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MANGANA GOLDFIELD

1. INTRODUCTION

The previous examination of Mangana Goldfield was undertaken in 1907 and a report issued as Geological Survey Bulletin No. 1. This publication is now out of print and has not been available to the public for many years.

The present geological survey represents portion of a plan for the re-examination of the goldfields of the State.

Since the mine workings are closed down and the greater number are now inaccessible, difficulty was experienced in gaining fresh information with reference to the lode and rock structures, and their mutual relationship. Much of the details have of necessity been taken from previous reports.

The survey was based primarily on the Mangana mineral chart. The lodes and available workings were surveyed by chain, compass and abney level, and connections made to corner pegs of mineral sections. Heights were calculated from the clinometer readings and chain measurements starting from aneroid datum at Mangana, which was based on actual height above sea level at Fingal railway station.

The survey was commenced on 5th October and completed on 26th October, 1936.

The writer desires to express his appreciation of the able services rendered by Mr. H. Chesshire who acted as field assistant during the survey. Thanks are due to local residents who supplied information with reference to the mines and workings.



11 PREVIOUS LITERATURE

List of Publications and Type Reports

The following list includes all departmental publications and type reports relating to mining activities within the district.

PUBLICATIONS

- (1) C. Gould: Gold at Mangana. 31st July, 1869 (Legislative Council Paper No. 20)
- (2) G. Thureau, F.G.S. ; Mount Victoria, Dan Rivulet, Black Boy and Mangana Gold Fields. December, 1884 (Parliamentary Paper No. 61, 1885)
- (3) A. Montgomery, M.A.: Report on Some Portions of Mangana Goldfield. 25th September, 1894. (Report of the Sec. for Mines, 1894-5)
- (4) W.H. Twelvetrees: Report on the Strata in the shaft of the New Sovereign Mine, Mangana, 6th November, 1899 (Report of the Secretary for Mines, 1899-1900)
- (5) W.H. Twelvetrees : The Mangana Goldfield, 22nd November, 1907. (Geological Survey Bulletin No. 1)

TYPE REPORTS

- (1) A.M. Reid, Advisory Report on Golden Entrance Mine, Mangana. 25th January, 1929.
 - (2) P.B. Nye, M. Sc., B.M.E. : Report on Cheshire's Prospect at Richardson's Gully, Mangana. 28th October, 1930.
 - (3) K.J. Finucane, M. Sc. : Report on Brock Bros. Mine at Richardson's Creek, Mangana. 28th July, 1932.
 - (4) K.J. Finucane, M. Sc. : Report on G.A. Brock's Prospecting Operations at Fern Tree Gully, Mangana. 28th July, 1932.
 - (5) K.J. Finucane, M. Sc. : Report on the Argyle Mine, Mangana, 18th October, 1932.
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Mangana was originally known as the Nook and it was there that the first discovery of payable gold in Tasmania was made in February, 1852. The metal was washed from alluvial deposits in Richardson's Creek, about 150 yards below the road bridge, by Keeling Richardson who was a servant of James Grant, a landowner of Tullockgorum. Some two hundred miners were soon assembled but the numbers were much reduced by the end of the year.

In several of the affluents of Richardson's Creek, particularly Major's Gully, the deposits proved to be rich but the gold became much depleted during the next 20 years.

Following the alluvial discovery gold was found in a quartz reef $\frac{1}{2}$ mile to the south of Mangana in 1859, and the Midland Company was formed to undertake the mining. Quartz crushing, the first in the State, was commenced in the same year and resulted in the recovery of 250 oz. of gold in the first four months from quartz yielding 8 oz. 10 dwt. of gold per ton.

In the years between 1879 and 1905 this mine was operated at different periods by The Old Union Gold Mining Company, the Reunion Gold Mining Company, The Sovereign and New Sovereign Companies and Mangana (Tasmania) Gold Reef's Limited.

The reefs worked by the Fingal Company on Grant's Creek was the next to be exploited and was in operation with the aid of a 10-head battery in 1867.

Two years later in 1869 J.C. Goodhall located and prospected several reefs on land granted to W. St. Paul Gellibrand along the south-eastern slopes of Tower Hill and these were later developed by Tower Hill Freehold Company.

Again in 1877 J.C. Goodall discovered the Alpine, Buckland and Cardinal reefs, and subsequently these were worked by three separate companies, namely, Alpine Quartz Gold Mining Company, Buckland Freehold Gold Mining Company and Cardinal Prospecting Association till about 1890. In 1896 the Golden Entrance reef was located and mining operations were carried out intermittently by the Golden Entrance Company and tributaries from 1900 to 1907 which produced 2415 oz. 2 grs. of gold from 665 tons 6 cwt. 3 lb. of quartz.

During the next 20 years mining, and prospecting were quiescent but in 1927 C.S. Chessire located the southern continuation of the Golden Entrance reef which resulted in the formation of the Argyle Gold Development Company in 1929. The mine did not get beyond the developmental stage and only a trial crushing was produced.

In 1932 alluvial mining again came into prominence for a short period during which 25 men produced gold to the value of £400 by panning methods.

For several years past no mining has been attempted on the Mangana Goldfield and the only prospecting is represented by some driving undertaken from the end of No.4 Adit on Mangana Reef.

Complete records of production from Mangana since the inception of mining are not in existence, but it is recorded in "The Mineral Industry" that from 1898 to 1905 6274 oz. of gold were recovered from quartz and 196 oz. from alluvials. Many years ago it was estimated that 5000 oz. of alluvial gold had been won, the largest proportion of which was obtained from Major's Gully.

The Mines Department records over a number of years group the gold production from Mathinna, Mangana and Fingal together, so that it is now impossible to obtain the full amounts from Mangana. Where the latter district is shown separately the figures given are 8302 oz. from quartz and 1555 oz. of alluvial gold.

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IV GEOGRAPHY AND PHYSIOGRAPHY

(1) Location and Access:

The Mangana Goldfield is situated about the township of Mangana in the north-eastern part of Tasmania and is located five miles to the north-west of Fingal. A well graded motor road connects the two townships. The Government railway-line between Conara Junction and St. Marys passes through Fingal.

A metalled road from Mangana establishes communication with the mining settlement of Storeys Creek, situated approximately ten miles to the east-south-east.

Mangana is connected northerly by road with the agricultural settlement of Tower Hill in a distance of three miles, from whence Mathinna is reached by cart track. The last named township is served by a first-class road from the railway centre at Fingal.

A second-class road also extends north-westwards in the direction of Tower Hill.

(2) Topography:

The small township of Mangana occurs at a height of approximately 850 feet above sea level. It lies in a flat floored valley formed about the confluence of Richardson's Creek and Grants Creek. In the south the valley widens perceptibly towards its junction with the larger plain in the vicinity of Tower Rivulet.

From the valley sides, near Mangana, steep hills rise abruptly 650 to 1000 feet to form portion of a deeply dissected plateau. The hills represent spurs extending south-easterly from Tower Hill, an eminence five miles north-west of Mangana.

Dividing the spurs are numerous streams the largest of which is Richardson's Creek, running in a general south-easterly direction to join Tower Rivulet. Calder's, Major's and Fingal (Grant's Creek) Gullies contain the principal south flowing tributaries of Richardson's Creek, while the waters of Harrison Creek, Sharkey Creek and Sailors Gully flow westerly and combine with the main system east of the township.

Tower Rivulet, known locally as Ben Lomond Creek, constitutes the southern boundary of the area and takes its rise in the Ben Lomond Range to the west of the district. It flows in a general westerly direction to its junction with Richardson's Creek where it turns south-ward and enters South Esk River about 3 miles west of Fingal.

(3) Climate and Meteorology:

The climate of the district is essentially mild and agreeable. Snow is unknown in the less elevated parts about Mangana, but frequently settles on the higher regions like Ben Lomond Range and to a lesser extent on Tower Hill. In the late autumn and early winter periods frosts often occur with moderate severity.

The following table shows the average monthly and yearly distribution of the rainfall.

Average Rainfall Data of the Mangana District

Station Number	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Years of Records													
Mangana 17	199	231	231	291	298	401	322	273	268	346	174	206	3240

100 points = 1 inch.

(4) Topography in Relation to Mining

The deep dissection of Richardson's Creek and its tributaries has provided advantages for exploration and exposed numerous quartz reefs which were traced without difficulty along the valley sides. In addition, the steep hills rising from the streams provide means of attacking the lodes by way of adit levels.

Thus the topographical features are such that the lodes are easy of access and can be mined at comparatively low cost.

V GEOLOGY

(1) Summary

The results of the Geological Survey are shown in the Geological Sketch Map on Plate 11. In this map the various geological formations which outcrop at the surface are indicated, and the boundaries between the formations are shown.

The major portion of the Mangana area is occupied by Lower Palaeozoic slates and quartzites, which are the oldest rocks occurring within the district. In the north-west region sedimentary strata of the Permo-Carboniferous system overlie the above rocks. Towards the south-west dolerite of Upper Mesozoic age intrudes the Lower Palaeozoic rocks. Tertiary sands and gravels occupy the floors of the open valleys and these are covered in vicinity of the streams by and merge upstream into, gravels and alluvium of Recent origin.

