

BEACONSFIELD AND SALISBURYMINING DISTRICT.

GOVERNMENT GEOLOGIST

REPORT on the future Prospects as regards Productiveness and  
Permanency of the Beaconsfield and Salisbury Mining Districts  
by G. THUREAU, F.G.S.

The Beaconsfield District presents, irrespective of its well known auriferous character, many features alike interesting to the mining community and to the geologist. Within a confined area the following metals, their ores, and other valuable minerals are found to exist in remunerative proportions, although not yet developed to the extent warranted by the pronounced character of most of their indications. We have to, in that region gold, iron, copper limestone, marble, asbestos, and possibly coal. Before reporting on the metalliferous and mineral deposits above named, I would draw attention to the geological features exhibited by the strata forming the country rocks in their vicinity.

The whole district now about being dealt with is located west of the Tamar River, consisting of a series of low ridges descending from the much higher ranges traversing the country in the west and in the south. To the west, serpentines and allied rocks prevail, and in the south sandstones, probably of the Devonian era, are found to compose these ranges. Amongst the ridges on "foothills" the one running from the north-west to the south-west and known as the Cabbage Tree and Blue Tiers has been found to contain the more valuable metalliferous deposits, although both iron and copper are found to exist in other parts of this district, like the beds of limestone and of marble. With regard to these two ranges it may be remarked that both at one time formed a continuous ridge without a break, but now they are severed by the Blyth's Creek, the present passage of which forms the "Gorge".

The Cabbage Tree Range belongs entirely, so far as it has been denuded of the more recent formations, to the Silurian era, and as a matter of fact that system of rocks protrudes, like an island, and recent Tertiaries at its flanks and base. The range forms quite a conspicuous feature in the locality, rising to an altitude of about 300 feet above high-water mark at the Middle Arm of the Tamar River. The schists composing in same are frequently of a high crystalline character, gradually merging in depth, and to the west (towards the serpentines) into metamorphic beds of excessive density. Within these beds whether "altered" or otherwise, soft friable slates and sandstones (fossiliferous) alternate with hard silicious grits and conglomerates, sometimes stained by chlorites, intercalated beds of conglomerates occur, principally formed of rounded pebbles to the size of beans, consisting of blue quartz, quartzites, indurated sandstones and slates, with a silicious base as a binding medium. At the north-western extremity of this range (on the Dundee Gold Mining Company's ground) the strata observe a bearing of N. 54° W; they dip N. 26° E., at angles from 60 to 75 degrees; and at the summit the bearings are N. 36° W, with a dip of 50 degrees north, still lower down the range N. 42° W, so that the country presents a great variety in the bearings and angles of inclination of the rocks. The whole series are exhibiting, in places, considerable folding, which eventuate in syn- and anticlinal sections.

From near the summits of the range several fluvial or alluvial tributaries have been found to take their origin, in which a fine sand prevails nearer the surface, evidently the result of disintegration of the more friable sandstones and grits; these latter have been converted, at greater depths, into an indurated hard sandstone, and through infiltration of peaty matter into a dark and hardened formation (Secondary). By the same disintegration, auriferous vein matrices were decomposed, and thus these shallow tributaries became gold-bearing to a moderate extent, so that they now form a portion of what is crushed or put through the batteries.

It may be here observed that those peculiar beds of conglomerates above referred to have, at the hands of the miners received the denomination of "Cabbage Tree Rock", a term new to geological science. The more friable sandstones exhibit rarely the following petrifications, viz.— anellideæ, fucoids, corallidæ, and traces of graptolites in the slates. The series is, besides, characterised by extensive beds of limestones, both argillaceous and fossiliferous, splendidly suitable for building purposes; also marble of a good ornamental quality, and calcareous sandstones with clay-slates. Other sandstones, of probably carbonaceous eras, overlie the Silurian formations in places, for instance near the south end of the Blue Tier where the Silurian rocks (here partly metamorphosed) are clearly separated from the more recent sandstones by a "dyke" of intrusive rock - probably a porphyritic diorite - and where the recent beds overlie the older formations. Still more recent rocks crop out at the Middle Arm, comprising beds of coarse fossiliferous sandstones and conglomerates composed of black slates, quartzites, sandstones and quartz in pebbles, alternating with bands of greenish clays or probably decomposed shales; all these, towards the town of Beaconsfield are in turn overlaid by beds of Tertiary gravels, either marine or fluviatile, here and there concretionary in composition. Besides these more or less recent gravels, there occur layers of red to brown clays alternately, which are again, near the eastern base of Cabbage Tree Range, submerged beneath a peaty deep black deposit, alternating with very rich brown clayish soil, in which large and small erratic boulders of brown iron ore are embedded.

Close under, and skirting that range, a deep channel or "gutter" has been discovered, but the "true bottom" of this auriferous deposit has not so far been found, although shafts and a bore have been sunk in order to explore what has every appearance of turning out a very valuable piece of ground of good extent for gold mining purposes. Judging from what has been disclosed in the various workings at the base of the range, where the coarser gravels, composed of semi-rounded fragments of sandstones, slates, and some quartz, rest immediately on the bedrocks, which, however rapidly dips towards the channel mentioned above, there is evidence as if the valley filled now with diluvial gravels, &c., had been gorged for a time, and of beds of very coarse gravels, overlying finer sands and gravels, having thereby accumulated for many feet in thickness. Through these accumulations the modern water-courses wore the new channels now extant.

