

REPORT ON THE MATHINNA GOLDFIELD.

PART I.

[With Eight Plans.]

Government Geologist's Office,
Launceston, 29th March, 1906.

SIR,

IN accordance with your instructions, I proceeded to Mathinna on the 7th August last year, and remained on the field till the 17th of that month. Later in the year I visited the district, from 13th October to the 10th November, and again from the 7th to the 22nd December.

No departmental report on this field has been issued since 1892, and the work done since then on some of the large mines necessitated prolonged examination. Even now it has not been possible to finish inspection of the whole field. Consequently, it has been thought advisable to issue this part of my report as a first instalment, in preference to waiting for the completion of the whole.

Mathinna (the native equivalent for its original name of Black Boy) is a neat-looking township of some 800 inhabitants, situate 17 miles north of Fingal, at the base of the spurs descending from the Tower Hill range. Continuous aneroid readings in connection with simultaneous observations at the Victoria Museum, Launceston, gave for Mathinna a height of 1024 feet above sea-level. This figure probably approximates the truth as nearly as is possible with an aneroid, which, as is well known, cannot be relied upon for absolute readings. There is no use in giving aneroid readings a fictitious appearance of accuracy, and hence, for the purposes of this report, the height of the township above sea-level will be taken as 1000 feet.

The road to Mathinna from Fingal runs along the alluvial flat bordering the South Esk, in which gravels, carrying more or less gold at different places, have been deposited. These flats are part of the Malahide estate, extending nearly all the way from Fingal to Mathinna. At Mathinna they are joined by the deltas of the Long Gully and the Black Horse Gully, which are ravines or valleys scooped out on each side of the Gate spur or ridge.

The parallel of Fingal (250 feet below Mathinna) forms the southerly termination of the auriferous slate series, if we except the patches of slate between Bicheno and the

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Schoutens. This slate and sandstone series, the carrier of innumerable gold-bearing quartz reefs, extends northwards without a break through Mathinna to Mt. Victoria, and is bounded on the west by Ben Lomond and on the east by the Tasman Sea. It is the basement rock below the drift of the valleys, and rises to the tops of the lower hill ranges, but towards the summits of the high mountains is overlaid by grits, sandstones, and shales of Permo-Carboniferous and Mesozoic age. Through these has protruded the eruptive diabase, which, in columnar form, builds the peaks of the dominant mountains of this area. The South Esk River takes its rise some distance west of Mathinna, and describing an immense sweep to the south runs a course of 140 miles before it empties its waters into the Tamar, at the Cataract Gorge, Launceston. The gravel of the Cataract Gorge carries a little gold, which has been carried there all the way from Mangana or Mathinna. The distance forbids any anticipation that payable quantities are to be found in the Gorge, which, moreover, is of too recent an origin for that, even if the distance had been less.

The auriferous series at Mathinna is assumed to be of Ordovician (or Lower Silurian) age, partly from its analogies with Victorian strata, partly because while elsewhere in Tasmania Upper or Middle Silurian beds are fossiliferous, this series has so far yielded no fossil remains. It is strange that no graptolites have yet been discovered. I looked over the surfaces of the tips at most of the Mathinna mines, but could find no signs of fossils, nor could I hear that any discovery had ever been made. Some of the difficulty in finding any is perhaps due to fossil impressions occurring mostly on the bedding-surfaces, whereas most of the fragments of slate on the mine heaps are cleavage-flakes. There is no real schist in the series, though some of the varieties of slate have improperly been called by that name. The rocks comprise clay slate, graphitic slate, arenaceous or sandy slate, sandstone, quartzite, argillaceous sandstone, and frequently of a mixed character, partaking of the characters of both slate and sandstone.

It is only occasionally that any difference can be detected between the bedding-planes and cleavage-planes. It is seen, however, in the upper tunnel at the Eldorado (now Ophir), where the former dip easterly at about 45° , and the latter westerly at a very steep angle. The latter strike throughout the field between N. 25° and N. 30° W., underlaying to the east of the Golden Gate shaft, to the

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east, and west of the shaft to the west. I attempted, during my stay in the district, to trace the directions of strike and underlay from one mine to another, hoping to be able to deduce some rule which might be useful in forming an idea of the lines along which mineral may be sought. I cannot say that I have evolved any complete theory, but some of the observations are, to say the least, suggestive.

The field must not be considered by itself, but must be regarded as part of a mineral belt extending from Mangana to Mt. Victoria, and even further north. The mean direction of the lamination-planes is approximately the same all through the belt (and these are probably cleavage-planes), and the bearing which this has upon reef-formation is apparent when we consider that in all probability the direction of the main reef is dependent upon the strike of these planes. Compressive lateral force produced the planes of separation, and thus formed channels for the passage of silica, which, relieved from superincumbent pressure by the secular folding and splitting of the strata, welled upwards into the beds along the linear directions created for it. There is a good deal of white mica (muscovite, sericite) in some varieties of the slate, and most of this mineral is probably not original, but the product of dynamic metamorphism. Some of it, on the other hand, may be derived from the waste of older granite, as must have been the fragments of felspar which occur (in microscopic size) in the more sandy slates met with in some of the mines. The granite of which the mineral formed a part was obviously of much greater age than any of the known granites on the East Coast, which are approximately Devonian: and we can form no more than a very shadowy idea of where those ancient granite ranges can have been—certainly distant, for the Mathinna sediments were deposited in a comparatively, though not very, deep sea.

The main fractures on the Gate line at Mathinna strike north, or a little to the east or west of it, and these are naturally accompanied by others coursing south-east and north-west, in accordance with the laws of strains, but the former are the more important, and continue for long distances, not perhaps in uninterrupted courses, but overlapping each other. In the New Golden Gate Mine it seems to be a rule that when the reef is gold-bearing, its course is east of north, and when west of north it is barren. There must be a reason for this, and possibly it is that more resistance was met with in breaking through the strata in a north-easterly direction, and consequently

the conditions were more favourable to precipitation from a solution: while a north-westerly direction was nearer to the strike of the laminations, and the flow of silica would be less checked.

The axis of an anticlinal runs through the Tasmanian Consols shaft, and close to it at the 1000-feet and 1100-feet levels, and is also observable in the New Golden Gate Mine, from the 1100-feet level downwards, called saddle or horse country in the latter mine, the new make of quartz descending upon it and falling away into separate reefs east and west. In the Consols I was fortunate enough to see the central arching of the anticline. The centre does not show regular folding, but an abrupt junction, pointing to rupture. The Gate and Consols line of lode is closely connected with this anticline. On the east side of Long Gully the strata underlie easterly, on the western side they underlie westerly. The dominant underlay in the Gate ridge is westerly, and the laminations right across the Black Horse Gully and in the hills to the west of it have a continuous dip to the west. We have, therefore, in the Long Gully, an important anticlinal axis and an important lode-line, and it is difficult to believe that the two are not related, even if the course of each is not actually identical.

The strata exposed in the side of the new road below the Gold Estates shaft and Cemetery underlie westerly, and this dip continues southwards to the New Golden Gate, where it can be observed in the surface excavations west of the mine; thence to the Volunteer Consolidated Extended section the dip is westerly. The apex of the arch south of the South Gate shaft seems to be on the crest of the ridge, where vertical laminations are seen in the rock. Following the Long Gully southwards the easterly dip prevails at the South Miner's Dream, Telegraph tunnel, and Mountaineer. The Derby shaft of the Jubilee Mine is apparently on the axial line of the fold, for east of the shaft the strata dip to the north-east, while on the southern side of the creek and at the Mountaineer they underlie south-westerly. We have therefore an axial line persisting from Mathinna to the Jubilee having a strike of S. 20°-25° E., along or parallel to which a system of gold-quartz reefs is developed. This system has been traced as far north as the Golden Stairs sections, and continues into the reefing country on the north side of the Esk, beyond which indications of a similar stratigraphical fold, accompanied by numerous reefs, have been observed at intervals on the line of the

Dan and Dorset valleys, as far as Alberton. We are in the presence here of a geological fact which clears up a good deal of what was otherwise vague and uncertain, and which compels the belief that the various reef occurrences in the Mathinna field are not sporadic, or exceptional and casual, but are part of the results of an orderly and comprehensive, even vast, process which has involved the whole line of country from Tower Hill to Mt. Victoria. The recognition of this lends strong encouragement to continued work in this field, for such a far-reaching process must have produced deep-seated effects, and in my own mind I feel sure, viewing the question quite apart from the chances of mining in any particular spot, and in the dry light of geological science, that the deposits of gold which have already been worked have neither exhausted the possibilities of the field nor furnished any adequate idea of the sources of gold which yet await discovery.

The longest distances of reef actually followed are, perhaps, the east reef of the New Golden Gate and the west reef of that mine and the Tasmanian Consols. The respective distances are as follows:—On east reef, 511 feet; on west reef, 1020 feet.

But individual reefs need not be expected to be strictly continuous for extreme distances. It will be found that they come to an end at intervals, and parallel ones come in, either totally distinct or connected only by stringers of quartz. This indicates extensive fracturing of the country, and is now looked upon as more favourable for ore deposits than single fissure channels. This is a repeated phenomenon in the Mathinna field. Hence, the reefs which are found in distant properties along the line are not continuations of the others, but still are results of the same fracturing and filling processes. Thus slight variations in course are of no value in determining identity or otherwise of the various reefs, for the bearing of two overlapping reefs may be identical. These "splices" are of quite common occurrence, and explain how it is that the various reefs may vary in direction while the reef-zone or belt of strata within which they occur maintains a uniform strength for a long stretch of country. It can be understood, accordingly, how unsafe it is to stand on an outcrop and conclude that it is an actual continuation of a reef on the same course some distance away.

The general experience of the field is that the surface-rock, and down to a depth varying from 50 to 150 or 200 feet, is unsettled. Down to 50 or 70 feet it is weathered and broken, as a rule, though in some parts of the field

the unoxidised blue slate is met with sooner. In the New Golden Gate Mine the blue slate does not appear until the 116-foot level is reached. This broken nature of the ground near the surface, accompanied by numerous irregular vein-channels of no great importance in themselves, is only what has been observed in mining fields nearly everywhere, and has been explained by supposing superficial cracks and fractures to have been filled with silica brought by atmospheric water descending from the surface. Many of the crevices at the surface are believed to be due to shrinkage, arising from decomposition changes in the rock itself, and not to fractures connected with any reef system. At the same time, reefs which are strong and solid in depth show their channels right through to surface in a degenerate form, and often quite blank. Thus, in the surface adit of the New Golden Gate Mine, the track of the main reef at 20 feet from surface appears only as a line of pug, so that no wonder it was passed over at the time: and Loane's reef merely showed as a soft band a few inches wide, with a little quartz in the sole of the drive, where Mr. Loane sank upon it. The superficial rock of the district has been everywhere affected by atmospheric agencies, oxidised, often carbonated, hydrated, swollen, broken up in places, and its position changed by the action of gravity after cracking, so that surface observations of underlie and bearing of the strata are often contradictory and unreliable. A good deal of this superficial disturbance is noticeable on the crest of the Gate ridge, where blocks of twisted slate are exposed with their laminae bearing in different directions. An instance of how the simple weight of overburden may alter the underlie of strata locally occurs in the approach to the tunnel of the Victorian Golden Gate Mine, where the slates are flexed and broken by the mere swelling and weight of surface-soil.

It does not seem likely that the broken veins and quartzless reef-channels noticed so frequently at shallow depths were ever large, solid reefs comparable with some of those which have been met with at deep levels. I distrust the opinion which considers them as the superficial fragmentary remains of large and important reefs. Similar attenuations and disappearance of quartz from the reef-channel may take place at great depths, and *per contra*, huge reefs of barren quartz may occur cropping out at the surface itself. The most reasonable conclusion appears to be that an unfavourable condition of reef near the surface betokens simply weak parts in it, which may and do occur everywhere, both at upper and lower levels,

and are the more affected and altered when they happen to be within the zone of weathering. The experience of the New Golden Gate and Tasmanian Consols Mines shows that poor reef indications at surface may be replaced in depth by splendid bodies of stone. So long as there is a channel with signs of lode action at or near the surface, there is also the possibility of solid stone in depth. Mining companies should ever keep this consideration in mind.

If we seek to class these reefs among the types met with in different parts of the world, we must rank them in Dr. R. Beck's division of pyritic gold-quartz reefs, *i.e.*, reefs of gold-bearing quartz with dominant iron pyrites. An increase of arsenopyrite leads to another type laid down by Beck, *viz.*, arsenical gold-quartz reefs. Varying proportions of each pyrite connect the two types. Following Dunn and Courtis, I have sought by microscopical examinations of the fluid cavities in the quartz for some distinctly recognisable relation between structure and gold contents, but unsuccessfully. The presence of the associated minerals still remains the most favourable indication, though even this is not an infallible one.

In the neighbourhood are no basic or neutral eruptive rocks which could have any sort of connection with these reefs. The diabase, which crowns the summits of the adjacent high mountains (Tower Hill, Huntsman's Cap, Mt. Saddleback, Mts. Albert and Victoria) is of Mesozoic age, and long subsequent in date to the auriferous reefs. To the north-east of Mathinna, on a meridian 10 miles to the east, the granite region begins. It is there traversed by gold-bearing quartz reefs, which also enter the adjoining sandstones; and we must refer the Mathinna reefs in all likelihood to siliceous fluid expelled from the underlying granite magma in the last stage of its consolidation.

As for the source of the gold, it must be borne in mind that reefs in the granite carry gold also, which cannot possibly have been derived from any sedimentary country-rock. Any theory of origin must cover the case of the reef both in granite and stratified rocks. It would be unreasonable to contend that while the gold in the granite reefs was derived from the igneous magma, when the reef entered sandstone the igneous gold by some incomprehensible means became exhausted, and the reef began to collect gold from sea-borne sediments.

The few observations which I have been able to make in various parts of this State would tend to support the supposition that the origin of our gold-quartz is mainly

granitic, and that the formation of the reef is essentially connected with tectonic disturbance of the stratified rocks.

Facts connected with the mode of occurrence of the gold may be discussed with advantage.

