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REPORT ON GOLD AND COAL AT PORT CYGNET.

Government Geologist's Office,
Launceston, 31st May, 1902.

SIR,

AGREEABLY to your instructions, I have paid two visits to Port Cygnet, where alluvial gold was found as far back as 25 years ago, and abortive lode-mining was carried on in 1898-9.

The problem which has confronted the gold-seekers has been to find the source of the gold which has been won in quantity from the alluvium of flats and creeks. In 1898 a grain of what was claimed to be gold was shown to me at Lovett in a piece of stone from one of the shows then being worked, but it was never proved that it was not copper pyrites. A few days later the late Mr. J. Harcourt Smith noticed specks of free gold in some of the stone from Mt. Mary Mine, and his samples, assayed by Mr. W. F. Ward, Government Analyst, returned 4 dwts. 2 grs. gold per ton. Apart from this, no undoubted gold has ever been seen in the bedrock. As a good deal of gold has been shed from the hills, the search for its original home is of interest and importance. Though fruitless hitherto, it deserves attention, and ought to be persevered in quietly and steadily.

It is impossible now to find out exactly how much gold the district has produced from first to last, but the most trustworthy information which I have been able to collect places the figure at about 3000 ounces. Most of this came from the flats near Lymington, a township situate on the west side of the arm of the Huon called Port Cygnet, and 2½ miles south of Lovett, which is at the head of the inlet. These flats are surrounded by steep hills, from which the metal has beyond question been derived.

On Mr. Coad's ground in this flat a company worked successfully for a couple of years, and took out a lot of gold. At the mouth of the creek, Forster's Rivulet, north of Lymington, Mr. Lane sank in the drift just above the bridge seven or eight years ago, and got fine gold, averaging half a grain to the dish; the wash is said to have been very rough.

About 1½ mile west of Lymington I was shown wash near Mr. Lane's from which £60 worth of gold had been taken out. A shaft had been sunk in detrital quartzose porphyry* for 25 feet without bottoming on bedrock. Below the surface-soil is 3 inches to 1 foot of cement, forming a dark pug; then, below this, is an oxidised brown detrital clay, a false bottom 1 foot thick, then clay again below. The cement yields 20 or 30 colours per dish. A few holes have been put down here, and colours obtained. The cement, which is a white sand, with iron oxide and hornblende, thins out as it runs up the hill to the south. It is observed here, as elsewhere on the field, that the reddish stone carries the gold. The cement grains are angular, and have no doubt been derived from denudation of the hill-slope. The gold is coarse and jagged, some of it with curiously hooked points sharp enough to prick the finger. These forms suggest a solution and re-precipitation of the gold. The creek between Lane's and Devereux is said to have yielded coarse gold.

From here I went further south up the hill to Denis Murphy's property, where a little excavating work had been done. The creek gives colours of gold all the way up. A few feet have been dug into the soil, and then broken stone met with. The stone is reddish and variegated, and contains no visible metal besides a little iron and copper pyrites, but I was told that samples had been sent to the West Coast, and had assayed 2 dwts. gold and a little silver. On examining this parti-coloured stone closely I detected in it casts of the Permo-Carboniferous fossils, *Fenestella* and *Spirifera*, and saw at once that this was the contact boundary between the mudstones of that system and the intrusive alkali-porphyries. This contact-line crops out more or less horizontally along the northern slope of the hill about three-quarters of the way up, and is further indicated by several springs. Higher up to the west are beds of metamorphosed sandstone, grit, and shale; and Black Jack, the high hill further west, is said to have a similar covering in part. It seems to me very probable that gold has been precipitated along the contact-line. The hill at the back (S.W.) is a high narrow ridge, which descends on the south steeply to the River

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* I use the word porphyry here in a field sense, and to make the description intelligible to residents in the locality, where the term is well known. It comprises all or any of the porphyritic soda-trachytes, dacites, sölvsbergites, tinguaites, nephelinites, and alkali and elaeolite syenites, which form the petrographical complex at Port Cygnet.

Huon. At the top the Permo-Carboniferous strata are permeated with opaline silica and chalcedony, and from the hill-saddle Kube's can be seen down the creek, where pieces of gold as large as a finger-nail have been found.

I next proceeded to Martin's show by going along the Back Road towards Wattle Grove and turning off to the east at Martin's cottage. On R. Lewis' ground a trench has been cut across the contact-line of the porphyry and Permo-Carboniferous shale. The section exposed in the cut is as follows:—

S.W.	Shale. (*a*)	Contact formation. (*b*)	Unaltered porphyry. (*c*)	N.E.

