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Tasmania

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BULLETIN

No. 42

Lefroy and Back Creek
Goldfields

BY

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Minister for Mines for Tasmania



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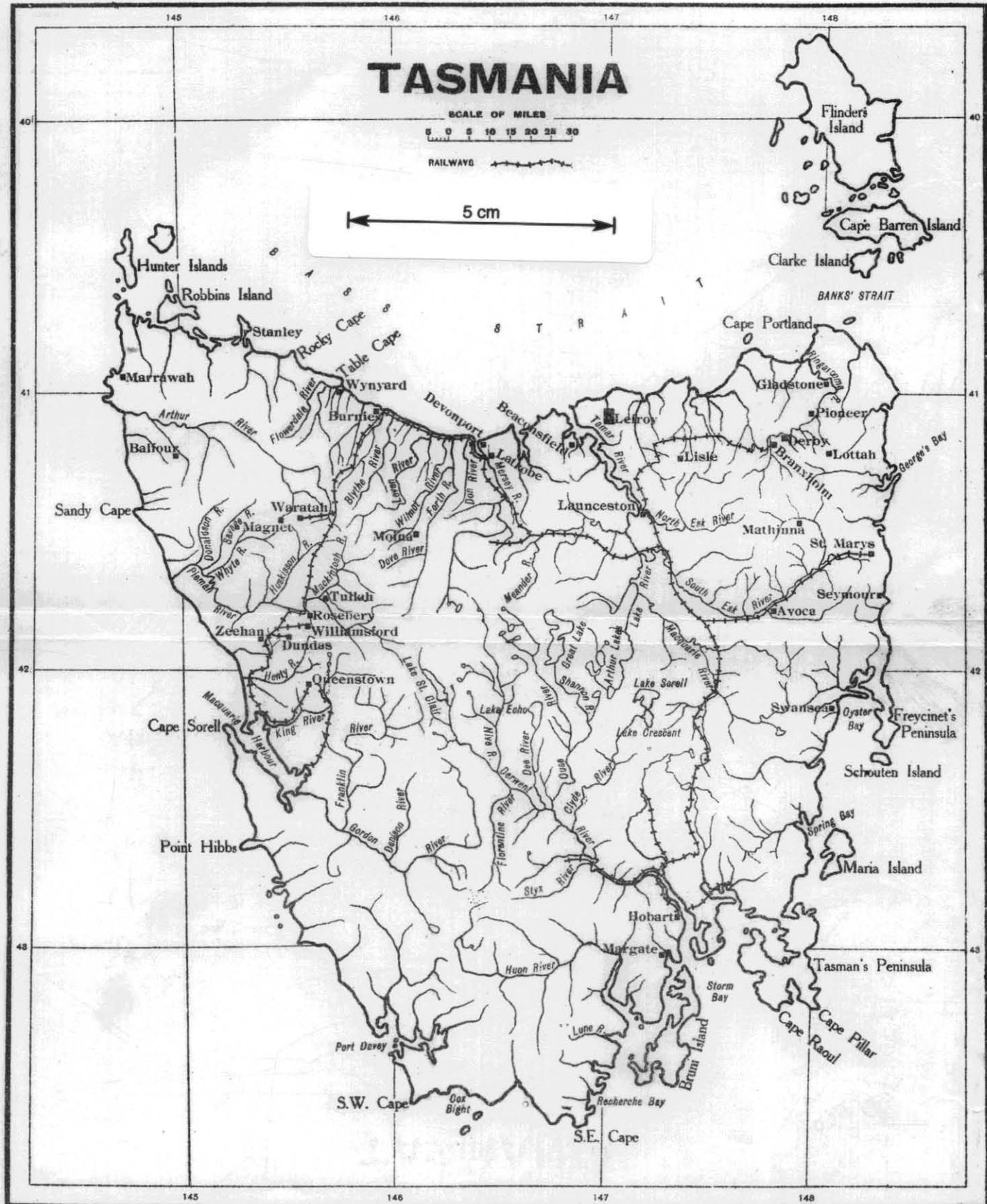
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TASMANIA

SCALE OF MILES

0 5 10 15 20 25 30

RAILWAY

5 cm

LOCALITY MAP

LEFROY

I.—INTRODUCTION.

THE period spent in surveying the Lefroy field was from the 3rd July to 16th August, 1933. Surveys of the reefs where they could be traced on the surface were made with compass, chain, and clinometer, and the heights were found by aneroid. Owing to the fact that practically all the mines were closed down, the workings were inaccessible for inspection, and all particulars of underground workings and structures, except in a few cases, are taken from old reports on the field. The survey was based on the mineral chart of the district, together with a recent survey made by Mr. J. Wilkes.

The writer desires to express his appreciation of the services rendered by Messrs. A. Ponting and E. C. Floyd, who acted as his field assistants during the survey. He also wishes to thank the residents of the district who supplied him with information on the old workings.

II.—PREVIOUS LITERATURE.

The reports dealing with this and adjacent areas are—

Thureau: On the Mineral Resources and Permanency of the Lefroy Field. (House of Assembly Paper No. 118, 1882.)

Thureau, G.: On the Future Prospects of Deep Mining of Gold-bearing Quartz Lodes at Lefroy. (Legislative Council Paper No. 107, 1883.)

Montgomery, A.: On the Geological Structure and Mining Development of the Lefroy Gold-field. (Report of Secretary for Mines, 1896-7.)

Twelvetrees, W. H.: Volunteer Gold Mining Company. (Parliamentary Paper No. 63, 1899.)

Twelvetrees, W. H.: On the Country Between Back Creek and Lefroy. (Report of Secretary for Mines, 1907, p. 7.)

Nye, P. B.: On the Golden Zone Mine, Lefroy. (Departmental Report, 13th November, 1925.)

III.—HISTORY.

