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TASMANIA

REPORT

OF THE

SECRETARY FOR MINES

FOR

YEAR ENDING DECEMBER 31

1907

Including Reports of the Inspectors of Mines, Government
Geologist, Mount Cameron Water-Race
Board, &c.



Tasmania:

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TABLE OF CONTENTS.

	PAGE
Annual Report of the Secretary for Mines	1
Diamond-drills: Statement of Work done	36
Gold won	38
Coal: Quantity raised, Value	39
Tin: Statement of Export and Production	40
Silver Ore: Quantity and Value	41
Copper, Blister: "	42
Copper Matte: "	42
Copper Ore: "	43
Iron Ore: "	43
Asbestos: "	44
Wolfram: "	44
Bismuth: "	45
Silver-Lead and Copper Ore smelted	45
Persons engaged in Mining: Average Number of	46
Land applied for: Total Area	46
Leases issued	47
Miners Employed: Average Number of	48
Leases in Force	48
Leases in Force: No. of, for various Minerals	49
Mining Companies Registered	50
Total Revenue	50
Dividends paid	50
Quantity and Value of Minerals raised since 1880	51
Net Revenue: Comparative Statement	52
Report of the Mt. Cameron Water-race Board	53
Mining Managers' Examination Papers	55
Certificates of Competency granted by the Board of Examiners	59
Annual Report of the Government Geologist	62
Annual Report of the Assistant Government Geologist	68
Annual Report of the Chief Inspector of Mines	70
Table showing rate per 1000 killed and injured for Year 1907	72
Analysis of Statistics for the Western Division	73
Table showing number of persons killed and injured for the Year 1907	74
Mining Accidents, 1892, to 31st December, 1907	76
Annual Reports of the Inspectors of Mines	77
Geology of Tasmania	100
Enstatite-Augite Bearing Diabase from Tasmania	107

GEOLOGICAL REPORTS, &c.

	PAGE
Report on Bell Mount and Middlesex	i
Shepherd and Murphy Mine	x
All Nations Wolfram Mine	xv
Iris Claim	xx
Section 1037-M, E. W. Clarke... ..	xxi
Section 970-93G, Packett	xxi
Section 1442-93G	xxii
Black's Workings	xxii
Narrawa P.A. Reward Section, 35-93G	xxiii
Bell Mount Gold Diggings	xxiv
Great Caledonian Mine	xxv
Devon Mine	xxvi
Note by Mr. W. F. Petterd on Examination of Altered Spodumene from the Shepherd and Mur- phy Mine	xxxj
Report on Gold at Port Cygnet and Wheatley's Bay, Huon River	xxxiii
Petchey's Bay Gold Mining Syndicate	xxxiv
Lymington Mine	xxxvii
Mt. Mary Mine	xxxviii
Livingstone Mine	xxxix
Report on Mangana Goldfield	xlv
Mangana Gold Reefs Mine	liv
Golden Entrance Mine	lxv
Alpine, Buckland, and Cardinal Mines	lxviii
Tower Hill Mine	lxxi
Fingal Company's Mine	lxxii
Union Jack Mine	lxxii
Pincher Reef	lxxiii
Specimen Hill	lxxiii
Alluvial at Mangana generally	lxxv
Report on Mathinna Goldfield, Part II.	lxxvii
Scott and Pickett G.M. Co., N.L.	lxxx
Commercial Reef	lxxxiii
Pride of the Hills Reef	lxxxiii
O'Brien's Reef	lxxxiv

PLATES.

Mangana Reefs' Shaft	lvi
Mangana Battery	lvii



REPORT OF THE SECRETARY FOR MINES.

Mines Department,
Hobart, 18th May, 1908.

SIR,

I HAVE the honour to submit my Report upon the Mines Department and the Mining Industry for the year ending 31st December, 1907.

GENERAL REMARKS.

The aggregate value of the minerals and metals raised during the year was £2,777,150, the highest yet attained; being an increase of £20,012 on the value of the output for the preceding year. During the first half of the year the market prices for tin, silver, and copper were fairly high. At the beginning of the year tin was quoted at £192 10s. per ton; it reached £200 on the 3rd July, and receded to £125 10s. at the end of the year. The average price (taken from the Mt. Bischoff Company's weekly London advices) was £175 8s.

Silver started at 2s. 7 $\frac{1}{2}$ d. per oz., and with small variations retained its value until October, when it averaged 2s. 4 $\frac{1}{2}$ d. for that month, falling back to 2s. 1 $\frac{1}{4}$ d.; giving an average for the year of 2s. 6 $\frac{183}{1000}$ d.

For the month of January, copper averaged £106 17s. 1d. per ton, falling back to £98 13s. 6d. for April, and continuing gradually to fall in price until averaging only £60 0s. 1d. for December; the average for the year being £87 1s. 5 $\frac{3}{4}$ d.

The number of leases issued during the year was 892, embracing an area of 31,255 acres; as against 730 leases, of 19,912 acres, during the previous year. The total area held under lease on the 31st December was 77,610 acres.

In my last Report I drew attention to the desirableness of increasing the vote for tracks to mining fields, and I was very pleased to notice that the amount on the Public Works Schedule for 1907-8 had been considerably increased; the amounts being—Roads, £6850; Tracks, £3100; and Bridges, £170; a total of £10,120.

Many of the existing tracks require cleaning out again, especially the Harris Reward, Jukes Proprietary, Linda Valley to King William Range, and the track between Queenstown and Mt. Read. The intervening country between Queenstown and Zeehan is worthy of some attention being paid to it, in the way of tracks for facilitating prospecting.

The industry is a most important one, and should be fostered and encouraged in every possible legitimate manner. The opening-up of tracks is of little value to prospectors if they are not kept clear and open.

It has been pointed out that in the wilder parts of the West Coast it would pay the Government to establish nuclei. If a prospector takes a horse out with him he has to carry horse feed as well as provisions, and consequently can only carry sufficient supplies for a few days, and when they are running out he has to return again to replenish them. A great deal of valuable time is thus spent in travelling, and men become disheartened and give up in despair. If small areas were burnt out during the summer and laid down in grass seeds they would be of immense assistance to the prospector, who would then be certain of obtaining horse feed, and could use the horse for packing out his kit and provisions.

A number of suspension bridges and cages have been erected over some of the deep gorges and rivers on the West Coast by the Public Works Department, under the

supervision of Mr. James Harrison, Inspector of Mines, and these have proved of great benefit to prospectors.

Applications for reward claims, for an aggregate area of 400 acres of land, have been lodged for the discovery of manganese, zinc-lead, nickel, copper, and scheelite, in new localities. The lastnamed mineral has been discovered on the south coast of King Island. The lode is stated to be from 12 to 20 feet wide, the walls well defined, and there are 200 feet of backs. There is a plentiful supply of water and wood, and a good shipping port within half a mile.

The lode is said to carry, in addition to scheelite, considerable quantities of molybdenite, bismuth, and tantalite. A bulk assay of the ore, made at the British Flag Company's plant, on the Fraser River, has proved that 80 per cent. of the ore contents can be saved in treatment. The Government Geologist will probably visit the island in September, when an extensive examination of this, and other deposits, will be made and reported upon.

The demand for the Geologist's services has been found to increase to an extent that renders it impossible to meet the requirements of applicants, who are legitimately entitled to satisfaction. Outside his geological work, he, as Chief Inspector of Mines, together with the inspectors, has official care of the mines of the State, and his duties in this connection necessarily make inroads on his time. Consequent on the recent remarkable expansion of mining, a state of things has arisen under which geological examinations in various parts of the island have left no time for inspections in the more important districts of the Western Mineral Division. The Department found itself obliged to take into consideration the matter of reviving the appointment of an assistant, a post which has been vacant since the retirement of its last occupant, in 1904. A direct request to the same effect was also received from the West Coast, and it was recognised that the time had arrived for terminating a state of things which was unjust to the

growing industry. Accordingly, the appointment of an Assistant Government Geologist has been made, and it is believed that in Mr. Leonard Keith Ward, B.A., B.E., a brilliant graduate of the Sydney University, a choice has been made which will redound to the credit of the State.

It is desired to mark the importance of this new departure, and to impress it with the stamp of permanency by giving to the geological branch the title of Geological Survey. The intention is to commence making systematic geological surveys of the mining fields, one by one, and issuing maps of same and reports thereon, as the work progresses. An effort is being made to issue the geological publications in an improved style, and in a form which will correspond with the increased requirements of the important industry to which they relate.

Since his appointment, Mr. Ward has furnished geological reports on the Mt. Farrell field, and the western portion of the country traversed by the Great Western Railway survey route from Linda Valley to Mt. King William.

Mr. Ward will proceed to the West Coast about the end of June, and will be engaged for some months making a geological examination of the country and mines in the North-East Dundas district, in continuation of the work the late Assistant Geologist (Mr. G. A. Waller) was engaged in about four years ago.

Upon a recent visit to Zeehan my attention was directed to the desirability of more frequent visits to the West Coast being made by the Government Geologist, and to the advisability of stationing the Assistant Government Geologist permanently at Zeehan.

Since Mr. Waller retired from the service there have been so many demands upon the time of the Government Geologist that it has not been possible for him to give any attention to the West Coast, but now that he has an assistant, he will probably be able to make periodical visits to the more important centres.

Mr. Ward is already devoting all his time to West Coast work. The mere fact of his taking the train from Launceston, instead of Zeehan, does not affect his work in the least. There are many good reasons why he should return to headquarters to write his reports and prepare his geological plans, assays, analyses, &c., all of which were discussed and fully considered before Mr. Ward was appointed.

APPENDICES.

Appended will be found the following Reports:—

Annual Report of the Mount Cameron Water-race Board.

Report of the Government Geologist.

Report of the Assistant Government Geologist.

Report of the Chief Inspector of Mines.

Reports of the Inspectors of Mines.

The Government Geologist's Reports on:—

Mathinna. (Part III.)

Mangana.

Port Cygnet.

Bell Mount.

A Paper by W. H. Twelvetrees, on the Geology of Tasmania.

A Paper by A. Osann, on an Enstatite Augite-bearing diabase from Tasmania.

GOLD-MINING.

The total quantity of gold won during the year was 65,354·252 fine ounces, valued at £277,607, being an increase of 5330·855 ounces, and £22,644, on the previous year.

A quantity of gold has been obtained in the tin drifts on the North-East Coast, particulars of which will be found in another part of this Report, under the heading of "Bucket Dredging."

Beaconsfield.—The yield from this district was 35,820½ fine ounces gold.

The Tasmania Gold Mine has been the principal producer, with 32,401 ounces of gold. The total quantity of gold won from the mine is 670,893 ounces. Owing to the mine being flooded last year it became necessary to construct very extensive protection works at Blythe Creek, and 3500 feet of fluming, 28 feet high, were erected, giving a further waterway above the level of the fluming 40 feet wide. The sinking of Grubb's shaft was continued to a depth of 1311½ feet.

During the last quarter of the year the company purchased the North Tasmania Mine; the ventilation was improved, and prospecting operations at the 400-feet level were started.

The East Tasmania Company has been, by means of the diamond drill, trying to locate on its property the continuation of the Tasmania Company's reef.

Lefroy.—The New Pinafore Gold Mining Company is now turning its attention to prospecting the deep lead, with a view to working the alluvial. Two thousand pounds has been provided by Parliament for the purpose of assisting the company, on the pound for pound principle—(a) in sinking the existing main shaft on Section 380-873 below its present depth of 1200 feet vertically from the natural surface of its mine; or (b) for opening up or exploring the lodes below the said depth of 1200 feet, and in otherwise prospecting and developing the mine below that depth; or (c) exploiting or developing the deep lead at Lefroy by driving either from the shaft known as the East Pinafore shaft, on Section 155-g, or other convenient shaft, at a depth of 340 feet or more; and at such depth in proving such lead by rising, boring, cuddying, cross-cutting, driving, or sinking, or other mining operations.

The quantity of gold won from this field was 818¼ ounces.

A little alluvial prospecting is being carried on by small parties. Operations have been principally confined to shallow workings and cyaniding the old tailings from the New Pinafore Mine.

The Government Geologist furnishes the following Report on the country between Lefroy and Back Creek:—

There is a stretch of country forming the divide between the Lefroy basin and Back Creek which has been hardly prospected at all, though it is intersected by numerous quartz reefs and ironstone formations. It is in the southern part of the broken hill range, which abuts on the sea-coast at Black Rock and 14-mile Bluff, and is, in a direct line, 7 miles from the shore-line.

It is not more than 3 miles north-east of Lefroy, and extends really to Back Creek, which makes it unaccountable why the stream of prospectors flowing to and from those centres has never been arrested midway by this rather inviting area. Its geology is comparatively simple, as the country consists of slate, sandstone, and quartzite, referred in Tasmania to the Ordovician system. The strike of the strata is about N. 30° W., with a general dip to the S.W. In the Back Creek basin these are overlaid by Tertiary basalt and infra-basaltic auriferous drifts of middle Tertiary age. No intrusive igneous rock appears in the district. The nearest signs of granite are boulders and stones of this rock, which may be seen in alluvial ground on the east side of Slaty Creek, above the bridge on the George Town-road, and a little further along the road towards George Town, where a little prospecting was done a few years ago, under the impression that the occurrence was a granite outcrop. Similar stones are seen near the Volunteer, south of Lefroy, and Mr. Richards, of George Town, informed me that he has recently discovered some solid granite, a few miles N.E. of George Town, on the iron ore reward claim. It is probable that these boulders mark the line of underlying granite, though the

fact that the stones which are found are of different varieties of granite makes one hesitate.

The reefs throughout the area under review observe, for the most part, a strike corresponding with that of the Lefroy lodes, namely, approximately, east and west, or a little north of east and south of west; only when they follow the planes of the country do they assume directions nearer to north. The reefs, therefore, form a series north of and parallel with the Lefroy reefs. There is another set of reefs in the district which conform in direction with the north-westerly strike of the strata. Many of these reefs are formations of clayey iron oxide or slaty gossan, sometimes carrying inter-laminated quartz. They apparently occupy the place once occupied by the country rock, afterwards penetrated and replaced by pyrites, bearing silica, and finally becoming what they now are by oxidation of the pyrites. Such formations frequently carry free gold, which has been probably released from the pyrites. They have not been followed down by mining works sufficiently deep to trace their change into normal quartz reefs in depth, but there is no reason to doubt that this change takes place. What is their exact connection with the ordinary quartz reefs of the district is difficult to say until more is learned of their occurrence and behaviour. Mr. Alex. Montgomery, a former Government Geologist, considered that they had no connection with the auriferous series of lodes. Since, then, however, gold has been found in them. From an occurrence at W. G. Barker's show, where a normal quartz reef impinges on one of these iron-stone lodes, I am inclined to think that the latter type is of slightly earlier date than the ordinary quartz series.

In this district, and apart from the Back Creek field, where three or four parties are working, three parties are carrying on work at present, which may be described as of a prospecting nature.

Messrs. Hart, Gaunt, and Barker, are sinking to prove an ironstone reef on one of their three 20-acre prospecting

claims. Mr. Ignatius O'Keeffe is prospecting quartz reefs south of Mr. W. Barrow's farm, and Mr. Barrow is proving a quartz reef south of the track to Back Creek. This is all the work going on over an area of several miles of country.

Hart, Gaunt, and Barker's Sections (H. No. 1 Mine).— In about the middle of the central section, in February last, Mr. W. G. Barker made a gold discovery at the contact of a quartz reef, striking N. 75° E., and dipping N. W., with an ironstone or gossan formation striking N. 30° W., and dipping S.W. The quartz reef has been cut across at surface by 13 trenches and excavations in a distance of 340 feet. Its width varies from a track to a couple of feet. No gold has been found in this reef apart from the contact occurrence. At the north-east end of the line of trenches the sinuous strike of the country slate and of the gossan formation mentioned above brings the latter again into contact with the line of the quartz reef. An assay of the gossan has given 2 dwts. per ton.

A small shaft, 14 feet deep, was sunk at the other end of this line where the gold was first found, as much as 3 ozs. per ton, and the reef was driven on both ways for 28 feet without finding gold. Its width was 1 foot. Twenty feet west another shaft was sunk (the 36-foot shaft), and openings were made at 10 feet, 19 feet, and 36 feet. At 10 feet a connection was made with drive from the 14-foot shaft. In the roof of the level the footwall of the quartz reef, dipping W., is shown, abutting on the footwall of the gossan formation dipping S. Specimens of gold were obtained from this drive close to the contact of the iron and quartz. Small leaders of quartz penetrate the gossan, and the latter then yields good prospects of gold. The quartz reef is not seen for 12 or 14 feet in this drive, which has been extended west from the shaft for 26 feet. At the 19-foot a crosscut has been opened for 24 feet, cutting through the gossan, which widens from a few

inches to a foot. The country is softer for a foot above and below the flat gossan, consisting of reddish, streaky slate. The gossan dips at a low angle, 30° . An assay has returned 2 dwts. 16 grs. per ton. At the 36-feet level has been driven east and west (253°) 17 feet E. and 49 feet W. along the course of the quartz reef. The east drive shows the reef in end 1 foot wide, but barren. The slate country in the drive strikes N. 30° W. The reef in the west drive is followed on the south side, but towards the end appears to have broken, and to have been recovered only in the north arm of a "T" crosscut at the end of the level. No gold having been met with in this level there does not seem to be much encouragement for continuing work on the quartz reef.

A couple of chains to the south-east of this shaft is an excavation called the central shaft, which has been sunk partly on the underlay of the gossan lode for 11 feet, and a drive then opened out for 17 feet under the flat gossan. The gossan here is barren, or yielding only a trace of gold. A main shaft is now being sunk 36 feet to the south of the 36-feet shaft, and has now reached a depth of 80 feet. It has passed through the gossan reef, and is being continued to below ground water-level, when a crosscut will be opened out and the reef proved. Where passed through in the shaft at 35 feet down the gossan shows only traces of gold by assay, but in depth it is hoped that the iron oxide will have been replaced by gold-bearing quartz. At any rate, this is the best way of ascertaining what these ferruginous formations really are below the superficial zone of alteration. The ironstone channel is underlaying away from the quartz reef as it descends, and there can be no further junctions of the two. The latter will probably continue on its course for an indefinite distance; but the former is the reef which has to be proved at this mine, and only continued work can show at what depth an alteration in the filling will take place.

W. C. Barrow's Shaft.—This is on a reef about $\frac{1}{4}$ -mile north-east of the farm about 2 feet wide and striking N. 80° E., with a southerly dip. It has been trenched upon in four places east of the shaft, but some of the trenches have not been deep enough. The shaft is sunk on the reef to a depth of 20 feet. The stone is white quartz, with some impregnations of finely-divided galena. This is one of the few reefs in the district which are mineralised, but the location in it of any gold shoot would be purely speculative work, though the presence of galena is an indication that it is auriferous at some point in its course.

O'Keeffe's Section.—Mr. Ignatius O'Keeffe has uncovered an ironstone reef south of Barrow's farm, striking 303° , and has prospected about on surrounding formations, of which there are several.

Back Creek.—This district is one of the alluvial leads which were at one time worked by a large number of men, and are estimated to have yielded between 9000 and 10,000 ozs. gold. Spurs running in a south-easterly direction carry down alluvial drift in lines known as Old Lead, Red Lead, White Lead, into the Back Creek basin. The two latter leads, at their eastern terminations, plunge beneath a Tertiary basaltic lava sheet. These leads, which are mostly on the hill slopes, therefore belong to a time prior to the flows of lava, when their present channels were the bottom of their respective valleys. The White Lead is the most northerly of the three, and is about $\frac{1}{4}$ -mile long by a couple of chains in width. The white clay of the wash has given the lead its name. Parry and Birkett's claim comprised perhaps the richest ground. The wash consists of sandy clay, white vein quartz, and ironstone. The ground has been worked over and over again. Its depth is from 2 to 7 feet.

Gilham's shaft is at the head of the White Lead. A small shaft has been sunk here recently to a depth of

10 feet, and a short drive has been put in for 17 feet south, cutting a reef with a south-east strike and a north-east dip, but the level is too shallow and the stone too poor to claim much attention.

North of the above is Gilham's reef near the top of the spur, and 70 feet above the gully. A reef of kindly-looking quartz 2 feet wide has been cut through. It strikes N.W. and dips S.W. The stone is iron-stained, but barren. It was worked some years ago. This side of the spur has not received much attention, but it has no doubt shed some of the gold found in the lead.

The Red Lead is so called from the ferruginous nature of its wash; is three times the length of the White Lead, and is separated from it by a low spur. The drift is often a red cemented sand, 17 or 18 feet deep. A great number of diggers' holes exist everywhere, generally 12 or 13 feet deep. William Birkett has some alluvial workings in it, and is now attempting to drain the flat. Both above and below his workings is dirt valued at 1 oz. to $1\frac{1}{2}$ oz., but nothing could be done here owing to the water. Further north, Easther and Gibbons are working the furthest claim on this lead, which runs up against the dividing saddle at the Franklin Mine.

On the north side of the saddle is the old Australasian slate quarry, and on this side, too, there is deep ground, 25 to 30 feet deep.

There is nothing in any of the reefs hitherto discovered at Back Creek to lead one to suppose that they were the source of all the gold obtained from the leads. The principal source has still to be discovered. There has been a good deal of prospecting from first to last, and it is surprising that some valuable reefs have not been found, especially as the angular character of much of the gold and quartz shows that the auriferous stone and gold have not travelled far. It may be that future prospecting work will be more successful. One thing is certain, viz., that

careful and intelligent prospecting cannot fail to throw light on the subject.

Mathinna.—The New Golden Gate Company has been sinking below the 1800-foot level and prospecting the reefs below that depth. The company crushed 2042 tons of quartz, from which it obtained 2392 ounces of gold, employing an average of 45 men. The total quantity of quartz obtained from the mine is 271,348 tons, which has yielded 227,417 ounces of gold. The total amount paid in dividends is £355,200, or £11 2s. per share; and the total amount paid for Dividend Tax is £16,638 10s.

The Tasmanian Consols Company has been reconstructing its concentrating works, constructing a haulage line from the shaft to the battery, and making other surface improvements.

Golden Horseshoe.—This mine is situate at about $1\frac{1}{2}$ mile from Mathinna, on a hill bounded by the junction of the South Esk River and Dan's Rivulet. A temporary main shaft has been sunk 65 feet, and it is expected to pass through the lode at 100 feet. This lode is gold-bearing on the surface. A prospecting shaft has been sunk on gold-bearing stone to a depth of 80 feet, but the country passed through is very much disturbed, and the gold-bearing stone is small. The company has purchased a 10-head battery within easy access of the workings. This battery is run by a turbine capable of giving 10 to 12 horsepower, supplied by a water-race $2\frac{1}{2}$ miles in length.

Lisle and Golconda.—Two hundred and nine ounces of gold have been won from these fields by alluvial mining, 17 men having been employed.

Lyndhurst.—Early last year interest was revived in this field through a number of sections having been taken up, which have since been forfeited. The Lyndhurst Company is prospecting the old Southern Cross Mine.

West Coast.—Very little gold is now obtained by alluvial miners on the West Coast. Many of the old hands have left the fields, and there appears to be little inducement for younger men to take up the work of the old pioneers.

Port Cygnet and Petchey's Bay.—Attention has been paid again to deposits of gold in this district. The alkaline porphyries have intruded into the Permo-Carboniferous strata here, and the quartz and altered rock at the junction between the two carry gold at various points. Some of this has been shed into the creeks and flats, and a good deal has been recovered at different times. As far as is known, about 3000 ozs. have been won altogether.

The Petchey's Bay Gold Mining Syndicate has lately bored the shores of the Huon River at Wheatley's and Kube's bays. Coarse gold was obtained from the former, and very heavy gold has been got from Riseley's Creek. The syndicate intends thoroughly testing these bays and the bay at Lymington before starting with a dredge. A certain quantity of gold is sure to be present, but those interested in the venture should assure themselves that there is scope enough for a dredge before making a commencement.

At Mt. Mary, near Port Cygnet, a working party has sunk a shaft 73 feet, and driven 6 feet on a siliceous formation at the bottom, not far from the porphyry junction. Samples from the face have been assayed in the Government Laboratory by the Analyst, Mr. W. F. Ward, but only a trace of gold was detected in them. On the other hand, a small piece of reddish contact rock from the trench at surface, which showed specks of gold, assayed 3 ozs. 4 dwts. gold and 2 dwts. 12 grs. silver per ton.

On Mt. Livingstone a shaft has been sunk about 60 feet on porphyry banded with quartz, carrying small quantities of galena, blende, and arsenopyrite, but samples

taken from the heap and selected from the most likely-looking stone yielded only a minute trace of gold. None of the reef matter in these occurrences round Port Cygnet has ever been found to contain gold in payable quantity. The quartz appears to be a contact development, and sweals and disappears alternately. The brecciated line of country along the contact has undoubtedly shed the gold which has been won from the alluvium. The latter has been derived from the slow waste of the hills, and as it does not carry gold in large quantities, it may be assumed that the reefs or formations exposed are not rich. The occurrences of gold may be looked upon as irregular, and likely to be payable only when some unusually rich shoot is struck. The chance of finding these pay-shoots may be regarded as a matter of prospectors' luck. The most that a geological examination of the ground can do is to point out the lines along which search may be most usefully made.

SILVER-LEAD MINING.

The quantity of silver-lead ore produced was 89,762½ tons, valued at £572,560, being an increase in quantity and value of 2644½ tons, and £110,117, on last year.

The silver-lead mines on the West Coast are now well established, and are producing regular outputs. The principal producing mines are the Mt. Zeehan (Tas.), Zeehan-Montana, Zeehan-Western, Florence, Oonah, Silver Queen Extended, South Comstock, &c.; and at Mount Dundas, Comet, West Comet, and Hercules.

Zeehan District.—During last session of Parliament a sum of £3000 was voted for the purpose of assisting the Zeehan-Western, Limited, on the pound for pound principle, for the purpose of sinking its shaft and opening and exploring below the 800-feet level. The shaft is the deepest on the Zeehan field, and it is hoped that operations below that depth will result in proving the continuance

of the rich lodes which exist at shallower levels in the mine, and thus inspire confidence in other mines on the field by establishing the existence of lodes at a depth.

At the Florence Mine there has been very decided improvement. A new lode has been opened up, which has given good returns to the company and the tributers.

At the Colonel North Mine (Grubb's) the machinery is receiving a thorough overhaul; when this is completed the mine is to be unwatered.

At the Victoria Zeehan Mine work has been confined to sinking the main shaft, which is now down to a depth of 180 feet.

Operations at the lower levels of the Oonah Mine have been suspended pending the erection of a plant to treat large bodies of stannite ore which have been opened up.

At the Comet Bell Mine the main shaft has been put down for another level, and driving for the lode has been started. Several parties of tributers are working between No. 2 level and the surface with satisfactory results.

Sunrise Company to the south of the Comet Bell Mine, has erected a large water-wheel, and will resume mining operations when this is completed.

Dundas District.—The Comet Mine is being worked on tribute.

The West Comet is sending out large quantities of fluxing ores to the smelters at Zeehan.

The Adelaide Mine, after having been shut down for some years, has been taken up by a strong English company, and a pumping and winding plant has been erected. The main shaft is being repaired.

Mt. Read District.—The Hercules Mine is maintaining a steady output of sulphide ore, and developments of a favourable character have taken place in No. 4 workings.

Prospecting, by means of a diamond-drill, has been carried on for some time north of the Hercules Mine, but no satisfactory result has yet been attained.

Rosebery District.—The Tasmanian Copper Company has been forwarding about 1000 tons of ore per month to the Zeehan smelters.

The Colebrook Company is completing the erection of its smelting furnace for the treatment of its own ore and that of other mines in the vicinity.

Mt. Farrell District.—The North Mt. Farrell Company has completed its water-power scheme, and has started the construction of a steam tramway (in lieu of the wooden tramway) to the Emu Bay Railway-line. It is roughly estimated that the company has 60,000 tons of ore opened up and ready for stoping.

The other mines in this district, viz., the Mt. Farrell, McIntosh Tribute, and Tullah, are all working with very encouraging prospects, and there is every confidence of a bright and prosperous future for this field.

Mr. L. K. Ward has spent some considerable time in making a geological examination of this field, and his report is now in the hands of the printer, and will be published shortly.

North-Western District.—The Magnet Silver Mining Company has replaced the steam plant for driving the concentration mill by a hydraulic plant. This consists of 3 miles of races and a pipe column 1300 feet long by 20 inches diameter, the whole being capable of supplying about 300 horsepower. Besides the mill, the air-compressor plant is also driven by the use of Pelton wheels. The wheels are actuated under a total head of 410 feet, and it is intended to use the surplus power for winding and for generating electricity for lighting purposes.

The concentrating mill is under reconstruction. Its capacity will be 800 tons per week—and it is being built on the step-by-step reduction and concentration principle, with the object of dumping nothing except in the state of fine sands. The crushing appliances consist of 30" × 15" rolls and 5-foot grinding pans of the Watson-Deny type. The dressing machines are Hartz and May compound jigs, card tables, Luhrig vanners, and canvas straights. The sizing will be done by trommels, shaking screens, Callow screens, and thickening boxes.

The main tramline has been reballasted for its full distance of 10 miles. A telephone installation has also been made.

The pumping and winding are done by means of compressed air, and owing to the growth of the mine this work will shortly require enlarging.

The mine has continued to open up splendidly. The No. 8 level crosscut has just cut the lode at its deepest point. The formation is 60 feet wide, 40 feet of which is fair milling ore, and 5 feet is fit to send straight to market. Drives have been started north and south, but no stoping has been done, the whole of the ore being thus in reserve.

The No. 7 level main crosscut immediately above showed the lode to be 44 feet wide. This is now being stoped. Up to the present 400 feet has been driven on the lode with the face in the south drive carrying 5 feet of marketable ore (crudes) and 14 feet milling ore. About 28,000 tons of ore have been mined during the 12 months, and about an average of 190 men employed. It is stated that about three years' ore is in sight at the above output.

COPPER-MINING.

The total quantity of copper and copper ore produced was 9035½ tons, valued at £869,666. This shows a decrease of 1889½ tons, and £65,258, on the previous year.

The output of the Mount Lyell Mining and Railway Company, Limited, has been steadily maintained, the mine having produced 8247 tons of blister copper, containing 8144 tons of copper, valued at £745,253 8s. 9d.; 697,120 ounces of silver, valued at £87,437 13s. 7d.; 19,265 ounces of gold, valued at £81,876 5s.; a total value of £914,567 7s. 4d., being a decrease of £40,806 19s. 6d. on the previous year. The amount paid in dividends was £330,000.

The principal event has been the attaining of a vertical depth below the surface of 1000 feet, at the Mt. Lyell Company's North Lyell Mine, and locating thereat, on both sides of the main shaft, a continuation of the profitable ore-bodies that have marked the development of this mine, the stability of which may safely be reckoned as equalling that of the parent.

Workings at the latter pyritic extractions for smelting and chemical (superphosphates) purposes continue unceasingly, while at the reduction-works a series of turbo-blowers are being installed in order to assist or supplant those (Root's) now in existence.

The Consols Company is erecting a concentrating plant, and is completing the erection of a winding-plant on its main shaft.

On the northern fall of Lyell, and facing the Sedgewick Valley, the Tasman Lyell Extended and the Comstock Consolidated mines have continued prospecting; the former persistently, while the latter has had recently added to its plant a portable Pioneer diamond-drilling machine worked by a gasoline motor. That, as it becomes known, must prove a boon to prospecting isolated places, as there is no part of the machine that cannot be carried by a man. It has attained a depth of 150 feet in conglomerate, and is capable of accomplishing from 400 to 500 feet.

Work of a desultory character has been done on the copper mines of the Mt. Lyell West, Old Juke Lyell, and Great Lyell South sections.

At Darwin, the Thompson P.A. has kept a couple of men going on its property; likewise the Wood Syndicate. Both need capital.

Mr. W. H. Taylour, of Queenstown, has forwarded to the Department samples of copper ore from mining works on the Darwin Copper Syndicate's leases at east and south Mt. Darwin. During the past month encouraging results have been met with while exploring the country close to the conglomerate capping of the sub-range upon which the old Darwin Proprietary and South Lyell leases are situated. Some 500 feet above the old underground workings, where the pyritic ore occurs, and in contact with the red sandstone associated with the conglomerate capping, a belt of talc-like schist has been struck, similar in many respects to that prevailing at the North Lyell and Tharsis Mines. In several places in this schist veins of cupriferous pyrite occur. This schist has been traced by the syndicate for about 6 chains, and wherever it has been cut into, veins of rich ore have been struck. One vein is a foot wide, and the ore fairly solid, where struck in the drive. It is intended to put in an adit 200 feet below this, and the owners hope to locate an ore-body of appreciable dimensions. Some of the pyritous ore contains high gold values (0.85 oz. per ton). What looks like a fissure-lode has been discovered on the granite plateau of South Darwin, showing dense iron sulphide, stated to be associated with some copper. During the summer it is hoped to prove this lode by driving below the outcrop. This belt of country, which is the southern prolongation of the Lyell-Farrell line, deserves the attention of the geological staff.

TIN-MINING.

The quantity of tin ore raised was 4343 tons, valued at £501,681, an average of £113 4s. 2.72d. per ton.

The statistics for this metal for the past year have been :—

District.	Ore won. tons cwts.	Men employed. Europeans. Chinese.	
Northern and Southern			
Division	29 15	23	—
North-East Division	2770 10	872	94
Eastern Division	521 12	329	34
North-Western Division ...	136 5	62	—
Western Division	884 14	397	—
	<hr/> 4342 16	<hr/> 1683	<hr/> 128

Northern and Southern Division.—The only mine working in this district during the year was the Shepherd and Murphy Mine, near Middlesex.

The Cox's Bight tin field has been abandoned.

North-Eastern Division.—Briseis Tin Mines, Limited, has been the largest producer, with 1017½ tons of tin, and distributed during the year £112,500 in dividends. This company has taken over the tin mine on the other side of the Ringarooma River, recently held by the New Ringarooma Tin Mining Company, and during the year brought in a supply of water from the company's main race, for the purpose of working the property.

The New Brothers' Home Company, which adjoins the Briseis Tin Mine, is being worked by the Briseis Company; it has produced 394¼ tons of tin ore, and has distributed £16,500 in dividends.

The Arba Company has been working persistently, and has produced 97¼ tons of tin ore.

The Moorina Tin Mining Company has been systematically following the deep lead, which, on account of the great overburden, has been compelled to suspend operations pending the raising of further capital to work upon a large scale.

Pioneer Tin Mine has produced 301 $\frac{3}{4}$ tons of tin ore, and has paid £24,975 in dividends. On the 6th February 10 inches of rain fell in six hours, and the bywash from the lagoon would not carry this quantity of water, which broke over into the workings and filled them up. The bywash has been cut down and enlarged. A deep cutting from the river has been brought up, and the creeks confined to their original channels round the lagoon by a high earth embankment, protecting the workings from further floods. The new plant has been finished (a plant for working the bottom bench of ground), and fitted with a nozzle to utilise the drainage from the tailings paddock. Ground is being prepared for a large dam-site up the Frome River, preparatory to making a start on it. Boring operations are still in progress on the company's leases, and have proved the area of payable ore marked out for working to be very much greater than was originally supposed.

South Mt. Cameron Tin Mining Company.—The plant consists of two high-lift centrifugal pumps, capable of discharging 5000 gallons per minute against a 240-foot head of water, and five high pressure underfired boilers steaming up to 140 lbs. to the square inch; one vertical compound surface condensing engine, capable of developing 250 indicated horsepower with economy; one Allen engine of the two-crank compound double-acting self-lubricating type (imported), capable of developing 400 indicated horsepower; three boilers, feed water-pumps, and condensers; also one of Edwards' air-pumps.

Electric Light Plant.—One high-speed direct connected engine and dynamo of self-contained design, capable of running twelve large arc lamps and 50 incandescent lamps.

The mine is situate on terrace land, consequently all the water has to be pumped up from the Ringarooma River, and in some places conveyed through spiral riveted

pipes, 18 inches diameter, for a distance of 3000 or 4000 feet, and then by 12-inch pipes to the giant nozzles.

The wash in many places requires from 50 to 60 lbs. per square inch on the nozzle-bits to break up the hard cement wash small enough for the sluice-boxes. The particular advantage of the ground is that no such thing as overburden exists; the tin oxide existing in the wash and drifts occurs from surface to bottom, thus rendering everything passing down the tail-race reproductive. The two tail-race boxes extend from the working faces to the river, about $\frac{1}{2}$ -mile in length, consequently all the hard matter has the chance to break up and deposit the oxide in the boxes instead of the river. During the past year 41,200 cubic yards of hard bottom was removed to make room for the sluice-boxes, &c., and 134,800 cubic yards of drifts and wash were treated for 71 tons 12 cwt. of tin oxide, and 82 ozs. 15 dwts. of gold saved. The average number of men employed was 42.

Purdue Tin Mines.—This company holds about 300 acres of land. A large proportion of the ground is said to carry tin, but the exact area that may reasonably be considered payable cannot be stated until systematic boring has been carried out. The highest point of the company's ground is about 200 feet above the Ringarooma River. It is therefore necessary to lift water to that height from a race which takes its supply from the Ringarooma River. This race is 4 miles in length, and is capable of carrying 100 sluice-heads of water. The machinery consists of a Babcock and Wilcox boiler, supplying steam for an Allen's Company engine, by which a turbine pump is directly driven. The pump delivers 112 sluice-heads of water, through a 3-inch nozzle, giving a pressure-head at the face of 100 feet. Sluicing operations were commenced on the 24th August, and from that date to the 16th February, 1908, 46,000 cubic yards of material have been treated, for a return of 63 tons of tin oxide. The company has installed a complete electric light plant.

The closing down of the Scotia and the Cybele mines caused a good deal of depression in the district for a time, and threw a large number of men out of employment.

The Dorset, Ringarooma, and Gladstone companies are working by means of bucket-dredges, particulars of which will be found in another part of this report under the heading "Bucket-dredging."

Eastern Mining Division.—The alluvial mines throughout the district have maintained their usual output. Small parties of alluvial miners at Weldborough, St. Helens, and Avoca have been contributing their quota to the general output.

The Mt. Lyell Company's prospecting operations over a large area of land at Blue Tier have ceased. No very good results, therefore, appear to have been obtained. The area was thoroughly and systematically tested by means of diamond-drills, but the records of the bores have not been made public.

The Anchor Tin Mine has obtained 202 tons of tin oxide. Towards the end of the year the company started to open up new faces, by which it expects to increase its returns. Certain radical changes have been made in the battery, which will greatly reduce the quantity of water required.

Western Mining Division: Heemskirk.—Mayne's Tin Mine has changed hands, and the people who are working it are well satisfied with the results they are obtaining.

There are a few small parties working on the southwest portion of the field, on the northern side of the mount.

There are about 30 tin miners employed.

North-East Dundas.—Good returns are being obtained from the Renison Bell, Brumby's Section, Duncombe, and

Maddox, Flight's, Kemp's, Penzance, Sligo's, and numerous small parties.

Stanley River.—Very little has been done on this field during the year, the drawback being the difficulty in getting supplies over the Pieman River when it is in flood. A suitable site for a suspension bridge has been obtained, and men are employed in marking off a track to the field. When this work is completed pack-horses can go straight from Zeehan on to the tin ground. There is room for a large number of miners on this neglected field.

North-Western Mining Division.—Dividends have been declared by the Mt. Bischoff Tin Mining Company, Registered, during the year, amounting to £36,000, bringing the total up to £2,124,000.

The quantity of tin ore produced during the year was 730 tons, bringing the total quantity up to 66,563 tons. Several important developments have taken place lately, and the future prospects of the mine appear to be very encouraging.

Bischoff Extended.—During the year a deep adit has been put in to cut the lode 200 feet below No. 3 level. In driving 127 feet on the lode 340 tons of lode-matter were obtained and sent to the battery, which gave a return of 30 tons tin oxide. The company has constructed a new tramline down the face of the hill, and is busy erecting a new battery at the foot. This will cause a considerable saving in cost, as there will be only one handling of the ore.

Whyte River.—The Cleveland Company is busy constructing a tramline into the mine. When completed, the battery will be placed in position. The mine is being well opened up, and the manager is confidently looking forward to good results when crushing commences.

COAL-MINING.

The total quantity of coal raised amounted to 58,891 tons, valued at £50,057, being an increase of 5996 tons on the previous year.

The raisings at the respective collieries were as follows:—

	Tons.	Average Number of Men employed.
Mt. Nicholas	23,070	70
Cornwall	25,604	61
Spreyton	1417	7
York Plains	522	2
Mt. Cygnet	1289	2
Sandfly	6789	51
Woodbridge	50	2
Illamatha	150	2
	<hr/> 58,891	<hr/> 198

The Dulverton Coal Mine has been closed down, and two new collieries, viz., the Woodbridge and the Illamatha have been added to the list.

The Catamaran Coal Mine has suspended operations pending reconstruction for the purpose of obtaining more capital.

A new discovery has been made near Strathblane, Port Esperance, from which some excellent samples have been obtained. There has been a good deal of inquiry for coal sections, consequent upon the coal strikes on the mainland, and large areas have been taken up under prospectors' licence, and are being prospected.

IRON.

The quantity of iron ore mined was 3000 tons, valued at £1150.

The Blythe River Iron Mines, Limited, in the first quarter of the year, raised 1000 tons of hematite iron ore

for export to New South Wales; and the Tasmanian Iron Company at Penguin raised 2000 tons of ore.

WOLFRAM.

The output of wolfram was as follows:—Middlesex Mines, 16 tons 5 cwt.; Ben Lomond Mines, 37 tons 12 cwt.

The All Nations Wolfram Mine, at Middlesex, has a lode, which has been opened upon by a deep open-cut along its course for about 12 chains. It varies from 6 inches to a foot or two, averaging, perhaps, 9 inches, and has been broken out to a depth of from 8 to 10 feet. The present owners have extracted the smalls from the loose parts of the lode, and obtained 8 tons of wolfram ore by sluicing, which has ranged from 66 per cent. to 72 per cent. tungstic acid. The idea of the owners is to get capital into the property, which comprises four mineral sections, and thoroughly prove it. The mine is about 12 miles from Wilmot township.

ANTIMONY.

At Hall's Creek, near Lynchford, Messrs. Thomas and Berry have driven across a black decomposed pug formation, similar to that in which the nodules of loose stibnite were found near the surface, but without any results of importance. Samples of the rich ore have been received from Inspector Curtain, and an assay made of some of this by Mr. F. B. Jackson, of the Mt. Bischoff smelting works, gave the following results:—

Gold	Nil
Silver	Trace
Lead	1·05%
Copper	Nil
Arsenic	0·02%
Antimony	66·57%

BUCKET-DREDGING.

Prior to the construction of dredges on the Ringarooma River by the Dorset Bucket-dredging Company, No Liability, and the Ringarooma Dredging Company, No Liability, mining, by means of bucket-dredges, had not proved of a successful character, probably owing, principally, to the hard and rocky nature of the river beds in which they were employed.

In June, 1901, the Queen River Dredging Company constructed a dredge for the purpose of working for gold in the bed of the Queen River, near Lynchford. The plant was constructed to treat 100 cubic yards an hour, with 22 buckets, carrying $3\frac{1}{4}$ cubic feet of stuff, at the rate of 12 per minute. The bucket-rope was supplied with three sets of grab-hooks. The ladder over which the buckets ran had a telescopic stage of 8 feet, and would work to a depth of 25 feet below water-level. The water for the screen and gold-saving tables was supplied by a 10-inch centrifugal pump. The whole plant was lighted by acetylene gas. The wash was principally composed of large pudding-stone boulders, and was not of a payable nature. Operations ceased about the end of June, 1902.

The Whyte River Dredging Company constructed a dredge for the purpose of working for gold in the beds of the Whyte and Rocky Rivers on the West Coast. The machinery was supplied by the Salisbury Foundry Company, of Launceston. The dredge was not able to work successfully owing to the hard nature of the river bed, which, being full of crevices, held the gold, the machine simply puddling up the wash and leaving the gold in the crevices in the bottom. A little gold was obtained, but not sufficient to pay working expenses, and after three or four months' work operations ceased.

The Gladstone Tin Development Company, No Liability, whose property is situate at Gladstone, North-East Tasmania, was the first company to construct a bucket-dredge

in the State, for the purpose of obtaining tin by that method of mining. It was built in the year 1905, by Mr. C. Isbister, of Victoria, who also had the contract to erect the machinery.

The pontoons, which are built of Tasmanian hardwood, are 95 feet long, 36 feet wide, and 7 feet in depth.

The machinery, which is erected on the pontoons, is driven by a 35 N. horsepower engine. A separate engine is used for driving the pump (15-inch centrifugal), which is capable of lifting a stream of 40 sluice-heads of water.

Steam is supplied to the engines by a 40-horsepower multitubular boiler. The buckets which lift the dirt travel upon a ladder, after the principle of an elevator. The ladder is strongly built of steel, is 72 feet long, and will allow dredging to be carried on at a depth of 32 feet below water-level. There are revolving tumblers at each end of the ladder. The top tumbler, which causes the buckets to revolve, is geared to the main driving gear, which is driven by the main engine, by means of a belt.

The buckets have a carrying capacity of $4\frac{1}{2}$ cubic feet, travel at the rate of 12 per minute, and are capable of lifting over 14,000 cubic yards of material per week. The material the buckets carry is deposited into a perforated revolving screen, 32 feet in length, in the centre of which is a stationary perforated pipe, which discharges the water lifted by the pump. The force of water through the pipe washes the dirt, the fine material and metal going through the perforations in the screen into boxes 62 feet in length and 5 feet in width, two of which are placed on each side of the screen. The coarse material is deposited at the stern of the dredge by means of a chute, which is placed at the end of the screen. The mode of working is as follows:—The dredge, being built in a dam, the bottom is reached by degrees, by lowering the ladder as the buckets elevate the dirt. On reaching the bottom, the dredge is pulled gradually across the face or dam, and then pulled ahead sufficiently to insure that the bottom will be

thoroughly cleaned up on the return journey. The navigation is done by steel wire ropes, attached to a winch, which is driven by a 20 horse-power engine. The dredge is lighted throughout by an electric plant.

The Dorset Bucket-dredging Company, No Liability.—The company was formed for the purpose of working the tin drifts on its sections near South Mt. Cameron. The pontoon was built of Tasmanian hardwood, by the company, on day labour, under the supervision of its manager.

The dredge was designed by Mr. F. W. Payne, of Dunedin, New Zealand. The hull is 125 feet long, by 48 feet wide, by 10 feet deep. The machinery was made by the Austral Otis Engineering Company, of Melbourne; and the engine, by Marshall, England. The hull was built, and the machinery was erected, by the company's manager, Mr. John Gordon.

The pontoon was floated on the 31st January, 1907, after which the machinery had to be erected, and the dredge started work in August, 1907; and up to the 31st December worked 234,000 cubic yards of dirt, for 42 tons of tin oxide and 48 ounces of gold.

The Ringarooma Bucket-dredging Company, No Liability, during the year erected a dredge for the purpose of working the tin drifts near South Mt. Cameron.

The size of the pontoon is 92 feet by 36 feet by 8 feet deep. The buckets are $4\frac{1}{2}$ feet, and the dredge has worked 5084 hours, or, approximately, 212 days; and treated 242,800 cubic yards of material. The tin won amounted to 29 tons.

The capacity of the plant is estimated to be 7000 cubic yards per week.

The three lastmentioned dredges are working in close proximity to each other, and are the only dredges of their type now in operation in the State.

The following return shows the quantity and value of mineral products for the State of Tasmania during the year ending 31st December, 1907:—

Mineral.	Quantity.	Value.
		£
Gold *	65,354·252 ozs.	277,607
Silver-lead	89,762½ tons	572,560
Blister Copper †	8247 "	832,691
Copper and Copper Ore	7884 "	36,975
Tin Ore.....	4342¼ "	501,681
Iron Ore	3000 "	1150
Coal	58,891 "	50,057
Wolfram	40¾ "	4411
Bismuth	3½ cwts.	27
Total .....	...	£2,277,159

* Fine gold, including gold contained in blister copper and silver-lead bullion.

† Value of gold deducted.

The amount paid in dividends was £616,089.

GEOLOGICAL AND MINERALOGICAL.

From time to time samples of Tasmanian minerals and rocks have been sent by the Department to Prof. H. Rosenbusch, Heidelberg. In the recently-published second volume of his great work on the "Microscopical Physiography of Minerals and Rocks," are numerous references to the abovementioned specimens from Tasmania. Among others, mention is made of the dyke rock at the Magnet Mine, in which the silver-lead lode now being worked occurs. The Professor says:—"Mention may be made of the fact that the peridotites and pyroxenites can also be developed in dyke form. There is lying before me a specimen from the Magnet Mine in Tasmania, which certainly is completely altered, but which, in a fresh state, would be called Websterite-porphry. Porphyritic crystals of thoroughly chloritised pyroxene (the outlines of which point partly to monoclinic, partly to rhombic systems) lie in a groundmass of angular chlorite fragments. The

chlorite belongs to the pennine variety. Irregular and evidently secondary quartz grains are not rare in the groundmass. There is singular absence of iron ores."