Having thus given an outline of the more prominent geological features observed in this region, it is but natural to turn now out attention to the metalliferous and mineral deposits found to occur in the former, with a view of arriving at their present value and prospects for permanency or otherwise. These deposits comprise the following:-

<u>Metalliferous</u>	{	(Gold..	{	(a) Auriferous Lodes
			(b)	Ditto Tertiaries (from Pliocene to Recent)
<u>Mineral</u>	{	(Copper	(a)	Veins of Cupriferos Pyrites
		Iron	(d)	Large massive Surface Deposits
			(e)	Limestones
			(f)	Marbles
			(g-	Asbestos, and
			(h)	Coal

METALLIFEROUS DEPOSITS(a) Auriferous Lodes.

There is an important question that suggests itself to any one attempting to study the Beaconsfield mines in their auriferous matrices, and that, is, the cause of the average parallelism of the proved auriferous lodes and veins, and likewise the parallelism of their disturbing agents to their regularity, - the crosscourses and faults. So far as my observations have extended, the principal lodes trend from nearly east to nearly west, and the cause of this regularity in strike, taking the whole series of those lodes and veins into consideration, is doubtless "deep-seated" thus proving them to be "true fissures," not diminishing in richness with greater depths, and not subject to more than the present ordinary irregularities.

Taking the Tasmanian Gold Mining Company's lode, the discovery of which by the Messrs Dally gave the first impetus to gold vein mining in this district, as an example, it was found afterwards that the upper portion of that lode, down to about the 200 feet level, were of an abnormally disordered and fragmentary character in comparison with more regular auriferous lodes in other mining countries, here the veinstone occurs embedded between the walls in a black carbonaceous substance in a partly disjointed state evidencing much local disturbance since the lode had first been formed. The more recent disturbances, by means of which a main "crosscourse" and faults were from time to time originated, had no doubt a great influence upon the lode formation in progress or in situ.

At the same time it is satisfactory to note that, at the lower levels the lode appears to become more regular, the same as it must have been previous to the disturbing agencies referred to. That want of regularity in its strike and dip cannot, however, be regarded as prejudicial to the extent and value of it, inasmuch with more than a score of "faults" heaving the lode, and one principal cross course, the displacements have been of such a character and description as to add a considerable length and depth also in a given extent of ground than what would have been the case if this lode had simply traversed the country on its regular course in straight lines and without those interruptions; and it is quite possible as in many cases on record, that its value may have been enhanced considerably from the same causes. I could not ascertain whether this want of regularity, attended by the necessary of increased working expenses during researches for missing portions of the vein, have outweighed or exceeded the above-mentioned advantages accruing from the additional lengths of veinstone obtained. In the upper levels the stone is of the ordinary description, but at the 205 feet the quartz has become much more mineralised, and it exhibits the characteristic laminated appearance and those sulphurets which distinguish auriferous veinstones, and which are always found in all gold mining countries as permanent. The width of this reef varies from about a foot to twenty feet in places, and it maintains its course in underlay or strike irrespective of bedding or cleavage in the wall rocks, like other and similar permanent lodes.

With regard to the other parallel auriferous lodes or veinstones discovered for some distances north or south of the above premier lode of Tasmania, it may be stated that they are likewise subject to disturbing influences; but with them, in most cases, the matrices are neither so well developed, nor are they so regular and rich in their yields. Those reefs occur partly in oblong blocks, and the fissures are now often filled in with the fragments of the adjacent wall-rocks, and, in several instances, the matrices are very considerably impregnated with sulphurets carrying gold; in other instances these auriferous formations lie between the beds of the country rocks, forming, properly speaking, "ore beds" The examination of the various

mines has proved their reefs to occur in the Lower Silurian strata so far as traced; and taking, for instance, the whole length of gold-bearing stone proved on the Tasmanian line at about 3000 feet along the average strike, it is observed that but very little exploitation has been attempted both east and west of where its character has been reliably proved, though there are very strong indications for its continuing farther in both directions, though, may be, overlaid by more recent formations of rock.

The gold obtained from the Tasmanian reef by the Tasmanian Company's batteries, &c., averages about £3 16s. in money value per ounce of gold, thus not reaching quite so high a price as that from other quartz mining districts in Tasmania. In the Beaconsfield reefs it occurs both free and associated with sulphurets of iron, arsenic, copper and lead.

Outside of the Tasmania, Florence Nightingale, Moonlight, and Little Wonder Gold Mining Companies, the mining operations have not, so far, added much to the production of gold; and a few data regarding those mines may not prove uninteresting.