(2) The Sedimentary Rocks

(a) The Cambro-Ordovician System

(1) Lithological Character and Occurrence

The rocks of this system occupy the greater portion of the surface throughout the area, and consist of slates, quartzites and sandstones. The outcropping slates are brown to buff coloured varieties, but at depth they may be black, blue-grey, purple or light-grey in colour. They are thinly laminated parallel to the bedding planes. The quartzites generally contain mica along the bedding planes and, like the slates are light coloured near the surface and become darker at depth. The lighter colour near the surface is due to alteration by superficial weathering, and the sandstones represent the weathered and softened derivation of the quartzites. Intermediate types between the slates and quartzites occur, and these may be either arenaceous slates or argillaceous quartzites according to the texture and composition of the variety. The slates generally predominate in the eastern part of the area, but in the west the quartzites are more abundant.

This series of rocks is important as being the repository of the gold-quartz reefs of the district and are thus of particular interest from the economic point of view.

These rocks form part of the Mathinna Series of slates and quartzites which constitute a belt extending north-erly to Lyndhurst easterly to the coast and westerly to Storey Creek.

The only fossil evidence for age determination consists of poorly preserved plant remains obtained in sand-stones beds of the series at Warrentinna. These have been described by Dr. Cookson, who compared them with *Hostimella* sp.

contained in Silurian rocks of Eastern Victoria. Such psilophytales have been identified in rocks older than Silurian. Owing to the fragmentary nature of the Warr-entinna fossils the doubt still remains as to their precise identity.

It has been the practise of recent years to refer the Mathinna series of rocks to the Cambro-Ordovician system and until further evidence is available no alteration is considered advisable.

(11) Structural Features:

The slates and quartzites in the vicinity of the lode channels to the east of Mangana are characterised by a pronounced cleavage or slight schistosity which in places completely masks the bedding planes. Cleavage also occurs in the rocks over the remaining portion of the field, but to a minor degree only. The strike of the cleavage or schist-planes appears to agree in general with that of the planes of bedding.

The strike of the strata throughout the area is north-north-west; it varies from N20°W to N50°W but the strikes most commonly recorded were N12°W and N25°W, and these probably indicate the general direction. The dip of the strata westward from Mangana is to the south-west at angles between 65° and 80°. East of Mangana, in the area of intensely cleaved or schistose rocks, the strata dip both north-east and south-west at angles ranging from 80° to 85°. No definite folding can be observed but, from the mapping of the dips recorded, a zone of close folding with axes along the general line of strike is indicated.

(b) Permo-Carboniferous:

The rocks of this system consist of conglomerates with small thicknesses of sandstone and mudstone. The conglomerates are composed of rounded pebbles of quartz, quartzite, and slate distributed irregularly through a sandstone matrix. These strata outcrop at a distance of 2½ miles to the north-west of Mangana on the Alpine spur and within ten chains of Alpine Reef, where sandstone conglomerates overlies Cambro-Ordovician slates and quartzite. The rocks again outcrop three quarters of a mile further north-east, on the spur between Calder's Bully and Fern Tree Creek. Along the road to Tower Hill, in this belt, good exposures of sandstone conglomerates and sandstone stand out in small cliff faces. At the head of Fern Tree Creek the conglomerates are overlain by black mudstones containing thin seams of poor quality coal.

This series of rocks is horizontally bedded and overlies the Mathinna slates and quartzites with a marked unconformity. Fossils appear to be absent but there is no doubt, on lithological and structural grounds, that they represent the basal beds of the Permo-Carboniferous System.

(c) Tertiary:

Deposits of Tertiary age consisting of clays, sands and gravels have been formed in the wider parts of the valleys of Tower Rivulet and Richardson's Creek. Those of Tower Rivulet extend southerly in a belt of increasing width and thickness to South Esk River. The Richardson's Creek deposits combine with the Tower Rivulet sediments to the south of Mangana, and to the north and north-west extend into the lower portions of the large tributary valleys. They eventually merge into gravels of recent origin in the higher ground.

(d) Recent:

Gravels of recent origin have been formed along the courses of the smaller streams and the upper parts of the larger tributary valleys.

Alluvium of this age is spread over the major portion of the Tertiary deposits in Richardson's Creek and Tower Rivulet flood plains.

(3) Igneous Rocks:

Dolerite (diabase) of Upper Mesozoic age occupies a considerable portion of the country between Richardson's Creek and Otway's Creek, due west of Mangana. A small exposure of dolerite, in this instance largely decomposed, also occurs on Alpine Hill along the track to Cardinal Mine from the township.

The rock is a fine to medium grained type, composed essentially of plagioclase felspar and augite. Its petrological character and mode of occurrence are similar to the typical diabase found elsewhere in Tasmania and no further description is necessary.

In the Mangana area the dolerite is intrusive into Cambro-Ordovician slates and quartzites in the form of transgressive bodies.

(1) The Auriferous Quartz Veins.

These constitute the only lode type in the district and consist of quartz veins containing gold. The quartz is generally of the milky white variety and of a dense nature, but in some of the veins it is vitreous and coarse in grain. Near the surface the quartz is usually characterised by partings stained brown by oxides of iron, but below the zone of oxidation minor amounts of sulphide minerals are distributed through the quartz. Where these are present pyrite is the dominant mineral but arsenopyrite, galena, chalcopyrite and sphalerite also occur in minute quantities.

The lode channels vary in width from a few inches up to 25 feet and with few exceptions are filled with quartz. The Mangana and Golden Entrance reefs, however, are not wholly composed of quartz since at numerous points the channels are filled with mixtures of slate and quartz veins, while in places quartz appears to be absent.

The lengths of the reefs vary from approximately 20 feet up to 1500 feet. The Golden Entrance Reef with its southerly continuation in the Argyle Mine is the longest, as quoted above, but this is exceptional and in general the greater number of the veins are short.

The strike of the veins is north-north-west in conformity with the strike of the enclosing strata. The direction of dip varies from north-east to south-west and in many instances agrees with the dip of the surrounding rocks. The veins to the east of Mangana dip in the former direction while those to the west and north-west of the township have the opposite inclination, with the exception of two reefs in the Tower Hill group. High dips from 65° to 85° are the general rule, the exceptions being the Underlay, Union Jack and Fingal Reefs, in the eastern group, which dip at angles varying between 30° and 40° .

(2) Relationship Between the Veins and the Geological Features

The quartz veins are all contained within the Cambro-Ordovician slates and quartzites.

Several parallel zones can be distinguished in which isolated groups of veins occur. The largest zone is situated immediately to the east of Mangana and contains the greatest number of veins including the principal productive reefs, namely, Mangana and Golden Entrance. This zone extends north-westerly for a distance of 100 chains over a width of 35 chains and corresponds with the area of close folding in which a maximum development of highly cleaved slates occurs.

Minor discontinuations of the principal zone occur $1\frac{1}{2}$ miles and $2\frac{1}{2}$ miles to the north-west, along the same general trend, at Golden Bully and Tower Hill reefs respectively.

The next important zone includes Alpine, Buckland, Cardinal and Richardson's Creek group of veins, situated two

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miles north-west of Mangana. This zone is three quarters of a mile west of, and parallel to the northern discontinuation of the eastern zone, but is decidedly smaller in extent, being 40 chains in length and 20 chains wide.

The remaining zones are small and constitute the two areas of Specimen Hill and Otway's Creek, a quarter of a mile and one mile west of the township respectively.

(3) Secondary Enrichment:

It is significant fact that no mines at Mangana were found to be economically workable below 200 feet from surface. In a number of the workings the lodes were unpayable at a depth of 50 feet and less. Where several ore-shoots have been worked in the one lode, as at Golden Entrance and Mangana Gold Reefs mines, it is observed that a line along the bottom of the various stopes is generally parallel with the surface contour.

Free gold is present along iron stained partings in the upper adit workings of Mangana or Sovereign reef and both Twelvetrees (1) and Reid (2) record the occurrence of gold in association with oxides of iron in the Golden Entrance reef.

Enrichments, unusually high in some instances, occurred near the surface in the majority of the lodes operated and the evidence indicates that they were of a general secondary character.

(4) Alluvial Deposits:

Payable alluvial gold was discovered in 1852 and during the following 30 years a considerable quantity was won by individual miners and small working parties. The metal was obtained from the gravels spread over the floors of the present valleys, principally in Major, Sharky, Sailor, Calder and Richardson's Creeks.

Majors Gully deposits, below the junction of Fern Tree and Golden Gully Creeks, received the most attention; the deposits obtain a thickness of 10 to 40 feet and in places are reported to have been rich in gold. These were worked to a large extent from shafts and drives, and the material treated at surface in cradles and sluice boxes. After a lapse of a great number of years a small revival in alluvial mining occurred during the world depression in 1932, when about 25 miners working intermittently won gold to the value of £400. It is reported that during this period nuggets weighing 4 oz. 15 dwt., 1½ oz. and 5 others of half an ounce each were obtained. A considerable quantity of gold bearing gravels remain unworked in Majors Gully, and in 1935 an attempt was made to treat the deposit by hydraulic sluicing methods.

A race was commenced with the object of conveying water from the head of Golden Gully, but was not completed and the scheme was abandoned.

(1) Twelvetrees, W.H. Geo.Sur. Bull.No.1 The Mangana Goldfield, 1907

(2) Reid, A.M., Advisory Report on Golden Entrance Mine, Mangana, 1929.