Zeehan Stannite.—The stannite lodes of the Oonah Mine have always been of interest, apart from their economic value, owing to the light which they throw upon the genesis of the silver-lead lodes of the Zeehan field generally. Not only stannite, but also wolfram and bismuthinite, occur in them, an association which points unmistakably to derivation from underlying granite. The high percentage of silver, 50 to 100 ozs. per ton, in this ore is remarkable. Otherwise the composition agrees with the typical stannite (or "bell metal ore") of Cornwall as far as the main constituents are concerned. The general tin content is 9 or 10 per cent. The highest percentage of this metal, obtained in Messrs. Conder and Coates' laboratory in Launceston, has been 17 per cent. Mr. J. H. Levings, of Zeehan, has recently made a complete analysis of a piece of apparently pure and homogenous stannite from the Oonah Mine, and he has kindly given permission to use his figures in this connection. They are as follows:—

Silver	0·298 = 97·3 ozs. per ton
Tin	23·27 as sulphide
"	0·64 as oxide
Copper.....	26·77
Iron	12·11
Bismuth	2·27
Antimony	0·505
Arsenic.....	Trace
Zinc	0·475
Sulphur	32·10
Silica	1·40
Oxygen	0 14
	<hr/>
	100·278

Mr. Levings states: "All Zeehan stannites contain tin as oxide; sometimes reaching 15 per cent. of total tin. Antimony is not an essential of Zeehan stannite; mostly

it is absent. From bulk samples I have got a trace of it, and 0.5 per cent. arsenic, the latter, perhaps, from arsenical pyrites."

Tasmanian Diabase Rock.—This rock, which in the form of trapp, sill, or laccolite, is so general as an intrusive in the Permo-Carboniferous and Mesozoic strata of the island, is readily recognizable by the eye alone. It varies in texture however, and sometimes is more siliceous in aspect than usual. An analysis of the siliceous variety from North-West Bay, near Hobart, has recently been made by Dr. Pohl, in Professor Dittrich's laboratory, in Germany, and is published in a paper by Dr. Paul, of Sydney, in *Tschermak's Min. u. Petr. Mitteilungen* (Vienna, 1906).

Dr. Paul enumerates the constituent minerals as labradorite felspar, pyroxene, amphibole, orthoclase felspar, and quartz (intergrown), with accessory ilmenite, apatite, and pyrite. The variety is referred by him to the Konga diabase or quartz diabase occurring in Scandinavia. The analysis is as follows:—

Si O ₂	56.74
Ti O ₂	1.26
Al ₂ O ₃	15.46
Fe ₂ O ₃	3.08
Fe O	7.58
Mn O	trace
Mg O	2.54
Ca O	7.64
Na ₂ O	3.08
K ₂ O	1.59
H ₂ O	1.28
P ₂ O ₅	0.15
	<hr/>
	100.40

Specific gravity, 2.906

GEOLOGICAL SURVEY BRANCH.

During the year the Government Geologist has prepared reports on the Bell Mount and Middlesex districts; on

gold, at Port Cygnet and Wheatley's Bay; on the Mangana gold field. These reports are appended.

He has also compiled quarterly reports on the Mineral Industry of the State for the first three quarters of the year, when he represented that his time was so fully occupied, and his movements in the field so hampered by their preparation, that I was compelled to relieve him of the work, and have undertaken their compilation myself.

For these, as well as for the special district reports, there is a considerable demand from abroad and from visitors arriving in the State. Our publications lying upon the tables of public libraries and institutes throughout the world may be regarded as of distinct service in directing the attention of investors to the mineral resources of Tasmania.

The appointment of Mr. Leonard Keith Ward to the position of Assistant Government Geologist (mentioned in the first part of this Report) will, I feel sure, not only materially strengthen this branch, but give general satisfaction to the Department and to the mining public.

INSPECTORS OF MINES.

The three inspectors have satisfactorily discharged their duties in the districts severally allotted to them. Their reports are appended.

MINING MANAGERS' EXAMINATION.

The annual examination of candidates for mining managers' certificates was held in March. Three candidates presented themselves for examination, and two succeeded in obtaining second-class certificates.

DIAMOND-DRILLS.

The diamond-drills were not in operation during the period under review.

MOUNT CAMERON WATER-RACE.

The report of the board is appended.

DEPARTMENTAL STAFF.

The only changes which took place in the staff during the year were the appointments of Mr. L. K. Ward as Assistant Government Geologist and Inspector of Mines, and Mr. E. W. Turner as Warden of Mines, Western Division, *vice* Mr. L. E. Chambers.

REVENUE.

The net revenue for the year amounted to £24,794 7s. 7d., being an increase of £557 15s. 2d. on the previous year. This amount does not include the sum of £4623 12s. 9d. deposited as survey fees with applications for leases.

CONCLUSION.

In conclusion, I desire to thank officers of the Departmental staff for the loyal and efficient manner in which they have performed the duties allotted to them.

I have the honour to be,

Sir,

Your most obedient Servant,

W. H. WALLACE, Secretary for Mines.

The Hon. DONALD CAMPBELL URQUHART,
Minister for Mines.

DIAMOND-DRILLS.

Statement of Work done to 31st December, 1907

Year.	Locality.	Direction of Bore.	No. of Bores.	Total Distance Bored.	Average cost per foot, inclusive of Labour and Fuel.
	No. 1 DRILL.			feet.	£ s. d.
1882-3	Back Creek—For Gold	Vertical	7	1330	0 10 9
1883	Lefroy—For Gold	Ditto	4	1011	0 5 3
1884	Tarleton—For Coal	Ditto	1	401	0 5 6
1886	Longford -For Coal	Ditto	2	1585	0 4 0½
1886-7	Harefield Estate—For Coal	Ditto	1	725	0 6 5
1887	Cardiff Claim, Mount Malcolm—For Coal.....	Ditto	1	562	0 17 11½
1888	Killymoon Estate—For Coal.....	Ditto	1	504	0 4 7¼
1888-9	Seymour - For Coal	Ditto	5	2266	0 7 8½
1889)	Beaconsfield (Phoenix G.M. Co.) For Gold	Ditto	1	781	2 0 2
1890)	Beaconsfield (East Tasmania G.M. Co.)—For Gold	Ditto	1	978	0 14 9½
1890	Spring Bay—For Coal	Ditto	4	937	0 6 10
1891	Ravensdale—For Coal	Ditto	1	114	0 11 1½
1891-2	Back River, Prosser's Plains—For Coal.....	Ditto	2	854	0 6 1¾
1892-3	Lefroy (Deep Lead Syndicate)—For Gold.....	Ditto	4	979	0 15 9
1893	Lefroy (East Pinafore Co.)—For Gold	Ditto	1	317	0 10 3
1895-6	Sandfly—For Coal	Ditto	4	2130	0 11 5
1898)	Blue Tier (Anchor Co.)—For Tin	Ditto	9	876½	0 9 1¾
1900)	Llandaff—For Coal.....	Ditto	3	1944	0 7 4
1901-2	Recherche (Catamaran Co.)—For Coal	Ditto	2	956	0 9 3
1902	Ditto (Moss Glen Co.)—For Coal	Ditto	2	667	0 7 6
1903					
	TOTAL .....	...	56	19,917½	

No. 2 DRILL.					
1882	Beaconsfield—For Gold	Horizontal, underground	1	68	No record
1883	Mangana—For Gold	Ditto	1	546	0 15 1
1884	Guy Fawkes Gully, near Hobart—For Coal.....	Vertical	1	612	0 5 6
1885	Malahide Estate, near Fingal—For Gold	Ditto	5	1397	0 5 6
1886	Carr Villa, near Launceston For Coal	Ditto	1	571	0 5 4
1886-7	Waratah (Mount Bischoff Alluvial T.M. Co.) For Tin	Ditto	7	1548	0 6 1½
1887	Waratah (Mount Bischoff T.M. Co.)—For Tin	Ditto	7	841	0 11 8
1887	Ditto	Horizontal, underground	1	53	0 7 8
1888	Old Beach—For Coal	Vertical	1	593	Abt. 0 10 9
1888	Campania—For Coal	Ditto	1	600	0 7 7½
1888	Richmond—For Coal	Ditto	1	500	0 5 1¾
1889	Back Creek—For Gold	Ditto	4	787	0 8 5½
1891	Macquarie Plains—For Coal.....	Ditto	2	989	0 4 5½
1891	Jerusalem—For Coal	Ditto	1	344	0 4 9½
1892	Langlosh Park - For Coal	Ditto	4	1249	0 5 3¼
1893	Southport—For Coal	Ditto	1	612	0 5 3
1894	Zeehan (Tasmania Crown S.M. Co.)—For Silver ...	Horizontal, underground	2	319	1 0 2½
1902	Eden—For Coal	Vertical	2	566	1 0 7½
1902-3	Farm Cove—For Coal	Ditto	1	571	0 5 6
TOTAL.....		...	44	12,766	

Aggregate number of bores 100
 Total distance bored 32,683½ feet

W. H. WALLACE, Secretary for Mines.

No. 1.

RETURN showing the Quantity and Value of Gold won during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	ozs. dwts.	£
1880.....	52,595 0	201,297
1881.....	56,693 0	216,901
1882.....	49,122 6	187,337
1883.....	46,577 10	176,442
1884.....	42,339 19	160,404
1885.....	41,240 19	155,309
1886.....	31,014 10	117,250
1887.....	42,609 3	158,533
1888.....	39,610 19	147,154
1889.....	32,332 13	119,703
1890.....	20,510 0	75,888
1891.....	38,789 0	145,459
1892.....	42,378 0	158,917
1893.....	37,687 0	141,326
1894.....	57,873 0	217,024
1895.....	54,964 0	206,115
1896.....	62,591 0	237,574
1897.....	77,131 0	296,660
1898.....	74,233 0	291,496
1899.....	83,992 0	327,545
1900.....	81,175 0	316,220
1901.....	*69,491 0	295,176
1902.....	*70,996 0	301,573
1903.....	*59,891 0	254,403
1904.....	*65,921 0	280,015
1905.....	*73,540 10	312,380
1906.....	*60,023 8	254,963
1907.....	65,354 5	277,607
	1,530,676 2	6,030,671

* Fine Gold.

5 cm

Diagram showing Total Quantity & Value of Gold won in Tasmania during the years 1880-1907

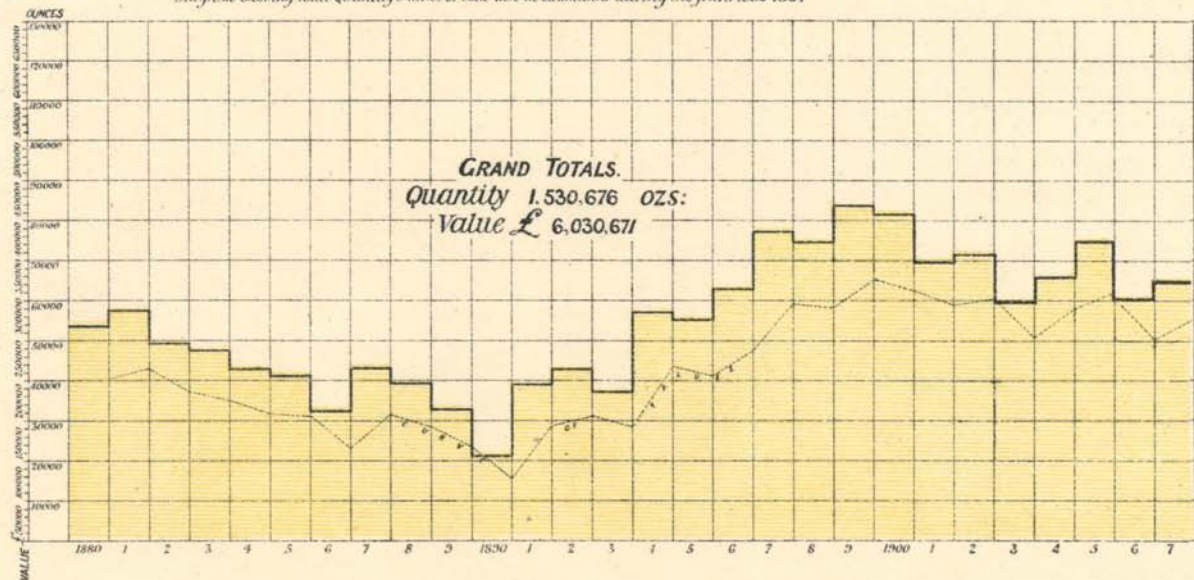


Photo Algraphed by John Vail Government Printer Hobart Tasmania.

5 cm

Diagram showing Total Quantity Value of Coal raised in Tasmania during the years 1880-1907

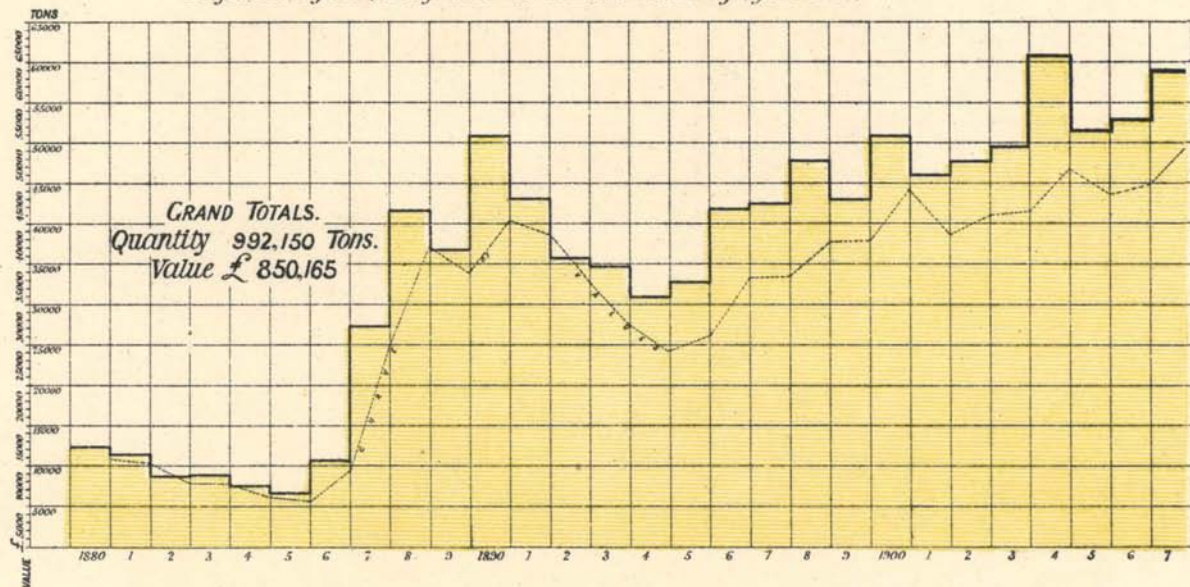


Photo Algraphed by John Vul Government Printer Hobart Tasmania

No. 2.

RETURN showing the Quantity and Value of Coal raised during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1880	12,219	10,998
1881	11,163	10,047
1882	8803	7923
1883	8872	7985
1884	7194	6475
1885	6654	5989
1886	10,391	9352
1887	27,633	24,870
1888	41,577	37,420
1889	36,700	33,030
1890	50,519	45,467
1891	43,256	38,930
1892	36,008	32,407
1893	34,693	27,754
1894	30,499	24,399
1895	32,698	26,159
1896	41,904	33,523
1897	42,196	33,757
1898	47,678	38,256
1899	42,609	38,349
1900	50,633	44,227
1901	45,438	38,451
1902	48,863½	41,533
1903	49,069	41,709
1904	61,109	51,942
1905	51,993	44,194
1906	52,895½	44,962
1907	58,891	50,057
	992,150½	850,165

No. 3.

RETURN showing the Quantity and Value of Tin exported from Tasmania during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, and 1904, compiled from Customs Returns only, and Tin Ore produced during the Years 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1880	3954	341,736
1881	4124	375,775
1882	3670	361,046
1883	4122	376,446
1884	3707	301,423
1885	4242	357,587
1886	3776	363,364
1887	3607 $\frac{1}{2}$	409,853
1888	3775 $\frac{1}{4}$	426,321
1889	3764	344,941
1890	3209 $\frac{1}{4}$	296,368
1891	3235	291,715
1892	3174	290,083
1893	3128 $\frac{1}{2}$	260,219
1894	2934	198,298
1895	2726 $\frac{3}{4}$	167,461
1896	2700	159,036
1897	2423 $\frac{1}{2}$	149,994
1898	1972	142,046
1899	2239 $\frac{1}{4}$	278,323
1900	2029	269,833
1901	1789 $\frac{1}{2}$	212,542
1902	1958 $\frac{1}{4}$	237,828
1903	2376 $\frac{3}{4}$	300,098
1904	2171 $\frac{1}{2}$	255,228
1905*	3891 $\frac{1}{2}$	362,670
1906*	4472 $\frac{3}{4}$	557,266
1907*	4342 $\frac{1}{4}$	501,681
	89,515 $\frac{2}{3}$	8,589,181

* Tin Ore produced : Customs having ceased to issue Returns.

5 cm

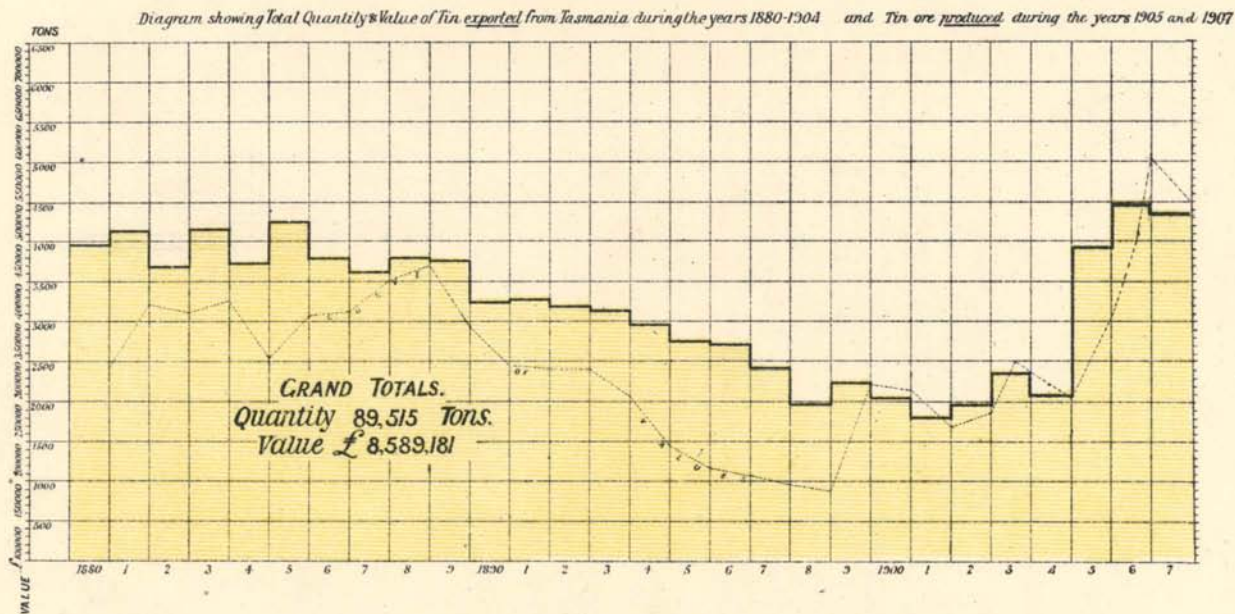


Photo Algraphed by John Vial Government Printer Hobart Tasmania

No. 4.

RETURN showing the Quantity and Value of Silver-Lead Ore produced during the Years 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1888	417	5838
1889	415	7044
1890	2053	26,487
1891	4810	52,284
1892	9326	45,502
1893	14,302	198,610
1894	21,064	293,043
1895	17,980	175,957
1896	21,167	229,660
1897	18,364	200,167
1898	15,320	188,892
1899	31,519 $\frac{1}{2}$	250,331
1900	26,564	279,372
1901	28,774	207,228
1902	46,480	218,864
1903	42,422	192,492
1904	51,138	203,702
1905	75,270 $\frac{1}{2}$	246,888
1906	87,117 $\frac{3}{4}$	462,443
1907	89,762 $\frac{3}{4}$	572,560
	604,266 $\frac{1}{4}$	4,057,364

No. 5

RETURN showing the Quantity and Value of Blister Copper produced during the Years 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1896	41½	1245
1897	4700	322,500
1898	4955½	400,668
1899	8598	735,305
1900	9449	907,288
1901	9981	879,625
1902	7745	*462,151
1903	6684	*478,023
1904	8371	*582,540
1905	8610	*704,287
1906	8708	*862,444
1907	8247	*832,691
	86,090	7,168,767

* Value of Gold contained deducted.

No. 6.

RETURN showing Quantity and Value of Copper Matte exported during the Years 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1902	2500	50,112
1903	3727	83,624
1904	—	—
1905	—	—
1906	—	—
1907	—	—
	6227	133,736

No. 7.

RETURN showing the Quantity and Value of Copper Ore produced during the Years 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1896	34	1020
1897	75	2250
1898	394	8128
1899	1695	26,833
1900	4221½	63,589
1901	11,221	130,412
1902	5994	65,270
1903	102	790
1904	104	1640
1905	1150¾	52,939
1906	2234½	72,480
1907	788¼	36,975
	28,014	462,326

No. 8.

RETURN showing the Quantity and Value of Iron Ore produced during the Years 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1897	894	812
1898	1598	1598
1899	3577	3474
1900	5375	5995
1901	612	417
1902	2386	1075
1903	5980	2905
1904	6840	2975
1905	6300	2600
1906	2600	1100
1907	3000	1150
	39,162	24,101

No. 9.

RETURN showing the Quantity and Value of Asbestos produced during the Years 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1899	200	363
1900	128	113
1901	46½	45
1902	—	—
1903	—	—
1904	—	—
1905	—	—
1906	—	—
1907	—	—
	374½	521

No. 10

RETURN showing the Quantity and Value of Wolfram produced during the Years 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
	Tons.	£
1899	3½	99
1900	53¾	2058
1901	—	—
1902	—	—
1903	—	—
1904	15½	1147
1905	32½	2371
1906	19¾	1465
1907	40¾	4411
	165½	11,551

No. 11.

RETURN showing the Quantity and Value of Bismuth produced during the Years 1904, 1905, 1906, and 1907.

Year.	Quantity.	Value.
		£
1904	6 cwt.	15
1905	3½ tons	800
1906	6 cwt.	24
1907	3½ cwt.	27
	4 tons 5½ cwt.	866

No. 12.

RETURN showing the Quantity of Silver-Lead and Copper Ore smelted for period 25th June to 31st December, 1896, and 1st January 1897, to 31st December, 1907.

Year.	Ore Smelted.	Products.			Yield.			
		Silver-Lead Bull'n.	Blister Copper.	Matte.	Copper.	Silver.	Gold.	Lead.
	Tons.	Tons.	Tons.	Tons.	Tons.	Ozs.	Ozs.	Tons.
1896	26,028½ ³ / ₂₀	—	—	2417 ⁶ / ₂₀	1235 ¹ / ₂₀	75,951	4707	—
1897	90,773½	—	34761½ ² / ₂₀	257 ¹⁰ / ₂₀	35831½ ⁴ / ₂₀	334,349	16,485	—
1898	170,933	—	4992	—	4783	606,123	24,418	—
1899	275,239	2295	8463	89 ⁸ / ₂₀	8362	1,089,657	27,615	—
1900	363,113	4817	9449	—	9341	1,215,036	26,255	—
1901	355,528	1839	9982	50	9880	800,317	21,717	—
1902	411,736	6825	7727	2882	8841	1,674,816	24,719	6654
1903	399,032	7560	6683	3413	8094	1,855,158	25,238	7529
1904	433,366	—	8371	—	8265	1,896,134	26,809	7754
1905	466,578	9422	8611	—	8596	2,075,431	26,469	9086
1906	479,775	9380	8768	—	8613	2,150,405	24,986	9300
1907	472,658	10,590	8248	—	8145	2,147,120	24,531	10,060

No. 13.

RETURN showing the Average Number of Persons engaged in Mining during the Years 1880 to 1907 inclusive.

Year.	Number.	Year.	Number.
1880.....	1653	1894.....	3433
1881.....	3156	1895.....	4062
1882.....	4098	1896.....	4350
1883.....	3818	1897.....	4510
1884.....	2972	1898.....	6052
1885.....	2783	1899.....	6622
1886.....	2681	1900.....	7023
1887.....	3361	1901.....	6923
1888.....	2989	1902.....	5934
1889.....	3141	1903.....	6017
1890.....	2868	1904.....	6194
1891.....	3219	1905.....	6581
1892.....	3295	1906.....	7005
1893.....	3403	1907.....	7516

No. 14.

RETURN showing the total Area of Land and Number of Sluice-heads of Water applied for during the Year ending 31st December, 1907.

Mineral.	No. of Applications.	No. of Sluiceheads.	Area.
			Acres.
Asbestos	1	...	10
Coal	5	...	470
Copper	95	...	5800
Galena	12	...	750
Gold	96	...	1386
Iron.....	8	...	360
Minerals.....	234	...	11,900
Manganese	1	...	80
Nickel	1	...	80
Silver.....	49	...	2461
Slate	2	...	340
Scheelite	2	...	160
Tin.....	242	...	5845
Zinc-Lead	1	...	40
Machinery Sites	10	...	68
Dredging Claims.....	11	...	104
Water-rights	158	891	136
TOTAL.....	928	891	29,990

No. 15.

RETURN showing the total Number and Area of Leases issued during the Year ending 31st December, 1907.

Mineral.	Number.	Sluiceheads.	Area.
			Acres.
Bismuth	1	...	40
Coal	9	...	2758
Copper	38	...	2900
Gold	84	...	1056
Iron	1	...	80
Minerals	152	...	9486
Nickel	1	...	80
Silver-Lead	26	...	1632
Shale	4	...	740
Tin	394	...	11,352
Wolfram	1	...	120
Machinery Sites	6	...	30
Mining Easements	27	...	121
Dredging Claims	32	...	576
Water-rights	116	506	284
	892	506	31,255

No. 16.

*RETURN showing the Total Number of Leases in force on
31st December, 1907.*

Mineral.	Number.	Sluiceways.	Acres.
			Acres.
Bismuth	1	...	40
Coal	29	...	5182
Copper	56	...	3089
Gold	222	...	2671
Iron	11	...	528
Limestone	4	...	383
Lithographic Stone	1	...	97
Minerals	256	...	16,767
Marble	1	...	317
Nickel	6	...	180
Phosphate of Lime	1	...	3
Precious Stones	1	...	80
Silver	172	...	9850
Slate	1	...	200
Shale	8	...	1780
Tin	1333	...	33,961
Wolfram	8	...	552
Machinery Sites	35	...	123
Mining Easements	75	...	436
Dredging Claims	79	...	1494
Water Rights	490	1978	1430
	2790	1978	79,163

No. 17.

*RETURN showing the Average Number of Miners employed
during the Year ending 31st December, 1907.*

	Europeans.	Chinese.
Northern and Southern Division	894	—
North-Eastern Division	884	94
Eastern Division	650	34
North-Western Division	607	...
Western Division	4353	...
	7388	128

No. 18.

RETURN showing the Number and Area of Leases held under "The Mining Act," in force on 30th June in Years 1901 to 1903 inclusive, and on 31st December, 1903, 1904, 1905, 1906, and 1907.

Nature of Lease.	In force on 30th June, 1901.		In force on 30th June, 1902.		In force on 30th June, 1903.		In force on 31st December, 1903.		In force on 31st December, 1904.		In force on 31st December, 1905.		In force on 31st December, 1906.		In force on 31st Dec., 1907.	
	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.
For Minerals, Silver, Tin, &c.	1388	Acres. 60,865	1063	Acres. 45,399	950	Acres. 40,068	826	Acres. 33,325	868	Acres. 33,824	944	Acres. 34,325	1307	Acres. 43,036	1844	Acres. 65,047
For Coal, Slate, Shale, &c.	55	7566	52	7819	66	10,767	54	9119	47	7546	45	7185	35	6025	45	7962
For Gold	566	6091	425	4166	310	3117	243	2505	222	2268	195	2087	167	1836	222	2671
Dredging Claims	—	—	—	—	—	—	15	124	29	469	51	1196	91	2027	79	1494
Mining Easements	—	—	—	—	—	—	34	225	39	234	45	282	47	298	75	436
Water-rights Mineral and Gold	267	1318 sluice-heads	300	1691 sluice-heads	299	1514 sluice-heads	281	1460 sluice-heads	346	1495 sluice-heads	251	1477 sluice-heads	391	1606 sluice-heads	490	1978 sluice-heads

No. 19.

RETURN showing the Amounts paid in Dividends by Mining Companies during the Year ending 31st December, 1907.

Mines.	Dividends.		
	£	s.	d.
Copper	330,000	0	0
Gold .....	...	
Tin	195,452	0	0
Silver	90,637	0	0
TOTAL	£616,089	0	0

No. 20.

RETURN showing the total Amount of Rents, Fees, &c., received by the Mines Department during the Year ending 31st December, 1907.

Head of Revenue.	Amount.		
	£	s.	d.
Rent of Auriferous and Mineral Land.....	22,283	14	3
Fees, ditto ditto	2510	13	4
Survey Fees	4623	12	9
TOTAL	£29,418	0	4

No. 21.

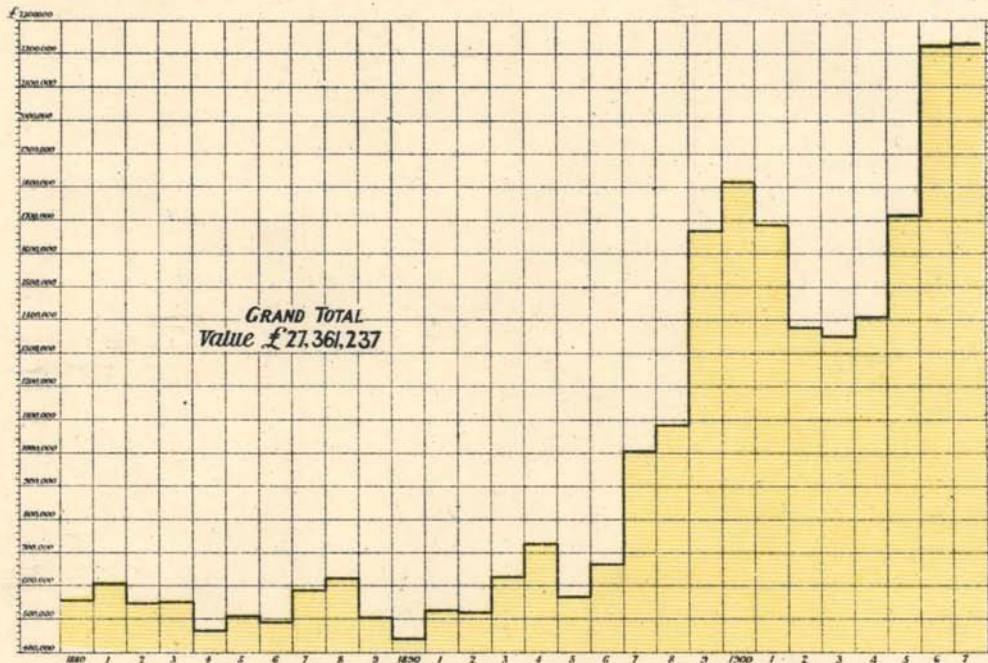
RETURN showing the Mining Companies registered during the Year ending 31st December, 1907.

Number of Companies.	Capital.
24	£108,970

In addition to the above, 23 Agents for Foreign Companies and 7 Syndicates, under 60 Vict. No. 51, were registered.

Diagram showing the Annual Value of Minerals & Metals raised in Tasmania from 1880-1907

5 cm



"Photo Algraphed by John Vail Government Printer Hobart Tasmania.

No. 22.

*RETURN showing Quantity and Value of Minerals and Metals
raised in Tasmania from 1880 to 1907 inclusive.*

Mineral or Metal.	Quantity.	Value.
		£
Gold	1,530,676 ozs.	6,030,671
Silver-lead ore	604,266 tons	4,057,364
Blister Copper.....	86,090 "	7,168,767
Copper and Copper Ore.....	28,014 "	462,326
Copper Matte	6227 "	133,736
Tin	89,515 "	8,589,181
Iron Ore	39,162 "	24,101
Coal	992,150 "	850,165
Wolfram	165 "	11,551
Bismuth	4½ "	866
Asbestos	374 "	521
Unenumerated prior to 1894...	...	31,988
Total .....	...	£27,361,237

No. 23.

COMPARATIVE Statement of Revenue from Mines, being Rents, Fees, &c. (exclusive of Survey Fees), paid to the Treasury for the Years ending 30th June, from 1880 to 1903, and for Six months ending 31st December, 1903, and for the Years ending 31st December, 1904, 1905, 1906, and 1907.

Year.	Amount.			Year.	Amount.		
	£	s.	d.		£	s.	d.
1880.....	8944	5	11	1895.....	15,323	1	9
1881.....	20,936	5	5	1896.....	20,901	13	2
1882.....	23,077	1	9	1897.....	25,631	0	3
1883.....	15,439	14	5	1898.....	33,061	13	9
1884.....	6981	11	10	1899.....	24,696	10	5
1885.....	11,070	5	7	1900.....	28,380	11	10
1886.....	12,523	10	4	1901.....	21,569	5	2
1887.....	14,611	11	5	1902.....	19,471	0	1
1888.....	23,502	8	4	1903.....	17,776	14	3
1889.....	17,254	9	0	1903, 1 July to 31 Dec.	14,758	17	1
1890.....	26,955	4	9	1904, Jan. to Dec.	16,631	8	2
1891.....	37,829	16	5	1905.....	20,208	17	0
1892.....	17,568	18	4	1906.....	24,136	12	5
1893.....	16,971	9	2	1907.....	24,794	7	7
1894.....	16,732	7	7				

The above Statement does not include Stamp Duties upon Transfer of Leases and Registration of Companies, nor the Tax payable upon Dividends, from which sources large sums are derived.

REPORT OF THE MOUNT CAMERON WATER- RACE BOARD FOR THE YEAR ENDING 31st DECEMBER, 1907.

6th February, 1908.

SIR,

WE have the honour to submit the report of the Board for the year ending 31st December, 1907.

No. 4 Syphon.—The work of renewing this syphon was taken in hand by the Board, and instructions were issued to the Engineer in Charge to effect a survey of the route, and submit plans and specifications for consideration. Tenders were invited for the supply of 3125 feet of steel piping, 30 inches in diameter by $\frac{1}{4}$ of an inch in thickness, and the tender of Mephan Ferguson, of Victoria, was accepted. There being no plates of a suitable size obtainable in the Commonwealth, delay has been caused through having to import them from America. The contractor has the work well in hand, and has undertaken to deliver the pipe at Boobyalla by the end of the present month. Everything is in readiness for laying the column, which will not occupy more than two or three weeks after the arrival of the pipes on the ground.

No. 5 Syphon.—In response to the Board's request, the Government placed a further sum of £4000 upon the estimates last session of Parliament for the renewal of No. 5 syphon, and the Engineer is now engaged preparing his plans and specifications to enable the Board to call for tenders at an early date.

Water.—The quantity of water available during the year was sufficient for all requirements.

Syphons.—The breaks in syphons Nos. 4 and 5 have been as frequent as heretofore, and it is only owing to the constant attention of the Manager and Channel-keepers that they have been prevented from totally collapsing. The cost of all repairs to the pipes has been £74 18s. 9d., but when the new No. 4 syphon is erected there will be no further expense in this direction for iron bands, as there will be hundreds of them available on that syphon which can be utilised for the other syphons.

Flumings.—Flumings Nos. 3, 5, and 7 have been replaced by rock cuttings and embankments, and No. 13 was commenced, but had to be suspended owing to the falling off of the receipts for the sale of water, out of which such repairs are paid for. Directly the revenue is available this work will be completed, as it is of a very urgent character.

Water.—The quantity of water supplied to the customers during the year was 1934½ sluiceheads, and the quantity of tin ore raised was 48 tons 0 cwt. 1 qr. 12 lbs., as against 94 tons 7 cwt. 1 qr. 23½ lbs. last year. The decrease in the quantity of tin ore raised is mainly owing to the closing down of the Scotia and Cybele Tin Mines, and the fact of large areas of tin ground commanded by the race having been held and locked up by single companies; but as some of these areas have recently been

forfeited, small areas may be taken up again by smaller companies or co-operative parties.

The revenue amounts to £956 12s. 9d., being a decrease of £1879 5s. 2d. as compared with the previous year.

The Engineer in Charge has furnished the Board with details of the work performed during the year.

Statistics for the year are as follows:—

Average per week of claims supplied, 12.

Greatest number supplied in any one week, 18.

Total number of heads supplied—

Under fixed or cash scale	6577.
Under royalty or credit scale... ..	1296 $\frac{1}{2}$

Total	1954 $\frac{1}{2}$
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Tin ore raised for the year:—Royalty scale, 16 tons 2 cwts. 1 qr. 12 lbs.; fixed scale, 31 tons 2 cwts.; total, 48 tons 0 cwt. 1 qr. 12 lbs.

Average number of men employed per week, 28.

Total receipts for the year:—Water sold, fixed scale, £521 3s. 5d.; water sold, royalty scale, £420 11s. 5d.; other receipts, sale of asphaltum, &c., £14 17s. 11d.; total, £956 12s. 9d.

Expenditure.—Cost of maintenance and management:—

	£	s.	d.	£	s.	d.
Salary and wages... ..	603	18	0			
Repairs to syphon pipes...	74	18	9			
Repairs to flumings	42	11	8			
Travelling expenses	21	12	10			
Stores and tools	35	7	7			
Stationery and printing	6	6	0			
Insurance	3	6	0			
				788	0	10
Renewal of flumings				948	14	0
No. 4 syphon (6 Edw. VII.						
No. 23)				867	12	9
Completion of overflow-						
channel at intake, &c.				78	9	9
Total				£2682	17	4

W. H. WALLACE, Chairman.

W. H. TWELVETREES,	} Members of the Board.
EDWARD L. HALL,	
JOHN SIMPSON,	
S. HAWKES,	

The Hon. the Minister for Mines.

MINE MANAGERS' EXAMINATION.

MARCH 24TH, 1908.

SUBJECT—MINING.

1. Describe the different methods of driving in running ground.
2. Describe, with sketches, a rock-drill.
3. Describe the ordinary explosives used in mining, and for what special purposes would you use each, and what precautions would you take in using them.
4. What would you consider the most economical method of removing 1,000,000 cubic yards of overburden 100 feet deep, consisting of partly decomposed basalt containing boulders up to a ton weight? Describe the methods and the plant you would use.
5. Describe the methods and appliances used in a hydraulic-sluicing mine.
6. You are required to work a deep alluvial gold lead with much water in it. Describe, with sketches, how you would set about it.
7. A mine has been opened up to a depth of 150 feet, and there is a daily flow of 30,000 gallons of water, of which $\frac{1}{4}$ is making in the sump. What size of pump would you put in to allow opening up to a depth of 500 feet? What size of shaft would you require? Show by sketches how you would place the pitwork in the shaft. Assume various conditions.
8. Describe in detail the method you would adopt for signalling in a shaft at present 500 feet deep, and which, in addition to an output of 100 tons a day, has to be sunk 100 feet a year in wet ground.
9. A lode, dip about 60 degrees, varies in width from 3 to 6 feet, and is payable throughout. Describe how you would stope it out, and at what vertical distances apart you would place your levels—
 - (1) With good standing walls;
 - (2) With bad standing walls.
10. Describe the safety appliances you consider necessary in connection with winding from mines, and how you would test winding-ropes and connect them to winding-engine and cage.
11. A drive on a lode is timbered with 12-inch timber; a stope is being brought up below it. How would you pick up the level—
 - (1) In good ground;
 - (2) In heavy ground.

Give sketches.
12. Describe the various machines and appliances used in connection with the ventilation of deep mines, and methods of distributing fresh air to the various working faces.

SUBJECT—ORE-DRESSING AND SAMPLING.

1. Describe a canvas table. What are its advantages and disadvantages?
2. Compare a jaw-breaker with a gyratory-breaker. Which would you prefer, and why?
3. Describe a system of sampling from the faces of a quartz mine to the tail-race, to obtain the value of the ore in the mine, to test the different appliances in the battery, and to test the saving of the battery as a whole.
4. Describe the appliances you would use in a concentrating plant to treat 20 tons of silver-lead ore per 8 hours when the ore is in coarse and fine particles through the gangue.
5. How would you sample a shipment of 20 tons of black tin?
6. Describe in detail a machine for treating coarse sand containing 5 per cent. of—

- (1) Iron pyrites;
- (2) Galena;
- (3) Cassiterite;

and state what percentage of the contents you would expect to save in each case, and what weight of concentrates you would obtain from 100 tons treated.

SUBJECT—MINING GEOLOGY.

1. Explain briefly the various theories which claim to account for the filling of metalliferous veins.
2. Define the terms—

Zone of Oxidation;
Vadose Circulation;
Barysphere.

Give the chief ores of silver, lead, copper, and zinc existing at depth and those usually met with near the surface, accounting for the presence of the latter.

3. Describe briefly the development of methods for the recovery of faulted veins, and illustrate present-day methods by an example.
4. Give any examples of secondary enrichment you know of, with your explanation of the occurrences.
5. Give any examples you can of the effect of wall-rock on the metallic contents of lodes.
6. What do you understand by the terms slickensides and flucan, and what class of vein do they usually indicate? Give examples; or give examples of banded structure with your explanation of its formation.
7. Describe any system of deep leads with which you are acquainted, and discuss the probable source of metallic contents as a guide to exploitation.

SUBJECT—MINING SURVEYING.

1. Describe the usual methods of ascertaining horizontal distances in surveying.
2. Give field notes of the survey of a mine with a main shaft and two levels, as required annually by the Mines Department.

3. In selecting a theodolite, what would be the principal points of construction to which you would pay attention, and how would you test them?
4. Describe carefully the adjustment of the transit theodolite.
5. Describe the level, and the precautions you would take in using it to ensure accurate work.
6. A winze is sunk on a vein of varying underlie. Describe your method of survey, and give field notes.
7. The tangents of a 10-chain curve include an angle of 120° . Shew how to set the curve out by offsets and deflection angles, giving the necessary calculations.
8. In a certain traverse, it is impossible to measure the lengths of two sides not contiguous, but their bearings and lengths of other sides and bearings are obtained. Shew how you would obtain by latitude and departure the length of the sides and area of figure.
9. Describe any method of ascertaining the True Meridian.

SUBJECT—SURFACE WORK.

1. Give sketch designs of a trestle bridge 30 feet high for a train of mine trucks.
2. Give sketch plan of an ore-bin to hold 100 tons of quartz.
3. Give sketches showing pit-head gear for a self-dumping skip in a vertical shaft.
4. In designing a water-pipe for a power scheme, do you consider it wise to have large pipes at the top of the column and smaller ones at the bottom?
Give your reasons in the following cases:—
 - (a) A column everywhere under a low head;
 - (b) A, say 30" column, for first 200 feet under 60-feet head, and for last 1000 feet under head rapidly increasing to 600 feet.
5. How would you make comparisons between the motive-powers for machinery of a large mine in a locality where fuel is fairly cheap and inexhaustible, and water-power may be obtained at considerable initial cost?
6. Two steel plates, each $\frac{3}{8}$ -inch thick, are lap-jointed and rivetted together by two rows of $\frac{3}{8}$ -inch steel rivets, the pitch being 3 inches, and the rows $1\frac{1}{2}$ inches apart. What is the least percentage of strength of the joint?
7. If a water-pipe be made with joints as in the previous question, and is 36 inches internal diameter, what head of water would it safely carry?
8. Neglecting friction and the weight of the lever and valve, what proportions must exist between the different parts of a safety-valve of the lever and ball type in order that the addition of each pound weight on the end of the lever just balances an increase of one pound pressure in the boiler?
9. What would be the indicated horse-power of a single-cylinder high-pressure steam-engine having a cylinder 20 inches in diameter by 36 inches stroke: revolutions, 60 per minute; average pressure throughout the stroke, 30 lbs. per square inch? What brake-horse power would you expect from the above engine?
10. The lower end of a water-pipe 600 yards long from a reservoir is under a head of 115 feet. For the first, or

upper, 400 yards this pipe has an internal diameter of 6 inches; at the lower end of the pipe a jet $1\frac{1}{4}$ inches in diameter discharges 227 gallons per minute. What is the smallest diameter of the lower 200 yards of the pipe?

SUBJECTS—ARITHMETIC, MENSURATION, AND MINING ACCOUNTS.

1. Find the value of

$$\frac{(3\frac{1}{2} - 2\frac{1}{2}) \div \frac{2}{3} \text{ of } \frac{3}{8}}{2\frac{2}{3} \div (\frac{1}{2} + \frac{1}{4})}$$

and express the result as a decimal.

2. Two cog-wheels work together, one having 360 teeth and the other 100. If the first revolves 20 times in one minute, how many times will the second revolve in an hour? And if the latter turns a drum whose circumference is 5 feet, how many miles of thread will it wind upon the drum in a working-day of 11 hours?
3. Find the number of tons of firewood contained in a stack of the following dimensions:—Bottom length, 90 feet 6 inches; top length, 45 feet 9 inches; height, 10 feet; in 5-foot lengths; reckoning 50 cubic feet per ton.
4. Find the dividend on £6894 13s. 4d. at 1s. 3d. in the £.
5. Four men dig a trench in $15\frac{1}{2}$ days working 10 hours per day each. Supposing them to have worked 8 hours a day, how many days would they have occupied?
6. Describe the books and form of accounts which you consider desirable for controlling the receipts and distribution of stores.
7. Name, describe, and give illustrations of the accounts and statistical returns which a mining manager might be expected to send in monthly to the head office.

SUBJECT—MINING LAW.

All questions are required to be answered.

1. How would you neutralise the fumes arising from an explosion of nitro-glycerine which cannot be effectively disposed by ventilation?
2. How should cages be covered for protection to persons ascending or descending shaft?
3. At what angle should ladders be placed in a shaft for the convenience of miners? What space should be allowed between the rungs of such ladders; and what space must be allowed between the rungs and the wall?
4. What is the limited length of rope or chain ladders which may be used in a shaft during sinking operations?
5. In raising or lowering men, what is the limited rate of speed at which a cage or bucket is allowed to travel?
6. What provision is required to be made in a mine which is liable to an inundation or burst of water?

The following Lists of Certificates granted since the inception of the Board of Examiners for Mining Managers' Certificates are published in accordance with a resolution passed at the Interstate Conference of Boards of Examiners held in Melbourne in March, 1906 :—

SERVICE Certificates of Competency granted by the Board of Examiners.

No. of Certificate.	Name.	Date of Certificate.
1. 92	Davies, Joseph	28 Sep. 1892
2. 92	Ruffon, Geo. Donald	28 Sep. 1892
3. 92	Sinclair, George Peace	28 Sep. 1892
4. 92	Heighway, John Felton	28 Sep. 1892
5. 92	Irvine, Peter	28 Sep. 1892
6. 93	Daniel, John	29 Mar. 1893
7. 93	Marshall, John Henry	29 Mar. 1893
8. 93	Aaron, Gabriel	29 Mar. 1893
9. 93	Webb, George	29 Mar. 1893
10. 94	Payne, John Greaves	3 Apr. 1894
11. 94	Wesley, William Henry	3 Apr. 1894
12. 94	Andrews, Thomas	3 Apr. 1894
13. 95	Richards, Moses John	17 Apr. 1895
14. 95	Richards, Stephen Eddy	5 Nov. 1896
15. 98	Stubs, Joseph Thomas	20 Jan. 1898
16. 98	McCrackan, John	20 Jan. 1898
17. 98	Heery, Luke	5 Mar. 1898
18. 98	Curtain, Cornelius Henry	13 Apr. 1898
19. 98	Clerk, Frederick Malcolm	14 Apr. 1898
20. 99	Craze, John	25 Jan. 1899
21. 99	Tilley, George Reynolds	17 Apr. 1899
22. 99	Hooper, Thomas Martin	17 Apr. 1899
23. 99	Vincent, Thomas	17 Apr. 1899
24. 1900	Brown, William	9 Jan. 1900
25. 1900	Rosewarne, David Davey	4 Oct. 1900
26. 1901	Buddon, William	1 Mar. 1901
27. 1901	Yeates, Alexander	29 Apr. 1901
28. 1902	Ireland, Mark	22 Apr. 1902
29. 1902	Woolcock, John	23 Sep. 1902
30. 1903	Powell, Robert William	5 May, 1903
31. 1904	Muir, John James	27 July, 1904
32. 1904	Moyle, John	5 Dec. 1904
33. 1904	Ridley, John	12 Dec. 1904
34. 1906	Brough, Daniel	23 Apr. 1906
35. 1906	Berrill, Samuel	23 Apr. 1906
36. 1906	Barker, George	24 July, 1906
37. 1907	Wisch, John G. A.	6 Nov. 1907

COLLIERY Certificates of Competency granted by Board of Examiners.

