# REPORT ON DEEP SINKING AT THE MOONLIGHT-CUM-WONDER GOLD MINE, BEACONSFIELD.

[One Plan.]

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*Government Geologist's Office,*
*Launceston, 30th June, 1902.*

SIR,

I BEG to report that, according to your instructions, I visited the Moonlight-cum-Wonder Mine at Beaconsfield on the 14th December last, and again on the 14th inst., in order to examine the nature of the strata and their possible bearing on the discovery of payable gold-bearing quartz at the depth attained in that part of the Cabbage Tree Hill.

The hill owes its name to the grass plant which grows upon it freely, and which in the early times was dubbed locally with the name of cabbage tree. The name has been transferred to the predominating rock, which is a quartz conglomerate with often fairly large pebbles, sometimes, however, sinking to the nature of a grit or coarse sandstone, with or without scattered pebbles.

The hill lies at the back or to the west of the town of Beaconsfield, is about two miles long, and the summit (at the north end) is 230 feet above the township, or 330 feet above sea-level. It runs N.W.-S.E. The hard sandstones and conglomerates are the axial formations of the range; they form the crest, having resisted denudation more successfully than the softer slates on the west flank and the friable sandstones on the east slope. The range is not an anticlinal. There are a few minor undulations of the beds in the centre, but these are insignificant, and do not affect the general dip of the strata, which is to the N.E., on the east side as well as on the west. The form of the hill is thus unmistakably the effect of erosion.

No fresh light has been thrown upon the geological age of these strata since Mr. Montgomery's report in 1891, in which he surmised the probability of their belonging to the Cambrian period. The few fossils which have been found do not enable any definite opinion to be formed, but from

the casts of orthis found by Mr. Joseph Davies in the workings of the Tasmania Mine it would seem that the age is not greater than Ordovician (Lower Silurian).

In the Wonder part of the hill gold-mining has been carried on for the last 23 years. The Little Wonder and the Moonlight companies amalgamated at the beginning of 1900, and in their ground is that of the Olive Branch, which was started in 1884. All the original companies obtained gold from comparatively shallow depths. Generally good stone was found as deep as 250 feet; it then grew poorer down to 300 feet.

The present main shaft was sunk by the Little Wonder Company to 400 feet, and opened out at 125 feet and 400 feet. The new company has carried the sinking down to 800 feet, opening out at 600 feet and 800 feet. Opening sets have also been placed at 500 feet.

### 125-feet Level.

This is not accessible. A drive N.W. was put in for 28 feet and S.E. for 60 feet, and a crosscut S.W. for 52 feet. I am informed that the stone was not so good in the drives as it was when cut in the shaft, and the country was broken and mullocky. The gold-bearing stone sunk upon from the surface for 50 feet was 6 inches to 1 foot in width, and is stated to have been worth about 1 oz. per ton. About 30 tons was raised from this place in the Little Wonder days. Where the stone was widest it is said to have been poorest.

### 400-feet Level.

At this level 347 feet of driving has been done from the Wonder old shaft workings along an ill-defined and unsatisfactory reef, which, I am told, returned no stoping stone. In the bottom of the level, at 105 feet east from the shaft, a winze was sunk to an alleged depth of 110 feet, and is said to have been stopped by an influx of water. Gold-bearing stone is reported to have come in a few feet from the bottom. There is some trustworthy evidence as to some of it yielding prospects, but none as to its being payable. No stoping was ever done in the 400-feet level. Mr. J. T. Stubs recommended in 1900 that an effort be made to find out what really does exist at the bottom of the winze. The east drive at the 614-feet level has now proved a formation which is probably the same as the lode formation in the 400-feet level, but it has proved altogether unsatisfactory at this depth. If the owners care to explore further they

might open out a level at the 500 feet, where opening sets are in position. A crosscut would have to be driven for about 30 feet, and then an exploratory drive extended to the bottom of the winze; and, if the appearance of the stone warranted it, a level west could also be driven. I must say the prospect is not very bright, as the level above had poor stone, and the level below is poor. Still, if it is not done, as will appear from subsequent remarks, the shaft will have to be abandoned.

### 614-feet Level.

At this level a crosscut N. 30° E. has been driven for 86 feet, cutting through a lode formation just north of the shaft, in hard, compact sandstone, dark in colour. North of the lode the crosscut has been built across to keep back the carbonic acid which, derived from the decomposition of carbonates, exudes freely from the country-rock in this mine. The manager informed me that the crosscut continues to pass through dark conglomerate and sandstone for its entire length.

