THE LINDA GOLDFIELD: ITS AURIFEROUS AND OTHER MINERAL DEPOSITS.

Launceston, October, 1886.

Geological Features.

It may be observed that, in adopting the above heading for this Report, I was influenced by the fact that the principal gold deposits do not occur on Mount Lyell at all, but on a spur running northerly from Mount Owen, the eastern flanks of which spur are drained by tributaries falling into the Linda River, and these watercourses have been found gold-bearing, whereas similar tributaries on the western flanks of Mount Lyell empty themselves also into the Linda, but so far have not produced any gold. Mount Lyell proper occupies a position within the junction of the Linda with the King River (see chart) and easterly of Mount Owen; and it may likewise be deemed advisable to state that the crests of most of the prominent mountains comprising the Western Cordilleras of Tasmania, and named after eminent men of science, are not composed of quartzites or other allied rocks, but are invariably capped by massive beds of coarse conglomerates which overlie several hundred feet in thickness the quartzites and other metamorphic schists. It is a question whether these conglomerates belong to the Silurian era, as the angles of their dip average from 25 to 40 degrees only, and true Silurian slates and sandstones at lesser altitudes observe an inclination of from 65 to 80 degrees. These latter on approaching the sea coast are represented in auriferous country, and I found the first petrifaction on the West Coast in the same. These beds invariably dip to the west (whilst the former, conglomerates, dip all to the south), but in themselves they exhibit (as shown in the sidlings) both synclinal and anticlinal sections. At the road camp half-way between the King River G. M. Company and the Linda goldfield, greenstone (diabase) rests immediately on the barren quartzose schists, whilst the country towards that gold mining claim has been protruded by several dioritic dykes, and the Silurian schists in that vicinity have become distinctly metalliferous, as several gullies (Lynch's Creek) falling into the Queen River have been wrought with sometimes considerable success, and in several instances their hackly and quartziferous gold has been traced up to auriferous quartz veins, upon which all operations had to cease on account of the impossibility of transporting crushing machinery by means of the mostly impassable tracks, which are now only being improved tardily, and a road made from Long Bay, Macquarie Harbour; this fact has more than anything else retarded the development of a large and evidently very rich gold and mineral district, as alluded to below.

In numerous instances fine samples of rich gold were shown as coming from a wide area of country, embracing Mount Sorell in the south, where, at Flannigan's Creek, the recent alluvial is paying well, and Hall's party are working an old pliocene channel 600 feet above that creek with marked success. Going north several miles south of Mount Owen, an "Iron Blow" was discovered, with some gold in the gullies, but owing to the difficulty of getting supplies there it was abandoned. Then we have the Linda goldfield proper, which, besides its famous "Iron Blow," should support a large mining population if water could be made available all the year round. All the gullies "fed" by the Iron Blow on the west of the Linda River would have been payable or rich if the claims had a large supply of water and a good pressure to hydraulic the beds of gravel, over 70 feet in height in places. Crossing the northern connecting spur of the Mount Owen and North Mount Lyell—under which Watson's alluvial claims are located, and which at the higher point have produced the heaviest quartz gold in this locality (one exquisite specimen, fit for any Museum, weighing 6½ ozs., of which about 4 ozs. was pure crystalline gold),—several gullies and older deposits (Evert & Co.) have been worked with great success, as falling from that divide into the Queen River. Still further north, at Mount Sedgwick, it was reported to me that an auriferous Iron

Blow had been found; also still further away similar deposits occurred at the head of the Henty River; then crossing the Pieman River, in the upper forks of the Meredith River, under Mount Livingstone, land has been taken up on a similar formation; then, as is well known to me, an "Iron Blow" occurs at the Rocky River, where the largest Tasmanian nuggets were found, which, it will be remembered, were considerably encrustated by iron ores; and lastly, "Iron Blows" occur crossing Long Plains, and in the vicinity of Specimen Reef.

For two or three years past I have had my attention drawn to the ferruginous character of the gold found across Long Plains towards and beyond the Whyte River, and this discovery of the "Iron Blow" at Linda may, it is earnestly hoped, be the precursor of other and as valuable discoveries. In several localities, for instance, payable gold has been traced up creeks and gullies until an intersection took place of a mass of iron, whereupon the gravels ceased to be remunerative, which in itself is a very suggestive feature if regarded in the light of the Linda discovery.