No. of Certificate.	Name.	Date of Certificate.	Class of Certificate.
1. 92	Brain, Austin Lionel Bennet	28 Sep. 1902	First class
2. 1907	Wallace, Archibald Campbell	23 Apr. 1907	Second class
3. 1907	Williams, Thomas James	8 May, 1907	First class

CERTIFICATES of Competency granted by the Board of Examiners.

No. of Certificate.	Name.	Date of Certificate.	Class of Certificate.
1. 92	Dunstan, Alfred John	28 Sep. 1892	First class
2. 92	Ekborg, Benjamin Pherson	28 Sep. 1892	Second class
3. 92	Hill, Charles	28 Sep. 1892	Second class
4. 92	Booth, John Robert	28 Sep. 1892	Second class
5. 92	Stapleton, Michael	28 Sep. 1892	Second class
6. 92	Lewis, Philip	28 Sep. 1892	Second class
7. 92	Hanlon, Christopher	28 Sep. 1892	Second class
8. 92	Williams, Luke	28 Sep. 1892	Second class
9. 92	Macandrew, Harold	28 Sep. 1892	First class
10. 92	Harris, William	28 Sep. 1892	First class
11. 93	Stapleton, Michael	29 Mar. 1893	First class
12. 93	Hanlon, Christopher	29 Mar. 1893	First class
13. 93	Potter, Joseph Matthew	29 Mar. 1893	First class
14. 93	Hilder, Alfred	29 Mar. 1893	Second class
15. 93	Matthews, Peter	29 Mar. 1893	Second class
16. 93	Richards, Stephen	6 Sep. 1893	First class
17. 94	Brain, Austin Lionel Bennet	3 Apr. 1894	First class
18. 94	Thorpe, Walter	3 Apr. 1894	Second class
19. 95	Williams, Luke	17 Apr. 1895	First class
20. 96	Levings, Joseph Henry	6 May, 1896	First class
21. 99	Goodall, Thomas Charles	14 Apr. 1899	Second class
22. 1900	Schloesser, Robert	19 May, 1900	First class
23. 1900	Nicholls, Charles Berresford	19 May, 1900	First class
24. 1900	Sale, William Robert	19 May, 1900	Second class
25. 1900	Williams, Richard	19 May, 1900	Second class
26. 1900	John McPeake	1 Aug. 1900	First class
27. 1901	Sawyer, Basil	20 Feb. 1901	First class

CERTIFICATES of Competency—continued.

No. of Certificate.	Name.	Date of Certificate.	Class of Certificate.
28. 1902	Provis, John	22 Apr. 1902	First class
29. 1902	Bird, Robert Chisholm	22 Apr. 1902	Second class
30. 1902	Briggs, William Albert John	22 Apr. 1902	Second class
31. 1902	Bartlett, William Henry	22 Apr. 1902	Second class
32. 1902	Phoenix, William	22 Apr. 1902	Second class
33. 1902	Wright, Herbert E.	22 Apr. 1902	Second class
34. 1902	Craze, John	30 Apr. 1902	Second class
35. 1903	Waller, Richard Fitz-arthur	5 May, 1903	First class
36. 1903	Brickhill, Hector Gordon	5 May, 1903	First class
37. 1903	Barker, Reginald Fredk.	5 May, 1903	First class
38. 1903	Vincent, Thomas Henry	5 May, 1903	First class
39. 1903	Crittendon, James Henry	5 May, 1903	First class
40. 1903	Weston, Eustace Moriarty	12 Aug. 1903	First class
41. 1903	Clark, Lindesay Colin	31 Aug. 1903	First class
42. 1904	Martin, Edward Patrick	17 Feb. 1904	First class
43. 1904	Herman, Hyman	29 Apr. 1904	First class
44. 1904	Murray, Russell Mervyn	29 Apr. 1904	First class
45. 1904	More, George Allan	14 Oct. 1904	First class
46. 1905	Beamish, William Abraham	3 Jan. 1905	First class
47. 1905	Andrews, Thomas J.	1 May, 1905	Second class
48. 1905	Hitchcock, William E.	1 May, 1905	First class
49. 1905	Smith, George Oliver	18 July, 1905	First class
50. 1906	Rockett, Hildreth Peyton	23 Apr. 1906	Second class
51. 1906	Hales, Richard Chilman	23 Apr. 1906	Second class
52. 1906	Debenham Arthur John	28 June, 1906	First class
53. 1906	Coote, Charles Edward	18 Oct. 1906	First class
54. 1907	Marks, Oscar Sidney	8 Mar. 1907	First class
55. 1907	Phelan, Bernard Fredk.	23 Apr. 1907	Second class
56. 1907	Moline, Arthur Howard Pritchard	23 Apr. 1907	First class
57. 1907	Macartney, Ross Kenneth	23 Apr. 1907	First class
58. 1907	Williams, Thomas James	8 May, 1907	First class

GEOLOGICAL SURVEY OF TASMANIA.

REPORT OF THE GOVERNMENT GEOLOGIST.

Geological Survey Office,
Launceston, 7th May, 1908.

SIR,

I HAVE the honour to submit my report as Government Geologist, and Mr. L. K. Ward's report as Assistant Government Geologist, for the year ending 31st December, 1907.

During the year I have prepared the following geological reports:—

1. Report on the Bell Mount and Middlesex District, 17th June, 1907.
2. Report on Gold at Port Cygnet and Wheatley's Bay, Huon River, 22nd June, 1907.
3. The Mangana Goldfield, 22nd November, 1907.
4. The Mathinna Goldfield, Part III., 13th December, 1907.

Mr. Ward is preparing a report on the Mount Farrell Mining Field, which will be issued shortly.

Bell Mount and Middlesex.

I visited this district in March. The area comprises a tract of mineral country forming the high land for 20 miles south-west from the Wilmot township.

The field in general consists of Silurian sandstone, covered in parts by basalt of Tertiary age, and penetrated by intrusions of granite, which is usually regarded as approximately of Devonian age. At Bell Mount itself, older (pre-Silurian) rocks are exposed.

The factor which controls the mineralisation of the rocks in this district is the granite. The lodes, whether occurring in the sedimentary strata or the granitic porphyry, evidently derived their metals (tin, tungsten, bismuth, molybdenum, copper, lead, gold, silver) from the granite magma.

I endeavoured to ascertain whether certain minerals could be determined as characterising certain horizons, for in that case important guidance could be furnished for prospecting, but the present relative depth of occurrence did not appear to have any decisive bearing on this point. In any case, none of the lode exposures are far from granite or granite porphyry.

The Shepherd and Murphy Mine is actively producing a mixed tin, wolfram, and bismuth ore, which is concentrated on the spot and the concentrates despatched to Launceston to undergo there a magnetic process of separation, by means of which the magnetite and pyrite are discarded, the wolfram recovered, and a tin-bismuth ore produced for export.

The All Nations Mine has a wolfram lode carrying a thin selvage of bismuth carbonate. Some surface work has been carried on, and a few tons of wolframite shipped, realising good prices; but operations are suspended for the present, pending

flotation. Several ore deposits of the tin wolfram group occur in the district, *e.g.*, Dalcoath, Sparks, Narrawa, Blocks, &c., which at present are not being worked.

The old Bell Mount gold diggings, which yielded about 4000 ozs. of gold, are now abandoned; and the Great Caledonian Mine at the top of the 5-mile rise is also a venture of the past.

The Devon Mine, with a small galena lode carrying good values of gold and silver, is working steadily. Its position in the gorge of the Dove River and its distance from a shipping port impose a heavy tax on the mineral produced. Better means of communication with the Wilmot township would seem to be imperative, if the mine is to be worked continuously.

The lodes throughout the district have been explored for the most part only in a tentative way, yet the results of work so far are encouraging. The tin-bearing porphyries and granites extend eastwards to the Forth River, and pass over to Mt. Claude, where discoveries have been made recently of tin and silver-lead ores. To the west is a wide expanse of practically unproved country. The mines in this part of the State are disadvantageously situated for getting their ores to market, and deserve all the assistance which the State can properly grant.

Port Cygnet.

In April I examined some ground taken up for gold-dredging at Wheatley's Bay, Huon River, and the gold mine of Mt. Mary at Lovett.

Alluvial gold-seeking at Lymington and Lovett was begun 30 years ago, and some lode-mining was started near Lovett about nine years since. A belt of alkaline porphyry traverses the district, and at intervals along the line of its contact with the Permo-Carboniferous strata a development of quartz and opaline silica occurs, associated with pyrites and a little visible gold.

Some of this gold has been shed into the creeks and flats, and has been recovered by alluvial workers. The whole produce of the district has been close upon 3000 ounces. This year a syndicate applied for two dredging claims—one in Wheatley's and Petchey's Bays, in the Huon River; and the other at the mouth of Forster's Rivulet, Lymington—but after some preliminary boring had been done it was felt that the propositions did not offer sufficient scope for a modern plant.

The lode mining in the district has been unsuccessful so far, although the reddish contact stone at the Mt. Mary Mine at Lovett shows specks of gold on the joint faces.

At the Livingstone Mine the quartz is poor, and what gold there is is distributed irregularly. The presence of arsenopyrite, chalcopyrite, blende, and galena in the stone is, however, a favourable indication. Quite apart from the unique plexus of alkali rocks, the occurrences at Port Cygnet are geologically interesting, as being of later origin than that of the gold quartz reefs in other parts of the island. It does not appear that the gold is at all disseminated through the porphyry. It seems to be limited to the altered rock at the contact-line between the porphyry and the Permo-Carboniferous strata, or to quartz-veins at or near the contact. The deposition is patchy, and there is no great inducement to spend much in lode-mining. Still it is quite possible that some part of the contact-line may eventually be discovered which will prove rich enough to work

Mangana.

This goldfield surrounds the small township of the same name at the base of the foothills of Ben Lomond and Tower Hill.

I made an examination of the district in July, and the report thereon was published as the first of the new series of geological survey bulletins. I found the only active mines were the Mangana Gold Reefs and the Golden Entrance.

The main shaft at the former mine has been sunk to 819 feet, but the result has been disappointing, as no quantity of stone has been raised from lower than 300 feet. Exploration to the south of the shaft would probably lead to better results, and there is in the upper levels a good deal of stone which is nearly payable, and would, if some higher-grade patches were met with, pay for raising.

The Golden Entrance Mine is being worked on tribute, on a scale which does not do justice to it.

On Buckland's Freehold some important reefs have been worked, and others are known to exist. I understand an effort is being made to resuscitate work on this ground.

The slate and sandstone strata which enclose the gold quartz reefs belong to the Ordovician system, and to the auriferous belt which runs through the gold mining districts of Mathinna, Mt. Victoria, Warrentinna, and Lyndhurst. Their northern continuation from Mangana crosses the River Lyne near its confluence with the South Esk. The present Grant's Rivulet flat at Mangana (Fingal Valley, as it is called locally) is below the fold of a former anticlinal arch, and the positions of the Mangana reef lines are probably related to the processes which were concerned in the formation of this fold in the strata.

The first discovery of alluvial gold in the island was made at Mangana in 1852, and the first gold quartz reef was also discovered here. Many of the reefs which are known on the surrounding hills were worked at one time, but operations were generally suspended as soon as poor crushings were raised.

With imperfect financing and impatience on the part of shareholders, the field lost its supporters, although some of the richest stone ever seen in Tasmania has been obtained from more than one of the reefs.

Mathinna.

In December I visited Mathinna, and examined the Scott and Pickett line of country, which is situate between the Golden Gate and Consols' line on the north-east, and the Mangana line on the south-west. The only work being carried on was at the Scott and Pickett Mine, 2½ miles south-west of Mathinna. A shaft has been sunk 65 feet, and driving carried on on the reef. The shoot of gold-bearing stone is short, and exploratory work will have to be undertaken by the owners. There is some chance of meeting with a reef intersection in a northerly direction.

Other reefs in the vicinity are the Commercial Reef, Pride of the Hills Reef, and O'Brien's Reef. On my next visit to Mathinna parts of the district not yet embraced in the series of my reports on the field will be examined, and when the whole district is finished a general map will be prepared and issued.

Mt. Bischoff.

In August I visited the Mt. Bischoff Tin Mine at Waratah, to examine ground on the Don Hill which it was contemplated to

prospect by means of boring. I reported to you thereon. While at Waratah I examined anew the geological features of this great mine, which I dealt with in my Waratah and Corinna report of June, 1900.

At the Mount there is a hidden granite mass, which is the source of the tin, and which has communicated with the present surface by intrusive dykes of quartz porphyry. These dykes themselves contain tin ore, and are traversed by tin-bearing veins and lodes, which are chronologically subsequent to the dykes, representing, however, the after-action of the same eruptive process. The dykes have been topazised and tourmalinised in connection with the deposition of the tin ore. During the past year the large basin of the Brown Face was practically worked out, and the mine received a set-back, from which it is now recovering with the aid of new discoveries made at the main tunnel level, which it is believed will enable a good output to be maintained. No geological reason can be adduced for doubting the downward extension of the Mount Bischoff tin ore deposits to greater depths than those at which they have been worked hitherto.

Gladstone.

In my report of 1901 I mentioned that gold quartz reefs had been opened up at different times in this district, with not much success, and referred to the probability of numerous reefs being concealed at their outcrops by the widely-spread alluvial covering. On a visit to Gladstone in September this year I examined a reef 6 miles north of the township, known as the New Imperial Reef. A small shaft had been sunk on it to 25 feet, exposing an arsenical gold quartz reef giving fair results by assay. It belongs to a group of reefs in the Gladstone district in which the gold is associated with silver, arsenopyrite, galena, and zinc-blende, and which are of the type often met with in or near masses of granite. The oxidised parts of these reefs show free gold, but in depth it is generally found that most of the gold is locked up in the pyrite. A further discovery has been made in the vicinity. If, on adequately testing these reefs, any of them can be proved to be worth developing, a welcome addition will be made to our list of productive goldfields.

Back Creek.

In September I also visited the country between Lefroy and Back Creek, which comprises an area that has been very little prospected.

The quartz reefs for the most part form a series north of and parallel with those at Lefroy. Another set of reefs in the district are gossan formations, conforming in strike and dip with the strata. One of these (the H. No. 1) was found this year to carry gold at its contact with one of the quartz reefs, and has been sunk and driven upon with a view of prospecting it in depth. Some prospecting has also been carried on on other reefs in the neighbourhood.

The Back Creek alluvial leads are also being prospected by small parties, but the principal source of the gold that has been obtained from these in the past remains to be discovered. The angular form of much of the gold and quartz indicates that these have not travelled far.

Water-pollution.

In November, in company with Inspector Griffin, I visited the Brookstead estate, on St. Paul's River, in order to report to you whether the alluvial tin deposits on that property could be worked without emptying the tailings into the river.

After examining the ground, we were of opinion that it would be possible to retain the tailings, and purify the water to some extent, by allowing it to settle in reservoirs before returning it to the St. Paul's River. Discolouration of the water could not be avoided.

Iron Ore near Forcett.

In December I examined the deposit at Lewisham, near Forcett. Some work was done here 25 years ago, and the ore smelted, I believe, at works on Battery Point, Hobart. The excavation at the old quarry exposes a face 10 feet high by 100 feet in length of limonite and hematite.

The deposit rests on Permo-Carboniferous freestone, and passes into the hill to the north below a covering of basalt. The ore itself is associated with soft sandy beds, which belong either to the freestone just mentioned or to Tertiary sediments immediately below the basaltic covering. I sampled the whole face, but this included much impure ore. The cleaner parts of the sampling were assayed by Mr. W. F. Ward, Government Analyst, and yielded 50.7 per cent. metallic iron. The area which may be assumed as workable would be 100 or 150 square feet, not including what may exist below the sheets of lava.

Progress Reports.

I prepared these for the first three quarters of the year. Mining managers and companies as a rule, while anxious to see accounts of their work duly published in these reports, do not show any alacrity in furnishing statements which can be used for that purpose. This is unfortunate, as the reports are looked for and enquired after in many parts of the world.

Since 1900 I have compiled these reports uninterruptedly, but it has recently become more and more apparent that their preparation hampers my movements in the field, and consequently I have recently had to represent to you that it is impossible for me to continue them and at the same time plan my journeys effectively. It is with satisfaction that I understand that you have decided to relieve me from the work of compilation, and that the report for the December quarter is being issued from your office.

Geological Survey.

At the end of the financial year the appointment was made of Mr. Leonard K. Ward, B.E., B.A., Lecturer in Geology at the Westralian School of Mines, Kalgoorlie, as Assistant Government Geologist. I have pleasure in mentioning that the quality of Mr. Ward's work since his arrival entirely justifies his selection for this appointment.

The organisation of work on a defined basis and on a scale appropriate to our requirements has been arranged. The accomplishment of regular surveys of mining fields is being proceeded with; certain improvements have been made in our publications, and others are being planned.

The increased work has caused the question of more office accommodation to become pressing, and it will be desirable to bear this in mind when the contemplated additions to the Public Buildings are made. A room will be necessary for Mr. Ward, and one is requisite for keeping collections in, and as a working-room. A further room is urgently wanted for drafting work. At present the draftsman's table is required by three persons simultaneously, and the want of accommodation must inevitably produce delay in work.

Office.

The correspondence this year comprised 3175 letters, publications, &c., in and out. The office library has been enriched by numerous bulletins and publications received from the geological surveys and mining departments of other countries, and our reports have been forwarded to them in return. I have to acknowledge, with thanks, the receipt from the proprietors of copies of the *Launceston Examiner*, *Daily Telegraph*, *Zeehan and Dundas Herald*, *Australian Mining Standard*, *Queensland Mining Journal*, *New Zealand Mines Record*, *New Zealand Engineering and Mining Journal*, *New York Engineering and Mining Journal*, &c. A collection of ores is being prepared, by request, for Dr. E. Weinschenk, the well-known Professor of Geology in the University of Munich.

Mr. F. S. Grove is still in charge of the renewals to the Mount Cameron Water-race. Miss Higgs ceased to act as typist on the 9th November, by the automatic operation of the "Public Service Act" governing the term of service of persons employed temporarily. Her duties were discharged to my satisfaction.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES,
Government Geologist.

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

REPORT OF THE ASSISTANT GOVERNMENT
GEOLOGIST.

Launceston, 7th May, 1908.

SIR,

I HAVE the honour to present the following report on the work upon which I have been engaged during the year ending 31st December, 1907.

It was not until the end of August that I joined the Tasmanian Government Service, and I proceeded at once to the Mt. Farrell Mining Field. The examination of this important district occupied my attention until the end of November, and as a result of this fieldwork a report, together with a geological map of the area, will shortly be ready for publication.

The Mt. Farrell Field presents many points of interest to the student of mining geology, and the information gathered should prove of value in the elucidation of other problems concerning the mineral occurrences in neighbouring areas. The report in course of preparation will include some discussion of the probable mode of genesis of the lodes. The appreciation by prospectors of those facts which have been noted with regard to the sources of the metallic ores should undoubtedly result in material advantage to the State, and lead to the discovery of hitherto unknown deposits.

In addition to the presentation of the results of my observations upon the general and economic geology of the area, the report will contain a detailed account of the present condition of the mines and the operations now being carried out by the several mining companies represented on the field.

Appended is a brief summary of the salient geological features of the district.

The principal mineral-bearing area of Mt. Farrell consists of a series of schistose sedimentary rocks, with which are associated massive and schistose igneous rocks. The latter are in the main feldspathic porphyries, and the schistose types derived from them are best termed "porphyroids." The ridge of Mt. Farrell itself is formed of a dense and coarse conglomerate, commonly found on the summits of the West Coast Range. Here the beds of conglomerate stand on edge, and apparently rest unconformably upon the schistose sediments.

The rock formations which constitute the foundations upon which the abovementioned series rest, hardly outcrop on the mining area. They are in all probability the quartzitic schists and mica schists of the hills lying to the east of Mt. Farrell. Under all these formations the granite of Granite Tor appears to dip, and its western extension probably exists in depth below the Farrell field.

The complex of igneous and sedimentary schists, viz., the porphyroids and slates, are tilted to a high angle by orogenic movements. The lodes of the principal producing area occur on the western flank of the mountain, and their strike is usually within a few degrees of north and south. The dip usually coincides with the dip of the divisional planes in the schists. The geological map will show clearly that the lodes have no genetic

connection with the country rocks in which they are immediately enclosed. The lode fissures extend from slate into porphyroid and into massive felspar porphyry, and the same lode type occurs in all three of these rocks. However, there are certain differences in the physical structure of the lodes, according as they occur in the slate or in the porphyroid.

The principal lode type represented is that of the sideritic lead ores. The pyritic lead type is also represented in the case of one mine. The copper deposits of the field are of less importance, and are not yet proved to be considerable in extent. These are, in my opinion, the result of local variations in the mineral content of the ore depositing solutions at the time of the filling of the lode fissures; and are probably rather the more markedly cupriferous portions of a lode which usually carries galena as the predominant metallic mineral than copper veins pure and simple. The copper pyrites associated with the galena in all of the lodes of the field is so constantly present that it constitutes the most notable character of the lead ores.

The field contains some quartz reefs, which are not in themselves metalliferous. However, they have been formed prior to the ore deposits, and the fissuring of the district subsequent to their formation has allowed some portions of the quartz bodies to be filled with lead ore. In this way one remarkable line of vughs in the quartz has been almost completely filled with galena. Iron ore is found here and there, but never in masses of any considerable size.

The whole district shows a remarkable freedom from the processes of oxidation and secondary enrichment, and hardly any gossans are to be seen. This is doubtless the result of the physiographic features, for all the mineralised area is situated upon steeply-sloping ground which is subject to the active progress of degradation.

There are several indications which point to the stanniferous granite of Granite Tor as the proximate source of the ore bodies of Mt. Farrell, and this feature brings the Mt. Farrell field into close relationship with the other mineralised areas of the West Coast.

The mines now operative are all in the early stages of their existence. The deepest workings on the field are hardly below the level of the button-grass plain cut by the Murchison and Mackintosh Rivers, and the deeper workings of the principal mine—the North Mt. Farrell Mine—show no signs of deterioration. This fact is certainly one which should afford much comfort to the managements of both this mine and others in the district.

I have the honour to be,

Sir,

Your obedient Servant,

L. K. WARD,

Assistant Government Geologist.

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

REPORT OF THE CHIEF INSPECTOR OF MINES.

Chief Inspector of Mines Office,
Launceston, 30th May, 1908.

SIR,

I HAVE the honour to present my report on the inspection of mines during the year ending 31st December, 1907.

The annexed tables and diagram supply information in a tabular form relating to the number and nature of accidents which have occurred at the mines and smelting works in this State during the 12 months.

I append the annual reports prepared by the Inspectors of Mines, viz., Mr. M. J. Griffin for the Northern and Southern, Eastern and North-Eastern Divisions; Mr. James Harrison, Inspector for the Western and North-Western Divisions; and Mr. C. H. Curtain, Inspector for the Lyell District.

The number of persons employed this year in and about the mines and smelting works was 7516.

The cases of fatal injuries were 6; and non-fatal serious injuries were 64. The death rate from accident was 0.79 per thousand, compared with 0.57 per thousand in 1906, and 1.06 per thousand in 1905. It is gratifying to observe that the fatality rate keeps low.

The ratio of serious non-fatal accidents has slightly increased, but this may be due to greater strictness in registration.

The term of 14 days' disablement has been adhered to as the criterion of the seriousness of all doubtful accidents, and as this is also being observed by the inspection departments of the other States of the Commonwealth, more useful comparisons of State statistics can be made than was formerly the case. Not only does the adoption of this method lead to useful uniformity, but the seriousness of an accident is gauged thereby far better than by leaving it to the uncertain opinion of a mining manager, or to the certificate of a medical man, who probably would class an accident as serious only when it endangers life, and take no account of the time it prevents the sufferer from resuming his occupation. From an Inspector's point of view the period of disablement is the first criterion to be applied. The occasional difference which occurs between mining managers and Inspectors as to the gravity of an accident, and the difficulty of defining the term "serious injury" comprehensively, make it advisable to amend the Act by requiring all casualties to be reported, leaving the registration of accidents to be dealt with, as now, by the Department.

Several minor amendments of the Act need to be made. Suggestions have been received from various sources, which have been carefully considered and forwarded to you with recommendations.

With an increased number of men engaged in mining, the divisional Inspectors have had an unusually busy year. Inspection on the West Coast has to some extent been hampered by the arrangement which burdens the Inspectors with duties connected with the Public Works Department. Unfortunately,

official inspection cannot ensure freedom from accidents, fatal or otherwise. Examination of the reports and statistics appended hereto will show that the majority of the casualties were not due to negligence of the rules, nor even to the lack of any rules, but were either purely accidental or owing to carelessness on the part of the sufferer. These misadventures can best be diminished in number by the exercise of constant care by the mining managers and superintendents, who should vigilantly watch mining practice and guard against possible dangers. The visits of the Inspectors do not relieve managers from their responsibilities, as is often supposed, but are otherwise beneficial in inspecting the way in which work is conducted in the various mines. Dangerous practices are put down, and careful methods receive recognition. Sometimes miners are not enjoying due protection, not because the manager is unreasonable, but because the mine owners are carrying on operations too parsimoniously for the safety of workers. In such cases the Inspectors intervene, with good results.

Proceedings have been taken in cases where breaches of "The Mining Act" occurred.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES.

Chief Inspector of Mines.

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

TABLE showing Rate per Thousand Killed and Injured in the different Divisions for the Year 1907.

Division.	Average Number of Men employed.	Number of Accidents.	Number of Persons.		Total number Killed & Injured.	Average per 1000 Killed and Injured.	Average per 1000.	
			Killed.	Injured.			Killed.	Injured.
Northern and Southern	894	13	Nil	13	13	14·541	Nil	14·541
North-Western... ..	607	5	Nil	7	7	1·153	Nil	1·153
North-Eastern	978	6	3	3	6	6·134	3·067	3·067
Eastern	684	5	Nil	5	5	7·309	Nil	7·309
Western.....	4353	39	3	36	39	8·959	0·689	8·270
	7516	68	6	64	70	...	...	...

Diagram showing the ratio of fatal accidents
in mines in Tasmania.

Rate per 1000 men employed.

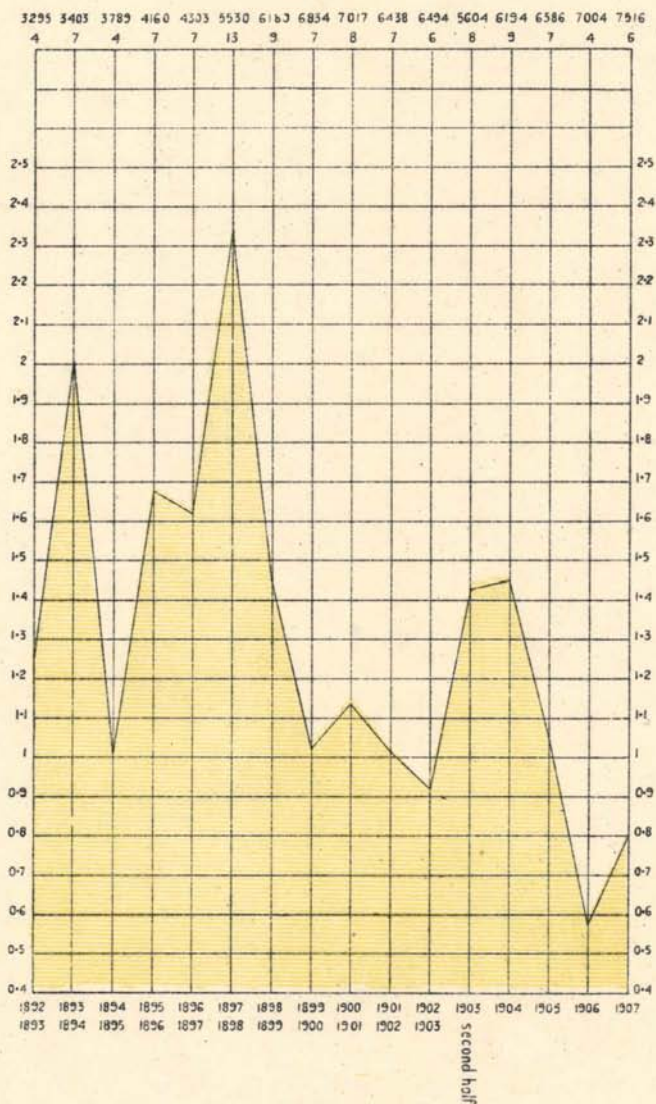


Photo Algraphed by John Vail Government Printer Hobart Tasmania

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Analysis of Statistics for the Western Division.

Division.	Average Number of Men employed.	Number of Accidents.	Number of Persons.		Total Killed & Injured.	Average per 1000 Killed and Injured.	Average per 1000.	
			Killed.	Injured.			Killed.	Injured.
Mount Lyell	2260	23	1	22	23	10·177	0·442	9·734
Zeehan, &c.	2093	16	2	14	16	7·692	0·955	6·688
	4353	39	3	36	39	8·959	0·689	8·270

TABLE showing the Number of Persons Killed and Injured in and about the Mines of Tasmania during the Year 1907.

PLACE OR CAUSE OF ACCIDENT.	INSPECTION DISTRICTS.													
	Northern and Southern Division.		North- Eastern Division.		Eastern Division.		North- Western Division.		Western Division.				TOTAL.	
									Zeehan and other Districts.		Lyell District.			
Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	
UNDERGROUND—														
Falls of Ground	3	...	...	...	...	...	1	1	...	1	2	2	6
<i>Shaft Accidents—</i>														
Machinery	1	...	...	...	...	...	...	1	...	...	...	1	1
Things falling down shafts	1	...	...	...	...	...	...	...	...	...	1	...	2
Haulage	2	...	...	...	2
Falling down passes and shafts.	1	...	...	...	...	...	...	...	...	...	...	...	1
Total	3	...	...	...	...	...	...	1	2	...	1	1	6

<i>Miscellaneous (underground).</i>														
Haulage—														
Trams, &c. ....	...	2	...	...	...	...	...	...	...	...	...	...	...	2
Sundry accidents .....	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Explosives .....	...	1	...	...	...	...	...	...	...	1	...	...	...	2
Total .....	...	4	...	...	...	...	...	...	...	1	...	...	...	5
<i>Total Underground . .</i>	...	10	...	...	...	...	...	1	2	3	1	3	3	17
<i>ON SURFACE—</i>														
Smelting-works .....	...	...	...	...	...	...	...	...	7	...	4	...	...	11
Machinery .....	...	4	...	...	...	1	...	4	...	...	4	...	...	13
Falls of ground .....	...	...	2	2	...	1	...	...	1	...	2	2	...	6
Falls of stone .....	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Tramways .....	...	1	...	...	...	...	...	...	3	...	3	...	...	7
Falls of persons .....	...	...	...	...	...	...	...	...	...	...	6	...	...	6
Miscellaneous—														
Guy-rope giving way ...	...	1	1	...	...	1	...	1	...	...	...	...	1	3
<i>Total Surface</i>	...	6	3	2	...	3	...	6	...	11	...	19	3	47
GROSS TOTAL, 1907.....	...	16	3	2	...	3	...	7	2	14	1	22	6	64
Total during 1906.....	1	16	...	4	1	8	...	1	1	8	...	24	4	61

COMPARATIVE Table of Statistics of Accidents in and about the Mines of Tasmania from 1st July, 1892, to 31st December, 1907.

Period.	Number of Miners employed.	Number of Accidents.	Number of Persons.		Total killed and injured.	Average per 1000 killed and injured.	Average per 1000.	
			Killed.	Injured.			Killed.	Injured.
1 July, 1892, to 30 June, 1893	3295	28	4	25	29	8·8001	1·214	7·586
" 1893 " 1894	3403	25	7	20	27	7·934	2·057	5·877
" 1894 " 1895	3789	26	4	24	28	7·300	1·058	6·332
" 1895 " 1896	4160	22	7	16	23	5·529	1·682	3·847
" 1896 " 1897	4303	36	7	31	38	8·831	1·627	7·204
" 1897 " 1898	5530	36	13	33	46	8·318	2·351	5·967
" 1898 " 1899	6180	35	9	34	43	6·957	1·456	5·501
" 1899 " 1900	6834	19	7	16	23	3·365	1·024	2·341
" 1900 " 1901	7017	29	8	23	31	4·417	1·140	3·278
" 1901 " 1902	6438	38	7	35	42	6·524	1·088	5·437
" 1902 " 1903	6484	44	6	43	49	7·557	0·925	6·632
" 1903, to 31 Dec., 1903	5604	27	8	20	28	4·977	1·428	3·569
1 Jan., 1904 " 1904	6192	73	9	65	74	11·951	1·454	10·497
" 1905 " 1905	6586	34	7	30	37	5·618	1·063	4·555
" 1906 " 1906	7004	65	4	61	65	9·280	0·571	8·709
" 1907 " 1907	7516	67	6	64	70	9·314	0·798	8·515

REPORTS OF INSPECTORS OF MINES.

MR. INSPECTOR GRIFFIN (stationed at Launceston) reports:—

I have the honour to submit my annual report on mines inspected by me in the Northern and Southern, North-Eastern and Eastern Divisions of the State for the year ending 31st December, 1907.

Accidents.—Three fatal and 21 non-fatal accidents have been reported and recorded during the year. A detailed list is appended to this report.

The number of fatal accidents, three, is the same as for the preceding year. The non-fatal is much lower than for the preceding year, being 21, as against 28 in the year 1906. One of the fatal accidents, the man Edward Bradshaw, who was killed when working alone in his miner's claim, was of a nature that can scarcely be reached, and certainly not controlled by mining rules or inspection. A number of men of this class work about the tin mines, generally by themselves, and very often in old open-cut workings where there is even more danger than in opening up new ground. If seen and spoken to about any apparent defects in the method of working, they feel offended; as to rules and regulations, they know nothing about such things. "There is no one else to be hurt," they say, "and if I cannot look after myself after all the years I have been at the game, well, then it is no use trying to make me by printed rules." I have come to the conclusion that since there is no rule to prevent a man from working by himself, such as care to do so must only take their chance, as a dozen Inspectors could not make them alter their methods. Of the other two fatal accidents, Vaughan was killed in a shaft, and there is certainly no person to blame for the unfortunate occurrence; not so, however, in the derrick accident at the Purdue Mine, where the unfortunate man, Stewart, was the victim of the carelessness of others.

Of the 24 accidents recorded, 15 were surface and nine underground. Thirteen were caused through inexperience or want of caution on the part of the injured men themselves; eight were purely accidental or unavoidable; and the remaining three were due to owners or their managers.

Prosecutions.—In one case only was it found necessary to prosecute for a breach of the regulations. The mine manager of the Moorina Tin Mine was proceeded against under Rule 57 (Part I., First Schedule) for allowing Thomas Brent to work by himself in ground that was dangerous in the open-cut face of the mine. He pleaded guilty, and was fined £2, with 8s. court costs.

Observance of Rules and Regulations.—There is an improvement in this direction. The new "Mining Act" is, I think, being better understood, at least there is not so much opposition to its provisions as at first.

Alteration of a Rule.—The Tasmania Gold Mining Company applied through the Chief Inspector of Mines for an alteration

in General Rule 26 (Part I., First Schedule), to enable it to carry on other work from a shaft in its mine at the same time as the work of shaft-sinking was being proceeded with. The rule referred to forbids the sinking of a shaft "below any place where men are at work, unless such shaft, to a width of the winding compartments below such place, be covered by a securely-constructed pent-house." The winding engine is at the surface, and sinking operations were going on at or below the 1250-foot level. The shaft is a large one, five times as great in sectional area as ordinary mining shafts, and sinking from the 1000-foot level by means of buckets and air-winch would be too slow. The company commenced cross-cutting from the 1250-foot level, but no mullock or material was caged from this place, excepting at such times as the men engaged shaft-sinking were out of the bottom. This was safe enough, but according to the wording of Rule 26 could not be permitted. I had therefore to order its discontinuance, and recommended the company to apply for an alteration, which the Governor in Council, under Section 197 of "The Mining Act, 1905," is empowered to make, if recommended by the Chief Inspector of Mines, in connection with the working of any mine where the observance of the general rules is not reasonably practicable. The application was granted, and the rule altered to read:—"During shaft-sinking operations no material or tools shall be caged from any other place in such shaft while men are at work in the bottom of the shaft, unless the winding compartment so used be protected to its full width below such place by a securely-constructed pent-house." The object of the rule in the first place was that men shaft-sinking should be protected from injury by things falling down the shaft, such as stone, mullock, tools, drills, &c., when being hoisted or lowered by, put on, or taken off any cage or bucket working in the shaft. The alteration now permits this company to sink with cages, and to do other work, such as cross-cutting, driving, rising, &c., at the same time, and without pent-house protection, provided that no material or tools from such working places shall be caged, hoisted, or lowered, excepting at such times as all men are out of the shaft.

Complaints.—No complaints in writing, that is complaints strictly within the meaning of Section 178 of the Act, were received during the year. Complaints from anonymous writers have been received, but of these, of course, the Inspector is not required to take any notice; nevertheless, they are considered, and sometimes found on subsequent investigation to be not altogether without foundation. One complaint, however, made in writing was not anonymous, but the writer was not "a person employed in the mine" he referred to. This had reference to the, as it was alleged, unsafe condition of a long tail-race tunnel (900 feet long) on the Weldborough Tin Mining Company's mine, which it was said was a death-trap into which men were afraid to go, preferring to leave the mine rather than risk their lives in such a place. I had frequently inspected the tunnel, and had not much doubt as to its being safe enough. Now, however, that a complaint had been made, I made a special journey to the mine, about 80 miles by rail and coach, to find when I got there that there was little or no truth in the complaint made. As to men having left the mine because it was

considered dangerous, this was a pure fabrication. Subsequent to my inspection the mine manager wrote complaining that the timbering of the covered race, referred to above, had been tampered with, that two or three sets were knocked down, and that he evidently had an enemy in the neighbourhood. Under our new Act the Inspector is not allowed to divulge the name of his informant in cases where a complaint is made as to the insecure state or alleged danger in a mine, no matter whether such complaint is found to be frivolous or not. This may be well enough so far as it applies to miners actually engaged in the mine, but not so when applied to outsiders, such as my informant in this case. In such cases the name of the informant should be disclosed, and thus give the person complained against an opportunity of defending himself.

Explosives.—No casualties have occurred during the year from the use or handling of high explosives, which is mainly due to more care being taken in storing, handling, charging, &c. Magazines as a rule are kept in good order, dry, and well ventilated.

Equipment.—There is an improvement in the general equipment of mines worked from shafts, and it was not found necessary to condemn any rope, chain, hook, or safety appliance in use. It is, in these times, rarely that accidents occur from the breaking of ropes or chains. Careful inspection, cleaning, changing, and recapping, such as is now the practice in all, or nearly all, the big mines, is better than trusting to even the best safety appliances.

Ventilation.—The metalliferous mines have fairly good, in some cases very good, ventilation, supplied by natural means, excepting in one or two cases where small blower-fans are in use. The Tasmania Gold Mine at Beaconsfield, from being one of the worst ventilated mines in the State a few years ago, has now good ventilation, obtained solely by natural means. Natural ventilation is, however, subject to atmospheric changes. When the temperature at the surface is higher than in the mine, circulation fluctuates or ceases altogether; and mechanical appliances are then required. At this mine two of the large working shafts (Hart's and Grubb's), as also the Lefroy air-shaft close to these, are down-cast, the cold air passing to the deepest parts of the mine, thence circulating upwards through the workings and westward, until it finds a return to the surface by means of the up-cast shafts, four in number, viz., Florence, Phoenix, Gate, and old main shaft—the latter is sometimes used as down-cast. The rise in temperature in the pyritic and limestone belts out west at the old upper levels materially aid the pull on the air current. There are of course places in the mine, such as winzes, dead ends, &c., that natural ventilation unaided by mechanical appliances scarcely reaches. The North Tasmania Gold Mine, now owned by the Tasmania Gold Mining Company, Limited, who purchased this property during the year, has been undergoing a thorough overhaul. A large Root-blower, formerly used in the big mine, is being installed, and in all probability will effect good ventilation in this gas-hole of a mine, where even moderately good air was unknown before. The deep mines at Mathinna—New Golden Gate and Tasmanian Consols—the working shafts of which are

only about 100 yards apart, are now connected by drives at the 1500-foot levels; by this means improved ventilation is secured to both mines. The "Consols" mine was, until this connection was made, dependent on a single shaft for all purposes, and although the ventilation of the mine was not to say bad, at any time, yet there was always a sense of insecurity where there was only one means of escape for the men from a deep (1600 feet) mine like this. Under First Schedule, Part I., General Rules, Section 1, of "The Mining Act, 1905," the Inspector is empowered, subject to the authority of the Minister, to order the construction of connecting drives for ventilation and escape at the joint expense of the owners, provided the workings are not more than 300 feet apart. The connection made in these mines was simple enough, as on both sides drives had already been constructed up to the boundary. There was at first some dissent on the part of the "Gate" company, who objected to an entrance being made to their mine over which they would not have complete control. Questions were also asked, "In the event of one mine being abandoned, and water rising to the connecting level and flowing into the other mine still working, what indemnity would the latter mine have against costs incurred in preventing this?" Water would never rise to the air-connecting level in the Consols so long as the workings in the "Gate" mine, only a short distance away, were below that level. The "Gate" shaft is now 200 feet below the bottom of the "Consols" mine, and 300 feet below the connecting drive between the two mines. The foregoing objections were, however, overcome by explanations given, and the two mines were connected at the joint cost of the companies concerned, without the Inspector having to resort to compulsory measures. Both mines have now fairly good ventilation. The other metaliferous mines have, as a rule, fairly good ventilation.

Coal Mines.—The smaller collieries are for the most part well ventilated by natural means. Of the larger ones, the Mt. Nicholas and Cornwall have each returns to up-cast furnace shafts. The Sandfly, which has recently suspended operations, for a time at least, depended entirely on natural ventilation; latterly, however, the ventilation has not been good in places, and either fan or furnace will be required when work in this mine is again resumed.

The Mt. Nicholas Colliery has had passable ventilation during the year, rather erratic at times, owing to the scattered workings in the old pit and leakages into the return air-way, where they should not occur if a little more care were taken.

Cornwall Colliery.—There is not much improvement in the ventilation of this mine, as compared with what it was a year ago, when I refrained only from condemning it as inadequate on the understanding that the company would procure and instal an electric fan to improve the ventilation. The fan has not yet reached the mine, but, I am informed, will soon come to hand: it had to be ordered from America, hence the delay. In April last the system of working was altered from "pillar and bord" to "long-wall"; since then the ventilation has improved somewhat, as the circulation of air is made easier by reason of the continuity of the long-wall face as compared with the other method of working, where the air has to be portioned off into each bord. The electric haulage also helps to improve ventila-

tion, as apart from the breathing of horses and the amount of oxygen used up, there is dust constantly from their feet that chokes the air-ways.

Accidents or Mishaps not attended with Injury to any Person.—The following were not reported directly. In some cases accidents or mishaps of this kind are recorded in the weekly inspection book at the mine; others, again, are neither reported nor recorded:—

The eastern cage at main shaft, Tasmania Gold Mine, was poppet-headed. The detaching-hook acted all right, and no damage was done. This was not a case of over-crowding, but the engine-driver, Thos. Owen, started the engine the wrong way, the cage rising from the brace instead of being lowered. Owen, whose past record as an engine-driver is good, he having worked on this mine for the past 29 years as driver without having a mishap, was allowed to remain on—an exception to the rule.

At the Cornwall Colliery one of the ponies in use in the mine hauling the skips from the faces to the terminus of the electric tram-line was electrocuted by coming in contact with the copper cable that runs along beneath the roof of the main heading. The animal, in turning round touched with its ears the wire. A slight shock caused it to plunge and catch the iron hames on the wire, and it is thought the animal's shod foot must have touched the iron tram-rail at the same time, as it was instantly killed. Provision has since been made for switching off the current while the ponies and drivers are at the terminus. I have also given orders that the electric current is to be cut off at the power-house during such time as men are passing to and from their work, morning and evening. No serious results have so far arisen from contact with the wire, although several men, including the manager, and even the Inspector, have had slight shocks, often through the medium of a wet hat. It would seem that the risk of fatal, or even serious, accident is not great unless one's foot is on the rail at the same time as head or hand comes in contact with the wire above.

Inspection.—The mines in the different divisions allotted to me have been visited and inspected as often as practicable, the principal ones four times in the year, less important ones three times; outlying places, such as Middlesex in the west, and the coal mines of the south, were visited twice during the year. Special visits were made to Gladstone (twice), Beaconsfield, Burnie Copper Mine, Sandfly Colliery, Moorina, Derby, and Weldborough (once each). The cause of all serious accidents, as well as the fatal ones, was enquired into as soon as practicable, and in most cases an inspection of the place before it was interfered with was made, excepting in some cases of non-fatal accidents, where inspection before work is resumed is not necessary, and the enquiry can be made on the occasion of my next visit to the locality. I find that inspection of the place, and a thorough investigation into the cause of accidents of a serious nature, where there is implied negligence on the part of manager or man, has a salutary effect, especially if made without undue delay, and witnesses are examined on oath. Some men, and indeed some managers as well, do not appear to realise that they themselves have erred, or have even been guilty of a breach of the Mining Regulations, until in giving evidence at an enquiry

they have to admit a want of knowledge of the provisions of the Act, or even negligence.

Progress of Mines.—In gold-mining no new mines of any consequence have been added to the list. An attempt was made to reopen some of the old mines on the Lyndhurst Field. Mr. John Wren, of Melbourne, expended a good sum in having the Prince Imperial and other reefs there tested, but the whole venture suddenly collapsed. The Lyndhurst G.M. Company is doing something at the old Southern Cross Mine, but so far progress is slow.

Lefroy.—There is not much doing on this field. Mr. G. Barker made a discovery at Back Creek; an iron formation carrying gold at its junction with a small quartz reef. Some sinking is being done, but so far the iron has not been proved to be the capping of a payable reef. Clark, Hill, and party discovered a small reef near the Point and Crown, on which they have sunk a small windlass shaft 50 feet, and opened on from 12 to 15 inches of stone. A trial crushing of 6 tons from near the surface gave 7 ounces of gold. This show is called the "Blue Jacket." New Pinafore has done a lot of prospecting for both lode and shallow alluvial during the past year, but has not succeeded in discovering anything worth mentioning. The company is now turning its attention to prospecting the deep lead, with a view to working this alluvial. The inception of the lead is on the Lefroy township. Government aid will be given, to assist the company in this work. Thousands of pounds have been expended in prospecting for reefs in the Lefroy district, but very little has been done to prove the value of the deep lead known to exist there, and there are good and substantial reasons for believing it to be rich in alluvial gold.

Beaconsfield.—The Bonanza Company has sunk its shaft 200 feet; the total depth is now 800 feet. A steam-winding plant was installed at the beginning of the year. This has greatly facilitated sinking operations. *Tasmania Gold Mine.*—Grubb's shaft has been sunk a further depth of 300 feet below the 1000-foot level. A plat was cut at 1250 feet, and a crosscut is now being driven at this level. Hart's shaft was sunk another 100 feet or so below the 1100-foot level, but operations had to be suspended for the time being on account of the great in-flow of water. The main drainage is intercepted here before reaching Grubb's shaft, which is further to the east. The old main shaft pump has been dismantled, and columns drawn, as there is no further use for it at this place, the water being now pumped from the deeper levels by the three pumps, two of which are at Grubb's and one at Hart's shaft. These new pumps are working smoothly and well, and were, in November, throwing four and a half million gallons per day. *North Tasmania Gold Mine.*—This property is now owned by the Tasmania Company, which has cleaned up and repaired the levels and stopes, overhauled the machinery, installed a powerful ventilating fan, and otherwise put things in order preparatory to the commencement of extensive prospecting operations. The East Tasmania had the diamond-drill at work, and bored to a depth of a thousand feet or so, but has long since ceased work. Mr. W. J. Phillipson (Tasmania Tailings Syndicate) is still working away at the sand, and obtaining values up to 2 dwts. by cyaniding. A new boiler has been added to the barge plant on the creek.