The Tasmania Gold Mining Company, by driving their present deep adit (which connects by means of an iron tramway with their batteries - 50 heads - at Middle Arm Creek) for a distance of 2140 feet from the corner of Weld Street in a westerly direction, obtained 82 feet of "backs" opposite their Golden Gate shaft; and under the summit of Cabbage Tree Range about 200 feet will be available. At the end of this tunnel their lode measures 2 feet 6 inches in width, and it is of an average payable character. Beneath that adit there are Nos. 3 and 4 levels in active operations upon the various runs of reef forming the Tasmania lode. The winding and pumping machinery at that shaft is being employed for raising both water and quartz and for lowering miners and mining materials. It is not deemed necessary for the purposes of this part report to give a detailed description of all the various extensive workings, but only to mention that they are carefully planned on a large scale, well secured with good timber, and systematically worked. In No. 2 adit level the reef was found to occur in a peculiar form, whether viewed in its transverse or its longitudinal sections. Two distinct bodies of gold-bearing quartz form a junction at that level 14 feet in width: above and beneath that junction the reef is parted into two separate bodies, presenting at the same time both a syn- and anticlinal formation, or, in mining phraseology, an "inverted and a proper saddle". In both occurrences the two reefs thus separated are outside of "Horses" and sandstone and slate. Above the junction the stone measured 4 ft. and 6 ft. wide respectively, and below same each "leg" is 5 ft. in width. The longitudinal section renders the matter still more complicated, because, owing to the occurrence of a "fault", the reef is not only displaced from south to north, but there has also been a "downthrow" to the north at the same time, and a "folding back" by means of which the acute angle with which the eastern stone meets the "fault" is reversed hitherto by the mining oblique one. In all these cases of "faults" numbering, as far as observed hitherto by the mining manager, considerable over 20, the displacements from east to west have been to the north, so that, as each block was displaced, its foot-wall became the hanging-wall of the next block, and so on, except one - the "Main crosscourse" - which throws or "faults" the lode to the south. To be more explicit as to the great irregularities occurring on this line of reef, and which repeat themselves from level to level, it may be stated that to the east of that crosscourse, which throws the lode out of its course for a distance exceeding 250 feet, the country is soft, whilst to the west it is composed of hard, dense, black, contorted rock, with cuperiferous stains on the joints, thus proving the downthrow. The crosscourse itself is of but very inconsiderable width; its western wall is smooth and striated, indicating the direction of the displacement; the eastern wall is soft, brittle and short-jointed, evidently the result of frictional heat.

The disordered positions and the general conditions of this lode cannot fail to be very instructive in other mines where faults, heaves, and crosscourses may seem to cut off valuable lodes, which, however, by applying the experience had in this mine, are only temporary displacements which can be easily discovered and rectified with advantage.

The No. 4 level at 205 feet from the surface, had to be driven 90 feet west before the reef was again intersected, and as this is the deepest part of this mine, it was satisfactory to observe the nicely streaked appearance and pyritous character of this gold-bearing stone, so highly indicative of the future permanency of this lode and of the mining operations upon the same.

An inspection of the Geological Sketch Map presented with this Report will show that the Florence Nightingale Company's Mine is located close to the Tasmania Company, and therefore a very great deal of what has been observed in regard to the latter applies to the former. The Florence Nightingale shaft is 214 feet in depth, with a wall of 10 feet; this being the deepest shaft on the line of reef a great deal of water has to be contended against, necessitating the constant employment of very heavy pumping machinery in order to free the lower workings at this depth from their vast influx of water.

At the bottom level a crosscut has been driven due south for a length of 42 feet to the reef, which there underlays two feet in six feet, with an average bearing of nearly east by west in a country dipping east. The lode averages 2 feet 6 inches in width and returns a pretty regular yield of two ounces of gold per ton of crushed quartz. The richer "shoots" of gold dip east and the whole formation of the lode which traverses the country in a regular manner appears at this depth to be of a very satisfactory character as to permanency to great depths.

The Phoenix Company's mine, located also upon the eastern slope of Cabbage Range and not upon the "Tasmania" line of reef cannot be so far classed amongst the remunerative or profitable mines at Beaconsfield, yet, as a representative of a line of reef parallel to the Tasmania, it has been proved to be also subject to dislocations; and a concise description - with sketch plan to refer to - will probably be found interesting, as proving besides the large extent of disturbances this district has been periodically subjected to.

Their main shaft has attained a total depth of 178 feet, and at that depth, from an exceedingly roomy and excellently timbered plat, their lode was intersected in a crosscut wide enough for double tramway, at a distance of 184 feet S. 3° W.

The reef lies between the bedding planes of the country rock - consisting nearly all of iron pyrites and a little quartz; it is about 10 inches in width on average, and has been proved to carry gold at present in small percentages. One visible fault displaces the whole formation for a distance of about 5 feet, and, as shown on the plan, there are evidently other faults causing further displacements in the lode, not yet traced, occurring between the present workings and those of the old Star Gold Mining Company which are about 200 feet distant, and which, if as reported, gave moderately remunerative returns.

On the opposite or west side of the Cabbage Tree Range, it is believed on substantial grounds that the western continuation of the Tasmania lode has been discovered; at any rate the two companies there, which are on gold-bearing and profitable stone have proved already a good length on a rich reef, leaving but a small gap untried (but now actively prospected for) before the connection can be established between the eastern and western mines and workings on what is supposed to be the same line of reef, viz., the Tasmania. It is rather a significant circumstance, and not easily explainable that whereas the quartz in the Tasmania Company's upper levels is rather loose, and embedded in a black carbonaceous mineral, the

quartz in the western mines just over the hill is friable certainly but clean and white at similar depths.