The Mount Lyell Gold Mining Company's Gold Deposits, Linda Gold Field.

These comprise a very extensive and, so far as they have been tested in the surface workings to a depth of a little less than 40 feet, quite phenomenally rich gold deposits, differing either in a geological or mineralogical point of view from any other I have had occasion to examine for a long period past, or that have been recorded by scientists in the mining world at large.

These deposits occur between metamorphic schists of a light colour at the footwall, and similar strata intercalated by quartzites and bunches of pyrites* at the western hanging-wall. The outcrop of the "formation"† disappears beneath, or is capped by a thickly bedded stratum of conglomerates and brown hard sandstones. The outcrop of what may be termed a huge fissure of this iron formation observes a strike of North 20° West, and it has been traced in that direction to continue at least for 1½ miles. For the whole of this distance it evidently maintains its auriferous character, as Cooney's, White's, Henry's, and other creeks, which fall into the Linda River (see sketch plan), have all been and are now producing very satisfactory yields of gold whenever an ample supply of water is available for sluicing purposes. The distance of one mile and a half has been mentioned as the limit to which this "formation" has been traced north,‡ but strong evidence exists to prove that it continues still farther north, because alluvial gold, or rather "*formation gold*," has been found in the hill sides and in gullies in very paying quantities. It may be mentioned that the gold thus found, both on the Linda watershed and on that falling into the Queen River, is of a very fine character, and of a similar description throughout, and not waterworn. The gullies referred to are situate from 3 to 4 miles north from the Mount Lyell Gold Mining Company's prospecting and reward areas. As a matter of fact the gold is of such a uniform description as would point to only one source, viz., the disintegration and decomposition of the "formation" at the surface. The surface outcrops of this "formation"‖ throughout are characterised by the occurrence of a very little quartz of a wavy character, *baryta* taking its place predominantly. These singular deposits consist, at or near the surface, of immense blocks of bluish black iron ore, exhibiting in places a kind of stalactitic structure (hematite), but auriferous to a degree; some of these blocks exceed 15 to 20 tons in weight, and through being sundered, from atmospherical action and denudation, other and smaller fragments compose a very massive outcrop; others, again, have been left by further denudation on the hill sides, or found resting-places in the alluvial gullies below. On the south side of Cooney's Creek the Mount Lyell Gold Mining Company are enabled, from the steepness of the hill, to obtain "backs" from the level of their camp for a height of about 350 feet at the south end of the outcrop; considerably more height of stopes can be obtained north of Cooney's Creek up to the "Iron Knobs," which characterise Mr. Curtain's section in that direction; so that it is very clear that extraordinarily large quantities of gold-bearing ores are available for systematic mining operations, and subsequent treatment for gold extraction. At the level mentioned the quantity of ore is no doubt large, and can be obtained by means of adits; if, however, a site is chosen some 20 or 30 chains lower down towards the Linda River, then it is quite evident that an almost inexhaustible supply of ore can be got for manipulation. The longitudinal extent, great width, and present visible height of these gold-bearing deposits being so very satisfactory, it only remains for me to describe the composition and width of this unique gold "formation," in order to permit the authorities and the general public to arrive at something like an estimate of the capabilities of this, our latest and—so far—richest gold discovery.

It appears that Messrs. Crotty & Co., having discovered "free gold" amongst the conglomeratic gravels and iron blocks on the northern slope of a spur descending from Mount Owen, sluiced away the surface deposits, leaving the larger blocks behind, some of which were subsequently found to be gold-bearing, to a depth of from 2 to 6 feet; and though, owing to the extreme fineness and lightness of this gold, fully 70 per cent. must have been lost owing to the crude appliances

* When the word "pyrites" is used in this report it means those of iron.
† The "formation" here alluded to refers to Crotty's discovery of the "Iron Blow," or Blue Iron (auriferous).
‡ I found the first gold on Mr. Curtain's section, 1½ miles north of Crotty's discovery.
‖ In my opinion, as explained further on in this report, these so remarkably interesting and very valuable gold deposits do not come within the category of what is understood as "lodes" or "reefs" by mining geologists or miners.