The minerals associated with the noble metal in the reefs are pyrite, arsenopyrite, chalcopyrite, galena, and zinc-blende. We know that all these sulphides are precipitants of gold. In Prof. Liveridge's experiments* their value in this respect was in the following order:—1. Iron pyrites. 2. Copper pyrites. 3. Arsenical pyrites. 4. Galena. 5. Zinc-blende. These have been proved to precipitate gold from solution in the laboratory, and the probability is that they have precipitated the gold found in the reef-channels. Van Hise† says:—"The gold is thrown down from its salts by the baser sulphides, not as a sulphide, but as metallic gold, because gold and sulphur have such weak affinity, and gold is so easily reduced to the metallic form."

The reefs in the Gate belt carry in their payable portions from 1 to $1\frac{1}{2}$ per cent. of sulphides, containing from 5 to 10 dwts. gold per ton. For a long time the New Golden Gate sulphides which were contained in 1-ounce stone yielded 10 ounces gold per ton, and quite recently some pyrites from the 1600-foot level yielded 80 ozs. gold per ton.

Galena and blende are universally regarded on the field as good indications for gold; and colours of gold may sometimes be seen in hand-specimens close to those minerals, as well as to copper pyrites. The mottled and looser-textured quartz is considered more favourable for the occurrence of gold than is the white, tight, glassy variety, though on the other hand gold is sometimes seen in the most unkindly-looking stone. In the upper parts of the New Golden Gate reef the sulphides, when present, are distributed indifferently all over the stone, but in the lower levels they are apt to occur in bands, separated by bands of white quartz with scarcely a speck of pyrites. In the lower levels of this mine there is a noteworthy absence of the zinc-blende, which was one of the sulphides in the upper levels.

In some parts of the Mathinna field high returns have been obtained from small quantities of stone at shallow levels, notably at the Miner's Dream Mine, where yields are recorded of from 3 to 11 ozs. gold per ton. Some of the quartz from the City of Hobart adit is recorded as

* Journ. Roy. Soc., N.S.W., 1893, p. 329.

† A Treatise on Metamorphism, by C. R. Van Hise, 1904, p. 1171.

averaging quite 2 ounces to the ton of stone; and there are other instances. The Eldorado in the old days had some crushings which returned from 2 to 3 ozs. gold per ton. These rich surface and shallow yields are the general experience in gold-mining everywhere, and from careful examination of innumerable specimens from mines in this State I feel almost certain that there has been an enrichment by re-precipitation in the zone of weathering. On this theory, once this zone has been passed through, although the stone will be poorer, there is no reason for anticipating any progressive impoverishment as long as a shoot lasts. The New Golden Gate stone has been remarkably uniform in quality down to the lower limits of the shoots in the reefs. The falling off which appears in the published accounts is only apparent, as the returns include quantities of stone which were probably outside the shoot, and this has reduced the average for many months past to 8 dwts. per ton. The gold-bearing shoot at the Tasmanian Consols is even better at the 1300 and 1400-foot levels than it has been anywhere at a higher level. Re-precipitation in the zone of weathering tends to explain the greater purity of the gold near the surface, as compared with that at greater depths. It has apparently been dis-associated from its accompanying silver, and the proportion of the latter metal is accordingly relatively greater in depth at any particular mine. Figures, which Mr. H. J. Wise kindly furnished me with in 1904, in reference to this question are highly interesting. They represent the average fineness of the battery-gold won from the New Golden Gate Mine between 1890 and 1903, and are as follows:—

<i>Year.</i>	<i>Gold.</i>	<i>Silver.</i>
1890	·9035	·080
1891	·9125	·073
1892	·9055	·084
1893	·9096	·080
1894	·9022	·087
1895	·9084	·079
1896	·9057	·082
1897	·9031	·087
1898	·8978	·089
1899	·8922	·092
1900	·8843	·100
1901	·8812	·100
1902	·8849	·098
1903	·8834	·099

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The above shows that on the whole the gold was more free from silver in the upper levels. A similar result appears on examination of returns from another deep gold mine in our State. Mr. W. Radford was good enough to favour me with some figures compiled by Mr. J. T. Stubs, General Manager of the New Pinafore Mine, at Lefroy. These have been compiled from mint reports, extending over a period of fourteen years, and refer to battery-gold won from the New Pinafore reef.

Aliuvial gold from the 200-feet level. —

<i>Gold.</i>	<i>Silver.</i>
·9535	·035

From surface to the 360-feet level: —

<i>Gold.</i>	<i>Silver.</i>
·9450	·045
·9550	·035
·9492	·040
·9005	·065
·9550	·040
·9375	·055
·9492	·040
·9175	·075

From 1100-feet and 1200-feet levels: —

<i>Gold.</i>	<i>Silver.</i>
·9040	·075
·9015	·070
·9255	·060
·8500	·055

These results are in accord with those obtained at Mathinna, and Dr. J. R. Don has established similar differences between shallow and deep gold in Victoria and New Zealand.*

Discontinuous quartz-veins, which are frequently seen to close up and disappear, when followed down by shallow pits ("Native Cat reef"), are common on the hill range west of Black Horse Gully. These veins affect sandy zones of the general slate country, and have silicified the rock immediately adjacent, sometimes only for a few inches on each side, sometimes for a foot or two. The silicified

* The Genesis of certain Auriferous Lodes, 1897, p.p. 44-46.

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wall-rock follows the vein, and thus the appearance is occasionally produced of a band of sandstone crossing the country-rock at an angle to the direction of the general laminae. There is no reason to suppose that the lode-channel really terminates where these veins disappear. Where they occur, they are usually numerous, and indicate a rather extensive zone of fracturing, which, if followed down to substantial depths, would in all probability give way to a zone with fewer fractures and more important reefs. It is in the highest degree improbable that they are independent vein-systems. Cracks and fissures in the rock will be found to connect them with the larger reefs in depth. Though they are often too narrow to be payable, they may be regarded as valuable indicators of more persistent channels below. It is matter of general observation that earth fractures, produced by regional strain, are most numerous near the surface, and most erratic; while they are fewer and more regular at a greater depth. The disappearance of these irregular veins may consequently often bring the operations of small working parties to a standstill, but should not discourage companies with capital from sinking to the lower zone.

Although folding of the rocks has been intense at Mathinna, and arches are formed here and there, the auriferous quartz-bodies do not appear to prevail in the apices and troughs of the country as in saddle reef. At the same time, the rock folding and rupturing have produced channels which have determined the deposition of the vein-silica. Examples exist of fractures due to compressive stress as well as to tension. These fractures or lode-channels have generally been subjected to a little movement after formation, producing a more or less smooth wall on one side, while on the other, more often than not, a ragged edge exists, caused by the silica wandering into the adjoining country.

From the New Golden Gate northwards the fracture or reefing-zone is indicated by the workings at the Tasmanian Consols, the reef under the Catholic church on the hill, the old works at the Spur Mine at the back of J. Polley's, and the reefs on the Golden Stairs in the extreme north. Going south from the New Golden Gate this zone is crossed by the main and second slides in the Gate levels, which represent fractures or breaks in the country, persistent from level to level. The main slide has been traced down to the 1400-foot level. Below that the workings have not advanced sufficiently to meet with it. As will be explained

later on in this report, there seem to be grounds for believing that these slides are not dislocators of the reef, but simply supplied channels for its deviation. They have certainly produced either a downthrow or upthrow of the country, but their direction is that of the slates, and the latter continues unchanged south of the fault. The reefing-zone also continues south through the South Gate, Miner's Dream, Telegraph tunnel hill, old City, Jubilee, and Mountaineer. This is a distance of $2\frac{1}{2}$ miles in a direct line north-westerly and south-easterly. Further south not much has been done until the Sunbeam and Twilight old mines are reached, nearly half-way to Mangana.

Parallel reef-zones exist both to the east and west. On this visit I examined that to the immediate west, leaving the eastern line for my next journey. The central or Gate zone is perhaps 10 to 15 chains wide. The western zone is about double that width, and the reef-systems are more varied. On the Eldorado and Gladstone hills most of the reefs strike a little to the north of west, and on the City of Hobart the dominant strike is north and south, accompanied by subordinate fractures east and west. The Black Horse Gully separates this western zone from the Gate line. The gully does not denote any divisional line of faulting; still, the crosscuts from the Gate and South Gate mines tend to show that a barren strip of country separates the two zones. In addition, the strata on the two hills differ somewhat in nature, those on the Eldorado side being more sandy.

The Eldorado and Gladstone hills abound with gold-bearing reefs, running mostly in north-westerly or westerly parallels, none of which have been worked at more than shallow depths. The general strike of the strata is $N. 25^{\circ}$ to 30° W., and the underlie south-westerly. This dip prevails through the hill, though there are some minor folds. Minor faults also exist in this tract, displacing the lodes here and there. A little further west on the City of Hobart and Martyn's line, the reef channels assume again a north and south direction for the most part, though the strike and dip of the strata remain unchanged. Strictly speaking, this line of country passing through the City of Hobart ground should be regarded as a parallel zone, distinct perhaps from the Eldorado zone of east and west reefs, though geologically the two are one. The City of Hobart main shaft was sunk to 660 feet, and the reef worked at 500 feet. A good many shafts of less depth

have been sunk on this property; but the above is the deepest reached on this zone. Mr. Martyn's shafts further south are down 60 and 72 feet from surface on a north and south reef. Outside these workings this reef-zone has not been explored; and its prolongation both north and south requires examination.

New Golden Gate Mine.

Sections 13-87G, 320-87G, 185-87G, 295-87G, 261-87G, 81-87G, 1441-93G.

The New Golden Gate Mining Company has been working its mine since 1888, during which time it has raised 267,140 tons of quartz, and produced 222,755 ozs. of gold, an average of 16 dwts. 16 grs. per ton of quartz, and realising £847,075 7s. 4d. Its share capital is £9600, in 32,000 shares of 6s. per share. The total amount which this famous mine has paid in dividends is £355,200, or £11 2s. per share.

The main shaft has been sunk to a depth of 1620 feet, and the reef opened upon at 17 levels, from 116 feet to 1600 feet from the surface. This is consequently the deepest mine in the State. It is what may be called a dry mine, and well ventilated, and the work and appointments throughout are creditable to both company and manager. Owing to the increasing depth and a little increase in the water, an electric pumping plant has been installed recently, and is giving high satisfaction.

The principal features of the mine are, (1) the two powerful gold-bearing quartz reefs, Loane's reef and main reef, going down from the surface adit to the 800-foot level (Loane's to the 900-feet); (2) the new make or east reef, beginning over the 800-foot level and descending to the 1600-feet; (3) the west reef (Nos. 1 and 2), about 60 feet west of the shaft, descending from about the level of the 1300-feet to the 1600-feet. This may be the same as the western reef intersected in the surface adit, but as nearly 1200 vertical feet of unproved ground exists between them, their identity is a matter of conjecture. It is probable that they are different reefs.

In the surface adit an ill-defined formation was passed through between Loane's and the western reefs, known as the central reef, but this has not been seen lower down. It most likely junctions with the western reef in depth.

Loane's reef is the only one which goes up to the surface. Mr. A. Loane, prospecting in the adit driven by the

old company, sank a winze on the reef-channel which had been intersected, and which showed a little quartz. A few tons of quartz were got out, yielding between 1 and 1½ oz. gold per ton, and the present company was formed in 1887. Mr. Thos. Andrews, the present manager, took charge of the mine, and insisted on sinking a main shaft, which was at once started. The oxidised soft rock persisted to about 100 feet from surface, and was then succeeded by the unaltered blue slate of the deeper zone. At that depth a new parallel reef was cut through in the shaft, which received the name of the main reef, and which has since been followed down parallel with Loane's to a depth of 800 feet, and distant from the latter 10 to 30 feet. This important reef is not recognisable in the surface adit. A line of "dig" in the adit-walls may possibly represent it, but an effort of the imagination is required to connect the two.

Above the 116-foot level neither of these reefs proved valuable; at most, only little short shoots occurred in the reef-channels. At the 176-foot or No. 2 level they were still very poor, but at 236-feet or No. 3 level the gold started to make in both reefs. At this level, Loane's reef strengthened to a width of 9 feet, and yielded quartz worth 2 ounces gold per ton. North of the shaft these reefs run parallel, but south they converge and finally junction, forming a fine body of gold-bearing stone where this takes place, attaining a width of as much as half a chain. As deep as 800 feet, Loane's reef when cut was over 28 feet of clean payable quartz, the average being perhaps 6 to 8 feet at the different levels. The average of gold contents of the stone won from the two reefs has been about 18 dwts. gold per ton. The underlay of both reefs is to the east, and its mean amount is 1 in 8; at the 800-foot level they are vertical. Loane's reef continued to yield gold down to the 900-foot level, and then dwindled to a track; the main reef also giving out at the 800-feet. In 1896 a new reef (east reef) from 4 to 13 feet wide, was struck at the 900-foot level. This was followed up to the 800-foot level, and has been worked in the lower levels, attaining a width of 22 feet of stone. From 800 to 1100 feet it descends vertically, about 50 feet west of Loane's reef, but thence to 1500 feet underlies east at 1 in 2. At 1600 feet the reef is again vertical, or underlying very slightly to the east. Large quantities of stone have been crushed from this reef down to the 1300-foot level, but below this the quartz has been poor, though undiminished in size.

The western reef has been driven on at the 1300, 1400, 1500, and 1600-foot levels. It may be regarded as a western leg of the new make, the eastern leg of which formed the east reef. Its underlay is to the west. Between the two reefs is the horse or centre country of the great axial fold mentioned earlier in this report. The western reef is a strong and persistent channel, varying from 4 to 15 feet wide, returning variable stone, some of it very good, but on the whole not realising expectations. It continues north into the Tasmanian Consols Mine.

The exact position of affairs underground may be best understood by considering some of the levels separately, and the following descriptive notes will assist in this. The upper levels were dealt with in Mr. A. Montgomery's report of the 12th September, 1892, since when the mine has been developed to a much greater depth, and the problem has become an entirely different one.

500-foot Level.—The crosscut from shaft has been driven 350 feet west, and intersected reefs which are assumed to be the central and western ones, which were seen above the 176-foot level and in the surface adit, but which here are of no value. East of the shaft the Main and Loane's reefs have been worked with advantage. West of the shaft is the perplexing slide country.