The lode formation was met in cutting the north chamber, and at 20 feet north of the shaft a level S.E. has been opened upon it and driven 115 feet. The country is for the most part blocky, with soft patches between blocks of conglomerate. The formation has no walls, and its strike is identical with that of the encasing sandstone. It carries a run of lumpy and bunchy quartz; at first a few inches of fractured stone associated with pyrites, dwindling in some places to a mere track, and again swelling into a bunch of quartz 6 to 18 inches wide. Where the stone widens out its appearance is mottled and favourable—as nice a looking quartz as could be wished. Fifty-five pounds weight of stone was sent to Messrs. A. Parker and Co., of the Victorian Smelting and Metallurgical Works, Footscray, for treatment. They report as follows:—"Having crushed and well mixed the parcel of quartz received, we made three determinations, as follow:—1. Contents of crushed stone, gold equal to 2 dwts. 6 grs. per ton; silver, a trace. 2. Percentage of pyrites (ordinary), 2·2 per cent., which on assay gave gold equal to 5 dwts. 1 gr. per ton; silver, trace. Memo.—The gold is evidently in free condition; the free gold was carefully removed from the pyrites; still, if they were at all gold-bearing, far more gold than assayed should remain." The dip of the lode in this level is first about 45° to 50° to the south, but after 20 feet of driving it becomes steeper, and finally changes over to the north, and maintains

the new underlay to the end of the level. At 68 feet in the level the lode, carrying 6 to 8 inches of stone, has been heaved 11 feet to the north. The level was continued right across the fault, proving clean country beyond, consisting of hard crystalline dark sandstone. A seam of pug 1 inch wide marked the heave, and a little quartz followed the fault on a smoothly-polished wall. The lode was recovered and driven upon for 47 feet further. It was of the same appearance and width as on the west side of the fault. About 10 feet east of the heave the lode attained its maximum width—5 feet—but was poor in gold contents. The country-rock then changed to a black fine-grained brittle sandstone, with seams of carbonaceous pug, and the lode splits up into small portions at about three or four fathoms behind the end.

The country in the end of the drive is hard black sandstone, sometimes lumpy and gritty. A sinuous seam or string of quartz lies on the south wall in the face, and no other track or sign of any lode is visible. Behind the end short crosscuts (cuddies) have been put in N. and S. In the north crosscut the rock is hard black sandstone, and a bunch of quartz is visible on the west side. In the south crosscut some seams of pyrites appear, which are perhaps a part of the lode formation, and would bear a little south of the present end of the level; but as the lode began to split two or three sets back from here, all the strings could not be followed. The principal one was kept in the back of the level. The lode channel in the level consists of soft mullocky ground, between hard country on each side.

Enough has been done in this level to prove the value of the lode, which is simply nil, and I can see no indications to encourage further driving.

A long crosscut has been driven from the shaft at the 614-feet level for a distance of 382 feet S. 30° W. For 30 feet the crosscut passes through massive beds of hard dark sandstone, dipping N.E. at high angles. It then intersects 20 feet of broken sandstone, a course of shattered rock. This is loose, and requires false sets for a short distance, and then gives place to stone not quite so loose. The country has evidently been strongly shaken, and the probability is that the shattering took place in Tertiary times in connection with the basaltic eruptions. At 50 feet from the shaft the crosscut passed through a lode formation 9 feet wide, dipping N.E. with the enclosing strata, and consisting of broken country carrying lumpy quartz and pyrites. This

was driven upon S.E. for 60 feet. The drive shows alternating hard and soft country, with strings and veins of quartz, yielding no gold in dish-prospects. Beyond a decrease in the quantity of pyrites there is no essential change throughout the 60 feet driven. The end of the drive is in clean country, and further driving is contra-indicated. Short crosscuts have been put in north and south behind the end, both in hard sandstone. In the south crosscut there is a little pyrites, but nothing to speak of.

South of this drive the zone of broken sandstone continues for 14 feet, then growing solid for 33 feet, when it is replaced by soft argillaceous country, with much lime carbonate, for 40 feet. From there to the end of the crosscut is dark slate, much of it shining, graphitic, and twisted, and with parallel seams and lenticles of quartz. The face is in grey smooth slate, bearing N. 40° W., and dipping N.E. at 81°.

