cent. iron, 2·4 per cent. silica, 0·5 per cent. phosphorus, traces of sulphur. This is a fair-quality iron ore, but the phosphorus percentage is a little high. It is a different ore altogether from that of the Penguin Creek deposits, and is nearly related to that of the Blythe. It is, in fact, on the southerly strike of that deposit, and is possibly a continuation of it. This is important, and the connection between it and the Blythe ore should be traced to the north-east. Lower down, on the other side of the hill, a tunnel has been driven, in hard micaceous ironstone, to cut some

supposed formation ; but it was discontinued, and the 40-foot shaft sunk instead. A few feet south of the tunnel there is gossanous yellow micaceous rock, and a small shaft has been sunk 16 feet in it. Some assays of the gossan are reported to have returned 1 oz. (or a little over) silver per ton. A little below this, I observed a number of pieces of quartz, under the roots of a fallen tree, as if a vein were below. North of the camp, a formation of massive iron pyrites has been struck, in indurated slate, assaying a little silver and copper. Thus, in several parts of the property, indications of mineral are found, and though the Messrs. Rutherford have been very enterprising in prospecting, more work of that nature remains to be done, and should be done if the possibilities of the section are to be proved. Obviously, the first thing to be attempted is to develop the copper lode at the tunnel in depth. Unfortunately, there is no means of getting at it by adit workings, and it will be necessary to sink on it. From its position, at the bottom of the hill, water is likely to be met with, but could be coped with by means of a small pumping-plant. The intention of the Association is to let a contract for sinking the shaft, and the nature and extent of the ore-shoot below will soon be ascertained.

Blythe P.A.—This mine is on the east side of the Blythe River, 3½ miles from its mouth, on an extended prospecting claim in the name of J. C. Stewart, formerly Section 4919-93M, 80 acres, held by J. F., A. J., and L. Morris, and T. Reeves (west of J. Evans' purchased 50a. 3r. 3p., 50-31). The road up to the mine passes up from the Blythe bridge at Heybridge, through the basaltic farms, for 3 miles, when a turn-off to the west leads to Anderson's farm, whence a foot-track descends over sandstones and slates into the valley of the Blythe River. About 10 chains up a creek flowing into the river, Messrs. Morris and Reeves discovered some copper ore four or five years ago (a little below the present tunnel). A couple of holes were sunk on it, and some very good assays obtained. The formation seems to be a parallel one to that in a shaft a little higher up. Some nice blocks of quartz, containing iron and copper pyrites, with black oxide of copper, have been thrown out. A chain to the north, a short tunnel of 39 feet has been driven north-east into the hill by the present Association. The tunnel is in slate, and it is difficult to know why it was driven, because the shaft-lode crosses its line outside the approach, and the farther it is extended the farther away it leaves the lode. At 31 feet in, a crosscut has been driven 16 feet in a south-easterly direction, in the end of which a seam of

white quartz, 8 inches wide, runs across the stratification, and forms a bunch in the roof; about $2\frac{1}{2}$ feet behind the face, it is cut off by thinly laminated black slate. A few little seams of rotten black slate were intersected, which are said to have contained some oxide of copper. A few feet south of the tunnel, a small shaft, 7 feet by 5, has been sunk 10 feet on a copper ore formation. On the east side is a vein of quartz 2 inches to 4 inches wide, associated with about 8 inches of veined slate; the whole charged with iron and copper pyrites. This development of quartz does not follow the line of strike of the slates. I took several samples from this shaft, and they were assayed by Mr. W. F. Ward, Government Analyst, with the following result:—Copper, 12.2 per cent.; silver, 2 ozs. per ton; gold, trace.

A small seam of soft black slate, which contains a little black oxide of copper, crosses the shaft south-west to north-east. These seams have no doubt received their copper contents from the lode, and this will explain the occurrence in the tunnel. The quartz seems to follow the strike and dip of the country. On the west side of the creek, opposite the tunnel, there is a hard outcrop of silicified slate and quartz, which might be a continuation of the lode holed into lower down the creek. Between it and the hole, an attempt has been made to cut the lode in the steep western bank; but the cut is not deep enough, and probably not far enough in for the purpose. These two lodes or formations are not more than half a chain apart. High ground exists on both sides of the creek, but that to the south and west is much higher than northwards, in which direction not more than 100 feet of backs could be gained on the line of lode, and then the drive would come out in a valley before entering another spur. Morris' lode would have to be driven upon south, and connected with the shaft by a crosscut, and the two lodes proved simultaneously. It is intended, I believe, to continue the sinking of the shaft to test the formation on which it has gone down. The means of getting mineral away is excellent, as the Blythe Iron Mine tramway bounds the section on the west, and descends by the banks of the river to its mouth. This copper ore deposit deserves testing; it is at present quite undeveloped. The tunnel work has been useless for the purposes of proving any lode, but the work at the shaft and Morris' excavation show that lode-matter exists, charged with copper ore. The few assays made must be taken as simply confirming this, and not as giving an idea of its value; for it is to be remarked that, in all the copper ore occurrences along the coast, secondary ore is often found in the form of black oxide,

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which enriches the assay value, but cannot be depended upon as a factor in the valuation of the deposit. In view of the vein formation at this mine, with copper contents and in favourable country-rock, it is desirable that it should be given a good trial.