Gold was first discovered in the district at Specimen Hill by S. Richards and party, who were working from George Town; they were granted a reward of £2000 by the Government, and the Reward Mine was opened. The Specimen Hill (the east part of the Land-o'-Cakes line) and the Shamrock (East Volunteer) were the first mines to be opened, and the township Nine-Mile Springs sprang up around these mines. The development of the field at this time seems to have been hampered by the leasing system then in force, which prohibited prospectors from working on leased property, and so locked up much property from the reach of the prospector. In 1873 Commissioner Bernard Shaw reported that quartz-crushing operations had almost ceased, but that the value of the gold won from the alluvial deposits in 1872 was £8000.

From Nine-Mile Springs prospectors worked west, and the very rich Golden Point and Native Youth lodes were discovered. Here a new township sprang up, named after Governor Lefroy, and having a population of about 800. After two or three years the gold in these reefs gave out and the place became almost deserted. It is worthy of notice here that the history of Lefroy shows a series of alternate periods of activity and depression. This fact is due to the distribution of the gold values in the reefs, where the gold may be rich in the upper parts, but in the levels below 400 feet the lode becomes unpayable. This means that the mines rapidly became worked out, and a period of depression followed, until prospectors discovered fresh lines of reef.

The Chums reef, followed by the Land-o'-Cakes and Golden Era, was the next to be found, the Chums line being found by Mr. A. D. White and party. In 1881 rich returns were being obtained from the New Chum line, chiefly on the Prospector (New Chum) and West New Chum Mines. Besides these two numerous leases were taken along the line. The New Native Youth Mine was then still the scene of active mining operations. At this time a plant for treating the pyrites for gold was

installed. At 400 feet in depth the gold values again became very low, and in 1884 the field, for the third time in its history, was in a state of partial collapse.

A few of the companies kept on working in a small way, till in 1891 the Pinafore lode was discovered by J. T. Stubs and party. This led to a great revival in mining, and the Volunteer reef was again opened up. From this time the production of the field steadily increased, till in 1895 it was 21,544 oz., value £86,401. In this year mining at Lefroy underwent a boom period, and eight old mines were reopened and twenty-nine new ventures were started. Many of these were fraudulent enterprises, but fourteen of the new companies, besides six of the old, were still working after the boom period had passed. In this period of prosperity the New Pinafore and Volunteer Mines were the chief dividend payers, later being joined by the West Volunteer Mine.

In 1896 the gold again gave out at the 400-foot level, and the New Pinafore and Volunteer Mines started on a campaign of deep-sinking and exploratory cross-cutting and driving, in the hope of finding gold at deeper levels. The New Pinafore Mine continued this campaign until 1902, being able to carry on with Government assistance and by cyaniding the battery tailings. On both these mines shafts were sunk to 1200 feet, on unpayable ground all the way, in the hope that the values would improve. Unfortunately surface enrichment, the cause of the concentration of the gold near the surface, had not been recognised, and so it was not seen that the values would be unlikely to recur in depth. Since these two mines ceased operations no large reefs have been worked, except in some cases where some of the old mines have been reopened. Some small reefs have been worked, and these have often been very rich near the surface; but the values rapidly fall off in depth. Until 1900 the field had yielded £700,000, and about £280,000 had been paid in dividends.

IV.—GEOGRAPHY AND PHYSIOGRAPHY.

(1) LOCATION AND ACCESS.

Lefroy is on the north coast of Tasmania, about 10 miles east of the Tamar Heads and 5 miles from the sea. It can be reached by main roads from Launceston and George Town, and there are roads leading east towards the Scottsdale district.

(2) TOPOGRAPHY.

(a) General.

The topography of the district is one of fairly gentle slopes and slow streams. The highest part of the area is in the south, where near Specimen Hill the country rises to a height of about 650 feet, the lowest part being to the north, where the valleys are about 200 feet above sea-level.

The contours were drawn from heights found by aneroid and clinometer along the traverses of the various reefs, and should be fairly correct where the reefs are close together. Where they are widely spaced, however, the accuracy of the contours will not be so good, and in the outer portions of the field they have not been drawn.

(b) Streams.

The central part of the area is drained by Blanket Creek, which runs along the eastern edge of the main gold-bearing area. Two tributaries of Blanket Creek, Sludge Creek and Chum Creek, drain the important auriferous area. To the west the country is drained by Slaty Creek, and the drainage in the extreme south runs into Fourteen-Mile Creek, an affluent of the Tamar River. The south-eastern portion drains into Back Creek.

(3) CLIMATE AND METEOROLOGY.

The climate of Lefroy is mild and agreeable. The annual rainfall is about 33 inches, most of the rain coming from the north-west. The driest part of the year is in the months of January and February, in which the average monthly rainfall is about $1\frac{1}{2}$ inches. The wettest months are from June to August, when the average monthly rainfall is about 4 inches.

V.—GEOLOGY.

(1) SUMMARY.

The oldest rocks occurring in the district belong to the Mathinna series of the Cambro-Ordovician system. In the south-west portion of the area Permo-Carboniferous sediments, mainly conglomerates, occur. Tertiary river gravels are the next deposits in order of age, these being overlaid by basalt flows, which are again covered by alluvial material and gravels.

(2) ROCK SYSTEMS.

(a) Cambro-Ordovician.

These rocks are the most western occurrence of the Mathinna series, and consist of sandstones and slates, the former predominating in the central part of the field. The sandstones are sometimes uncleaved and fairly soft, but usually they are strongly cleaved and rendered almost schistose by the development of parallel flakes of secondary mica. This alteration of the original sandstone probably developed as the result of differential pressure, perhaps acting just before or at the same time as the introduction of the auriferous reefs.

No fossils have been found in these rocks, although some of the rocks appear to be quite suitable for the preservation of organic remains. Most of the rocks appear to be too altered to allow fossils to be preserved, but even in the more unaltered rocks there is no sign of any fossils.

The strike of the sediments is usually between 320° and 340° , and there is a general dip to the west. The strike and dip are often disturbed in proximity to faults, but in the undisturbed country the dip is from 30 to 50 degrees west.

(b) Permo-Carboniferous.

The rocks of this age are mainly conglomerates, and can be traced on the surface by the pebbles derived from them. On the east side of Slaty Creek some sandstones occur. The material can be seen

in a prospecting shaft at the Londonderry Mine, and it can be traced over to the Slaty Creek bridge on the George Town-road, where the pebbles can be seen at the top of the shaft of the Mole Creek and Zeehan Mine. The pebbles consist of quartzite, quartz, granite, and conglomerate, the first two being the most abundant. Glaciated pebbles are not common, although one or two have been found showing the characteristic faceting and grooving.