In the Moonlight Company's mine the auriferous quartz occurs in rather an irregular manner, sometimes quite thin, and frequently attaining very fair proportions considering the considerable depths (110 feet) that have been reached. Good indications present themselves at that depth for a more regular formation coming in, but at the same time it would be desirable if more systematic ways with the new shaft contemplated to be sunk, no doubt a complete change will be inaugurated. This was the first company which discovered their present payable reef at the western side of the range which has a bearing of S. 50° E. on the average.

The Little Wonder Company's mine workings contrast favourably with those of the last-named as they are well secured with timber, free from accumulations of mullock or "addle", and though the course of the reef vertically and longitudinally is of a similar irregular character, yet the levels are of good working size, avoiding unnecessarily sharp curves and angles, thereby permitting much more rapid transport of mined vein stuffs, &c. to their main shaft. The strike in the strata is S. 50° E., exhibiting numerous contortions disordering the course of the lode considerably, but the strike of the level but reef is on the average S. 70° E. In the main shaft, which is 130 feet deep to the present bottom level, but 150 feet to the bottom of the shaft, the lode was met with at near the surface, but it disappeared until about 60 feet had been sunk, where it came into the shaft again, and thence pursued a vertical course always remaining in sight whilst the shaft was being sunk deeper to its present depth. In driving the 130 feet level, and in the stopes overhead, it has been observed that the very rich "shoots" of gold in the reef dip as from a common centre both east and west, which feature is so very frequently met with in the deep quartz mines of the Bendigo Goldfield, Victoria.

Other mining companies, viz, the New Providence Olive Branch, Garfield, &c., in the west, and the Lefroy and Dally's United in the east, are more or less in a yet progressive state, and they have not so far succeeded in meeting the "Tasmania" or any other payable lodes. The first two, from all appearances, will obtain a continuation of the "Tasmania" reef at a depth, and so will the eastern companies, for there is no reason why that lode, which has been the richest proved in Tasmania, should not continue both west and east, though at both ends the silurian strata which encloses that and probably other valuable lodes may be overlaid by more recent formations of rock. The prospecting of the eastern continuations will be doubtless greatly facilitated and aided when the powerful pumping and winding machinery has commenced to work, which former is being erected under the auspices of a "Drainage Union" which comprises a number of local proprietaries joined together for that purpose, and which company will soon commence operations in the large shaft sunk by the Lefroy Gold Mining Company, Registered.

The Rising Sun Gold Mining Company's mine is located just above the Gorge at the south end of the Cabbage Tree Range, and the variety of valuable metalliferous deposits in the district has been added to by the discovery of both copper and a little silver, made in this mine. The lode appears a very strong one, and carries pyrites of copper principally, which on assays gave a fraction over 26 per cent of pure copper per ton. Operations have been suspended at a time when greater inducements offered for going on, and of proving the full extent and value of a very promising metalliferous deposit.

The auriferous formations at Blue Tier (Salisbury), south of the Gorge are of a very interesting character and the indications met with augur well for the future, when, in the partly abandoned mines thereabouts, active operations have been resumed with a view of exploiting the auriferous and other metalliferous deposits at far greater depths than what they are at present. The unusual variety of the ores, including gold, - the undoubted

chemical reactions still going on at the present time, evolving much higher temperatures in the workings than the ordinary warmth of a combination of the sulphurets and of limes of various kinds which permeate the country rocks, - must be recognised as indicative of metalliferous deposits not yet discovered, and which indicates in other mining countries, under precisely similar circumstances, are regarded as favourable to future development.

The Victoria Gold Mining Company have driven a main tunnel under the Blue Tier Range for a total length of 1200 feet; of these 605 feet bore to the west, and the remainder to the north, The first portion of the tunnel from its mouth passes through alluvial clays and decomposed sandstones, which, on regarding their former solidity, are of a calciform character; a deal of water highly charged with ferruginous matter exudes at the sides, forming ochreous accumulations so frequently met with in the vicinity of ore deposits. It appears that these workings were undertaken for the purpose of again intersecting at a lower level, strata which had produced coarse gold and rich auriferous pyrites, and if such has not been so successful as was desirable the cause of it will have to be ascribed to the fact that that auriferous formation, which at shallower levels yielded this gold, is now represented by gold-bearing sulphurets principally, and very little free gold. The whole occurrence of gold presents some very remarkable features which deserve to be recorded. The country, it appears, consists of sandstones, slates, and a bed containing a deep black soft clay, locally termed "pug" another local term comprises the "slides". I have come to the conclusion, with the sandstones, after examination that these so called slides are, as there is no displacement, "altered shales," and, with the sandstones, most probably belong to the carbonaceous era, as evidenced by their general lithological character and mode of occurrence. The whole formation strikes east by west, and dips to the south. At nearly right angles with that dip across joints traverse the beds, which are also intersected by nearly vertical joints. It is only at the intersection of those vertical joints with the "slides," so called as the soft decomposed slates have a very dark and greasy appearance, that "nests" or bunches of auriferous matrix have been found to occur; these nests, &c. at the shallower levels contained coarse lumps of free gold, which at deeper levels is incrustated or embedded in sulphurets of various kinds. For a considerable distance traces of gold have been found in the bottom of this tunnel, but the great influx of water has hindered and prevented any further mining operations being carried on in order to test these favourable indications. It is, however, quite possible that all future operations will have to be carried on with auriferous sulphurets, and their subsequent treatment will also require to be more scientific than the ordinary crushing and amalgamation with gold bearing and mineral quartz. The assays made of these pyrites is very encouraging, ranging as they do from over an ounce to thirteen ounces per ton of dressed pyrites.