Mathinna.—New Golden Gate Company has sunk its main shaft 200 feet on to the 1800-foot level, at which depth the reefs, both east and west of the shaft, have been cut. Tasmania Consols.—Battery concentrating works reconstructed and added to, boilers grouped, incline haulage-line constructed from shaft to battery, and stone-crusher added to plant. These improvements have reduced cost of crushing and concentrating, &c., by 50 per cent., as compared with the old plant. A "Schram-Hasker" diamond-drill purchased by the company is in use in the mine, boring horizontally at the bottom levels. The Miner's Dream has not done much, but is still alive. The City of Hobart Company had a reef on its property tested by B. Searl and party working on tribute, but it did not last long. The Volunteer group is still idle.

Alberton.—The New Ringarooma Gold Syndicate has been working, with varying success; want of capital is the trouble. New River Freehold G.M. Company has obtained more capital, and was about to resume work at the close of the year.

At Golconda the New Wyengatta Gold Mining Company resumed work in August. New poppet-heads have been erected, and a steam-winding plant installed. The company is now in a better way of working than heretofore, and the prospects in the mine are very encouraging. The New Panama G.M. Company is tunnelling and prospecting, but nothing has been discovered to warrant opening up on.

Tin Mines.—North-Eastern Division.—The New Aberfoyle T.M. Company constructed a head-race 21 miles from the off-take on the Boobyalla River to their tin mine on the Ringarooma River, which is now being opened up. The source of water-supply is not very good in the summer time. The complete failure of the Cybele Tin Mining Company came as a surprise only to those who were unacquainted with the locality and circumstances. The Purdue Tin Mines Company commenced the erection of a pumping plant early in the year. This was completed some three months ago, since which time sluicing operations have been carried on with very satisfactory results. The plant comprises a three-stage 12-inch centrifugal pump, 15-inch rising main, Allen engine, Babcock boilers capable of throwing 11½ sluice-heads (1725 gals. per minute) to a height of 172 feet. The water is brought into the pump-sump, which is 30 feet above the river, by means of a large head-race, 4 miles in length, with its off-take on the Ringarooma River. By this means risk of stoppages during times of flood are being avoided; it also offers a means of getting rid of a lot of sand. The South Mount Cameron Tin Company has replaced its old pump by a more powerful and up-to-date one. The Pioneer Extended Company has purchased the plant (gravel pump, engine, boiler, &c.) of the Weldbrook Tin Mining Company. The Pioneer Tin Mining Company has, during the year, added a fourth barge and pumping plant to their works. An extraordinary rainfall occurred in February last, and the mine was flooded through the sudden overflow of Bradshaw's Creek. The three plants at work were completely submerged, and it was nearly three months before sluicing operations could be again resumed. Fortunately the new plant, although nearly finished, was not in position for working, and could be kept afloat; it was soon finished, and used for pumping out the flood-water. The company is now

about to commence the construction of a large reservoir on the Frome River, for the purpose of running an electric power station, which will be capable of supplying electric energy sufficient to drive all the machinery on the mine. The Briseis Tin Mines Company commenced sluicing off the overburden at the North Briseis (late Ringarooma Company). A large main has been laid across the Ringarooma to carry a supply of water from the company's upper race. A series of prospecting tunnels have been put in from a little above river-level on the western side of the hill, to test the drift. The Arba Tin Mine is now well equipped with machinery, and good progress is being made. The T.P.C. Mine is still going on the lode formation. The percentage of tin is low, and there is a good deal of copper, which does not help matters. An option syndicate has been prospecting the old Bell's Hill lode, but nothing much has come of this.

Weldborough.—The Weldbrook Tin Company has ceased to exist. The plant was purchased by the Pioneer Extended Company. The Fancy Creek Company have had some very heavy slips of the basaltic overburden in their open-cut face on the township section. There is no wash or drift at this face. The basaltic covering is on a soft granite intersected with innumerable small quartz veins, from mere threads up to 4 or 5 inches in thickness; these carry tin, which is won by sluicing away the soft granite. The Weldborough Tin Company has a few men working on a formation similar to the Fancy Creek, of which mine it is a close neighbour. The Mutual Hill Tin Mine Company finished its head-race construction, pipe-laying, &c., some few months back, since which time the work of opening up the mine has been carried on. So far the overburden of basalt, chiefly soil and loose boulders, has been brought down and sluiced off or removed from the tin-drift level. This is a great mistake, when the fall into Main Creek on the west side offers such splendid facilities for getting rid of the overburden, the Ringarooma fall on the north side being the outlet for the tin-drift sluices. If properly managed, this mine will, I believe, come to the front as a tin-producer. Briseis Extended Company.—Latterly good progress has been made in the way of removing the top stuff, comprised of modern river shingle and surface sand. In doing this some few feet depth of the older bottom drift was sluiced off and some very nice seams of tin exposed. Mount Paris Tin Company has been getting some ore from the old tunnels. A new tunnel is now being driven to test the lode-formation higher up the hill. It is understood that the company is about to enter upon a more comprehensive scheme of working, and that the battery and concentrating machinery will be removed to a lower site near the Dorset River, where water can be obtained and used, to take the place of the steam power now in use. Anchor Tin Mine.—Mr. J. B. Lewis has done everything possible to be done in the way of reducing working costs. The fall in the price of tin has, however, caused considerable speculation as to what will be the fate of this, as well as other mines, working on low-grade ores should the tin market go much lower.

St. Helens.—Not much doing round here. The Royal Ruby and Thureau's Deep Lead companies are working, but on a very limited scale. The Priory tin lode was worked for a time, and one or two crushings were made with a five-head battery

erected at the mine. The lode was not payable, and the plant was sold to the Full Moon Company at the Blue Tier.

Avoca District.—The Mt. Rex Company did some driving south at the No. 1 level in their mine, but nothing came of this. They are now driving at the bottom level, on the course of a horizontal diamond-drill bore, to tap some stone discovered by the drill. The machinery has been idle during the year. Some alluvial is being worked, with fairly good results. The Gipp's Creek alluvial mine is working, but the output is not large. Twenty men, single or in small parties, are working at head of Story Creek, getting tin and wolfram. The Story Creek Alluvial Company worked for a few months, and closed down. Brookstead Estate Option Syndicate.—During the year an option has been held by Messrs. Hancock and other South Australian gentlemen over this estate, which is the property of Messrs. Fitzgerald, and is situate on the St. Paul's River, 12 miles by road from the Avoca township. Six to seven thousand pounds have been expended in prospecting the very extensive alluvial deposits, as well as the tin lodes known to exist, and with it is understood, satisfactory results. Before finally deciding to take over the property, however, the syndicate approached the Government *re* the tailings question. Pollution of the South Esk River, into which the St. Paul's flows, has been going on for several years past, owing to sludge tailings, and even gravel, being allowed to pass into it from the sluicing operations of several tin mines in the vicinity of Avoca and South Ben Lomond. Complaints have been made by landholders, farmers, and graziers having frontages on or through whose property the Esk flows, many of whom use the water for domestic purposes, of the discolouration and the amount of silt it contains. The township supplies of Evandale and Perth are affected, and the authorities of these places complain of the quantity of silt deposited in tanks and reservoirs. It is felt that something must be done, and done without unnecessary delay, to prevent further pollution of this river, which has a course from Avoca to Launceston, of 70 or 80 miles, through a very fine pastoral and agricultural country. It is claimed by those directly interested in alluvial tin mining that this branch of the industry cannot be carried on profitably unless those engaged in it are allowed to deposit tailings, &c., in the stream flowing through the mining areas. To settle, as far as possible, the question, so far as the Brookstead Option Syndicate and the depositing of tailings in the St. Paul's would be concerned, the Government desired information, and instructed Mr. W. H. Twelvetees, Government Geologist, and myself to report "as to whether the alluvial tin deposits there can be worked without putting tailings into the St. Paul's River." We are of opinion that they can, *vide* our report furnished to the Secretary for Mines under date 6th November, 1907.

Silver Mines.—The Round Hill Silver Mine Company at Mt. Claude, near Sheffield, commenced operations about the half-year in the old Mt. Claude tunnels. Subsequently an entirely new discovery was made further west. A large body of ore was uncovered, which is said to give highly satisfactory results of both silver and lead. The Devon Silver Mine on the Dove River, Middlesex, has been working, and showing improved values during the year. Operations are a good deal hampered

owing to the difficulty of getting supplies into, and ore away from, this almost inaccessible locality. Everything has to be packed in the winter time to the Shepherd and Murphy Mine, 8 miles, and in summer time to the top of the Caledonian Hill (5 miles rise), a rise of about 1600 feet in 3 miles of winding and zig-zag pack-track. There are times during the winter when communication with the outside is completely cut off by floods, snow storms, &c. Shepherd and Murphy Mine (tin, bismuth, and wolfram).—The company completed a new head-race, which has greatly added to the water-supply, and has given increased head-pressure for driving the battery and machinery. A thorough overhaul of the machinery was made, additions and improvements effected, and the plant made more efficient in every way. Latterly mining operations have been going on steadily. Burnie Copper Mine.—A lot has been done during the year in the way of surface work and mine development. A main shaft 14 feet by 4 feet 6 inches was put down 150 feet, and equipped with steam-winding plant, safety cages, &c. This is only a temporary plant, to be replaced by more powerful machinery if the mine proves payable. A lot of surface work had to be done, such as cleaning, road-making, building, &c. Quite a township has sprung up on the hill where the mine road junctions with the road leading up from Hythe to the "West Pine." The name of the new township is "Cuprona." Copper Creek Syndicate Mine.—Situate on the Leven River, west of Gunn's Plains, about 12 miles from Ulverstone. This is as yet only in the prospecting stage. Some tunnelling has been done, and the main lode cut at a shallow level. An adit is now being driven from the creek level.

Coal Mines.—There is not much that is new in the way of development in connection with these. The Nicholas Company opened a new pit on the 4-feet seam west of the old workings. Frequent faulting of the seam in these latter made long-wall most difficult working, and further extension in a north-easterly direction had to be abandoned. Some few places are still going, working back to the south-east and towards the outcrop. Work has also been resumed on the 6-feet seam, which is 15 to 20 feet above the "4-feet." Only 4 feet of the bottom coal is being sent to market. The remaining 2 feet of top coal is difficult to clean, on account of several thin bands running through it. Prospecting, for what there is good reason to believe will eventuate in the discovery of a large seam, is now going on. Bores put down some 75 feet from the level of, and not far from the entrance to, the present working tunnel, have in each case bottomed in a cavity 11 feet deep, supposed to be formed by the burning out of a large coal seam. The fact of there being no sign of a seam outcropping on the hillside at this level is in favour of the "burned out" theory, as in the event of the seam being burned out at the outcrop subsequent subsidence of the surface soil and rock would obliterate any trace of the outcrop. The Cornwall Colliery has changed from the "pillar and bord" to the "long-wall" system of working, and the change is proving to be of great advantage in the working of the mine. The Sandfly Colliery Company has suspended mining operations, owing to financial difficulties. The great cost involved in the construction of 12½ miles tramway from the mine to North-West Bay, together with jetty-building, rolling-stock, &c., proved to

be too great a burden in addition to the excessive cost of mining and getting the coal to market. The tramway, with its quick curves and steep gradients, is a costly line to work and maintain, and this, added to the cost at the mine, which appears to have been excessive, brought things to a climax. Nothing has been done at the Catamaran Coal Mine during the year. It seems a pity that this coal seam, which for size and quality of coal is certainly the best in the southern part of the State, should be neglected.

Bucket-dredging.—The Gladstone dredge has been doing fairly well during the year. At South Mt. Cameron the Dorset Company's new dredge was started about the half-year, and is working with satisfactory results. This is one of the largest, best-equipped, and most powerful bucket-dredges in use for mineral working in the Commonwealth States or New Zealand. The cost of working this, as compared with either of the other (Gladstone or Ringarooma) dredges is not much greater; the result in tin won is more than the two put together.

LIST of Accidents in Inspector Griffin's District for Year 1907.

Fatal, 3 ; non-fatal, 21 ; total, 24.

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single.	Nature of Injuries.	Particulars.
1907. 23 Jan.	Sandfly Colliery Co.	Margate	Explosion of powder	Roberts, Milford	Married	Scorched hand and side of body	Was stooping to take two plugs (about $\frac{3}{4}$ lb.) of powder out of a tin when it exploded ; he sustained burns on hand and side of body
9 Feb.	Briseis Tin Mines Ltd.	Derby	Fall of earth from open-cut face	Sullivan, Sydney	Single	Cuts on head and bruised back	Working in open-cut face ; heavy fall from face carried out further than usual ; Sullivan fell when running away and was caught by stuff from fall
19 Feb.	Moorina Tin Mine	Moorina	Fall of earth in open-cut face	Brent, Thomas	Ditto	Left leg broken below knee	Employed as nozzleman, he was working by himself during night time, when a heavy fall came away from the face and caught him as he attempted to escape
24 Feb.	Tasmania Gold Mining Co. Ltd.	Beaconsfield	Sudden escape of steam when uncovering cylinder	Burt, Wm.	Ditto	Scalded on both arms	Was assisting to take off cover of h.p. cylinder of pump engine ; some steam left in cylinder through drum cock being stopped, caused it to spring off suddenly, and Burt was scalded
7 Mar.	Ditto	Ditto	Caught his arm round cap-piece to save falling & strained muscles	O'Toole, W.	Ditto	Muscles of arm strained	Was working in stope, and stooping over, when a small piece of wood struck him on the head ; to save falling he caught hold of the cap piece and strained the muscles of his arm

3 April	Ditto	Ditto	Fall from chain ladder	Tresidder, Henry	Married	Fracture of thigh-bone, bruises on body and cuts on arm	Was ascending by means of chain ladder from sink of Hart's shaft; slipped when just at top of ladder, and fell 19 feet to bottom, sustaining broken thigh, also cuts on arm
8 April	Ditto	Ditto	Attempting to get off a cage while it was moving	Floyed, Thos.	Ditto	Sprained back	Attempted to get off top deck of cage before it was lowered on to catches; cage ascended again, and he was caught under some staging and got a squeeze
3 May	Mt. Nicholas Colliery	Mount Nicholas	Slipped on tramline	Rigby, Wm.	Single	Top joint of thumb jammed off	Was pushing a skip on tram-line, slipped and fell: wheel of skip passed over his thumb, crushing top joint off
About 10 April	Miner's Claim, Britannia Creek	Upper Cascade, Ringarooma	Fall of earth in open-cut face	Bradshaw, Edward	Ditto	Fatal	Was tin mining in old open-cut workings and worked alone; being missed for several days a search was made, when Bradshaw's body was found buried up in debris
9 May	Bonanza G.M. Co.	Beaconsfield	Lowering cage, got foot caught	Hampton, John	Married	Jammed foot	Was assisting to lower a cage from vertical to horizontal position; got his foot jammed beneath it as it fell
13 May	Tasmania Gold Mining Co.	Ditto	Caught in machinery in motion	Cutterill, George	Single	Two fingers jammed	Cleaning stuffing box of cylinder, got his fingers jammed between guard-plate and slide-block
22 May	Purdue Tin Mining Co.	Gladstone	Breaking of guy-rope	Stewart, George	Married	Fatal	Was engaged bricklaying beneath Babcock boiler; a strain was being put on tackle to lift steel smoke-stack, guy rope snapped, shear legs fell, plank struck Stewart on head

LIST of Accidents in Inspector Griffin's District for Year 1907—continued.

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single.	Nature of Injuries.	Particulars.
1907. 10 June	Tasmania Gold Mining Co.	Beaconsfield	Door of tool-box slamming	Lee, John	Married	Fingers jammed	Was employed at Beauty Point jetty works; was putting tools in large box, when the door suddenly slammed and jammed his fingers
5 July	Moorina Tin Mine Co.	Moorina	Fall of earth in open-cut face	Amos, Leslie	Ditto	Fracture of left thighbone	Was on night shift attending to nozzle in open-cut workings; went rather near to the face and was struck by a large lump from a heavy fall that took place
10 July	New Aberfoyle Tin Mining Co.	On Water-race 12 miles west, Gladstone	Fall of earth in shallow pit or shaft	Vaughan, Albert Austin	Ditto	Fracture of skull. Fatal	Was timbering up trial pit, 12 feet deep, in line of water-race tunnel; a large lump of stuff fell on him from side shaft, a lath fracturing his skull
6 July	Thureau's Deep-lead Tin Mine Co.	St Helens	Fall of earth in open-cut face	Morling, Wm.	Ditto	Broken arm	Worked by himself as tributor; went too near face and was caught by a fall of earth
20 July	Tasmania Gold Mining Co.	Beaconsfield	Caught in machinery in motion	Smith, Harold	Single	Right arm torn off at shoulder	Engaged as vanner boy; attempted to snatch off belting that had become wound around a pulley in motion; got his hand caught, and his arm was torn off
27 July	Ditto	Ditto	Small piece of stone falling in shaft	Goodson, John	Married	Severe cut on wrist	Engaged at sinking of "Grubb" shaft; a small piece of stone fell from somewhere striking him on the wrist and inflicting severe wound

1 Oct.	Sandfly Colliery Co. Ltd.	Margate	Fall of stone from roof	Mudge, Robert	Ditto	Injury to back, causing paralysis of legs	Mudge was working a bord coal face, and was kneeling to bore the coal, when a large lump of the roof clod fell, portion striking him across the back.
28 Sept.	Ditto	Ditto	Fingers caught between skip and prop	Hudson, George	Ditto	Fingers badly jammed, first joint of two amputated	Hudson was working in coal face and tried to run out a loaded skip, the wheeler not being there, and got two fingers jammed; top joints had to be amputated
17 Oct.	Anchor Tin Mine Ltd.	Lottah	Fell before empty truck	Burr, Wm.	Single	Bruised about hips and buttocks	Horse-driving on tramway, slipped and fell before empty wagon, wheels passed over his body; he was apparently not much injured, but was a week in hospital
14 Nov.	Tasmanian Consols G.M.	Mathinna	Foot caught by crank of engine	Street, Edward	Married	First joint of great toe cut off	Street left his work as lander, and went to talk to engine-driver; he inadvertently put his foot on bed log of engine and had his great toe cut off
17 Aug.	Anchor Tin Mine Ltd.	Lottah	Bar slipping, fall on rock	Lehner, J. W.	Ditto	Severe cut on head	Lehner was barring down stone in open-cut face; a flake of stone broke, and he fell, sustaining bad cut on head.
6 Dec.	Tasmania G.M. Co.	Beaconsfield	Mullock falling from hanging-wall	Kerrison, Walter	Ditto	Two fingers badly crushed	Was cleaning down in stope when a large piece of mullock fell from hanging-wall, crushing his fingers

MR. INSPECTOR HARRISON (stationed at Zeehan) reports:—

In submitting my annual report, I am pleased to state that the field generally is in a very prosperous condition.

Safety Appliances, Ropes, and Cages.—All the mines worked by machinery are well supplied with the necessary safety appliances. Ropes are examined, tested, and condemned if considered necessary. Cages are tested by both managers and Inspector as often as convenient.

Ventilation.—The ventilation of the mines is good, and there have been no complaints in this respect.

Magazines.—These are kept clean and in good order. Most of those constructed for the mines are underground. This system, I consider, to be the safest and best.

Health of Employees.—The health of the miners on the whole is good. The principle disease the doctors have to contend with is pneumonia, brought about by excessive rains and very changeable weather.

Accidents.—I regret to state we had two fatal accidents and 21 others. Seven of the latter were from the Tasmanian Smelting Company, and should not be classed as mining accidents. One of the former was of an avoidable character.

Prospects of the Field.—The Zeehan portion of the district is well maintaining its reputation as a producer of high-class galena ore. The Mount Zeehan (Tasmania) Company is putting down another main shaft, on which powerful machinery has been erected. While the deeper levels of the Spray workings of this extensive property fully prove by their value the necessity of a main shaft. *Zeehan-Montana.*—This mine is worked from three main shafts, all of which are raising payable ore. *Zeehan-Western.*—The mine is worked principally by tributers, but the manager is now making arrangements to sink his main shaft to a depth of 1000 feet. *Oonah.*—Arrangements are being made for the erection of smelters on the field, to treat the large bodies of stannite ore that have been exposed in the deeper levels. The mine also gives employment to tributers, who are working the shallow levels to advantage. From the western lodes large quantities of sulphide ore of low grade are being sent to Melbourne for the manufacture of manures. *Florence.*—This mine is turning out rich ore in considerable quantities, and is giving good returns to both the proprietors and the tributers. *Comet Bell.*—Has completed sinking its main shaft, and is now cross-cutting to strike the lode. *Silver King.*—Property still idle, with the exception of a very few tributers working on the surface. *Colonel North.*—Getting ready to unwater main shaft. *Victoria-Zeehan.*—Erecting good pumping and winding plant on new main shaft.

Dundas.—The Comet Mine has been worked successfully by tributers for several years; but they are not in a position to go any deeper, and I am afraid if assistance is not given by the company, the mine will soon have to close down. There are large lodes of low-grade fluxing ores that can be worked above water-level if a market could be obtained. *West Comet.*—This mine still continues to supply the local smelters with fluxing ores of good character.

Mt. Read.—The Hercules Company supplies the smelters with the usual amount of sulphide ore, and gives employment to about 100 men. The Mount Read Company has also a few men employed, but their year's work has not proved a success. Ring Valley.—A fair supply of rich fahl ore has been sent away during the year, but the manager finds it necessary to suspend mining operations pending the erection of a plant that will allow him to sink.

Rosebery.—The Tasmanian Copper Company has opened up immense bodies of sulphide ore, and supplies about 1000 tons per month to the Zeehan Smelters. The Primrose Company is also delivering ore of similar character. The Colebrook Company is busy erecting a smelting furnace, constructing trams, and getting ready to turn its ore into matte on an extensive scale.

Mt. Farrell.—The North Mt. Farrell Company still maintains a large output of high-class galena ores. The capacity of the dressing mill has been about doubled during the year. We have also the Mt. Farrell, Thomas' Blocks, the Tullah P.A., and Mt. Farrell Blocks, all working with good prospects. The Murchison River Company has shut down for the time being.

Waratah.—During the year the prospects of the Bischoff Tin Mining Company have very much improved. The same applies to the Bischoff Extended. The Cleveland Mine at the Whyte River is erecting a 10-head battery.

North-East Dundas.—Several very important and extensive finds have been made in this direction. A number of men are working the alluvial deposits, and machinery will soon be employed treating the rich lodes that have been discovered.

Heemskirk.—The northern portion of this field is engaging more attention than it was. A strong syndicate is prospecting the Tasman River flats, with the intention of building a dredge. There are also a number of small parties working the alluvial on various portions of the mount; some of them with very good results.

Stanley River.—This field is still idle, as there is no proper means of communication from Zeehan. Until a bridge is put over the Pieman River this large district is likely to remain idle.

General.—Prospectors are out in all directions, and we have numerous small parties at work. I am pleased to state that the Government has adopted a good progressive policy in opening up tracks and erecting wire-rope crossings over the rivers, which allow the prospector to go further afield without the chance of being cut off by floods.

LIST of Accidents in Inspector Harrison's District for Year 1907.

Fatal, 2; non-fatal, 21; total, 23.

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single.	Nature of Injuries.	Particulars.
1907. 6 Jan.	Tasmanian Smelting Co.'s Works	Zeehan	Slip of timber	Lyng, H. C.	Married	Loss of thumb and crushed index finger	Caused by slip of timber while erecting large shed
2 Jan.	Comet S.L.M. Co.	Dundas	Fall with truck	Jeffries, J. J.	—	Sprained ankle and bruises on face and shoulders	In trucking, opened the wrong door of the shaft, and ran the truck into open compartment, falling after it 75 feet into water
4 Jan.	Tasmanian Smelting Co.'s Works	Zeehan	Tapping furnace	Gleeson, P.	—	Burns on ankle and foot	In tapping slag stream was so diverted that it ran over his foot
8 Feb.	Mt. Bischoff	Waratah	Struck by stone	Smith, Robt.	Single	Fractured skull	Struck with stone while feeding stone-crusher
24 Feb.	Tasmanian Smelting Co.'s Works	Zeehan	Splash from slag pot	Large, Chas.	Ditto	Burns on foot	While tipping slag pot it struck side of bank
30 Mar.	Magnet	Magnet	Boiler pipe bursting	Hogan, M	Ditto	Burns on face and hands	Blow-pipe of boiler burst and blew boiler door open
	Ditto	Ditto	Ditto	Collins, Henry	Married	Ditto	
	Ditto	Ditto	Ditto	Evans, Robt.	Ditto	Ditto	
2 May	Florence Mine	Zeehan	Fall of earth	Lamerton, Wm.	Ditto	Cut over eye and bruises on body	Working in a trench when a slip took place
8 May	Tasmanian Smelting Co.'s Works	Ditto	Hand slipped under truck wheel	Brent, Thos.	—	Crushed fingers	Trying to chock wheel of moving slag truck, when hand slipped, and wheel went over fingers
16 May	Mt. Bischoff	Waratah	Caught in belting	Negus, J.	Single	Broken arm and bruises to face, &c.	Was caught in belting while drawing his hand over pulley-wheel gear of concentrating table

7 June	Zeehan-Montana	Zeehan	Fall of staging	Donaghy, Colin	Married	Bruised ribs	While standing on stage it gave way
29 June	Zeehan-Western	Ditto	Drill projecting from cage	Murphy, Joseph	Widower	Cut leg	While descending in cage his drill caught the timber and cut his leg
4 July	Tasmanian Smelting Co.'s Works	Ditto	Truck passing over foot	Storey, C.	Married	Crushed foot	Was trucking ore to bins when he caught his foot in staging and the truck went over it
10 July	Hercules	Mount Read	Fall of earth	Bamber, Hy.	Ditto	Fatal	Fall of earth took place in stope crushing his head
8 July	Tasmanian Smelting Co.'s Works	Zeehan	Fall of truck brake	Clifford, Ernest	Single	Crushed foot	Caused by brake of truck falling on his foot
28 July	Hercules	Mount Read	Explosion	Schmidt, Max	Married	Fractured leg, lacerated hand, &c.	Caused by explosion of charge on returning prematurely
28 July	Florence	Zeehan	Escape of hot water	Clough, Wm.	Single	Scalded face, arms, and back	Plug came out of hot-water pipe
30 July	Magnet	Magnet	Fall of rock	Anthony, James	Married	Broken ribs	Fall of rock from hanging-wall
17 Oct.	Mt. Zeehan (Tasmania)	Zeehan	Cage descending	James, John	Single	Fatal	While sinking, the driver allowed cage to descend
2 Sept.	Tasmanian Smelting Co.'s Works	Ditto	Explosion of hot ore	Howson, James	—	Body cut	—
16 Nov.	North Mt. Farrell	Farrell	Fall of stone from blast	Panitzki, Fredk.	Married	Injured shoulder-blade	Stone from open-cut blast fell through roof of shed
11 Dec.	Mt. Bischoff	Waratah	Fell down haulage line	Bartlett, Ernest	Single	Broken collar-bone	Fell 16 feet down inclined haulage line

MR. INSPECTOR CURTAIN (stationed at Queenstown) reports:—

For the statistical year just ended I beg to summarise the various items that have come under my notice.

Accidents.—There were 23 accidents reported, but only one proved fatal. Details are given in the appended list. The tabulated list does not contain accidents of a lesser degree, where the injured persons have not returned to work within the stipulated period, and have not been reported to me.

Mines.—Those in operation were the Mt. Lyell group, Lyell Blocks, Consols, Crown Lyell, Comstock Consolidated, Tasman and Crown Extended, and Copper Mines of the Mt. Lyell West, all of which have put forward efforts to improve their prospects. The chief development is centred in the North Lyell Mine, where, with depth, the ore-body has increased in quantity and quality. Its continuance being recently located at the No. 10 level, which is 1000 feet below the surface outcrop. The average number of men remain similar to that totalled when this part of the State was proclaimed a separate district.

Ropes and Cages.—At present all the working ropes, including those on the main haulage are in good order, which comment may also refer to the cages, these being at stated intervals tested by the mine officials.

Ventilation.—While awaiting connections, exception has had to be taken to the air in close stopes and rises; also the dust arising, especially in the latter, which, as the depth increases and the ground becomes hotter, will need a revision of the regulations, whereby a standard quality of air shall be maintained in all working faces throughout the mine.

Rock-drills.—Where these are used in dry siliceous country, or, for that matter, wherever dust is generated by them, a provision will have to be made in "The Mining Act" definitely stating that in all such cases each machine will have to be provided with an efficient and wholesome spray, or other suitable means of arresting or allaying the dust, otherwise it will be only a matter of time when the evils attending older fields will become established on this one.

Sanitation.—The pan system, in the matter of removing and cleansing, receives attention. There are, however, instances where the smell emanating from these latrines is offensive, and for that reason these "depositories" should receive periodical visits from a qualified health officer.

Explosives.—An accident, accompanied by shock and prostration happened to a ganger while charging a deep hole, by its premature explosion. On examining the ammunition, it was found hard and frozen, which state was subsequently found attending other samples of the same brand underground, necessitating a record being minuted that no nitro-glycerine compound should be issued for immediate use that was not fit and in a suitable state for that purpose. Notice has had to be taken respecting the pernicious practice of permitting loose detonators and plugs of gelignite lying promiscuously about, and thereby providing means for occasioning serious trouble, including the smelters, where a man named O'Connor was injured from that cause. Beyond these instances there is no other that

could be considered as a complaint against the large quantity of explosives that have been used in this district.

Magazines.—Those in use are in good order, especially the three main ones belonging to the Mount Lyell Company, where quantities up to 10 tons are stored in each. This company's annual consumption is about 60 tons.

Gold (Alluvial or Otherwise).—Outside the Mt. Lyell Company's returns there has been a scarcity of this metal, which is likely to continue, as the places which were the chief sources of supply are being abandoned, and as there is little likelihood of younger men taking up this calling, it must eventually cease.

In conclusion I must state that outside the Mt. Lyell Mining and Railway Company, the prospects of the established mines have not improved, but with this company's development at its North Lyell workings the prosperity of the ensuing year is safe.

LIST of Accidents in Inspector Curtain's District for the Year 1907.

Fatal, 1 ; non-fatal, 22 ; total, 23.

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single.	Nature of Injuries.	Particulars.
1907.							
4 Jan.	Mt. Lyell Mine	Mt. Lyell	Collision of trucks	Jackson, Wm. Rd.	Single	Broken thigh	Empty trucks were run on to the wrong line and collided
25 Jan.	Mt. Lyell Reduction Works	Lyell	Bucket leaving rail	Hurren, James	Ditto	Crushed fingers	His hand got between fastening-clip and front-hanger
16 Jan.	Mt. Lyell M. and R. Co.	North Lyell	Foot slipped	Mears, Alfred Thos.	Married	Broken leg	Slipped while helping to carry a rock-drill
16 Feb.	Ditto	Ditto	Rolling stone	McCulloch, Thos.	Single	Crushed foot	Crushed by a stone which he had dislodged in the stope
21 Mar.	Ditto	Mt. Lyell	Knocked down by trucks	Moore, Robt. Hy.	Married	Bruises on body and leg	Driving horse at the open-cut ; was knocked down by loaded rake
25 April	Mt. Lyell Blocks	North Lyell	Clothes catching belt	McDermott, Gilbert	Single	Cuts on face	Caught while regulating a Wilfley driving-belt
26 April	Mt. Lyell Reduction Works	Queens-town	Fall from platform	Robinson, John	Married	Bruises on head and body	Fell from receiving platform on aerial central station
16 May	Mt. Lyell Blocks	North Lyell	Cut by saw	Schwind, John	Ditto	Cut fingers	Assisting sawyer, when his fingers touched the saw
18 May	Mt. Lyell Reduction Works	Queens-town	Jammed in lift	Timothy, Joseph Jas.	Ditto	Broken foot	While ascending a lift his foot got jammed between lift and side timbers
9 June	Mt. Lyell M. and R. Co.	Mt. Lyell	Moving trucks	Crawford, John	Single	Bruised and shaken	Tried to mount trucks in motion, and was jammed against wall of tunnel

10 July	Mt. Lyell Blocks	North Lyell	Fall of earth	Hall, Hy.	Ditto	Fatal	Collapse of stope caused instantaneous death
10 July	Ditto	Ditto	Ditto	Simpson, James	Ditto	Scalp wound and shock	Same accident as preceding
16 July	Ditto	Ditto	Timber falling down chute	Thompson, Charles	Ditto	Fractured leg	Timber being shackled, slipped and fell to bottom of chute
28 July	Mt. Lyell M. & R. Co.	Mt. Lyell	Fell over working bench	Major, Geo. Hy.	Ditto	Bruises and sprained ankle	Fell over the bench in open-cut owing to his light going out
July	Ditto	Ditto	Fall of rock	Lake, George	Widower	Shin-bone splintered and bruised	While working at the open-cut a piece of spoil came away
15 Oct.	Mt. Lyell Reduction Works	Queens- town	Fall of m tal- bar	Fordham, Thos.	Single	Crushed foot	Was preparing a bar of metal, when it toppled over
18 Oct.	Mt. Lyell M. & R. Co.	Mt. Lyell	Fall over bench	Lee, Frederick	Married	Bruises and shaking	While landing a machine, fell from one bench to the other
26 Oct.	Ditto	Ditto	Lost his balance and fell	Coates, John	Ditto	Broken leg	Was barring down, when he slipped and fell about 4 feet
28 Oct.	Ditto	Ditto	Fall of stone	Holder, Hy.	Single	Bruised leg	In open-cut a piece of spoil fell and injured his leg
5 Nov.	Ditto	Ditto	Slip of roofing iron	McKenzie, H. R.	Married	Scalp wound and shaking	While reroofing a lean-to an iron-sheet slipped and caused him to fall
18 Nov.	Ditto	Ditto	Slipped while walking	Cox, Robt. Jas.	Single	Broken ankle	Walking down incline; trod on a loose stone, and fell
2 Dec.	Ditto	Ditto	Fall of rock-drill	Nelson, Jno. J.	Married	Abdominal bruises	The drill collared and canted over, falling upon him
23 Dec.	Ditto	Ditto	Ditto	Wilson, John	Single	Scalp wound and cut on arm	A similar accident to the preceding, and the same machine

GEOLOGY OF TASMANIA.

By W. H. TWELVETREES, Government Geologist.

TASMANIA is a geological outlier of Eastern Australia. Its Pre-Cambrian and early Palæozoic history can be delineated only imperfectly. In Mesozoic times some connection existed with the Australian part of Gondwana Land. In the early Tertiary it was separated from the adjacent island continent; subsequently the land connection was restored, to be again broken, since when it has remained an island. Dr. A. W. Howitt and Mr. C. Hedley have pointed out that the last land connection was between Wilson's Promontory in Victoria and Cape Portland in Tasmania, *viâ* Flinders Island and the Kent group, and that an elevation of from 200 to 300 feet would lay dry a tract of country between Victoria and Tasmania.

The rugged nature and the remoteness of the mountain fastnesses of the island have been great impediments to geological research. In spite, however, of the physical difficulties, it has been possible to fix the stratigraphy of a large portion of the State, though the lower Palæozoic strata need further study before they can be satisfactorily determined. As far as examination has proceeded, the following systems can be recognised:—

- (1) Pre-Cambrian.
- (2) Cambrian.
- (3) Ordovician.
- (4) Silurian.
- (5) Devonian.
- (6) Permo-Carboniferous.
- (7) Trias and Trias-Jura.
- (8) Tertiary.
- (9) Quarternary.

(1) *Pre-Cambrian*.—The diagnosis of the Pre-Cambrian must be accepted as provisional. It is probable that they belong to the Algonkian division of the group. Among them may be mentioned the quartzites and mica schists of the Port Davey districts. These are strongly developed in the south-west of the island as biotite and muscovite schists, greatly contorted, alternating with white saccharoidal quartzites, all striking north-west and dipping south-west. High headlands of quartzites, which have resisted denudation, jut out on the south coast, with bare, snow-white crests visible for many miles. Ores of copper, antimony, and lead occur in these schists. The contorted quartz schists and white quartzite of Rocky Cape, on the North-West Coast, are also considered as Pre-Cambrian. These are traversed by granitoid and basic dykes carrying copper ore. The quartzitic and micaceous schists west of the King William and Denison Ranges belong to the Pre-Cambrians. Garnetiferous amphibolite in the Collingwood River Valley, the amphibolite of the Rocky River, enclosing lenses of magnetite and pyrrhotite and copper pyrites, and the zoisite-amphibolite of the Forth River, are also ascribed to the Pre-Cambrian group.

(2) *Cambrian*.—This system is represented by friable yellow sandstones, containing casts of *Dikelocephalus*, *Orthis*, *Bellerophon*, &c. These occur at two widely-separated localities on nearly the same meridian, one being on Caroline Creek, between Railton and Latrobe, the other on the Humboldt Divide in the Florentine Valley. Mr. R. Etheridge reports that the fossils appear to be of Upper Cambrian age. The crystalline sandstones, quartzites, and conglomerate of which the Thumbs and the Denison Range are composed are believed to be Cambrian.

(3) *Ordovician*.—The slates and sandstones of the goldfields of Lefroy, Mount Victoria, Mathinna, Mangana, &c., in the northern and eastern parts of the island are referred to this system, though few fossils of any stratigraphical value have been found. Their bearing is either east or west of north, and anticlinal axes are long and continuous. The gold quartz reefs which traverse them began to form apparently at the close of the Upper Silurian. Large and important mines have been opened on these reefs, and every geological consideration that can be adduced points to the permanency of the goldfields.

The conglomerates and sandstones at Beaconsfield, together with the blue limestones which prevail in that district at Blyth's Creek and Winkleigh, as well as the Chudleigh and Railton limestones, may be provisionally regarded as of Ordovician age. The Blyth's Creek limestone has yielded imperfect casts of corals, and the Railton quarries contain remains of *Actinoceras* and other cephalopods.

A series of clay slates occurs between Zeehan and Mount Read, known as the Dundas slates, and believed to be of this age. Ill-preserved traces of graptolites have been noticed in them. These slates extend to Mount Read, Mount Black, and the Red Hills, and along their junction with intrusive quartz porphyry rocks (felsite, keratophyre, granophyre, porphyroid, &c.) large lenses of complex gold and silver bearing sulphide ores of zinc, lead, and copper have been formed.

Another group of rocks at the base of the Ordovician is the Gordon River series of limestones, sandstones, and slates. The limestone in this group is fossiliferous. The organic remains include *Favosites*, *Orthoceratites*, *Raphistoma*, *Orthis*, *Rhynchonella*, *Euomphalus*, *Murchisonia*, &c. The limestone reappears to the north-east of Mount Farrell, in the bed of the Mackintosh River, a short distance above its junction with the Sophia River. East of the Valley of Rasselas these rocks occur again in the Florentine Valley and at the Junee.

(4) *Silurian*.—The Silurians are strongly developed at Zeehan on the West Coast, at Middlesex, and Mount Claude, Heazlewood, and the Eldon Valley, Queen River, &c.

At Zeehan conglomerates and tubicolar sandstone underlie the limestones, slates, and sandstones, which are intersected by the numerous galena-bearing lodes which have yielded the ore for which this field is so well known.

The fossils found in limestone and quartzite belong to the genera *Hausmannia*, *Asaphus*, *Illaenus*, *Cromus*, *Rhynchonella*, *Strophodonta*, *Lophospira*, *Murchisonia*, *Eunema*, *Tentaculites*, and the beds are considered by Mr. R. Etheridge to be homotaxially equivalent to the lower portion of the Upper Silurian.

Similar tubicolar sandstone occurs near Bell Mount, Middlesex, and on the Five-mile Rise, and casts of *Hausmannia* (or *Phacops*), *Rhynchonella*, *Orthis*, and coral have been found.

Clay slates in the Eldon Valley, containing fossil casts of *Calymene*, *Orthis*, *Cardiola*, are considered to belong to the Upper Silurian.

At the Heazlewood limestone and sandstone have yielded remains of *Hausmannia*, *Cromus*, *Cornulites*, *Rhynchonella*, *Tentaculites*, and *Favosites*.

Sandstones and limestones in the Queen River District have been identified as Silurian (Middle or Upper Silurian). These are west of Queenstown. Brachiopods and trilobites have been found also on the east side of the Lyell Razorback, indicating a similar age for rocks on the Lyell and Lyell Blocks mining properties there. The Queen River sandstones are charged with casts of *Spirifera* and *Orthis*.

Trilobite-bearing Silurian rocks also occur north of the Pie-man River, near the Wilson River.

In the Zeehan field the Silurian slates are largely accompanied by contemporaneous and intrusive sheets and dykes of vesicular melaphyre. The igneous rock corresponds very closely with the German spilite, an amygdaloidal diabase, sometimes called lime diabase.

Massive conglomerates crown most of the West Coast mountains, the Dial Range on the North-West Coast, Mts. Roland, Claude, &c. These have generally been ascribed to the Devonian, but more recent data point to the commencement of the Silurian as more probable, and even a still greater age is possible.

The quartz-porphyrries or felsites which form the backbone of the West Coast Range are the geographical axes of Mts. Darwin, Jukes, Huxley, Tyndall, Read, Murchison, and Farrell. They carry copper ore associated with lenses of hematite and magnetite, chloritic and felspathic copper-bearing schists, some of them probably schistose porphyries, flank them and are enclosed in them. The felspathic schists of Mt. Lyell belong to this group. Sufficient is not known of this geological formation to enable its age to be stated definitely.

Associated with the rocks of the Silurian system in the northern and western parts of the island is an extensive development of serpentinite, the altered form of gabbro and its appendages, peridotite and pyroxenite. This rock is found in the Heazlewood district, at Trial Harbour, in the Dundas district, in the Forth Valley, and near Beaconsfield. The difference of age between it and the Devonian granite is slight. Chronologically some of the granite is later.

(5) *Devonian*.—Granite occurs in a meridional line down the East Coast, extending from Flinders Island to Maria Island. It forms Mt. Cameron, Mt. Stronach, the Blue Tier, Freycinet's Peninsula, and is exposed at Ben Lomond and at the base of Mt. Arthur. Exposures are also seen at the Hampshire Hills, Granite Tor, Middlesex, the Magnet and Meredith Ranges, Heazlewood, &c. The quartz-porphry dykes at Mt. Bischoff, the tourmaline lodes at Mt. Black and in the Dundas district, the stannite lodes and quartz porphyry dykes at Zeehan, all denote a granitic reservoir below a large portion of the mineral fields of the West Coast. No granite intrusion into Permo-Carboniferous strata has been observed. The normal granite is a dark mica one, but muscovite and lithia micas appear in the tin-bearing varieties. Tin-bearing lodes occur on Ben Lomond

and Mt. Heemskirk, while on the Blue Tier floors or stocks of altered granite form huge tin ore-bodies of low grade. Porphyry dykes at Mt. Bischoff have shed the vast accumulation of tin ores which has been mined by the Mt. Bischoff Company for the last 34 years with wonderful success.

(6) *Permo-Carboniferous*.—The base of the system is formed by glacial conglomerates, grits, micaceous sandstones and flagstones, well seen on Brun and Maria Islands and elsewhere in Southern Tasmania. Fossiliferous mudstones and limestones form a lower division of the system, while the upper division comprises the Tasmanite shale and coal measures of the Mersey Basin, with upper marine mudstones and shales in the Mersey Basin and at Hobart, and the coal measure series of Mt. Cygnet and Southport. The characteristic fossil plants of the coal measures of this system are *Glossopteris*, *Gangamopteris*, *Noggerathiopsis*. The seams average from $1\frac{1}{2}$ to 2 feet in thickness, and the analyses show from 36 to 42 per cent. fixed carbon, 41 to 48 per cent. gas, 2 to 9 per cent. ash, and 8 to 12 per cent. moisture. They are known as the lower coal measures of Tasmania.

South of Wynyard and at Barn Bluff cannel coal or kerosene shale is met with. The Wynyard or Preolenna seam of this coal is in sandstone, overlying fossiliferous mudstones, and assays up to 76 per cent. volatile matter. The Barn Bluff cannel coal has only been observed in loose blocks, supposed to have been disturbed by glacier action.

At the close of the system, or during Mesozoic times, a local intrusion of alkaline rocks, alkali and nepheline syenites, &c., occurred, traversing the Permo-Carboniferous strata south of Hobart, from Oyster Cove and Woodbridge on the Channel to the Huon River in a N.E.-S.W. line.

Auriferous quartz and pyrites have been developed near the line of contact of these igneous rocks with the Permo-Carboniferous sandstones and mudstones, and a good deal of free gold has been shed into the flats.

(7) *Mesozoic*.—The fresh-water beds, which succeed the Upper Palæozoic, belong to the Mesozoic division, but cannot as yet be subdivided with certainty. The nearest approach to a subdivision would be as follows, but the reference to European equivalents is nothing more than an attempt at correlation homotaxically:—

(c) Cretaceous (?)—

4. Diabase in intrusive masses, sills, and dykes.

(b) Jura (or Rhætic)—

3. Upper coal measure sandstones.

(a) Trias (?)—

2. Sandstones and shales with coal at Ida Bay.

1. Variegated sandstones with remains of heterocercal fishes and amphibians.

The variegated sandstones occur at Knocklofty, the Domain, Ross, &c. Remains of *Adrolepis* have been found at Knocklofty and Tinder-box Bay. Bones of an amphibian (*labyrinthodontine*?) have been obtained from the Government House quarry in the Domain.

The upper sandstones are readily recognised by their soft felspathic nature. They are generally greenish-grey to yellow-

ish-brown, sometimes white. They are widely distributed throughout Eastern and South-eastern Tasmania, and occur also in the extreme south. They are largely interrupted by intrusions of diabase. They flank the central, eastern, and western tiers, and fringe isolated mountains, *e.g.*, Mt. Nicholas, Mt. Victoria, Ben Lomond, Ben Nevis, Mt. Dundas, Cradle Mountain, &c. From Fingal and Mt. Nicholas they extend on the outskirts of the diabase ranges southward to Seymour, Bicheno, Llandaff, Spring Bay, and all over South-eastern and a large part of Southern Tasmania.

These measures enclose the coal seams, averaging from 4 to 12 feet, which are worked at Mt. Nicholas, Cornwall, York Plains, and Sandfly collieries. The analyses of this coal range from 53 to 60 per cent. fixed carbon, 23 to 31 per cent. volatile matter, 9 to 16 per cent. ash, 2 to 4 per cent. moisture, and the coal is not a coking one. A sub-anthracite coal is raised at York Plains, and at the Sandfly Mine a seam of anthracite occurs containing 80 per cent. fixed carbon and 8 per cent. volatile matter.

The fossil flora from these measures must be regarded as characteristic for the Mesozoic. The list includes *Thinnfeldia*, *Pecopteris*, *Tæniopteris*, *Sphenopteris*, *Alethopteris*, &c.

The diabasic intrusions cut up the coal measure areas into different basins, and cover large portions of the Central, Eastern, and Southern districts.

(8) *Tertiary*.—A great stratigraphic break exists between the Mesozoic and the succeeding strata. This Tertiary system cannot be subdivided as in Europe. Two divisions, Palæogene and Neogene, are adopted in Tasmania. According to this arrangement the subdivisions are as follows:—

(a) Neogene (= approximately to Pliocene).

Under this head would fall various river terraces and estuarine deposits.

(b) Palæogene (= Eocene to Miocene).

3. Basalt lavas.

2. Fluvialite and lacustrine clays and sands, tin ore drifts, and deep leads.

1. Fossiliferous marine beds at Wynyard (= Eocene).

The marine fossiliferous beds at Wynyard are covered with the basalt which, generally throughout the island, appears to separate the Lower from the Upper Tertiaries. The extensive lacustrine deposits within the watershed of the Tamar cover an area of 600 square miles, and embrace widely-spread pre-basaltic or Palæogene clays and sands, which form a series 900 to 1000 feet thick. Such sediments with fossil leaves of European genera occur at Launceston, Dilston, Windermere, Beaconsfield, Waratah, Strahan, St. Helens, Burnie, and on the Derwent. In the north-east and east the sub-basaltic gravels are worked on a large scale for tin ore, and yield most of the alluvial tin of the State.

At the close of the Palæogene a great outpouring of basaltic lava took place, and this rock is very general throughout the island, though rarer on the West Coast.

The rock is usually olivine basalt, but nepheline basalt occurs on the Shannon Tier, and at Sandy Bay, Hobart.

The Neogene valley terraces can only be distinguished from the earlier Tertiaries by position and lithological characters. Some of the gravel drifts of the Derwent, of the Longford Plains, and in the neighbourhood of Launceston belong to this subdivision. The close of the Tertiary, or the beginning of the Quarternary, witnessed a glacier epoch in the west and centre of the island. The highlands round Barn Bluff, Mts. Tyndall, Lyell, Sedgwick, Jukes, Darwin, &c., and the western edge of the great central plateau abound with tarns, ice-scratched stones, and moraines. No proof of glacier condition in this period in the eastern part of the island has been adduced yet.