(c) *Tertiary.*

These are pre-basaltic stream deposits, which appear on the surface only at the heads of the leads before they pass underneath the basalt. The direction of the pre-basaltic streams can be inferred from the position of the basalt itself, since it flowed down the valleys which existed at that time. The deposition of Tertiary material in this part of Northern Tasmania is intimately connected with the movements of subsidence and elevation which affected the land surface during the Tertiary period. The bottoms of the ancient river valleys have been shown by boring to be sometimes 270 feet below the present surface, and below sea-level. In other parts of Northern Tasmania, notably the valley of the South Esk, thousands of feet of fresh-water deposits have been found in the old river valleys. This indicates a filling up of the valleys during a continued subsidence of the land surface, and the country must have been very rugged to prevent it from becoming totally submerged. The rugged aspect of the country was probably accentuated by faulting, which was a direct result of the subsidence already referred to.

In the portion of the deep lead worked by the Pinafore Company the bottom of the gutter was about 230 feet beneath the present surface. In prospecting along the Morning Star lode, about 10 chains to the south of the latter, the bottom of the gutter was found to be 100 feet below the surface, giving an average grade of 1 in 5 to the ancient stream-bed. The drive from the prospecting shaft passed through only 40 feet of alluvial material, yet a winze 40 feet deep was necessary to reach the bottom of the gutter; this gives a slope of 2 in 1

to the banks of the stream, which must therefore have been flowing in a gorge. These facts show that precipitous conditions prevailed at this period, and give ample explanation of the occurrence of immense boulders and blocks of sandstone which were found in the workings of the Pinafore alluvial deep lead mine.

These conditions may have been a natural consequence of the rugged topography, or they may have been the result of a fault, there being no definite evidence in either case. With such marked relief as there was at that period, waterfalls and rapids would be expected to occur, and it is quite probable that this represents such an occurrence. The Morning Star reef is heaved 45 feet to the north at the alluvial gutter, but this is apparently in the wrong direction if the eastern portion were to be down-faulted, the reef having a south underlay. This does not take into account horizontal movement along the fault-plane, which is always likely to be an important factor, so it is possible that the fault may actually represent a down-throw on the eastern side. However, there is no definite evidence to distinguish whether there has been a fault or otherwise. The Pinafore lead has a flat gradient to the point where it passes underneath the basalt. The formation of this lead evidently represents a later period than that of the preceding lead, occurring when the valley was almost filled with sediments and the earlier basalt flows, the stream consequently not having much fall, and thus a flat grade. These remarks apply also to the Native Youth and Golden Point leads, which run by the side of, and underneath, the recent alluvium of Sludge Creek.

(d) *Basalt.*

The flows of basalt occurred at the same time as the filling of the old river valleys with Tertiary deposits. In the bores two flows of basalt can usually be recognised, but in one bore there were four. Hard basalt never outcrops on the surface, usually being found as a typical red clay. This is usually covered with surface gravels. Solid basalt has been found only in shafts.

There does not seem to be any means of determining the age of the basalt, except, perhaps, by petrographical similarities with basalts of known ages. The basalt at present is confined to the river valleys, but for reasons explained below this cannot be taken as proof of the occurrence of a comparatively recent flow. During the basalt flows the land surface was presumably undergoing subsidence, and the valleys were becoming filled with deposits rather than being deepened by erosion. Hence the streams would continue flowing over their old courses on fresh deposits lying on the basalt, and would not develop twin streams, which are typical of basaltic flows in old river valleys where active erosion is taking place. The present physiography would thus generally be a worn-down remnant of the much more pronounced relief which once existed. Hence the confinement of the basalt to the present valleys gives no indication of the age of the flows.

(e) Pleistocene and Recent.

These deposits consist of gravels, the recent ones, which are all to a certain extent auriferous, being deposited along the present streams or as surface gravels scattered over the country.

A puzzling feature of these deposits is the occurrence of very rounded gravels on the hills of trigonometrical points C and A, near the East Pinafore shaft and the east of the township respectively, and also to the west of the Monkland reef. These now form rounded hills, and have evidently acted as a protective covering from weathering agents. The size of the gravels indicates that the streams must have been swift, and they would probably represent the material dropped by the swift-flowing streams coming from the steep hills when they reached the flat basaltic area. The occurrence of these gravel-covered hills is a good indication of the considerable amount of erosion which must have taken place since the basalt flows.

The Demijohn lead is above the present level of Sludge Creek, and may represent an early bed of that stream.

(3) STRUCTURAL GEOLOGY.

(a) *General.*

This area is essentially one of faulting, and folding is practically absent. The reefs occur along east-west faults, and other faults of the same period cut across these.

(b) *Folding.*

The rocks do not seem to have been subjected to any great folding movements, and dip at 30 to 50 degrees to the west, with a strike from 320 to 340 degrees. Near the faults the strike and dip become disturbed, and sometimes the beds dip to the east or become almost vertical, but generally maintain approximately the same strike. The rocks at Back Creek, about 6 miles north-east of Lefroy, have the same strike as those at Lefroy, and dip to the east, showing that there must be at least one anticlinal axis between Lefroy and Back Creek.