(*a*) is the ordinary laminated soft shale of the Permo-Carboniferous system.

(*b*) is stone which is partly altered porphyry traversed by veins of opal and chalcedony, and partly a development of hematite and quartz. The quartz is thickly studded with white iron pyrites.

(*c*) is not separated by any sharp line of demarcation from (*b*), but is porphyry gradually recovering its normal aspect.

The contact-stone (*b*) has a very favourable appearance, and the samples which I took, when assayed by Mr. W. F. Ward, the Government Analyst, returned 5 ozs. 11 dwts. 1 gr. silver per ton and a minute trace of gold. Mr. Robert Harvey, of Lovett, also submitted a sample to Mr. Ward, who reported 6 ozs. 18 dwts. 20 grs. silver and a trace of gold.

It is evident that some deposition of metal has taken place here, and it is quite possible that a portion of the contact might be found which would be rich enough to work. A little work here would not be out of place. It is as promising a spot as any which I have observed along the contact-line, and though the stone is not payable just where opened upon, richer patches may occur. At the same time, I must point out that we cannot reason from the surface indications that the stone is bound to improve in depth. It may or it may not. A feature of contact deposits is that they are extremely irregular and patchy, and anyone spending money on this outcrop must be prepared to take the chances.

Murphy's Outcrop.—This is about a mile north of Martin's. It consists of reddish porphyry, which denotes the line of contact, and is streaked with chalcedony or opal. At the time it was being worked it was reported to carry a little

gold, but this is not substantiated, and its general appearance is not so favourable as that of the other shows.

Mt. Mary Mine.—This is west of Lovett, and is now abandoned. We have here another unquestionable contact of alkali-porphyry with Permo-Carboniferous shale and mudstone grit. The usual reddish contact-rock has a brecciated and tuff-like appearance, but this may be due to crushing. When work was stopped the outlook was not promising, Mr. Harcourt Smith's sampling right across the formation yielding only traces of gold.

Livingstone Mine.—The shaft and tunnel at this mine are on the Livingstone Hill, two miles N.E. of Lovett, still in the porphyry belt, and about 600 feet above sea-level. Near a contact with Permo-Carboniferous strata the porphyry is laminated with parallel bands of quartz, in the aggregate 2 to 4 feet, and called the reef. A shaft was sunk 60 feet on the underlay. Some broken quartz on the surface towards the north-east indicates the continuation of the contact-line, and was thought to be derived from a reef forming the backbone of the hill ridge, but a tunnel has been driven into the hill upwards of 500 feet without intersecting any reef, though it is believed to have been extended far enough to do so if one existed.

The first assays which were made (in Victoria) of specimens from here returned 3 ozs. 23 grs. and 1 oz. 12 dwts. 6 grs. per ton. Then 48 lbs. of stone sent to Footscray gave 10 dwts. 13 grs. free gold per ton. The first trial of one ton returned 3 dwts. free gold and 2 dwts. from the pyrites. Later a parcel of six tons was sent, and yielded no free gold, but 3 or 4 dwts. per ton from the pyrites. A remaining ½ cwt. of the first ton was then assayed by Messrs. Parker at Footscray, but only yielded 13 grs. free gold to the ton. These poor results completely extinguished the hopes of the adventurers, who thereupon relinquished work.

There is here again sufficient evidence to connect the occurrence of the gold with the silicification of the rocks at the contact, but the results are not good enough to encourage much expenditure. The quartz does not belong to a true reef, and it is useless to look for such reefs in this zone of rock. The quartz is simply a contact development, sometimes perhaps in the form of segregation veins away from the contact. It may be expected to alternately swell and contract, and die away at intervals. It and the associated altered and brecciated line of country are the carriers of the free gold. There is evidence that the pyrites also contains gold, and as pyrites is disseminated throughout the eruptive

rocks of the district, the country-rock may contain small quantities of the precious metal. The gold in the alluvium is the result of long wearing-down of the hills which surround the present valleys. I fear that the concentrations of gold in the stone are not heavy, or there would be more gold in the creeks. Evidences point to the creeks yielding certain quantities and then becoming exhausted, from which I infer that the sources of supply are limited.

