REPORT ON SOME PORTIONS OF THE MANGANA GOLDFIELD.

Geological Surveyor's Office, Launceston, 25th September, 1894.

SIR,

I HAVE the honour to submit to you the following Report on some of the mines in the Mangana Goldfield, visited on the 20th and 21st instant, in pursuance of instructions. My visit was only a flying one, and did not admit of a minute examination of the field, or even of the mines to which especial attention was directed, no surveys being made of them, and no tests of the quartz. A good deal of stone from several of these reefs has been at one time and another crushed in stamp batteries, and the results of these tests on a working scale are much to be preferred to any assays of small parcels that could now be taken, especially as the stone left untouched in the reefs has presumably been found too poor for removal, and consequently would give an unfairly low return if tested. When the best parts of a reef have been taken out it is impossible to get a fair test of the lode without breaking a considerable quantity of fresh ground.

The township of Mangana is situated about five miles W.N.W. from the Fingal Railway Station, with which it is connected by a good cart road. It lies in a valley among high spurs from the Ben Lomond Range and Tower Hill, at an elevation of 890 feet above sea level. The valley is formed by the coming together of several streamlets running in rugged gullies, known as Major's, the Golden Gully, Ferntree Gully, Calder's, Richardson's, and so on. Between Mangana and Fingal these unite with the Tower Rivulet, often called locally the Ben Lomond Creek.

Wide alluvial flats are seen from Mangana towards Fingal along the course of the Rivulet, which merge into the larger plains along the South Esk Valley. Borings in the latter have shown a great depth of alluvial material, lying deep below the present bed of the river. The valley has evidently therefore been greatly filled up with river detritus since its first erosion. All the branch valleys leading into it therefore also show rapidly increasing depth of alluvial matter as they debouch upon the main valley. At Mangana township the alluvial deposits are not very deep, not, I understand, more than 40 feet, but they rapidly become deeper going towards Fingal into the main flats. From the township upwards the gravels get shallower, and gradually pass into the modern shallow shingle in the rocky beds of the mountain creeks. Gold was first discovered in this neighbourhood in 1852, and soon afterwards the shallower parts of the valley were worked out by diggers with considerable success. For many years past very little alluvial mining has been done. From the information given to me it would seem that the deepest lead was difficult to work by manual labour on account of its being very wet, and it is very doubtful if it was ever thoroughly worked. Seeing that it has very often proved possible to successfully work by hydraulic sluicing ground that has been gone over by diggers, it seems not unlikely that this field also might be so dealt with. A good supply of water could be obtained without very great expense from the Tower Rivulet, available for the greater part of the year, if not for the whole of it, and with the aid of hydraulic elevators the whole of the flats could be very cheaply sluiced. The matter seems to me to have enough probability of success to make it worth while going to the expense of thoroughly testing the gravels by means of two or three lines of shafts across the valley, and of making the necessary surveys for getting estimates as to cost of bringing in high-pressure water. The serious difficulty of disposal of the sludge so as to prevent damage to the agricultural lands of the Esk valley would also have to be provided for.

On the spurs round the head of the alluvial ground several gold-bearing reefs have been discovered, and some mining works have been carried out. The fact, however, that much of the most promising country is not Crown lands, but in private hands, has militated very much against the development of the district, as prospectors have not been free to enter upon the freehold properties with any certainty of being able to secure benefits from discoveries they might make.

Specimen Hill.—This is a rather low spur forming the south-western side of the valley in which Mangana township lies. On Robertson's freehold and on a small strip of Crown land along its north edge there is a great deal of quartz, and "specimens"(quartz showing gold) are said to be frequently found. Two or three shallow water-courses running down the slopes of the hill have been worked for the gold concentrated in them, and even now men occasionally find it worth while to go over the older workings in wet weather when there is water for washing the dirt. Towards the south-east end of the spur some of the gravel has been carted away to be washed. Where there is so much gold about the surface it is probable that there are gold-bearing veins to be found below. Some work has been done on a reef of rubbly quartz, striking N. 15° W. and underlaying to the westward, which crosses from Robertson's freehold into sections of Crown land formerly held by Messrs. S. M'Clean and others: this was of small size, but is said to have been proved gold-bearing over several chains length. With the exception of one small shaft, now in bad order, work on this lode appears to have been confined to surface trenching. More to the south-east some seven or eight chains, there is on the crown of the hill a shaft sunk two or three years ago to a depth of

49 feet, which has been put down between two reefs seen on surface, one rubbly, the other of white quartz. At the bottom of the shaft a cross-cut was made westward to the rubbly reef, and good golden stone is said to have been obtained, but financial difficulties caused the enterprise to be given up for the time.