A curious geological feature obtains in this tunnel i.e. the eastern strata consists, up to a certain point, of light coloured calcareous sandstones dipping south-east; a short distance beyond that point, at low angles, the dip is nearly in the reverse direction, and the country at once changes into very dense coloured and greatly contorted metamorphosed strata. This appears to be due to the occurrence of a dyke of intrusive rock, quartzose, feldspathic and apparently porphyritic. This dyke, I found to be in itself metalliferous, as it contains in the joints "millerite," or "sulphuret of nickel", light to dark yellow in colour, and occurring in brittle capillary long prismatic crystals besides other sulphurets. I believe this is the only place in Tasmania where this species of nickel besides other nickel ore has been found up to the present time and a hydrous composition\* I observed is now forming in the tunnel under evolution of heat, probably due to the decomposition of sulphurets when moist air is coming into contact with same and the calcareous sandstones already referred to. It should be stated that at some distance beyond the very dense black rocks alluded to, softer sandstones appear, exhibiting non-auriferous quartz leaders.

With regard to that remarkable rise in the temperature from causes, assigned, it was deemed necessary for the purpose of this Report, and in the interests of science, to obtain further particulars and consequently I requested Mr. Campbell, the mining manager, to furnish me with the result of a series of thermometrical observations, according to instructions I gave him at the time, and which he has carried out to my entire satisfaction.

It appears that on the 27th February last a thermometer registering only up to 120° Fahrenheit was available, and with same it was observed that, at the outside of the tunnel, in the sun, the mean temperature registered 80° Fahr: at a distance of 605 feet from the mouth of the tunnel, and inside of it, the temperature fell to 60° Fahr., owing to a strong current of air at the time passing through the workings. At 1000 feet in the tunnel from its mouth, in the workings and up a few feet in a "rise" and about three feet outside the course or line of the cold current aforesaid, the temperature rose to 103° Fahr.; then the instrument was placed about six feet from the last position or point, where there was no perceptible current, where immediately the barometer registered 120°, or as high as it was able to register, though it is more than probable that a still higher temperature rules, the limits of which could not, with the means at hand be more accurately ascertained. Under this remarkable and undoubted increase of temperature, it is not at all surprising to perceive, with the various minerals in situ, that such is probably due, in a great measure, to strong chemical reactions going on which favour and develop the origination of Secondary deposits such as are now being in the course of incessant formation in those workings.

Having, in the first instance, ascertained by personal observation and ordinary tests, for my own satisfaction, that the metal "nickel" occurred here, both as a sulphuret and as a secondary hydrous compound, I deemed it necessary to have an accurate analysis of a deposit which promises to become of considerable importance and value in the future. The Hon. Minister of Lands, to whom I sent a sample of that mineral, on my suggestion authorised the Government Analyst to make an analysis by which the presence of nickel was, in the first place, to be ascertained, which he did, confirming the result of the tests I had made previously. Nickel, then, according to my examinations and his analysis, is present without doubt, and in what appears to be satisfactory percentage also, †

It must not be omitted to be stated, however that both examinations were made of the secondary deposit only, which is evidently being formed through water, percolating in the joints of the country rocks, becoming impregnated with dissolved mineral salts, which, on contact with the calcareous rocks and the pyrites abounding thereabouts lead up, to this great rise in the temperature, causing other solutions to be formed, which, in turn, cause the precipitation of these "secondary deposits" in a cooling atmosphere, § as is the case in the tunnel just described.

If such be, indeed the course of formation on the facts adduced, it is equally logical to infer and to demonstrate a greater richness and value for the primary deposits, from which the secondary deposits are being derived, in the manner delineated above; consequently the early resumption of mining operations in these mines, and the prospecting for, or the working of the deeper primary deposits when so found, should not any longer be delayed. As a preliminary, and because the sinking, &c. promises to be very expensive on account of the very heavy influx of water to be contended against the use of the mining diamond drill in such easy rocks for boring is recommended for testing the ground by drilling at various angles below the tunnel level, whereby reliable "cores" can be obtained indicating the location of primary deposits and for analysis by the Government or any other competent (scientific) scientist.

It is quite possible that this combination of hydrates and sulphurets with nickel has caused an effect upon the mercury the reverse of what is needed for good amalgamation with gold thus, in a measure explaining the reduction in their yields of gold; and, in

9/15

future all these matters require most careful attention, and the adoption of a more effective treatment by skilful persons.\*

Still farther south a considerable amount of prospecting has been done by the Blue Tier and other gold mining companies: that proprietary has also tunnelled in the same range for a distance of 208 feet. For all that distance a large formation of crystalline and ferruginous quartz, only very moderately auriferous was intersected, closely resembling flat reefs in Victoria, though here indications are not wanting for a gradual underlay to the south-west. Several cross-drives, save one, exhibit the same features and character of the quartz without any material change. In a cross drive connecting with another small tunnel, also driven into the same side of the range as the last one, the quartz, after rising step-like a short distance, underlays to the east. Here a small "saddle formation" was observed which had been proved to carry good to a very limited extent in the soft selvage or "flucant" separating it from the enclosing wall-rocks. Like greenish stains were seen at intervals in this and other parts of the mine, indicating the presence of nickel ores, which may prove yet of some importance should more positive deposits of that ore, so plainly indicated, be found in this locality. Speaking generally, the range, above the various tunnel levels has been tested for those auriferous deposits to so considerable an extent, and, as the indications are all much better below those levels it is clear that future efforts should be confined to the prospecting operations by means of shafts and cross-cuts below the tunnels.