At 190 feet west of the shaft a slide traverses the cross-cut. It is here a break in the country 4 or 5 inches wide, bearing S. 30° E., and dipping south-westerly at an angle of 3 in 7. A level has been driven along it in a south-easterly direction, and at 125 feet in, a strong reef was driven across, with 25 feet width of solid quartz. This was followed south for 70 feet, when a fault occurred, bringing the quartz round to the north-west, in which direction it was followed through three more subordinate faults. The reef is thus cut up into separate segments by these four breaks, each successive segment being removed further west and north. No. 1 segment was the large block south of the first slide, and appears to be cut clean off at the south end of the stope, the smooth slickensided wall of the fracture denoting movement. It is noteworthy that some of the quartz passes through the slide without deflection, and then dies out. Between this and the next slide a segment of reef striped with quartz has been to all appearance heaved north, a phenomenon repeated a little distance further north by a further slide. The quartz veins in these three blocks of stone are in parallel lines, but the stone between the two following slides is more

mixed with country, and the direction of the veins is not so evident.

The features of this occurrence are peculiar. The smaller segments of quartz are only partly divided by smooth faces or breaks, *i.e.*, the latter do not extend fully across the stope. In the fourth segment the quartz veins are not at right angles to its course as in the others, but in strings parallel to the walls of the fault; and the last slide does not appear to be so clearly cut as the others.

The long level further west is along the course of a long slide, only 50 feet south of this line of breaks; consequently, if we could replace the faulted segments in what seems at first glance their original position, they would form a reef crossing that level. But there is no sign of a break in the level-walls which would indicate the passage of any reef. How then account for the present positions of the reef segments? It must be confessed that this is difficult, and more requires to be known before a definite conclusion can be drawn. A possible explanation is that the quartz between the two main slides was deposited there in broken country subsequent to or simultaneously with the formation of the main slide-channels, following, perhaps, a somewhat tortuous course, and that the broken country-zone has afterwards been subjected to minor secondary faulting which has displaced blocks of country and reef.

At 348 feet west of shaft the crosscut enters the level driven along the long slide north-westerly for 200 feet and south-easterly for 500 feet. Towards the end of the north-western drive, 47 feet behind the face, a turn was taken due west, with a view of getting outside the broken country. At 30 feet from the end a slide consisting of one or two inches of white clay crosses the level north-westerly and south-easterly, and close to it is a band of intensely-folded slate. The level is apparently not yet beyond the disturbed zone. The south-east (or, as it is called, the south) drive from the crosscut follows a kind of soft slide running with the country between good slate walls. As the drive proceeds the slates become twisted, and carry eyes and lenticles of quartz; evidently a disturbed belt. For the last 260 feet the drive continues due south. Broken bars and arches of quartz here and there show the continuance of somewhat unsettled country.

At 108 feet behind the end crosscuts have been driven east and west on a reef formation. In the west crosscut, driven 38 feet, this consists of parallel quartz veins and

black slate 1 foot to $2\frac{1}{2}$ feet wide, and the same formation has been followed for 64 feet in the east crosscut, carrying little lumps and veins of clean white quartz. In the face it has a twisted appearance, and does not look kindly.

The line of clay crossing the north drive towards its end is supposed to be the second main slide.

At 30 feet behind the end of the south drive an exploratory crosscut east is now being driven. At 290 feet it has entered a reef channel, which is being driven across. It has been fairly well established by west crosscuts in the Gate and South Gate mines that the country to the west of the disturbed zone is reefless for a good distance, while formations are known to the east (at the South Gate). This exploratory crosscut must be considered as a good piece of work.

1200-foot Level.—The deeper levels of the mine, where driven far enough, show features common to all, for from the surface downwards in each successive level going south a main slide appears to cut off the reefs. Its average bearing is $N. 35^{\circ} W.$ — $S. 35^{\circ} E.$, and its hade is 3 in 7 to the south-west; consequently, it interferes with the reef further south in each level as the mine gets deeper. This occurs with such unvarying uniformity at each level as to enable a pretty accurate forecast to be made of the behaviour of the reef at the level below. Strenuous efforts have been made to recover the reef beyond the slide, but so far its southern extension has not been found. The occurrence in the 1200-foot level is so typical that it may be discussed in detail.

The arched reef formation occurs at and near the shaft, dipping westerly in one direction and easterly further in the crosscut. The crosscut before reaching the east reef takes a bend easterly in hard slaty sandstone. It cuts the east reef and passes through it for over 12 feet. The reef was here found to be poor. The level was continued on the reef south nearly 500 feet, the last 170 feet being reported as 12 feet wide of clean stone, assaying 17 dwts. per ton. The shoot of gold-bearing payable stone in this level has a length from north to south of between 200 and 250 feet, and at its southern end is traversed by the main slide. Just north of the slide was very good stone—17 to 18 dwts.; but the quality fell off to half that value after passing through the fault. At the slide the reef bends round to a right angle with its previous direction, and follows the fault-line north-westerly, eventually dying out. This has always been called the "drag" of the reef, being

similar to what is frequently seen in the fault-channel of a dislocated reef. As, however, the strike of the country is practically unaffected by the slide, it is highly probable that the great bend in the reef is a deviation along the pre-existing slide-channel rather than a reef-faulting. If the reef has really been faulted, the faulted part ought to be recovered to the west, which has not been done, in spite of a long crosscut in that direction. The conclusion which I arrived at on examination of this occurrence was that the reef itself had not been faulted. It seems possible that the fracture of the country and the deposition of silica in it were practically simultaneous. The consequences of such a conclusion are far-reaching, for if it be true, search for a faulted portion of the reef would be unnecessary, and all that could be done would be to follow the deviation; which, in fact, has also been done for 200 feet north-westerly.

The level has been extended beyond the slide due south for 270 feet. At 200 feet it passes through a second slide, striking north-westerly and south-easterly, and dipping south-westerly. A few inches of slate and quartz are met with. The country between these two slides is disturbed, showing twisted and curved slates, but preserving the same general strike as that back north. Immediately south of the second slide the country is deflected to a due south strike, but recovers its normal bearing within a few yards. It is usually a grey slate with small bands of a darker graphitic slate, which continues to the end of the level.

At the end of the level a crosscut due west has been driven 260 feet, to explore the country in that direction and pick up any faulted part of the reef. The country passed through is mostly hard grey slate, with two hard quartz-veined bands of blocky stone, emitting some water. One of these water-channels marks an anticline. This crosscut is now suspended. The position of the end is 90 feet from the western boundary of the 3-acre section, and 180 feet from the southern boundary of same. This crosscut has carried out the useful work of testing the ground south of the slide in a western direction, and has proved the non-existence of a faulted reef within any reasonable distance. If the reef has been faulted at all, it has been heaved an extreme distance into O'Kelly's section on the western side of Black Horse Gully. Works on that section or in the Eldorado ground would have an off-chance of meeting with it. But, as said above, I doubt whether there has been any heave. It is more likely that a reef-

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zone continues indefinitely to the south, within which crosscuts at intervals would disclose discontinuous reefs all along the north and south line. Within the limits of the zone, i.e., within a short distance of the main anticlinal axis, reefs and makes of quartz undoubtedly exist, and if the Gate reef has for a time lost itself, as it were, in the slide-channel, there is every likelihood of it being succeeded further south by fresh splices and stretches of reef.

In the 1200-foot level, at 180 feet north of the slide, a crosscut east has been recently started, and at 190 feet east of the level is passing through a wide reef channel carrying bands of quartz from 6 inches to a foot wide. At the time of my visit a width of 20 feet of this formation had been cut into. The primary object of the crosscut is to cut a west leg dropping from the main reef; a further aim is to prove the country east of the Gate reefs, which is known to be in the reefing line.

1300-foot Level: East Reef.—The reef was struck in this level in 1899, where it showed 4 feet of gold-bearing stone. The same lode-channel of hard country and veins of quartz as met with above was passed through in the crosscut from shaft. The reef rapidly improved when driven on south to 6 feet of payable stone. At about 100 feet from crosscut it began to widen considerably, and soon reached a width of 16 feet, but of moderate value, viz., 3 to 8, or sometimes 9, dwts. per ton. The value is said to have varied a good deal. Near the slide the reef formed a large body of clean stone, 15 feet wide and of variable quality; a rise put up proved a block of highly-payable quartz.

After driving 550 feet from crosscut the first main slide crossed the reef, bearing S. 27° E., and dipping south-westerly. A curious report exists on the mine that the slide still moves. Once a sound like a dynamite explosion was heard, and all the men left their places, but all that ground has been stoped since and nothing was ever seen. No doubt tension still exists in the strata, and is relieved by rupture now and then. The same thing has been noticed in other mines in the State. The ground has been stoped on the north side of the fault, but only a track, as it were, passes through to the south. At about 60 feet south of the fault the stone made again in a large shoot, at first barren, and further on carrying a few dwts. gold to the ton, but there is no stope south of the slide. The end of the drive south of the slide is now filled in, but I am told that it was extended through the second slide with a little stone, which died out.

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The east reef, where struck by the crosscut from shaft in this level, is striking north and south, and is within 20 feet of the eastern boundary of Section 13-87G. Further south it bears to the west of south as much as from 10 to 20 degrees.

West Reef.—220 feet west of the east reef at the 1300-foot level the crosscut intersected the No. 1 west reef, as the main western reef is called. It is here small and poor, and the walls converge downwards, but the winze 10 feet to the north shows that it descends vertically to the level below. It only shows leaders of quartz in a 7-foot channel here, and carries no gold. It has been driven upon north 260 feet, or within 65 feet of the Consols boundary. The winze at the end of the drive goes down to the level below, and proves that the channel is identical with the one at the 1400-feet. Half-way in the drive is a blow of stone, which, however, is practically barren.

Twenty feet further west what is called No. 2 west reef has been reached by the crosscut, but the appearance of this wherever it has been cut in the mine tends to show that it is part of No. 1 west.

1400-foot Level.—At this level a long crosscut from shaft traverses north and south the whole width of Section 13-87, *i.e.*, to within 15 feet of the west boundary, and 20 feet outside the east boundary. At the latter point the east reef was met with, and has been driven on 33 feet north and south, to within 150 feet of the slide. Where it was intersected, it was 26 feet wide, white quartz, hard and poor. For the full distance driven the reef is well defined and clean, but the assays did not show more than 1 to 3 dwts. gold. The gold-bearing shoot at this level is apparently still ahead of the end, and will be shorter here than in the level above. This shortening of the shoot suggests its pinching out in depth, if nothing exists parallel with the level, and suggests search at deep levels for splices or parallel shoots rather than for a continuation of the present shoot downwards. On the other hand, some continuation downward along the slide-plane is probable.

West Reef.—At 112 feet west from the shaft the crosscut at this level intersects No. 1 west reef, and at 33 feet further No. 2 west reef.

This was a new discovery at the time. No. 1 reef has been driven on south for 440 feet to the slide, and north 197 feet close to the boundary. At the intersection a body of gold-bearing quartz was met with 12 to 15 feet wide, and continued for 100 feet south, varying from 4

to 12 feet wide, and assaying from 8 to 24 dwts. gold per ton. This stone was proved to go down 30 or 40 feet, and up about 50 feet, when the value and width of the reef declined. The reef in the drive between here and the boundary was reported as varying in size from 5 to 12 feet, and in value from 5 to 14 dwts. per ton. In the end it is 6 feet wide, clean stone, but for a chain back considered too poor to stope.

The south drive on reef showed the channel to be variable, from 4 to 12 feet wide, with stone sometimes highly payable, then bunchy and uncertain. A good block of stoping ground above this level was opened out for a length of 250 feet. In a great part of the drive the quartz is discontinuous—in nice little blocks of good stone, but too short to open out. The drive constantly receives heads and channels of pug from the west, which sometimes carry good stone, and seem to be of the nature of connecting spurs between No. 1 and No. 2 west reefs. For the last 200 feet in this level the only stone met with has been in little isolated bunches, but it is 6 feet wide a little distance behind the slide. The slide, which crosses the level 10 feet behind the end, on a north-westerly and south-easterly bearing, cuts off the large clean stone, but allows stringers and a band of quartz to pass through and curve round to the south-west. The rock-wall on the western side of the level passes through the slide with just a break, but no disturbance. I was told that the quartz was poor up to the slide.

Two crosscuts west from this level have intersected No. 2 west reef; one at 195 feet from flat sheet, driven 28 feet, and communicating by a pass with the level below; the other at 110 feet further in, and driven 40 feet. The first crosscut showed the reef with about 4 feet of stone in it, and the second exposed only a few inches of quartz with an easterly underlay.

The No. 2 reef intersected in the main crosscut is a mixed quartz formation, with a channel 6 feet wide at the end of the drive north, 54 feet from intersection. The quartz in this channel occurs as leaders and bands—about a foot of stone in the largest bands. Another 50 feet of driving would bring this drive into the main level north.

The indications are that what is known as the No. 2 west reef is an integral portion of No. 1, a long narrow horse of country dividing the two parts.

The long main crosscut west intersects at 135 feet from the west boundary a small break or slide, considered to

be the main slide. It is not quite on the line of that slide as cut at the end of the level south, which, if prolonged, would touch the western boundary. Having regard, however, to the distance between the two points, it is quite possible that the two faults are identical.

1500-foot Level.—Only the west reef has been driven on at this level, viz., for 370 feet south of the shaft and 180 feet north, or to within 30 feet of the north boundary. In the south drive stone 4 to 15 feet wide was proved of varying quality, a good deal of it low-grade. The ground above this level has been stoped up to the level above in the south drive. North of the shaft a shoot of gold-bearing stone for about half the length of the drive has been proved, beginning about half-way in.

1600-foot Level.—This is the deepest and most important level. The crosscut east of the shaft intersected the east reef at 150 feet, and that west of the shaft passed through the west reef at 140 feet.

The east reef where struck was 5 feet wide, and gold-bearing up to 5 or 6 dwts. gold per ton. It has been driven on 150 feet south without any improvement in quality—in fact, the gold going south has disappeared. When I saw the end, the reef was 6 feet wide, with 5 feet of quartz in bands, and there was still quartz outside the walls of the drive. Water from the reef channel was dripping from the roof; the stone was a little mineralised and of favourable appearance.