in use, the heavy "pitch" adopted for the sluice-boxes and the rush of thick water, still some 4 to 500 ozs. of gold were obtained since their discovery. I was shown a piece of ground which had been sluiced in this manner, measuring but 30 feet square by an average depth of only about 3 feet 6 inches, which had yielded over 100 ozs. of free gold, as much or considerably more being carried away by the water as detailed above, or left in the disintegrated, hard, and ferruginous residues, which there rest on beds of pure iron pyrites of very considerable extent and unknown thickness. It may also be stated that these surface workings, in which gold can be seen everywhere, especially after showers of rain, which are very frequent in that locality, extend for a length of over 300 feet along the strike of the formation, and for a width of 57 (fifty-seven) feet for the richest ores, and not less than 3½ chains in width additional (actual measurement) of solid iron pyrites, which latter I regard as gold-bearing, notwithstanding certain assays indicating so far to the contrary.

The various Plans and Sections accompanying this Report will not only be found of good service, but may be relied on as tolerably correct, considering the time, weather, and journeys I had to pass through.

The "formation" is shown at the "eastern footwall," both in an open cutting and in a short tunnel, sufficiently to permit bearings to be taken and the underlay of same to be ascertained; at the opposite, or hanging-wall, the observations are not so facilitated, only a partly fallen-in tunnel admitting of such to be done. After carefully examining the deposit between its two walls, and in all the open surface workings, I became convinced that it presented not the slightest resemblance or similarity to any lodes, reefs, or even dyke formations that I had become acquainted with during many years past, inasmuch as the metalliferous and mineral "contents" of the "formation" do not in any way or manner assimilate with any of those vein deposits or dykes.

Immediately beneath the "Iron Blow" or blocks of iron ore described above, a variety of more or less gold-bearing minerals occur, which are quite unique in their respective characters, and in which gold has not hitherto been found in Tasmania, nor, with the exception of one mineral,* elsewhere. These minerals require, therefore, great attention, study, and knowledge, in order to enable one to ascribe to them their proper place in the classes comprising metalliferous and mineral deposits; to trace the whole of them back to their origin, and thus support a theory I have formed, will fully meet the case.

As the question of origin of these singular deposits forms an important matter when engaged in determining their permanency or the opposite, I would offer the following remarks on this subject. In my opinion, based on very careful examinations, the so-called "schists" or "slates," whether of the "auriferous micaceous iron" or "hydro-mica" kinds, which are here so richly permeated with very fine gold, are simply "volcanic muds" thrown up by some kind of hydrothermal action at periods in the geological age which cannot yet be ascertained from the confined area I have been able to survey, and which I submit should be extended at as early a date as possible. Their slaty cleavage is doubtless due to vertical pressure, as a very great height of this formation has evidently been denuded during pliocene times, and also lateral pressure from contraction on these hydrothermal centres gradually becoming less and less active as their subterranean passages and super-aerial vents became closed up until a last emission of baryta had taken place. The gold was probably held in solution, or ascended with the volcanic mud in the form of a vapour, returning, as explained below, to its solid metalliferous form on a reduction of the temperature taking place near the surface.

The eastern footwall underlies at an angle of 64 degrees west, and the western, or hanging-wall, inclines in the same direction at about 75 degrees. Although these walls are fully 280 feet apart, the "formation" they inclose differs in every respect from any other in Tasmania, and stands in bold contrast with any other elsewhere. Taking off 3½ chains of solid pyrites along the western hanging-wall, we have still over 57 feet of "rich" ores along the footwall. This formation has been named by several persons claiming to be experts as "auriferous micaceous iron schists," also "hydro-mica schists," "iron blow," and "blue iron;" but after having carefully examined the whole of these deposits, I have come to the conclusion that those convertible terms, so extraordinary in their kind, do not come within the definition of "schists" at all, although a kind of semi-stratification can be observed. There are no laminations or bands, and a total absence of linear persistence, as one would expect to find with a lode or similar mineral formation of any sort, and the whole formation, with no quartz to speak of, exhibits a very strong deposit of iron pyrites, chiefly of a very dense character. The principal portion and richest in gold of this deposit is of a dull mauve colour, in which the gold is thickly disseminated†, although principally in the finest particles, up to pieces several pennyweights in weight. These larger ones present a leaf kind of form, evidently as if resulting through pressure into the crevices of this solidified volcanic mud. This very peculiar kind of ore, which easily falls into a fine blackish powder on handling, is a kind of fine soft "tufa" semistratified through the simultaneous(?) or subsequent interspersion of baryta, which, after cooling