This crosscut has been driven quite far enough to show the character of the ground in that direction. It shows also the strata which would come into the shaft if the latter were sunk deeper.

### 800-feet Level.

Now, as regards the downward extension of the shaft lode. At the 614-feet level it was cut 6 feet north of the shaft in excavating the chamber, and had an underlay to the south. It was cut again in the shaft 4 feet below the plat, and continued nearly vertical for 19 feet, and then underlay south out of the shaft. At 32 feet from plat it was again met, with a north underlay this time, and walls 3 feet apart, carrying 6 to 9 inches of quartz on the footwall. Mortar tests gave prospects of fine gold. At 40 feet below plat it underlay north out of the shaft, viz., at 654 feet from shaft collar, and this is the last that has been seen of the lode; but, within 30 or 40 feet of the bottom, a formation was met in the shaft, which was considered might be the one followed in the east drive from the crosscut at 614 feet. This supposition cannot be accepted, as the steep dip of that formation would take it 200 feet below the present bottom of the shaft, and even a variation of 5° in the dip would still bring it 75 feet below the shaft. A drive of about 50 feet south from the shaft ought to intersect it.

At 800 feet a long crosscut has been driven north for 312 feet. The country at the shaft is dark sandstone, dipping at a high angle to the north-east. At 48 feet north of the

shaft this is succeeded by a zone of broken rock similar to that met with in the south crosscut at the 614-feet level, though, from what I have just stated, it cannot be identical with it. Veins and bunches of quartz occur in the loose blocks of rock, but do not pass continuously from one boulder to another. The shattering action has apparently taken place subsequently to any flexure of the strata. This belt continues in the crosscut for 36 feet, when a formation of grit and pug, with blocks of sandstone, veined and spotted with quartz, and carrying iron pyrites and galena (both powdered and in slugs), is passed through for 107 feet. There is no wall of division between this formation and the country; the edge of the broken zone is a ragged one. It was struck in the crosscut at nearly a right angle to its course, but its northern wall crossed in a south-east direction. When the formation was first broken into it yielded small slugs of galena, with blende and pyrites, and I am told that for the first 8 or 10 feet dish-prospects always yielded powdered galena. The gritty, crumbly material seems to contain more pyrites than the pug does. Samples which I took were assayed by Mr. W. F. Ward, the Government Analyst, but returned neither gold nor silver. The company crushed 25 tons of this, and obtained 14½ cwts. concentrates and 1 oz. free gold. Much weight cannot be attached to the quantity of gold, as it is not absolutely certain whether all of it belonged to the stone crushed. The concentrates were sent to Dapto for treatment, and 10 dwts. 9 grs. gold was obtained from 13 cwts. 1 qr. 10 lbs. of stuff. Further analysis of these concentrates showed them to contain 0·8% copper, 2·5% zinc, 33·2% iron, 38% sulphur, 22% silica. An assay was further made of three bags of the formation material, returning a trace of gold and 2 dwts. 8 grs. silver per ton. These results are, of course, in the highest degree unfavourable. The last few yards of the formation in the crosscut show dark-brown clay intermixed with sandstone and conglomerate, and the northern wall is nothing more than an irregular vertical division between the clay (with blocks of sandstone and conglomerate) of the formation and the grey calcareous conglomerate and sandstone of the country. The formation is vertical, or the dip, if anything, is slightly to the north-east. A drive east has been put in upon this formation for 176 feet. It was first driven 74 feet in the channel; then the latter was lost for 19 feet, the drive going forward in hard and irregularly-jointed conglomerate faced with calcite. This was stopped, and the drive at the 74 feet point bent to the north into the

formation, and pursued somewhat in the form of a semi-circular curve. The reason for taking this somewhat peculiar direction was that the formation being apparently in the shape of a wedge, its north wall was met with in the drive, and then followed until it thinned out.

This formation is a belt of shattered country—not a true reef-channel. It has not extended far to the east; at the same time, similar conditions re-appear further east in the Moonlight and Tasmania workings, where belts of broken rock occur in otherwise sound country. It is referred to by Messrs. Montgomery and Ward in their paper on "A Carbonaceous Deposit in Silurian Strata at Beaconsfield," 1892, in which they say:—"Here and there in the mines we come upon examples of free passage of water through the broken rock. In one of the branches of the West Tasmania reef the workmen followed blocks and strings of quartz which were interspersed through a large quantity of broken country-rock, filling a somewhat wide lode-channel. In places great holes were found still existing between the fallen blocks, and in many of these loose gravel and sand derived from the disintegration of the softer conglomerates were lying, evidently carried there by subterranean waters flowing with some velocity. In the western end of the Tasmania Mine a somewhat similar state of things occurs. One of the underground captains, in describing the condition of the country, said that the rock appeared just as if it had been blown up by a heavy explosion of powder and allowed to settle down again."