My knowledge of this property is derived from hearsay, not having had an opportunity of examining it thoroughly, which would take two or three weeks. Taking the statements made to me as correct, and they are borne out by what I have frequently heard of this hill from disinterested miners, it appears that there is every inducement to give it a good prospecting trial. The crown of the spur being only about 150 feet above the township flat, and the slopes not at all steep, it would not be advisable to tunnel into it, as a very long adit would be required in proportion to the height of "backs"(portion of reef between adit and surface) gained. The most economical way of prospecting would be by costeaning, that is, sinking rows of small shallow shafts and connecting these by drives. As the reefs appear to be running to the N.N.W. the lines of costeaning should run E.N.E. By this means the reefs would be cut below the loose surface debris, and each could then be further prospected in the manner that circumstances would show to be most advisable: from what is seen in the Alpine and Buckland's mines I think it very probable that there will turn out to be several parallel lines of reef in this hill.

Reunion Mine, formerly *Union*.—This mine was not visited by me on the present occasion, as it had been shut down for some time. I saw it, however, in November, 1892, when work was in progress, and now offer some particulars from my notes of that visit. The mine is situated on the north-east side of the Mangana valley, the reef running north-westerly into a high hill. The main workings were on Section 102-83, and consist of three tunnels on the course of the reef, and a main shaft sunk for 174 feet, with workings therefrom. The lowest or main tunnel is 306 feet in length, and runs N. 51° W., and communicates through an air-shaft 180 feet deep, with an intermediate level 112 feet higher up on the reef, which has followed it still farther north-west 396 feet. The intermediate level in turn communicates by winzes with the No. 2 tunnel 84 feet higher, from which the reef has been stoped in parts to surface to a maximum height of about 145 feet. The reef has therefore been followed for a total distance of 702 feet, and the height from the lowest workings in the shaft to the highest on the outcrop on the hill is about 492 feet. The upper workings are not now accessible, but from the old plans of the mine it appears that there were two shoots of gold stoped out, one towards each end of the workings. Both shoots appear to have been of considerable length (230 and 280 feet) on surface, but to have become quite short below. In the workings from the shaft the reef was considered to be 26 feet wide from wall to wall, but the quartz was confined to layers of from one to four feet in thickness on the walls, the remainder of the reef filling being mullock and slate, often showing excessive contortion of the laminæ of the latter, and frequent slickensides from pressure and movement of the walls. At the time of my visit gold-bearing and barren stone were to be seen divided from one another by clayey partings, and quite irregularly intermixed, suggesting the possibility that an older gold-bearing reef had been torn open by earth movements and the fissure further filled with more or less barren material. In character of the stone and general appearance the reef in these lower workings strongly recalled to my mind that of the New Golden Gate Mine in the neighbouring Mathinna Goldfield. I have not been able to obtain the amount of gold that has been got from this mine from first to last: it is a considerable amount, and some very rich stone has been taken out at times, but on the whole operations have been unpayable owing to the shortness of the shoots of gold. The chance of better success at deeper levels is, however, good enough to warrant further exploration in depth, and sooner or later no doubt companies will be formed willing to risk their money in the venture.

It is important to note in connection with this reef for comparison with the others to be mentioned, that it has a north-westerly course like them, but underlays to the east, and that it is undoubtedly a fissure load of considerable magnitude.

There is a battery of 15 stamps driven by a 14 h.p. engine close to the mine, and connected with it by a good tramway. The battery is of an old type, and the gold-saving appliances not at all first-class.

Cardinal, Buckland, and Alpine Mines.—For convenience these may be dealt with together, as the reefs are approximately parallel members of a group of veins lying close together. The main workings are situated near the top of a high spur separating Richardson's and Calder's Creeks, the highest being 1805 feet above sea-level (aneroid measurement). The old Alpine battery used to be situated at the point of the spur at the junction of the creeks, its site being 995 feet above the sea: there are therefore 810 feet of vertical height between it and the outcrop of the Alpine reef on the top of the spur. The sides of this are very steep, and there are excellent opportunities for tunnelling either across or along the lodes.