* Baryta, which, I believe carries gold in some of the Queensland mines.

† The black powder of this mauve-coloured rock gave an assay of 187 ozs. of gold per ton, I am informed by one of the owners.

assumed a lamellar form, thus producing a kind of cleavage in this otherwise amorphous rock. In volcanic countries sublimates of sulphur or chlorides can be and are being formed, or the sulphuretted acids—decomposing pyrites—give rise to gypsum, which spread in a network of threads and veins through the hot, steaming, and decomposing mass. If "baryta" is substituted for gypsum, this would exactly apply to this formation.

The apparent semi-stratification, therefore, appears partly due to the intrusion of baryta in volatile forms as well as to carbonic gases, which latter, in all probability, precipitated this fine gold within cooling influence nearer the surface, and partly to lateral and vertical pressure.

Extract from an eminent modern mineralogist's work, in which the deposits of "sinter" (a silicious deposit) are treated, and which process closely assimilates, although the products are different:—"Around these geysers and mud volcanoes 'sinter' is no longer formed, and, their surfaces exposed to the weather, crack into fine shaly rubbish (powder) like comminuted oyster shells." This latter feature can be seen in some instances in specimens in our collections.

Baryta, it may be stated, and its components, when moistened with strong solutions of nitrate of cobalt, give before the B.P., in the O.F. flame, a brown bead, which, on exposure to the air, breaks up into a darkish grey powder, thus substantiating what has been averred of these volcanic muds; and that, on the exposure of this compound, the baryta causes the production of powder rich in gold, especially so when the former maximum intensity of these heated chemical reactions, when in a state of activity, are taken into consideration.

That that activity was of a drastic character in this locality is proved by the occurrence in the same rocks, and in a parallel fissure of the "Iron Blow" some nine chains distant, of a zone of chiefly pure native copper, very productive in places, and well worth attention when it can be transported to Long Bay at cheaper rates than at present.

As regards the supposed presence of mica in this volcanic mud, I believe the surcharge of "specular iron" which abounds in this district, especially close to and in this "formation," has been erroneously taken for the former mineral, and thus the "schists" (?) were assumed to be the right classification, and in all probability their peculiar mauve colour is due to admixture of manganese and iron with their various combinations.

The subjoined sketches of the various workings and the "faces" or "stopes" will, it is hoped, sufficiently illustrate the actual mode of occurrence of these "flat cone-like" bands of gold-bearing matrices, and it will be noticed—though *in loco* these features may, at times, not be quite so distinctly visible, and they require time and attention to discern the same—that the apices from either wall, on coming within the scope of the "vents," become decomposed; especially is this the case in the pyrites bands from the hanging-wall side. In my opinion the presence of those massive beds of solid pyrites exerted a very great influence, whilst perishing, in the formation of the richer deposits by coming into contact with the intensely volatile substances held in solution in the centres of the vents, and which were vomited at the mouth of, in all probability, several centres of hydrothermal action.

Recapitulation.

I would here point out, that according to the theory adopted for explaining the origin of these most valuable and remarkable gold deposits, the following would indicate the successive periods of auriferous deposit:—

1. Formation, by volcanic and plutonic action, of huge fissures in an already gold-bearing belt of rocks.

2. Such fissures being immediately and partly filled by sulphuretted iron under pressure, by sublimation and injection from below, crystallising slowly against the hanging-wall.