A drive north was recently started on this reef, and a winze begun 10 feet from the flat sheet. The stone showed gold freely, and a small crushing from the drive (43 tons) returned 1 oz. per ton. The gold in the winze is rather erratic, disappearing and reappearing at intervals. The north drive has been extended to 30 feet without improvement. The wall on the east side is well defined and smooth. A few feet back from the face a head crosses the drive and has checked the stone, but the face is black with mineral. The reef in the winze is 4 feet wide, stone clean, wall defined, and everything promising. The occurrence of gold here is the most important feature of the mine at the present juncture, but this will be referred to later on.

The crosscut west from the shaft at 140 feet cut the west reef, which at this point is 10 to 12 feet wide, with about 5 feet of lode-slate. The quartz is low-grade. This reef has been driven upon north for a distance of 140 feet, but has supplied nothing to the battery. The drive

is on a large reef, and the face carries a large formation on the footwall. On the west side at the end gold-bearing stone was found, worth about 5 dwts. per ton, and a rise goes up on this to the level above. A point of stone comes into the drive from the east, and at the end of the drive a crosscut east has been driven about 30 feet; the face of this is in quartz-veined slate. It is probable that the point referred to is the cap of a quartz body going down below this level. The end of this drive is 70 feet from the north boundary, and there is every reason to believe that the reef is the one upon which the Tasmanian Consols has driven north, only this drive is 172 feet below the 1400-foot level of the Consols, and 17 feet further west. The main crosscut has been carried some 20 feet further west through reef and lode slate formation. The indications are that the two parts of the west reef have junctioned here.

The solid and wide reef followed in the north drive with moderate, though not payable, assay values, augurs well for future work at a deeper level.

After the above review of the deeper levels we are now in a position to consider the general prospects of this great mine.

These at present are visibly dependent upon the east and west reefs. The former has been stoped roughly (neglecting certain gaps) a vertical distance of 250 feet from below the 1000-foot level down to the 1300-foot level for an average length of 250 feet; but below this no stoping has been done, as though the reef is powerful and clean, the gold-shoot seems to have thinned out. The pitch of this shoot is to the south, and the main slide is practically the southern end of it, though gold-bearing quartz continues westward a short distance in the slide-channel before it finally dies out.

Efforts have been made to pick up the heaved reef on the south side of the slide, but in vain, and after examining all the conditions, I am of opinion that there is very little chance of finding it, as the indications are that the reef has deviated along the channel, and has really not been faulted at all. It has been followed in various levels to the end of its deviation. This does not, however, preclude there being a continuation southwards south of the slide country; not the same reef perhaps, but in the same line. The reef-making process which was at work certainly extended southerly and south-easterly, forming the long north and south reefing-line referred to before in this

report. Consequently, it is quite possible that the South Gate Mine, deepened to 1000 feet, might open up reefs of the same character as those in the New Golden Gate. The reefing-line is in a direction east of south. The long crosscut west from the 1200-foot level has failed to pick up anything in its course, and this result is not encouraging for discoveries on the western side. Crosscuts to the east have a much better chance, and this has been recognised by the Gate management.

As regards the main shoot of gold in the east reef, it has not been proved below the 1400-foot level. A winze was commenced at the end of this level, in order to prove the reef down to the level of the 1600-feet, and in the event of success, the latter would be driven south to connect. Unfortunately, the walls of the reef at this spot showed signs of converging, and the funds available do not allow any risk of unprofitable work being taken. Consequently, sinking was suspended, and properly so, under the circumstances. All the same, however, this work is desirable whenever funds will permit it. Still, it would appear as if the gold shoot has been for some time contracting as it descends, and it is possible that it will have disappeared altogether by the time the 1600-foot level is reached.

It is useless to disguise that the company has to face the possibility of one of those blanks in the reef such as have occurred in other mines, and have been perseveringly passed through to payable stone at a greater depth. An uninterrupted gold-shoot in one reef or the other for at least 1200 vertical feet, as has existed in this mine, may be described as a persistent run of the precious metal, and a blank sooner or later would have to be expected: but both experience and theory teach us that the blank is only a passing phase. The magnitude of the scale on which gold has been deposited from the 1300-foot level upwards forms the very best reason for believing that deeper sinking will eventually lead to another gold-bearing zone.

The most important feature in the whole mine at present is the discovery of gold in the reef at the 1600-foot level, 400 feet north of the main shoot at the 1300-feet. Stone worth 1 oz. per ton was met with here, but the gold gave out and is now being sought by a winze. The fact of gold occurring at this point, unconnected with the south shoot, makes it nearly certain that the discovery is a parallel shoot. It may therefore be the cap of a new make of gold descending from this level indefinitely. The

management is doing its utmost to locate the shoot with certainty. When this is done the mine is likely to receive a new lease of life.

There are thus at least three or four directions in which capital may be expended advantageously, viz:—

1. Locating the new gold-shoot at the 1600-foot level.
2. Sinking the main shaft deeper, to explore and prove this shoot in depth.
3. Pushing out exploratory crosscuts east; and perhaps,
4. Sinking on the old south shoot from the 1400-foot level.

I am inclined to think No. 4 is the work of least immediate promise, and would be very likely to turn out disappointing; still there is a possibility.

Nos. 1 and 3 are being attended to by the management, and all that can be done is being done, and done thoroughly.

No. 2: The work of sinking the main shaft deeper, so as to get at the new shoot of gold below the 1600-foot level, is of prime necessity, and may be strongly commended to the owners.

From the above remarks it will be seen that the only policy which can save the mine is an exploratory one. It is ridiculous to talk of the mine as having come to an end while there is a strong reef with patches of gold at its deepest level. The situation would never have arisen if a strong reserve fund had been built up in the palmy days of the mine; but it must now be accepted, and funds provided for a definite policy of exploration.

From the behaviour of the reefs and a review of the structural features of the mine generally, one may feel almost sure that northern parallel shoots of gold exist, and there is no reason why they should not prove as important as the one already worked. It is for the mining engineer to search for them in the most profitable and approved way; and I would lay the greatest stress on this work. Immediate further sinking of the main shaft is involved in this view.

With reference to the west reef, it has, on the whole, been disappointing as regards its yield of gold. Still, it has sent a good deal of quartz to the battery from the 1300-foot level downwards; and the quantities of stone being taken from it in the Tasmanian Consols Mine further prove its importance. A comprehensive policy for the Gate mine must include the development of this reef. The fine body of quartz in it at the 1600-foot level, north

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drive, invites further work. Although low in grade at that point, it may improve at increased depth; at any rate, it is too encouraging to be left alone.

The New Golden Gate Mine has a very complete gold-saving plant, consisting of 40 stamps, 8 boxes (5 stamps in each), 3 copper plates to each box (none inside), one Watson and Denny pan for the blanketings, a hydraulic classifier to each 10 heads, 1 Wilfley table and 1 Frue vanner to each 10 heads. The cyanide plant comprises 4 distributing and 4 leaching-vats (100 tons capacity), 6 slime-vats with agitators (12 tons), and 3 zinc-boxes. The quartz is tipped direct into hopper, and without passing through a stone-breaker is hand-fed into the battery, one feeder being employed for each 10-head of stamps. The stamps vary in weight. Mr. T. J. Andrews, the general manager, says that a few years ago stamps of 750 lbs. were in use, with a drop of 8 inches, and 75 blows per minute, but that some of them have been replaced by heavier stamps, increasing the weight by a heavier shank, and a solid disc instead of the screwed disc, and at present most of the stamps are a little over 900 lbs. in weight, with 6 inches drop, and 90 blows per minute.

The quartz is crushed through a 200-hole grating, and passes over two ripples, then over the copper plates and blanket strips. The blanketings are ground in a Watson and Denny pan, and amalgamated with mercury. After the blankets, the sand passes to the hydraulic classifier, and two classes are formed, No. 1 going over the Wilfley tables, and the slime-pyrites over the Frue vanners. The tailings are then pumped to the cyanide plant, each distributing-vat holding 100 tons of tailings, which are trucked into leaching-vats in front and below. The slime passes in the overflow, and is caught as far as possible in a series of 6 settling-vats, each provided with an agitator driven by an air-winch. The tailings are leached with cyanide, and being fairly clean, do not require any special previous treatment. The gold is extracted in zinc boxes. The tailings residues are trucked from the leaching-vats and drawn up an inclined tramway with air-winch for tipping. The slimes are agitated and allowed to settle before decanting solution; these are not rich enough to warrant filter-pressing.

The 40-head battery, crushing full time, treats 420 gross tons per week of six days. The battery amalgam is worth about one-third gold, and the gold realises about

£3 16s. per oz. The cyanide bullion is worth a little under £3 per oz. The concentrates are sent for treatment to Cockle Creek, N.S.W.

An electric pumping plant has been recently installed in the main shaft, and is a complete success. The manager informed me that he could raise 2500 gallons per hour with it, but that the hourly quantity to be lifted was only about 1200 or 1400 gallons.

It may be mentioned that for several years the quartz raised and treated has cost between £1 8s. and £1 9s. per ton, including management expenses.

South Golden Gate Mine.—The Section 295-87G now belongs to the New Golden Gate Company, and the old South Gate shaft is situated in the north-eastern corner, 114 feet south of the north boundary-line. Work has been relinquished, and my information is derived from Mr. Andrews and the mine plans. The main shaft has been sunk 400 feet, and crosscuts driven at 200 feet and 400 feet. In the 200-foot crosscut and at 20 feet from the shaft a 6-foot reef formation was passed through, carrying some quartz, but no gold. This runs approximately with the country, and underlies east. It was driven on a short distance, with no results. It appears to be the Snake reef, which was sunk on by the Snake shaft 20 feet north of the boundary; and what is thought to be the same reef was exposed in a small shaft or pit opened by the roadside just south of the Gate residence. No certain information is available respecting the results of the old Snake shaft, but it is said that some half-ounce stone was got from it.

At the 400-feet in the South Gate shaft two long crosscuts were driven east and west. The west one was pushed 194 feet, or within 11 feet of the western boundary, without cutting anything beyond a wall at 107 feet from the shaft. In the east crosscut at 130 feet from shaft a reef formation, about a chain wide, was passed through, which must have been the Snake reef; and 84 feet further in a second formation, 75 feet wide, was intersected. Continued driving for further 150 feet failed to disclose any more reefs.

If the bearing of these formations is reported correctly as N. 25° W., we cannot connect them with any of the reefs worked in the New Golden Gate. The Snake reef is not far from the position which the main slide might be expected to occupy, but its underlay is easterly. The real relations of the South Gate reefs to the slide are

doubtful. We do not know their strike sufficiently well to be able to produce them northwards towards the Gate mine. As far as can be judged from appearances, they would intersect the Gate reefs on their underlay if they persist so far. It is regrettable that they were not explored more fully. As the Snake reef was gold-bearing where worked from the shaft, other parts of the reef will almost certainly be found gold-bearing also. The formations are mullocky or slaty where they have been cut, but as their strike is more or less with the country, it is probable that they will last for some distance, and may make more quartz at some point or other. I have charted them as south of the slide, assuming the bearing of the latter to be uniform throughout, but I am far from certain as to where the main slide would strike these reefs.

Tasmanian Consols Mine.

This company leases Sections 70-87G, 174-93G, 173-93G, 1008-87G, 57-87G, 204-83, 130-G, and 75-93G.

The work is being done on Section 70, at the shaft begun by the old North Golden Gate Company. The levels of the different crosscuts from the shaft are as follows:—150 feet from surface, 390 feet, 540 feet, 900 feet, 1000 feet, 1100 feet, 1200 feet, 1300 feet, 1400 feet. The New Golden Gate shaft is 190 feet south of the boundary, and the Tasmanian Consols shaft 62 feet north of it, so that the two shafts are not more than 252 feet apart, but the collar of the Tasmanian Consols shaft is 28 feet below that of the Gate. Accordingly, the levels in each mine do not correspond exactly with each other.

The west reef of the New Golden Gate has been developed in this mine at the 1200, 1300, and 1400-foot levels. It cannot be connected satisfactorily with formations seen in higher levels. As this is the only productive reef so far worked in this mine, I will take these lower levels first.

1200-foot Level.—At this level crosscuts have been driven west 130 feet and east 40 feet. The west cross-cut, after passing through 50 feet of dark slate, dipping west, intersected a wall, and traversed an irregular reef formation for 15 feet. On the east side a vein of quartz about a foot wide, and carrying a little gold, has been cut. Then a further vein, 6 inches, was cut, and on the west side is mixed formation about 6 feet wide. The reported

values of the quartz are from 8 to 10 dwts. per ton. The crosscut was continued with the object of cutting another reef further west. The face is in dark, smooth slate, dipping west: 3 feet behind it is a 5-inch vein of quartz underlying with the country.

Levels were driven on the reef north and south. The south drive, 50 feet, to the boundary, has not opened up payable stone. About half-way in is from 6 inches to a foot of stone on the footwall, and a bunch of mottled quartz is in the face on footwall side, about 1 foot wide.

The north drive, at 30 feet from crosscut, carries 2 to 3 feet of mineralised stone on footwall, with a little gold; and at about 60 feet this improved to a body of payable quartz the full width of the drive. Stone was sent to the battery from the stopes above this level for a length of 80 feet by 20 feet high. The south end of the stopes comes to within 30 feet of the crosscut. At 90 feet from crosscut a rise has been put up 42 feet through the stopes. The reef was payable up to 20 or 25 feet, then fell off in grade and size. At 12 feet it was 5 feet wide; at 18 feet, 3 feet wide; at 25 feet, 2½ feet wide; at 40 feet, it is broken and valueless. Some rich stone was disclosed by this rise, some of the assays returning between 1 and 2 ozs. gold per ton; but values, on the whole, were irregular and poorer than below the level. The stope ends 30 feet north of the rise; and 20 feet further north a crosscut west was driven off the level for 21 feet in slate country with quartz veins, but with no result. About 15 feet behind the rise the reef appears to be divided, a splice going off east. A few feet north of the crosscut, on the east side of the level, a reef goes off to the east with 2 feet of clean low-grade stone. It may be wider, but has only been cut into for 2 feet. This appears to be a splice taking the place of the main reef, which crosses the level to the west. Ahead of this make, only bunches of quartz occur in the roof. Further north, at 220 feet from the main crosscut, a crosscut east has been driven for 75 feet. The main level continues north past this crosscut for 38 feet in clean slate country without any sign of a reef. It would seem here to be too far to the west.