Mining from shafts and drives was also attempted in the gravels of Richardson's Creek between Mangana and the junction with Major Gully, but little information is now available.

South of the township a wide alluvial plain, on west side of Richardson's Creek, extends to Tower Rivulet, and eventually to south Esk River. The underlying gravels are possibly gold bearing but, probably owing to the area being improved freehold property, they have not been tested and the value of the ground from a mining aspect is unknown.

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V11 THE MINING

(1) Mangana Gold Reefs Mine
Section 11313/M, 31 acres

Plans and sections of this mine are shown on Plates 111, V, V1, V11, and XV.

The mine is located half a mile south-east of Mangana Township.

Different parts of the reef were worked by various companies including Union Gold Mining Company, Reunion Gold Mining Company, Sovereign and New Sovereign companies and Mangana (Tas) Gold Reefs Ltd. between the years 1879 and 1907. Subsequently the property was leased to various individuals but no gold has since been produced.

The Mangana or Sovereign reef extends north-westerly from Sailor's Gully Creek to the fall into Sharkey Creek on a general bearing of 315° , a distance of 1150 feet. The dip is variable but is generally to the south-east at an angle of 68° .

The channel varies in width from less than one foot to 25 feet and is filled with irregular quartz veinlets traversing cleaved and schistose slates. In addition solid quartz veins ranging up to 6 feet in width occur, usually following either one or other of the reef walls. The latter are not always well defined but are usually so when followed closely by the large veins.

Slickensides in the channel are a prominent feature and indicate movements along the strike of the reef subsequent to the mineralisation. In the upper levels of the mine the reef is traversed by films of iron oxide but at depth minute aggregates consisting of pyrite and arsenopyrite are present together with lesser amounts of galena and chalcopyrite.

It is evident that a process of secondary enrichment has taken place near the surface which has influenced the formation of irregular shaped ore shoots at various points along the outcrop, and which extend downward to a depth seldom exceeding 200 feet. The latter is well illustrated by the stoping shown in the longitudinal section on Plate V1 herewith.

The principal workings of the early companies, prior to the formation of Mangana (Tas) Gold Reefs Ltd. consisted of four adits driven north-westerly on the course of the reef and situated at progressively higher levels from Sailor's Gully Creek to within 60 feet of Sovereign Hill summit.

The following description has been taken to a large extent from mine plans and Twelvetrees (3) report:-

No. 1 Adit - This is the highest level and is connected by shaft at 165 feet from portal, with the surface at crown of hill. The adit is now caved at entrance and is

(3) Twelvetrees, W.H., The Mangana Goldfield, Geo.Surv. Bulletin No. 1, 1907.

inaccessible. It originally extended for 275 feet along the channel, which in places attained a width of 20 feet. Large bodies of quartz occurred but a considerable portion was composed of broken slates with some mixed quartz. In adit end the reef is reduced to three feet in width, half of which is quartz and the remainder mixed slate and quartz.

Surface trenching proved the reef to extend 240 feet north-west of Sovereign shaft. These works indicate that the channel has split into two branches of solid quartz the eastern one being five feet and the western two to four feet in width.

No. 2 Adit - This adit is situated 137 feet below No. 1 Adit and was driven 625 feet. The reef at portal consists of 3 feet of solid quartz dipping at a high angle to the west along the western wall with three to four feet of mixed quartz and slate on the eastern side. The adit has collapsed 75 feet from entrance beyond a body of iron stained quartz extending over a width of 12 feet.

No. 3 Adit - No. 3 Adit was driven 720 feet and was commenced 94 feet below No. 2 Adit. Near the mouth the channel has a width of 4 feet and exhibits irregular quartz veins in slate. The footwall is well defined and dips 80° to the west. At 120 feet from portal, where Union shaft passed through the level on the way from surface to No. 4 Adit, the reef is similar in character but has increased to five feet in width. At 186 feet it decreases to three feet wide and contains little quartz. Farther in, at 260 feet the channel is nine feet wide and shows six feet of solid quartz on hanging wall.

The adit has caved at 300 feet where stoping was carried out on three feet of footwall quartz, leaving six feet of quartz on the hanging wall side.

Between this level and No. 2 Adit unusually rich patches of quartz yielding as much as 30 ounces of gold per ton were reported to have been stoped.

No. 4 Adit - This is the lowest adit and was started at 112 feet below No. 3 Adit and 25 feet below collar of the main shaft, near Sailor's Gully Creek. The adit had collapsed many years prior to 1936, but in that year was reopened by T.M. Brennan who drove it another 44 feet, making a total length of 596 feet. The latter work was undertaken with the object of testing the reef vertically below the ore stoped above No. 3 Adit, but was abandoned as traces of gold only were disclosed.

In the face the lode is composed of veins and bunches of quartz in soft slate over a width of eight feet. The dip is 85° to the east and shows a well defined footwall but no definite hanging wall.

Originally a crosscut was driven at 190 feet from the entrance towards the south-west for a distance of 100 feet. This was accomplished with the object of intersecting possible parallel lodes to the west, but was not successful in locating anything of importance.

Union shaft joins the level at 340 feet and at this point is 180 feet below the collar.

Main Shaft Workings

No. 1 Level, 115 feet - A south-westerly crosscut from shaft traversed quartz and slates for 29 feet to hanging wall of the reef. The latter was then followed in 87 feet of driving. Solid quartz occurs in the face. The reef was stoped up to No. 4 Adit (90 feet) and down to No. 2 Level (60 feet), along an average length of 65 feet.

No. 2 Level, 174 feet - This level is represented by a north-west drive on the reef for a distance of 175 feet. The reef, as exposed in the chambers adjoining west side of shaft, consists of mottled quartz, five feet in width. Stoping above the level has extended over a length of nearly 100 feet. A short crosscut at 50 feet from shaft intersected the reef across 19 feet of mottled quartz, dipping at an angle of 50° to the north-east. At 140 feet the central portion of the reef is represented by four feet two inches of quartz and in the face this has increased to 19 feet in width.

No. 3 Level, 214 feet - A wide formation of quartz and slate was cut in the shaft, but the full width westerly was not ascertained.

At 12 feet north-east of shaft a drive extends north-westerly almost 200 feet. The reef followed consists of a mixture of quartz and slate and is two feet six inches wide.

Above the level some old stopes are said to exist.

No. 4 Level, 319 feet - A north-easterly crosscut of 50 feet connects with drive extending north-west and south-east on footwall side of reef. North drive has a length of 150 feet and commences on a quartz vein and soft formation reported to yield 7 dwt. gold per ton. A cuddy on east side of 40 feet passed through flat quartz veins traversing slate. On west side of level at this point quartz going underfoot was said to contain 7 or 8 dwt. gold per ton. At 70 feet along the level a rise connects with No. 3 level above. Here the reef was two feet wide and some of the quartz from the lower portion yielded up to 13 dwt. gold per ton. Higher in the rise the reef contained less gold. Further along the level the material in the channel is soft, but in the face solid mineralised quartz occurs with dip to north-east at 60°-65°. This is stated to contain 3 dwt. gold per ton.

South drive extends over a distance of 125 feet along footwall side of the reef. The latter consists of auriferous quartz veins from five inches to one foot in width. At 25 feet from face an easterly cuddy exposed a flat quartz vein seven inches wide. The level towards the end appeared to leave the main channel as dark slates with minor veins are present, and a deviation from the general strike was made.

No. 5 Level, 419 feet - At this level a north-easterly crosscut intersected the reef at 150 feet after passing through veined slates. The drive was cut north-westerly along the soft channel carrying quartz veins over a width of 10 feet in one place, but without defined walls. Silicified slate and barren quartz veins occur in face of drive.

A small parcel of mineralised quartz taken from the back of the drive near shaft is reported to have yielded three ounces of gold per ton.

No. 7 Level, 619 feet - Crosscuts from No. 7 level were driven 260 feet north-easterly and 110 feet south-westerly. In the eastern crosscut veins and bunches of quartz were passed through at intervals. At 170 feet from shaft a drive was put out for a similar distance on an irregular quartz vein varying from 3 to 12 inches in width. In the face this vein diminished to three inches, near the back, and is represented by a track above the floor. A five ton crushing taken from back of level, at 35 and 85 feet respectively from crosscut, is reported to have yielded 7 or 8 dwt. of gold per ton. It is doubtful whether this vein corresponds with the channel followed in No.5 level. If it is the same the angle of dip has altered from 55° to 75°.

In the western crosscut quartz veins occur in a formation immediately west of shaft. Near the end barren veins, two and three inches wide, traverse four feet of slate formation.

No. 8 Level - A drive extends 40 feet north-westerly from a chamber on east side of shaft. Scattered quartz and veins occur in slate along a channel over a width of three feet. A reef channel, seven to eight feet wide, is also exposed in shaft and a chamber on west side.

No. 9 Level, 819 feet - The lowest level is represented by crosscuts driven for 140 feet north-easterly and 113 feet south-westerly from the shaft. At 12 feet in eastern crosscut barren veins and bunches of quartz extend down from shaft but disappear before reaching the floor.

Broken bands of quartz, up to six inches wide, occur in the chamber on west side of shaft, and are connected upwards with quartz passed through in shaft on No. 8 level and below.