3. The remaining and open spaces within the fissure were then in active volcanic action as mud-springs, cold, except within the influence of the intensified action within the central "vents," throwing up periodically volcanic muds holding gold either in solution or in vaporised forms, when the then almost closed orifices after cooling were closed by a final discharge of volatile baryta, which it may be assumed caused, with the aid of carbonic and other gases, and very probably also of electrical action, induced amongst all these various ingredients held in solution at high temperatures, the deposition of gold in its present peculiar metallic forms. It was noticed that in these mauve-coloured gold ores there occurred frequently nodules of various sizes, but mostly of a flattened shape, composed at the outside of iron casings; these, I opine, were originally bubbles of gas filled with sulphuretted solutions or gas, and on the mud becoming more and more rigid they formed those nodules, in contact and in combination with iron.

4. The subsequent "inactive" or "dead" state of this whilom active deposit was as follows:—The massive iron pyrites were, to an insignificant depth, decomposed by the air and surface water,

charged with vegetable matter, into hard black (hematitic) iron ores, here and there to somewhat stalactitic; at greater depth they were changed into red iron ores (limonites), often enclosing nuclei of pure pyrites.

As regards the solidified volcanic muds, they more rapidly, on account of their more friable character, decomposed, and this contributed most, if not all, the alluvial gold at the hill sides and in the gullies and creeks.

Permanency.

In regard to the future *permanency* of these and other deposits, I find that, irrespective of the many thousands of from remunerative to rich ores in sight, in all the deeper workings the gold occurs as rich, if not richer, and as evenly distributed, than at the surface or shallower workings. The extent along the strike is so large, and the width, outside of the pyrites beds so unusually great, that, as found in other mining countries, we may anticipate with every confidence that these gold deposits will descend to very great depths, and thus be practically inexhaustible.

As regards the proper and perfect treatment of these ores charged with such fine gold, which have assayed, I am informed, from 15 to 180 ozs. of gold per ton, I submit that this is a fitting opportunity to observe that, in my opinion, the last test of about half a ton by the "chlorination" process at Sandhurst, Victoria, of at the rate of 15 ozs. per ton, cannot be received as altogether satisfactory,—firstly, because a qualitative analysis did not precede that mode of treatment in order to ascertain whether or not any deleterious ingredient existed in the ore, which, on becoming volatilized in the furnace, would enfilm the gold, and thus resist chlorination; secondly, that the residues or tailings were not all tested for any gold that might still be retained in such wastes. It would be far more advisable, from what I have seen in California and Nevada, U.S.A., that all ores should be previously analysed and assayed, and that technical manipulation should precede, in proper machines, with periodical additions of superheated steam, mercury, and certain chemical compounds, the chlorination process, which latter should be applied to both the concentrated residues and to the "wastes" also occasionally, as the requirements of the case may warrant.

Yield of Alluvial and "Formation" Gold.

The Messrs. Henry & Co., merchants, &c., of Long Bay, have favoured me with a Memo; viz.—They bought, in 1885, 400 ounces of gold, and in 1886, to the 22nd September, 550 ounces. Messrs. Harvey & Gaffney during the present year bought 251 ounces of gold; but both parties state that a considerably greater quantity of gold was taken away to the other Colonies. It has been estimated that the actual yield of gold from the Linda, Queen River, Lynch's Creek, and Mount Sorell exceeded 2000 ounces for that period. Amongst the gold known to have been obtained, the parcel from the "formation" of the Mount Lyell Gold Mining Company weighed from 4 to 500 ounces. When it is considered that water is always scarce in summer, and that the number of miners never at any time reached above 80, the following yield may be deemed satisfactory, especially as fully one-third of the time was taken up by them to pack their stores and supplies; viz.—

Messrs. Evert & Co. (two miners), three miles north of the "Iron Blow," obtained 109 ozs. during the last 12 months.

Messrs. Watson & Co. (two miners) obtained 80 ozs. of free and 20 ozs. of specimen gold in six to seven months.

Messrs. Zeplin & Co. (four miners) exhibited at the Launceston Mines Office 122½ ozs. of gold; time uncertain.

Messrs. North & Co. have done a great deal of work to prepare for hydraulicking on a large scale, and during the last six months they have obtained meanwhile 40 ozs. of gold.