The 75-foot crosscut was driven to intersect the east reef formation cut east of the main shaft. At one time it was suggested that this was the east reef in the New Golden Gate; but this cannot be the case, as that reef would be 90 or 100 feet east of the shaft, or only just inside the eastern boundary of the section. A reef has

been cut 3 feet behind the end, carrying 9 or 10 inches of quartz, with a north-west bearing. I doubt whether this is the same as the one in the crosscut east of the shaft; but it is probably identical with that cut at the end of a drive north of this crosscut, 50 feet back from the face. From that point the drive has been extended 107 feet north. This drive is supposed to be in the footwall part of the west reef, or on the east splice of the reef. About two-thirds of the way in, the reef rises in the floor and disappears again; and some quartz is seen in the level in two or three places. At the end a cuddy has intersected the east reef formation, $2\frac{1}{2}$ feet wide, which is here stronger and carries more clean quartz than in the crosscut. The cuddy has been pushed through to the clean slate on the east side, which is smooth and identical in appearance with that at the end of the crosscut. The quartz carries a little gold.

The crosscut east from the main shaft cut a lode at 27 feet, which has been thought to be the one cut at the end of the level north. If the latter is the same as the one cut in the other crosscut, this reef could very well be a different one, for the bearings are not identical. The relations of the country-rock, however, are similar in all three exposures, and this suggests identity in some way, for here, too, the sandstone of the crosscut gives way to dark, smooth slate where the reef is cut. The reef has been driven on east of south for 15 feet, carrying about 6 inches of white unpayable quartz for half-way in, which then degenerates into stringers. The underlay is to the east. To cut the east reef of the New Golden Gate at this level, it would be necessary to drive the crosscut further east for about 70 feet, but the reef would then be found to underlay out of the section. The reef which has been cut in the Tasmanian Consols east of the shaft is most likely the formation met with in the Gate crosscut near the shaft.

The work done on the west reef in the Consols has followed it at about 100 feet nearer the surface than in the New Golden Gate, but this appears to be the cap of it. At the 1200-foot level the stone forms a low crown, or apex, which was disappointing above the level, but has been found to improve and lengthen going below it.

1300-foot level.—The crosscut west cut the west reef at this level at 58 feet west of shaft. At the intersection the channel is about 20 feet wide, carrying an irregular

formation of quartz veins, but payable. The length of payable stone has increased at this level to 220 feet. The reef was strong for 60 feet along the level as far as No. 1 winze, where it is 6 feet wide, and of good quality. Northwards from there it pinches, but after 40 feet it opens out again to $7\frac{1}{2}$ feet, yielding very good stone; after another 40 feet, it contracted again. The northern end of the stope is in reef matter carrying a little gold, sufficient to go to the battery with other stone. North of the stoped ground the reef in the level varies from 3 to 5 feet in width, sometimes broken and irregular, and giving varying gold prospects. The face carries a well-defined footwall, and about 2 feet of stone altogether. Behind the end a flat floor comes in, cutting down through the lower part of the drive. The quartz is gold-bearing, but not payable. This is rather a long drive without any crosscuts.

At the bottom of the 40-foot winze (No. 1), from this level, there was, at the time of my visit, a fine reef of solid payable stone, $9\frac{1}{2}$ feet wide, opening out going south to 16 feet.

The level south from the crosscut has been driven to the boundary, where the horse of lode slate intersected at the flat sheet terminates, and the two portions of the reef come together. In the face the division is just showing, the eastern side of the reef dipping east, the western side underlying to the west. The reef is 13 feet wide, but is not payable in the end; or, rather, the stoping-ground seems to have come to an end here, a stope running back from here north for 70 feet, and up to 80 feet above the level, communicating with the intermediate end from No. 1 winze.

The north end of the 1300-foot level on this reef in the New Golden Gate Mine is 28 feet higher than this face, and 70 feet on the south side of the boundary. It is still poorer, and probably there is not much of importance between them, as the gold is making north in a cone-shaped shoot, the base of which lengthens in descending.

1400-foot Level.—This is the bottom level. The crosscut west intersected the reef at 43 feet, or 15 feet to the east of where it was passed through at the level above. The survey shows that this apparent change of underlay is not real, but due to difference of angles at which the crosscuts have been driven, the reef being practically vertical, or dipping west very slightly. Where the cross-

cut passed through the reef, the latter consisted of between 11 and 12 feet of gold-bearing stone. Levels north and south have been opened on it. When I saw the reef, soon after its intersection, it was a splendid body of quartz, 10 feet in width, well mineralised. The battery tests of it seem to show that it is worth about 10 dwts. per ton. Since my visit the south drive has been carried to the boundary. As the New Golden Gate has driven its 1400-foot level also to the boundary, on what is presumed to be the same reef, the two ends must be one above the other, separated by a vertical distance of about 28 feet. From the plans of the surveys of the underground workings of both mines, the reef at the 1400-foot level in the Consols is identical with that in the Gate at its boundary in its 1400-foot level, for the measurements give only 3 feet horizontal difference between each, the reef in the Gate being at that point 240 feet west of the north-east corner of Section 13-87c, while in the Consols it is 243 feet. This difference is not what I should have expected, for the Consols appears to be working on the eastern part of the reef (if there is any split), and on that supposition its reef should be to the east of the one in the Gate. But a few feet difference may exist in the survey, and absolute certainty cannot be attained unless a connection is made between the two mines. Whether, however, the workings are on one part or the other of the reef, and however the reef behaves, it is the west reef of the Gate that has passed through to the Consols.

An intermediate level is being driven at the Consols 50 feet above the bottom one, and is on a fine body of stone. The level north, at the 1400-feet, is also being pushed forward. This must be continued irrespective of any variations in the reef, as the length of the shoot has to be proved and developed in that direction. The form and direction of the gold shoot in this mine have not yet been precisely determined. From the analogy of the New Golden Gate we should judge that it will be found to pitch southwards. As far, however, as work has proceeded, it seems to show an approximately vertical shoot, widening north and south as it descends. More work is necessary before an opinion can be formed. The quality of the stone crushed varies within narrow limits, but is of payable grade, as may be seen from the following statement of crushings from the beginning of the company's operations to the end of last year, kindly supplied to me by the local agent, Mr. H. J. Wise.

Date.	Tons crushed.	Ounces won.	Per ton. dwts. grs.	Value. £ s. d.
1904—Oct. 27	13	8	12 7	30 3 9
"	13	10	15 9	35 18 3
Nov. 14	200	109	10 21	387 7 2
Dec. 14	660	374	11 8	1352 11 4
1905—Jan. 25	345	172½	10 0	624 14 9
Feb. 22	510	181	7 2	665 3 10
Mar. 22	508	162	6 9	585 6 5
May 16	460	240¾	10 11	879 10 5
June 14	423	169	7 23	616 9 8
July 26	570	251¼	8 20	918 6 10
Aug. 23	380	209	11 0	764 14 0
Sept. 20	336	192	11 10	703 16 2
Oct. 18	400	219	10 22	804 5 5
Nov. 18	645	312	9 9	1150 14 7
Dec. 20	870	383	8 19	1404 16 6
	(Plate gold) 137		...	483 6 8
	<u>6333</u>	<u>3130</u>	<u>9 21</u>	<u>11,407 5 9</u>

Average yield, including pyrites, 10·23 dwts. per ton.

From the above quartz, 77½ tons pyrites were obtained, containing 383 ozs. gold; and the average value of the tailings is 2 dwts. per ton. The average value of the pyrites per ton is 4 ozs. 18 dwts. 20 grs.

The presence of the strong and payable reef in the bottom level sufficiently indicates what the company's policy should be. Further sinking of the main shaft is indispensable, combined with exploration to the north. For the latter purpose two levels had better be selected: the 1400-feet for proving the present reef; and perhaps the 1200-feet for driving north into the next section, in order to crosscut to the line of the New Golden Gate east reef, which cannot be reached from these workings in any other way. As it stands at present, the mine is a partly undeveloped property, work, owing doubtless to financial circumstances having been carried on on a limited scale; but the opening up of the ore-body in the lower levels is putting fresh heart into the company, and there is now every reason for undertaking the new work with vigour. I would urge that no time be lost in beginning another sink at the main shaft.

Upper Levels.—I now proceed to notice the upper levels, in which the deep west reef cannot be identified. In the 392-feet level crosscut, quartz veins were cut near the west end, which, in Mr. Montgomery's opinion, heralded

the Gate adit central and western reefs. Since then a level has been driven 200 feet deeper, the 540-foot level, which has been extended 24 feet further west, and has cut in its end what would seem to be the same formation.

540 feet Level.—This is a crosscut level west, driven 277 feet. From the chamber it passes through a formation of slate, with veins of quartz 16 feet wide underlying west. I interpret this as the same reef formation as was cut in the level above at about this distance west of the shaft. Mr. Montgomery thought it was a western branch of an extension of Loane's reef. Five feet further in is another formation 2 feet 6 inches wide, which may pertain to the same channel. In the course of the drive various channels and quartz veins occur, some of the latter being lenticular and discontinuous. At 57 feet behind the end is a track of some fault 2 feet wide, crossing the level; and in the end itself is a reef formation 3 feet 6 inches wide, consisting of slate and white lenticular quartz of irregular habit, dipping west. This has evidently come down from the west end of the 392 feet crosscut. From its position it would appear to be the northern extension of the western reef met with in the New Golden Gate surface adit. If the crosscut in the 500-foot had been extended a little further west, the reef channel would have been defined with certainty. Now, if this reef is prolonged northwards on its line, we shall find that it corresponds in position with the reef struck in the west crosscut in the Gate Extended at 470 feet from the shaft. That reef, therefore, is the upper western reef of the Gate mine. It has not been seen at a lower level in the Consols, because none of the lower crosscuts have been driven far enough to intersect it. The 900-foot level crosscut is the nearest to it, having been driven to 196 feet west from the shaft. It is strange that the reef has not been driven upon from any of these crosscuts, as its behaviour and quality where it has been intersected form no proof of its value. It would be unusual if such a persistent reef did not carry economic values at some part or other.

900-foot Level.—At this level a crosscut west has been driven 196 feet from the main shaft, and a drive north for 54 feet on a reef channel.

In the crosscut, about 20 feet from the shaft, a formation is passed through, carrying 4 or 5 inches of stone on the east wall, and 6 to 15 inches on the west wall; the whole channel being about 8 feet wide, and underlying east. Thirty-six feet further west a formation about 20

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feet wide, is intersected, composed of crumpled, twisted, and mullocky quartz, also dipping east. The stone is developed mostly in the roof and walls; nothing much is seen in the floor. The slate strata are much disturbed in this cross-cut. The general underlay is east, though now and then the strata are vertical. Twenty-nine feet behind the end is a reef dipping east, with 6 to 9 inches of stone; and at the end is a $7\frac{1}{2}$ -feet formation of quartz veins, 1 inch to 4 inches. This is a good looking reef channel.

The distances between the levels reduce the determination of the reefs in this level to a matter of surmise. The channel struck at the end can hardly be the same as that at the end of the 500-feet.

The drive north from west of shaft is on the line of a formation which is 10 feet wide at the end, and merits being driven upon. A winze has been sunk at the end to a depth of 60 feet, and it is said that the stone gave a fair prospect, though it was rather narrow. The shaft at this level seems to be in the centre of the fold of the country.

1000-feet Level.—Crosscuts have been driven east and west from shaft, and a short level driven north and south on a load-line east of the shaft.

The crosscut west has been driven 107 feet from the shaft in slate country, dipping west. At 20 feet from the shaft a small quartz reef is intersected, which has 7 to 9 inches of stone, dipping to the west. At about 10 feet further west a little more quartz is met with, and at 36 feet from shaft quartz is seen lying irregularly in flat curves. For 15 or 20 feet behind the end of the crosscut formation country is passed through with mineralised quartz veins, reported as carrying a little gold. When this was cut, it was thought to be the west reef of the Gate, but it is too far west for the lower west reef, and not far enough west for the upper or adit western reef. At the end of crosscut a lode formation about 2 feet wide, containing two veins, about 4 inches each, has been passed through, and a slate wall met with, vertical, or, if anything, dipping east.

The crosscut east has been driven 70 feet. At about 10 feet from the shaft it passed through quartz veins, and 10 feet further east intersected a lode 6 to 9 inches wide, dipping east. Towards the end the slate is very irregular, still dipping east. The end is in clean slate; a few small veins of quartz just behind it. A drive south goes from this crosscut at 17 feet from the shaft for 44 feet, on an irregular formation. A vein of quartz, 3 inches wide,

is seen in the middle of the roof, and parallel veins occur at intervals from this to the east wall of drive. Just behind the end a short crosscut or cuddy, 12 feet long, was driven to the west, in slate, with bunches of quartz.

A drive north from the main crosscut has also been put in for 43 feet, exposing irregular seams of quartz, and a cuddy west, behind the end, shows a formation $4\frac{1}{2}$ feet wide, with quartz veins. This is the reef cut east of the shaft at the 1200-foot level.

1100-foot Level.—A crosscut has been driven 40 feet west from shaft, and on intersecting the reef a level extended in a north-westerly direction for 210 feet on the reef track. An east crosscut from shaft has only been opened out for 12 feet in hard slate, showing in the end a miniature inverted saddle of quartz on the south wall. At the shaft the strata are vertical, but on driving west a change to easterly underlay takes place immediately. At between 37 and 40 feet west, two veins of quartz, 6 to 8 inches wide, were cut, one of which was reported at the time as carrying good gold. The crosscut was continued a little to make sure that there was nothing beyond, and then the wall of the formation was followed in a drive to the north-west. The underlay of the reef is west. The level is in an arch of the strata, which underlie east on the east wall. The veins driven on come together, but the stone is small and irregular. After driving 80 feet in a north-westerly direction, another reef formation, 3 feet wide, consisting of mullock and mineralised quartz of poor quality, was passed through, and the drive turned north to follow it. This was, at the time, supposed to be the west reef, though which west reef does not appear from the reports. It is not far enough west to be the western reef in the Gate adit, but it may possibly be a western branch of the west dropper from Loane's reef. It was driven on for 120 feet without any improvement. A cuddy at the end was driven east for 12 feet without disclosing any quartz. In the end of the level is a lode track with a little mineralised stone on the west wall, tailing out, but it may re-appear further on; and behind the end there is a little stone on each wall. It is a disappointing level, and requires crosscuts to clear up some uncertainty as to position.