The conclusions I arrive at are:—

1. That the porphyries do not carry free gold indiscriminately throughout their mass. I have examined thousands of specimens, and have never seen a speck. Any gold which they may contain is probably confined to the pyrites.
2. That quartz reefs in the true sense of the words are not to be expected. The country is younger than our Silurian slates, which carry gold quartz reefs elsewhere in the Island, and the eruptive rock is not siliceous enough for its surplus silica to be available for anything beyond segregation veins.
3. That the concentration of gold is confined principally to the silicified and brecciated rock at the contact of the porphyry with the sedimentary strata. I do not deny the possibility of minute quantities being associated with pyrites in the mass of the porphyry, but I am of opinion that if at any time lode-mining be found payable, it will be in the neighbourhood of these contacts.
4. That the occurrence of the precious metal is highly irregular, and this patchiness discourages mining, which will only be remunerative when some rich contact patches are struck; and this will be a matter of prospecting. As nearly all the ground around Lovett is private property, systematic prospecting is not likely to be carried on.

On the whole, therefore, I do not see that there is any single point where much outlay could at present be advised; nevertheless, moderate prospecting along the different contact-lines might disclose some deposit above the average, and I look forward to this happening in the future sooner or later.

Geology.—The sedimentary rocks are, as has been mentioned, the lower marine mudstones, sandstones, and shales of the Permo-Carboniferous. These have been pierced and traversed by intrusive abyssal and dyke porphyries, varying lithologically, but forming related varieties of the division of

alkali-rocks. The belt of this porphyry country around Lovett is about three miles wide, and extends across the Huon south-west to Desolation and Surges Bays. I was told that stone from the quarry in Surges Bay has assayed up to 8 ozs. of silver per ton. In a N.E. direction this zone stretches to Little Oyster Cove, where the creeks bring down sand with flaky gold associated with garnets, zircons, and sphene, characteristic accessory minerals of the Port Cygnet porphyries. Whether any of the porphyries are, as I at first thought, contemporaneous lava flows, is open to question. Some of them are strongly fluidal in structure, but this circumstance is not decisive. A series of undoubted dykes are seen on the beach south of the Regatta Ground, where they are, as determined by Professor Rosenbusch, sölvsbergite and tinguaite porphyries. The first one, going south about half a mile from the Regatta Point, is a dyke of grey-bluish sölvsbergite at the water's edge, about 5 feet wide, and running N. and S. About 100 yards further S., is a dyke of sölvsbergite (or tinguaite porphyry), 2 feet wide, of a greenish hue from the aegirine present in it. Its bearing is N. 20° W. Still further south is a dyke of garnetiferous mica-sölvsbergite, containing a variety of garnet, to which Messrs. White and Macleod gave the name of Johnstonotite in 1899. This dyke is 2½ feet wide, bears N. 10° W., is vertical, and is flanked on the E. by mudstone conglomerate hardened by contact. Further south is another dyke, also on the beach.

At the Regatta Ground itself a promontory exists of alkali and elaeolite syenite, differentiating at its margin, and in other parts into nephelinite and other basic rock varieties. On Mt. Mary a wonderful variety of alkali-trachytic, tinguaitic, and allied rocks exist, some of which seem plainly intrusive. On the Lymington Back Road a large intrusive rock-mass occurs, granitic to the eye, but dacitic in structure, and containing large porphyritic crystals of rhomb felspars. Dykes are also numerous on Mt. Livingstone and on the eastern side of the Port. Many of the rock varieties are probably new, as they are not comparable with the familiar European types, and their determination will be a work of time. Analyses of them are highly desirable. That the porphyries are later than the Lower Permo-Carboniferous is beyond doubt. On the other hand, Mr. R. M. Johnston established the existence of an axis of diabase down the promontory from Mt. Wellington to Three-Hut Point, and, recently, Mr. F. J. Ernst, by a traverse of the country between Lovett and Oyster Cove, has shown

the Mesozoic diabase to be younger than the porphyry, the Lovett exposures of the latter being divided from those at Oyster Cove by the Mesozoic rock. We are now able to confine the porphyries to the interval between the Lower Permo-Carboniferous and the Upper Mesozoic.

Professor E. G. Hogg lately discovered stones on Mt. Mary derived from the Permo-Carboniferous conglomerate, and bearing scratches which he refers to ice-action during that period.

Mt. Cygnet Coal Mine.