The Buckland's Prospecting Association, and later the Cardinal P. A. in 1889 and 1890, held a square block of 20 acres of land under lease from the proprietors of the freehold marked on the county map (Cornwall No. 2, Parish of Woodford) "320. 0. 0., C. Buckland pur.," on which also are situated the two 10-acre sections formerly held by the Buckland's Freehold Gold Mining Company, Registered. The ridge of the spur terminates within the north-east angle of the Cardinal section, and the ground thence slopes rapidly south-west and south to Richardson's Creek. About

three chains from the north-east boundary (which bears N. 32° W.) and perhaps five from the north-west one (bearing S. 58° W.) close to the top of the spur, at an elevation of 1720 feet, a shaft has been sunk 95 feet on the underlay of a reef running N. 28° W., and dipping about 82° to the westward; the ladders being in bad order through disuse, it was not safe to inspect the underground workings. From mining managers' reports kindly lent me by Mr. R. Crosby, and from information supplied on the ground by Mr. Charles Lewis, I have gathered the following particulars:— The shaft was sunk where good prospects had been obtained on surface, to a depth of 24 feet, and a level was then driven to the northward a distance of 34 feet on gold-bearing stone. The stone taken from the shaft and level and some stopes therefrom, making 50 tons in all, was sledged and carted to the Union battery at a cost of one pound a ton, and crushed for a yield of 41½ozs. of gold, which realised £156 12*s.* 3*d.* The shaft was then continued to a further depth of 50 feet, where a drive was put in 10 feet to the north: the prospects are said to have been very good to 35 feet, after which the reef became broken and patchy. Sinking being resumed, the shaft went down to 95 feet, a little gold being obtained, but nothing payable. The reef is said to have averaged about three feet in thickness, and to be a strong body of stone in the bottom. The quartz at surface of the shaft is rather vitreous, but contains a little iron and copper pyrites and some talc. To the north-west from this shaft there is another one some 35 feet distant also on the reef, and said to be 42 feet deep. It is reported to have yielded prospects that would be payable with a battery close at hand. A trench some 90 feet further north-west again shows the reef, about three feet thick; it is also said to have been cut on the southern boundary.

The crown of the spur runs north-west from the north angle of the Cardinal section about 22 chains to the workings on the outcrop of the Alpine reefs. Going along it from the last described workings we come upon numerous trenches showing large quantities of quartz, not known to be gold-bearing. One of the outcrops is very large, but is not cut into enough to enable its width to be distinctly seen. It seems likely that there are here one or more reefs lying parallel with the Alpine and Cardinal lines and between them. The old Alpine G.M. Company held three 10-acre sections of Crown land abutting on the north-west side of Buckland's Freehold. Two of these, formerly 125-87G and 72-87G, have been recently applied for to be held under mineral lease by Mr. R. Crosby (applications 95-93G and 96-93G). The outcrops of the lodes are near the middle of 96-93G, the more westerly of the two sections. On surface it is seen that the reefs have been stoped out for some distance, but a better view of them can be obtained from a lower level, where they are cut by a tunnel 100 feet below the outcrop. This tunnel goes in N. 83° 30′ W. a total distance of 210 feet, cutting the Alpine western reef at 155 feet. This has been followed N. 35° W. about 200 feet (not actually measured), at the end of which distance a cross-cut about 13 feet to the N.E. cut the parallel Alpine reef, which has been followed further north-west about 100 feet, making the total distance in this direction on both lodes 300 feet. Other cross-cuts, about 22 feet in length, from the Alpine reef to the north east have cut a very narrow reef channel known as the Eastern reef. The Western reef varies in thickness from 3 inches up to 2 feet, and the Alpine from 2 inches up to 2½ feet where seen in this tunnel; the stone is laminated, carries a little iron and arsenical pyrites, and is somewhat vitreous in appearance, like the Cardinal quartz. This glassy appearance is not generally liked by miners in auriferous quartz, but a very rich specimen shown to me from the upper levels of the Union mine proved that in this locality it may be associated with gold. A good deal of stoping has been done from this level to the surface, but I have not been able to get sections of the mine showing how much has been removed, and the shoots seem to have been somewhat short. Neither have I been able to get the tonnage of stone crushed or the weight of gold obtained. The proceeds of sale of gold have, however, been taken out for me by Mr. Crosby from the old company's ledger, as follows:—

	£	*s.*	*d.*
1880, three crushings	802	4	6
1881, one crushing	183	14	3
1882, two crushings.....	179	2	4
1884, two crushings	424	14	3
1885, four crushings	788	18	11
Total	£2378	14	3

A winze has been sunk on the Alpine reef to a depth of 100 feet below the tunnel. The stone from this is stated to have given a return of 18 dwts. to the ton from 80 tons.