There are several features in this mine which command attention, and should encourage the owners.

Firstly—A massive payable reef has been opened upon in the deeper levels, now followed downwards, for a couple of hundred feet, with improving results. The fact that

the same reef has been developed in the Gate for long distances with, on the whole, disappointing results, need not influence work here. A shoot of gold has been fortunately located, and it remains to go down further on this.

Secondly—Any amount of virgin ground lies to the north, and development of the reef by extension of the drives on it northward must be undertaken.

Thirdly—If the northern crosscut at the 1200-foot level is extended in a north-easterly direction, the east reef of the Gate can be reached and proved in the Consols property (on Section 204). If that reef is payable there, a new mine will result.

Fourthly—The reef which I believe to be the Gate Extended reef can be driven upon in the 392 and 540 feet crosscut levels; preferably, the latter.

Fifthly—The ground generally east of the shaft is comparatively untried, and when everything is in full swing and funds are available, ought not to be neglected. It has the disadvantage of being a rather narrow strip from east to west on Section 70-87g.

Work during the past eighteen months has greatly strengthened the position and prospects of the mine. Vigorous exploratory and developmental work may be recommended confidently. This, together with sound management, may be expected to achieve good results.

The battery comprises 20 heads of stampers, with plates and blanket strakes. The blanketings are treated by sluicing. A modern gold-saving plant would be advantageous. The company is at present installing a new winding plant.

Gate Extended Shaft.—This is on the Tasmanian Consols, Section 130-g, 20 feet from the east boundary, and formerly belonged to the New Golden Gate Extended Gold Mining Company. At the time of Mr. Montgomery's report it was sunk to 159 feet. It has since been deepened to 410 feet. From the bottom, crosscuts have been driven east and west; the east one to 311 feet, the west one to 863 feet. These are now inaccessible, but Mr. Wise has kindly furnished me with the fortnightly mine reports, and Mr. Andrews has supplied the particulars of underground survey, so that authentic information of these important workings is available. These crosscuts cut right across the line of the Gate and North Gate reefs, and show us what exists on this parallel at that depth. At 182 feet west of the shaft, a drive was put out 106 feet

to the south-east on a mullocky reef formation, dipping east, about 2 feet in width, carrying bunches and bands of quartz, but of poor quality. It was thought that this would lead to the reef near the old Perseverance shaft further south; but work in the mine was suspended in August, 1897; and in February, 1898, the long crosscut was again taken in hand. At 250 feet from shaft a solid body of stone was passed through, showing 2 feet on the south side of the crosscut, but of poor quality. At 354 feet a vein of highly-mineralised stone was intersected. At 364 feet highly-mineralised quartz was observed; and at 380 feet a 6-inch north and south vein of stone was cut through, associated with lode-matter and small veins of quartz. At 471 feet a lode formation was passed through, with a well-defined wall and 1 foot of reef-matter on it, composed of soft pug and rubbly quartz. This channel corresponds in position with the western reef in the Gate adit, and has been cut in the 392 and 540-foot levels of the Consols Mine.

A drive was started north on the hanging-wall of this formation, a foot of solid stone carrying gold and pitching north. At 80 feet from crosscut the reef consisted of 3 feet of lode-matter and a foot of solid stone on the west wall, carrying gold. At 64 feet a rise was put up for 37 feet in a mullocky reef with broken quartz 3 feet between walls. A cuddy was put in east from the drive, but only disclosed small veins of quartz. The drive was continued north to 177 feet from the crosscut in a formation 3 feet between walls, and described as very mullocky. It was then stopped, and no drive put out to the south on this reef. The main crosscut, continued west, passed through mineralised veins of quartz at 491 feet from shaft. At 560 feet intersected bands of quartz in hard country. At 585 feet passed through several small north and south veins of mineralised quartz. At 696 feet intersected many mineralised quartz leaders; and at 716 feet several small veins of quartz. At 767 feet intersected some barren stone; and at 783 feet, numerous quartz veins. At 835 feet cut through a small vein of quartz; thence to the end, 863 feet from shaft, through clean, barren slate.

The intersection of the reef which was driven on took place at 99 feet east of the western side-line of Section 130-G; and the end of the crosscut is 264 feet due west of that side-line, in Section 1008-87G, a little above and to the west of the new road.

The east crosscut has been driven to 311 feet from shaft, through slate. At 193 feet, a reef-course, 2 feet wide, was passed through, consisting of lode-slate, with a good hanging-wall, carrying a seam of pug, dipping east about 1 in 3. At 206 feet several strongly-mineralised veins were intersected. At 217 feet blue slate, with strong bands of quartz, slightly dipping to the west, was passed through.

A drive south was started at 193 feet on the reef-course to prove the reef worked in the old Caledonia tunnel, which was thought to be identical with this. For 50 feet from crosscut the formation was 3 to 4 feet wide, carrying some mineralised stone on the footwall; but at 86 feet, and thence to the end at 98 feet, it was broken and discouraging.

The main crosscut was continued east in slate, with occasional leaders of quartz; and at 311 feet from the shaft work was suspended in fairly-clean, dry slate.

Two hundred feet south of the Gate Extended shaft is an old shaft, said to be 60 feet deep, evidently sunk for prospecting purposes, but no information is available.

Tasmanian Gold Estates.

The Tasmanian Gold Estates Company, Limited, has taken over some of the leases formerly held by the Tasmanian Consols, and now hold 1007-87g (not transferred), 673-93g, 674-93g, 67-g, 68-g, 69-93g, 318-g, 319-g, 320-g, 321-g.

This is all ground lying to the south of the Consols, and is in a good position for the upper western reefs of the Consols. The reef now being worked in the Consols at the 1300 and 1400-feet levels, if it maintains its north course, will at that depth pass through the Consols Section 75-93g, just east of the eastern boundary of the Gold Estates Section 321-g. As, however, this would be a $\frac{1}{4}$ -mile to the north of the Consols shaft, a precise calculation cannot be made. If the reef in that distance bore a little west it would come into the Gold Estates section. In this section is the Star of Mathinna shaft, over 200 feet deep, from which a crosscut was driven west for a chain, cutting at 20 feet from the shaft a quartz reef 3 feet wide, dipping east. The reef has a smooth footwall, but carries no gold. Twenty feet further west a broken formation, 2 feet wide, dipping west, was intersected. These were at 150 feet from surface. At the surface, reef indications are seen at about 40 feet west of shaft,

and one outcrop is in the creek. These have been thought to be the South Gate formations, but Loane's reef, if its branches re-unite, and if it lives so far from the Gate Mine (30 chains), would pass through this section; and if it continues on a course only slightly to the west of north, might be expected to pass between the shaft and the western boundary of the section. It appears to me that the Gold Estates owners have a fair chance of meeting with something if they deepen this shaft and crosscut to the south-west under the Long Gully, and across the line of reefing country. I presume the same intention of proving this country by crosscutting under the Long Gully flat was present in the minds of the owners when they commenced sinking the new shaft north of the cemetery. This is on the top of the hill 15 chains south of west from the Star of Mathinna shaft. It has been sunk to 120 feet, but work is now suspended. One hundred and fourteen feet south-west is an old shaft, which was sunk 60 feet on a small vein running north-west and south-east, and underlaying east. This is reported as having had a fair gold value. A prospecting shaft has been sunk 100 feet close to it. The new main shaft would enable this vein to be proved, if sunk deeper. There is an outcrop under the Catholic church, which is on the Gate line of country, and appears to run with the country. I am not at all certain what this reef is. It would be eventually intersected by a crosscut east from the shaft. The shaft is too far west to be used advantageously for testing the extensions of the Gate reefs, but it has a use of its own in testing the ground on the north-west line from the Gate. New makes of quartz are likely to be developed along this line, which is the belt within which the reef-channels occur. It would appear, therefore, that the Gold Estates Company has at least two points where new work may be recommended, viz., this shaft on the hill, and the Star of Mathinna shaft over the valley.

The company has another old shaft at the back of Polley's Hotel, now filled in. It was sunk to 100 feet on a small gold-bearing vein, running north-west and south-east, with a westerly underlay. The eastern and central sections of the Gold Estates Company are situate within the Gate reefing-belt, and this position warrants deeper work. It is possible that the Gate reefs may not extend continuously so far north; but even in that case their place may be expected to be taken by fresh fracture-lines and makes of quartz belonging to the same general system, offering every encouragement for exploratory work.

Hen and Chickens.—On the northern section of the Gold Estates, 68-93g, a tunnel was at one time driven from the main road beneath where the Chinese store is now; and winzes were sunk on an east and west lode, which intersects a main north and south reef. It is reported that 3-oz. dirt used to be won from the Hen and Chickens workings, but at excessive cost.

Loane's Workings.—On Section 1295-93g prospecting was carried on in the old days, and a little fine gold won. Recently Mr. A. Loane cleaned out the trenches and picked up a gold-bearing vein underlaying west and bearing south-east, a little east of the Star of Mathinna shaft, and a good deal east of the Gate Extended shaft. It is considered to be the reef driven on south from the east crosscut in the Gate Extended. It may possibly be the same, but the drive in that crosscut was only 193 feet east of shaft, and the reef underlay east, whereas this vein dips west, and if true to its source, would run 50 or 60 feet further east of the shaft. The distance between the two, however, is 30 chains, and it is impossible to be positive.

Golden Stairs Mine.

Sections 137-g, 136-g, 10 acres each, chartered in the name of W. J. Todd; and 156-g, 10 acres, chartered in the name of J. Coombe. This property is at the northern end of Mathinna township, occupying the flat land on a level with High-street, which traverses the sections. It is within the reefing-belt of the Gate line, about a mile north-west of the New Golden Gate Mine. Slate country prevails in the eastern part of the property, and sandstone in the western part. The underlay of the strata is to the west, and this indicates, together with other considerations, that the western part of the sections lies a little to the west of the Gate axial line. The eastern part lies fairly within the productive slate zone, in which the great reefs have been worked further south.

Operations were started here many years ago, and the old Golden Stairs Company put down a main shaft on Section 136-g, about 14 years ago, to prove the main north-west reef, and 3 cross-reefs (east-west), over which, in the alluvium, a large quantity of gold had been obtained. The cross-reefs have been worked down to a depth of 30 feet with good results.

The main shaft has been sunk through slate to a depth of 230 feet, and crosscuts driven west at 150 feet and 230

feet. According to the mine survey, the crosscut at 150 feet intersected the main reef at 94 feet from shaft. The reef was then driven upon north for 55 feet. Mr. Stephen Richards reported the reef formations, where intersected, as being 8 feet wide, with 12 inches of quartz on footwall and 2 feet on hanging-wall. The quality is not known, as no battery test was made. The reef being wider and better in the floor of the drive than in the roof, the shaft was deepened, and a crosscut from the bottom cut the reef at 111 feet from the shaft. It was here found to be irregular and poor. It was driven upon 80 feet north and 29 feet south. To intersect the cross-reefs, it would require to be driven 170 to 220 feet further north, and this ought to be done, but at a greater depth. The main crosscut was continued west for a further distance of 115 feet, passing 30 feet beyond where it was expected to cross through No. 2 reef, which junctions with the main, or No. 1, reef at 100 to 120 feet south of the shaft. This crosscut, it will be noticed, proves the ground west of the shaft, but the ground east of the shaft, which is the slate belt of the Gate, has not been tried. A long crosscut should be driven east from the shaft to test this ground. This is an important piece of work, and should not be omitted when operations are resumed at this mine. If this is done, and the main reef is also followed north and south in the bottom level, the mine will receive a good test. The position of the property, and the amount of gold won from the reef detritus at surface, warrant finding sufficient capital for exploratory and developmental purposes. If the exploratory work gives any encouragement, the main shaft should be deepened at once, as the indications are that it is not quite deep enough for the reefs to be settled and free from disorder.

Close to the back of the gardens, north-west of the main shaft, is an old prospecting shaft, sunk either on the main reef or on Markey's cross-reef, from which a crushing was taken, worth, I am informed, 3 or 4 dwts. per ton.

Sixty-two feet south-west of the main shaft is another old prospecting shaft, upon a reef about 4 feet wide, which has been stoped at surface under the mullock-tip. It is said that the stuff crushed went 3 to 6 dwts. per ton. This reef junctions with the main reef 89 feet south of this shaft, but has not been cut in the bottom crosscut, and the upper crosscut was not extended far enough to intersect it. The stone from this reef was crushed at the City of Melbourne battery.

Three hundred and forty feet north of the main shaft is the Welcome Stranger shaft, on the north side of Wilson-street, in Section 137-g. Some loose specimens at surface, aggregating 11 or 12 ounces, were found, and led to the discovery of a reef-channel, N. 77° E. I am informed that the outcrop dirt, after being washed, went 12 dwts. per ton. A shaft was then sunk to a depth of 40 feet, at about 20 feet north of the outcrop, and the track of a reef was cut in a drive, but no gold being found, work was abandoned. About 14 years ago, on an assurance that gold had been left in the bottom workings, these were cleaned out, but only a reef-channel with two walls was disclosed.

South of the Welcome Stranger shaft, by the roadside, some white quartz, carrying coarse gold, was sunk on to a depth of about 20 feet.

North of the Welcome Stranger is another formation. Good alluvial gold has been found in the flat to the east, but the alluvium to the north becomes too heavy for tracing reef outcrops.

At the corner of Wilson and Mangana streets an underlay shaft was sunk three years ago by Messrs. Markey and Todd, on an east and west reef, with northerly underlay, but no crushings were taken out. An outcrop is visible on the opposite side of the road. A little gold was found here by the former manager, Mr. S. Richards. South and east of this, the ground has been sluiced, and still gives good surface prospects.