The geological features of Mt. Cygnet are a repetition of those observed in so many of our coalfields. The summit of the mountain is diabase, and the flanks are sandstones, which, from the fossil plants preserved in the coal shales, *Gangamopteris* (a dwarf form), and *Vertebraria australis*, are referred by Mr. R. M. Johnston to an upper horizon in the Permo-Carboniferous, *i.e.*, somewhat younger than the Mersey coal seams. A section of the formations in the district would be in descending order:—

Mesozoic.

- Diabase, occupying the crest of the range, intrusive into coal-measure sandstones and porphyries.
- Alkali porphyries intrusive into Permo-Carboniferous mudstones, sandstones, and shales.

Permo-Carb.

- Sandstones, conglomerates, and shales, containing coal seams at Mt. Cygnet.
- Marine beds, with casts of *Spirifera* and *Fenestella*.
- Dark shaly mudstones.

The Mt. Cygnet Mine is situate 2½ miles E. of Gardener's Bay, and a wooden tram with horse-traction, 3½ miles long, furnishes the means of transport to the jetty. Work has been carried on intermittently for a good many years; at one time the production was 2500 tons a year. It eventually came into the hands of Mr. Robert Harvey, who has been working it of late years. When he took it over, in 1897, it had been closed down for 18 months, and it took a little time to bring up the output again. However, in 1898, 1899, and 1900, the annual output was raised to 1600 tons, and in 1901 to 3000 tons.

The samples which I took of the coal were assayed by Mr. W. F. Ward, the Government Analyst, with the following result:—

Fixed Carbon.	Ash.	Gases, &c.	Moisture.	Sulphur.	
69·5	16·4	12·7	1·4	Not determined.	No coke formed.

The coal has been used for steam purposes by several firms in Hobart, at R. Harvey's fruit factory at Lovett, and at the mine. The steamers object to the residue, and it seems that in all cases the best effect is got by burning a little wood with it. It is a dull, compact coal, and answers well for domestic use, burning slowly without much flame, and without any spluttering. It gives out great heat in the grate, and remains alight for a long time without requiring to be replenished, burning quietly away to a soft ash. During the strike at Mt. Nicholas Colliery this coal was very favourably received in Hobart, and gained a distinct footing in the market. A feature of the coal is that, if left without stirring, it will remain alight for an indefinite time; this I have had an opportunity of observing upon more than one occasion.

The seam dips into the mountain in a S.S.E. direction, at an inclination of 1 in 8 = 7°, averaging 3 feet in thickness, but varying from 18 inches in bumpy ground to 4 feet when settled. Some of it is 3 feet 6 inches and 3 feet 9 inches, but it does not appear to exceed 4 feet. I measured 3 feet 6 inches, with an inch of parting dividing the upper part from the bottom, at about 1 foot from the floor. Twenty-five feet below it is another seam, but only containing a foot of coal; it is said, however, to be superior for steam purposes; and 12 feet below is a small 2-inch seam.

The floor is clay resting on dark sandstone, and is fairly regular. The roof is grey hard quartzose sandstone, which in places shows broad glistening surfaces, with a singular sheen, due to the reflection of light from the facets of the closely-packed quartz grains. Sometimes a conglomerate takes the place of this sandstone. The roof rolls a good deal, descending into the seam here and there. The incline goes down to the first flat sheet 800 feet on the slope, 100 feet vertical, and a road east has been opened out at this point for 15 chains, when the seam was stopped by a fault. The coal has been taken out as far as possible, and the working places have fallen in. The dip was continued another 100 feet, and 180 feet driven east from the bottom flat-sheet. Six stalls were being worked when I was there last, and the end of the road was getting into settled ground with a 3 feet 6 inches seam of good quality coal, having left the rolling part of the roof behind. I anticipate everything will go on smoothly till the 15-chain fault is reached.

Two or three hundred feet above the mouth of the tunnel is a bed of fireclay, which has been bored into for 10 feet. This deserves examination.

The mine appears to be on the edge of the coal basin, for to the west the measures run out into bands of fossiliferous stone, continuous with the coal. For the future of the mine, it is desirable to prove the ground east of the fault, which it is quite possible may be insignificant. The mine is a valuable little property, the working facilities are good, and it is within a convenient distance from Hobart, where there is a market for the output. The infusion of a little more capital into the undertaking would permit of the more extended development which it deserves.

While I was at Port Cygnet I received from Mr. Joseph Harvey, Mr. Robert Harvey, Mr. Tolland, and Mr. Langdon, the colliery manager, much information and assistance, which I desire here to acknowledge.

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

W. H. TWELVETREES,
Government Geologist.

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