These reefs appear to lie almost exactly in the strike of the containing country, and conform with its stratification in dip also, except the Alpine reef, which at the tunnel level underlays to the eastward or across the dip of the layers of country. The section, however, does not show definitely that these have not also suffered a corresponding bend at this point. Both Alpine and Eastern reefs should have been cut in the tunnel before it reached the Western reef, but, apparently, they have been so small as to be unnoticed, or have been poor and therefore disregarded. At the S.E. end of the workings upon it the Alpine reef seems to be filled largely with country rock, somewhat impregnated with quartz, and something very like it is seen crossing the tunnel at about the right distance before reaching the Western reef. There are also some other large veins of quartz lying in the stratification planes of the country rock nearer the tunnel mouth. The reefs are well

defined, with smooth well-marked walls, and though lying with the country strata must, I think, be considered fissure lodes likely to be permanent in depth.

The quartz from the mine used to be sent down an inclined tramway worked by gravitation which joined the incline from the adjacent Buckland's Freehold mine. The foot of the incline was 160 feet above the battery site, and connected with it by a tramway.

The Buckland reef is parallel to the Alpine ones, and should lie to the north-east of them some 165 feet or thereabouts; the Alpine working tunnel would therefore pass over it without cutting it. The outcrop has been traced on surface for some 200 to 300 feet, perhaps more, and shows some gold in a few prospecting trenches recently re-opened. Its course is N. 21° W. and underlay to the westward about 1 in 4, lying in the stratification planes of the country. Two shafts have been sunk on it, following the underlay, one 110 feet deep which communicates with a main working tunnel at the head of the inclined tramway, the other further to the south-east, 50 feet deep. The tunnel is 300 feet in length, having been prolonged past the Buckland reef, which was cut at 162 feet in order to prospect for the Alpine reefs, but these were not reached. The Buckland reef was cut almost on the boundary between the Buckland Freehold and the Alpine ground, and a winze was sunk on it to a depth of 120 feet according to an old plan of the mine. Forty-five feet below the tunnel an intermediate level appears to have been opened out, and another one some 23 feet lower. The former is shown on the plan as driven 60 feet S.E. into the Buckland ground and 28 feet N.W. into the Alpine, the latter 75 feet into the Alpine, and from the end of it a winze has been sunk 50 feet. From these workings a good deal of stoping has been done right up to surface, and there is said to have been from 18 inches to 2 feet of payable stone yielding from 12 dwts. to over an ounce to the ton; one crushing is said to have given two ounces to the ton. Another parallel reef about a foot thick with well defined walls was cut in the tunnel 36 feet before reaching the Buckland reef, and was followed 70 feet to the S.E., but was very poor.

In both the Alpine and Buckland mines the shoots of gold-bearing stone have been worked out down to the tunnel levels, and followed some distance below these by the uneconomical method of working through winzes and by underhand stoping. In both mines lower levels were required in order to work the reefs to advantage. Had the Buckland tunnel been continued a little further it would probably have cut the Alpine reefs, but at a point some distance from the known shoot of gold. The Buckland tunnel is 105 feet vertically below the Alpine one, so by driving from it along the Alpine reefs a fair height of backs could be obtained, and at the same time an unknown portion of the lodes would be prospected.

As far as I can learn, neither company had much available working capital for performance of dead-work in the mines, and when these ceased to pay for themselves operations were abandoned. The Alpine Company, however, began a very important piece of work, which unfortunately they were not strong enough to carry to a conclusion. This was the driving of a low-level cross-cut from Calder's Gully to cut through all the known reefs. This tunnel is 1220 feet above sea level; that is, 585 feet below the outcrop of the Alpine reef, 485 feet below the Alpine tunnel, 380 feet below the Buckland tunnel, and 500 feet below the outcrop of the Cardinal reef, according to my aneroid measurements. According to a plan of the mines lent to me by Mr. R. Crosby, the distances from the mouth of the adit to points vertically under the outcrops of the Buckland, Alpine, and Cardinal reefs are respectively 840, 970, and 1500 feet. The Buckland, Western Alpine, and Cardinal reefs all underlay westward, and though the Alpine reef shows at the tunnel level an easterly underlay it is most probable that it also will turn again to the westward. Taking the average underlay at 1 in 4, the above distances to be driven would be increased to 956, 1116, and 1625 feet respectively. The tunnel was driven a distance of 409 feet, but got into a belt of very hard metamorphic sandstone country, in which progress was very slow even with machine drills. The Government Diamond Drill was then applied for, but as its limit of boring in a horizontal plane is 500 feet, it was pointed out that it was not likely to reach the reefs. As the directors of the company wished to find out how much more of the very hard country remained to be penetrated, and also if there were any reefs to the east of the Buckland one, the drill was nevertheless obtained and set to work, and bored a total distance of 545 feet 7 inches, making the total ground proved by the adit and bore 954 feet. The first 140 feet bored proved to be the hard metamorphic sandstone with occasional beds of slate: the remainder of the distance was softer country, consisting of layers of slate and sandstone, the latter often carrying small quartz veins. Between 533 and 540 feet a vein of solid quartz 20 inches thick was passed through, and the last foot bored was also in white quartz, but the drill was not fit to go further. It seems likely that the bore was getting near the neighbourhood of the Buckland reef.