(c) *Faulting and Its Relation to Quartz Reefs.*

Most of the reefs are seen to lie along fault-planes, since the beds on either side of the reefs do not coincide, and for this reason the reefs and faulting should be discussed together. The auriferous reefs are remarkably parallel, and have a bearing of about 80 degrees. On the plan the reefs are seen to bend along their length, but this is due to the underlay changing the course of the reefs on slopes. Most of the reefs dip to the south, but the Native Youth and other smaller reefs dip to the north. The Recruit, Pinafore, Clarence, Tablier, Land-o'-Cakes, and Volunteer reefs show signs of repeated movement along the fault-planes in the formation of slickensides and the crushing of the quartz and mullock, first into a fault rubble, and finally into a pug. The reefs often show the effect of repeated openings of the fissure with the introduction of more quartz. The auriferous quartz seems to have been the earliest, since it has been found on the walls of the fissure with valueless quartz adhering to it. Mr. Montgomery described some effects due to faulting, such as pieces of valueless quartz, with a streak of

gold on it, formed by a piece of gold being rubbed over it, and the formation of square yards of slickensided surface in some of the mines, notably the Volunteer. Often the faulting movement has taken place in a shear zone between two well-defined walls. These shear zones are as much as 200 feet wide, and can be described as lode-channels; locally they are termed "formations." In these lode-channels the reefs may occur anywhere between the two walls, usually on the hanging-wall or footwall or both, and the country-rock in the channel is twisted and filled with little veins of "buck" quartz along strain cracks.

Besides the auriferous east-west reefs there are two other systems of reefs, running approximately N.W.-S.E. and N.E.-S.W., which cut the auriferous reefs, and so are younger than them. Of these, the north-west system is the commoner. These faults, or "slides," often have a low angle of dip, usually to the west, and the only one which the writer was able to examine, in the Old Comrades Mine, appeared to be an overthrust fault. It is quite probable that horizontal movement was often a predominating factor in the movement along these fault-planes. The fault-planes are usually filled with quartz, or sometimes pug, and the country-rock becomes converted to a dark slaty rock, with a crinkled surface along the cleavage-planes. This crinkling of the surface gives the rock an appearance of having been squeezed, with the resultant crinkling of the minerals along the cleavage-planes. The rock, when dry, is a dark-grey colour, but in the mines when wet it appears black. In thin section it is seen to consist mainly of micaceous material, with a little quartz, the mica and chlorite having a parallel arrangement to give a schistose texture to the rock. This rock can easily be distinguished in the hand specimen from the normal country-rock, and is a good indication of the proximity to a fault.

It is seen from the plan that the main reefs lie in a belt of country running to the west of north. There are some reefs outside this belt, but they are relatively unimportant in size and value. This belt agrees very well in direction with the strike of the Cambro-Ordovician rocks, and this suggests that the

reefs are connected with a particular series of strata. The general system of fractures in this field agrees very well with the results of experiments by Mead and Cloos on the effect of shearing actions on different materials, the latter investigator using clay. The first set of fractures was due to tension, and inclined at 45 degrees to the direction of shearing, and would correspond to the auriferous east-west lodes of the field. The next two sets were due to shear, and formed at an acute angle bisected by the tension fractures; these would correspond to the slides. Since the fractures are confined to a certain belt of rocks, the most probable origin of the shearing movements would be a differential force acting on a series of strata, and being taken up by a weak set of strata between two stronger sets. The rocks in the central belt are sandstones, which have been rendered somewhat schistose by the development of parallel flakes of mica, in planes generally not parallel to the bedding. These rocks were altered from the original sediments probably by the forces acting during the faulting and injection of the reefs. The rocks to the west of the belt, as at Slaty Creek, consist mainly of hard slates, and to the east, near the Welcome Mine, of white sandstone, and still further east, at the Sea View Mine, of hard slate.

There is one auriferous reef, the Golden Point and Crown, which runs north-easterly, and does not have the normal course. The country-rock is extremely shattered, and probably represents an area of intense local shear, in which a cross-fracture formed at the same time as the normal east-west fractures.

VI.—ECONOMIC GEOLOGY.

(1) QUARTZ REEFS.

The auriferous, or "reef," quartz can be distinguished by the fact that the quartz is slightly crystalline, and has small vughs with projecting crystals. The non-auriferous, or "buck," quartz has a hard, vitreous appearance, and there are no crystals developed; this is the quartz which is found in the slides, strain cracks, &c.

The mineral with which the gold is found most abundantly is stibnite and its decomposition product, cervantite. Pyrite, chalcopyrite, and arsenopyrite also occur. The association of the gold with these minerals will be discussed in the section dealing with secondary enrichment.

(2) SECONDARY ENRICHMENT.

None of the mines on the field have been payable below the 400-foot level, and it seems clear that the reefs have undergone secondary enrichment. This involves the solution of the gold and the migration of the solutions downward until the permanent water-level, at about 400 feet in depth, is met, where the descending water, with free oxygen, mingles with the larger body of neutralised water, and the gold in solution is precipitated. This does not mean that the gold is concentrated at the water-level, since precipitation can occur at all depths. The gold is also distributed by the fact that, as erosion proceeds and the surface falls relative to the reefs, the gold which has been precipitated near the water-level must come close to the surface before it is redissolved, thus giving a vertical range of a zone where neither solution nor precipitation is taking place. It is just a possibility that the present surface coincides with shoots of gold in all the reefs, but the regularity with which the values in the reefs have given out at a depth of 300 to 400 feet makes this very remote, and it can be neglected.

The gold from the Lefroy field is of very good quality, and shows very plainly the effects of the refining process which occurs during surface enrich-

ment. The following figures were compiled from mine reports extending over a period of 14 years, and refer to battery gold won from the New Pinarofore reef:—

Alluvial Gold from the 200-Foot Level.

Gold.	Silver.
·9535	·035

From Surface to 360-Foot Level.

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

From 1100-Foot and 1200-Foot Levels.

Gold.	Silver.
·9040	·075
·9015	·070
·9255	·060
·8500	·055

These figures show a marked increase in the fineness of the gold in the upper levels and in the alluvial deposits.

The amount of enrichment in the reefs must have been considerable, since below the enriched portion they never contain more than 1 or 2 dwt. of gold per ton, which is very low compared to the values obtained in some of the mines. To obtain this enrichment 2000 feet at least of the upper parts of the reef must have been eroded away, and most of the gold carried down in solution to enrich the successive upper levels of the reef. In addition to this, at no time could the rate of erosion have been greater than the rate of solution and downward migration of the gold, since the gold would have been washed from the reef, and so lost. This fact

provides a good explanation for the variation in values of the different reefs, since if at any time a local rapid rate of erosion occurred some, if not all, of the gold would be lost, and the reef would become correspondingly poorer.