In west crosscut, at 26 feet from shaft, a three inch quartz vein is exposed in the back; 20 feet beyond this a slide, striking N 20° W and dipping south-west, crosses the level.

A short drive is situated 13 feet east of the crosscut face. It was driven on a quartz-slate channel, fourteen inches in width, and exposed six inches of barren quartz in the end. The reef dips at 80° to the north-east and has a smooth defined footwall.

The records of production from this mine are most incomplete but those for the available years are shown in the following table:-

Company	Period	Quartz	Gold ounces
Mangana (Tas.) Gold Reefs Ltd.	1898	2659	530oz. 10dwt.
Tributers	1902	369.5	257oz. 10dwt.
"	1903	29	3

The average value of the ore produced during this period was 6 dwt. 8 gr. of gold per ton.

It is recorded that, for the years 1867 and 1866, Union Quartz Crushing Company recovered 1379 oz. 13 dwt. of gold valued at £4,307/9/6, but it is doubtful if the quartz treated by this company was obtained from Mangana Reefs mine.

(2) Golden Entrance Mine

Sections $\frac{1777}{G}$ $\frac{1776}{G}$ & $\frac{1546}{93G}$

The Golden Entrance mine is located 15 chains east of Mangana Gold Reefs mine on the northern fall of Sailor's Gully. A track about 60 chains long deviating eastward from Fingal-Mangana road connected with the workings.

The Golden Entrance reef was discovered by J.S. Goodall Jr. and three mineral leases were obtained in 1896. Early in the following year the sections were acquired by B. & J.E. Smith, but were transferred to a Melbourne syndicate known as the Golden Entrance Company in September, 1900. This company operated principally in the years 1900-02 and over that period treated 265 tons, 18 cwt. 3 grs of ore from which 1951 oz. 2 dwt. 23 grs of gold was obtained. From 1903 to 1905 the mine was worked by tributers who broke 441 tons of ore for a return of 988 oz. 3 dwt. of gold. The mine was let on tribute again in 1907 but results over this period are not recorded. Twelvetees reports that up to 1907, 1051 tons of ore had been crushed for 2801 oz. of gold valued at £10,264. 9. 11 (average 2 oz. 13 dwts. 8 grs. per ton).

Portion of the area was held under lease by individuals between 1910 and 1924 but little, if any, gold was won.

During prospecting operations in 1927 and 1928 G.E. Chesshire uncovered the southerly extension of Golden Entrance reef, on south side of Sailor's Gully, and subsequently the Argyle mine was developed.

For details of the Argyle mine see unpublished report by K.J. Finucane, 1932.

Plans and sections of the workings appear on Plates III and IV

The Golden Entrance portion of the reef trends north-westerly from near bottom of Sailor's Gully to the hill top overlooking Sharkey Creek, and has proved at surface over the greater part of 1122 feet.

The strike is variable at surface but follows a general course of north 39° west. The reef dips at 80° to the east in the south but at northern end it inclines to the west at a similar angle. The channel is generally filled with soft lode slates in which are contained quartz veins and bunches of quartz of various sizes. It is most erratic in width and varies from a few inches to a recorded maximum of seven feet. A characteristic feature of this reef is a smooth plane following the strike and often dividing the channel in two parts. Slickensides occur along the parting and indicate movement subsequent to deposition of the quartz. Most of the gold obtained appears to have accompanied films of limonite in the quartz or along oxidised planes in lode slates. The section showing stoped ground in Plate IV suggests that little gold was found below a depth of 100 feet from surface and this indicates a secondary enriched zone in the upper part of the reef.

As the mine is now inaccessible for the greater part, the following description of the workings has been compiled from the mine plans and Twelvetrees (4) report.

The mine openings consist of three adits driven on the reef at different levels from the hillside falling to Sailor's Gully. An adit crosscut and drive were also put in from the northern fall of the hill on Sharkey Gully side. The producing portion of the mine was operated to a large extent by way of shafts from surface.

These underground workings are shown in the plan and section on Plate IV.

No. 2 Adit - This is the lowest opening in the Golden Entrance mine and is 124 feet above Sailor's Gully Creek. It is now caved at entrance and is inaccessible. The adit originally extended for approximately 170 feet and was driven on an easterly dipping lode channel, consisting of quartz veins and bunches in soft slate, for 150 feet. At the latter distance a westerly cross course, dipping 55° to the north, occurred and the reef was not traced further in this opening.

150 Foot Level Adit - This adit is 230 feet above the creek and 150 feet below collar of No. 2 Shaft. It was driven north-westerly along the course of the reef, which for the greater part is little more than a well defined track carrying a little quartz in places and dipping to the east at 80°.

No. 3 Shaft connects with surface at 170 feet and 50 feet beyond, the lode channel widens to 15 inches, where it consists of quartz veins and soft slate but contains little gold.

No. 1 Adit - No. 1 Adit or Winze Adit is situated 100 feet above the 150 foot level adit and 50 feet below collar of No. 2 Shaft. The latter passed through the level at 118 feet from portal and the adit continued for a total distance of 250 feet. Inspection is now only possible for the first 70 feet in which a lode track is reported dipping east at 80°. Quartz stoped from above the adit is reported to have varied from a few inches to a maximum of seven feet in width and in some places yielded 6 to 7 oz. of gold per ton.

In the cutting at entrance to this adit No. 3 Shaft was sunk 100 feet to the 150 Foot Level Adit, after connecting with No. 2 Level (100 foot level) at 50 feet from surface.

No. 2 Shaft - Originally this was apparently the main working shaft and is situated 130 feet north-west of No. 3 Shaft. It passes through No. 1 Adit at 50 feet from collar and connects with No. 1 Level (70 feet Level) 20 feet lower.

No. 1 Level extends for 80 feet to the north-west and 55 feet south-westerly. It is recorded that rich ore

(4) Twelvetrees, W.H. Geo. Surv. Bulletin No. 1, The Mangana Goldfield.

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was extracted from stopes in the south-western drive and that 81 tons yielded 289 oz. of gold.

No. 2 Shaft was sunk a further 30 feet to No. 2 Level (110 foot level) and drives extended 70 feet north-west and 130 feet south-east. Stoping above the latter drive was carried out on quartz up to one foot in width. Probably the last ore taken from the mine was obtained from a narrow vein below the floor of No. 2 Level towards the south-east end. The parcel contained 50 tons and after treatment at the Bairnsdale School of Mines yielded 350 oz. of gold.

A pass from the south side of shaft connected No. 2 Level with the long adit from Sharkey's Gully, 25 feet lower.

No. 1 Shaft - This shaft is located 250 feet north-west of No. 2 Shaft and is 108 feet deep. Short levels have been opened each way on the reef at depths of 56 feet and 85 feet respectively.

At 56 Foot Level the north-west drive was extended for 43 feet and stopes taken to surface along the first 19 feet. Some of this ground was particularly rich and at 30 feet from surface a portion of the reef, 24 feet by 30 feet in area yielded 480 oz. of gold. One parcel of $4\frac{1}{2}$ tons was reported to contain 25 oz. of gold. South-east drive reached a distance of 33 feet and stopes were extended to a height of 20 feet above the level for the full length.

The 85 foot level was driven 17 feet north-west and 33 feet to the south-east. At the latter point a rise connected with 56 foot level.

No. 4 Shaft - This shaft is situated 30 feet north-west of No. 1 Shaft and was sunk 30 feet on the reef and then abandoned.

Surface - The reef has been traced at surface by means of shallow shafts, pits and trenches over a distance of 300 feet north-west of No. 4 Shaft. It there consists of quartz veins extending over a maximum width of four feet. The largest single vein is 12 inches wide at its greatest width. Gold was determined by G. Chesshire in 1932 in the shaft shown as 18 feet deep, but was proved not to extend below 15 feet from surface.

Sharkey's Gully Adit - The adit was commenced from north side of hill on the fall to Sharkey's Gully. It was driven as a crosscut for 420 feet in slate and then as a drive on the reef to 30 feet south-east of No. 2 Shaft, near which it was connected with No. 2 Level by a pass. Where intersected the reef channel is two feet six inches wide and filled with soft slate traversed by quartz-veins. The adit has now collapsed at 475 feet from portal. Near this point the reef dips at 80° to the west and the channel varies in width from one foot to one foot six inches. A quartz vein four inches wide occurs along the hanging wall, and is separated from broken quartz veins and slate on the footwall side by the characteristic clay parting of the reef. When driving the adit a little gold was located near the end where the channel 1 foot 6 inches wide contained a few inches of quartz in soft slate.

Eight feet from adit portal a winze was sunk in 1932 by Chesshire and Ward on a quartz vein striking north-west to a depth of 15 feet. The vein was one foot six

inches wide near the top but decreased to half an inch in the bottom. The quartz contained gold down to 10 feet only and 5 oz. of gold were obtained by hand crushing and panning.

The vein was again cut in a shaft six feet deep on northern side of adit entrance by Thomas and Henricks in 1934. The quartz vein at this point is one foot ten inches wide and vertical. On south side of entrance a cutting exposes several small quartz veins in slate. They are gold bearing only near the surface.

The probable southerly continuation of this vein series is exposed in three trenches ranging between 90 feet and 250 feet from Sharkey's Gully Adit, where a quartz vein up to four inches in width is uncovered to a shallow depth.