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\* Since then the Government Analyst has forwarded to the Hon. Minister of Lands the following letter, viz:--

Government Laboratory,  
Hobart,  
14th April, 1883.

Sir,

I have the honor to enclose Report of the Analysis of the Mineral from the Victoria Gold Mining Company, Salisbury, which has been carefully examined.

It is not described in any work on Mineralogy to which I have been able to refer, and as it varies somewhat in composition, I am unable to assign any definite chemical formula to it. I should be glad, however, to examine further specimens to determine within what limits this variation occurs, as it is a matter possessing considerable interest.

The results of analysis given represent the average composition; the figures forwarded some time ago to the Inspector of Mines were roughly obtained from selected portion of the mineral.

I have etc.

F. W. WARD

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\*Hydro-Nickel Magnesitic? - DANA.

†Nickel, when pure, is worth about four shillings per pound

‡The Government Analyst, Mr. W. F. Ward, has very courteously furnished the following analysis for this Report:-

The following are the results of my very interesting mineral received from you:-

Government Laboratory,  
Hobart,  
9/3/1883.

	per cent
Nickel oxide.....	9.15
Iron protoxide.....	1.08
Sulphuric acid.....	34.20
Water.....	<u>44.80</u>
	<u>100.33</u>

And it is mentioned that the analysis will be repeated with great care as soon as other work will permit.

It will thus be seen that the deposit has for its metallic base the metal nickel, and it is therefore judicious of my part to state that the sulphuret of nickel in the dyke mentioned above, or any other metalliferous deposit occurring in that locality, deserve every attention and careful analysis, because the larger percentage of nickel in the "Primary" deposits would be of additional value to whatever gold may be discovered in the workings if carried to greater depths than what they are at present. At nine per cent of pure nickel there would be, at a low rate of calculation about 160 lbs of that metal in every ton, the value of which would have to be added to the yield of gold in the same quantity of mineral.

\* § It is a well known fact in chemical science that hot solutions if cooled, will precipitate ingredients held only whilst in a heated state.

REPORT on Mineral from the Victoria Gold Mining Company, Salisbury

The Mineral occurs in crystalline masses of a pale green colour the cavities and parts of the surface being covered with minute white hair-like crystals; the fracture is saccharoidal, and of a sea-green colour. The hardness is about 2; the taste metallic astringent; powder white; readily soluble in water. When gently heated it melts in its water of crystallization, afterwards intumescing, and leaving a buff-coloured mass resembling pumice, which is infusible before the blow-pipe, giving off sulphurous acid, and turning brown on the surface owing to the per-oxidation of the iron present.

The following shows the average composition:-

	<u>Per cent</u>
Aluminium Sulphate.....	30.02
Nickel Sulphate.....	11.60
Magnesium Sulphate.....	4.95
Lime Sulphate.....	4.77
Iron (Ferrous), Sulphate.....	3.57
Water.....	<u>44.90</u>
	99.81
Metallic Nickel.....	4.40
Metallic Zinc.....	1.93

The formation of this mineral is doubtless due to the oxidation of Sulphides of Nickel, Zinc, and Iron in contact with rock capable of yielding Alumina and Magnesia, which would explain the evolution of heat stated to occur during its production.

W. F. WARD  
Government Analyst.

By this Analysis, it will be perceived, the per-centage is reduced by one-half, but as it is not the secondary, but the richer primary deposits, which require attention, the results will still be of a favourable nature, whenever they are worked in a skillful manner.

(b) Tertiaries (From Pliocene to Recent)

These gold drifts comprise the alluvial (post-pliocene) at Brandy Creek, the newer pliocene at the Port Phillip and Beaconsfield Cos. mines, comprising the reef washes at the base of the Cabbage Tree Range, and the deep (older pliocene) gravels in the gutter already referred to. The first two may be dismissed from notice, as they do not offer any special feature requiring consideration, except that, in the case of the Port Phillip and Beaconsfield Companies, these gravels are of considerable extent, and in the former have been proved remunerative to work by means of mills operated by water-power at very cheap rates, or otherwise the low yields of gold, from  $\frac{1}{2}$  dwt. to 3 dwts per ton (water power) would not as it now does, leave a margin of profit.