Since Permo-Carboniferous deposits occur at the south-western portion of the area, a considerable amount of erosion, with its corresponding surface enrichment, must have occurred before Permo-Carboniferous time. Until the Permo-Carboniferous rocks were worn away, probably in Miocene time, the Cambro-Ordovician rocks would be protected from further erosion. In connection with this it is worth mentioning that actual enrichment of the reef cannot occur without erosion of its upper portions, and the only process which can occur is the migration of gold, in solution, through the reef, with precipitation of the same gold; this may cause impoverishment of the upper parts of the reef. The only enriching process which might occur is the migration of gold in solution from the sides to the bottoms of the valleys, where it would be precipitated, causing enrichment of the portions underneath the valleys. This might be a considerable factor in mountainous country, but with fairly flat relief it is not probable that it would be important. The distribution of the gold throughout the reef seems to be more even than with the other metals, and does not seem to depend so much on the permanent water-level; slight enrichment is sometimes noticed near the depth of permanent water-level, but usually the effect is not marked, or may even be absent.

A number of small reefs have been found which have been very rich near the surface, but which fall off in value, and become very small at depths under 100 feet. These veins probably represent the lower portions of reefs of which the wider parts have been eroded away, and from which the gold has been concentrated in the lower portions.

In Tertiary times when subsidence occurred and was at a maximum a stationary period of erosion would take place, and the gold would become distributed throughout the reef down to the permanent water-level. Since this would lie deeper under-

neath the surface of the hills than the valleys, the depth of enrichment would be greater, the values scattered over a greater depth, and hence the grade of the reef would be poorer. Then uplift occurred, and while in the valleys deposition was still taking place, active erosion began on the hills. Thus the upper enriched portions were partly or completely worn away, and also the parts that remained had not such good values as the parts underneath the valleys for the above reason. It is probably for these reasons that nearly all the payable mines on the field have been situated in valleys.

If any easy passages are provided for the downward migration of the gold solutions, it would be expected that good gold values would be found in relation to them. Such passages are provided by the faults or slides which cut across them. An improvement in the value of the reef is usually noticed near the fault, and forms many of the shoots of ore worked in the mines. Since the gold solutions working down the fault-plane tended to work down into the reef on the footwall side rather than into the reef on the hanging-wall side, the values in the reef on the footwall side are usually better than on the hanging-wall side of the fault.

It might be expected that the gold, when migrating downwards in solution, would move outwards into the transverse fault-planes and become deposited there. I have heard, from verbal communication, that this actually did occur in the Pinafore Mine, where some mining was carried out on the quartz along a slide. This, however, is an exceptional case, and, in general, no gold is found along the slides. The reason for this is the absence of precipitating agents for the gold. The auriferous reefs contain sulphide minerals, and these, principally stibnite and pyrite, precipitate the gold from solution. Gold is associated with pyrite in the primary parts of the reefs, as in the deep levels of the Pinafore Mine, but it is also a precipitant, and is important in the first place by yielding, as a decomposition product, ferric sulphate which is a solvent for gold. It has been found in mining operations that stibnite and its decomposition pro-

duct, cervantite, are the commonest associates of the gold, and thus it seems to have been a good precipitant.

(3) ALLUVIAL DEPOSITS.

(a) *Pre-Basaltic.*

The pre-basaltic alluvial deposits seem to have been formed at different periods, the later ones when the valleys were becoming filled with deposits and (perhaps) the earlier flows of basalt. The earliest of the leads may be called the Deep Lead, because this is the only one which has been worked underneath the basalt. It has been worked in the mines which are described below.

Lefroy Deep Leads Company.—The shaft for this mine was sunk 287 feet, and work stopped when the war broke out, and was never continued.

East Pinafore Mine.—In the shaft of this company bedrock was struck at 236 feet from the surface, and it was found to have 8 feet of wash resting on it, with 8 feet 6 inches of brown clay, fine gravel, and decayed wood resting on top of the wash, and the rest chiefly basalt. The shaft was not in the gutter, and the bedrock dipped to the east, but some good wash was obtained. The water in the alluvial material was very heavy, and work was discontinued in this quarter and concentrated on the Pinafore reef.

Golden Era.—The workings to be described were from a shaft just to the south of the reef and just on the west of the main road. In prospecting at the 170-foot level in a north-easterly direction from the shaft, black clay was cut at 340 feet from the shaft, and the bedrock appeared again 60 feet further on. The bottom of the gutter was proved by shafts to be 15 feet below the drive, or 185 feet from the surface. The wash was very irregular, and had some large boulders. Pan prospects from the western side of the channel were satisfactory, and good coarse gold was obtained. Pyrite was common in the lower parts of the wash. Work was finally abandoned owing to difficulties with ventilation and water.

New Golden Heart.—The alluvial workings on this mine are described in the description of the mine workings.

Pinafore Company.—A shaft, marked on the plan, was sunk in 1914 by the Pinafore Company to work the deep alluvial ground. A shaft was sunk 260 feet, and a drive was extended 230 feet west, at the end of which a 28-foot rise tapped the gutter in very heavy boulder wash, large blocks of sandstone, and smaller shingly material. The prospects were good, but patchy. A gutter drive was extended 280 feet south, with extreme difficulty owing to the immense boulders, and prospects improved, beautiful samples of coarse gold up to $2\frac{1}{2}$ dwt. being obtained. A connection was made with the blind shaft from the New Golden Heart Mine. Work proved unpayable owing to the immense boulders and sandstone blocks in the gutter, and operations ceased in 1915.

King Prospecting Association (Morning Star Reef).—The work on the alluvial gutter is described in the description of the workings on the Morning Star reef.

Diamond Drill Bores.—Two sets of bores were sunk in 1883 and 1892, four bores each time, and the records are given below:—

DIAMOND DRILL BORES, 1883.

No. 1 Bore.

Surface, 254 feet above sea-level. Bedrock, 34 feet above sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface clay, earth, &c.	8	6	8	6
Rubby basalt	12	6	21	0
Basalt	154	6	175	6
Sandy clay, brown clay, and wood	16	6	192	0
Wash	0	6	192	6
Sandy clay and floating reef	27	6	220	0
Sandstone bottom	26	0	246	0

No. 2 Bore.