In the Wonder Mine there does not appear to be any inducement to test this formation westwards, and it has no great continuous vertical extension, as it does not occur overhead in the upper crosscut. The crosscut N., at 614 feet, has been driven far enough to intersect it, and the shattered formation in the south crosscut at that level ought to be still south of the shaft at the 800 feet. A crosscut has been driven south of the shaft at the 800-feet level for 38 feet, through the same hard rock as was passed through in the upper crosscut, and the southern belt of shattered country, with its accompanying formation, is, if persistent (which is uncertain), still to the south. Unfortunately, the experience gained of the formation is not encouraging enough for further extension of the crosscut.

It is unsafe to rely upon any calculations as to the extension of these formations, for their existence is due to the dislocations to which the Cabbage Tree Hill has been subject in not very distant times, geologically speaking. The large

loose blocks of stone in the zone of shattering denote severe displacing action. In the Eureka claim on this lease recent timber was found in the drive, 370 feet below the surface, associated with boulders of conglomerate. Mr. Heerey informed me that a large log of this timber, 3 to 4 feet in diameter, had to be cut with an axe; this semi-lignitic deposit extended for 40 feet. He also states that in Sam. Statton's find, at a depth of 132 feet, several years ago, the miners, while at work, heard a noise as if the shaft were coming together, and found that two fissures, 6 to 8 inches wide and 3 feet apart, had opened in the conglomerate. In Messrs. Montgomery and Ward's paper, referred to above, a deposit of brown coal is described as occurring in the Tasmania and Moonlight workings, at a depth of 422 feet in the latter mine, introduced from surface into the broken rock formation.

The crosscut north, after intersecting the pug formation, entered grits veined with calcite, and its present end is in grey limestone. The strata are jointed and interrupted by headings, making the ground bad for shooting. Where the beds are at all regular the dip is northerly, probably N.E. Behind the end the crosscut passed through a peculiar brown earthy carbonaceous deposit approaching in character to semi-lignite or brown coal. It is 9 feet wide on the west side of the drive, but is represented on the east side by only a couple of narrow seams a few inches thick. Despite the compact bedded appearance of the deposit, I am of opinion that it is the result of percolation from the surface subsequent to the laying down of the Silurian strata. It may be compared with the occurrences mentioned by Messrs. Ward and Montgomery. A sample has been analysed by Mr. W. F. Ward, with the following result:—

| | Per cent. |
|---|---|
| Fixed carbon ... ... ... ... ... ... | 13·9 |
| Gases, &c., lost at red heat... ... | 27·0 |
| Mineral matter (ash) ... ... ... | 21·0 |
| Moisture lost at 212° F. ... ... | 38·1 |
| | 100·0 |

The crosscut has been useful in that it has proved the country to the north, the only direction in which there was any hope of cutting a reef within a reasonable distance. It has now overlapped W. Statton's line of lode, which is a discontinuous formation. Statton drove a tunnel 250 feet long from the north-east side of the hill, intersecting a small

run of gold-bearing stone at about 150 feet from the surface, which has a direction crossing the present north crosscut. The stone was split into several leaders, and I am told that the formation contained a good deal of yellow sand. Statton's drive on this was discontinued within about 50 or 60 feet east of the Wonder crosscut, but the run of stone has not passed through the latter, although the crosscut has been extended beyond the line where it might be expected to intersect it. As no other reef is known to exist ahead, driving has very properly been suspended, and I do not see any reason for resuming it.