Tin and gold ores are the most important products of the deposits of the Tertiary system. They are won from the alluvial gravels and leads of the period. The sands in the Savage River and other tributaries of the Pieman and Huskisson have been worked for osmiridium. Zircon sand, near Table Cape, has also been exploited. Tertiary clays are used largely for brick-making and pottery, the gravels for road-making. Lignites exist, but are not yet industrially important. Though there has been great volcanic activity, there are no signs of Tertiary metalliferous veins.

(9) *Quarternary*.—These deposits may be classed as follows:—

(b) Recent.

3. River alluvium and sand dunes.
2. Raised beaches and helicidæ sandstones.

(a) Pleistocene.

1. River drifts.

The later terrace drifts in the valleys of existing rivers are referred to the Pleistocene. Sand dunes, consolidated to shelly sandstones, occur on Cape Barren, Badger, Kangaroo, and other islands in Bass Straits, containing shells of helix, succinea, &c. These sandstones sometimes overlie a raised beach. The raised beaches on the North and South Coasts indicate elevation within the Recent period. Some of the glacier phenomena may belong to the Pleistocene, and have continued even to the Recent period.

(10) *Ore-deposition*.—The period during which the deposition of metalliferous ores was most active was the interval between the Upper Silurian and Permo-Carboniferous. Ore-deposition has been associated principally with the consolidation of the gabbroid and granite masses. Nickel sulphide and osmiridium owe their origin to the serpentine at the Heazlewood, Trial Harbour, and Dundas. On the other hand, the granite magma is responsible for the lodes of silver-lead all over the island, whether these pierce quartz-porphyry, as at the Devon and Mt. Tyndall, slate, sandstone, and limestone, as at Zeehan, or ultrabasic dyke rock, as at the Magnet. The pyritic lead, zinc, or copper ores of the West Coast Range (Mt. Lyell, Mt. Read, Mt. Black, &c.) are also most probably due to the action of the acid magma. Tin and wolfram ores are naturally referred to the same source, and the quartz reefs of the Ordovician strata must

be regarded as the result of the expiring effort of the cooling magma to get rid of its surplus available silica. A few veins of barren quartz occur in the Permo-Carboniferous strata, but beyond the exceptional case of the alkali porphyries at Port Cygnet, the chapter of metal-bearing lode action closed, as it began, with the Devonian period. Within that period, therefore, were accumulated the great stores of mineral which the mining industry of Tasmania is now drawing upon. The mines of gold, silver, lead, copper, and tin rank high among the famous mines of the world. Her mineral wealth may, in fact, be considered remarkable when, despite the small area of the island (26,000 square miles), the value of the mineral produced for the year ending 31st December, 1907, amounted to £2,277,159. The industry is thriving, is on a sound and established basis, and with the careful administration and care which it receives it may with confidence be expected to continue a highly important asset of the State for a quite indefinite period of time.

ON AN ENSTATITE-AUGITE BEARING DIABASE FROM TASMANIA.

By A. OSANN, Freiburg. (1)

[Translation by W. H. TWELVETREES, Government Geologist.]

As an annex to W. Wahl's interesting investigations of enstatite-augite in diabases, (2) the author here describes a diabase from Launceston, Tasmania, which he has received from Professor F. W. E. David, of Sydney. According to Johnston's geological sketch-map of Tasmania, (3) greenstones (diabase, otherwise dolerite) have a very wide distribution in this island; they compose in particular a considerable part of the mountainous land of the centre, and spread also to the northern, eastern, and south-eastern coasts. Their occurrence is always associated with Carboniferous and Mesozoic sedimentaries, with which apparently they alternate as intrusive masses. Twelvetrees and Petterd (4) give a general petrographic description of them, and see in them close relationships to the Hunne and Kinne diabases. F. P. Paul (5) has described a konga diabase from the neighbourhood of Hobart, in the southern part of the island. The rock contains, always in parallel intergrowth, two pyroxenes of somewhat different colour and of different optical axial angle; closer information respecting the size of the latter is not given.

Further information respecting the geological occurrence of the diabase now to be described is not in the author's possession.

It is a medium-grained, very fresh rock, of grey colour, with macroscopical pyroxene and lime soda felspar; the former forms irregularly bounded grains or thick (up to 6 mm.) long rods of bright greenish-grey colour. Ophitic structure is not developed. Under the microscope also the diabase appears to be very fresh, and composed essentially only of feldspars and pyroxene; amphibole and mica are altogether absent. The plagioclase has quite the habit of andesite feldspars. Crystographically it is always very well developed, in thick plates parallel to (010), and then elongated in the direction of the *a* axis. Sections show the combination (010) (001) (110) (110) (101) (201). Twinning lamellation, according to the albite law, is probably present in every individual; and is frequent according to the pericline and Carlsbad laws. Zonal growth is universal, and this appears

(1) Central blatt für Mineralogie, Geologie, und Paläontologie, 1907, No. 23, pp. 705-711.

(2) W. Wahl: Die Enstatitaugite, Mineral. petr. Mitteil., 26, p. 1.

(3) R. M. Johnston: Systematic Account of the Geology of Tasmania, 1888.

(4) W. H. Twelvetrees and W. F. Petterd: On Mesozoic Dolerite and Diabase in Tasmania. Proc. Roy. Soc. of Tasmania, 1898-9.

(5) F. P. Paul: Beiträge zur petrographischen Kenntniss einiger foyaitisch theralitischen Gesteine aus Tasmanien. Mineral. petr. Mitteil., 25, p. 267.

particularly in sections parallel to (010). A basic centre is surrounded by an acid envelope, which is sometimes furnished with a narrow, more acid, marginal band. The boundaries of these zones are generally sharp. The following measurements were taken on (010), observing crystallographic contours and orientating for uniform brightness:—

Centre.	Envelope.	Marginal Band.
— $33\frac{1}{2}^{\circ}$ = Ab ₁₁ An ₈₉	— $18\frac{1}{2}^{\circ}$ = Ab ₄₆ An ₅₄	
— $29\frac{1}{2}^{\circ}$ = Ab ₂₅ An ₇₅	— $21\frac{1}{2}^{\circ}$ = Ab ₄₂ An ₅₈	
— $34\frac{1}{2}^{\circ}$ = Ab ₇ An ₉₃	— $23\frac{1}{2}^{\circ}$ = Ab ₄₀ An ₆₀	
— $33\frac{1}{2}^{\circ}$ = Ab ₁₁ An ₈₉	— 22° = Ab ₄₁ An ₅₉	
— 35° = Ab ₅ An ₉₅	— 19° = Ab ₄₆ An ₅₄	— 12° = Ab ₅₅ An ₄₅
— 30° = Ab ₂₄ An ₇₆	— 20° = Ab ₄₄ An ₅₆	— 13° = Ab ₅₄ An ₄₆

Accordingly, the centre is basic bytownite-anorthite, the envelope is labradorite, and the narrow outer band is basic andesine.

Under the microscope the pyroxene is very brightly coloured. In thin mounts the larger grains are, as a whole, nearly colourless, only on the edges a more intense grey-brownish tint is apparent. Small grains have also the same colouration. Pleochroism is scarcely perceptible, even in very thick slices and isolated grains. Crystallographic boundaries are infrequent, and confined to the prism zone. As a rule well-defined feldspars pierce the larger pyroxene grains, and small grains of augite with irregular forms are squeezed between the feldspars. Obviously, the crystallisation of pyroxene began before that of the feldspars, but that of the latter lasted longer than that of the former. On this account, and also in consequence of the presence of a feldspathic mesostasis, the structure deviates from a purely ophitic one. Besides a prismatic cleavage there is one parallel to (010), apparent by means of infrequent, but clean and continuous, cracks. Parting parallel to (001) can be recognised only in places. The cracks corresponding to this face are always crowded together in spots, and never traverse an entire pyroxene section. A twinning connected with these striæ is not shown. Frequently the parting proceeds from large prismatic cleavage cracks, and at the same time there begins an alteration of the pyroxene to green decomposition products; according to this it is certainly to be regarded as secondary.

The augite acts as a host for numerous inclusions of small dimensions. The smallest of these are colourless, rounded, and frequently carry a moving gas-bubble. The larger ones are cloudy, sometimes scarcely translucent, apt to be drawn out in tubular form, and constitute in places a complete network. Apparently these also are fluidal inclusions. Their decomposition is irregular; they collect in swarms, so that with a low magnifying power their host appears as if traversed by irregular cloudy zones. With striking frequency these zones occur in the vicinity of large cracks, so that for these inclusions also a secondary origin is probable.

Grains of pyroxene are often intergrown with one another polysomatically, as can be seen even in ordinary light along the course of the cleavage cracks. In polarised light, however, another phenomenon appears: Grains of uniform cleavage, which in ordinary light, both in respect of colour and refraction, appear perfectly homogeneous, fall into generally two, rarely

several, individual parts, which differ by reason of a slight dissimilarity in the strength of double refraction or position of the directions of vibration. The boundaries of these individuals are always sharp, and are irregular, as is their mutual relation, so that any difference in age is not apparent. Each of the individual parts can extend to the margin of the entire section, and assume there a deeper colouration. Sometimes the whole phenomenon recalls such as is shown by strongly-squeezed and shattered quartz grains; a similar feeble undulose extinction declares itself. Nevertheless, secondary pressure is here certainly not the cause. The rock, moreover, shows no trace of pressure effects, and the course of this phenomenon in neighbouring pyroxene individuals cannot be referred to any common direction of pressure.

The optical differences are best seen in weakly birefringent sections. With a favourable section approximately normal to the acute bisectrix, one kind of these individuals (for brevity named pyroxene *A*) shows a grey polarisation colour, while the other (pyroxene *B*) remains completely dark. In convergent light *A* gives the figure of a biaxial crystal with a moderate, but in different grains, a somewhat variable axial angle; with *B*, on the other hand, the cross either does not open at all, or only slightly, and in a plane normal to the axial plane of *A*. One can best convince oneself of the latter by choosing a spot in the neighbourhood of the boundary between two individuals, *A* and *B*, and placing the mount at 45° push it. Just as the boundaries of *A* and *B* appear sharp in parallel light, so here also the passage from one position of the axial plane to the other is immediate and with a leap. The position of the bisectrix *C* is apparently exactly identical in both individuals. Since their intergrowth, as is shown by the coincidence of both systems of cleavage cracks, is parallel, one of them must have a normal-symmetrical axial position. From the angle of the cleavage cracks, and in the case of twins on (100), from the position of the twinning plane it is seen that *A* has symmetrical, *B* normal-symmetrical, axial position. This is a further instance of normal-symmetrical axial position in pyroxene, as described by Wahl in the augites of the diabase of Richmond and the eucrite of Juvinas. Unfortunately very few sections were suitable for measuring the axial angle. In a very thick slice two intergrown grains were measured with a Klein's lens: *A*, $2E = 45 - 46^\circ$; *B*, $2E = 12^\circ$. Accordingly, for a monoclinic pyroxene, *A* has a strikingly low value, which, according to Wahl, is characteristic of diabase augites poor in lime.

With increasing birefringence the optical differences between *A* and *B* diminish, and sections on (010) allow only slight differences in polarisation colour to be noticed, but none in the extinction. The latter amounts to $C : C = 45 - 46^\circ$. On cleavage flakes on (110) the extinction was found varying between 31° and 35° , but it was impossible to determine whether it was different between *A* and *B*.

The attempt to separate the pyroxenes *A* and *B* by means of heavy solutions was unsuccessful. In the Rohrbach solution, in which epidote of 3.47 sp. gr. just sank, the augite began also to sink, and the microscope showed this to belong to the dark marginal zone. The clear grains sank within a very small interval of dilution, and the irregularly distributed fluidal inclusions evidently exert a greater effect on the specific gravity of their

hosts than the anticipated chemical differences of *A* and *B*. Nothing remained therefore but to analyse the clear pyroxene by itself, i.e., as a mixture of *A* and *B*. The analysis (by Professor Dittrich) gave the following results under I. Under Ia. are the corresponding molecular quotients:—

	I.	II.	III.	Ia.
Si O ₂	51.87	51.30	50.36	0.8588
Ti O ₂	0.21	0.72	0.80	0.0026
Al ₂ O ₃	2.02	2.36	2.49	0.0198
Fe ₂ O ₃	3.50	2.22	2.35	0.0219
Fe O	8.98	18.83	18.15	0.1249
Mn O	0.18	0.57	0.56	0.0025
Mg O	16.26	16.56	11.37	0.4029
Ca O	15.70	6.96	13.97	0.2797
Na ₂ O	0.16	0.21	0.26	0.0026
K ₂ O	0.09	0.37	0.19	0.0010
H ₂ O	1.20	1.00	0.55	
	<u>100.17</u>	<u>101.15</u>	<u>101.09</u>	

II. and III. are quoted for comparison. Under II. is the composition of a pyroxene from the diabase of Källsholm, Föglö (with 0.05 NiO). According to Wahl the apparent angle of the optic axes varies between 36° and 26°; the average is 30°. Under III. is the composition of a pyroxene from a coarsely granular quartz diabase from Schtscheliki (with 0.04 NiO), with 2E between 73° and 40°, greater therefore than that of II. In both occurrences the greater and smaller values are, contrary to our pyroxene, connected by transitions in one and the same individual.

The low lime content, as well as the optical characters, prove that our pyroxenes, *A* and *B*, belong to the enstatite-augite series of Wahl. According to the optical relations a still lower content was to be expected. Strikingly low is the percentage of FeO. Wahl found the proportion CaO : FeO + MgO in various enstatite-augites to be very nearly 1 : 6, and sees in this diminution of CaO as against the total of the other two oxides the factor which mainly conditions the small axial angle. At all events, that is correct. Still, the proportion of FeO : MgO, as in rhombic pyroxenes, must also exert a not unessential influence on this angle, respecting the importance of which we are still quite in the dark. In Analysis I. the proportion CaO : MgO + FeO is nearly as 1 : 2. Alkalies and sesquioxides vary so little in the analyses given that their influence on the axial angle seems to be inconsiderable. Owing to entire ignorance of the proportions of their admixture, nothing further, of course, can be established as to the chemical differences between the *A* and *B* pyroxenes of the Tasmanian diabase.

The high water content in Analysis I. is striking. Before the water was determined, which was done by Penfield's method, the powdered mineral was dried two hours at 105°. Hygroscopic water to the extent of 1.20 per cent. is therefore excluded. Hydrous decomposition products could not be determined microscopically in the powder, and only traces of them are recognisable in slides of the pieces of rock used for isolating. It is questionable whether the plentiful, but very minute, fluidal

inclusions can be made responsible for this amount of water. Perhaps one might suppose a primary]-(content in the pyroxene.

As already mentioned, the structure of the rock is not typically ophitic, notwithstanding the very late age of the pyroxene. A mesostasis occurs in areas of meshwork, which, as can be seen in thin slides, consists of two colourless minerals, distinguishable by somewhat differing refraction and double refraction. The mineral with stronger refraction and double refraction forms either radiating aggregates or irregularly outlined spots, which, as a rule, have uniform optical orientation in one meshed area. It agrees in refringence and birefringence with the acid margin of neighbouring plagioclase crystals, and attaches itself to these with identical orientation. According to this, it is andesine. The other mineral, in which this andesine is embedded, might, in harmony with the not inconsiderable potash content of the rock, be orthoclase. Quartz appears to be entirely absent.

The sparse iron oxide is attracted by the magnet; but according to the titanic acid content of the total analysis, which considerably exceeds that of the pyroxene, it must be titaniferous.

The analysis of the diabase, also by Professor Dittrich, gave as follows:—

	I.	II.
Si O ₂	52.49	56.14
Ti O ₂	0.62	0.49
Al ₂ O ₃	16.44	10.35
Fe ₂ O ₃	2.60	—
Fe O	5.30	6.81
Mn O	trace	—
Mg O	6.18	9.92
Ca O	11.71	13.42
Na ₂ O	2.06	2.13
K ₂ O	1.09	0.74
H ₂ O under 110°	0.15	—
H ₂ O under 110°	1.42	—
P ₂ O ₅	trace	—
	100.06	—

From the molecular ratios given in column II. (all iron calculated as FeO) results follow as under:—

s	A	C	F	a	c	f	n	m	k
56.5	2.87	7.48	22.67	2	4.5	13.5	7.4	7.4	1.03
58.	3.38	6.39	22.34	2	4.	14.	7.7	8.6	1.05

In the bottom row the corresponding values are quoted from Wahl; for the diabase already mentioned from Källsholm on Föglö. On the whole the figures for A, C, and F are very similar. The silica coefficient of Föglö is somewhat higher than that of Launceston; the former rock contains some quartz. In Launceston the lime soda felspar, with a very little basic andesine, is essentially labradorite, with bytownite, down to anorthite; in Föglö it is labradorite, with only sporadic grains of bytownite. This finds expression in the ratio A : C, and also in the values a and c. The pyroxene of Föglö contains only 7 per cent. CaO, compared with that of Launceston, 15½ per cent. Therefore, m in the former is considerably higher than in the latter. The alkali ratio (n) is nearly the same in both rocks, therefore one should expect some orthoclase also in that of Föglö.

REPORT ON THE BELL MOUNT AND MIDDLESEX DISTRICT.

Government Geologist's Office,
Launceston, 17th June, 1907.

SIR,

I HAVE the honour to report that, in pursuance of instructions, I proceeded to this district on the 5th March, with the view of examining the deposits at present being proved or exploited by the mining companies of the field.

There are two routes of access to the district. The Mole Creek-road, *viâ* Liena and Lorinna, leads to the south end of the district over a distance of 20 miles to 25 miles. At present the field is more easily accessible *viâ* Sheffield and Wilmot. The coach takes the traveller from the Railton railway station to Sheffield, 8 miles; thence a mail-cart runs to Wilmot, 11 miles. A partly-made road is passable in fine weather by spring-cart or bullock teams from Wilmot to the Shepherd and Murphy Mine, 11 miles, or about 14 miles to the Bull Plain selections, after which the track is used by pack-horses for 5 miles to the Devon Mine on the Dove River.

Sheffield is on the high plain of Tertiary olivine basalt 900 feet above sea-level, with Mt. Roland to the south forming a rugged, picturesque mass, rising to 3100 feet above Sheffield. The run to the Forth Valley is through gently undulating country covered with the cultivated fields of thriving settlers. The chocolate soil, derived from the rapid waste of the basaltic lava sheet, is highly favourable for crops of oats and potatoes.

The older rocks are first seen on descending into the valley of the Forth. This river has carved out a deep gorge-channel down through the basalt capping into underlying sandstones, quartzite, and conglomerate of undetermined age. The bridge over the river here is about 200 feet above sea-level. The road then rises 600 feet to the township of Wilmot, bringing the traveller again on the basaltic sheet.

Wilmot, 11 miles from Sheffield, is the centre of a district with a present population of 800, which is rapidly increasing. Seven years ago dense scrub covered the site of the present township, but it is now a thriving little place, with school, store, bakery, post office, two boarding-houses, and a butter factory which is supplied by two

thousand cows. All the ore from the mines passes through Wilmot to Devonport, the Devon Company having to pay £3 19s. 6d. per ton, and the Shepherd and Murphy £2 12s. 6d. per ton. The freight of potatoes from here to Devonport is £1 per ton. This myrtle land is all taken up on the divide between the Forth and Wilmot Rivers by sturdy, independent farmers, who are busy scrubbing and dairying, and are laying the foundations of a thriving pastoral and agricultural industry. It is not pleasing to see the great destruction of timber which necessarily goes on in the absence of a railway, which would enable it to be conveyed to other parts of the State where it would be used. Considerable divergence of opinion as to routes prevails in Barrington, Sheffield, and Wilmot, and the disagreements on this question have perhaps helped to retard decision on this matter; but if the West Coast is ever to be connected with this part of the island by a direct trunk-line from Mt. Farrell or Rosebery to the Mersey, the most direct and useful connection with the mineral country would be through Wilmot.

The enterprise of the Wilmot settlers, moreover, has advanced the question of route considerably within the last year or two, and is also now making out pretty clearly the direction in which settlement is destined to extend. Land is now taken up all along the south road from Wilmot to the V.D.L. track, at the Caledonia Mine, a distance of 17 miles, and selections are extending from this road in a westerly direction down into the valley of the Iris River and up to the boundary of the Middlesex Plains block. It is impossible to withhold admiration of the energy with which this great tract of waste uninhabited land is being reclaimed for the service of man. The only caution necessary is to see that in the eagerness and rush mineral-bearing land is not alienated, as there is reason to fear has happened in the past.

The road rises to an elevation of 2000 feet above sea-level at Bell Mount (so-called from its shape as seen from the Sheffield side), and after passing the Shepherd and Murphy Mine, to which a branch road descends, maintains a general height of 2300-2500 feet as far as Bull Plain, after which it rises gently between 100 and 200 feet to the old Caledonian camp on the V.D.L. Middlesex track. South of this track is the stupendous gorge of the Dove River, which has cut its channel down 1600 feet below the level of the surrounding country, and flows, a clear stream with much noise and force, at the bottom of

the valley. The heavily timbered sides and precipitous granite cliffs between which the rushing river pursues its headlong course combine in producing a scene of wild, rugged beauty which stamps itself indelibly on the traveller's mind and memory.

GEOLOGY.

The field as a whole consists of Silurian strata overlaid in parts by Tertiary basalt, and penetrated by granite and quartz-porphyry usually considered to be of Devonian age. Still older rocks (pre-Silurian) occur at Bell Mount.

Time did not permit me to visit Mt. Roland, which is a few miles south of Sheffield, and is capped by conglomerate and red sandstone dipping away gently to the south. Mr. G. A. Waller reported that the bed-rock underlying the conglomerate at Mt. Roland is syenite. This has a very important bearing on the vexed question of the age of the conglomerates which so frequently form the summits of the mountain ranges of the West and North-West Coasts. This question is not so much whether they are Upper Silurian or Devonian, for we have nothing to guide us in this respect, as whether they are prior or subsequent to the consolidation of our metal-bearing granites. The fact that on Mt. Roland the conglomerate reposes on the granitic rock is suggestive of the intrusion, and therefore later age, of the latter, because it can hardly be supposed that the interval of time available would have been sufficient for the denudation of the country down to the horizon of the plutonic rock. Once, however, admit that the granite was intrusive into the conglomerates, and the search for ore-deposits in the latter need no longer be regarded as a vain quest. The hardness of the rock may be an unfavourable feature, but veins of quartz do occur in these conglomerates, and gold, *e.g.*, at Black Bluff, is associated with them.

Mr. G. A. Waller records *Rhynchonella* casts from the conglomerate series on the east slope of Mt. Jukes identical with the Upper Silurian specimens from Zeehan. I have recently received from Mr. Hartwell Conder, M.A., a tubicolar fossil cast from the conglomerate on the peaks of Mt. Lyell similar to those found in the fossiliferous sandstone at the Lyell Blocks Mine, and frequent also in the Silurian strata of the Middlesex district. These occurrences make the pre-granite age of the conglomerates very probable.

An outcrop of quartzite is seen on the road from Wilmot, on A. C. Hall's farm; also yellow sandstone. This in all probability belongs to the Silurian. On the south boundary of the Parish of Narrawa the basaltic soil is left at Sloane's farm, and the series of ancient schists, flagstones, sandstones, and quartz-porphyry begins. These form the hill known as Bell Mount, round the eastern and southern flanks of which the road winds, exposing the edges of the strata at about 2000 feet above sea-level. Thinly-bedded purple flagstones or arenaceous slates strike N.W.-S.E., almost vertical or with a slight dip to the north-east. These are followed by hard pink sandstone and a brown schistose quartz-porphyry.

The Bell Mount flags and porphyry are the oldest rocks in the district. They are almost certainly pre-Silurian, but nothing more definite at present can be said about their age. Quartz veins occur in them, and indications of copper ore exist. These strata form a belt which evidently extends a little to the south, for similar rock has been observed on the Narrawa section, but it is cut out further south by the Silurian sandstones and granite.

After leaving the schist belt alternating exposures of Silurian sandstones and Tertiary basalt occur. Just where the branch road goes off to the Shepherd and Murphy Mine on W. D. Weston's block is quartzite, which disappears under the basaltic covering going south. The main road passes over the basalt in the north part of Section 1332, T. J. Clerke, but then enters the Silurian sandstones and quartzite country for the remainder of that section and the one immediately south, when high basaltic land supervenes and continues south as far as R. Quail's 104-acre section. At the creek south of this similar Silurian sandstones and conglomerates continue as far as the edge of the Dove River Gorge.

The sandstone, with characteristic fossil casts and impressions, extends, with interruptions by granite and quartz-porphyry intrusions, over the Shepherd and Murphy and All Nations sections, where it carries tin and wolfram lodes. It is seen at the Caledonian camp and along the Five-mile Rise, as well as on Mt. Claude on the east side of the Forth. It is often hardened into a white quartzite. The most abundant fossil or impression of some organic remains is what is locally called "pipe-stem," somewhat resembling in form a part of the stem of an ordinary clay pipe. These are sometimes a foot in length, and slightly curved. They lie in all directions, sometimes

parallel with the bedding, sometimes vertical, and project from the surfaces of weathered stones, though their substance is wholly made up of quartz grains, and no structural parts have been preserved. Mr. Robt. Etheridge, of the Australian Museum, Sydney, to whom I submitted specimens, had thin sections prepared for microscopical examination, but in the absence of any signs of structure could not undertake to say what the specimens might represent. The forms which they most resemble appear to me to be the dwelling-tubes constructed by some tubicolar annelides, and if we must give the rock some more definite name than "pipe-stem," I should think that tubicolar sandstone would be a convenient one for the time.

Dr. Noetling, late paleontologist on the Geological Survey of India, to whom I showed the rock, also thought this interpretation a probable one. The same organisms occur at the base of Mt. Zeehan in similar white sandstone underlying conformably the fossiliferous limestones, sandstones, &c., of the Zeehan mining field, which, from Mr. Etheridge's determination of the fossils, are established as of Upper Silurian age. According to Mr. Waller's ideal section of Mount Zeehan, this tubicolar sandstone overlies the conglomerate, which he regards as the basal formation of the Upper Silurian. Examination of the conglomerates in different localities is needful before any general statement can be propounded with confidence, but meanwhile evidence of a close association between the two series is accumulating. This sandstone forms such an excellent stratigraphical horizon that its relations with its associated beds become very important for Tasmanian geology, and no opportunity of examination of it or the conglomerates in different places should be lost.

Mr. Waller sent some of the other fossils collected from this rock near Bell Mount and at the Five-mile Rise to Mr. R. Etheridge for determination, and as his identifications have not yet been published, I place them on record. Mr. Etheridge says:—

"The trilobite consists of the thorax and pygidium of one of the Phacopidae, either *Phacops* proper or *Hausmannia*, but without the cephalon (or head) it is difficult to say which.

"The *Rhynchonella* I believe to be *R. borealis*, v. *Schlothemii* of the Middle and Upper Silurian.

"The remains in the yellow mudstone from the vicinity of Bell Mount are two: one is the surface cast of the

corallite mouths of a monticuliporid coral, but in this condition unnameable; the other is the impression of the valve of an *Orthis* of the type of *O. calligramma*, Dalman, of Middle Silurian age."

The sandstone and conglomerate formations extend westward across the Iris River, the higher ground at Stormont and Black Bluff being conglomerate. In the Bismuth Creek below the Shepherd and Murphy Mine, on Mr. T. J. Clerke's Section 2853, a dark limestone crosses the stream, and more of this rock is seen on A. C. Hall's section, 237 acres, towards the Iris River.

On the Shepherd and Murphy Section 1437-91m, under the battery and extending south up the hill, is a bed of wollastonite-epidote rock much charged with magnetite and intersected freely by veins of a flesh-coloured lime silicate mineral which has not yet been accurately determined, but which appears to be wollastonite. A tin-wolfram-bismuth lode passes through this bed, which is conformable with Silurian quartzite and sandstone (the tubicolar sandstone). The bed must have originally been limestone, and is a striking sample of contact metamorphism, the substance of the rock with the newly-formed lime minerals (wollastonite, epidote, vesuvianite, diopside, garnet, being the result of silication of the original limestone. The iron may be due to one of two processes, named by von Hise, either deposition from solutions carrying carbonate of iron, or the incomplete oxidation of the ferrous iron of the new silicates. Or there is the direct contact theory, according to which the iron is supposed to have been derived in solution from the granite associated with the gases or solutions which have permeated the sedimentary rock and caused its metamorphism. The nearest exposure of granite rock at the Shepherd and Murphy is the quartz-porphyry in the southeast corner of Section 2134-91m, which no doubt underlies the field, and is responsible for the metamorphism.

A belt of quartz-porphyry and granite stretches across the country from west to east on the southern half of Section 949m, T. J. Clerke, on Section 950m, H. Conder, on part of Section 1037-m, E. W. Clarke, across the Dalcoath sections and the blocks south of the Narrawa Creek to Mt. Claude. It reappears a couple of hundred feet down the Dove River Valley, and continues across the river till it meets with the ancient mica schists. There is reason therefore to believe that granite or quartz-por-

phyry exists at no great depth below the surface, between the Shepherd and Murphy and the Caledonian Mine.

The granite is everywhere to be regarded as the factor governing the mineralisation of the rocks in this field. Although lodes may be met with in the sedimentary strata, the metals which they contain (tin, wolfram, bismuth, molybdenite, copper, lead, gold, silver) obviously had their source in the granite magma. Vogt's views of the formation of tin veins still represent those most generally held, viz., that they originated during the consolidation of granite or immediately afterwards, and that the genetic process consisted in an extraction from the siliceous magma by means of hydrofluoric and hydrochloric acids of fluorides of silicon, tin, boron, and lithium.

The solution was pneumatolytic, the substances existing as gases contained in solutions, and ascending in existing channels in which the deposition of the metals took place. The wall rocks were usually metasomatically altered at the same time.

The deposits which are met with in the district may be classified as—

1. Pyrito-spathic lead veins—Devon Mine.
2. Pyritic lead veins—West side of Bell Mount.
3. Quartz-topaz, bismuth-wolfram-cassiterite veins—Shepherd and Murphy.
4. Quartz, bismuth-tungsten veins—All Nations.
5. Tin-bearing stockworks in granite and quartz-porphry—Dalcoath and All Nations.
6. Cupriferous quartz veins—Narrawa.
7. Pyritic gold quartz veins—Old Caledonian.
8. Alluvial deposits of gold, tin, and wolfram.

Thus, the district is eminently a mineral one, and now that it is being brought more in contact with the settlements of the North-West Coast, prospecting may receive a fresh impulse and fresh discoveries be made.

It would have an important effect on exploration if it could be determined that certain minerals in this district are characteristic of certain horizons. There is, however, nothing to show that any one of the metals affects a greater or less depth than any other.

The silver-lead lode at the Devon Mine is at the lowest depth of any in the field, both absolutely and relatively, viz., 1100 feet above sea-level and 1400 feet below the upper surface of the granite in a quartz-porphry modification of the granite mass. The minerals of the lode are gold and silver bearing galena and a little chalcopyrite.

The next lowest occurrence which I visited is a formation in granite-porphry south of the Narrawa Creek, on the fall to the Forth River, sunk upon by Mr. Black. This is about 1600 feet above sea-level. The metals are wolfram, bismuth, molybdenum, and a little gold.

The Narrawa lode has been opened upon in quartzite or indurated sandstone at about the same level as the preceding. The minerals present are silver, chalcopyrite, wolfram, and gold.

The Shepherd and Murphy lodes are in metamorphosed limestone and sandstone (or quartzite), at a height of from 1800 to 2200 feet above sea-level. These carry tin, wolfram, bismuth, and a little molybdenite.

The All Nations lode is in sandstone (or quartzite), at from 2300 to 2400 feet above the sea, and contains wolfram, with a little gold, bismuth, and a minute quantity of molybdenite. In the quartz-porphry on the same property tin and wolfram are disseminated.

It must be remembered that all the occurrences were once deep-seated, and that present heights above sea-level have no real bearing on the subject. The real datum line in the enquiry is the upper surface of the granite or porphry. In the case of the Devon Mine the upper surface is 200 feet below the level of the tableland, so that that lode is really being worked at a considerable depth below the boundary of the granite. It is singular that no tin has been discovered in this lode.

With regard to the porphry at the All Nations it is impossible to say how much of it has been removed by denudation, but having regard to the proximity of the Upper Silurian sediments it is not likely that the quantity wasted away has been considerable, and the lodes in sandstone on that property and at the Shepherd and Murphy cannot be very far from underlying granitic rock.

The conclusion therefore is that superficially the tin and wolfram deposits of the district appear to prevail at no great distance from the boundary-line between the sedimentary and the granitic rocks, penetrating into the granite and porphry on the one side and into the overlying sandstones on the other.

This does not mean that wolfram or tin ore will necessarily die out as depth is gained, which would be an unwarrantable inference, but simply that in this field, as far as can be seen from the few trials which have been made, tin or wolfram veins most likely to be profitable should be looked for in the porphyries and granite of the

tableland and in the sandstones and quartzites adjacent to these. There is a very widely-spread idea that wolfram pinches and disappears in depth. This distrust is, I believe, largely due to the irregularity of the deposits in general. It is what may be described as a patchy mineral, occurring often in rich bunches with intervening blanks. This irregularity leads to irregular and costly mining, and when a blank is struck confidence in the mine frequently disappears and work is suspended. Thus, wolfram mining, perhaps more than any other, is marked by an abundance of abandoned attempts.

As a compensation in wolfram mining, the vughs and bunchy deposits often yield large quantities of ore.

The same remarks apply to tin ore. Tin lodes are admittedly extremely variable, and there is generally some uncertainty as to the permanence of any particular shoot or pay zone. But the occurrence of a blank should not lead to the belief that the deposit as a whole is exhausted.

Where tin and wolfram are in separate lodes, difficulties in treatment are non-existent; but where these ores co-exist in the same lode, and as at the Shepherd and Murphy Mine with bismuth as well, there is more trouble, as the concentrates have to be subjected to a process of magnetic separation before anything like the full value of the ore can be realised.

The demand for metallic tungsten has fluctuated considerably during the last few years, but has increased recently with its growing applications and uses in industry. It has long been familiar as an ingredient in the steel used for armour-plates, but a great use for it at present is in making the self-hardening steels for lathe tools, enabling lathes to be driven at a much greater speed than when ordinary tool-steel is used. The point seems to be that the friction heat which softens the common carbon steel tool does not affect the tungsten steel. This means a thorough revolution in works plants, and the consequence is that the world is being scoured for wolfram deposits at present. The recently-created motor industry is also absorbing increasing quantities of tungsten steel. A new metallic filament lamp, known as the Zircon-Wolfram lamp, has lately been introduced, and this application will increase the demand still further.

Molybdenum is now being used for the same metallurgical purpose as tungsten. It occurs in minute quantities,

as the sulphide, molybdenite, on the Shepherd and Murphy, All Nations, and Packett's sections, but nothing sufficient to be payable has been discovered.

It is however widely disseminated in the granite and porphyry of the district, and possibly some deposits of value may eventually be discovered.

SHEPHERD AND MURPHY MINE.

This property is 12 miles south-west from Wilmot, and comprises the following sections, charted in the name of W. G. Soper:—1802-M, 79 acres; 1437-91M, 80 acres; 1456-91M, 80 acres; 2134-91M, 78 acres; and 187-93W, 5 acres. The mine is on Section 1437, on the northern slope of a hill spur descending to Bismuth Creek. The country to the north, west, and south of the mine is Tertiary basalt, but at the mine itself and across the creek on the east the lava sheet has been denuded, and the Silurian sandstone, or occasionally quartzite, is exposed. Some abrupt cliffs of solid basalt occur in the creek and on the roadside near the bridge, so that it is very evident that this valley must be of considerable age, and has been gouged out again through the basalt sheet, or the present creek crosses the channel of the older one, which was running east and west. At any rate, the old channel was very deep where the bridge is now.

Seven parallel lodes have been discovered on the hill spur, running east and west. Of these, Nos. 2, 4, and 6 are the most important. No. 6 is the most northerly, 600 feet south of it is No. 4 lode, while No. 5 lode is 93 feet north of No. 4. No. 3 lode is 87 feet south of No. 4, and No. 2 lode is 142 feet south of No. 4. No. 1 lode is about 150 feet south of No. 2 lode.

No. 6 is the lode on which most of the work has been done recently. At about 50 feet above the creek at the battery a crosscut adit (No. 3 adit) has been driven 390 feet in a south-easterly direction, intersecting the lode at that distance. From the point of intersection a drive has followed the course of the lode for 350 feet, with a mean bearing of a degree or two south of east. The lode is vertical, or with a northerly underlay if any, and averages about 22 inches in width. Its economic minerals are cassiterite, wolframite, and bismuthinite, in varying proportions. Roughly, the concentrates assay about 33 per cent. each of tin and wolfram. Thus, the last lot of concentrates from the mill went 32.5 per cent tin and 30.8

per cent. wolfram. The gangue is quartz, accompanied by pale fluorite, calcite, wollastonite, occasionally spodumene, a hydrated mica, and a little topaz. The adit has been continued 12 feet beyond the intersection of the lode. The country which it has traversed from start to finish is a belt of a peculiar massive-looking rock, breaking into large heads like an eruptive. There can be no doubt, however, that it is a metamorphic rock, and was originally limestone. Its essential components are lime minerals, wollastonite, vesuvianite, epidote, garnet. Numerous veins of a flesh-coloured mineral intersect it, which have a superficial resemblance to felspar or carbonate of manganese. From investigations, however, carried out by Mr. W. F. Petterd, it would appear that the mineral is wollastonite (silicate of lime).

The presence of a good deal of magnetite makes the rock dark. Green mica is abundant in it locally. Limestone crops out a little further north, in the banks of the Bismuth Creek, on T. J. Clerke's Section 2853-m, and I picked up stones of it on Hall's 237 acres towards the Iris River. On this section Mr. Selwyn Brown found the metamorphic rock again, but I was unable to verify this. The drive west on the lode continues in the metamorphic lime-rock for about 120 feet, and then passes into quartzite or crystalline Silurian sandstone. The junction of the two rocks in the drive is very difficult to fix accurately, as the metamorphic rock loses its magnetite, and becomes lighter in colour as well as less massive and softer. As the rock grows softer the lode improves. Owing to the heads in the rock its true bearing is not easy to determine, but it appeared to me that the general strike was east of north, and the underlay west of north, the quartzite underlying it. But I must confess there is some doubt about this, owing to the difficulty mentioned. At the east end of the drive the lode splits, and a rise is going up on one of the legs to the level above. A block of lode 350 feet long by 100 feet in height has therefore been made accessible by this drive, and Mr. Hitchcock, the mining manager, estimates on a conservative basis that it will yield 3000 tons of ore stuff. At the west end of the drive the lode has also split, and how it behaves further west can only be ascertained by continuing the drive in that direction. The backs westward, however, will diminish, as there is a depression in the ground. It is uncertain, too, whether the drive would pass under the basalt or into it, for there is some reason to fear that the volcanic rock is

deeper to the west. However, it is a work that will have to be done some time or other.

The same lode was formerly cut in No. 2 adit 100 feet above the No. 3, at a point 50 feet east of the rise at the end of No. 3 level, and was driven on 86 feet east and 227 feet west. The adit was begun in soft shale and clay, changing to quartzite a few yards in. This is just south of the boundary of the metamorphic lime-rock. At 80 feet west the stopes begin, and have been carried to surface, a height of 30 to 50 feet above the level, on a lode between 1 and 2 feet in width. Going west the lode passed into the wollastonite rock and improved, which is in accordance with what has been observed in the level below. The split in the lode corresponds with the one below.

The lode, although split going east, maintains the same width of gangue in the aggregate, and the drive should be continued east for exploratory purposes, even though there is an east blank in the level above. A fresh shoot of ore must in time be met with. A work of prime importance also is to extend the low adit so as to intersect the other lodes in the hill. The owners will then be in a first-class position for developing their property.

No. 5 and No. 5a. Lodes.—These are comparatively unimportant at present. No. 5~~a~~ has been driven on a few yards east and west. The lode is in quartzite country, and from 5 to 8 inches wide, decreasing going west. A few feet further south is No. 5 lode, containing a little wolfram, but only 4 inches in width. These two veins are only 12 feet apart, and will possibly be found to unite.

No. 4 Lode.—This has been intersected by No. 1 adit 230 feet above the No. 3 adit in 258 feet of driving, and driven upon 85 feet east and 63 feet west.

The lode above this level has been stoped to surface some 50 or 60 feet. As the surface of the ground falls both east and west, nothing much is left to work upon. In the west end the lode is split up with 5 to 7 inches in the middle of the drive and a small seam on each side. A little coarse wolfram is showing in the gangue. An intermediate level driven west comes in from the surface 35 feet above it, and the ground has been stoped out between the two. A block of lode 180 feet by 60 feet has been stoped away here. The mouth of the intermediate adit is 130 feet from the east boundary of section, or from the No. 1 adit to the section boundary 400 feet.

This No. 4 lode has ranged between 8 inches and 2 feet in width, and carried profitable quantities of tin ore, with wolfram and bismuthinite and carbonate of bismuth.

Further east near the creek, just east of the boundary-line of Section 2134, a short adit (creek drive) has been driven south-west for 100 feet, and then continued west for 21 feet on No. 4 lode or one of its forks. The lode gangue shows a little tin oxide, wolfram, molybdenite, bismuthinite. This drive is 87 feet below the other workings on No. 4 lode, and is a piece of work which ought to be continued, so as to come below the old stopes above the levels from No. 1 adit. Continuing the drive about 100 feet would bring it below ore worked out at surface above the entrance to the intermediate adit, and an additional 100 feet would lead to below the old stopes mentioned above.

No. 3 Lode.—This was intersected by No. 1 adit 87 feet south of No. 4 lode. It is, however, merely a lode-track, and no work has been done on it.

No. 2 Lode.—This has been cut by No. 1 adit 145 feet south of No. 4 lode, and has been driven upon 163 feet east and 100 feet west. This lode and No. 4 were the lodes that were worked in Mr. Mitchell's time. No. 2 has an average width of 15 inches. Westward it will go into shallow country. It had some good shoots of bismuth ore, with tin and wolfram.

No. 1 Lode.—The adit has been continued 168 feet further south, and beyond the south boundary of the section. No. 1 lode is a vein 140 feet south of No. 2, and parallel in direction to the others.

The present position as regards ore at this mine seems to be as follows:—Nearly 200 tons of ore stuff ready for crushing were stacked outside the adits at the time of my visit, and ground estimated to yield between 5000 and 6000 tons of ore stuff has been made accessible. At present the east end on No. 6 lode and the end in the creek drive on No. 4 are perhaps not payable to drive, but having been driven the lode above them is payable to stope away. The split in the east end of No. 6 forms two branches each 8 or 10 inches wide, and these are still separate in the rise 25 feet above the level.

In the level the north branch is being carried, and the south one left for a time. The two ends mentioned must be kept going, for two levels should always be advancing if the ore reserves are to be maintained. Once the dress-

ing-floors start there will be a constant drain on the stocks of ore in the mine, and progressive mine work will become more than ever a necessity. The floors were being remodelled at the time of my visit, and when ready they will comprise stone-breaker, rolls, jigs, 10 heads of stamps, 2 Wilfley tables, and 2 Frue vanners, and it is intended eventually to erect a magnetic separator at the mine.

The concentrates have an average value of about £100 per ton, which would give a value of £3 to each ton of crude ore. An improved water supply is being provided by the construction of a race $5\frac{1}{4}$ miles from the Weaning Paddock Creek. The lodes, though small, are persistent, and though several little displacements of them occur there is no serious faulting noticeable. There is very little doubt as to their continuance eastwards across the creek into the adjoining hill on Sections 1332 and 2134, and there is also no conceivable reason why they should not continue west across Section 1802 (with possible interruptions by basalt) into A. C. Hall's private land. For my own part I have not the slightest doubt but that they are there, and that some of this important group of veins extend right through from the Iris River on the west to beyond the All Nations sections on the east. In the latter direction they will eventually enter the granite-porphry rock exposed at surface. The great piece of work which in the future lies before the mine-owners is to prove the lodes in the hill by continuing the low adit right across the lode zone.

Up the hill in basaltic alluvial clay are boulders of cemented conglomerate, containing layers or bands of coarse black tin oxide accompanied by some topaz. The conglomerate consists of quartzite pebbles bound together by a siliceous cement, and is apparently the debris of an old alluvial deposit which has covered these lodes at one time or other. The most probable explanation is that the deposit was covered by the Tertiary basalt, and has been subsequently broken up and released by its denudation.

From the point of view of the mineralogist and mining geologist the lode at the Shepherd and Murphy Mine possesses a certain degree of interest. The coarse crystallisation of the gangue minerals might easily suggest a comparison with the structure of pegmatitic veins, and this reference is strengthened by the occurrence of beryl and spodumene, but there is a singular absence of felspar and original mica.

The process which has been at work seems to have been that usually concerned in tin ore deposition, not dry sublimation, but deposition from gaseous solutions. Hence we see the usual association of tin ore with the fluorides (fluorspar and topaz) and hydrated mica, accompanied, however, by the lime products of the metamorphosed limestone through which the lode passes for a certain distance (wollastonite, calcite, vesuvianite, epidote, &c.). The hydrated mica in the lode, colourless to light-green in colour, requires analysis for exact identification of the species to which it belongs. There can be no doubt, however, that it is secondary. Such micas are known in some instances to have been derived from topaz and spodumene. The large flesh-coloured patches of the silicate of lime, wollastonite, in rosetted aggregates are striking characteristics of some portions of the lode.

A complete investigation of the complex mineral composition of these lodes may be recommended to students.

ALL NATIONS WOLFRAM MINE.

This property comprises four mineral sections, viz.:—1332-M, 78 acres; 1019 and 949-M, each 78 acres, T. J. Clerke; and 2853-M, 80 acres, T. J. Clerke. These are situate about 12 miles south-west of Wilmot township, the main road from Wilmot towards the Caledonian Mine passing through the central (1332-M) section at an elevation of about 2000 feet above sea-level.

The main or No. 6 lode of the adjoining Shepherd and Murphy Mine has been worked to within 700 feet of the west boundary of Section 1332, and will apparently cross that boundary into the All Nations property at about 290 feet north of the south-west corner peg. The ground, covered with standing timber, then rises to the east to a height of about 600 feet, and no attempt has been made as yet to trace the lode through the section, but at 3 chains north of the south-east corner peg of Section 1332 the wolfram lode-line has been shown by a few trenches to cross the south-west portion of Section 1019-M and enter Section 949-M in a direction 10 degrees south of east. The last traverses in the east end of the Shepherd and Murphy No. 6 lode show a slight inclination to the south of east, and the probability is that this tin-wolfram-bismuth lode and the All Nations wolfram lode are either identical or connected. If so it is a remarkably persistent one, extending through nearly three sections, and possibly still further.

In Sections 1019 and 949 the lode has been opened upon by a deep open-cut along its course (now and then deep enough to necessitate covering with timber) for a length of $12\frac{1}{2}$ chains, including a 30-foot tunnel at the western end of the workings. Along the open-cut line three shafts have been sunk, 20 feet, 53 feet, and 66 feet from surface respectively.

The lode varies from 6 inches to a foot, or occasionally even to 2 feet, in width, averaging perhaps 9 inches, and has been broken out nearly all along the open trench to a depth of 8 or 9 feet, in some places to 10 or 12 feet. It underlies steeply to the south, while the country dips to the north. It splits now and then, as at the lower shaft, but reunites. A branch has gone off north in the open-cut opposite the camp, and is not seen again, unless it has joined the main lode further east.

This lode is one of the most remarkable in the State, consisting of combed quartz crystals throughout, some of which are of great size and beauty. The crystals have been noticed as large as 14 inches in circumference. Some are pellucid; others are of the smoky variety. Vughs are frequent, and have been as much as 2 feet in width and 6 to 8 feet long. From one of these cavities as much as a ton of ore was obtained. The vughs are generally full of water, and the lode stuff is very hard between one vugh and another.

The lode mineral is the tungstate of iron, known by the name of wolfram. It occurs amorphous, or occasionally in imperfectly crystalline form, implanted on and between the quartz crystals of the lode, and can be very easily separated from the gangue.

The present owners have abstracted simply the smalls from the loose upper part of the lode by sluicing, leaving the harder lode-matter on the banks of the cutting for future treatment. The stones thrown out on the banks seem to be fairly well charged with wolfram, and good dish prospects can be obtained everywhere from the smaller lode stuff associated with them.

A distinct feature of the ore in this lode is its purity. It is unaccompanied by pyrites or any deleterious mineral. Assays made by Messrs. W. & J. Lemprière, of Sydney, have shown the tungstic acid contents to go as high as 72.8 per cent.; and Mr. W. F. Ward, the Tasmanian Government Analyst, obtained by assay 72 per cent. The assays of bulk shipments, the original sale notes of which were shown to me, showed 66 per cent., $68\frac{1}{2}$ per cent.,

70·5 per cent., 70·6 per cent., 71 per cent., and 71½ per cent.