Surface, 194 feet above sea-level. Bedrock, 60 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	3	0	3	0
Gravel and clay	9	0	12	0
Rubby basalt	10	0	22	0

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Basalt	141	4	163	4
Black clay	1	8	165	0
Brown clay	2	0	167	0
White sandy clay and fine gravel	2	6	169	6
Floating reef, gravel, and sand	13	8	183	2
Brown clay and wood	2	6	185	8
Sandy clay and wood	20	4	206	0
Sandy clay	14	0	220	0
Slate boulder	0	6	220	6
Sandy clay and fine gravel	29	6	250	0
Sand and gravel	4	0	254	0
Slate bottom (not altogether certain, as no core was obtained)	10	0	264	0

No. 3 Bore.

Surface, 211 feet above sea-level. Bedrock, 11 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	6	0	6	0
Soft rock and clay	14	0	20	0
Basalt	150	9	170	9
Black clay	3	0	173	9
Brown clay	6	6	180	3
Floating reef and fine gravel	4	0	184	3
Clay and fine gravel	4	0	188	3
Clay and wood	6	0	194	3
Floating reef, gravel, cement, and wood	6	0	200	3
Brown sandy clay	18	0	218	3
Sand, clay, floating reef, and gravel	4	0	222	3
Sandstone bedrock	16	0	238	3

No. 4 Bore.

Surface, 197 feet above sea-level. Bedrock, ?

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	9	0	9	0
Rubby basalt	21	0	30	0
Basalt	96	6	126	6
Basaltic clay	16	0	142	6
Brown and black clay, wood, and fine gravel	1	0	143	6
Wash (gravel)	4	6	148	0
Vesicular basalt	3	3	151	3
Basalt (some of it vesicular)	30	3	181	6
Basalt	14	0	195	6
Basaltic clay	0	6	196	0
Black clay	3	0	199	0
Brown clay	21	10	220	10
Sandy clay	1	0	221	10
Gravelly wash	3	6	225	4

No. 4. Bore—contd.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Pipe clay	15	0	240	4
Sand and wood.....	3	0	243	4
Gravelly wash and wood	4	10	248	2
Gravel	0	6	248	8
Sandy clay, gravel, floating reef, and wood	8	0	256	8
Gravelly wash	6	10	263	6

It was not certain if this bore reached bottom. Some gold is reported to have been got in the lowest gravel.

DIAMOND DRILL BORES, 1892.

No. 1 Bore.

Surface, 163 feet above sea-level. Bedrock, 12 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface material, clay, earth, &c.	11	4	11	4
Scoriaceous vesicular basalts	24	10	36	2
Basalt, more solid	16	6	52	8
Vesicular basalt	36	7	89	3
Hard brown fine sand	4	0	93	3
Hard vesicular basalt	11	2	104	5
Dark-brown compacted fine sand	4	6	108	11
Whitish-grey compacted fine sand	2	8	111	7
Soft scoriaceous basalt	6	2	117	9
Brown sandy clay	2	11	120	8
Grey sandy clay	1	0	121	8
Compacted coarse and fine sand and fine gravel with peaty markings.....	2	3	123	11
Greyish sandy clay with peaty markings	8	0	131	11
Brown compacted fine sand and mud with carbonaceous mark- ings	12	5	144	4
Basalt, partly vesicular	28	4	172	8
Brown compacted fine sand and mud	2	9	175	5
Light-coloured bluish slate (bot- tom)	15	1	190	6

No. 2 Bore.

Surface, 160 feet above sea-level. Bedrock, 60 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil, &c.	14	0	14	0
Blue clay	1	0	15	0
Hard rubby basalt	57	4	72	4
Hard brown clay	1	9	74	1
Rubby basalt	2	4	76	5

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Brown clay.....	0	10	77	3
Rubby basalt.....	8	7	85	10
Blue clay.....	1	10	87	8
Brown sandy clay with slate and quartz pebbles and decayed wood.....	6	3	93	11
Grey sandy clay and decayed wood.....	8	7	102	6
Brown clay with carbonaceous matter.....	21	9	124	3
Basalt, vesicular.....	6	1	130	4
Basalt, very hard.....	69	8	200	0
Black clay.....	1	0	201	0
Brown clay and carbonaceous matter.....	3	3	204	3
Coarse gravel, floating reef, and decayed wood.....	10	8	214	11
Brownish sand.....	2	6	217	5
Coarse gravel, floating reef, and wood.....	2	11	220	4
Soft sandstone, showing quartz veins.....	22	6	242	10

No gold found in the bore.

No. 3 Bore.

Surface, 164 feet above sea-level. Bedrock, 87 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil, &c.....	8	6	8	6
Hard rubby basalt.....	68	0	76	6
Brown clay.....	2	5	78	11
Rubby basalt.....	5	9	84	8
Brown clay.....	2	0	86	8
Brown clay, fine gravel, floating reef, and wood.....	6	5	93	1
Fine sandy clay and wood.....	6	6	99	7
Brown clay and carbonaceous matter.....	29	2	128	9
Basalt, vesicular.....	38	8	167	5
Basalt, hard.....	41	0	208	5
Basalt, soft.....	1	1	209	6
Black clay.....	2	0	211	6
Brown clay.....	0	6	212	0
Gravelly wash, floating reef, and decayed wood.....	10	3	222	3
Brown sandy clay and wood.....	2	6	224	9
Coarse gravel, floating reef, and decayed wood.....	3	9	228	6
Blue sandy clay.....	4	10	233	4
White sandy clay.....	2	0	235	4
Brown sandy clay and wood.....	3	4	238	8
Sandstone boulder.....	5	0	243	8
Gravelly wash and floating reef.....	7	5	251	1
Soft sandstone bottom.....	15	5	266	6

No gold found in the bore.

No. 4 Bore.