During the last two years three parties of miners obtained from three gullies falling into the upper forks of the Queen River in the aggregate 480 ozs. of gold.

Mr. Hall and mate obtained at Mount Sorell, in an old gravel bed 600 feet above Flannigan's Creek, 53 ozs. in nine days, &c.

These returns of gold would be considered large and remunerative if the small number of miners employed at about half-time are considered. These prospectors think nothing of carrying from 60 to 80 lbs. each of provisions through impenetrable scrub, across deep rivers, flooded morasses, along positively dangerous sidlings; and strong looking men have succumbed after but a year's or so packing, and are but the wreck of what they were before, fit for but very light work.

Besides gold, copper, chiefly found in its pure malleable state, occurs along a zone about 9 chains east of the original "Iron Blow." One vein measures twelve, and two others two to three inches wide. It occurs in quartzite, embedded in a kind of hard brown clay, and appears to account for the lumps of pure copper found in Messrs. Watson's claim, North Mount Lyell, weighing from 2 to 6 lbs each. Sometimes from 1½ to 2 lbs. of pure native copper can be washed in a dish.

Specular iron occurs in quartz veins; and compact, porcelaineous, hard magnesian limestone has been found 17 miles from Long Bay, near the track.

Requirements.

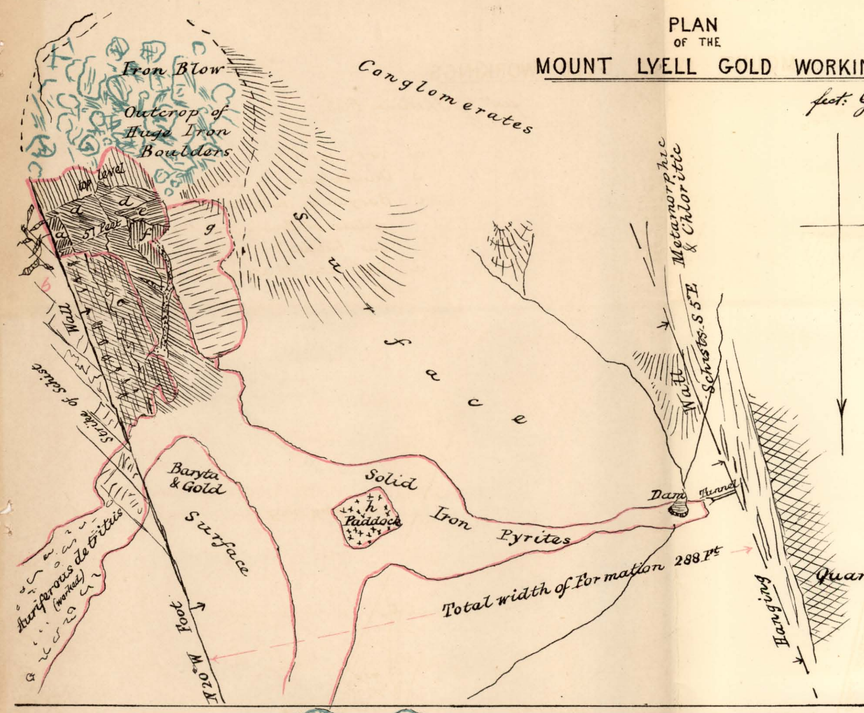
As the population is daily increasing, numbering at the date of my departure, the 29th September last, nearly 200 persons, as against 60 to 75 in 1885, the incessant traffic has cut up the road and tracks very considerably; and at least a hundred men should be put to work on the road from Long Bay in order to get the worst portions made this season.