(3) Underlay Reef

Section 11313/M, 31 Acres

The Underlay reef occurs on South side of Sharkey's Gully at 14 chains north-west of Sovereign shaft at Mangana Gold Reefs mine.

A plan of the workings is given on Plate 111 herewith.

The lode exposed near the surface in three shallow underlay shafts and several trenches over a distance of 330 feet. The low angle of dip of 35° is constant throughout its length; while the general strike is north. It consists for the greater part of solid quartz varying from nine to twelve inches in width.

The first work was undertaken about the year 1872 in the most northerly shaft, from where a trial crushing is reported to have yielded 6 dwt. of gold per ton.

The central shaft, about 20 feet deep on the underlay, was sunk in 1931 by C. Chesshire and D. Ward. Gold occurred in the reef to a depth of 15 feet only, and the ore was not milled. A sample taken across 12 inches of solid quartz in this shaft, at six feet below surface, was assayed with the following result:-

Gold	Trace
Silver	19 grains

At 25 feet east of northern end of the reef the tops of several quartz veins have been cut in shallow trenches. The strike of these veins appears to be parallel with that of the Underlay reef.

(4) Union Jack Mine

Section 1529 10 acres.
93M

Union Jack reef is situated in the southern part of abandoned mineral lease No. 1529/93G. It was developed in the early stages by Union Gold Mining Company about the year 1887. During 1902 when the mine was leased to T. Parker and G. Smith, a parcel containing 20 tons of quartz returned

10 oz. of gold. The mine has not been worked since.

Mining development and prospecting consists of an adit, tunnel, three shallow shafts and numerous trenches as illustrated on Plate V111.

The work at greatest depth was carried out in the adit, the portal of which is located 300 feet north of southern corner of the section. The reef has a flat dip to the east and adit was driven along hanging wall on a distance of 244 feet. For the first 156 feet the reef consists of solid quartz varying from four to twelve inches wide. Then over a length of 17 feet the lode channel is filled with slate and numerous narrow quartz veins over a width of two to three feet. At 200 feet from portal, a rise on the reef, which here dips at 31° to the east, connects with a vertical shaft from surface. The adit level at this point is 67 feet vertically below surface. At bottom of rise the reef consists of solid quartz four inches in width. A sample taken across it at this point was assayed and the result showed, Gold - nil, Silver - Trace. From the rise northerly the vein gradually narrows until in the face only one inch of quartz is showing. At 267 feet in the adit a westerly crosscut extends 50 feet and exposes a veinlet and bunch of quartz in the end.

The tunnel is located 158 feet north west of the adit and is 25 feet above it. It commenced as a crosscut on a bearing of 355° and intersected the reef at approximately 20 feet. The tunnel is now collapsed along the drive but is reported to have been driven through the crown of the hill, and this would give maximum backs of 70 feet above the level. A quartz dump at entrance to tunnel was sampled and on assay showed, Gold - nil, Silver - trace.

It was from the tunnel that the greater part of the ore was produced by Union Gold Mining Company and sent to Union Quartz Crushing Company's battery.

The main vertical shaft is 73 feet north-east of tunnel and 50 feet higher. It was sunk to an approximate depth of 40 feet and later connected by the rise from adit level. A small parcel of quartz from bottom of this shaft is reported to have yielded 1 oz. of gold per ton.

Another reef outcrops in the eastern portion of this section at one chain west of the western corner of section 1590. It stands out boldly to a height of five feet above ~~936~~ the general level of the surface over a width of four feet and consists of solid quartz dipping to the east at an angle of 60°. To the south-east it has been traced along a bearing of 135° in a trench and open cut at intervals over a length of 150 feet. In the open cut at south-east end the lode channel has a width of 10 feet, and dips to the east at 70°. Iron stained quartz, one foot three inches wide, occurs on both the footwall and hanging wall which are seven feet apart. The channel between these large veins is filled with slates traversed by quartz veinlets.

(5) Fingal Mine

320 Acres, W.A. Tully, & C.A. Downing, Pur.

This mine is located on private property 70 chains north-east of Mangana, on eastern side of Grant's Creek in Fingal Gully. The Mangana - Tower Hill road passes five chains to the west of the mine.

The property was first developed by Fingal Quartz Crushing and Gold Mining Company about the year 1864. In 1867 the company recovered 317 oz. 2 dwt. of gold, valued at £1170/4/11. No other production figures are available, but it is said that an average of 6 dwt. of gold per ton was obtained when treating the quartz in the battery adjacent to the mine.

Two reefs occur at the mine, the Fingal reef and a short vein to the south-east of the principal one, as shown on Plate V111. The Fingal reef was primarily operated by means of shallow underlay shafts and was underhand stoped from surface over nearly half the total length. Later two vertical shafts were sunk east of the outcrop, to cut the reef on its easterly dip. Quartz dumps near the main or southern shaft indicated that the reef was intersected. It is doubtful if the reef was reached in the northern shaft since the spoil dumps in the vicinity consist almost entirely of slate.

Underground workings are inaccessible but the reef can be traced at surface along the course of caved stopes and underlay shafts over a distance of 400 feet. It has a strike of 353° and dips to the east at low angles varying from 35° to 42°. In the deep underlay shaft shown at northern end the reef is exposed, dipping east at 40°, in an underground stopes, to a depth of approximately 25 feet. It consists of solid quartz on the footwall over a width of 30 to 34 inches. This is overlain on hanging wall side by 9 to 12 inches of brecciated quartz and weathered slate with a defined parting between the two portions of the reef. Post-mineral faulting is indicated along the lode channel. A quartz dump at collar of this shaft was sampled and the assay result showed, Gold - 1 dwt. 7 grs., Silver - 6 grs.

At 100 feet south of the above shaft 12 inches of broken iron-stained quartz dips east at 35° from surface through a short vertical shaft, into the underground workings. Farther south workings are caved and the reef cannot be examined. Representative samples taken from two quartz dumps near main vertical shaft gave the following results on being assayed.

	SOUTH DUMP	NORTH DUMP
Gold	2 dwt. 15 grs.	Nil.
Silver	6 grs.	Trace

The other reef worked on the property is situated 100 feet east of the south end of Fingal reef. It extends south on a bearing of 158°, through underlay shafts and surface stopes, over a length of 100 feet, and dips east at 45°. Where exposed, the reef consists of broken iron-stained quartz varying from one to three feet in width. A little arsenopyrite is visible through the quartz when freshly broken. This reef is reported to have been worked about 100 feet down on the dip.

A line of trenches and small cuts extend south-easterly from Fingal mine through 19A. 2R. 10P. of land purchased from the Crown by W. Robertson to a vertical shaft on the south-east boundary of the block. A quartz vein, up to 12 inches in width, showing in a trench adjoining this shaft and veins indicated by broken quartz on the dumps of some of the other openings may represent southerly continuations of the reefs at Fingal mine.

(6) Pincher Reef

19 acres, 1 rood, 26 perches, W. Robertson, Pub.

The workings on this lode appear on Plate V111.

Pincher reef is situated 35 chains north-east of Mangana. It crosses the lower part of Harrison's Creek, a small east flowing tributary of Grant's Creek. The general strike approximates 133° but towards the south it is irregular as shown by the disposition of deep trenches or surface stopes along the reef, the mapping of which suggests cross faulting. The reef dips at angles between 75° and 80° to the east at the southern end and in the north at 85° to the west. The width, where exposed, varies from 2 inches to 12 inches of quartz.

The workings are shallow and extend at intervals over a length of 470 feet. It cannot be ascertained at what date the principal developments were undertaken, but it was certainly more than 40 years ago. It is reported locally that at one period a brushing of 10 tons returned one oz. one dwt. of gold per ton.

A short adit, 80 feet south of Harrison's Creek, was driven by J. Simpson and P. Homan in 1934, on a bearing of 185°, over a length of 85 feet. Some irregular veinlets and bunches of quartz were intersected near the end which probably represent Pincher reef at this point. Traces of gold are stated to have been obtained.

An adit on north bank of the creek was driven along hanging wall of the reef for 47 feet. It consists of a quartz vein, two to four inches wide, following a cleavage plane of the surrounding slates. At 31 feet from portal stoping was carried out over the back to a height of 10 feet along a similar length.

At 50 feet south-east from southern end of Pincher workings H. J. Rodman in 1935 sunk a shaft to a depth of 50 feet on a small cross vein striking a general bearing of 93°. The width of the vein is three to four inches and it dips to the south at 85°. A drive was driven along it from bottom of shaft for 38 feet easterly and 14 feet to the west in 1936. In sinking the shaft, a sample obtained at 12.5 feet from surface, across three inches of quartz, gave an assay value of 2 oz. 11 dwt. 18 gr. gold and 3 dwt. 22 gr. silver per ton. Quartzites over a width of 19 inches adjacent to the vein were also sampled and the assay return showed 3 dwt. 10 grs. gold and 1 dwt. 7 gr. silver to the ton. A parcel of quartz weighing 2 tons 1 cwt. 40 lb. of quartz taken from upper part of shaft was crushed at the Ballarat School of Mines and 2 oz. 15 dwt. 7 gr. of gold recovered by amalgamation. An assay of pyritic tailings from the plant showed 6 dwt. 6 gr. of gold per ton. A further crushing of a one ton parcel from above a depth of 40 feet in the shaft yielded 15 dwt. of gold. An assay of a sample taken from the vein in the shaft at 10 feet above the 50 feet level gave a return of 12 dwt. of gold per ton. Other samples were

taken across the vein over widths of three to four inches on either side of the shaft at the bottom, and were assayed with the following results:-

	<u>East side of shaft</u>	<u>West side of shaft</u>
Gold per ton	6 dwt. 7 gr.	3 dwt. 3 gr.
Silver per ton	2 dwt. 21 gr.	2 dwt. 8 gr.