Surface, 197 feet above sea-level. Bedrock, 73 feet below sea-level.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface clay	9	0	9	0
Basaltic boulders	9	0	18	0
Basaltic clay	6	6	24	6
Basaltic boulders	2	0	26	6
Basalt, rubbly	13	8	40	2
Basalt, solid	83	8	123	10
Black clay	6	5	130	3
Brown clay, floating reef, and fine gravel	5	0	135	3
Brown sandy clay and wood	9	3	144	6
Basalt, vesicular	51	10	196	4
Black clay	1	6	197	10
Brown sandy clay and wood	22	8	220	6
Gravelly wash, wood, and pyrites	5	7	226	1
Whitish sandy clay, fine gravel, and floating reef	5	2	231	3
Bluish clay, fine gravel, and floating reef	1	11	233	2
Whitish clay	4	0	237	2
Brown clay and wood	1	0	238	2
Sand and wood	2	6	240	8
Gravelly wash with much pyrites	8	4	249	0
Bluish clay, fine gravel, and sandstone boulders	2	6	251	6
Gravelly wash	11	2	262	8
Gravelly wash with large sandstone boulders	7	4	270	0
Soft sandstone bottom	9	0	279	0

No gold found in the bore.

This bore was sunk about half a chain south-east of the No. 4 bore of the 1883 series, as to which there was some doubt if the bedrock had been reached.

From the records it is seen that the No. 3 (1883) bore is on the old spur between the ancient Blanket Creek and Sludge Creek valleys, which therefore had not joined at that point. It is also seen that it is uncertain whether the line of three bores sunk in 1892 had crossed the gutter, but, considering the position of the bores on the side of the basalt flow, it is probable that they have not crossed the gutter, and that more bores to the east of those already sunk would strike bedrock at lower levels.

The descriptions of the workings of the deep lead show that there are probably good values to be obtained from the wash in the gutter. The only

part where the gutter has been worked was at the top part of the sub-basaltic portion, and it is obvious that torrential conditions prevailed at this point. This is shown by the enormous boulders and steep grades, and conditions would be bad for concentrating the gold in the stream-bed, although some very coarse gold was found, and the expense of working would be very much increased by the boulders in the wash. At points lower down the lead, as in the East Pinafore shaft, good gold has been obtained on the side of the gutter, and it is probable that the values improve, or at least are maintained, in the gutter itself.

Before any mining is attempted on the deep lead the position of the gutter should be found by boring, although the results of the boring should not be taken as an indication of the value of the wash. The best position for mining would probably be just below the junction of the two branches, i.e., the Sludge Creek and Blanket Creek branches. The Sludge Creek branch seems to have had a much steeper grade than the Blanket Creek branch, and therefore would be a much faster flowing stream. When the Sludge Creek branch entered the slower moving stream, much of the gold which was carried along in the swifter portions would be dropped, with a consequent enrichment just below the junction of the two branches. To obtain the position of this junction a systematic scheme of boring would have to be carried out.

Other pre-basaltic leads have been traced on the surface to the point where they pass underneath the basalt, where the workings were discontinued. It is unlikely that all these are branches of the deep lead, and they seem to have been formed at different periods in the filling of the original deep lead valley. The principal leads which belong to this class are the Pinafore, Golden Point, and Native Youth, and Kerrigan's lead, with other less important leads.

Pinafore Lead.—This lead has been followed from a point to the east of the Pinafore main shaft, just on the opposite side of the road, along the course shown on the plan to the point where it passes underneath the basalt. It runs out on to the

surface, and disappears for about 3 chains, but reappears, and the wash can be seen in the upper parts of the White Pinafore shaft. Considering the grade of the lead, it is unlikely that it passes down to the bedrock of the deep lead, but it probably runs on to one of the basalt flows, and is covered by the later flows.

Some coarse gold was obtained in the alluvial work at the head of the branch of the deep lead which is seen about 10 chains south of the Pinafore reef, and more or less parallel with it. The gravel where the shafts were sunk was well rounded, and had granite and conglomerate boulders, evidently derived from the Permo-Carboniferous sediments. One of the West Pinafore shafts, sunk close to the edge of the basalt, proved the alluvial matter to be 50 feet deep; but the gutter was not cut.

Golden Point and Native Youth Leads.—These leads, although called by different names, seem to belong to the same line of deep alluvial ground which runs along the east side of Sludge Creek. At the north end the Native Youth lead passes underneath the basalt, but here, again, it seems unlikely that the lead passes down to bedrock, but runs on to one of the earlier basalt flows. The lead has been thoroughly worked from shallow shafts, the deepest of which are about 30 feet.

Kerrigan's Lead.—This lead runs across the top of the spur on which the Launceston road enters Lefroy, and passes underneath the deep gravels of the recreation reserve. The wash was well water-worn, and yielded some good gold values.

In the flats on Blanket Creek above the bridge on the Piper-road there is wash 16 feet or more in depth, and containing gold. Basalt occurs to the east, and Montgomery considered that the deposits were probably on the margin of a lead lying underneath the basalt.

(b) *Post-Basaltic.*

The post-basaltic alluvial deposits may be divided tentatively into the Pleistocene and Recent. The Pleistocene are those occurring away from the pre-

sent stream courses, but are younger than the basalt flows. The Recent deposits are those which have become concentrated in the present stream courses or on the surface.

Demijohn Lead.—This lead occurs well above the present level of Sludge Creek, and is probably an old course of this stream. It has been intensively worked by shafts, the deepest being 16 feet, to the point where it runs out on to the surface. At the time of my visit Mr. T. Lanham was commencing sluicing operations at the bottom of the lead, the tail-race being cut in basalt clay.

Poverty Gully.—A large amount of work was done in this gully in the early days of the field. At the bottom of the gully is Poverty Flat, where alluvial gold can be obtained in small amounts.

The alluvial deposits in the stream-beds are generally not payable, probably owing to the absence of a bedrock bottom on which the gold can become concentrated. The surface gravels are often slightly auriferous, and also the rounded gravels which cap the gravel hills that have been referred to. Alluvial work has been carried out in some of the gullies, and also on some of the surface gravels; but these are all unimportant.

The age of this deposit is not certain, since it may pass down underneath the basalt.

VII.—MINING PROPERTIES.