As the English standard is 66 per cent., and Australian quotations are usually based on 70 per cent. ore, the grade of this ore is very satisfactory. As far as is known it exceeds that of any other wolfram ore shipped from Tasmania, and would (for 71 per cent.), at present ruling prices in Launceston, fetch here £160 per ton.

A few flakes of molybdenite occur in the lode occasionally, and there is a selvage on the hanging-wall from 1 to 3 inches wide, containing carbonate of bismuth and gold. A good dish prospect of gold may be obtained from this selvage anywhere. Samples which I took from it have been assayed by Mr. W. F. Ward, Government Analyst, with the following results:—

Bismuth	4·8 per cent.
Gold	11 dwts. per ton.
Silver	4 dwts. per ton.

The owners have worked in a desultory way, in winter, when a little water was available, for the last two and a half years, with two or three men, sending out enough ore to pay for working and prospecting expenses. To date, they have shipped to Sydney 8 tons 3 cwt. wolfram ore.

A peculiarity is that no tin ore occurs in this lode, while the same lode (if the two are identical) in the adjoining mine carries tin, wolfram, and bismuth.

The length of the lode-line and its persistence would of themselves indicate its continuance in depth, besides which No. 6 lode, its supposed prolongation in the Shepherd and Murphy ground, is being worked 500 feet lower than the All Nations outcrop. The best part of this wolfram lode is comprised in a stretch of about 400 feet in length, in which shoots or patches of ore occur at intervals; in fact, nearly all the ore shipped has been won from this part of the lode.

Whether the shoots persist and widen out or not in depth will have to be ascertained by lower workings. Work was not proceeding while I was there, and I was unable to form a proper opinion as to the value of the lode at the lowest part of the workings, but the general appearance of the lode stuff thrown out from the trench was encouraging. I could see, however, that like all wolfram lodes, it is somewhat bunchy. Barren stretches may be expected, alternating with richer parts.

The highest backs available from the bottom of the western No. 1 shaft to the crown of the hill in advance of the present workings may be about 150 feet, and 40 feet additional may be secured by a crosscut to the shaft from the Narrawa Creek, a good deal of which would be an open drive. This would be the lowest depth at which the lode can be attacked by crosscutting on this side of the hill. This creek when I was there was sending down from one to two sluiceheads of water, and would probably supply sufficient water for dressing on the comparatively small scale required during five or six months in the year. By impounding it might be made to last longer.

The full development of the mine, however, must take place from the western side of the hill on Section 1332-M. The first step towards this is to trace the outcrop over the hill on that section by means of trenches, and to open an adit on its course eastwards. This will eventually come below the present workings in Section 949, only some 500 feet lower down. In the meantime it will be an exploratory adit, proving the lode, and if the latter answers expectations it can be easily worked and the ore stuff treated at works to be placed on the northern Section 2853-M lower down the Bismuth Creek.

An encouraging feature of the exploratory undertaking on Section 1332-M is that the lode in each of the bounding sections carries long and payable shoots of ore. If a fair amount of capital is introduced into this enterprise there is hardly scope for it in the present works on the eastern side only. It is apparent then that the natural and complete development of this property depends largely upon the discovery and behaviour of the lode on the western side of the hill in the unworked section.

On this side of the hill it must be remembered that the lode in all probability will be tin-wolfram, and the exploratory work will show whether the two outcrops belong to one and the same lode, or whether there are two lodes to be dealt with, one a pure wolfram lode and the other one carrying both metals.

Work could be continued at the same time on the lode on the eastern fall on a moderate scale, taking care to keep expenditure as low as possible. All this is on the understanding that the wolfram market remains favourable.

The price of this metal has doubled itself during the past year, and although the exact prices obtainable by producers is generally a matter for negotiation, the

demand resulting from new uses is so strong that it is expected rates will continue firm for a considerable time. The steel industry is absorbing all it can obtain, and latest advices are that the market is in an excited state. Constant enquiries are being received respecting wolfram mines and discoveries, so that it seems likely that producers will be sure of a good market for some time to come. The consumption of tungsten for high-speed tool steel is rapidly increasing, and the great toughness which it imparts to steel (often in conjunction with molybdenum and chromium) makes it sought after by the manufacturers of armour plates and projectiles. It is also increasingly used in the manufacture of motor and other car axles, springs, &c. The world's annual output of wolfram ore is about 3000 tons, of which Australia contributes a little more than half.

Up the hill southwards search has been made for the Shepherd and Murphy No. 4 lode, which is a parallel one, 600 feet south of No. 6. Small veins carrying wolfram and carbonate of bismuth have been found, but no lode corresponding with the one sought for. Stones of white pebbly sandstone with tin ore on the joint faces are scattered on the surface, which have possibly come from a belt of conglomerate on the hill crest. A long costeaning trench up the hill from here discloses loose stones of quartz and veinstuff carrying tin ore, wolfram, and carbonate of bismuth.

These trenches require to be cut rather deep to lay bare any solid lodes. On the south side of the crest the ground falls rapidly to the Iris section (H. Conder, 950-m), and the conglomerate zone gives way to quartz-porphyry, the marginal part of a granite mass. This quartz-porphyry occupies the southern half of Section 949-m, and contains great possibilities. Veins which intersect it carry tin ore and wolfram. Most of the ore occurs on the joint faces of the rock, but some of it appears to be disseminated promiscuously, and it is by no means impossible that prospecting will result in discovering some part in which the ore is sufficiently concentrated to pay for working. A good deal of the alluvial tin and wolfram ore found in the Iris workings has doubtless been derived from this quartz-porphyry, which also extends into that section. Some trenching was going on in the All Nations porphyry while I was at the mine, and some really good stones of ore were found. The nature of the rock warrants some expenditure in prospecting.

Down the Narrawa Creek, in Section 1019-m, alluvial tin ore has been won from time to time. A couple of tributors last winter took out 7 bags of high-grade ore. A wash from a few inches to 2 or 3 feet deep, and consisting of stones of quartzite, conglomerate, sandstone, and occasional lumps of vein-quartz, rests upon sandstone strata. Dishes of stuff washed showed about 2 ounces of tin ore per dish—black coarse tin with a few small topazes. The absence of wolfram indicates that the ore has not been derived from the veins on Section 949. I am rather inclined to think that it has come from some undiscovered source on the west side of the creek. As this is rather heavily timbered, it is not surprising that lodes have so far escaped discovery.

Lower down the creek the wash is deeper, where a party called the Lefroy Syndicate sluiced with a little water brought in from another small creek. Here the quartzite bed-rock is stained green with chlorite, and gives prospects of grey tin, quite different from the usual tin in the property, which is always black. By the side of the road, on Section 1332, there is a face of wash about 4 feet deep, which contains black and a little brown and resin tin ore. Prospects obtained were equal to $1\frac{1}{2}$ or 2 ozs. per dish. A man turned to recently and got 3 bags of ore from it. No wolfram is found in this deposit either.

These alluvial deposits are deserving of mention, not because they invite the attention of any other than individual workers or working parties, but principally because they point to the existence close at hand of some lode or lodes not yet discovered.

All these sections have plenty of myrtle and gum timber suitable for mining purposes. The only deficiency is water, and this difficulty must be met in the way mentioned above.

As matters stand, wolfram is the mineral at present available, but tin ore evidently exists at more than one spot on the property, and prospecting may bring payable deposits of it to light.

The strata through which the lode passes in all three sections consist of the "pipe-stem" sandstone or quartzite described in the earlier part of this report. The southern Shepherd and Murphy lodes, if they continue so far, will also be found in the same rock in Section 949-m.

IRIS CLAIM.

Section 950-m, 78 acres, H. Conder.—This is one of the sections formerly held by the Iris Tin Mining Company,

and was more recently acquired for a short time by the Tasmanian United Wolfram Company, Limited. In the northern part of the section a shallow alluvial deposit is being sluiced by tributors for a mixed tin and wolfram product, with a present value of about £100 per ton. The thickest wash seems to be about a foot, but as a rule it is not more than 3 or 4 inches, the overburden not carrying tin. Eight or 10 chains to the south of the workings basalt comes in, but at the workings and north of same the bed-rock is quartz-porphyry, and tin-bearing veins in this rock have apparently supplied the mineral which is being won. The porphyry ascends from the workings northwards to the centre of T. J. Clerke's Section 949-M, and the waste from this has probably contributed to the formation of the wash. The tin and wolfram ores are very little water-worn, and are frequently attached to small pieces of vein-quartz. Small topazes are very frequent.

The value of the ground is said to improve as the northern boundary is approached, but I believe on the whole it does not exceed 6 or 7 lbs. per cubic yard. From first to last 95 to 100 tons ore are estimated to have been won from here, but most of the deposit is now worked out, and there does not appear to be sufficient scope to induce the initiation of a water scheme, which is essential if anything more than desultory winter work is contemplated. There is a possibility of lodes being discovered in the course of stripping down to the bed-rock, but this is a rather slender chance. The high position of the section is against obtaining a water supply, and I fear the present method of intermittent work with idle spells in summer is what will have to be looked forward to unless a lode discovery is made.

SECTION 1037-M, 20 ACRES, E. W. CLARKE.

No work is being done on this section. The All Nations' wolfram lode must pass into it, but how it will behave when it enters the porphyry which is in the southern part of the section cannot be foretold. The section is one which, from its position, merits prospecting.

PACKETT'S SECTION, 10 ACRES, 970-93G.

This is a gold section, now vacant, situate south of one of the Narrawa reward sections. About nine years ago the disintegrated and cemented sandstone was dollied for gold. A trench was cut and a small shaft sunk at the head of a gully

going down to the Narrawa Creek. The sandstone carries small leaders of quartz with a little wolfram, and half-way down the shaft disseminated pyrites was met with carrying a little gold. The gold won is said to have been worth £3 12s. per oz. It is difficult to say what there really is in the formation, but as the slope to the Narrawa Creek is very steep, it would not be difficult to prove it by means of an adit. It is evidently connected with tin or wolfram veins, and it is not far from the junction with porphyry and granite in the eastern part of the section.

SECTION 1442-93G, 10 ACRES.

This is east of the preceding. An Adit known as Spark's drive has been driven south-west into the hill on the south side of the track, first in sandstone and then in soft porphyry. This was ten years ago, and the tunnel is now too wet and muddy to enter, but outside the entrance are stones of coarse quartz or granite-porphry containing wolfram and molybdenite. Quartz veins intersect the porphyry and carry coarse crystals of ore. A little pyrite is visible in the rock, which greatly resembles some of the tin-bearing rock on the Blue Tier, East Coast. The entrance of the tunnel is in Silurian sandstone, but further in the porphyry must have been struck; also an east and west lode.

About 10 chains further east, but whether on the same section or not I could not determine, are some workings recently operated by Mr. Black, but now abandoned.

BLACK'S WORKINGS.

South of the track and a little above it a cut about 20 feet long has been put into the hillside, showing a lode striking W. 10° N., and dipping towards the south. The quartz is 5 or 6 inches wide, and carries coarse patches and crystals of wolfram, with some bismuth carbonate and iron pyrites. Some of the quartz is smoky. The country-rock is a dark mica granite.

Still further east and on the track is Black's underlay shaft, sunk 35 feet in granite-porphry, on what would seem to be a copper wolfram lode. Lode stone 8 to 10 inches wide, carrying iron and copper pyrites and black oxide of copper with wolfram is piled at mouth of shaft. Bearing of lode, N. 65° W. To the east of this the lode has been trenched upon, showing stone much oxidised at surface. There is nothing payable in this lode so far.

Nearly a hundred feet lower down the hill are two more shafts sunk by Mr. Black in granite-porphry, 35 and 45 feet deep, and about 40 feet from each other. A large formation of mica and specular iron ore has been sunk on, being followed down on the underlay and then passed through into granite. In the west shaft hornstone was struck, indicating some contact. The formation strikes north-west. The oxidised lode-matter is traversed by narrow seams of wolfram between thin selvages of dark-green mica, and by veins of comby quartz containing a little wolfram. Native bismuth has been found, and a speck or two of free gold. Quartz veins in the granite-porphry carry a little molybdenite.

Though nothing payable has been found, there would seem to be some possibilities here. To the south, over the range, is the old Dalcoath property, where a stanniferous stockwork exists, which was not payable in the old days, and which presents a problem somewhat resembling that offered by the Blue Tier tin deposits. This was not visited as there was no one who could show me any way of getting to it.

NARRAWA P.A., REWARD SECTION 35-93G, 20 ACRES.

This is the section north of Packett's. A descent is made 400 feet to the Narrawa Creek over Silurian sandstone country, and on the north side of the creek and about 30 feet above it a tunnel has been driven into the high hill range on the course of the lode for about 150 feet in a direction 25 degrees north of west. Two short crosscuts have been driven west, and a small cuddy also west.

The country-rock is a dark-grey quartzite, permeated with vein silica and impregnated with iron and arsenical pyrites, and a little copper pyrites carrying gold and silver. This impregnated zone forms the lode. I could not see that it had any defined boundaries. It rather appeared as if it might be an impregnated band in association with some fissure which has supplied the mineral. The degree of impregnation varies in different parts, being less in some parts than others, but the siliceous character of the formation is rather constant. A lot of red ferruginous mud is issuing from the tunnel, and much water is falling through its walls.

This and its abandonment for some time past make its examination difficult, and I found it useful to confirm my observations inside by looking over the tip. Among the stones I found some quartz carrying a little wolfram. It

is possible therefore that some such occurrence as this is the primary vein quartz which has started the silicification of the formation. Some selected pieces of the lode-formation which has been driven on picked up by me were assayed by Mr. W. F. Ward, Government Analyst, with the following results:—

Gold	4 dwts. per ton.
Silver	3 ozs. 1 dwt. per ton.
Copper	2·2 per cent.
Tin	Not detected.

It is evident that this lode shows abnormal features. It may belong to the group of cupriferous gold-quartz lodes, or it may be an extreme type of tungsten veins. No tourmaline is visible to the naked eye. A microscopical examination of the lode-material may reveal features which would lead to more definite conclusions, but I am inclined to think that the formation is an extreme member of the wolfram lodes so prevalent in this district. In driving this tunnel further the aim should be to locate some solid shoots of ore, and consequently frequent crosscutting will be necessary, for the formation is a wide one and the impregnation irregular. It is quite possible that payable shoots may be found, but close testing is absolutely necessary. The hill rises above the tunnel some 700 feet or more, and if anything payable is found, working it will be an easy matter.

Mr. Waller found some of the Bell Mount schistose porphyries on the Narrawa section. From this it is plain that the contact between the schist series and the Silurian sandstones is close at hand. But it will not be well to attach too great importance to this, as it is more probable that the granite contact was the dominating feature in the process of ore-deposition here, and it is extremely likely that the lode minerals in depth will be tin and wolfram.

BELL MOUNT GOLD DIGGINGS.

These are now virtually idle, the only worker being Mr. Alex. Campbell, the brother of the original discoverer, Malcolm Campbell. In 1892 and 1893 the wash was feverishly worked, but since then the field has been more or less dormant. It is impossible to get at the exact quantity of gold ore won. I am informed that the banks can only account for purchases of about 1000 ozs., but the most reliable estimates put the total at about 4000 ozs. Nuggets up to 22 ozs. have been found, and many weighing from 1

to 2 ozs. Bell, Poverty, Mosquito, and Basalt Creeks flow through the deposit of alluvial, which is from 18 inches to 18 or 20 feet in depth. The wash consists of sandstone and quartzite conglomerate and schist. The gold generally lies at the bottom of the wash, and below this is frequently a false bottom of black carbonaceous pug. The hill north of C. Adams' house is composed of a heavy quartzite wash with a bottom of pipeclay. Poverty Gully, as it was called, is between two mounds of made ground. There was only one payable claim in it, and the largest nugget got was 4 ozs. The stones in the valley evidently came from Bell Mount, but the wash of which the hills are composed has not been traced to its source. The bulk of the gold has been got from the larger gully to the west. In that creek (Bell Creek) the bed-rock is blue slate underlying the false bottom of dark pyritiferous pug. At the head of the old Amalgamated claim the rock is a soft sandstone, with a strike of N. 60° E., dipping to the south-east. In the upper west diggings there would seem to be a genuine lead, the only one on the field. The wash is composed of red sandstone conglomerate and pipe-stem (tubicular) rock. It is significant, however, that the south end of the wash contains stones of basalt.

From what I could observe, I am inclined to refer the gold to quartz veins in the sandstones and conglomerates of the country, but too little is known of the country lying west of the Wilnot to say whether it has furnished most of the wash or not. Conglomerate and Silurian sandstone prevail in that country, but these rocks are also found all round. The matter is complicated by the occurrence of some Bell Mount schist in the wash. It is possible that there was here a large swamp or lake which was fed by streams coming from various directions. This supposition would solve the difficulties in an easy and natural way. The country to the north and west, preferably west, would be the source of the gold. That to the south is excluded, as it is tin-bearing country and would have shed tin and wolfram ore into the basin. The gold has not come far, and search may disclose the rich veins from which the gold won has been detached.

GREAT CALEDONIAN MINE.

This is in Silurian sandstone and quartzite at the top of the Five-mile Rise. A shaft was sunk, levels driven in sandstone permeated with veins of cellular silica, a crushing or two taken out and treated in a fifteen-head battery.

It is difficult now to see what there was to work upon. The mine was soon abandoned, the battery removed, and everything at surface has since been destroyed by a fire. The store close by the track is the only existing relic. It is useful as a camp and shelter-place in this solitary spot.

THE DEVON MINE.

Section 1831-93M, 40 acres, leased by the Devon Mining Company, No Liability, and Section 4021-93M, 40 acres, in the name of J. C. Macmichael, but owned by the Company, are at the bottom of a deep gorge carved out by the Dove River. The mine is $2\frac{1}{4}$ miles south of the V.D.L. track, *i.e.*, as the crow flies, but the zig-zag bridle-path which leads down to it is nearly 3 miles in length. The Dove River flows through the sections, and the mine is on its precipitous banks, on Section 1831-93M. On the west bank is a galena lode carrying a variable width of ore, *viz.*, from a few inches up to a foot.

The lode-channel also varies in width from a few inches to 3 feet on the outcrop, and is filled with quartz-porphry and quartz, with occasional carbonate of iron. Pyrite is present in the gangue, so that the lode may be described as belonging to the pyrito-spathic group of lead veins, though siderite is only occasional. A little blende and chalcopyrite accompany the lead ore. Pyromorphite also occurs, and cerussite is plentiful in the upper part of the lode.

The bearing of the lode in the northern end of the workings is a degree east of north, and in the southern end 29 degrees west of south. The dip is very steep to the east.

The country-rock is a rather dense quartz-porphry, composed of a ground mass of granular quartz, in which lie scattered larger crystals of quartz, orthoclase, felspar, and dark mica. The lode is in this rock, which passes into or joins granite in a southerly direction, while going north it abuts on quartzite or altered Silurian sediments. The hornstone which prevails at the contact makes it difficult to determine with the naked eye whether a given specimen belongs to the sedimentary or to the igneous series.

No tin or wolfram has been found associated with the galena, and there is nothing to show that the lode is in any way related to the stanniferous lode groups of the granite and porphyry of the Bell Mount district.

The output of the mine since 1899 has been 290 tons silver-lead ore. More than half this quantity assayed 5 dwts. 4 grs. gold per ton, $85\frac{1}{2}$ ozs. silver per ton, and 55.9

per cent. lead. Lately $8\frac{1}{2}$ tons were sold, assaying 2 dwts. per ton gold, 80 ozs. silver, and 60 per cent. lead, and realising, after deducting returning charges, £18 12s. per ton nett. The high gold contents are unusual for our galena ores. A selected sample of clean galena which I took was assayed by Mr. W. F. Ward, Government Analyst, and returned 80 per cent. lead, 3 dwts. 6 grs. gold, and 112 ozs. silver per ton. Work was suspended at the mine for nearly four years, but was resumed last November, since when 25 tons of galena have been raised.

The first adit (or No. 1 tunnel) was driven at about 20 feet above river-level in a westerly direction, and at about 70 feet in intersected the lode. In driving this adit a small formation with a westerly underlay was met with, but it does not seem to contain anything solid in the shape of a lode. Further in, about 10 feet east of the intersection of the lode, a small seam (6 inches) of quartz and siderite was passed through. Where intersected, the lode on foot-wall is very small. It has been driven upon 104 feet south and 24 feet north. In the south drive the lode-formation is a gossanous quartz from 6 to 10 inches in width. Very little galena (1 inch) is showing in the end. There is a rise up 40 feet from this level, and the lode on top carries 4 or 5 inches of ore going south and 3 inches going north in a gossanous formation. The north drive has been driven about 180 or 200 feet over the top of an ore-shoot which has been stoped up from the level below. It is now unsafe beyond a few yards from the flat sheet.

The main crosscut at this level has been continued west from the flat sheet for 25 feet, and would, it is estimated, have to be driven half a chain further to cut a parallel gossan formation seen at surface nearly 200 feet above river-level. The gossan outcrop is about 9 feet wide, inter-laminated with porphyry, and is stated to carry 3 ounces of silver per ton. Its bearing is N. 90° E., and it is vertical or slightly dipping to the east.

No. 2 adit has been driven west from about 6 feet above the river at about 120 feet north of No. 1 approach, and just on the junction of the granite with porphyry. A small seam was cut in the approach, 3 inches wide, with a westerly dip. It will accordingly junction in depth with the main lode. At 70 feet in the lode was cut, but only 18 feet below the level above. The lode has been driven upon 70 feet north and 145 feet south. There is a fair quantity of pyrites in this part of the lode, and when the carbonate of iron comes in the galena seems to disappear.

Up to a foot of ore has been carried, but discontinuously. Beyond the stope a little cuddy has been driven to pick up the lode which was done a little further south. The lode crosses and recrosses the drive in the form of a mere track, but from 9 to 12 inches of ore are stated to be underfoot. In the south end it has pinched to a carbonate of iron track. In the level above this the ore extended about 60 feet further south, so it would appear that the shoots are pitching north. In the north drive a winze 17 feet from the flat sheet has been sunk 17 feet, and the lode in its north end was showing 8 inches wide when the water interfered with the work. Some clean seams of galena 3 inches wide are seen in the roof of this drive, but the end is barren, with bands of quartz and gossan continuing on the west wall.

A shaft has been sunk from surface 70 feet and 110 feet north of the winze, and a drive south started from the bottom, which will in time come 40 feet below the present bottom of the winze. This shaft had not been unwatered when I was at the mine, the water-level in it being within 30 feet of the top. I was told that the lode at bottom is good, and showing about 3 inches of ore. It has since been driven upon, and widened out to 8 inches of clean galena.

It will be gathered from this report that the Devon Mine has a small persistent lode carrying ore of a high grade. The cleanness of the ore has enabled work to be carried on without going to the expense so far of putting up concentrating plant, but of course the present stage of the work is a purely transitory one, as what the mine is going to be will depend upon exploration. The present shoot will have to be followed down still deeper, and as the shoots will probably all pitch north, driving south is indicated as soonest likely to meet with a new shoot. At the same time the adit crosscut should be continued, to cut the western lode.

An encouraging feature is the relative poorness of the gossan, which descends to the lowest level yet opened. It is likely that it has been depleted of its silver contents, and that these have been carried down to enrich the lode at a greater depth. At the mine I felt some anxiety as to how the lode would behave going south, as it seems as if it would shortly enter the granite which exists south of No. 1 adit, but from the plan it is evidently turning westwards, and thus following the apparent direction of the porphyry in which it lies. There is nothing to indicate that the lode will not descend to a great depth, or that the

ore in it is merely a superficial concentration; and more than one shoot of ore will probably be met with on its course. Its only drawback is its small size.

The cost of transport of the ore to the coast has diminished of late years, but is still a heavy tax on the mineral, being £3 19s. 6d. per ton to Devonport. As long as the outlet from the mine is *via* Wilmot the freight must be heavy on account of the packing cost to the top of the Dove River Gorge, but the rate could be considerably reduced by the improvement of the road between the Caledonian and Wilmot, and more Government money could very well be expended on this. Whether the mine continues work or not, the road will benefit the settlers along the route, so there ought to be no hesitation on the part of the authorities in opening up suitable means of communication.

CONCLUSION.

The whole district is one of high interest from a mineral point of view. The granite contacts have given rise to ore deposits of a varied character—gold, silver-lead, tin, wolfram, copper, which though mostly concentrated in small lodes are of good grade. The lodes have so far been explored for the most part only in a tentative way, and some of them have given results which may be described as promising. The district is geologically connected with the country further west, where the same tubicolar sandstone and conglomerates prevail. Some gold mining of a prospecting nature is being carried on in that country by Mr. Black near the Black Bluff. Mr. Black has also tried some ventures in the Bell Mount district, but more than individual attempts are necessary in a field of this nature, because as a rule the lodes are small and require a good deal of progressive work to be carried on ahead of ore-winning. For the present the tin and wolfram mining will be chiefly centred in the Shepherd and Murphy group of lodes and their extensions towards the All Nations, and silver-lead mining at the Devon. However, a galena vein is known to exist between the Bell Diggings and Bell Mount, and the same mineral may crop up elsewhere. The tin-bearing porphyries and granites extend eastwards on the slopes to the Forth River, and pass over to Mt. Claude. Gold is rather widely distributed throughout the district, but though a fair amount of alluvial gold has been won, no veins of any great importance have been found. The

numerous small veins have shed their gold during the process of denudation, and this has been carried into the alluvial deposits which have been worked by diggers.

I do not think that the chances are in favour of any very high development of any one mineral. The field is more likely to prove one of numerous small and rich lodes.

The progress made in settlement ought to help mining on, if care be taken to prevent the further alienation of land upon which outcrops of mineral are likely to exist. The increasing number of settlers may be expected to keep the routes open to and from the mines, and by spreading more people over the land will tend to facilitate new discoveries of mineral. This district is on the eastern edge of the practically unproved country between here and Waratah, and the few mining attempts which are now being made along this fringe merit all the fostering care and encouragement which the State can legitimately afford.

I beg to thank Messrs. W. E. Hitchcock, R. Mitchell, W. Tresize, C. Adam, and Mr. T. J. Clerke for kind aid and information, and Mr. Alex. Campbell for fossils from the Bell diggings. These fossils indicate a Silurian age for the sandstones and quartzites.

I append a note furnished by Mr. W. F. Petterd on his examination of the spodumene mineral from the Shepherd and Murphy lode.

Owing to want of time a map does not accompany this report, but this matters less, as a geological sketch map of the Bell Mount district is attached to Mr. G. A. Waller's report of the 3rd April, 1901. That report should be read in conjunction with the present one.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES,
Government Geologist.

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

NOTE BY MR. W. F. PETTERD ON EXAMINATION OF ALTERED SPODUMENE FROM THE SHEPHERD AND MURPHY LODGE.

In forceps infusible: gives after considerable heating strong reaction for Li, and the same in powder on platinum wire glows and gives yellow flame of Ca. On coal in powder becomes somewhat white, but does not fuse or intumesce.

With Na_2CO_3 no reaction. With borax bead slight trace of Fe. In matrass the mineral in powder gives a distinct reaction for H_2O , showing the substance is hydrated, which is often the case in altered compounds. Apparently portion of the Si and Al is replaced by Ca, which is not unusual.

On strongly heating in the open tube it loses colour and becomes greyish-white. The mineral has a somewhat lamellar structure, cleavage fairly perfect; surface of cleavage faces inclined to be pearly. Fracture uneven, tough, lustre decidedly oily. Colour greenish-grey to almost olive-green, translucent at edges. Crystals prismatic, short, irregular, striated, and flattened or compressed. System apparently monoclinic. The substance is more often than not massive, with enclosed or attached crystals of cassiterite. In hot HCl a slight disengagement of CO_2 . Specific gravity, 3.4. Hardness, 4.5. Optically, refraction and double-refraction strong. In thin sections colourless and non-pleochroic.

With radium bromide (of 1,800,000 intensity), using a thin sheet of metallic aluminium as a filter to the natural glow of the preparation interposed between the assay and the cell containing the radium, a pale greenish light is observed, which is apparently characteristic; but after the mineral was strongly heated in the platinum forceps it did not respond to the emanations.

Some experiments were carried out with spodumene from other localities:—

No. 1. A large crystal 6 inches in length, colour greenish, white, and opaque, from Peru, Maine, U.S. America. This gave a distinct response to the radium rays. A chip was also used, and powdered mineral. The light was pale greenish. As before, a thin sheet of metallic aluminium was used as a filter.

No. 2. A somewhat large cleavage mass, slightly greener in colour than the preceding, also opaque, from Phillip

River, Western Australia. The radescence in this instance was not nearly so clear as that of No. 1, but still quite noticeable both in a fragment and in powder.

No. 3. Portion of a large crystal of the usual colouration, from Ulo, Sweden. No result from either thin chip or powder. Apparently not appreciably affected by the rays, though the specimen is quite characteristic in all respects, and the locality is well known to mineralogists.

No. 4. Transparent varieties of spodumene all gave a bright response to the rays. They were as follows:—Hid-denite, colour bright green, from Alexandra County, North Carolina, U.S.A. Triphane, colour clear yellow, from Minas Geres, Brazil. Kunzite, colour violet, strongly dichroic, from Pala, South California, U.S.A. These were all strongly radescent. The last becomes incandescent when heated in powder with the radium bromide.

REPORT ON GOLD AT PORT CYGNET AND WHEATLEY'S BAY, HUON RIVER.

Government Geologist's Office,
Launceston, 22nd June, 1907.

SIR,

PURSUANT to instructions received, I proceeded to the Huon River on the 5th April, to examine some ground taken up for gold-dredging at Wheatley's Bay and Lymington and gold-quartz mining works at Lovett.

Alluvial gold-seeking in this district was carried on thirty years ago, and about nine years ago some lode mining was started round Lovett. Whether visible gold had ever been detected in the stone has always been a debatable question, but the late Mr. J. Harcourt Smith claimed to have noticed fine specks in the stone at Mt. Mary, near Lovett, and his samples of the red ferruginous lode material at that mine when assayed by the Government Analyst confirmed his determination by returning 4 dwts. 2 grs. gold per ton. On my present visit to the same mine I saw similar specks in the same reddish contact rock, and a piece which came from this trench and showed numerous minute specks of what resembled gold scattered all over a joint face of the specimen, on being assayed by the Government Analyst, yielded 3 ozs. 4 dwts. gold per ton, and 2 dwts. 12 grs. silver per ton.

This gives a rather important clue as to where one may expect to find gold-bearing stone in the district, for this reddish stone is rather a feature of most of the reported occurrences. There is a N.E.-S.W. belt of alkaline porphyries ⁽¹⁾ which are intrusive in the Permo-Carboniferous strata at Lovett and Lymington, and at intervals along the contact line is found a development of quartz, opaline silica and chalcedony, associated generally with an impregnation of the contact rock with pyrite which has decomposed to hematite, giving it a characteristic reddish colour. It is this reddish-coloured rock which shows visible gold.

⁽¹⁾ The term porphyry is here used in a field sense, and includes all the rock varieties of alkali and nepheline syenites, tinguaïtes, essexites, sölvbergites, nepheline porphyries, &c. which form the remarkable assemblage of alkaline rocks at Port Cygnet.

Any veins of quartz that there are in the district seem confined to the rocks in the neighbourhood of the contact, but quartz veins are not abundant, and need hardly be expected to be strongly developed, as the eruptive porphyry is not sufficiently siliceous for much surplus silica to be available for the formation of reefs. However, a certain amount of lode action has taken place at and near the contacts, and it would seem as if these contact formations are responsible for the gold which has been found in the alluvium of the creeks and flats.

The auriferous porphyry belt strikes right through the country to Little Oyster Cove and Peppermint Bay on the Channel. Gold-bearing creek sand occurs near the former. In it are small crystals of sphene, garnet, and zircon, besides a little flaky, water-worn gold. This sand is evidently the detritus of the Port Cygnet porphyry series.

The lode formations possess a purely scientific interest in being the youngest gold matrix in the island.

The gold quartz reefs of the north and east are all prior to the Permo-Carboniferous, while these southern occurrences are intrusive into the Permo-Carboniferous, and consequently younger.

The whole produce of the district, all in the form of alluvial gold, has been close upon 3000 ounces. Several years ago I took great pains to collect information bearing upon this point, and though exact figures are out of the question, the above estimate is probably very near the mark.

PETCHY'S BAY GOLD MINING SYNDICATE.

This syndicate has applied for two dredging claims, one in Wheatley's and Petchey's Bays, and the other at the mouth of Forster's Rivulet and in Copper Alley at Lymington.

Between Lymington and Wheatley's Bay is a high hill-range which slopes steeply down to the Lymington Valley on the north, and to the Huon River on the south. The Permo-Carboniferous mudstones at sea-level are intruded into by the massive porphyry on both sides of the hill. This porphyry apparently rises into the heart of the hill, to a height of 700 feet above the river-level, and the gold deposited in the stone at or near its contact line with the sedimentary strata has been shed on the one side into the Lymington basin and on the other into the creek deposits and shore flats of the Huon River. One might expect therefore that the shore sands of the Huon would contain accumulations of gold. Such is in fact the case.

The beach in the little bay below Jno. Wheatley's 98 acres and H. Riseley's 24 acres is a flat floor of Permo-Carboniferous mudstone shelving off very gradually into the river. Dish prospects from the sand of this bay yield some very coarse gold. When I was there preparations were being made to bore with plant brought over from New Zealand, and test the bay thoroughly before going to the expense of a dredge. I was informed that as far as 500 or 600 feet from the shore the depth would not exceed 40 feet. North-east from this bay a valley opens into it covered with an alluvial deposit resting upon soft clayey porphyry about 40 feet above the river. A good many holes were sunk in this alluvial by former workers, from 6 or 7 feet to 24 feet. The wash as a rule is from 6 inches to 3 feet. The present syndicate have put down a dozen holes altogether. Some of these yielded only a few colours, others $\frac{1}{4}$ -dwt. each. Riseley's Creek, which flows through this valley, has always been considered to return the most gold. Mr. Kube showed me 4 or 5 ounces of gold which mostly came from this creek. The gold is mostly honeycombed and heavy, and coarse, one flat piece weighing 1 dwt. 14 grs.

West of the above is another little bay, Kube's Bay, just below Mr. Kube's house, and this receives Kube's Creek, which has yielded gold all the way down from the hills, but not so much as Riseley's. However, it was thought that this bay would also give good results. The syndicate had bored 25 feet in the bay when I was there, but only got 5 colours from one bore. There would seem therefore to be little encouragement here. The shores here are also mudstone, and on the east side of the bay a vertical dyke of porphyry traverses the country N. 77° E., about 2 feet 9 inches wide.

A fair quantity of gold has probably at one time or another been shed into these bays, but it must be recollected that the Huon is a tidal river, and much of the metal is likely to have been carried off and distributed elsewhere. My visit left upon me the impression that there is hardly enough scope for a dredging enterprise. From what I know of this district, I shall be surprised if the boring tests disclose enough gold to cover the cost of a dredge, and even if they do, a dredge would make short work of the limited area within the bay.

There is evidently a junction of the porphyry with the mudstones just above the bank of Wheatley's Bay, and it is just possible that the flat was once covered with the

sedimentary rock, which has been removed together with the gold-bearing vein material at the contact. But the bulk of the gold has, I think, been derived from the contacts higher up the hill to the north-east.

I ascended this hill with Mr. P. Hardy. Gold can be traced up the valley, and just where the foot of the slope begins a hole has been sunk 20 feet in mixed porphyry and sandstone wash and clay, showing colours of gold. No quartz is visible in the wash, and the alluvium is not bottomed.

Close by is another deep hole sunk as far as water. A chain further is also a hole sunk over 20 feet, but not bottomed. The stuff thrown out contains reddish contact stone similar to that on the hillcrest. Ascending the hill about 300 feet above the river is fossiliferous sandstone. A saddle here is 700 feet above the river, and there is apparently a contact of the porphyry and shale. Going north from this, the hill-range is composed of pebbly grit and conglomerate, with seams of chalcedony and contact stone, hornstone, &c.

It is from this hill slope that it is reasonable to suppose that most of the gold at the foot of the hill has been derived. But I think the main source has been lower down the hill, because the sandstones at the summit are pebbly, and there would have been more quartz associated with the gold at the base if both gold and quartz pebbles had been mainly derived from the hillcrest. There is reason, however, to believe that the quantity shed has been moderate, and unfortunately the slow accumulation of alluvial gold during the past ages does not necessarily mean that a payable outcrop will be found at the top of the hill. In the course of time a payable spot may be struck, but at present there is no indication to guide prospectors beyond the general trend of the north and south contact line, as shown by the reddish chalcedonised stone.

This syndicate is also preparing to bore at the mouth of and along Forster's Rivulet, north of the Lymington jetty, as well as on the shores of Copper Alley, the bay south of the jetty. I have not been able to learn exactly how this bay derived its name, but heard locally that the prisoners in the old days found signs of copper. It is possible that green iron stains on the mudstone surfaces, such as are seen at Sturges Bay, Cradoc Hill, Peppermint Bay, and many other places in this area, have been mistaken for copper. This green-stained rock has been tested

in the Government laboratories, and the colour found due to ferrous oxide.

The old company at Lymington took out a considerable quantity of gold from the shallow alluvial on Mr. Coad's ground during operations extending over a couple of years. This Lymington Valley has been carved out right across the line of porphyry from west to east, and naturally carries the concentrations from the waste of the rocks which have disappeared. In 1884 or 1885 Mr. Lane sank in the bed of Forster's Rivulet above the bridge, and is said to have got half a grain of gold to the dish. The position of the mouth of this rivulet is highly favourable, assuming a fair quantity of gold to have been brought down by the creek, but from what I hear the gold in the valley and on the surrounding slopes is extremely patchy. While the creek and the bay are suitable localities for search, I am inclined to think success doubtful, at any rate, on a scale that would warrant placing a dredge in position. However, the tests that are to be made will soon settle the question. If this bay and the one on the Huon River can be shown to yield sufficiently to be payable, the united claims would then justify further expense. Just south of the jetty a dyke or exposure of porphyry crops out in blue shale, and is seen again on the north side of the jetty. North of the rivulet and along the shore of the Arm to nearly half-way to Lovett the rocks are mudstone shale and mudstone conglomerate, traversed by dykes of porphyry. Opposite Green Point porphyry comes in, and continues thence all the way to Lovett.

LYMINGTON MINE.

In company with the Rev. Father O'Flynn and Mr. Davis, I visited the hill-saddle in the south-east corner of J. Direen's 22 acres, about a mile west of the Lymington township boundary, where on one side the hill descends steeply to the Huon, and on the other to the Lymington-road.

Here there is a cut into chalcedonised contact stone, but as this is on private property, a Lovett syndicate has gone a little south-east and put in a short adit, 60 feet, and also about 60 feet below the crown of the hill, which so far has only passed through softened and altered country rock of no value. A formation which is ahead of the adit face has been uncovered a little further east, but an inspection of this showed that it consists merely of

fossiliferous country carrying hydrated oxide of iron, and is not worth driving for.

In a westerly direction along the range towards Black Jack mudstones, shales, and quartzites continue to form the country rock, occasionally fossiliferous. At one spot the hardened mudstones are impregnated with iron pyrites. Still further west an excavation has been made in mudstone with a seam of limonite. The gossanous capping is rather inviting in appearance, but degenerates into a seam of limonite, which has the disadvantage of carrying no associated quartz nor pyrites.

All around is pebbly sandstone and conglomerate, the waste of which would give rise to a decided quartz wash. But quartz gold-bearing wash is rather exceptional here, and bearing this in mind, it is probable that the gold at the base has come from some part of the contact with shales and mudstones lower down the hill than these high workings. This view gains support from the general opinion in the district, that the best prospects are always found not on the top of this hill, but some distance down its sides.

The porphyry no doubt passes right under it, and there are lower points of contact from which most of the gold may have come.

MOUNT MARY MINE.

This is situate just south of the south boundary of the township of Lovett, in the north-east corner of W. Dance's 15-acre block. The country rock is pebbly mudstone and shale near its contact with alkali and nepheline syenite porphyry, which crosses the mountain and the Lovett valley to the Livingstone Hill in a north-easterly direction. At the contact itself a good deal of brecciated rock is seen, very likely due to the crushing force of the intrusion; and the familiar reddish contact stone carrying visible gold on the faces occurs at the outcrop.

Work was begun here in 1898, but after some time was abandoned, and only resumed at the beginning of last year, when a new shaft was started. In all, four shafts have been sunk. The first was only 14 feet in depth. At this time specimens of stone are reported to have given 4 dwts. and as much as 11 dwts gold per ton. The second shaft was sunk 60 feet, and the lode-channel intersected by a crosscut in 16 feet of driving to the north-west. Stone from this is reported as having assayed 2 dwts. 7 grs. gold per ton, but a sample from the whole width of

the lode (4 feet) taken by the late Mr. J. Harcourt Smith returned only traces of gold.

A third shaft was sunk 20 to 25 feet, and then abandoned. The fourth and present shaft has been sunk 73 feet. From the bottom a short crosscut has been driven south through the lode, which is here 3 feet wide, and has been driven upon east for 6 feet. In the lode-channel are up to 6 inches of green lode-stuff and silicified matter. A sampling which I took from the face was assayed by Mr. W. F. Ward, the Government Analyst, but only a trace of gold was detected. I was shown assay notes from Mr. Ward stating—2 dwts. 15 grs. gold per ton from green stuff; 8 grs. gold per ton from quartz; and 1 dwt. 7 grs. gold per ton from red stone. The 3-oz. red stone sent by me to Mr. Ward also came from the outcrop in a trench near by. As this trench has yielded several specimens showing visible gold, it might be as well to sink a little on the stone there. It is in fact the only formation in the district in which anything tangible in the way of gold is found, and I think a little money might be spent in proving it. From the manner, however, in which the gold occurs in this contact stone without any apparent channel, I am very much afraid that it will lead to the expenditure of money in search of something payable without resulting in anything really valuable. Still undoubtedly gold exists here, and there is an inducement to see how it goes down.

LIVINGSTONE MINE.

This is situate 2 miles north-east of Lovett on W. F. Rennahan's 173 acres, just north of the north boundary-line of John Thorp's 500 acres. A shaft has been sunk on the north-west fall of Livingstone Hill, which is a spur from Toby's Hill, at 600 feet above sea-level, on a quartz reef in nepheline syenite porphyry near the contact of the latter with fossiliferous Permo-Carboniferous strata. This shaft is not in a condition to enter at present, the collar having fallen in, but when I was here on a previous occasion it had been sunk upwards of 60 feet, following the parallel bands of quartz which, interlaminated with the porphyry, form the reef down to that depth on the underlay. This reef strikes a little north of east, apparently the same direction as the hill-spur, on the crest of which further east indications of the continuance of a line of quartz or reefing-stone are to be seen.

This shaft was sunk in 1898 on the strength of Victorian assays of specimens, which went 3 ozs. 23 grs. and

1 oz. 12 dwts. per ton. Subsequently an assay of 48 lbs. of stone gave 10 dwts. 13 grs. per ton. Later, a ton of stone was treated at Footscray, for 5 dwts. per ton. Then 6 tons of quartz were taken over, but no free gold was obtained, only 3 or 4 dwts. from the pyrites. Half a hundredweight which had remained over from the 1-ton lot was tried, and yielded only 13 grs. free gold per ton. These disappointing results led to the abandonment of work here. Some of the most likely-looking specimens taken by me from the tip were assayed by the Government Analyst, who could only detect a minute trace of gold.

The reef here is apparently a contact development, which may or may not be continuous. The likelihood is that the bands of quartz will be irregular along their course, though fairly constant enough in depth. Their behaviour in depth will most likely depend upon the accompanying line of the porphyry contact. The stone carries arsenopyrite, iron pyrites, copper pyrites, and a little blende and galena, an association of minerals which may be considered as a favourable indication for gold. It is in fact the most promising stone found in the entire district so far, and it is the only lode found entirely in porphyry. Evidently it has not carried much gold at the outcrop, or there would have been more of it found in the valley below. If it continues further east some more encouraging part may be found on its course. As matters stand at present, however, there is not much encouragement to go further with the work, in view of the poor results so far.

On the southern side of the ridge a tunnel was driven for about 400 feet, to intersect the reef at about 90 feet below the bottom of the shaft. The country through which it has been driven is the Permo-Carboniferous mudstone or sandstone traversed by dykes of porphyry. In driving, the direction of the adit was changed, and it now heads for the shaft. The reef line has not yet been intersected, but it cannot be far off. To settle the question as to whether the reef is likely to be permanent it would not be very expensive to continue the tunnel far enough for the purpose, and if the results then warrant further outlay, a new position should be selected for a working-shaft a little lower down the hill on the northern fall. It must be confessed, however, that looking at the results obtained so far from the shaft, any further work here would be quite speculative.

THE PORT CYGNET PORPHYRIES.

These combine to make a rock group so unique in Tasmania, and not altogether matched anywhere else in the world, that a few general remarks thereon are called for.

Increasing attention is being paid to the Port Cygnet eruptive rocks in Europe. They have been under the notice of the most distinguished European petrologists, Professors Rosenbusch and Brögger, and an important treatise (in German) on some of them by Dr. F. P. Paul, of Sydney, has recently appeared under the title of "Some Foyaitic-Theralitic Rocks from Tasmania." ⁽¹⁾

As is now well known, the rocks belong to the alkaline division of eruptives. They contain an excess of the alkalis, soda and potash, and consequently sodic minerals are plentifully developed in them, *e.g.*, soda orthoclase, sodic augite and amphibole, nepheline, sodalite, h  uyne, &c. It will therefore be readily understood how potent the waste from such rocks must be in forming a soil in the highest degree favourable for the fruit-culture for which the district is famous.

The petrographical classification of the rocks, as far as at present studied, may be stated as follows:—

1. *Family of the Alkali Syenites*—

(a) Plutonic representatives.

- (1) Quartz augite syenite, or akerite, according to Prof. Br  gger. This is the plutonic rock forming part of the promontory of Regatta Point and on the Back-road north-west of Lymington.

2. *Family of the Elaeolite Syenites*—

(a) Plutonic representatives.

- (1) Elaeolite syenite. Part of the promontory of Regatta Point, and on Mount Mary.
- (2) Jacupirangite. A dark facies development of the elaeolite syenite at Regatta Point.

(b) Complementary and dyke representatives.

- (1) Nepheline syenite porphyry.

(a) The biscuit felspar rock on Mt. Livingstone and Mt. Mary.

(1) Beitr  ge zur petrographischen Kenntniss einiger foyaitisch-theralitischen Gesteine aus Tasmanien, Dr. F. P. Paul. Wien, 1906.

- (b) The h  uyne-bearing rock on Mt. Livingstone closely related to the preceding.
- (2) S  lvsbergite porphyry. A greenish dyke south of Regatta Point.
 - (3) Mica-s  lvsbergite. A dyke south of the preceding.
 - (4) Tinguaitite. The dense green rock above Mt. Mary Mine.
 - (5) Tinguaitite porphyry. The rock on the summit of Mt. Mary, with porphyritic crystals of sanidine felspar and garnet.
3. *Family of the Essexites*—
- (a) Plutonic representatives.
 - (1) Essexite. Dark rock on the north side of Regatta Point.
4. *Family of the Theralites*—
- (a) Plutonic representatives.
 - (1) Monchiquitic shonkinite. A dark rock forming part of Regatta Point. Described formerly as mica-nephelinite, with the habit of a monchiquite. Called monchiquitic nephelinite by Dr. Paul, who also refers to its shonkinitic affinities.

The above list is far from exhausting the rock varieties found at Port Cygnet, but at any rate it presents the principal types.

Pyrite is met with sparsely distributed in the igneous rock, quite apart from any vein formation, but no gold in the rock has ever been seen in the hundreds of specimens that have been examined. This metal would appear to be confined to marginal parts of the porphyry and the adjacent sedimentary strata, where silica and metallic sulphides have been introduced.