From the above results it will be seen that although the vein was rich near the surface it became impoverished as greater depth was attained. Over the bottom 10 feet pyrite is present to a much greater extent than in the oxidised zone nearer the surface and there is little doubt that secondary enrichment has taken place in the upper part of the vein.

In the drive to the west of the shaft a three inch vein of quartz, having a north-westerly strike, makes a junction with Rodman's vein. A sample taken across this vein near the intersection showed an assay result of 13 dwt. 14 gr. of gold and 3 dwt. 10 gr. silver per ton. The vein was driven on to the north-west in 1937 for a short distance and was found to widen to 12 inches of solid quartz. A sample taken at this point was assayed and the result showed 8 dwt. 2 gr. gold and 12 dwt. 19 gr. silver per ton. This work proved the vein to be southern extremity of Pincher reef but no further prospecting was undertaken.

(7) Section 1207/93G, 10 acres

In the eastern part of this section, half way between Pincher reef and Union Jack mine, a series of trenches discloses the tops of three irregular, north-west trending quartz veins. A vertical shaft was sunk to about 30 feet near the hill top but as very little quartz is showing on the spoil dump it would appear that the work was unsuccessful in locating economically important veins.

(8) Golden Gully Mine

Section 1637/93G, 10 Acres, and 1349/93G, 5 Acres

Golden Gully mine lies two miles to the north of the township on eastern side of Golden Gully. The reef was discovered in 1889 and mineral leases acquired by J. Hall, C. Lewis and W. Cameron. Interests were later transferred to Golden Gully Gold Mining Company. J.C. Goodall held the mining tenement in 1898 and carried out a limited amount of prospecting.

The workings are shown on Plate 1X, herewith.

The reef crosses the boundary line between the sections with a strike of 138° and dips to the south-west at 75° to 80° . It is exposed in surface works consisting of shallow underhand stopes and open cuts over the greater part of 430 feet. A vertical shaft 54 feet farther to the south-east, sunk to an approximate depth of 15 feet, does not appear to have intersected the reef.

The reef at surface varies greatly from one foot six inches to ten feet six inches in width, but it contains very little gold. The assay result of a sample taken across the widest part in stopes near the southern end showed a trace of gold and 1 dwt. 1 gr. silver per ton. A sample taken across four feet of quartz in the small open cut, at 130 feet north-west of underlay shaft; returned a result of 13 gr. gold and 13 gr. silver per ton.

An adit, driven from bottom of Golden Gully for 247 feet towards the south-east end of the reef as exposed at surface, proved that the reef did not extend to that depth. At 140 feet from portal a drive extends for 28 feet north-westerly and exposes a few veinlets and small bunches of quartz in places. From this drive a rise, put up for about 30 feet towards the underlay shaft from surface, did not connect with it. At 145 feet in adit a drive of 80 feet south-easterly, with short crosscuts from either side, was unsuccessful in locating the reef and only disclosed a short vein one to two inches in width.

An open cut, 165 feet north-west of the principal workings; disclosing a solid quartz reef over a width of eight feet is known as Dowling's Buck reef. It is probably a discontinuation of Golden Gully Reef and is valueless.

(9) Tower Hill Freehold Mine

157 acres, 1 rood, 0 perches, W. St. Paul Gellibrand, Pur. and Section 202P/M, 10 acres.

This mine is situated three miles north-west of Mangana and 15 chains east of a road leading from the township in the direction of Tower Hill.

The reefs on this property were discovered by J.C. Goodall in 1869 and afterwards taken over by a company formed in Hobart. The greater portion of the outcrops showed free gold. Several crushings of quartz taken from near the surface yielded up to two ounces of gold per ton. The gold diminishes at a shallow depth and later crushings prior to suspension of operations showed low returns.

Plate X herewith illustrates the mine workings.

Four more or less parallel quartz reefs are present on the property. The zone in which they occur extends from south-east boundary of abandoned mineral lease No. 202P/M north-westerly through the section to nine chains beyond the north-west boundary. The most easterly or No. 1 reef is the longest and is tracable at surface through shallow caved stopes, trenches, shafts, etc., over a total distance of 1060 feet. It has a north-westerly strike and dips to the east at angles varying from 40° to 70°. The width varies along the strike from 12 inches to a maximum of five feet. Underground workings consist of three adits, The lowest of these is a crosscut commencing 100 feet to the north-east of northern corner of the section. The level was driven on a bearing of 217° for 246 feet in slates and quartzites. At 148 feet from portal a drive on hanging wall of No. 1 reef gives 90 feet of backs and extends 120 feet north-west and 29 feet to the south-east. The reef consists of solid quartz between defined walls. In north-west drive it varies in width from one foot six inches to three feet six inches. At 93 feet from adit a winze, sunk to an unknown depth on the reef at an angle of 40° to the east, is now water-logged and inaccessible. In south-east part of drive a rise

on the reef connects with a shaft from surface. Near this point the quartz vein has a width of one foot three inches to one foot six inches and dips to the east at 65° . In end of drive it diminishes to eight inches in the back and four inches in the sole.

A large spoil dump at entrance to adit, made up of quartz obtained from the drive, was sampled and an assay showed gold - nil, and silver - trace.

Another adit, located at south-east end of the reef, consists of a drive on course of reef bearing from 312° to 324° for 210 feet, to where the level had collapsed. Inside the portal the reef is exposed to a width of two feet with easterly dip at 68° . At 12 feet a shallow winze, excavated on the underlay, discloses quartz three feet six inches in width. From the winze the reef splits into small veins and the adit follows a narrow track showing a little included quartz at intervals. A crosscut driven easterly at 171 feet from the mouth, exposes irregular quartz veins over a width of 12 inches in a shallow winze, at a distance of eight feet from the adit. The veins die out before bottom of winze, six feet below the level.

At north-west end of reef, on north side of a small tributary of Golden Gully creek, is a caved adit which appears to have been driven on the course of No. 1 reef.

No. 2 Reef is immediately west of No. 1 reef. At the northern end it is 42 feet distant but in the south it probably junctions with No. 1 reef. It is developed at surface in trenches, pits, open cuts and shallow stopes at intervals over a length of 745 feet. Near the north-east end a caved adit is present in a position which suggests that the reef was intersected and driven on at this point. The reef dips to the east at an angle of 53° and in the old workings it is seldom less than six feet in width and in several places it reaches a maximum of 14 feet of solid quartz. No underground workings, with the exception of the adit, are known to exist on No. 2 reef.

No. 3 reef is 178 feet west of southern end of No. 1 reef. The strike is to the north-west similar to the adjacent reefs. In the extreme south it dips to the east at 87° , but about the centre the dip is to the west at 70° . Faulting appears to have taken place in vicinity of the latter where survey of the workings shows portion of the reef to be further to the west than the remainder. Width of reef varies from six inches to a maximum of four feet and is widest at northern end. The workings consists of trenches and vertical shafts spread over a length of 520 feet. The latter are waterlogged and the depths cannot now be ascertained. Several of these shafts were sunk with unsatisfactory results in 1933, when the section was leased by H. E. and G. A. Brock.

No. 4 reef crosses south-east boundary of the section in a north-westerly direction at 100 feet south-west of southern end of No. 3 reef. It is exposed in shallow shafts 35 feet apart on either side of the boundary line, where quartz is disclosed over widths of three to four and a half feet.

(10) Alpine Mine

Section 11443/M, 20 Acres.

Description of the workings on this mine as well as those on Buckland and Cardinal mines are contained in the reports of Thureau (5), Montgomery (6) and Twelvetrees (7), and some of the information has been used in this description. The workings of these mines are shown on Plate X1 herewith.

The Alpine Mine is located on top of Alpine Hill, between Richardson's Creek and Clader's Gully, at two miles north-west of Mangana.

Gold bearing quartz reefs were discovered by J.C. Goodall in 1877. Three sections of 10 acres each were leased from the Crown and later transferred to Alpine Gold Mining Company. The greater part of the mining was performed during the years 1880 and 1885.

Three closely spaced, parallel reefs, occur in western part of the section. They strike north-west and the longest (Alpine Western) crosses the western boundary to pass out of the section. The latter is the most westerly of the reefs and has been worked at surface in stopes and intersected by shafts and trenches over a distance of 630 feet. Where now exposed by these openings, the width varies from one foot to two feet three inches of solid quartz. It has a general underlay to the west and at southern end dips at an angle of 80° but further to the north, outside the section, the dip is flatter at 60°.

Alpine reef is about six feet east of Alpine Western and is indicated at surface by stoping over a length of 83 feet, in which a quartz vein is visible three to four inches in width.