On Section 156-g, Messrs. Markey and Todd sank a small shaft east of Mangana-street, on barren stone.

It is perhaps going too far to say that all the gold found in the alluvial covering on these sections has been shed from the known reefs; but unquestionably, the coarse gold which has been washed from the rubble over the reef outcrops has been derived from the reefs in question. The various discoveries of stone north and south of the main shaft speak in favour of a resumption of underground work. I look upon the property as an undeveloped one, which warrants going to the expense of a thorough trial.

CONCLUSION.

In concluding this first part of my report on Mathinna, I wish to emphasise my opinion that the goldfield has yet a long course of life before it. Its present unsatisfactory condition is mainly the result of two operating causes.

First, the large shoot of gold-bearing stone, which has been worked so uninterruptedly in the New Golden Gate, has become impoverished; and time has to be spent now in picking up the new shoot, which is almost certain to exist. Secondly, so many workings have been abandoned at comparatively shallow depths without thoroughly proving the ground, that, strange to say, they act as a deterrent, instead of inciting to fresh work; and, moreover, they tend to give the field a bad name. But confidence in the field ought to be sustained by a knowledge of the fact that the gold occurrences are not mere sporadic instances, but are integral parts of the great series of gold-bearing channels which extend in this belt for so many miles north and south. That these channels have been exhausted by the insignificant mine-openings made into them here and there along the line is an absurd idea. It may be regarded as a certainty that there still remains undiscovered an indefinite amount of gold in these reefs, and this should help to dispel pessimistic views. I look upon the Mangana, Mathinna, and Mount Victoria fields as forming a single geological unit. All three are indisputably charged with precipitated gold, derived, I believe, from one and the same deeply-seated source; and, as gold-fields, they possess, in my opinion, all the essential elements of permanence.

I beg to tender thanks to Messrs. H. J. Wise, T. Andrews, T. J. Andrews, Jno. Campbell, Geo. Webb, Ben. Searle, W. Stevens, Hitchcock, and others on the field, for information and assistance kindly given.

Part II. of this Report will be submitted at an early date.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES.

Government Geologist.

W. H. WALLACE, Esq.,

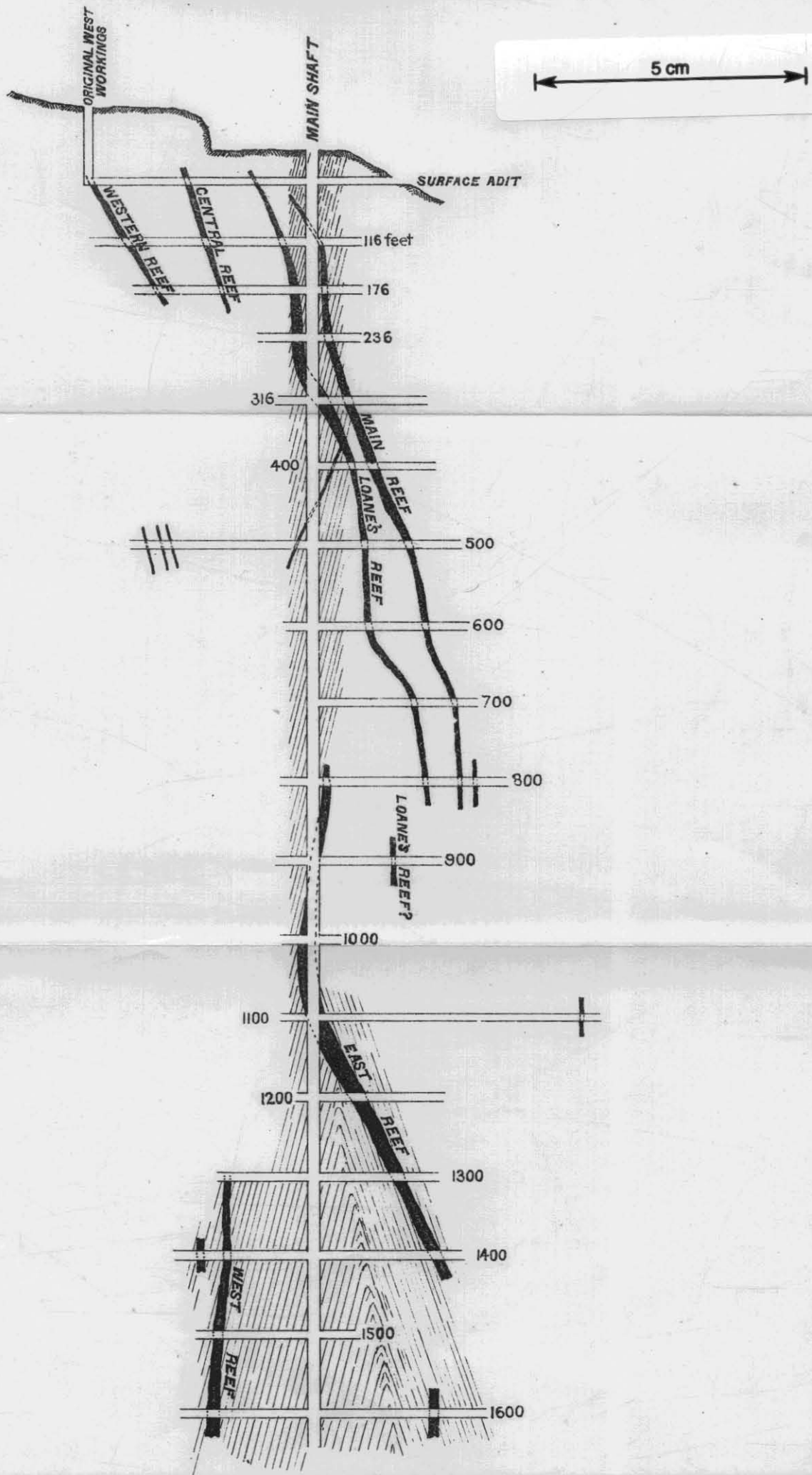
Secretary for Mines, Hobart.

NEW GOLDEN GATE REEFS

PLATE I

Cross section looking North

Scale 100 50 0 100 200 300 feet



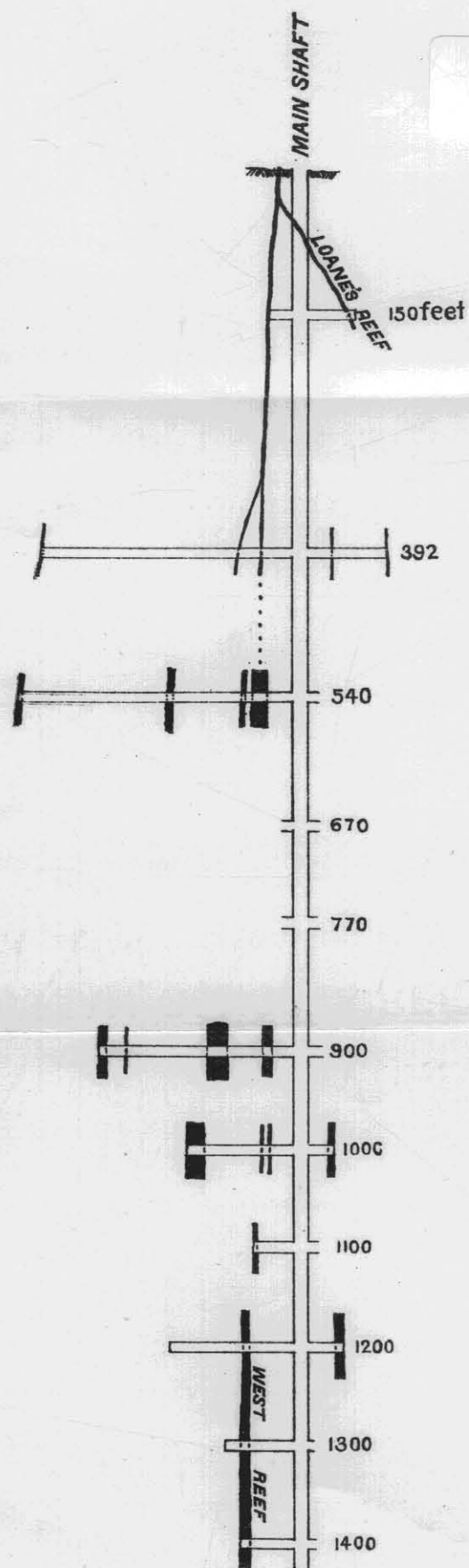
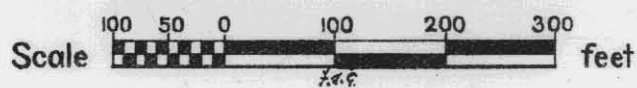
(45)

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TASMANIAN CONSOLS REEFS

PLATE 2

Cross section looking North



5 cm

(46)

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LEVELS ON WEST REEF

PLATE 3

5 cm

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

70
87G 10 ac.

13
87G 10 ac.

Tasmanian Consols Ltd.

New Golden Gate G.M.Co. N.L.

WEST REEF

MAIN SHAFT

WEST REEF

MAIN SHAFT

EAST REEF

(47)

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LEVELS ON WEST REEF

PLATE 4

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

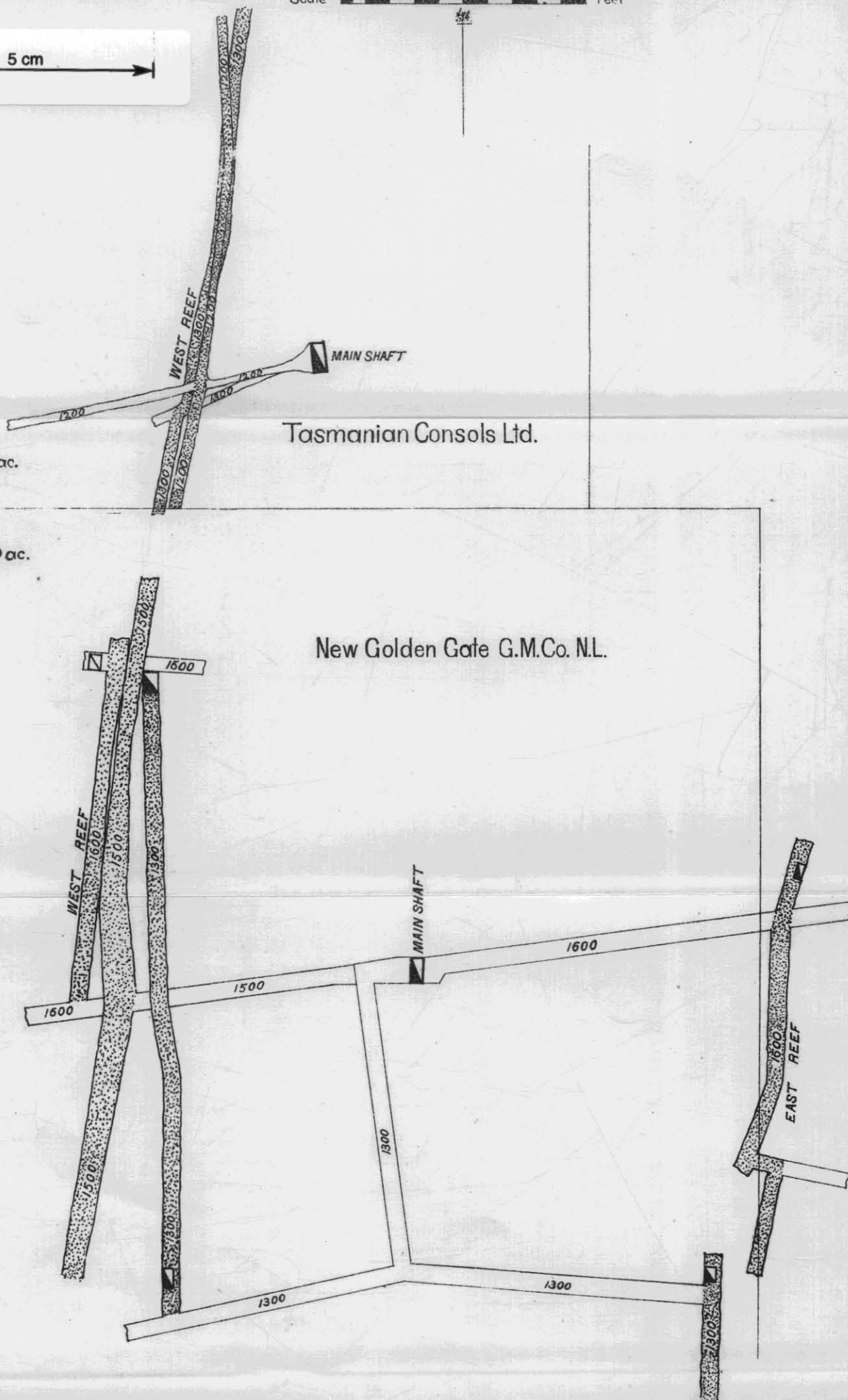
5 cm

70
87G 10ac.

13
87G 10ac.

Tasmanian Consols Ltd.

New Golden Gate G.M.Co. N.L.