The deep ground, however, in its partly unexplored condition deserves attention, because of the probability of its containing, rich gold drifts whilst occurring in the vicinity of the gold-bearing matrices in this district. At different periods this deep channel has been subjected to prospecting, but it is reported that none of the shafts or bores ever bottomed on the proper bed-rock, and that, consequently, whatever gold has been obtained came from an auriferous wash resting on a "false bottom" composed of a similar black, indurated, and secondary sandstone as that which occurs in the tributaries which have fed the lower, auriferous gravels with gold, but at more recent an age. It is a question of considerable importance for persons interested in the locality to have it, at any rate, proved whether there occurs a still deeper gold-bearing gravel beneath this false bottom, or which whether it and the deeper gravels filled with resting on the bed-rock belongs to the "miocene" epoch, during which the old river channels became filled with non-auriferous sands and gravels before the era of disintegration and denudation of auriferous (crystalline) strata commenced, and which latter resulted, as is well known in the deposition of tertiary gravels carrying gold.

The Queen Company's shaft was sunk to a depth of 119 feet and gold was found in the gravels from 45 feet in depth to the false bottom, averaging 2 to 3 dwts per ton, thus establishing a great thickness and a wide extension of gold-bearing deposits now altogether abandoned, but which would doubtless become profitable to work if manipulated properly, and on a large scale. There were three distinct layers of auriferous gravels one above the other, viz: - black, red, and white, - the first-mentioned being the richest. The workings in that mine proved a dip of the wash to the east, but not for a great width, inasmuch as shallow ground has been found which appears to confine this deep ground and to give it a southerly direction. The red mottled clays which here overlay that deep ground can be traced on the one hand from beyond the Beaconsfield Company's ground towards the Queen Company's old shaft, and on the opposite from near the Cosmopolitan Company's ground likewise heading for that shaft. This clay was met with in the main adit of the Tasmania G. M. Co. for a width of 60 to 70 feet, and those clays offered some difficulty in timbering owing to their swelling on being exposed to a changeable atmosphere. Mr Orchard's deep bore, and the old Ballarat shaft, 213 feet deep and not bottomed afford accumulating evidence of the continuance of the higher auriferous gravels, but they have not yet solved the problem as to the value of the gravels underlaying the false bottom. In Victoria and New South Wales they have frequently been found to be very rich, when not of the miocene age. The lower gravels above the false bottom are very remarkable for the well preserved trunks and limbs, of trees (said to resemble ~~xx~~ ferns) and seed cones found at a depth of 125 feet the former standing in a natural upright position. It would be interesting to compare these buried vegetable remains of that age, if still procurable with those that have been found in the Victorian gravels of probably corresponding age which were classified and named by Baron Von Miller, the Government Botanist in order to be in a position to define and compare the geological epochs here with those of Australia.

(c) Veins of Cupriferous Pyrites.

At a distance of about fourteen miles S.S. <sup>W</sup> of Beaconsfield, in the Westbury District, near Dry's Country, at Saxon's Creek, a very promising deposit, consisting chiefly of copper pyrites embedded in honeycombed quartz, has been discovered in a sandstone country, with bands of slate. The sandstones are from grey to light brown in colour, and the slates are bluish, with a satiny feel. The matrix consists, as already stated, of a cellular and porous quartz in which the ores occur in veins and oblong bunches as copper pyrites principally including the yellow and sometimes the grey species (Fahl Ore) and near the walls some carbonates, the matrix contains also carbonates of iron and some calcites. There is a divisional "wall" from which the veins (flat) containing the ore branch in several directions; as the ores have been intersected only for the height of 10 or 12 feet vertically in a tunnel and a small shaft at its mouth the extent of the deposit cannot be ascertained except from indications. So far as the workings have been carried out they disclose similar deposits of copper ores of good commercial value and there are also good indications for improvements at greater depths where the country becomes more settled than at present. Except in one instance the richer ores do not rise much above the tunnel level, and the more solid veins are found in the lowest part of the workings, where the water oozing up from below leaves large ochreous deposits denoting a continuance of similar metalliferous deposits as now disclosed.

There is every facility for working these deposits at an economic rate, as very good storage for powerful water pressure can be obtained at a moderate expenditure for the operations requisite at the mine and on the dressing-floors, though a good deal of the ore requires but little cleaning previous to smelting. An easy road exists most of the way to Port Sorell where the produce of the mine can be shipped for export.

IRON.- (d) Large Massive Surface Deposits.

Of these quite a number occur in various parts of the district west and north of Beaconsfield and examination proved that they were embedded in the serpentines or the schists and between those formations. A general resemblance of the components of the several deposits was noted, including limonites, fibrous hematites, and earthy iron ores, and also in their structure and mineralogical character. The whole of these ores form stupendous developments of deposits of really an excellent character, and it is not therefore surprising that at one time extensive preparations were made on a proportionate scale to work this almost unlimited supply of iron ores. The mines are yet in perfect working order, capable of furnishing an immeasurable supply of ore for smelting, and one company has connected their mines by means of an excellent railway with their large smelting works, which are equipped with every appliance necessary for producing, by the aid of powerful steam engines, pig iron in large quantities. (All these mines and other establishments are, however, now, and they have been for some time past, abandoned and the buildings are decaying in consequence. The history of the causes of such decay is well known and need not be here repeated; it was found that owing to an admixing of "chromium" the pig iron actually produced was of too brittle a nature to find a profitable market, which was already fully supplied with much better descriptions of suitable iron, and what told most against it was the uncertain per-centage of the chromium thus producing an unreliable metal as to quality).