G. THUREAU, *F.G.S.*

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

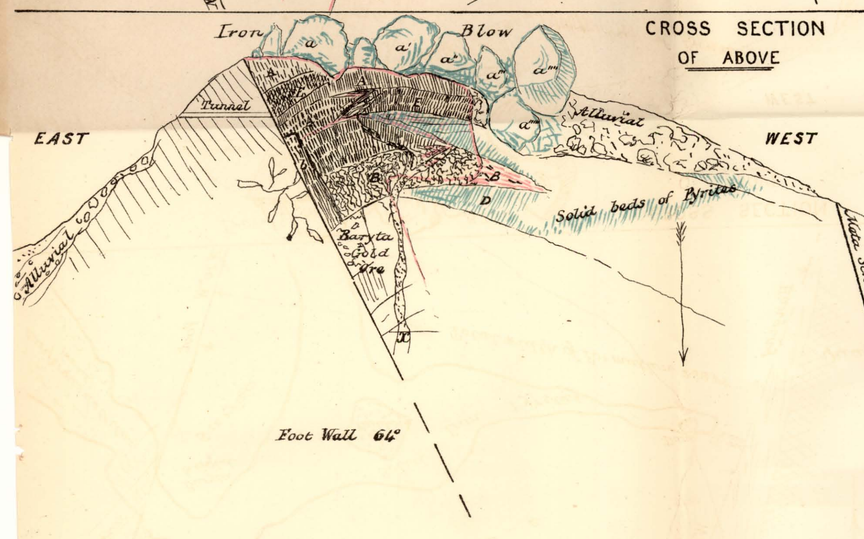
PLAN OF THE MOUNT LYELL GOLD WORKINGS

feet. G. Thureau F.G.S.