There remains the question whether the drive E. at the 800 feet should be continued or not. Some information has now been gained as to the nature of the formation upon which this has been driven. All its features are unfavourable. It is one of those exceptional occurrences which may easily mislead investors. I look upon the pyrites, blende, and galena as deposits of a later age than the (auriferous?) quartz veins which run through the substance of the shattered rock. The gold, which is present in small quantity, is probably a precipitate from re-dissolved gold at a much later date than that of the quartz reefs of the Cabbage Tree Hill. The most likely explanation is that mineralised waters, filtering downwards through the upper strata, deposited their metallic contents between the boulders of the shattered rock zone. The local shattering of the rock is thus largely responsible for the deposit, and when the workings emerge from these irregular patches of loose country the mineral instantly disappears. As there is no dependence to be placed on the continuance of any of these zones, it would appear extremely speculative to continue the drive for the purpose of following the mineralised formation.

I understand, however, that there has been an additional object in driving the level, viz., to bring the workings below the veins prospected on the Olive Branch section.

To do this a straight drive would have to be put in from the north crosscut, not following the meanderings of any formation, but taking a direct course to the objective point. Goninon's shaft on the Olive Branch is 578 feet from the north crosscut. This means a total length of 660 feet from the main shaft. There appear to me to be some strong reasons why the Olive Branch section should not be attacked from the Wonder workings. First, the air in the latter mine is peculiarly liable to contamination by carbonic acid gas, which, in spite of the blower, frequently interrupts work underground, and, long before the drive E. was

connected with the surface, serious trouble with the air would arise; secondly, to effect a connection with the surface for purposes of ventilation would be tedious and expensive; thirdly, to work the Olive Branch leaders from the present shaft would be more costly than following them down to comparatively shallow depths; fourthly, the depth at which the Wonder drive would come below the shallow workings, say 700 feet, is too great to warrant the entire resources of the company being used up for this special drive. The ground within 200 or 300 feet from the surface might be favourable, but it would be extremely hazardous to rely upon a continuance of payable shoots through unproved ground to so great a depth.

The Olive Branch system of veins seems to be a series of short runs of stone parallel to one another, but not continuous. Several pits and shafts have been sunk upon them, and some of the veins have returned small quantities of rich gold-bearing stone. Goninon's shaft was sunk to test some of these veins, and the present company has tributors at work in this ground.

I went into the Olive Branch tunnel to ascertain what promise the country gives at the nearest accessible point to this zone underground. It has been driven south-west right into the middle of the Cabbage Tree Hill, through sandstone strata dipping to the N.E. From near the end a long drive has been extended for 476 feet along what is supposed to be the Tasmania crosscourse, but no gold was obtained. At 92 feet in, a drive was turned off to the west and driven 224 feet. The ground enclosed in the angle formed by the two drives was evidently of value, as there is a great excavation here, 50 feet high, from which crushing-stone has been taken. A rise has been put up to within 90 feet of surface, and connects for ventilation with the bottom of what is known as the 90-feet shaft. The country is conglomerate, with numerous seams of quartz, up to 6 inches wide, intersecting in all directions, but with a general underlay to the west. The drive west appears to have been put in on the strength of a 3 to 4 inch vein of quartz, sometimes lying flat, sometimes vertical. The conglomerate country is very hard, and shows white quartz in patches. A narrow vein on the west side is said to have given very rich gold, but as a rule the veins are unproductive. They are much deflected by headings, and the quartz is of a vitreous aspect. In the end a head underlying east cuts off a set of small veins. A parallel 46-feet drive from a crosscut behind the main end shows tough pug and quartz on the west wall. The

end is in conglomerate, dipping N.E. Thin veins of quartz run between the bedding-planes, and are crossed at right angles by other veins.

I was informed that there is a drive N.W. over 100 feet from the bottom of the 90-feet shaft, and that very rich stone had been found in it, but that the vein was small and erratic.

As good gold was got in the old tribute leaders west of Goninon's shaft, and at 60 feet right back near the long S.W. tunnel, the shoot possibly comes down east. The main winze in the long tunnel has been deepened to 100 feet, but the 35-feet level was the deepest point to which I could get. The drive east was filled in; in the drive west a bunch of quartz has been risen upon, but no crushings taken out. The country is hard, and does not carry quite so much quartz as in the level above.

A winze was put down in the north drive this year to 36 feet on leaders 3 to 4 inches wide. These veins were sometimes 8 feet long, but not at all continuous; they only yielded small prospects. Thirty feet east has been driven from the winze this year, but only small veins met with.

We are here about 150 feet from the surface, or at the bottom of the main winze—250 feet—and, judging from the appearance of the country and the irregularity of the veins, any opinion as to whether the Olive Branch leaders now being prospected at surface will make into anything more defined is purely speculative. The indications, however, do not appear to me to justify either a long drive from the Moonlight-cum-Wonder crosscut or much further exploration from the Olive Branch underground workings, though the latter is the more feasible of the two.