The copper ore deposits of the North-West Coast may not appear very striking to those accustomed to the West Coast, where lode outcrops exist in profusion, and valuable minerals are found on every hand; but their comparative rarity and novelty in these admittedly agricultural districts make it important that, when found, they should not be passed over under the impression that, because the outcrops are modest in size and few in number, as far as is yet known, they are of no importance. One discovery infallibly leads to another, and no chance should be missed. It may be taken as a fact that all along this coast, wherever the superficial basaltic soil has been removed, or where from any other cause the ancient bedrock of slates and sandstones, or quartzites, is exposed, we have strata in which there is the possibility of finding deposits of copper. The few which have been discovered are disproportionate in number, and possibly in importance, to those still concealed. This is not surprising, for these areas have not been overrun by prospectors as in some of the exclusively mineral districts.

LEVEN DISTRICT.

Walloa Creek (Section 252-M, 40 acres, W. H. Applebee).— A copper ore deposit exists on this section, 3 miles south of Hardstaff's Mine. The easiest access is from Ulverstone, *via* the North Motton Road; the distance from the township to the bridge over the Leven, at Gunn's Plains, being 10 miles. A climb of about 2 miles up Walloa Creek, 400 feet above the bridge, leads to the outcrop in the steep creek bank. High hills on each side tower above the spot for about 500 feet. The country-rock is slate, striking north-east, and dipping south-east. The present outcrop attracted attention two and a half years ago, but there is some doubt whether it is not an old discovery made by the late Mr. Jas. Smith. On the south-west bank of the creek, a series of parallel calcite-copper pyrites formations occur in black and grey slate, sometimes graphitic. The main band or lode consists of a 6-foot belt of hard slate, with a vein of calcite carrying a little specular iron and copper pyrites, the latter well sprinkled through calcite and slate. About 3 or 3½ feet of ore-bearing calcite with slate intermixed may be taken as forming the lode; a little quartz is also associated with the mineral, and with the copper pyrites is a little

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bornite. I chipped samples from all over the exposed edges of the lode, on which a little work had been done so as to lay bare the solid formation, and these, upon being assayed by the Government Analyst, gave the following yield:—Copper, 4·8 per cent.; silver, 2 ozs. per ton; gold, trace. I was informed that higher assays had been obtained, viz.:—Gold, from traces up to 2 ozs.; silver up to 22 ozs.; with copper, 3 per cent. Mr. Percy Harrison, of Launceston, has kindly communicated to me the results of assays (made by the late Mr. Latta) of samples, which he brought back from this show. They were as follows:—Copper, 2·3 per cent.; silver, 9 ozs. 16 dwts. per ton; gold, none. Twelve or 14 feet to the east of this is another band, about 5 feet wide, of calcite veined with slate, carrying a little copper pyrites and galena.

The country on each side of the actual veins is impregnated sparsely with copper pyrites. The work which suggests itself as most advantageous here would be to drive in, and then crosscut right through to the lodes, to see upon what portion of the formation it would be best to put in a main level. About 20 feet further east, another band of slate, impregnated with iron and copper pyrites, occurs. This is about $2\frac{1}{2}$ feet wide, 15 inches of which seems to be the real channel; there is, however, no development of quartz. The position of the outcrop under these high hills is excellent for tunnelling, but rather inaccessible for transport; of course, the present exposure does not show ore which, with the present price of copper and the actual width of the lode, can be regarded as payable. The hope of the owners would be that future work might discover either richer or more powerfully developed portions of the lode. Intersection of the formation by the creek just at this spot is purely accidental, and it would not be reasonable to take its appearance here as a guide to what it may be in other parts of its course. A little improvement in width and richness would make all the difference, and it cannot be seen without some work and a little outlay whether this is possible or not.

CONCLUSION.

I was indebted to the kindness of several residents of the Coast during this journey for assistance and information, and to such I beg to tender my thanks. Among these were, at Ulverstone, Messrs. Frith, Applebee, and Johnson; at Penguin, the Messrs. Ellis, Denney, McKenna, Revell, Hutton, and Dale; at Burnie, Messrs. Jones, Sams, Leighton, Jewkes, and Rutherford. I have endeavoured in this report

to describe the mineral shows and outcrops in the North-West Coast districts as I saw them, and to specify where I consider prospecting may be undertaken most advantageously. I have not touched upon the Blythe iron deposit, because I have reported on that before, and no mining has been done there since then. It still remains idle, with slumbering potentialities of wealth. I have noted its probable extension a couple of miles south, as far as the Rutherford P.A. ground.

The Penguin Creek iron deposits, per contra, are being quietly and steadily worked, and support a profitable industry on a moderate scale. Other good iron ore formations exist at the south end of the Dial Range, near the summit, but their position prevents much being done with them until market conditions improve, which may be expected to take place when the iron-making industry is started in the Commonwealth. The other mineral which is to be found at different points over the whole area is copper. On each side of the Blythe River, in the Stowport Parish, two small mines have been started upon deposits which have encouraged their owners to attempt their development. On the east side of the Dial Range some copper-mining is proceeding in country highly favourable for ore; and at the back of Ulverstone, near Gunn's Plains, a deposit of copper ore is also being prospected. These comparatively small enterprises might not mean much in the thoroughly mineralised West Coast country, but being in an area which may be called virgin, so far as mining is concerned, they deserve to be watched and encouraged, for they may lead to something better than can be seen just at present. Beyond and beside these are possibilities. The geological factors are in favour of the deposition of ore on a large scale; inspection shows superficial and occasional ore occurrences, and it may be expected that future discoveries will justify a trust founded on indications of such a positive value.

I have the honour to be,
 Sir,
 Your obedient Servant,

W. H. TWELVETREES,
Government Geologist.

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