Underground workings consists of an adit crosscut, 110 feet below outcrop at southern end of Alpine Western reef, driven into eastern fall of the hill for 205 feet from portal, on bearing of 276°. Alpine Western reef was intersected at 157 feet and a drive extended approximately 200 feet north-westerly along hanging-wall of the vein. The drive bears 326½° and at 60 feet from adit a shaft from surface connects with the level. At 125 feet a winze was sunk to a depth of 100 feet and 80 tons of quartz taken out is stated to have yielded 18 dwt. of gold per ton. The vein in the drive dips at 85° to the west. It varies in width from two inches at southern end to a maximum of one foot two inches and averages about six inches. Although no stopes are visible over back of drive it is reasonably certain that the greater portion of the reef above drive has been stoped to surface. Thureau's report stated that the the quartz was strongly mineralised and yielded from half an ounce to over one ounce of gold per ton. Proceeds of the sale of gold supplied to Montgomery from the Company's records are as follows:-

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- (5) Thureau, G. Report on Mt. Victoria, Dan Rivulet, Black Boy and Mangana Goldfields, 1884, Parl. Paper No.61,1885.
 - (6) Montgomery, A. Report on Some Portions of the Mangana Goldfield, 1894, Sec. for Mines Report for 1894 - 1895.
 - (7) Twelvetrees, W.H. The Mangana Goldfield, Geo.Sur.Bull. No. 1, 1907.

Year	Crushings	£. s. d.
1880	3	802. 4. 6
1881	1	183. 14. 3
1882	2	179. 2. 4
1884	2	424. 14. 3
1885	4	788. 18. 11
Total:		£2,378. 14. 3

The end of the drive is now inaccessible. Montgomery reports a north-east crosscut of 13 feet from the end, which cut Alpine reef, dipping easterly. This was on north-westerly for about 100 feet and ranged from two inches to 2 feet 6 inches in width. Crosscuts from Alpine reef of 22 feet in length cut a narrow channel known as Eastern reef.

A representative sample taken from a quartz dump near adit entrance was assayed with the following results:-

Gold .. 3 dwt. 3 gr. per ton
Silver .. 19 gr.

The gold shoots in Alpine Western and Alpine reefs appear to have been comparatively short as indicated by stopes at surface, which extend over lengths of 210 feet and 65 feet respectively.

About the year 1883 a low level adit was driven westerly on a bearing of 254° towards the reefs. It commences from a branch of Glader's Gully Creek and extends for a distance of 392 feet from portal in slates and quartzites. From the end a bore hole was drilled horizontally in the same direction with the Government diamond drilling plant over a length of 545 feet 7 inches. At 533 feet 3 inches solid white quartz, 14 inches wide, was cut. The bore finished in 12 inches of solid white quartz which proved to be barren. These reefs correspond in position with the possible northerly extension of those cut in Buckland adit to the south. The bore hole ended 219 feet short of Alpine Western reef. The adit is 705 feet below outcrop of Alpine Western reef and 480 feet low than bottom of winze in adit drive. To interest the possible downward continuation of Alpine Western reef it would be necessary to drive adit 755 feet further.

In the consideration of any further work on these reefs it would appear advisable to test them in the first place by means of an adit 150 to 200 feet below the existing high level adit. Later, if prospects warranted the expenditure the low level adit could then be extended.

11 BUCKLAND MINE: H.J. Buckland, Purchaser, 320 acres and Section 11443/M - 10 acres.

The Buckland Mine is situated four chains to the south east of Alpine Mine. Buckland No. 1 reef was discovered by J.G. Goodall in 1877 and Buckland Gold Mining Company was formed to undertake the mining, the principal part of which was carried out during the years immediately following 1882.

Surface workings on Buckland No. 1 reef consists of stopes, trenches and two shafts extending over a distance of 211 feet on a general bearing of 331°. The shafts are located 22 feet apart near north-west end of workings. The southern shaft is 50 feet deep and the northern one connects with adit level at 110 feet. Several irregular quartz vein-lets are exposed in the stopes over various widths and the lode channel dips to the west at a steep angle. The reef crosses the boundary line dividing Buckland's 320 acres and Section 11443/M.

Underground workings consist of an adit crosscut commencing from east side of Alpine Hill at a point 115 feet below outcrop of reef. It extends on a bearing of 249½° for 258 feet. At 130 feet from portal a drive to the south-east of 50 feet in length exposes slates and quartzites striking at 156¼° along the drive and dipping 65° to the south-west. Quartz impregnations occur along a quartzite bed and for a short distance wholly replaces the latter to an average width of one foot. At 162 feet in adit a winze, 120 feet deep, is now waterlogged and inaccessible. Buckland's No. 1 reef is intersected at this point and a south-east drive on the footwall of the channel is now collapsed at 10 feet, where old stopes extend upwards to surface. The reef is exposed dipping 65° to the south-west at the intersection on north side of adit. It consists of solid quartz one foot six inches wide on footwall with quartz veins in slates over a width of one foot six inches on hanging wall side. The assay result of a sample taken across the solid quartz portion shows gold - nil, and silver - trace. The adit was driven another 96 feet and was discontinued before reaching the probable southerly extensions of Alpine reefs.

Undated and apparently inaccurate longitudinal sections of the mine are filed in the Mines Department. A composite section compiled from these is reproduced on Plate X11 herewith. The Section shows stoping on Buckland's No. 1 reef (one foot six inches to two feet in thickness) above adit drive on either side of the 110 feet shaft over a length of 84 feet. The stopes gradually diminish upwards and at surface are only 25 feet long. It should be noted that in the present survey the surface stopes measure 65 feet in length. The drive was continued beyond the stopes for a distance of 157 feet and short crosscuts put out on both sides without encountering payable quartz. The main winze, sunk at junction of adit with the drive, is shown to a depth of 120 feet. A level, 44 feet below adit, was driven 28 feet north-west and 57 feet south-east. The latter is connected by a winze with adit drive at 28 feet from main winze. At five feet below adit drive the gold diminished but another shoot of ore commenced at a depth of 32 feet. The greater part of the reef, two to six feet in width, was stoped to adit drive, but little stoping is shown below the 44 feet level. The stoping section illustrates the ore-shoot as pitching generally to the north-west.

A lower level was driven 98 feet to the north-west at a depth of 72 feet. At 62 feet along the level a rise goes up for 35 feet and at 75 feet a winze was sunk 41 feet.

Twelvetrees (8) records yields from 12 dwt. to over 1 oz. of gold per ton and an average of 18 dwt. per ton. for all quartz treated from the mine. J.C. Goodall, the first mine and battery manager, reported that for the twelve months ending 16th September, 1884 1319 tons of quartz were treated for a return of 1001 oz. 13 dwb. of gold. Later, under the managership of P. Irvine, 80 tons taken from the lower levels yielded 38 dwt. per ton.

No information is now available regarding the reef in bottom part of the workings, nor the reason for closing the mine. To test the reef under present economic conditions the first requisite would be to unwater the workings from main winze and thoroughly sample portions of the reef in unworked part of the mine.

Useful prospecting work would consist of driving another 10 feet from end of adit with the object of intersecting the possible southerly extension of Alpine Western Reef. Although Buckland No.1 reef appears to be barren at northern end in adit, exploration by driving along the channel to the north-west at that level might disclose another ore-shoot.

12. CARDINAL MINE: H.J. Buckland, Purchase, 320 acres.

This mine is situated 25 chains south along the spur from Buckland Mine, on the same freehold property.

Development was first carried out by Buckland Prospecting Association and later by Cardinal Prospecting Association in 1889-90.

The principal workings consist of three shafts on the reef spaced over a distance of 110 feet along a bearing of 334°. The northern and southern shafts are collapsed at 30 feet and 32 feet respectively. Central shaft which was probably the deepest (95) feet is now inaccessible. At 26 feet from surface in south shaft the reef dips steeply to the south-west and consists of broken quartz over a width of one foot three inches. A sample taken across the reef at this point have an assay result of Gold - 2 dwt. 2 grs. and Silver - 13 grs. From six to nine inches of quartz are visible below collar of central shaft and in a pit 20 feet farther north the reef is exposed over a width of two feet. At 30 feet in north shaft the lode channel dips at 73° to the south-west and contains nine to fourteen inches of solid quartz on hanging wall and quartz veins in slates over a width of three feet on footwall side. A sample taken across a width of four feet was assayed and the result showed Gold - 3 dwt. 10 grs. and Silver - 1 dwt. 20 grs. Stopping has been carried almost to surface between the various shafts.

Montgomery (9) reports that the main shaft was sunk 24 feet from where a drive extended north-west on gold bearing quartz for 34 feet. Fifty tons of quartz taken from that locality yielded 41 oz. 10 dwt. of gold valued at £156/12/3. The shaft continued to 74 feet and a north-west-erly drive opened out for 10 feet. The reef was solid and

(8) Twelvetrees, W.H. The Mangana Goldfield, Geo.Sur.Bull. No.1 1907 - p.29.

values proved to be regular down to 35 feet, but became broken and patchy below. Sinking was resumed to 95 feet on unpayable quartz and the reef proved to be solid in bottom of shaft. A shaft 35 feet farther north was sunk to a depth of 42 feet.

Twelvetrees (10) records the raising of 167 tons from stopes 50 feet from surface which yielded 13 dwt. of gold per ton. Tributaries later treated 20 tons of quartz recovered from a dump at the shaft which yielded 8 dwt. of gold per ton.