Whether these veins of quartz unite within a reasonable depth to form a good-sized reef is problematical. If the quartz be, as is assumed, the expelled residuum from the crystallisation of deep-seated granite, it will most likely be found in better-defined courses at a greater depth; but no rule for predicting the deposition of gold can be stated where the conditions of its precipitation are unknown. In the Tasmania Mine the reef-development has persisted upwards. The difference in behaviour of the Moonlight-Wonder system of veins from that of the Tasmania reef supports the theory that the two systems are distinct. Notwithstanding the popular local theory of the Tasmania reef splitting and giving off legs, one of which is the Moonlight-Wonder lode, Mr. Montgomery's opinion that the reef has been heaved southwards at the western crosscourse has

never been disproved by actual trial. It is difficult to imagine the mere displacement of the reef by a fault as sufficient to bring about such a radical difference in its nature as is seen in these two lode-systems.

The ground to the west of the Wonder main shaft has been tested pretty well from Statton's, Eureka, and Pyrites shafts, and does not invite the expenditure of more capital upon it.

A prospecting shaft has been sunk at the base of the hill below the battery, with a view of finding a lode which is said to have yielded some gold in old days. This shaft is down 34 feet, and a drive is being opened out at 30 feet. The work is not of great importance as affecting the company's future.

Looking at the property as a whole, it has been prospected with remarkable perseverance, but with the result that the work has failed to disclose a reef of any value. The only part which might be further explored from the shaft is at the 500 feet, but the work done at the 400-feet and 614-feet levels makes the discovery of permanently-valuable ground at an intermediate horizon doubtful.

Apart from this the right thing is being done in prospecting the Olive Branch leaders from the surface, with a view of following them down when payable stone is discovered.

I have to acknowledge my indebtedness to Mr. T. H. Walduck, M.H.A., and to Mr. Luke Heerey, the mining manager, for much information during my visit.

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

W. H. TWELVETREES.
*Government Geologist.*

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

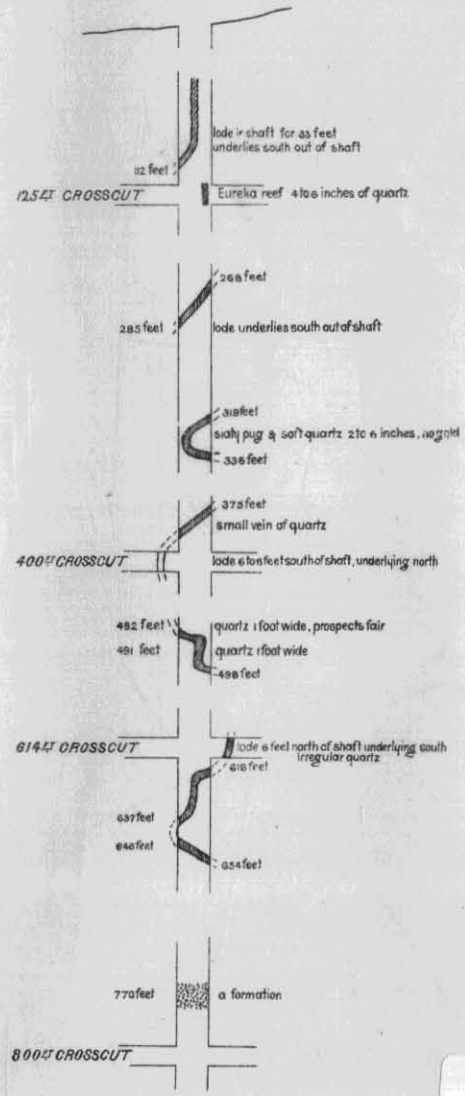
JOHN VAIL,
GOVERNMENT PRINTER, TASMANIA.