As regards the age of the porphyries, all that can be said at present is that they are intrusive in the Permian-Carboniferous beds. How much younger they are than these has not yet been demonstrated. They are found on the shores of D'Entrecasteaux Channel, and Mr. F. J. Ernst, in 1902, in making a traverse across the range, found that an outcrop of Mesozoic diabase exists between the channel and the Lovett occurrences, presumably cutting through the belt of porphyry. Of course, if this is a real

intersection, a step further is taken in the determination of its age, and the alkaline rocks must be referred to the interval between the Lower Permo-Carboniferous and the Upper Mesozoic. On this visit I made my way over the range east of Lovett, *via* Nicholls' Creek, and descended to Woodbridge on the shores of the channel, for the express purpose of studying the junctions throughout the traverse with reference to the age question. On the north side of the road along Nicholls' Creek, $\frac{1}{4}$ -mile from the Arm and 80 feet above sea-level, a fine contact occurs in a little quarry showing nepheline syenite porphyry underlying the mudstone strata which are fairly horizontal. The latter are hardened near the contact, but I did not notice any occurrence of mineral or vein formation. About a mile further along the road diabase is exposed, and beyond this is mudstone. The actual contacts unfortunately are not shown, and it is not certain whether it is the porphyry or the mudstone which is cut through by the diabase. On the eastern side of the range diabase is seen near the summit, and is succeeded lower down by the Permo-Carboniferous strata into which it has penetrated, and quite at sea-level the intrusions of porphyry in the mudstones on the north point of Peppermint Bay are met with. At present, therefore, what we know is that the Permo-Carboniferous beds are pierced both by diabase and porphyry, but the evidence available as to the relative ages of the respective intrusions is not absolutely convincing, though there is a high probability in favour of the pre-diabasic age of the porphyry. On the other hand, all the other occurrences of alkaline rocks in Tasmania are of Tertiary age.

CONCLUSION.

The general conclusions which I draw from this examination of the Port Cygnet district are very much the same as those embodied in my former report on this field. These are, briefly, that gold will not be found disseminated promiscuously through the porphyry, but is confined to the silicified and brecciated stone at the junction of the eruptive and sedimentary rock, sometimes in one, sometimes in the other, or in quartz veins connected with these contacts. The deposition of gold and mineral sulphides along these lines has not been great, and is irregular and patchy, and though prospecting has been carried on at several points, nothing payable has been struck so

far. The gold won from the creeks and valley flats has been derived from the slow waste of the contact lines, and it is only along these lines that prospecting has any chance. Unfortunately, however, there is not much encouragement for spending money on the lode formations in the hope of payable results. On the whole I do not think that enough gold exists in the bay sands to warrant the construction and installation of dredging-plant. Nevertheless, the Port Cygnet goldfield is so unique that I am not without hope that some day or other, by prospecting or by accident, some part of the lode-line of sufficiently high grade to work may be met with.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. TWELVETREES,
Government Geologist.

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

THE MANGANA GOLDFIELD.

[Four Plans, Two Photos.]

I.—INTRODUCTION.

MANGANA is a small township, 5 miles from Fingal by road, situated on an alluvial flat which forms the floor of a valley bounded by hill spurs descending from Ben Lomond and Tower Hill. The hills rise steeply from the plain, and consequently give the place a picturesque aspect. The native name Mangana had some connection with the river, for *Mangana Lienta* signified the South Esk River, distant 4 miles to the south.* A back road over the hills runs north to the township of Mathinna, and a tourist track has recently been made to the shelter-hut near the summit of Ben Lomond, where Col. Legge has established a thermometer station. The grade of the track up that mountain is comparatively easy, and Mangana forms an excellent base for expeditions. Mountaineers cannot do better than place themselves in the hands of Mr. Donald McLeod, of the Alpine Hotel, Mangana, who will make all arrangements for the ascent.

The goldfield is situate in the area of slate and sandstone strata of Lower Silurian (Ordovician) age, which forms a large auriferous belt of country running through to the northern coast of the island, and embracing the goldmining districts of Scamander, Mathinna, Mt. Victoria, Warrentinna, and Lyndhurst. The exact prolongation of the strike of the Mangana strata would cut the River Tyne near its confluence with the South Esk, and not the Mathinna field, as frequently asserted. The line of the Mathinna strata extended south-east emerges on S. R. J. N. Talbot's 500 acres, in the bend of the South Esk River, near Fingal.

II.—PREVIOUS LITERATURE.

The following reports have been published by the Government of Tasmania:—

1. Gold at Mangana, by Chas. Gould, Government Geologist, 31st July, 1869 (Legislative Council Paper No. 20).

* Fenton's "History of Tasmania," 1884, p. 443. The word "Munna," however, denoted wattle-tree gum; and "Mungunna" was the word for fish.

2. On some portions of the Mangana Goldfield, by Alex. Montgomery, M.A., Government Geologist, 25th September, 1894 (Report of the Secretary for Mines, 1894-5).
3. On the strata in the shaft of the New Sovereign Mine, Mangana, by W. H. Twelvetrees, Government Geologist, 6th November, 1899.

Mr. Gould describes four reefs discovered by Mr. J. C. Goodall along the summit and flanks of the ridge dividing the tributaries of Major's Gully, which are charted as Golden and Fern Tree Gullies. He is of opinion that if the shafts which were then being sunk prove the reefs to hold as good in depth as they appeared to be on the surface, there is sufficient stone in sight for several years' crushing.

Mr. Montgomery reports on the Reunion, Cardinal, Buckland, and Alpine mines; and on Specimen Hill workings.

The report on the New Sovereign Mine is an examination of the shaft workings of the mine now owned by the Mangana (Tasmania) Gold Reefs Company, Limited, as far down as 280 feet, the then depth of the shaft.

III.—PHYSIOGRAPHY.

Mangana was originally called the Nook, and the little valley forms a veritable nook at the base of the high hill ranges which rise abruptly from its borders. These hills are lofty spurs, which divide mountain-stream channels or ravines known as Richardson's Creek, Calder's Gully, Major's Gully (resulting from the confluence of Fern Tree and Golden Gullies), Grant's Creek, Sharkey's Gully, Sailor's Gully, &c. The spurs rise immediately round Mangana to a height of 700 or 800 feet, and towards the north they continue rising, and constitute shoulders or buttresses of Tower Hill, the summit of which is nearly 6 miles north-west of the township, and 3900 feet above sea-level. About 1000 feet above and north of Mangana is a small farming settlement called the Towers. Richardson's Creek receives the waters of the various creeks mentioned above, and itself flows into the Tower Rivulet (locally known as Ben Lomond Creek), a tributary of the South Esk River, 3 miles west of Fingal. The latter river follows a tortuous course of nearly 100 miles, till it empties into the Tamar, at Launceston. In the lower part of Major's Gully the Creek flows under the surface of the shingle. The narrowness of these gullies and the steepness of their sides point

to the excavating work of the streamlets having been performed in comparatively recent times. When they cross the course of reefs, they do good service to the prospectors by exposing these, and enabling them to be worked by adit levels. In the northern part of the field the direction of the ravines is more or less north and south, coinciding approximately with the strike of the reef-lines, and these consequently contribute to the formation of spurs which resist denudation. Hence the most accessible parts of reefs are frequently at high elevations.

IV.—GEOLOGY.

The strata of the field consist of slate and sandstone, considered to belong to the Ordovician (Lower Silurian) system. No fossils have been found confirming this reference, which is made only on stratigraphical and analogical grounds. The alternations of sandstone and slate show the cleavage partings in the rock to be mostly coincident with the lines of bedding. The sandstone is generally crystalline, and the whole series has been subjected to the processes of compression and cleavage, which in Tasmania are believed to have operated strongly at the close of the Silurian. It is made up of finely-divided detritus, derived from the wearing down of quartz felspar (granite) rock masses, which have now entirely disappeared from the locality, if indeed they ever existed in this part of the island.

The general strike of the beds is N. 25° W., and east of the township their general dip (underlay) is to the north-east, while west of Mangana, on the hills above Calder's and Major's Gullies, and on the Black Boy spur in the township itself, the strata dip to the south-west.

An anticlinal arch appears to have existed over the present flat of the Fingal (Grant's Rivulet) valley in the north angle of the township, and the reef-lines throughout the district are probably related to the processes of compression and strain, which may be considered responsible for the formation of this arch.

A strong unconformity exists between the slates and the beds of grit, conglomerate, and mudstone, which overlay them, and which pertain to the Permo-Carboniferous system. On the hills north of the township, at a height of between 950 and 1000 feet above the level of the plain, a layer of this conglomerate, 30 or 40 feet thick, covers the Ordovician strata. The pebbles are quartz, and sometimes slate, embedded in a sandstone matrix. Small cliffs of this

conglomerate are exposed on the hill ridge between Calder's and Fern Tree Gullies, about 5 chains south of W. Gellibrand's 157 acres, at 1000 feet above Mangana. On the Alpine Hill, also between Richardson's Creek and Calder's Gully, stones of this conglomerate are strewn on the surface about 100 yards north of the Alpine outcrop workings. Boulders of reddish sand and grit enclose pebbles of sandstone, slate, and quartz. A little further south, between the Alpine hut and the Cardinal shafts, a few feet of Permo-Carboniferous sandstone appear to overlie the older slate. East of Mangana, at the head of Sharkey's Gully, near Talbot's gate on the divide, and at an elevation of between 600 and 700 feet above Mangana, the hill capping is composed of Permo-Carboniferous mudstone. The residue of this covering is nowhere thick, and it is easy to see that the slate throughout the district has nowhere suffered any great denudation since it was first buried below the Permo-Carboniferous sediments. From this fact it may be inferred that no great waste of gold quartz reefs can have taken place, and, consequently, that the amount of gold present in the alluvial does not afford a fair criterion of the value of the reefs. Fossiliferous mudstones occur high up the shoulder of Tower Hill, as well as on the Fingal township. The difference of level between the two exposures points to considerable faulting somewhere, but it would require a very close examination of the geology of the locality to locate the line of displacement. The plain through which the South Esk River flows consists partly of alluvial matter, which was deposited in Tertiary times, and this gravel has been shown by borings to go down below the level of the present river bed. This alluvial becomes shallower towards Mangana, and at the township it is not more than 30 or 40 feet in depth. It gradually gives place to the modern wash of the mountain creeks in ascending the gullies. In Tertiary times the deposit probably extended higher up the low hill on Robertson's Freehold, to the west of the township, but some denudation must have taken place during subsequent elevation of the land. These Tertiary deposits in the South Esk basin extended as far north from Fingal as the present site of Mathinna.

Igneous rocks appear at a few places on the Mangana field, but, genetically, are quite unrelated to the gold quartz reefs. The summit of Tower Hill is formed of diabase (greenstone or trap), the plagioclase-augite rock which everywhere is found intrusive in the coal measure sedimentaries (both upper and lower, *i.e.*, Permo-Carbon-

iferous and Mesozoic) as sheets, pipes, dykes, or in some other form. On the flanks of the hill below the summit is a fringe of Permo-Carboniferous strata, but whether these pass underneath the diabase or whether the latter cuts them off is as yet an open question.

On the track to the Alpine Mine, about 400 feet up the hill, is a small patch of diabase, which has come up through the slate at this spot. The igneous rock is here greatly decomposed, and does not appear to be exposed for a width of more than 20 feet.

A further exposure of the same rock is on the 20-acre block of Robertson's Freehold, west of Mangana. It occupies the western part of that block and the southern angle of the adjoining 31 acres, and extends westward to the mining sections, $\frac{1}{4}$ -mile distant, forming a considerable mass.

A similar rock forms the top of Ben Lomond, the Fingal Tier ("Bare Rock"), and other heights in the neighbourhood. Microscopical examination shows an absence of the type of structure which would denote a deep-seated (plutonic) rock, as well as of that which characterises effusive (volcanic) rocks. Their micro-architecture (diabase type) conforms with that of rock masses which exist as laccolites or intrusive sheets.

The age of these rocks is not older than late Mesozoic, as it is clear that they have intruded into our Upper Mesozoic shales and sandstone, but any closer determination than this seems impossible for the present.

The quartz reefs at Mangana are for the most part enclosed in the Ordovician slate and sandstone strata. Only at one point did I see what appears to be an upward extension of the reefs into the overlying Permo-Carboniferous, viz., on the Buckland Spur, where an exposure in a trench shows a somewhat feeble continuation of the quartz into the flat-lying younger sandstone. However, more extended examination is necessary before what would appear to involve a younger age for such a reef can be used decisively for building any theory upon it. Quartz veins have been observed in the coal-measure sandstone elsewhere (on Ben Lomond and near Buckland, as well as at Port Cygnet). But the Mangana reefs typically are confined to the older strata, and their occurrence is probably closely connected with the tectonic processes of folding, which may be conceived as having released and enclosed the siliceous residue of the granite magma. That reef-formation is in some way related to the bending of the beds may be inferred from the change in dip of

reefs when found east or west of the township. All the reefs east of the Fingal Valley axis have an easterly dip, while those on the Buckland or Alpine Spur dip to the west. It is highly possible that a reef or reefs may exist along the axial line of folding below the plain of the Fingal Valley.

V.—ECONOMIC GEOLOGY.

The gold-bearing quartz assumes the form of veins and reefs, for the most part running in northerly and north-westerly directions, generally conforming with the enclosing strata in strike and dip, and varying in width from mere threads to as much as 25 feet in width. Some of these reefs are barren, or at all events not payable. The quartz generally is white and glassy, and not as a rule charged very heavily with pyrites. Where pyrites is present, the dominant species is iron pyrites. Arsenopyrite is subordinate. Copper pyrites, galena, and blende occur sporadically, and are good indicators of the proximity of gold. The rich stone found near the surface in this district has probably been indebted to processes of solution and re-precipitation for its wonderful gold contents (Golden Entrance quartz having yielded $39\frac{1}{2}$ ozs. per ton). Some of the reef-channels have been the seat of subsequent movements, which have torn and forced apart both quartz and the slate laminae, widening the reef and giving it a mottled appearance, which, if accompanied by pyrites, is a favourable augury for gold contents. Oxidised parallel partings in the stone are welcomed by the miner as very apt to carry gold. The reefs in the hills to the east of the township are in directions which cause them to cross the gullies, and the latter, notably Sharkey's and Sailor's, must have removed considerable quantities of quartz while carving out their channels. On the other hand, on Major's and the Alpine Hills, the ravines mainly run parallel with the reefs, which consequently have only been subject to the denudation going on upon the hill spurs.

It is probable that much of the alluvial gold which has come into Mangana from the north was not shed from the Alpine and Major Hill reefs, for these reefs are not cut by the main ravines. The local opinion is that the Permo-Carboniferous conglomerate or cement is responsible for a good deal of it.

Gold has been found both in the cementing sand of this conglomerate and in quartz contained therein, and the iron oxide with which much of the alluvial gold coming from the northern part of the field is coated confirms

the idea that gold is derived from the ferruginous cement. This is the view held locally, and much can be adduced in its support. There is not the slightest reason why alluvial and specimen gold should not exist in the Permo-Carboniferous conglomerate. During the time that it was being laid down the gold-bearing reefs were exposed, and must have shed their waste much as it is being shed to-day. It must be remembered, however, that these conglomerates were probably extensive sea beaches, and concentrations of gold in them were likely to be few and far between. Still, some auriferous runs may be found in them, and prospecting in this formation may be encouraged.

VI.—HISTORY.

The first discovery of payable gold in Tasmania was made at Mangana, in February, 1852, about 150 yards below the present bridge. The *Launceston Examiner*, of 18th February, 1852, stated:—

“Letters have been received in town announcing the discovery of gold within 4 miles of Fingal, by James Grant, Esq., of Tullochgorum. The following is an extract from a letter from a gentleman in the neighbourhood, dated the 16th instant:—‘Gold has been found within 4 miles of Fingal. I saw it myself. The largest piece was the size of a duck shot, the other pieces smaller.’”

Another paragraph appeared in the *Launceston Examiner*, of the 12th May, 1852:—

“James Grant, Esq., of Tullochgorum, has claimed on behalf of Keeling Richardson the reward of £500 offered by the Launceston committee in September last for the discovery of a goldfield in the northern side of the island. He states in the memorandum which he has submitted to the committee that, of the quantity forwarded, 1 oz. 38 grs. were procured by Keeling Richardson from about five bushels of soil, with the assistance of one man at the cradle, in eight hours.

“One of the pieces procured (a nugget) weighed 139 grs. The remainder consisted of smaller pieces.”

Mr. James Fenton, in his “History of Tasmania” (Hobart, 1884), writes on the subject as follows:—

“The first payable gold in Van Diemen’s Land was found at the Nook, 4 miles from Fingal, in February, 1852. It attracted about 200 persons for a short time. They thoroughly prospected the country round, and those who steadily persevered made it pay. Very minute

particles of gold-dust were procured along the Tower Hill Creek and on the hillsides, where beautiful specimens of crystallised quartz abounded, but in a few weeks the place was left in the hands of a few of the original claimants, who made a fair profit on their industry for a considerable time."

Mr. J. C. Goodall, the pioneer who has done so much in the way of prospecting and mining at Mangana for the last 42 years, has furnished me with the following statement, which gives some interesting historical information. He says:—

"I visited Mangana in 1866, and found the Union Company's quartz mine at work, this being the first gold-bearing reef discovered in the colony. The developments were being carried on by adits, and a 10-head battery was crushing the stone. On Grant's Creek the Fingal Company was shaft-sinking and quartz-crushing with a 10-head battery. The yield varied from 5 dwts. to nearly 1 oz. per ton, obtained by both companies. The Union was by far the more promising of the two mines. Its reef was from 4 to 12 feet wide, with some bulges of stone up to 20 feet, but the widest parts were poor, averaging from 3 to 7 dwts. per ton of fairly rough gold. An open-cut was put in half-way up the hill on a discovery of rich stone with very rough gold, so rich that I saw the manager crush over 50 lbs. weight in the mortar and it yielded over 4 ozs. gold. Several stones crushed by hand gave 1 dwt. of gold to the pound. In working this discovery barren reef matter and mullock were crushed with the richer stone, and the battery average was brought down to less than 10 dwts. per ton. Some time after this the Union Company closed down, and remained idle for years.

"The Fingal Company's mine was on a short shoot of stone worked to 170 feet in depth, and, on the whole, was not payable. The mine is situate on private property, and has been idle the last 30 years. I paid special attention to the country at the head of Fern Tree and Golden Gullies to ascertain whence the alluvial gold of Major's Gully was derived. On 10th January, 1869, I discovered the Tower Hill reef, showing good payable gold quartz, but to my astonishment I found it was on privately-owned land, 157 acres, belonging to the late William Gellibrand. Eventually a company was formed in Hobart, and I put up a 10-head battery. We had several crushings of good 2-oz. stone, but two or three poor crushings frightened

the shareholders and directors, and the mine was closed down. Only surface-scratching was afterwards done by co-operative parties, until the machinery was destroyed by fire. In 1877 I discovered the Alpine reef on Crown land, and secured the lease of Buckland's Freehold, on which estate I also discovered the Buckland No. 1 reef, which produced over 1000 ozs. of gold from 1319 tons quartz. The reef was from 18 inches wide at surface to 3 feet wide at the bottom of the winze, 170 feet. The Alpine and Buckland estates were floated into three separate companies in Hobart. The Alpine reef was not proved to any great depth (about 150 feet), and some excellent crushings were obtained. A few poor crushings caused work to be abandoned. Later I took up the forfeited Union leases, and discovered the Sovereign reef, on the top of the hill, which I worked for about a year, and then sold to a London company (Mangana Gold Reefs, Limited). I have prospected lately on the Buckland's Freehold, a 30 years' lease being held by Launceston investors, who also intend to start work on the Buckland No. 1 reef by putting in an adit 100 feet below the old workings. The last crushing from the bottom of the winze was 80 tons, yielding 152 ozs. gold, some 21 years ago."

Mr. James Fenton writes:—*

"The first quartz-crushing company (the Fingal) commenced operations in April, 1859. Its machinery was imperfect. It obtained about 250 ozs. of gold during the first four months. The stone crushed yielded 8 or 10 dwts."

Looking at Mangana as it is at present, with its numerous reefs exposed and mines idle and giving employment to not more than half a dozen men, it is difficult to realise that this was the first goldfield in the Colony. Although Mr. Fenton gives the priority to the Fingal Company,† I am informed that the Midland Company was the first quartz-mining company, which afterwards successively became the Union, the Reunion, the Sovereign, the New Sovereign, the Mangana (Gold) Reefs, Limited, all working on the reef in the Union or Sovereign Hill. Some of the richest quartz known in Tasmania came from this reef. All the gullies were scoured for gold in the old times, and responded excellently to the search. Major's

* "History of Tasmania," Hobart, 1884, p. 308.

† He probably means the company at the Fingal diggings, as the Mangana field was then called. This company was then known as the Midland.

Gully has the reputation of having been the best, and gave employment to 400 men in its palmy days. The largest nugget found on the field was obtained from Fern Tree Gully, which feeds Major's. It is variously reported as 7 ozs. and 11 ozs. in weight. Sharkey's Gully, opposite the hotel, also used to yield rich specimen quartz. The Golden Entrance Mine, on the divide between Sharkey's and Sailor's Gullies, has yielded about £10,000 of gold-bearing quartz, but it is now struggling along on tribute.

It is difficult to avoid recognising that in the old days a mistake was made in selling the mineral land round the township. The consequence is that many reefs are now on private property, and the mining population of Mangana, instead of prospecting and developing the lodes in the surrounding hills, leave their homes during the week and occupy themselves with tin-mining on Ben Lomond.

VII.—MINING.

(a) *Mangana Gold Reefs Mine.*

Mangana (Tas.) Gold Reefs, Limited.—Sections 1259-93G, 30 acres; Section 557-G, 10 acres; and 318-93G, 5 acres, battery site.

A gold quartz reef of variable width, but attaining in places a maximum width of 25 feet, runs right through the hill on Section 1259 from Sailor's Gully to Sharkey's Gully, and various outcrops have been also found on the southern section (557), one of which must be the southern continuation of the reef. It seems to be almost certain that the reef is traceable at surface for at least half a mile, and this is a strong indication of its persistence to a depth greater than that of the present workings.

The average bearing of the reef is N. 42° W., and the dip to the north-east. There is very little difference between the strike of the enclosing slate and of the reef itself; sometimes the bearing of both is identical; in dip, also, the reef follows the country.

Apart from the light decolourised slate in the superficial zone, the workings show mostly dark slate down to 200 feet below the gully, purple slate from 200 to 600 feet, and a compact grey slate between 600 and 800 feet. Where the reef is wide the quartz is mixed considerably with slate, giving the stone a mottled aspect. The width varies from under a foot to as much as 25 feet, of which, in the upper parts of the mine, from 4 to 6 feet of solid quartz is met with, the remainder being mixed quartz

and slate, occurring irregularly in the reef-channel. The slicken-sided lode slate points to reef movements subsequent to the deposition of the original vein quartz.

The reef minerals are pyrite, arsenopyrite, and a little galena and copper pyrites. The reef belongs to Beck's group of pyritic gold quartz reefs, in which the dominant sulphide is iron pyrites.

The former companies which worked this property (Union, Reunion, Sovereign) operated on the reef in the hill on the north side of Sailor's Gully, while the present company has explored it from a main shaft sunk to 800 feet below the gully floor. I am informed by Mr. J. C. Goodall that the first gold found in quartz at Mangana was obtained from this reef (Union). There is no return available of the total gold won, but it is certain that the amount was by no means inconsiderable, and some rich shoots were met with in the upper workings by the early companies.

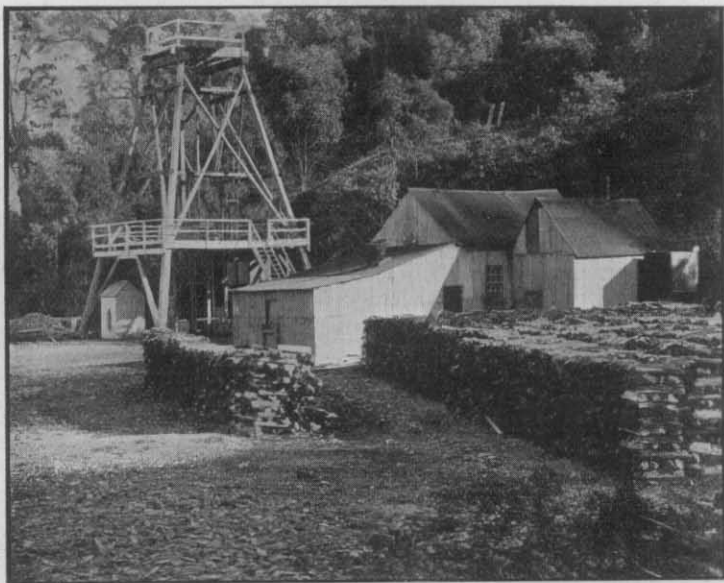
Upper Adits in Hill.—As said above, the work done prior to the present company consisted of adits driven north-west into the hill on the course of the reef. These are at different levels from Sailor's Gully to within 60 feet of the apex of the Sovereign Hill, the highest one communicating with the summit by means of the Sovereign shaft. Altogether, these upper works comprise 2200 feet of driving, 300 feet of crosscutting, and 750 feet of sinking and rising, besides an unascertainable amount of stopping.

The main adit (No. 4) has been driven into the hill from near the new shaft at 25 feet below the collar of the latter, and has been extended north-west 550 feet. No. 3, 112 feet above No. 4, has been driven 720 feet; No. 2, 94 feet above No. 3, has been driven 625 feet; and No. 1, 137 feet above No. 2, has been driven 275 feet.

All these have been driven on the reef, which in places is from 10 to 20 feet wide. Its character is extremely irregular, often soft and mullocky, and again widening into large bodies of hard stone. The quartz is white and but little mineralised, and very largely dissected by bands of slate.

No. 4 Adit.—At a little distance in this adit the reef-channel is 5 to 6 feet wide, but soft and mullocky, developing into a mixture of quartz and slate, the quartz often showing in curved bands. A little north of the main shaft the reef has been stoped up to surface and down to No. 1 level in the new mine. It is reported to have carried very good gold at times.

At 190 feet in a crosscut has been driven out south-west for 100 feet without intersecting anything of importance. It passes through regularly laminated slate country, dipping north-east. At one point a small vein of valueless quartz was cut. The crosscut was of distinct use as establishing the non-existence of parallel reefs outside the main channel. Between this and the 180-foot air-shaft (Union shaft) the reef has been stoped to surface on 2 feet of quartz for 120 feet beyond the crosscut in the Union

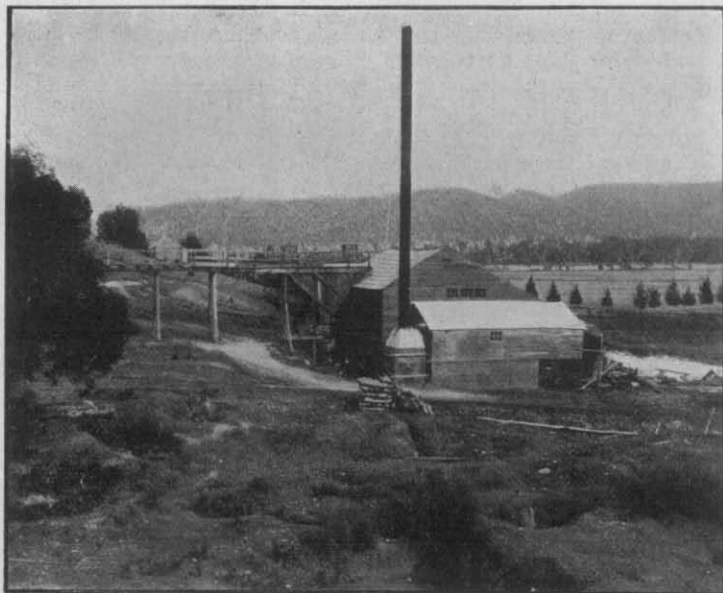


MANGANA REEFS SHAFT.

shaft, but beyond this there is not much quartz in this level. The face is 240 feet beyond the shaft, and this part of the adit is in soft, dark lode slate, which has been mostly worked with the pick. Short crosscuts would have to be put out each way behind the end to prove the width of the reef. The face carries lumpy white quartz for a width of 5 feet 8 inches. This stone, although barren, has a more favourable look than anywhere in this level north of the Union shaft. Further 400 feet of driving would bring this level under the Sovereign shaft, and in doing this it would pass below the large block of ground stoped

between the level above and the surface, and also meet the gold shoots pitching south.

East of the entrance to this adit a wide spur of quartz has run off to the east. Its full width has not been actually proved, but about 20 feet of it have been taken out and crushed. The stone for a width of 3 feet is reported to have returned 1 oz. gold per ton. What is left is valued at about 5 dwts. The hard bands of clean stone are said to carry the gold, which realised £4 per oz., the



MANGANA REEFS BATTERY.

highest value on the property, as the general range of the rest is from £3 10s. to £3 14s. per oz. The stone at the top of the hill was exceedingly rich, and it is said that the bulk of the gold was obtained from there.

No. 3 Adit.—This has been driven 720 feet. At the entrance the reef has an unusual westerly underlay. It is soft and small (2 feet 4 inches wide), and runs in soft arenaceous slate. As far as the Union shaft, the channel is mullocky and uninviting, but after passing the shaft the reef becomes harder. Its hanging-wall is smooth, and

footwall ragged. The level has followed a somewhat serpentine course. At about 250 feet north of the shaft the reef has been stoped up to No. 2. Just before this hard big stone comes in, and is exposed in the drive for a width of 9 feet. Some extraordinarily rich stone is reported to have been obtained from above this level—as much as 30 ozs. per ton. The shoot of golden stone appears to have been shorter in this level than in the one above it. I could not reach the end of the drive owing to it being blocked by a fall.

No. 2 Adit.—This has been driven 625 feet. Inside the entrance the reef is 7 feet wide, and there appears to be still more stone to the east. Quartz carrying gold 1 oz. per ton was obtained from here. Going north the reef attains a width of 12 feet. At about 100 feet from the Sovereign shaft the level is blocked by a fall of ground. The lode is said to have been lost in the end. The reef-channel has a westerly underlay in this adit.

No. 1 Adit.—This is the uppermost level, and has been driven 275 feet. The reef here consists of a channel of stone and mullock 20 feet wide. Near the entrance it is composed entirely of mullock. The quartz bodies here evidently make in bunches or blows. The Sovereign shaft, communicating with the apex of the hill, is 200 feet in, and there is a fine body of low-grade quartz here, estimated as worth a little under 4 dwts. gold per ton. From the large excavation seen, the stone has been worked up and down and in the side spurs. The reef becomes smaller after it passes the crown of the hill. In the end of the adit it is 3 feet wide, of which 18 inches are stone and the rest is mixed mullock and quartz. The sample taken from this adit by the manager and sent to London assayed 7 dwts. per ton.

Driving this adit 90 or 100 feet further would bring it out to daylight on the northern slope of the hill overlooking Sharkey's Gully, and No. 2 adit, if continued further 280 or 300 feet, would also emerge on the side of the hill, and even if driven only 150 feet it would come into country where it would have only 60 feet and less of backs.

These upper workings are evidently patchy, and the gold shoots seem short; but it seems to me worth while to relocate them and test the ground around and below them, so as to find some patches that would pay for working and relieve costs while development is going on at a greater depth. No. 4 adit might well be extended further

into the hill, and would have a fair chance of intersecting some of the principal shoots.

Workings from Main Shaft.

No. 1 Level, 115 feet.—The crosscut driven 29 feet south-west from shaft is in mottled stone and slate all the way. The drive north-west, 87 feet in length, is on the hanging-wall of the reef. Good stone has been driven on, and stone is still left inside the western wall of the drive. Solid stone is showing in the end. The reef has been worked from this level up to the No. 4, or main, adit, and down to the next level, 60 feet below, for a length of between 60 and 70 feet.

No. 2 Level, 174 feet.—This level has been driven north-west from the main shaft for a distance of 175 feet on the course of the reef. The reef is exposed in the chamber west of the shaft, showing about 5 feet of mottled quartz, nearly vertical. The stone has been taken out above this level for a length of about 100 feet. Fifty feet from the shaft is a short crosscut which intersects the reef, here 19 feet of mottled stone, dipping 50 degrees to the north-east. For 3 feet in this crosscut the quartz is very solid. Ninety feet beyond the crosscut solid stone 50 inches wide has been left standing, and the softer reef matter worked on each side of it. The west branch has been followed 10 or 12 feet, while the main drive has followed the eastern parting. Further north the stone enters the drive again, and the solid part of the reef widens out in the end to 19 feet. There seems to be plenty of quartz, and the problem is to find shoots of gold sufficient to pay for working. If this drive were continued it would meet the gold shoots from the hill workings.

No. 3 Level, 214 feet.—There is a wide band of reef matter here in the shaft, but the width has not been proved west. The formation is quartz and lode-slate. The level has been driven north-west at 12 feet west of the shaft, and continues on the reef for nearly 200 feet, but the end is partly blocked by a recent fall, owing to heavy rains. The reef as followed is $2\frac{1}{2}$ feet wide, consisting of mottled quartz and dark slate, with a good hanging-wall of black, greasy slate, dipping north-east. The slate forming the walls throughout the level is soft and mullocky. Old stopes exist above this level.

No. 4 Level, 319 feet.—A crosscut has been driven from the shaft north-east for 50 feet, and levels driven north-

west and south-east on the reef, the former for 150 feet and the latter for 125 feet.

Drive North.—The reef in this drive hugs the footwall side. The level begins on seams of quartz, and the formation is mullocky, which does not look very inviting, but the manager reports that it is worth 7 dwts. A cuddy east goes through slate seamed with flat veins of quartz, and fair stone (worth 7 or 8 dwts., I am informed) goes down in the sole of the level just opposite this. A little further north a rise has been put up to No. 3 level. Tributors worked here and did very well while the gold lasted, on a reef about 2 feet wide. Stone as high as 13 dwts. was got, but going up it grew poorer. Continuing in this level, some of the roof has been brought down by water, as the reef-channel is soft all the way. However, a change takes place in the end of the drive, and the first solid quartz in this level is met with. The face is solid white quartz, dipping north-east, at from 60 to 65 degrees. This stone is nicely mineralised. The manager informs me that it is worth about 3 dwts., but as there is fair gold at different points in the level the drive ought to be continued.

Drive South.—The reef is followed on the footwall side of drive, showing quartz veins 5 inches to 1 foot wide. The stone is said to be of good quality for this mine, and the manager recommends a rise being put up just south of the intersection of crosscut. The end of the level shows only dark slate with a few narrow veins of quartz. The drive here is apparently off the reef, and a short crosscut has been put in easterly 25 feet behind the end, but has only intersected a 7-inch flat vein of quartz. Some more cross-cutting is required to clear up matters.

No. 5 Level, 419 feet.—A crosscut north-easterly has been driven 137 feet from the shaft chamber. At 150 feet it intersected the reef. Throughout the crosscut the slate country is much disturbed and intersected by quartz veins, which are often greatly puckered. For the greater part of it the veins dip west; afterwards this underlay changes to east. Some of the veins are quite horizontal.

The reef has been driven on north-westerly for 90 feet on a mullocky channel. It must have been rather difficult to choose the place for driving, as the crosscut is crowded with quartz veins; but the right selection has evidently been made. About 40 feet from the beginning of the level a few tons of stone were taken out over the roof, returning, I am told, about 3 ozs. gold per ton. This stone showed

no visible gold, but was mineralised with pyrite, copper pyrites, and galena. The channel here is 10 feet wide, but without walls. Veins of quartz appear in the roof and wall of the drive, and at half a chain from the end a small crosscut has been opened, showing a band of quartz dipping east. The end of the level is in silicified, barren country, intersected by seams of quartz, and consisting mostly of siliceous lode slate. Though no gold has been found at this point, gold-bearing stone is quite likely to be met with if the drive is continued, as in the level above a nice shoot, though very short, was left going down at about this distance from the shaft. This level seems to have been stopped on account of poverty of the reef, and because no funds were available for prospecting.

The level 200 feet below leaves too great a distance between the two levels. Either No. 6 might have been driven, or a winze sunk from this drive.

No. 7 Level, 619 feet.—At this level crosscuts have been driven north-easterly and south-westerly, and from the eastern one a level has been driven 170 feet on a small reef.

The eastern crosscut has been driven 260 feet, nearly to the boundary of the section. At its commencement a few stray bands of quartz from the formation which descends with the shaft are seen. At 38 feet from the shaft a 3-inch vein of quartz runs across the crosscut, and 10 feet further along is more stone in the form of irregular veins, and still further is quartz in patches. The country is twisted round in curves, and the dip consequently is variable, sometimes vertical, or even west, but reverts to its normal easterly direction.

A couple of small stopes above the roof of the level have yielded 5 tons of stone; the yield is reported to have been 7 or 8 dwts. The quartz is apparently in bunches, as clean country is left in the roof; but it was never wide in this level, the stone being from 8 inches to a foot. Fifteen feet behind the end of the level a winze has been started in stone 4 to 6 inches wide. The end of the drive shows lumpy quartz 3 or 4 inches wide in the upper part of the face, dwindling as it goes down to a mere track of black slate. If this is the reef driven on in No. 5, as it in fact seems to be, its underlay has become much steeper between the two levels, increasing in fact from 55 degrees to 75 degrees inclination from the horizontal.

The west crosscut has been driven 110 feet south-westerly from the main shaft. Veins of quartz connected with

the shaft formation occur immediately on the western side of the shaft. Three feet behind the face of the crosscut a formation of quartz and slate about 4 feet wide was passed through. The quartz veins, 2 and 3 inches wide, twist with the folds of the country, and the stone is white and barren. This reef is not so strong in the roof, where it is represented by a few 2-inch veins of quartz, but in the lower half of the drive it is fairly strong on both sides. The stone is not very attractive looking, but should not be passed by without a short drive being put in. The end of crosscut is in light-coloured slate, dry, and regularly laminated.

No. 8 Level, 719 feet.—A chamber has been cut here and a drive put in for 40 feet in a north-westerly direction. Stone is scattered all over the roof of the drive, but the channel proper seems to be 3 feet wide, and is filled with mixed quartz and slate. The country-rock dips in its usual direction of north-east, while the quartz veins underlie south-westerly. The quartz is vitreous looking. The shaft here carries a reef-channel 7 or 8 feet wide, which tails out in hard slate in the western chamber.

No. 9 Level, 819 feet.—The bottom crosscuts have been driven at this level.

East Crosscut.—This has been driven 140 feet north-easterly from the shaft. At 12 feet from the shaft a block of slate with veins and patches of quartz occurs in the upper part of the crosscut. The quartz has come down from the shaft, but nothing is visible in the floor of the crosscut, so this seems to be the bottom of it. In this drive there is a barren cross-course with a little quartz on its hanging-wall crossing in a north-easterly direction, about $2\frac{1}{2}$ feet wide, and dipping north-westerly. The filling is dark slate. A little water is issuing from it, but the occurrence does not seem to be of any importance. In the end of the crosscut water is dripping, and a lode-channel of some sort is coming in with a north-easterly dip. The proper position for the main reef, judging from its position in No. 7 level, is about 40 feet ahead of this point.

West Crosscut.—This has been driven 113 feet south-westerly from the shaft. In the shaft itself stone has been passed through all the way from the chamber above, and is seen in the western chamber in the form of torn bands of quartz up to 6 inches in width. At 46 feet from the shaft a slide crosses the drive, striking N. 20° W., and dipping south-westerly. Half-way between this and the

shaft is a 3-inch vein of quartz visible in the roof, and 6 feet west of the fault is a patch of quartz, also in the roof.

It does not live to the south-eastern side of the drive, but its track in that side is indicated by somewhat softer slate. Just west of it some water trickles from the roof. When money is available, it might be driven on to make sure that nothing is neglected. Dish prospects have not shown any gold. In fact, no colours have been got from any trials at this level. The end of the crosscut is in grey slate, vertical, and very regularly laminated.

At 100 feet west of the shaft a drive is proceeding south-east on a reef-channel about 14 inches wide, and carrying in the end 5 or 6 inches of quartz. The footwall is smooth and well defined. The reef is nearly vertical, dipping at about 80 degrees to the north-east. Its filling is quartz and black lode slate. No mineral is discernible without washing. If the present angle of dip is maintained, this reef would enter the main shaft at about 280 feet lower down.

A small battery of 15 heads is situated at the mouth of Sailor's Gully, and is connected with the mine by tramway. The stamps are 7 cwts., and driven by a 14-horse power engine with Cornish boiler 28 feet by 6 feet 6 inches.

There is a Berdan pan with belt attached, and a sawmill connected with the plant for cutting all wood used in the mine; also an assay-house and furnaces, and a cyanide plant for treating the battery sand.

If the mine becomes payable, it will be by treating large quantities of stone, and for this the battery would have to be enlarged.

Everything at this mine is in good order, and the work carried out in a workmanlike and efficient manner. All that is necessary now is to settle the programme for future operations, and work with a definite object in view.

Reviewing the work done on this reef in former and recent years, it is undeniable that the deeper sinking has proved disappointing. The reason of this appears to be that the shaft has been sunk deep enough to pass out of the upper zone of gold-bearing stone, and not yet sufficiently deep to enter the second zone. The upper zone, as far as it has been proved, seems to occur in the reef from the surface down to about 200 feet, more or less. No stone has been taken out in quantity from lower than 300 feet.

Considering the developments in the upper part of the reef as being all connected with one another, and constituting a gold-bearing reef-shoot pitching at a rather low angle (30 to 40 degrees) to the south-west, there is a

probability that this will continue south-westerly into the adjoining section, which hitherto has only received desultory attention in the way of prospecting. Quartz has been cut in trenching at different points on this section on the slope of the hill falling towards Sailor's Gully, and I think this slope merits systematic exploration. Apart from the 300-foot level, no driving south has taken place from the main shaft, and it would be strange if the gold-bearing stone on the north of the shaft were not found on the south side as well. Exploring in this direction would necessarily mean following the stone successively to deeper levels. In addition to this work, it is worth considering whether the upper levels from No. 4 upwards, as well as the main adit, should not be continued north, so as to test the reef thoroughly below the hill workings. While this exploration work is in progress, prospecting might be undertaken in the upper adits, with a view of breaking stone that would at least pay crushing costs and relieve general expenses during search and development work down below. The whole proposition seems to be a low-grade one, and while considerable quantities of stone exist of a quality nearly payable, there is the chance that patches of sufficient extent may be found to raise the whole to an average that would pay for raising.

An alternative is to continue sinking the main shaft until another gold-bearing zone is met with; and such a zone, on the theory of parallel shoots, will probably in time be encountered, but at what depth it is impossible to say.

Underlay Reef.—This is on the company's property on the south side of Sharkey's Gully, bearing N. 5° W., and dipping easterly at about 30 degrees. It is thus a rather flat reef. At 5 chains south-east of the north-western corner of Section 1259 some very nice-looking quartz is exposed, laminated and impregnated with pyrites. This reef was worked between 30 and 40 years ago, and a trial crushing is reported to have yielded 6 dwts. It has been cut into for two or three chains, and seems to be fed by spurs of stone. One of these spurs is about 15 inches wide, a lode in itself. The reef is exposed to a width of 18 or 20 inches, but cannot be well examined, as the entrance to the underlay winze is blocked by a fall of stone. The workings now are evidently in a state that would discourage some from doing anything with the proposition, but the reef, *per se*, is somewhat attractive. It crosses Sharkey's Gully and passes north right through the old Union Jack section to the Fingal Mine in Grant's Gully, where it was worked

rather extensively. Reports of values vary from 6 to 10 dwts. On the south side of Sharkey's Ravine the reef strikes across a hill spur which would only allow of short and shallow drives on the reef-course unless a sufficient depth were secured by a shaft.

(b) *Golden Entrance Mine.*

Sections 1547-93G, 1569-93G, and 1568-93G—10 acres each.

This mine has been working intermittently since 1900, and is now being exploited on tribute by Messrs. Madden and Macleod. The reef was discovered by Mr. J. S. Goodall, Jun., since when 1050 tons of stone have been crushed for 2801 ounces of gold, of the value of £10,264 9s. 11d., averaging 2 ozs. 13 dwts. 8 grs. per ton. The first crushing yielded $39\frac{1}{2}$ ozs. gold per ton.

The reef crosses Sailor's Gully. About 20 feet above the track on the north side of the gully a small cutting was made into the reef nine or 10 years ago by Mr. Goodall, and a little gold said to be obtained. A body of slate and quartz has been exposed for about 10 feet, and some blocks of solid quartz thrown out.

Lower Tunnel (No. 2).—This is about 150 feet above the gully. Angle of slope of hill, 30 degrees. The adit has been driven on the reef for 150 feet in a north-west direction. The reef dips east here, while there is a local underlay of the country to west. At 20 feet in is a shallow winze 7 feet, sunk on material carrying a little gold. The reef-channel is filled for the most part with soft decayed slate, with a rather regular veinlet of quartz and a few bunches of quartz in the formation. Six-inch veins of quartz cross in the roof and east wall. Those in the roof are rather solid, but on their strike they die out and are replaced by slate. Twenty-five feet behind the end the country-rock is a more massive and siliceous grey slate in the lower part of the drive. In the upper part a cross-course comes in, striking west and dipping north 55 degrees. The level has been driven through to the north wall of the cross-course, and has touched the siliceous wall-rock, which is freely impregnated with pyrites. Driving has stopped here, but it is not clear that the reef has been heaved. If a displacement has taken place the reef, according to the laws of faulting, should be sought to the west. The workings ahead show that there cannot have been much dislocation, and the best way would be to drive on and put in short crosscuts.

Winze Adit (No. 1).—This is 180 feet above the lower adit, and has been driven 270 feet on the reef on a course varying from N. 40 degrees to 46 degrees W. The reef dips north-easterly, and the country south-westerly. At the entrance a winze has been sunk to 100 feet on the hanging-wall, with a very steep dip. A little way in the adit is an air-pass to the level below. The stone stoped was from a few inches to 7 feet in the widest part. At 140 feet in the No. 2 shaft from surface passes through this adit. Half a chain beyond the shaft a fall of ground has blocked the level, but it has been driven 2 chains further north. The timber in roof prevented examination, but the stone above here was very rich—6 to 7 ounces gold per ton. This was not continuous, but in patches. Only a little stone is now seen in the level, clinging to the east wall. The channel is filled with black greasy slate and pug.

Twenty-five feet below the level is an intermediate drive, which has been driven both ways. The south drive is for about 40 feet, and carried good stone. I was informed that 81 tons were taken out for 289 ozs. The reef varies here from a few inches to $2\frac{1}{2}$ feet at the widest. The south drive has been mostly stoped up to the level above, except just near the shaft and towards the south end.

No. 2 Level.—This is 45 feet below the collar of the main winze, and connects No. 2 shaft and winze. Towards the south end near the winze a small sink was made 6 feet below the floor of the level, and 50 tons of stone taken out and crushed for about 350 ozs. of gold. This was the last parcel mined and sent over to the Bairnsdale School of Mines for treatment. Just south of No. 2 shaft a pass goes down 24 feet to an adit driven from the north side of the hill.

The stopes above this level were in stone up to a foot in width. The sink referred to above shows quartz going down on the east side of the drive for a couple of inches wide only, but exceedingly rich stone was obtained from this point.

No. 3 Level.—This has been driven from the bottom of the main winze (No. 3 shaft) for 10 feet south and 50 feet north. The chain ladder had been taken away from the bottom, so these lower workings could not be examined. About 30 feet below No. 2 the track of the stone passes through the shaft corresponding with the southerly pitch of the make of quartz, but all along the No. 2 level there is very little stone.

Surface.—North of No. 2 shaft the outcrop of the reef twists in a serpentine way to the west, and resumes its normal bearing when it reaches No. 1 shaft. This change (accompanied by a flattening of the underlay) is also seen in the stopes above No. 1 level, but not in the level itself.

No. 1 Shaft.—This is 250 feet north of No. 2 shaft, and has been sunk to 108 feet. It is the point where work was first done on this mine. When 30 feet deep 480 ozs. of gold were won from 24 feet by 30 feet of reef, and one parcel of $4\frac{1}{2}$ tons is stated to have yielded 25 ozs. per ton. A few tons of gold-bearing quartz are lying outside the shaft, but were not considered rich enough to send away. There is a fair amount of pyrite in the stone, and the gold occurs in rusty patches, which represent decomposed pyrites. This probably accounts for the unusual richness of the quartz in free gold.

At 50 feet a level has been driven 30 feet south and 50 feet north. The ground has been stoped south for 15 feet from over the back of the level to surface, and north for 30 feet to 20 feet high. At 80 feet down, drives have been put in for 17 feet south and 30 feet north, and 20 feet north of shaft a winze connects the two levels.

No. 4 Shaft.—This is 31 feet north of No. 1 shaft, and has been sunk on the reef to a depth of 30 feet by the present workers. A few tons of stone have been raised, but not enough to send away yet. It is situate on the south brow of the hill, about 1566 feet above sea-level.

Sharkey's Gully Adit.—This has been driven on Section 1568 from the north side of the hill first as a crosscut in slate for 420 feet, and then on the course of the reef as far as 30 feet south of No. 2 shaft, and 24 feet below No. 2 level, with which it is connected by a pass. At first the reef-channel is about 2 feet 6 inches in width, filled with quartz and soft country. Near the end a little gold was met with, where there were a few inches of quartz and a soft "dig," about 18 inches altogether. The stone is mineralised.

A characteristic of the Entrance reef is a little parting, which forms a track that can be easily used as a means of identifying the reef. The stone occurs on each side of the soft parting.