Cardinal reef has been traced in trenches for 160 feet south of the mine. To the north the vein appears to split into two branches which gradually diverge. The east branch is intersected by trenches at intervals over a length of 12 chains and varies in width from eight inches to two feet. West branch varies in width from one foot six inches to two feet nine inches of solid quartz and is exposed in several trenches along a distance of seven chains. At 35 feet west of northern end of east branch Goodall No. 1 reef, striking on a parallel course, is exposed over a length of 320 feet in shallow shafts, trenches and an open cut. It dips to the west at angles between 60° and 75° and varies in width from two feet six inches to nine feet of solid quartz. About 50 feet east of northern part of Goodall No. 1 another quartz reef, varying from nine inches to 6 feet 6 inches in width, is exposed in a shallow shaft and three trenches. It dips to the west at 70° and strikes on a bearing of 350° along a length of 277 feet. At south end of the latter and slightly to the east two shallow shafts have been sunk on a quartz vein one foot six inches to three feet in width and coursing on a bearing of 328°. Ore shoots have not been disclosed in this group of veins and the gold content near the surface has been considered too low to warrant further development.

13. RICHARDSON'S CREEK MINE: Section 10848/M - 5 acres.

This mine is located 20 chains west of Buckland Mine on the western fall of Alpine Hill to Richardson's Creek.

Access is gained by means of a cart track deviating from Tower Hill road at one mile north-west of Mangana and following the south bank of Richardson's Creek.

Gold bearing veins were discovered by Cheshire in 1930 and a limited amount of surface prospecting was done. These workings were examined by P.B. Nye, Government Geologist, in October, 1930 who furnished a report under the title of "Cheshire Prospect at Richardson's Gully, Mangana". In 1931 Mineral Lease No. 10848/M of 5 acres was granted to C.A. Brock who undertook further development in the form of an adit crosscut and short drives on the reef at south end. In the following year K.J. Finucane, Field Geologist, examined the mine and furnished a report under the heading of "Brock Bros. Mine at Richardson's Creek - Mangana". The section was transferred to W.T. Gough and R.J. Cunningham in 1935 but no further development occurred and the lease was cancelled in 1936.

(9) Montgomery, A. Report on Some Portions of Mangana Goldfield, 1894, p. 3.

(10) Twelvetrees, W.H. The Mangana Goldfield 1907, p. 28.

A plan of the workings appears on Plate X1 herewith and as Finucane's description covers the latest workings no further reference to them will be made here.

14. SPECIMEN HILL WORKINGS:

Specimen Hill is a low meridional trending ridge rising to the west of, and 200 feet above, Mangana township.

Several old workings occur on various quartz veins and lodes extending along a north-south zone over a length of 40 chains. Underground workings are inaccessible and surface works are caved to a large extent.

A survey plan of the workings is included herewith on Plate X111.

199 acres, 3 roods, 17 perches. B.W. Oliver, Purchaser

Trilby shaft occurs one chain west of the eastern boundary of this property and two chains north-west of Mangana - Storey's Creek road. It was originally 50 feet deep but is now filled to within eight feet of surface. The shaft was cleaned out in 1933 but no defined lode was found. A little quartz is showing on the slate spoil dump about the opening. North-west of the shaft seven shallow trenches occur a distance of 290 feet and show a little loose quartz on the dumps.

19 acres, 3 roods, 38 perches. W. Robertson, Purchaser

On north side of the south-east boundary a line of trenches and pits extends northerly over a length of 130 feet with quartz showing on the spoil dumps. Goddall's vertical shaft 49 feet deep, sunk in 1891, is situated about the centre of these workings and 18 feet west of the line. This shaft is now caved at 14 feet from surface but exposes one foot six inches to two feet of broken quartz extending downwards. At 19 feet south-west of Goodall's shaft a flat spur of quartz, one foot six inches in width has been opened up in a small open cut.

Near the north-west corner of the block Brennan's adit was driven in 1899 from a gully on west side of the ridge. It extends on a bearing of $61\frac{1}{2}^{\circ}$ for a distance of 320 feet in slates and quartzites. The rocks have a regular strike of 338° and dip to the west at 80° . The objective of this adit is not clear at the present time but it is directed towards a lode near north-east boundary of the property, 1100 feet from the portal. This lode extends northerly from a caved shaft through collapsed ground over a length of 70 feet and is again cut in a trench another 30 feet north. An irregular body of quartz from nine inches to two feet six inches in width is poorly exposed in these workings. At 90 feet south of shaft and 20 feet lower a collapsed adit is seen to be directed towards the shaft. Quartz tips leading from the old portal indicate that the reef was driven on for a considerable distance. A representative sample taken from the dumps was assayed and the result showed - Gold, nil Silver, trace. At 70 feet west of the shaft another shaft was sunk vertically with the apparent object of intersecting the lode on the dip. This is now collapsed but a large slate dump about the collar exhibits no intermixed quartz, so the reef was evidently not found.

20 acres, W. Robertson, Purchaser

In the north-east angle of this lot Corbett's shaft was sunk, about 1888, to a vertical depth of 130 feet in slate. Several gold bearing veinlets were cut in the shaft. An easterly cross-cut was driven from bottom without intersecting anything of value. From the shaft two lines of caved shafts and trenches extend over 245 feet north-north-westerly. The position of broken quartz on the dumps indicates the presence of two parallel lodes about 30 feet apart. Specimens of gold bearing quartz are said to have been obtained from the surface workings and several tons of mixed quartz and slate yielded gold at the rate of 5 dwt. per ton when crushed.

- 15. OTWAY'S CREEK MINE: 199 ac. 3 roods, 9 perches.
M.E. Hall, Purchaser and Section
1004/93M - 10 acres.

This mine is situated on north bank of Otway's Creek in the eastern part of Section 1004/93M. The property was held under mineral lease by J. Gatty in 1887 and again in 1897 by J. McKenzie.

The workings are shown on Plate X1V herewith.

Two north-west trending lodes are exposed at surface. They traverse a narrow belt of slates exposed along the bottom slopes of Otway's Creek valley where the stream has corroded its way through a sill of Upper Mesozoic dolerite and revealed the underlying rocks.

The northern lode crosses eastern boundary of the section at 12½ chains from south-east corner. It is exposed over widths varying from 9 inches to two feet in two trenches and a pit at intervals over a length of 165 feet.

Southern lode is situated 140 feet to the south-west. At the south-east end an open-cut exposed solid quartz over a width of 22 feet dipping to the north-east. Further outcrops and trench openings over a distance of 300 feet along the strike, bearing 294°, show the lode varying in width from a few inches to 12 feet. In a trench about the centre nine inches of quartz are exposed with dip to the south-west at 63°.

Underground workings consist of an adit crosscut, the approach of which commences at 200 feet west of the south-west angle of Section 1005/93G. The adit courses at 357° for 54 feet. At 52 feet a crosscut bearing 60° for 16 feet exposes irregular veins and bunches of quartz in the end. The adit then turns to 340½° for 40 feet six inches after which it deviates on a bearing of 50° for a distance of 21 feet. At this point drives extend north-westerly for 23 feet and south-easterly for five feet. A quartz vein, nine inches in width, together with several small leaders are exposed in the face of the latter. At commencement of north-west drive a winze was sunk to a depth of seven feet on an irregular body of white, vitreous quartz, pitching to the south-east and varying in width of nine inches to two feet six inches. The adit continues in slates for a further distance of 34 feet to the north-east.

It is reported that a parcel of quartz from this mine was crushed and yielded only a small button of gold.

V111 CONCLUSIONS:

The principal reefs of Mangana Goldfield were among the earliest to be operated in the State. Although several minor discoveries have been made in later years and prospecting continued up to the last decade, mining is quiescent at the present time.

The known portion of the reefs appear to have been well tested and the ore shoots worked to various depths down to 200 feet from surface. The greatest depth attained in testing was 819 feet at Mangana Gold Reefs mine, but the lode was found to be unpayable below 200 feet, this depth evidently coinciding with the lower part of a secondary enriched zone. In practically every instance the other lodes of the field have been prospected below enrichments near the surface and proved the underlying primary zone to be low in gold. Probable exceptions to the latter are Buckland and Alpine reefs, the lower workings of which little is known to-day. Suggestions have been made in the text for further testing of these reefs.

Subsequent development of the field depends to a large extent on the disclosure of new lodes. In this regard the geological mapping of the district has been unsuccessful in exhibiting marked structural features which might aid in future prospecting for other reefs. However, the majority of the known lodes occur in north west - south east trending zones roughly parallel with the strike of the former and it is within these zones and any extensions that discoveries may be anticipated. This specially applies to the north-western extension of principal zone between Fingal and Tower Hill Freehold reefs. In this zone also search should be made for the probable south-easterly prolongation of Mangana Gold Reefs on the hill to the south of Sailor's Gully and other likely reefs in that locality. A north-western extension of Specimen Hill zone towards Major's Hill might also be expected.

In consideration of any future mining development the probability of secondary enrichments near the surface, associated with paucity of gold at shallow depths, should not be overlooked.

With reference to alluvial deposits legitimate prospecting consists of testing the gravels etc. underlying the plains to the south of Mangana and also the remaining gold bearing ground in Major's Gully by systematic boring and/or shaft sinking.

F. BLAKE
ACTING GOVERNMENT GEOLOGIST.

Mines Department,
HOBART.

28th July, 1939.