The prospects of the property may be summed up thus :—There are five known gold-bearing reefs, or, excluding the small Alpine Eastern reef, four, which have yielded payable gold and been of workable size—viz., the Buckland, Alpine, Alpine Western, and Cardinal—and there is very great probability that these are not the only gold-bearing members of the group. The surface outcrops show that there are other reefs belonging to the series in which no gold has been found, but which have never been tested by mining. From the Cardinal shaft to the Alpine outcrop the distance over which the group of veins has been proved at intervals to carry gold is about 25 chains. The facilities for mining by adits are unusually good, and good water for a battery is obtainable

close at hand. There is therefore much reason to hope that the enterprise of thoroughly opening up the series of reefs would be successful, and it may be confidently recommended as a promising mining venture in which the indubitable risk of failure is not in undue proportion to the chances of success.

The extension of the low-level Alpine tunnel across the whole group of veins so as to intersect them all should be the first work of any new company undertaking this enterprise, and the lodes should then be followed along their courses. Another important piece of prospecting might also be simultaneously undertaken, namely, searching for the outcrop of the lodes at the south-east point of the spur where they should cross Richardson's Creek. A cross-cut E.N.E. from Richardson's Creek from a point a little to the westward of where the prolongations of the known lines cross it, making due allowance for the underlay of the reefs, would probably be the quickest and best way of effecting this, and should the lodes be found it would then be possible to drive a main level along the course of the best one, which would come out close to the battery site, and would give a level 200 feet deeper than the Alpine deep tunnel. The parallel lines could be worked by cross-cuts from this main level.

It is very likely that the reefs in the Specimen Hill belong to the same group of veins as the Alpine and Buckland's lodes. The mean course of the lodes in the district, so far as I have yet observed them, is N. 31° W., which is the average of the following six :—

Specimen Hill rubbly reef	N. 15° W.
Reunion reef	N. 51° W.
Cardinal reef	N. 28° W.
Alpine, Western reef	N. 35° W.
Buckland reef	N. 21° W.
Reef near junction of Major's and Fern-tree Gullies	N. 38° W.

A line running N. 31° W. cuts through Robertson's Freehold on the Specimen Hill, where gold has been got, and also through the Buckland and Alpine sections : it would, however, require careful survey to make sure that the lodes are identical. That there is an auriferous belt of country along this line seems, however, beyond question.

On the spur between Major's Gully and Calder's Creek there are several outcrops of reefs which appear to run the same general north north-westerly course as those above mentioned, but have not yet been proved to contain gold. One of the most promising looking of these is seen on the N.E. side of the spur some 200 feet or so above the junction of Fern-tree Gully with Golden Gully, which together form Major's Creek. This reef strikes N. 38° W., and dips westerly into the spur apparently lying in the planes of bedding of the country rock. It has been traced for some 10 chains or more, and is a body of rather nice-looking quartz 2 to 4 feet in width, carrying a little iron and arsenical pyrites, but not yet known to be gold-bearing. It could be easily reached by an adit from Major's Gully, and seems to me to deserve some prospecting. Major's Gully and Fern-tree Gully are said to have been among the best for alluvial gold of all the creeks worked round Mangana.

The country rock of the district consists of metamorphic sandstones, black slates, and clay-schists, probably belonging to the Lower Silurian or Cambro-Silurian system. There are a few eruptive dykes met with penetrating these, one being seen on the spur on the track from the Alpine battery site to the Cardinal shaft, and another crossing the Tower Hill track near the northernmost corner of C. Buckland's Freehold. Both are extremely decomposed, and their original mineral constitution quite unrecognizable, but I suspect they are really portions of the diabase greenstone (or gabbro) formation forming the tops of Ben Lomond and Tower Hill.

Want of time prevented me from visiting the Tower Hill Freehold mine, situated on Mr. Gellibrand's property near the head of Fern-tree Gully about five miles from Mangana township, on which a great deal of work has been done. I understand that a local party have lately been at work again on this mine, and will soon have a crushing. The Golden Gully mine, on the east side of the Golden Gully, was also not visited : from my recollection of a visit to it in 1892 the reefs here also belonged to the north-westerly series, and carried a short shoot of gold.

The Mangana district has many features that would be made clear by a detailed geological survey, and much benefit to the mining development of it would probably result from such a work, this being made to extend from the gold discoveries near Tullochgorum right through to Mathinna.

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

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary for Mines, Hobart.