General Remarks.—There is abundant scope for useful exploratory work at this mine. The bottom level on the south side of the hill should be extended so as to bring it below the upper workings, and shafts Nos. 2 and 3 deepened to connect with it. The ground below No. 3 level

and south of No. 3 shaft may be expected to carry the continuation of the shoot which was stoped above, but below a certain distance from the surface the lode enrichment will possibly be found not to continue. The reef in depth will then have its normal characteristics. If necessary, a lower tunnel can be put in from Sailor's Gully below No. 2, at a spot where there is a fine body of stone at surface, and fairly mineralised.

(c) *Alpine, Buckland, and Cardinal Mines.*

The mountain spur between Richardson's Creek and Calder's Gully comprises parts of two 320-acre blocks owned by C. and H. J. Buckland. Some important reefs have been worked on this spur, and several others have been discovered and trenched upon at surface.

Alpine Reefs.—These are about 1000 feet above Mangana, on the western of two sections once held by the Alpine Company, north of and adjoining the Buckland Gold Mining Company's section. The reefs were discovered by Mr. J. C. Goodall in 1877. About the centre of the section they appear to unite, and form a single reef, which continues north beyond the limits of the section, and disappears under a capping of Permo-Carboniferous conglomerate. The two reefs going south vary in width, but attain a maximum of 2 or 2½ feet. They seem, however, to be only a few feet apart, and perhaps may be better considered as one reef formation. An adit has been driven at 100 feet lower than the outcrop, and the reef stoped upwards. The Alpine Company erected a 10-head battery at the mouth of Calder's Gully, constructed an incline and tramway, and got between £2000 and £3000 of gold. Stone from the winze sunk to 100 feet below the adit is stated to have returned gold at the rate of 18 dwts. per ton. A low adit was started down in Calder's Gully, which it was calculated would give 600 feet of backs. This was driven over 400 feet, and from the face a horizontal diamond-drill bore was put in for further 545 feet, making 945 feet altogether, without reaching the reef. Mineralised rock was shown in several of the cores. According to the survey the eastern reef should be 600 or 700 feet ahead of the bore.

Buckland Reefs.—The Buckland No. 1 reef was also discovered in 1877 by Mr. J. C. Goodall, and an adit driven which intersected it at 160 feet. A winze was sunk 110 feet on it, and levels opened out on it north into the Alpine ground at 45 feet and at 70 feet. These were con-

nected by a winze, and an underlay winze was also sunk from the 70-foot level a further depth of 50 feet. At the 45-foot a level was also driven north. A good deal of stone was broken, which has been reported as having yielded from 12 dwts. to over 1 oz. gold per ton. Mr. J. C. Goodall informs me that 1319 tons quartz were broken, returning 1001 ozs. 13 dwts. gold, during the time that he was mine and battery manager—September 7, 1883, to September 16, 1884. The last 80 tons crushed during Mr. Peter Irvine's managership were from the lower levels, and gave 38 dwts. per ton.

At the tunnel level, 110 feet from surface, the length of payable stone, according to plan, was 85 feet, and beyond that, in a southerly direction, the drive was extended 150 feet, but met with no payable stone. The quartz stoped below this level seems to be pitching north, and at 30 feet down the mine plan shows a new shoot of gold as having come in, and continuing downwards in stone 5 feet wide. These workings are inaccessible now, so there are only reports to go upon, but these are from former managers who were well acquainted with the mine. Mr. Peter Irvine, who is still a respected inhabitant of Mangana, says the average width of stone was 3 feet, and its average quality all through equal to 18 dwts. per ton.

The low Alpine tunnel was unfortunately abandoned before success was achieved. At present too little is known of the reef to warrant such a long adit at such a depth, but eventually, if work at more moderate depths proves satisfactory, it may become advisable to extend it. For the present a more desirable course would be to prove the reef by an adit a more reasonable depth below the present workings.

Cardinal Reef.—This is on the western brow of the spur, and near its southern end. Its bearing is N. 28° W., and its dip south-west. Three shafts have been sunk along the line of reef. The principal one, I understand, is 100 feet deep, but none of them can be entered in their present condition. Complete figures relating to the former output are not available, but accounts point to 167 tons being raised from the 50-foot level stopes, returning 13 dwts. gold per ton. Some of the stone is said to have gone as high as 35 dwts. The reef in the bottom was not payable. Mr. Goodall, who has come to my assistance with many valuable statistics of this field, tells me that the reef in the south end was 4 inches to 12 inches wide, and in the north end about .2 feet, but poor. Mr. Macleod states

that tributors crushed 20 tons of stone left at the shaft for 8 or 9 dwts. per ton, and some odd parcels gave from 15 dwts to $1\frac{1}{2}$ oz. The Cardinal is in a reefing line which embraces some parallel reefs, one of which at least is of considerable size. Mr. Goodall has done a good deal of trenching in this zone, north of the Cardinal shafts, and has exposed a strong reef of solid quartz in half a dozen trenches and an open-cut at intervals for over 4 chains from south to north on the N. 20° W. course of the reef. The first trench is about $\frac{1}{4}$ -mile north of the Cardinal shaft, and west of the Cardinal reef. A hundred feet north of this trench is the open-cut, which has been carried down 16 feet, showing solid stone 8 feet in width. Apparently this reef is widening as it runs north, for it was not more than 4 feet at the most southerly trench. The most northerly trench (which I did not see) is reported as exposing 17 feet of quartz. The open-cut has given gold prospects, and prospects obtained from surface loam lower down on the slope indicate a possible source in this reef-belt, which is about 100 feet in width. The reef in question has been called No. 1 reef, on the Buckland Freehold, which leads to confusion with the old Buckland No. 1 Company, which worked a different reef altogether. As it is such a prominent reef, and is a permanent land-mark on this ridge, it might be called Goodall's No. 1 reef, for sake of distinction.

Adit prospecting suggests itself for any one undertaking mining here, as adits could easily be laid out to go right below the outcrop at any depth desired. As for the Cardinal reef, it thins as it comes north, and is apparently replaced by Goodall's No. 1.

It will be noted that both country and reefs on this hill dip to the south-west, being on the western half of the Fingal Valley anticline. The quartz of which the various outcrops consist is the massive white variety which so often characterises the surface exposures of the reefs of the Mangana field, and in some districts might be looked upon as unfavourable. Experience at Mangana, however, has shown that high yields of gold have been associated with vitreous-looking quartz, which is often intersected by oxidised partings, forming a favourite matrix for gold, and which in depth frequently changes its character altogether, and becomes a mottled, laminated stone, with a fair proportion of mineral. Whether any particular "buck" reef will behave in this way is another question, but at any rate the vitreous habit of the quartz is, *per se*, not sufficient reason for condemning the reefs.

(d) Tower Hill Mine.

This is an abandoned mine on W. Gellibrand's purchased land, 157 acres, 3 miles north-north-west from Mangana, and over 1000 feet above the township. Like so many of the Mangana reefs, this one was discovered by Mr. J. C. Goodall, in 1869. It was worked by a Hobart company, and Mr. Goodall tells me that at first several crushings of good stone were taken out (up to 2 ozs. per ton), but after some poor battery-runs work was suspended, and has not been resumed since, except by co-operative parties. No very clear idea of the reef can be formed from the workings in their present condition. It has a north-westerly bearing, and shows at surface about 4 feet of white mineralised stone, disappearing to the north. The mine is on the spur between Golden and Fern Tree Gullies, with adits driven from the eastern side.

About 5 chains south of Gellibrand's boundary are some cliffs of Permo-Carboniferous conglomerate and soft quartzose sandstone, with embedded pebbles of white quartz and slate; and nearer the mine sandstone, belonging to the same system occurs also, though the reef itself is in the older slate. The slate dips south-west. The reef has a north-east dip.

Descending hence down Fisher's Hill, towards Mangana, on the west side there is a good deal of loose quartz, heavily charged with arsenical pyrites. The hill consists largely of grey sandstone, freely veined with quartz.

I did not see the Golden Gully Mine, which is a little way up that gully on the east side. I am informed that some fairly nice stone occurred on surface. An adit was driven with 50 feet of backs, but though there was a good body of mineralised stone it was barren of gold.

On the west side of Major's Hill outcrops of quartz have been tested a little. Some of these have a kindly look; others are hard and white. On the ridge, which is a razor-back, are stones of quartz of fairly loose texture.

These hills north of Mangana do not appear to have had the work done on them which their reefs would require. Some of the alluvial gold found in the gullies must have been derived from them, and their lines are too long and persistent for gold not to exist in them at some point in their course.

The reef-line on Robertson's Freehold, further south, seems to correspond with the Major's Hill line, and the Buckland Hill line with the sections on Otway's Creek.

(e) Fingal Company's Mine.

This was worked at least 40 years ago, on Grant's Creek. The greatest depth attained was 170 feet, and the mine does not seem to have been a payable one. The workings are 2 chains from W. Robertson's boundary, on Tully and Downing's land, and are on two parallel reefs a chain apart. Most of the gold was got out of the western reef, which is supposed to be that of the Golden Entrance. A good deal of hard white quartz is lying about at surface. The eastern reef was worked about 100 feet down on the underlay, and corresponds approximately in position with the line of the Union Jack and underlay reef further south. The battery which was formerly here is supposed to have recovered 6 or 7 dwts. from the stone. Mr. Cundy worked out some blocks of stone here 10 years ago, and got 6 dwts. per ton.

This is the furthest north that these long reefs have been seen. It is a remarkable instance of the persistency of the reefs at Mangana. In this instance the Golden Entrance reef would be shown to have a length of $1\frac{1}{4}$ mile, and the underlay reef $\frac{3}{4}$ mile.

(f) Union Jack Mine.

This reef is the continuation of the underlay reef, which passes up the hill north of Sharkey's Gully into Section 1527-93c, which is the old Union Jack claim. A little north of the south-west angle of the section is an ancient adit, which has been driven on the course of the reef for 250 feet. The latter still has a flat underlay to the east. In the adit about 8 inches of stone are showing at first, but further in it becomes softer and somewhat broken. At 200 feet in an underlay rise slopes up to a shaft which was sunk from surface. The inclination of the reef is sufficiently flat to walk or scramble up the rise. The shaft is 70 or 80 feet above the adit. Above the latter is an upper tunnel, driven right through the crown of the hill, with only 30 feet of backs at the most. The entrance to this is now fallen in. From the bottom of the shaft a small parcel of 1-oz. stone was taken. The quartz used to be trammed from the upper tunnel along a horizontal tramway for 150 feet west, and sent down an incline to Sharkey's Gully for treatment in the old Union Quartz Company's battery. The reef is so flat that it crops out at surface at 100 feet west of the tunnel and 12 or 15 feet above tunnel level. It cuts the country, being much flatter than the parting planes of the slate. The

appearance of the stone corresponds well with that of the underlay reef in Sharkey's Gully.

Five or 6 chains east a large reef crops out, with an easterly underlay. It is 12 feet wide, and has the characteristic central parting of the Golden Entrance reef, which, in all probability, it is. It is strongly mineralised with pyrite and iron oxide. The eastern portion of it is the more solid. Its bearing is about N. 40° W. It has been trenched upon in one or two places, the most northerly being 80 feet south of the southern corner of Section 1589. This should be driven on lower down the hill, and a rise would then cut the underlay reef as well.

What is probably the same reef has been cut further north, on W. Robertson's eastern block, where a shaft has been sunk on it. It shows there solid quartz about 1 foot in width. A few feet further north a cut has been put in, but not deep enough to expose any quartz. About 200 feet lower down, going north on the same course, is a small pit, about 12 feet deep, of which 6 feet consist of hill debris or overburden. Doubtless the same reef continues to the old Fingal workings.

It is impossible to form an opinion of these reefs from the abandoned ancient workings, but if any work was justified then, there would seem to be warranty for further testing them.

(g) *Pincher Reef.*

This reef is on the hill east of the township, where it overlooks the entrance to the Fingal Valley, or Grant's Creek Valley. Some tunnelling and shaft-sinking have been done on it, but how much stone has been taken out cannot be seen, neither are results available. It has a strike of N. 50° E., and dips south-east at an angle of 70° , and shows a width of 2 feet 4 inches stone between walls. The country is hard sandstone.

(h) *Specimen Hill.*

This is a low, somewhat flat-topped hill, on Robertson's Freehold Blocks, west of the township, covered with wash on the lower slopes. A little surfacing has been done with encouraging results, but there is not enough pressure of water available. The crumbly quartz detritus lying on the surface has apparently been shed from a series of veins running through the hill in a north-north-west direction, and forming an auriferous belt of about a chain in width. The slate strata crop out on the top of the hill, striking N. 20° W., and dipping south-west. On the

southern block of the freehold property stones of Permo-Carboniferous grit and mudstone are scattered over the ground, and it is probable that there is an occurrence of beds belonging to that system *in situ* somewhere near here. This would indicate that the undiscovered fault which has brought these beds down from the upper level to the Fingal township horizon must pass north of this. On the two northern freehold blocks diabase comes in, and passes away to the west as an intrusion, cutting-off the slates. Its former Permo-Carboniferous covering has been entirely removed by denudation.

Some shafts have been sunk at intervals on the line of quartz leaders and veins. The most southerly is the Trilby shaft, which is 50 feet deep. Some very nice gold was got here on Crown land, a chain inside the east boundary of 829-93c, 10 acres. A quartz gold-bearing wash rests on a yellow clay, which covers the slate bed-rock. North of this several trenches have been cut and quartz veins exposed. The depth of the wash varies from 8 inches to a foot.

Further north, in the freehold land, is Goodall's shaft, near the top of the hill, which has been sunk on a mass of quartz leaders. Quartz detritus lies here everywhere on the surface. The shaft was sunk 40 or 50 feet 12 or 14 years ago. Just below it a strong body of hard valueless quartz has been exposed.

Brennan's tunnel is an adit which has been driven into the hill on the western side for about 200 feet, at a shallow level, not more than 30 feet below the crown of the hill. It was put in with the intention of cutting the reef, but only one or two veins were intersected. This was about nine years ago. I do not think the position selected was a favourable one for the best results, as if the adit were continued, it would eventually emerge on the east side of the hill above the leaders there. A few stones of white barren quartz are seen on the tip.

Some trenching has been done in the depression running down the east side of the hill, and passing through a belt of small veins, some of which are oxidised and have a kindly aspect; others, however, being hard and white. A tunnel was put in on this side some years ago, and a flat vein near it carried very fair gold. There is an old shaft just above the tunnel with quartz going down in the walls. Near this point is the head of the gully workings.

On Specimen Hill proper a shaft was sunk eight or nine years ago by Mr. Corbett to a depth of 130 feet in slate, dipping south-west. One or two gold-bearing leaders

were passed through in sinking. From the bottom a crosscut was driven east. I was informed that nothing was won from this, but some nice specimens were got from trenching near the shaft. A few tons of quartz and slate were sent away for crushing, and returned about 5 dwts. per ton.

In the earlier days many of the auriferous leaders on this hill were pounded up and washed. Just north of this point diggers started on the alluvial gold shed from this hill, and kept working round the foot and up the gullies, in which a considerable quantity of gold seems to have been concentrated. There has been so much gold obtained in this way from the surface that it is next to certain that more exists at a depth. Whether the numerous veins unite in depth and form a strong reef-channel can only be ascertained by actual work, but it is, to say the least, probable that they do. The hill being so low in elevation (50 to 100 feet) adit-driving cannot be thought of. Mr. Montgomery advised sinking rows of shallow shafts and connecting them by drives. This would be useful preliminary work, but the real work of testing the reef or reefs would best be carried out from a shaft sunk to some depth, and well below the broken ground, which may be expected to prevail above the level of the Mangana Valley. A water scheme has also to be devised.

(i) *Alluvial at Mangana Generally.*

The actual lead or ancient bed of the tributary which flowed formerly from Mangana into the valley now occupied by the South Esk, a good deal below the present bottom of that river, cannot be traced with confidence above Mangana township. The ground at the mouths of the present mountain creeks does not exceed 40 feet in depth, and has no doubt accumulated from the creeks which flow down narrow ravines of comparatively recent origin. All these valleys have given employment to diggers, who have at different times worked some of the ground over and over again. The alluvial ground below Mangana deepens towards the South Esk, and, probably owing to it being private property, has never been thoroughly tested. It must have received a certain amount of gold from creeks which have now disappeared with the erosion of the country, though owing to the direction of the lead coinciding with that of the strata, and being parallel with the bearing of the principal reefs, the quantity of gold finding its way into the drift is likely to be

less than if the main valley crossed the strata. If the land had been open for mining its value, no doubt, would have been tested ere now.

It is difficult to ascertain how much alluvial gold has been won at Mangana. An estimate made in 1884 placed it at £60,000 worth, and assigned 6000 to 8000 ozs. to Major's Gully alone. Later estimates state 5000 ozs. as the gross returns. No figures pretending to any degree of accuracy can be obtained.

Major's Gully is said to have supported 400 diggers at one time. Near its mouth the ground is deep and wet, water flowing beneath the shingle, which chokes and hides the channel from view.

(j) Conclusion.

The present condition of Mangana, considered as the earliest goldfield in the island, is somewhat pathetic. It has been left by investors on one side, while the stream of capital has flowed to other centres. And yet the phenomenal returns from some of the reefs should suggest that there is here a legitimate field for search. The reefs, too, are in the golden zone, which extends for such a distance in this part of Tasmania. Some of them are barren, others are gold-bearing, and the chances appear to be neither more nor less than those of other parts of this auriferous belt. The Mangana Reefs is the only property on which anything like deep work has been done; the workings on other reefs are shallow, and often mere scratchings. Mangana evidently has not had a thorough trial yet.

W. H. TWELVETREES,

Government Geologist.

Launceston, 22nd November, 1907.

Geological Sketch Plan to accompany Report on the

MANGANA GOLD FIELD

SCALE OF CHAINS
0 10 20 30 40 50 60

H. H. Fyfe
Government Geologist
November 1907

5 cm

REFERENCE

- Tertiary drift merging into Recent Alluvium.
- Mesozoic Diabase.
- Permo-Carboniferous.
- Ordovician: slate and sandstone.
- Quartz reefs.
- Shafts.
- Dip and strike.
- Mine work generally.
- Barometric heights above sea level. (1200)



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W. and G.F. Lovett
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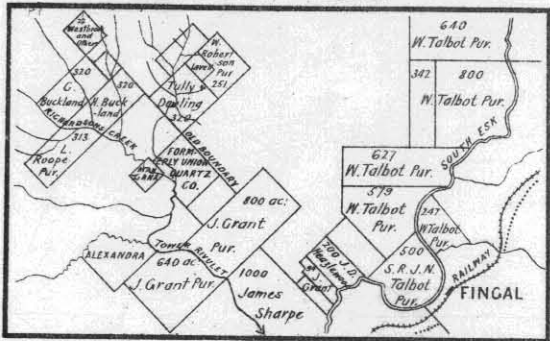
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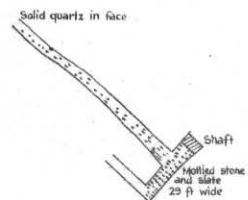
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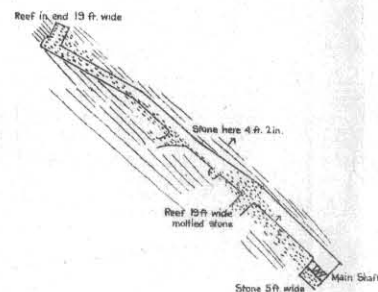
LOCALITY PLAN



NO: 1. LEVEL
115. feet



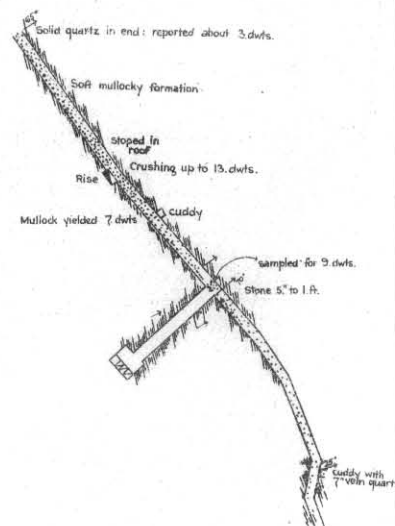
NO: 2. LEVEL
174. feet



NO: 3. LEVEL
219. feet



NO: 4. LEVEL
319. feet



NO: 5. LEVEL
419. feet

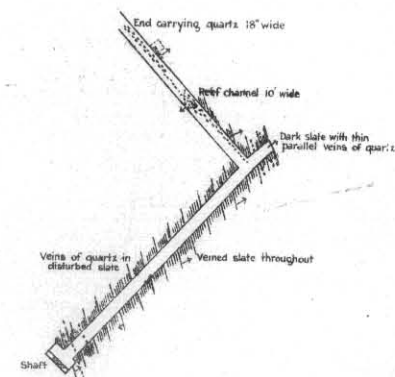


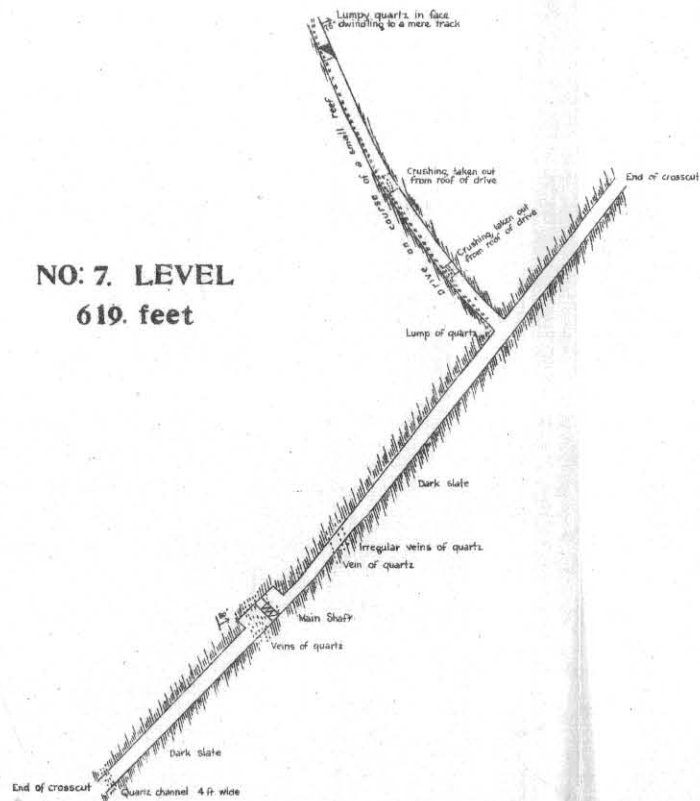
PLATE 2.

MANGANA GOLD REEFS PLANS OF LEVELS

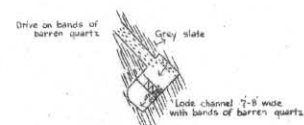
Scale of feet
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

W. H. Twiss & Co.
Government Geologist
Nov. 1907.

NO: 7. LEVEL
619. feet

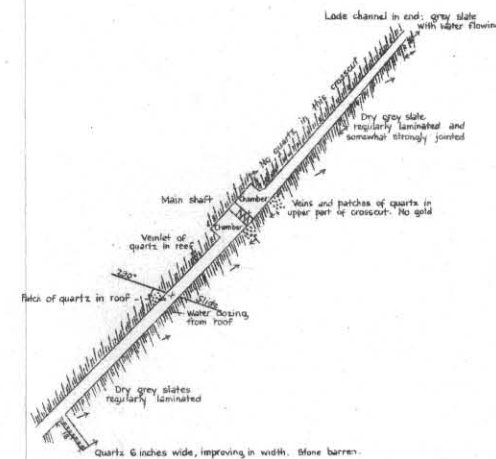


NO: 8. LEVEL
719. feet



5 cm

NO: 9. LEVEL
819. feet



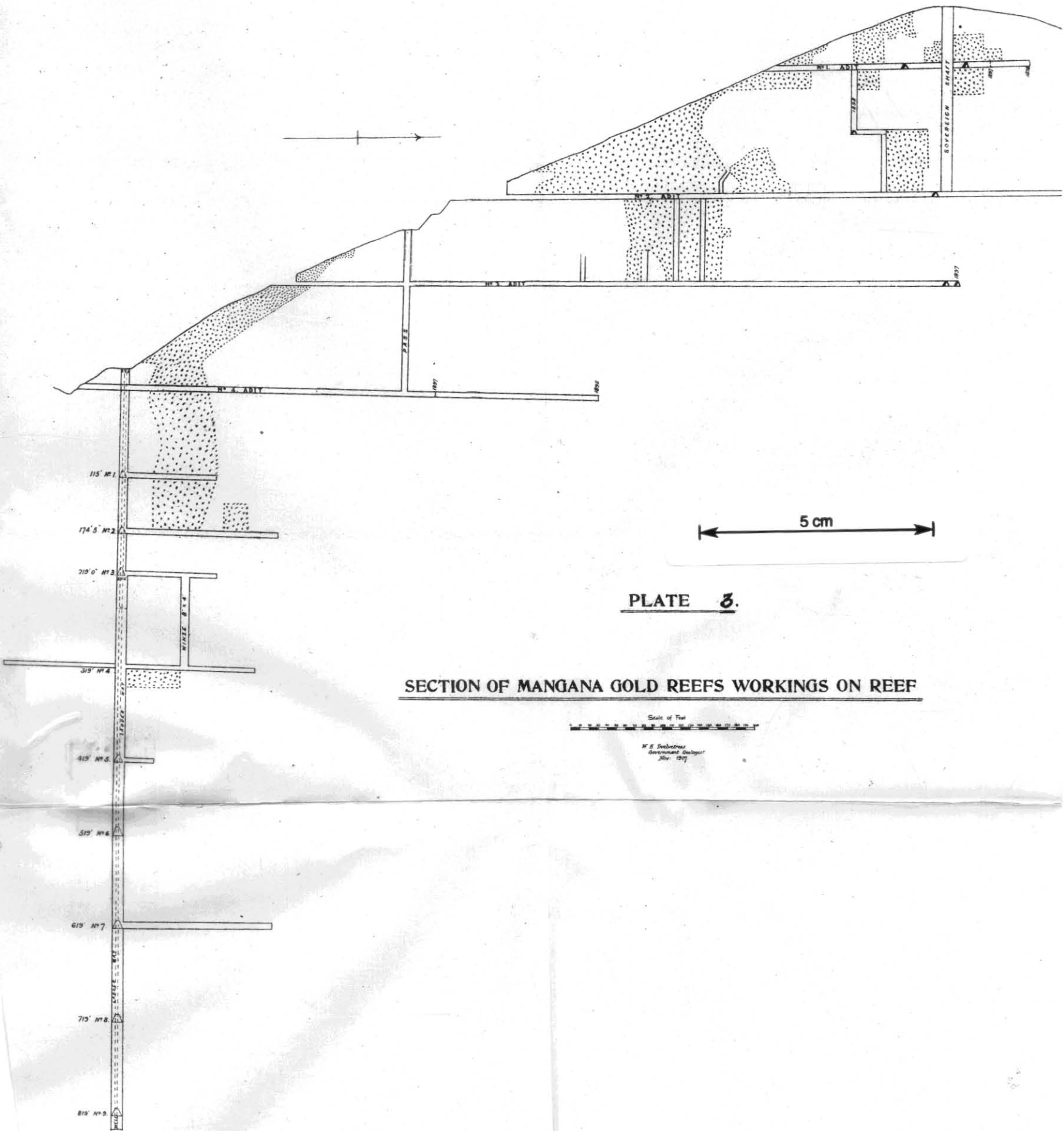


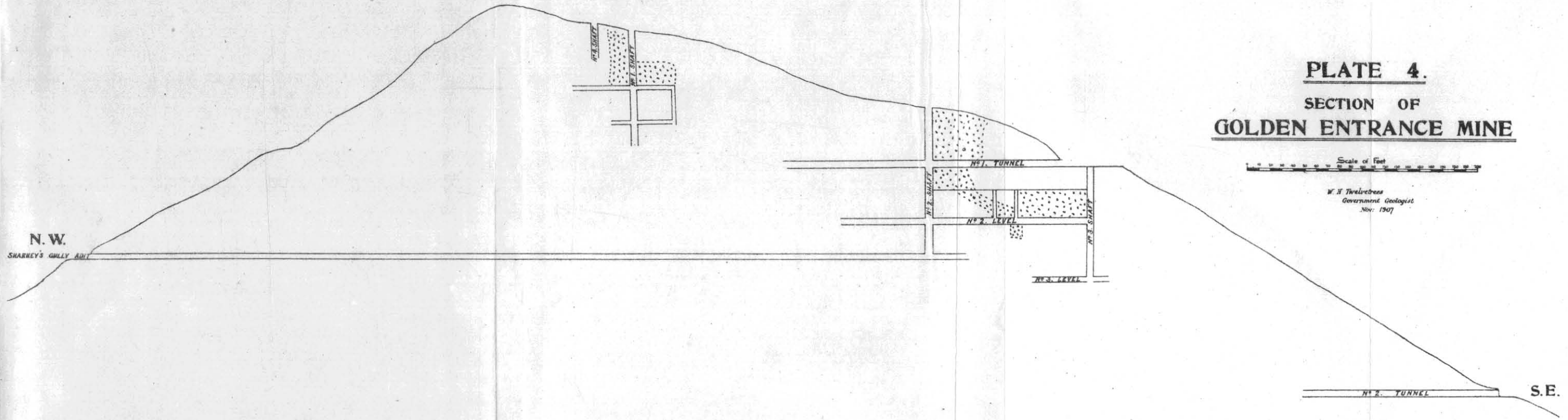
PLATE 8.

SECTION OF MANGANA GOLD REEFS WORKINGS ON REEF

PLATE 4.
SECTION OF
GOLDEN ENTRANCE MINE

Scale of Feet

W. H. Threlkeld
Government Geologist
Nov. 1907



5 cm

Photo-ographed by John Vail Government Printer Hobart Tasmania

THE MATHINNA GOLDFIELD.

PART III.

[Two Plates.]

I.—INTRODUCTION.

THIS part of the Mathinna Report deals with a comparatively small and outlying portion of the field, situate round the Scott and Pickett Mine in the upper part of a narrow valley which joins further north with that of the Sling Pot Creek, forming then one broad flat between the Volunteer and the Volunteer Consolidated spurs.

The slate and sandstone strata in which the Scott and Pickett valley has been carved out belong to the Ordovician auriferous series prevailing at Mathinna and Mangana. In respect of position in this series, they occupy a line of country apparently between the Golden Gate and Consols line on the north-east, and the Mangana line of country on the south-west. This line would embrace the strata on the mineral sections north of the Tower Hill farms.

II.—PHYSIOGRAPHY.

About $\frac{1}{4}$ mile north of Densley's land, the Sling Pot or Bull Bottom valley contracts, and the Sling Pot Creek forks off in a slightly west of south direction, leaving the Bull Bottom or Scott and Pickett valley heading a little south of east. The latter valley is now not more than 500 feet wide, but up at the mine narrows to a mere "V" shaped ravine. The valley and the hillsides are clothed with fine timber, comprising stringy-bark, iron-bark, peppermint, swamp, or white-gum, some of the trees from 10 to 20 feet in girth. A few small farming selections have been taken up along the valley, but the soil is none too fertile, and there is a deplorable dearth of water. After the spring snow-waters have descended from the mountain the creek subsides into its normal trickle from pool to pool, percolating through the sandy soil, and of little use either for farming or mining. The elevation of these farms is about 1100 feet above sea-level.

Above the Scott and Pickett battery the sides of the valley draw closer to one another; the slopes are steeper.

The sky-line on the tableland above is visible at a height of 500 and 600 feet. This is the high plateau connecting Mathinna with Tower Hill, which is between 3 and 4 miles south-west. The drainage of this part of the country is northwards into the South Esk River.

III.—GEOLOGY.

The strata of this part of the field are similar to those of the Mathinna field proper, and are of the same geological age. Alternations of soft, glossy clay slate, decolourised in the superficial zone, with sandstone and sandy slate occur everywhere. The sandstone is generally tough and crystalline, and constitutes locally the "hard" country of the miner.

The general direction of the cleavage planes of the slate and the laminations of the sandstone is from N. 20° to 30° W., and the dip or underlay to the south-west. A singular variation of dip is seen in the battery building of the Scott and Pickett Company, where the slate dips to the north-east at an angle of 45°. I have not seen this dip anywhere else on the strike of these strata, and the normal westerly underlay prevails to the immediate east, and also to the west, across the valley. It must, therefore, be a purely local disturbance.

The dominant dip of the strata to the north-west in this area, continuing also north-east to the Gladstone and Eldorado Hills, seems to show that the whole of this belt forms the west side of the anticlinal arch of the New Golden Gate and Tasmanian Consols line, to which I have referred in my previous reports.

About 500 feet above the Scott and Pickett, or 1700 feet above sea-level, stones of grit and conglomerate begin to appear on the hillside. These can be traced up to the plateau, where this formation covers the older slate. It belongs to the Permo-Carboniferous, and has been described in my recent report on the Mangana Goldfield. Its occurrence shows as plainly as anything could do, that the slate and sandstone strata of this field could not have suffered any very great loss by denudations before they were covered up and protected by the layer of conglomerate, which at one time must have spread in a wide belt all over this part of the country.

The nearest igneous rocks are the occurrences of diabase (of Mesozoic age) east of Fonthill and on Tower Hill, but they have no sort of connection with the auriferous quartz reefs at Mathinna.

IV.—ECONOMIC GEOLOGY.

Not many reefs have been opened upon in this part of the field, but the few which have been discovered belong to groups of the pyritic and arsenical gold quartz reefs. They are small, varying mostly between 15 and 21 inches in width, but, as a rule, are persistent, as far as their channels are concerned, for considerable distances, though the development of stone may be irregular. When shoots of gold occur, the value of the stone ranges from 1 dwt. per ton to, perhaps, a little under an ounce.

The associated minerals in the different reefs are pyrite, arsenopyrite, copper pyrite, galena, and zinc blende. Stone has been found with all these minerals, yet without free gold, nevertheless it is safe to say that they are reliable indicators of the presence of the precious metal in the reef. The quartz of these reefs varies in nature from a brittle, milk-white variety, which, though often barren, sometimes shows galena and free gold to a bluish-grey arseno-pyritic variety, forming one of the best-looking kinds of stone on the Mathinna field.

All the reefs which I have seen are fissure reefs, transgressing the strike of the country strata. One set has a strike about N. 20° E., while the direction of another is N. 75° W., crossing the first at nearly a right-angle.

V.—MINING.

The reefs which have been discovered are few in number, but I doubt not that others remain to be found, for the overburden in the form of hill debris is so constant that the bare rock is seldom seen on the slope of the hills, and the only chance of unearthing a reef is by closely observing the small ravines which score the hillsides. There has been no very extensive prospecting, which is hardly to be wondered at, for to prospect effectively here means the expenditure of considerable time and money in opening-out long and deep cuttings, almost at haphazard. The cuttings must be deep, so as to avoid passing over the caps of lodes, which do not always come right to surface.

The reefs dealt with in this Report are:—

- (a) The Scott and Pickett reef.
- (b) The Commercial reef.
- (c) The Pride of the Hills reef.
- (d) O'Brien's reef.

(a) *Scott and Pickett Gold Mining Company, No Liability.*

Sections 525-g, 10 acres; 526-g, 10 acres; and 534-g, 5 acres.

This property is situate nearly $2\frac{1}{2}$ miles south-south-west of Mathinna as the crow flies, or about 3 miles by road. It is on the east bank of the valley, which debouches further north into the marshy flat known as Bull Bottom. The battery is about 200 feet above Mathinna. The small creek which feeds it with an intermittent and inadequate supply of water flows past it down the valley through the farm lands to the north. A road has been cut recently right up to the property, though, as it is a little rough near the mine, carters look askance at it.

Mr. Pickett, prospector, was the discoverer of the reef, and the company bears his name, and that of his companion, Mr. Scott. The reef is an arsenical gold quartz one with a strike of N. 27° E., and dipping, on the whole, steeply to the north-west. This dip prevails at surface and down to the bottom level where the reef becomes nearly vertical, or shows a tendency to dip slightly to the east. This bending of the reef is probably a purely local feature.

Adit No. 1, South.—South of the shaft an adit crosscut has been driven 57 feet to the reef, which has been followed in a drive south-west for 110 feet. The reef-channel is a fracture line in the slate and sandstone strata, which course north-west at a right-angle to the reef.

Four trenches have been cut across the line of reef higher up the hill, north of the end of this adit level, mostly without exposing anything else than yellow, soft clay slate. The highest trench shows hard laminated sandstone, seamed a little with quartz.

On the opposite side of the small gully are several openings on the line of reef going south. One of these is a shaft where the reef has been stoped to surface. Further south, quartz is shown in a trench which has been cut on its course for about 10 feet. Trenches still further south do not show the reef, being probably too shallow.

No. 2 Adit Crosscut.—This was driven into the stope on this side of the hill, and has now fallen in. It was put in by the prospectors before the claim was floated into a company.

Main Shaft.—To prove the reef at a depth a 12-foot by 4-foot shaft, at 80 feet above the battery, has been sunk 62 feet plus $2\frac{1}{2}$ feet well, and a crosscut driven from the bottom for 82 feet in a south-easterly direction. The reef was cut through at that point, and levels driven on it

north-east and south-west. The channel here is 2 feet wide, with a 4-inch vein of clean quartz, the remainder being scattered quartz, pug, and slate.

North Drive.—Going north, the quartz increases to a width of 14 inches, but after 20 feet the stone dies out, and its line is replaced by a track of pug. Further on, the present manager has picked up a little quartz, 6 inches wide. A little gold has been carried from here to the face, and for about a foot it was shown to be payable. Beyond this is stone 10 inches to 12 inches wide, but with only a trace of gold, which continues in the roof. The reef in the face is 32 inches wide, with 3 or 4-inch bands of quartz interlaminated with slate. A pug seam occurs on the west wall, and on the east side is a lot of twisted greasy slate, favourable for reef formation. The slate foliae have twisted round to a course of N. 55° E., dipping south-east.

This is the most favourable-looking end in the mine. It is 50 feet behind the entrance of No. 1 north adit level, and something may occur between this and that. The upper level, also, is too near the surface to give satisfactory results in the first 100 feet. The owners will no doubt continue driving this end.

South Drive.—At about 10 feet south of the cross-cut gold began to make in the stone, which is from 10 to 20 inches wide, and has been followed up to the surface. Occasional bulges of stone, 3 feet in width, occur. The quality of the stone is said to improve as it goes up, but its length is diminishing. The length of stoping-ground at the drive level was about 30 feet, and there is said to be good stone going down. Beyond the south end of the stopes the track of the reef is marked by a line of pug, with a little barren quartz here and there. The face in the end of drive has a little water issuing from it. It consists of sandstone seamed and intersected by quartz veinlets, and has a line of pug on the west wall. There has been some twisting of the country here, as the strike of the strata coincides with that of the reef.

Where the reef was cut in the adit it was puggy for a width of 8 inches, and slightly mineralised. Here it was not gold-bearing, and it gives place along the level to quartz 4 or 5 inches wide, but still without gold. At 20 feet from the flat sheet payable gold came in, and the reef has been stoped up to surface about 50 feet above the level. South of this shoot of stone there is only the puggy track of the reef visible, with a little quartz here

and there. I am informed that a little gold can be got from prospects along the floor of the drive; but this part of the level is evidently south of the shoot of stone which has been worked. As this pitches north, of course, higher up it has existed further south. In the south end of the level is a little pug, otherwise the face is in country sandstone, with slate on the west wall. I am told that all the crushings prior to the time of the present manager came from this block of stone.

Adit Level No. 1, North.—One hundred and seventy feet north of the south adit the reef has been driven upon from surface in a north-easterly direction for 100 feet without disclosing anything of particular value. At about 25 feet in a short shoot of 3-inch to 4-inch stone occurs on the west wall of the drive, and further in is a 1-inch vein of quartz associated with a bit of pug. Just behind the face a cuddy has been driven west for 6 feet. In the end of the level the face shows an inch or two of pug, and the rest is slate. This adit being in the slate belt and not far from surface is in soft country all through.

The official figures furnished by the company give the crushings taken from the mine as 92 tons for 38 ozs. 4 dwts., but a little uncertainty exists in respect of the tonnage. Further 80 tons are now being crushed at the mine, and the yield is estimated as likely to be somewhere in the neighbourhood of 15 or 16 dwts. per ton. When this crushing is finished, all available stone will practically be worked out, and the company will have to consider its programme.

A short shoot of stone like that in this mine can only be followed down by a shaft, and a further sink would show whether the reef widens as it descends. With its present width and value it could hardly be worked profitably at a depth, but, of course, if it increased in width the outlook would be more hopeful. The present shaft has been sunk in rather hard country, but the bottom crosscut is in the slate country to the east, which underlies west, so that softer rock may be expected in further sinking. It may be said broadly that at Mathinna, wherever gold is met with it is always worth while to follow it and take the chance of improvements occurring. It is very improbable that this is the only shoot of gold in the reef. As the gold pitches north, obviously a fresh shoot would be soonest met with by driving south, but at a greater depth. By sinking deeper, also, it may be found that the present shoot of gold-bearing stone lengthens.

The continuation of the bottom drive north would be of an exploratory character. At about 20 chains north-east of the shaft an intersection by the Commercial reef takes place, according to the observed bearing of the latter; and in driving there is always a chance of meeting with intersections by reefs now unknown.

The quartz of the Scott and Pickett reef is for the most part a bluish grey quartz, carrying a great deal of arsenopyrite, with a little iron pyrites, zinc blende, galena, and copper pyrites. Large specks of free gold are not uncommon, especially in the whiter variety of quartz.

The 10-head battery attached to the mine would have to be improved if regular work were carried on; and a scheme for conserving water would also have to be devised. The present arrangements for crushing, conveying stone from mine, and conserving water are all impossible.

(b) *The Commercial Reef.*

This is on Sections 1292-93g, 10 acres; and 1293-93g, 10 acres; lying N. 80° E. from the Scott and Pickett, and on the brow of the hill, 500 feet higher up. The little gully in which the shaft is situate forks in two branches higher up the hill, and the Commercial sections are on the spur between the branches, where there is a broad and flat stretch of country, with stones and boulders of Permo-Carboniferous conglomerate scattered at intervals over the slate strata. A small quartz reef strikes S. 75° E., with hardly any underlay. What dip there is is to the north. A shaft has been sunk, and a little stoping has been done from the bottom. A long trench has been cut from this shaft westwards, and the reef taken out at surface. More trenches occur further west. The country at the shaft is soft slate; at the west end of the trench, seriticised sandstone. As mentioned before, this reef and the Scott and Pickett will intersect, and it might be as well to try and locate the junction on surface. In addition to the shaft on the reef, another seems to have been sunk in the country near by. Some returns have been reported as 1 dwt. per ton; others, as 6 dwts.

(c) *The Pride of the Hills Reef.*

Sections 170-g, 10 acres.

This reef is about a mile from the Scott and Pickett, in a north-north-east direction, and between 400 and 500 feet above that mine. It strikes N. 17° E., and is vertical. Some 9 or 10 years ago a shaft was sunk 70 feet on the

reef, and lower down the hill to the west an adit-level was driven on it for 51 feet. The reef in the face of the latter is 16 inches wide. The quartz is solid, white, and not well mineralised. Eighty or 90 tons of stone were broken out, and 15 tons crushed, for 15 dwts. of gold. The reef has been traced right over the hill. It would be interesting to trace the line of this reef towards the Scott and Pickett. The latter would lie as a parallel reef to the east of it.

A second reef exists near this one, and has also been sunk upon.

(d) O'Brien's Reef.

This is on Crown land, 9 chains south-west of the Scott and Pickett battery. It has been recently uncovered in the bank of the creek up the hill, opposite the battery. A small cut exposes it as a solid reef about 21 inches in width, lying between thinly foliated slate, but turning off south and cutting into the country as a flat reef. Its bearing is 15 degrees south of east, and dip southerly. The stone is hard and white, and unkindly in appearance. No gold has been recovered from it.

CONCLUSION.

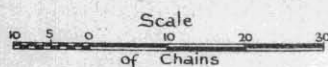
The locality described in this Report is a little remote from Mathinna, but its reefs are in the same general auriferous belt. They are, in fact, at rather an extreme distance from the Mathinna axial line of folding, but it cannot positively be affirmed whether this fact operates prejudicially or not until the survey of the whole field is completed. Meantime there is no reason for ceasing to prospect, for the locality is demonstrated to have been within the range of the agencies which were concerned in the deposition of gold.

W. H. TWELVETREES,

Government Geologist.

Launceston, 13th December, 1907.

LOCALITY PLAN OF REEFS



W. H. Twelvetyrees
Government Geologist
December 1907.

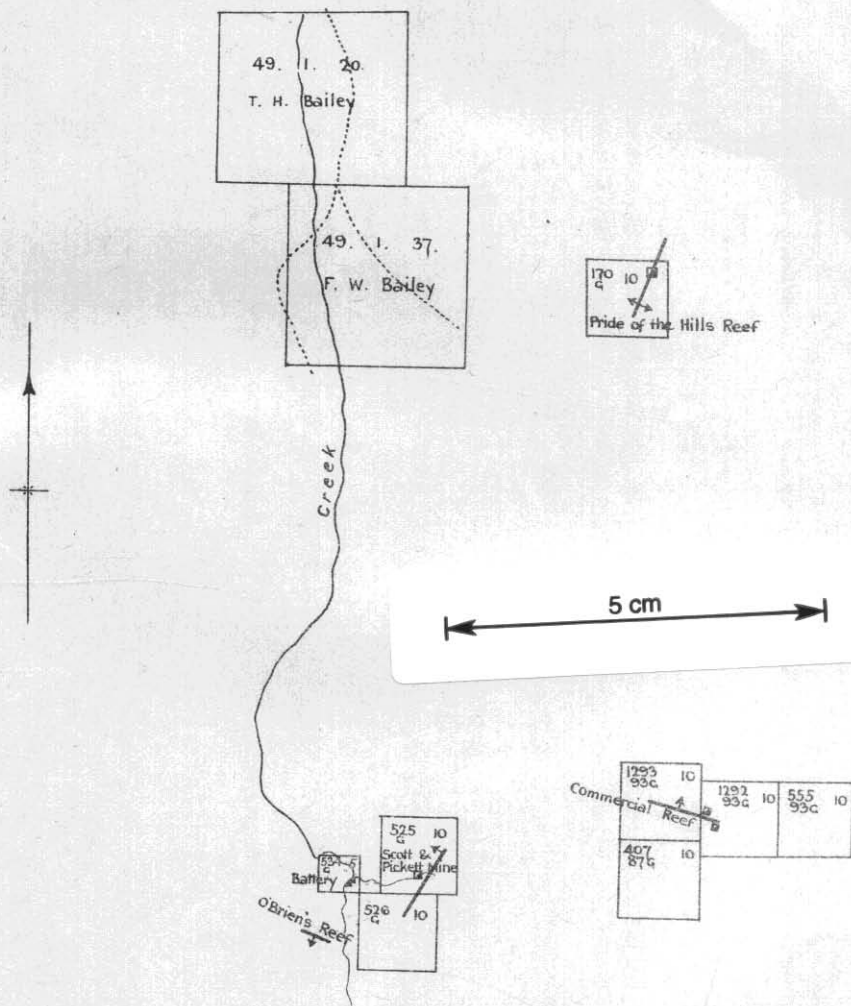


Photo-algraphed by John Vail Government Printer Hobart Tasmania

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PLATE 2.

PLAN OF LEVELS OF THE SCOTT & PICKETT GOLD MINE

Scale of Feet
10 20 30 40 50 60 70 80 90 100

W. H. Twilvetrees
Government Geologist
December 1907.

Scott and Pickett G. M. Co. N. L.

S.W. corner of Section 525 10ac

5 cm

End of Level in slate with pug 1'-2"
Cuddy
Quartz 1"
Quartz 3'-4" wide
for 12' in length
Adit Level
No. 1. North

Main Shaft
62 ft.
Crosscut
in slate
no quartz
Adit
No. 1. South
Crosscut
Rise connecting
with upper Adit
Reef
track only
Bunch of barren stone
End in sandstone
with veiniers of quartz
and seam of pug
Slate
Pug on W wall
Sandstone
Reef in face 2' 8" consisting of
Lode slate freely seamed with quartz veins 3"-4" wide
Carries a little gold
Stone 6"
Line of pug marks track of reef
Stone died out
Quartz 14"
Reef channel 2' wide with solid quartz 4",
remainder scattered quartz, pug and slate
(a) Stone 15" wide
Reef between (a) and (b)
stoped to surface. Width
of stone 10 to 20 inches
with bulges 3 ft wide
(b) Winze
Reef stoped to surface about 50'
Reef for stopes
Reef track of pug
with a little quartz
here and there

Photo-ographed by John. Kail. Government Printer Hobart Tasmania

B 15820.