a Very rich
b Quartz veins in Footwall
c Baryta in rich rock enclosing nodules of Brown Iron Ore — Gas bubbles?
d Soft rich Mauve colored Rock
e Yellow Iron Ore overlaying rich Mauve colored rock
f. Strong floor of Solid Iron Pyrites
g Brown auriferous Iron Ore
h Paddock 30ft x 30ft 3ft 6in deep Yielded 100oz free Gold
~~~ Extent of workings inside these lines

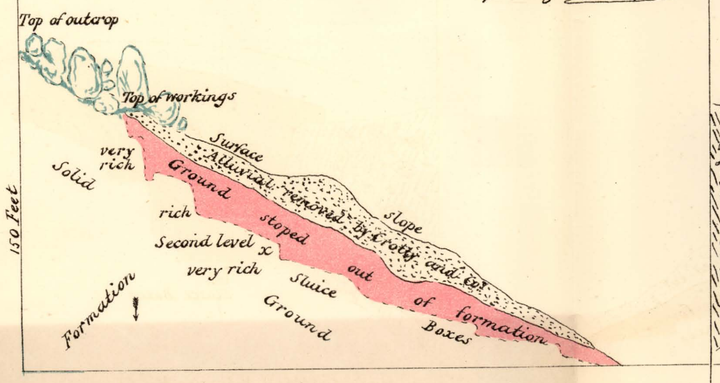
CROSS SECTION OF ABOVE



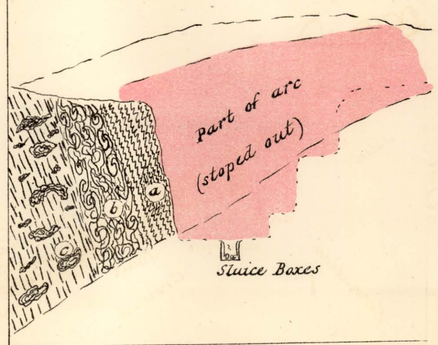
b Very rich Mauve coloured Rock
A Soft rich Mauve Rock (No decrease in size going down)
B.B' do do
C Red Iron Ore (limonites) decomposed at end of solid Pyrites beds
D do. Solid and strong floor of Pyrites
a a' a'' Loose Iron Boulders
x Vein of Baryta with branches
E Yellow Iron Ore (rich in gold)

LONGITUDINAL SECTION OF MOUNT LYELL GOLD WORKINGS

feet. G. Thureau F.G.S.



CROSS SECTION AT X. "Second level" East side.

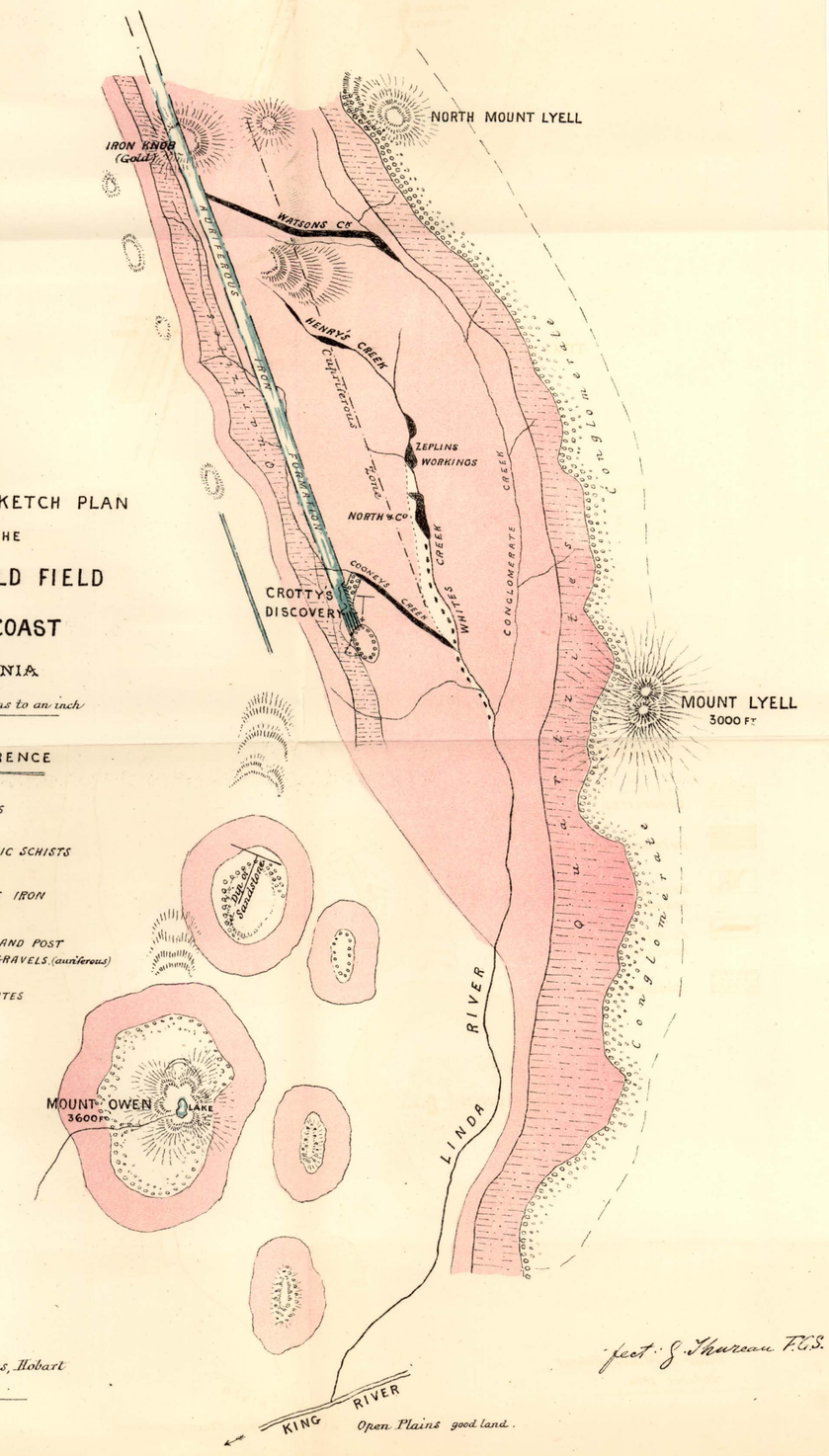


a. Semi-stratified Volcanic Mud
b. Similar; heavily charged with Baryta. } very rich
c. Baryta Rock; very rich enclosing nodules of brown Iron Ore — Gas bubbles?

5 cm

GEOLOGICAL SKETCH PLAN OF THE LINDA GOLD FIELD WEST COAST TASMANIA

Scale 20 Chains to an inch



REFERENCE

- QUARTZITES
- METAMORPHIC SCHISTS
- AURIFEROUS IRON FORMATION
- PLIOCENE AND POST PLIOCENE GRAVELS (auriferous)
- CONGLOMERATES

Office of Mines, Hobart October 1886.

feet. G. Thureau F.G.S.
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