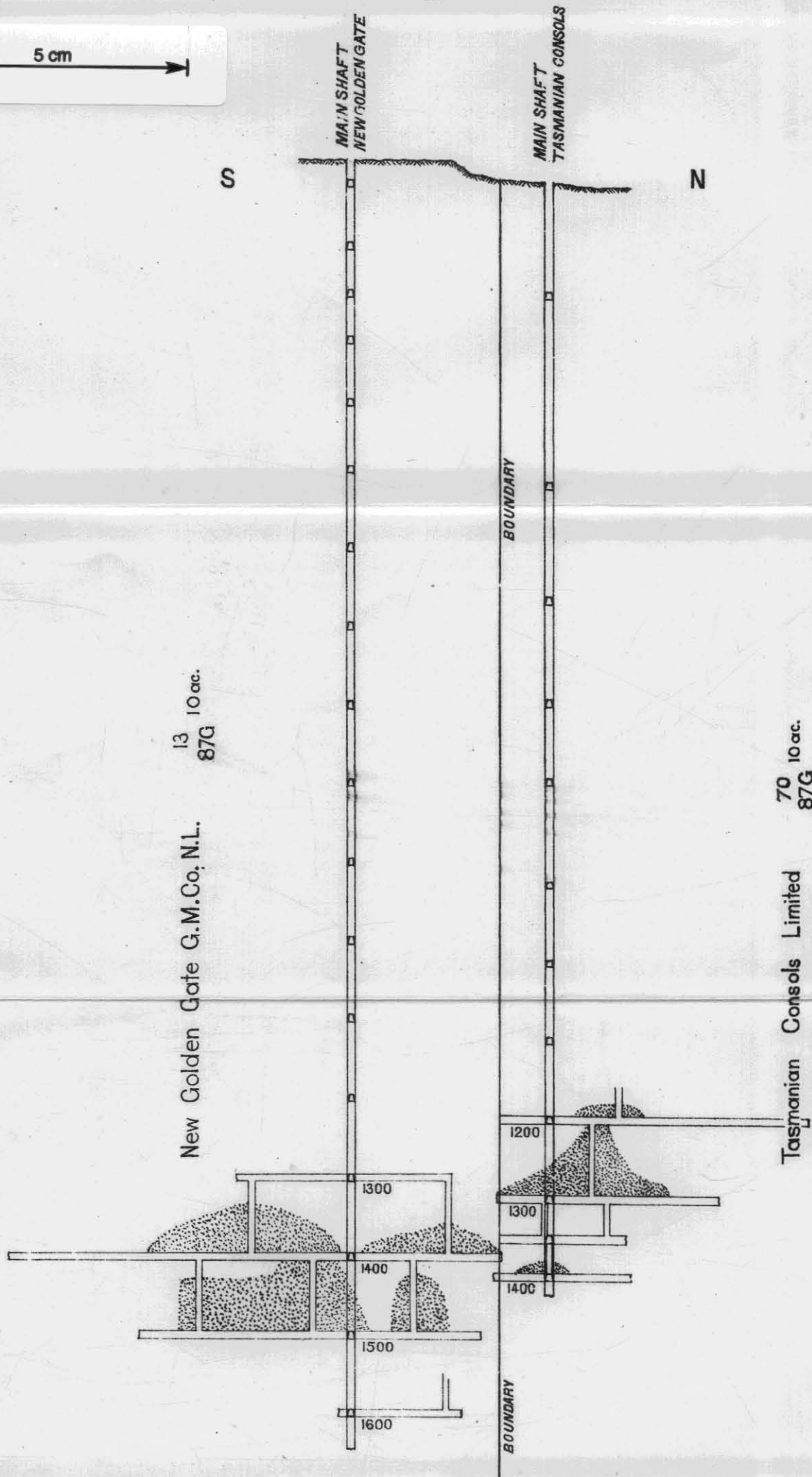
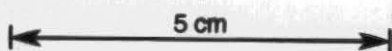
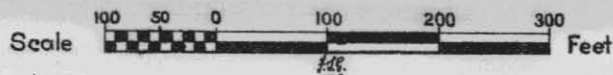


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52

STOPEs ON WEST REEF

PLATE 5



(b47)

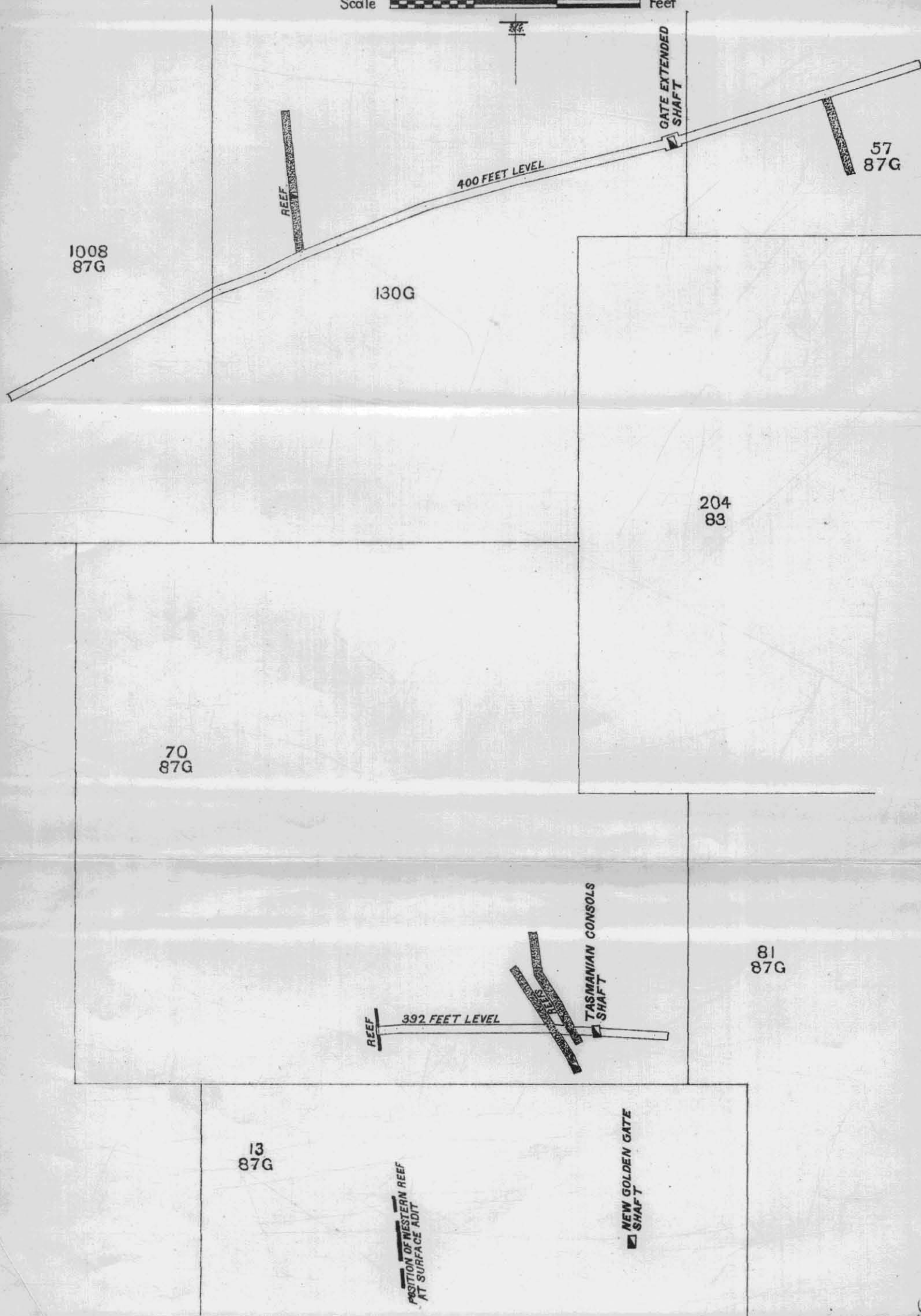
49/52

GATE EXTENDED CROSS CUT

PLATE 6

5 cm

Scale 100 50 0 100 200 Feet



(50)

28/52

GOLDEN STAIRS MINE

PLATE 7

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

5 cm

SHAFT WELCOME STRANGER

SHAFT

SHAFT

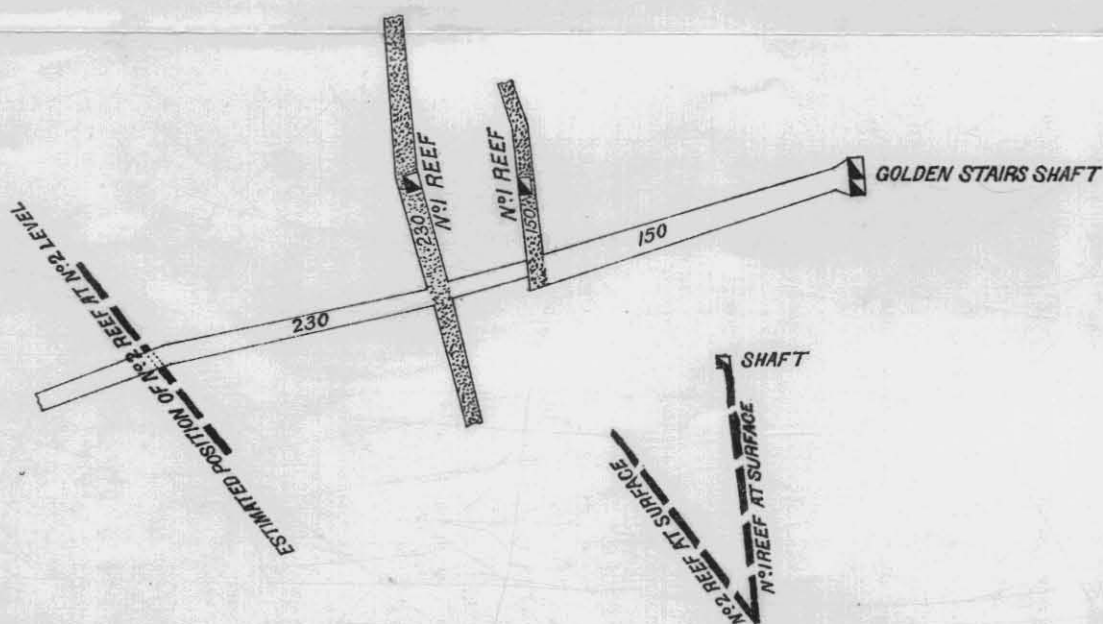
TRENCH

SHAFT

137 G

136 G

W.J. Todd



(51)

51/52

5 cm

LOCALITY PLAN

PLATE 8

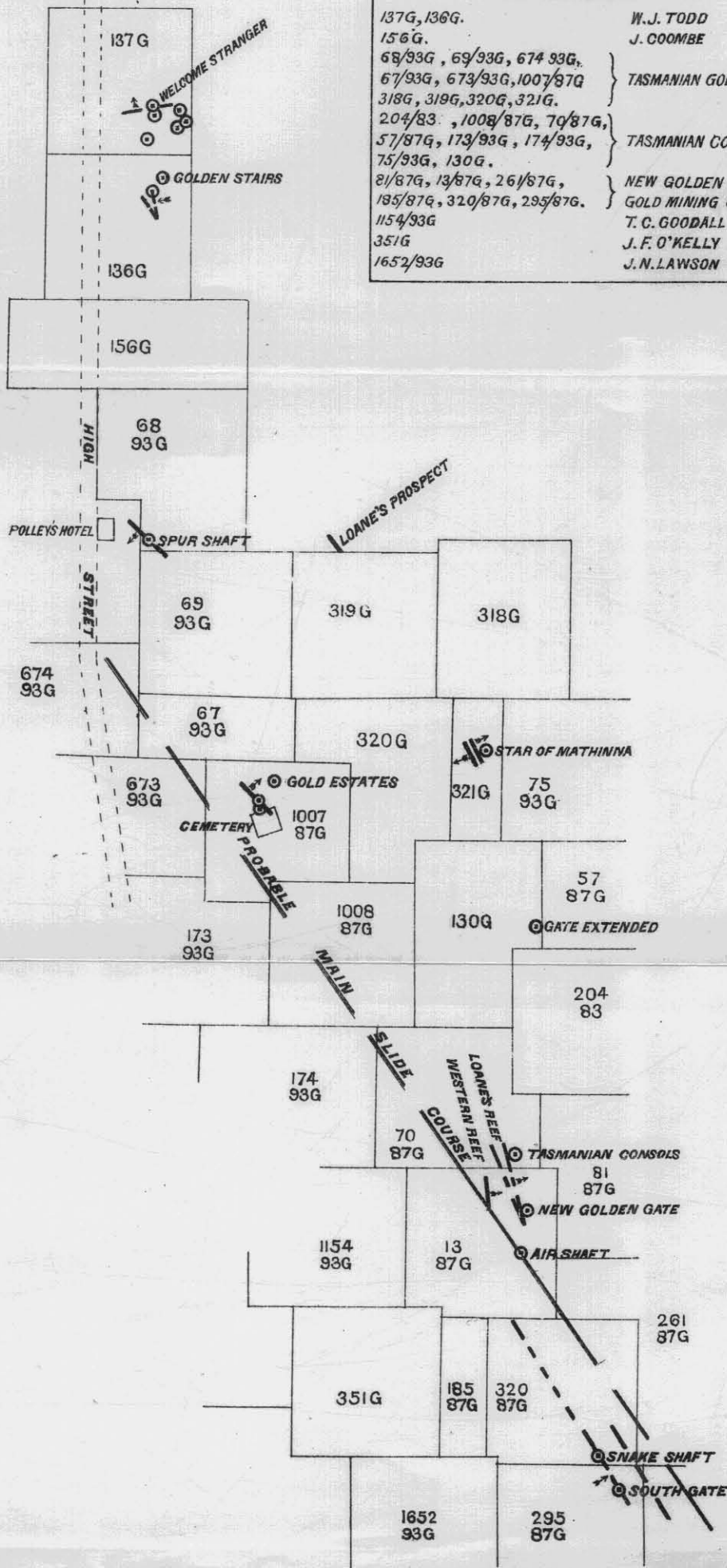
Scale 100 0 100 200 300 400 500 600 700 800 900 Feet

W.H. Twelvemore
Government Geologist
29 Mar. 1906

ROAD TO FINGAL
Wm Talbot pur.

REFERENCE TO SECTIONS

137G, 138G.	W.J. TODD
156G.	J. COOMBE
68/93G, 69/93G, 674/93G,	TASMANIAN GOLD ESTATES CO. LTD.
67/93G, 673/93G, 1007/87G	
318G, 319G, 320G, 321G.	
204/83, 1008/87G, 70/87G,	TASMANIAN CONSOLS LTD.
57/87G, 173/93G, 174/93G,	
75/93G, 130G.	NEW GOLDEN GATE GOLD MINING CO. N.L.
81/87G, 13/87G, 261/87G,	
185/87G, 320/87G, 295/87G.	
1154/93G	T.C. GOODALL
351G	J.F. O'KELLY
1652/93G	J.N. LAWSON



(52)

5/1/07