Considering the vast importance to Tasmania to see these mines and works re-opened for the production of chromic iron ores, either for export in their crude state (in ballast), or for the local reduction into pig-iron, or the still more valuable chemical compounds the following remarks should, I submit, deserve some attention and careful consideration. Whilst we cannot make use of the chromic iron ores owing, it is imagined, to the insuperable difficulties barring

the way, the following extracts will tend to show that elsewhere the consumption of that very class of ore is steadily increasing.

In the Annual Report of the State Mineralogist of California, U.S.A., for the year 1880, it is stated:- "Chromic iron abounds in California. It has been exported in the crude state in large quantities for consumption abroad. This mineral is becoming scarce at other localities, and the world must look at a great extent to our State for its supply. While we gain some revenue from the shipment of the crude mineral, the State would be still more benefited if some of our idle men were employed in its manufacture. It will not of course pay to buy potash salts at the present time to combine with it, and again to pay freight to a market, but there seems to be no reason why the "chromates" of lime, and lead, and the "sesquioxide" of "chromium" may not be produced to advantage in California."

And it is further mentioned, in another Report, "that the exportation of chromic iron ores increased from nearly 2000 to 6000 tons in seven years." It cannot be denied that these extracts would seem to open a far wider scope for the disposal of our chromic iron ores and the use of them than may have been anticipated. And as we have both lead and lime, some further investigations, appear to be very necessary in order to discover whether taking this unsaleable pig-iron as intermixed with chromium as useless, those much more valuable chemical ingredients for colouring pigments could not be produced here at a cheap rate.

As a preliminary step I would suggest that the various kinds of ore from the different mines ~~xxxxxx~~ should be subjected to a systematic "blending" process with a full record attached to each test, combined with regular changes in their "fluxes" because it is quite possible that some variety of ore exists there which in the course of treatment suggested would deprive the rest of this irregular and pernicious effect on its quality by "chromium."

It would also be judicious for the Government to authorise their Analyst to institute a series of tests of these ores for the ingredient of chromium, because if present in considerable quantities or percentages its extraction for manufacturing purposes would very probably be as beneficial to the colony at large as the cruder process of producing pig-iron, which would be always subject to deterioration not possibly controllable under the circumstances.

MINERAL DEPOSITS.

(e) Limestones.

These occur in regular beds as intercalated between the clay-slates grits, and conglomerates of the silurian strata, and amongst others one in particular deserves recognition, as it extends with trifling interruptions to the east of and for the whole length of the Blue Tier and Cabbage Tree Ranges, ultimately passing in its course beneath the Town of Beaconsfield. This bed is of considerable width and continues in depth with great regularity; the limestone is of very good quality, and only portions of its adjacent to the clay-slates at either side are of too argillaceous character to produce good quicklime, and the rest being very suitable for building purposes. The supply appears simply inexhaustible.

(f) Marbles.

These were not specially examined, but, on good authority, there should be, in the absence of good ornamental building stone near Launceston and elsewhere, an increasing demand for same, especially as the bricks used now do not appear to be of good quality.

(g) Asbestos

This mineral occurs as a component part at the Serpentine ranges situate west of Beaconsfield; that rock is in places, perfectly permeated with it, either in the form of isolated fibres or as strings, veins bands, and nests. As the length of fibre is of these asbestiferous deposits in strong veins the workings then made are so far not sufficiently advanced to enable one to pronounce favourably upon the deposits discovered hitherto. It should be borne in mind that the mining and the treatment of what are now simply impregnations, are rather expensive. I do not think unless the prospects have materially improved since my last inspection, that more than two per cent, of asbestos could be expected; none of the fibrous vein stuff was more than nine inches in length as against those of Gundagai, N.S. W. of nearly two feet three inches. It is to be hoped, with the rapidly increasing demand for this incombustible, that future developments will take place.

(h) Coal

It may be at once stated that strata were cursorily observed in the south-west somewhat resembling in character those generally associated with coal-bearing rocks in other localities. As this was quite an unexpected feature, and, as time was pressing careful examinations were just then out of the question, because, to establish reliably the existence of carbonaceous strata would require a much more extensive survey and operations, together with a course of observations to note carefully the "dip" of same to the horizon in order to trace and determine what may be, and are now, only indications.

CONCLUSION.

Taking a comprehensive view of the more valuable metalliferous and mineral deposits dealt with in this Report, there can scarcely be a doubt as to their future if only perseveringly and continuously worked. That the Cabbage Tree and Blue Tier Ranges have been proved to contain most valuable metalliferous deposits has, in the case of gold, been established in a very convincing sort of a way (Tasmania Gold Mining Company); and that there are very good indications for other, and probably as valuable deposits, is scarcely open to doubt. The deep alluvial ground at Beaconsfield, the unexplored continuations of the Tasmania Reef west and east, would have, with such yields elsewhere been developed before this the copper deposits, with their satisfactory assays, would have also had attention ere this, because both promise well and are well located for extensive operations. In all these cases the unrestricted and extensive use of Diamond Drills appears to be really indispensable as the proper tools to be used in advance of the more permanent underground operations.

G. THUREAU, F.G.S.  
Geological Surveyor

Launceston,  
Tasmania,  
May, 1883.

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