# PLAN OF DEEP WORKINGS
# MOONLIGHT CUM WONDER MINE

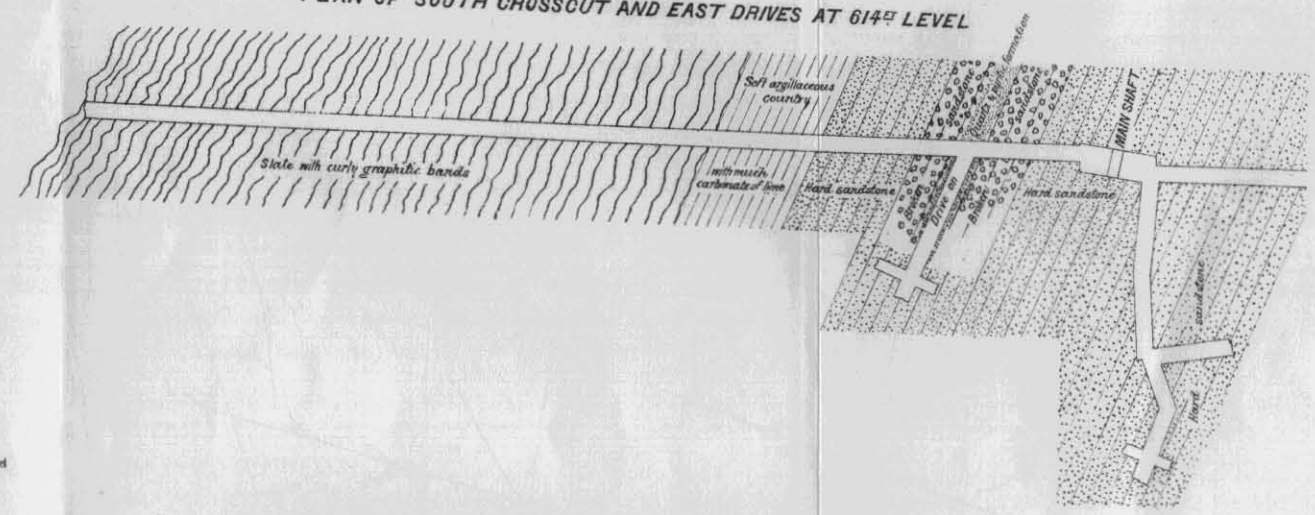
10 5 0 10 20 30 40 50 60 70 80 90
Scale of feet

W. H. Twelvetrees
Government Geologist
30 June 1902.

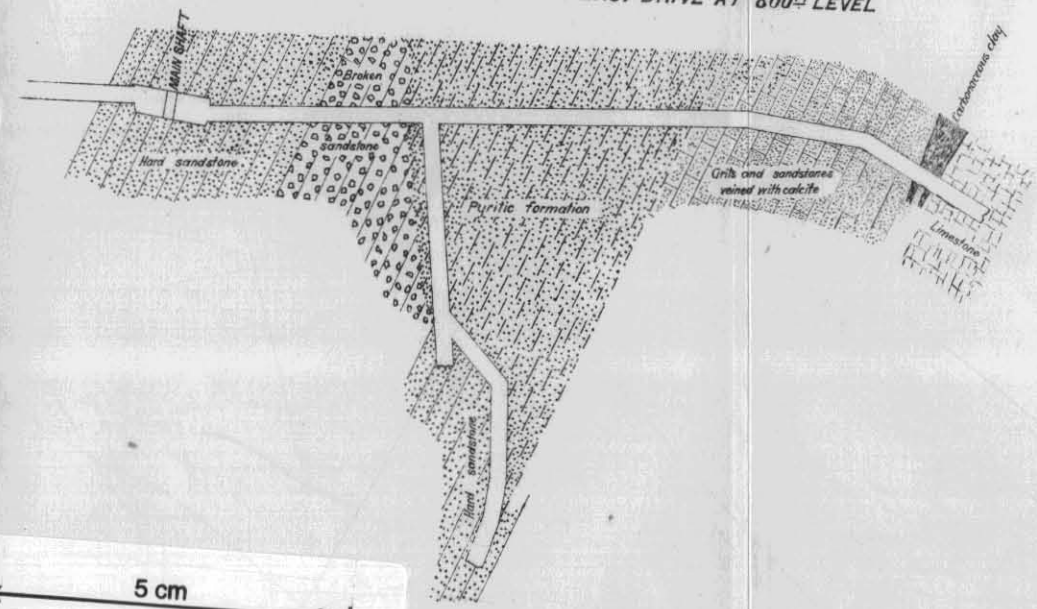
## SECTION OF SHAFT




## PLAN OF SOUTH CROSSCUT AND EAST DRIVES AT 614ft LEVEL




## PLAN OF NORTH CROSSCUT AND EAST DRIVE AT 800ft LEVEL




5 cm