Golden Zone Reef.—This reef was first worked in 1898 and 1899, being then held under a lease of 10 acres by Messrs. P. C. Weetman and F. H. Crockford. A whip shaft was sunk to 100 feet, and a level driven at 60 feet and 100 feet. A crushing taken out at the 60-foot level is said to have yielded 2 oz. per ton. In 1925 the Golden Zone Syndicate was formed, and the shaft was unwatered, and work commenced at the 100-foot level. Work was at this stage when Mr. Nye reported upon the mine in 1925. Later a shaft was sunk to 190 feet, and a level driven at 180 feet. The mine from the end of the year 1930 was worked by the Wallis Gold Mining Company.

The reef, at the 100-foot level in the whip shaft, consists of 1 to 5 inches of quartz lying against the footwall, and dipping south at about 80 degrees. The reef occurs between two walls, referred to as the hanging-wall and footwall, from 2 to 4 feet apart, the remainder of the material between the walls being sandstone similar to that in the country-rock. This fissure may represent a fault-plane, but, if so, the displacement would be very small. Five samples were taken from the 100-foot level, and these gave gold values ranging from a trace to almost 8 dwt. per ton.

Old Comrades Reef.—This occurs about 15 chains to the south of the Golden Zone reef. It was found in 1898, and a shaft was sunk to 98 feet, where the reef was cut off by a fault having a strike about 30 degrees east of north, and dipping at 25 to 30 degrees to the west. The drag on the rocks adjoining the fault suggests that it is an overthrust, but it is likely that horizontal movement along the fault-plane predominated. A level was driven at 60 feet, where some stoping was done; and at 86 feet, where a drive carried west on the reef gave unpayable results; and also where some driving was done in an endeavour to find the displaced portion of the reef. In 1932 and 1933 the Wallis Gold Mining Company carried out some more work, trying to find the displaced portion, but without success.

Perpetual Reef.—In Mr. Montgomery's report of 1897 it is stated that three lines of reef occur at the Perpetual Mine, at the east end of the reef. The southern one of these is a small leader, carrying a little gold, but too small to work. The central is Hackett's reef, which is the main reef. The northern reef is gold-bearing, but very small. It has been cut by a number of trenches and small shafts, one of which went down 40 feet, and a crosscut was put out 150 feet to the north, without any gold being found. About 1880 a great deal of work was done on Hackett's reef to the east of the Perpetual main shaft, and a number of prospecting shafts were sunk. One crushing mentioned by Montgomery is said to have been 15 oz. 16 dwt. per ton.

Perpetual Mine.—The latest particulars which I could find of the Perpetual Mine are from Mr. Montgomery's report, which contains information collected in September, 1896. A level was opened at 100 feet in the main shaft, and the reef followed for 74 feet east and 41 feet west, with crosscuts 103 feet north and 44 feet south. The dip of the reef was south at about 1 in 3, and the reef was small, from 2 to 8 inches, but with good gold. At the west end the lode became broken up into strings. The north crosscut was in solid, undisturbed country, but the south one was in very disturbed country, which evidently forms a shear zone, or "formation," to use the local term. Two leaders carrying gold were found in this south crosscut.

Passing west from the Perpetual Mine the reef has been traced in occasional trenches and shafts across the Currie River road, and at the west end of the reef a number of shafts have been sunk, some to a depth of 60 feet. The reef was here cut off by a fault.

Equilla Reef.—This reef was discovered in the year 1917. A number of shafts, the deepest being 60 feet, have been sunk on the lode, and it has been traced on the surface by trenches. The lode dips to the south, has an average width of 9 inches, and its value is from $\frac{1}{2}$ to $1\frac{1}{2}$ oz. per ton.

Recruit Reef.—This reef is about 15 chains south of the Old Comrades reef.

East Recruit Mine.—This mine is on the eastern end of the line of reef where it has been traced on the surface. The shaft was sunk to 98 feet, and at 94 feet a crosscut was driven to cut the reef, which dips south at 1 in 4. At this point the reef consisted of a vein of slickensided and brecciated stone, 1 foot wide. A drive was extended 40 feet west, the lode-matter at the end of this being 3 feet wide. No gold was found in the stone, but a little is in the rubble and pug.

The reef from the East Recruit shaft has been traced by trenches over a gully to the workings of the Recruit Mine.

Recruit Mine.—The reef was first worked at this point under the name of the Perseverance. The information is quoted from the particulars which were supplied to Mr. Montgomery by Mr. W. H. Stubs, dated 7th November, 1896:—

Perseverance.—Started work some 15 years ago, and after doing a good deal of surface crosscutting a good-sized rubbly lode was discovered, which contained fairly good gold in places. Three shafts were sunk, and the lode intersected—No. 1 shaft, 30 feet; No. 2, 60 feet; and No. 3, 160 feet. Nos. 2 and 3 shafts were connected at 60 feet from surface, and the lode driven on 160 feet. In No. 3 shaft the lode was driven on for a similar distance. From the three shafts a small amount of stoping was done, producing about 150 tons of stone, which was crushed in small lots from time to time, and yielded from 4 dwt. up to 16 dwt. per ton. The reef was, however, too patchy to prove remunerative.”

The Recruit Company reopened this mine, and two shafts—a whip shaft 105 feet deep, and a main shaft 310 feet, with levels at 190 feet and 303 feet—were sunk. The reef at the 190-foot level was driven upon for 102 feet east and 63 feet west, and some driving was also done at the bottom level. A little stoping was done from the 190-foot level upwards, and 30 tons were crushed for 15 oz. 1 dwt. of gold. A level was driven on the whip shaft 30 feet east and 32 feet west, and some stoping was done, 43

tons giving 43 oz. 10 dwt., but of this 13 tons was poor grade quartz, and gave only 10 dwt. of gold. The reef is a large soft lode, with good gold in parts, but inclined to be patchy.

White Pinafore Reef.—This reef was discovered about 1900, and was worked by the New Pinafore Company. The main shaft levels were at 120 feet and 200 feet, and from the plan it appears that the reef was faulted between these two levels, and the lower part heaved to the north. Some stoping was done above the 120-foot level.

For the rest of its course the reef has been traced in prospecting shafts and trenches, but on the west it passes under deep gravels, and has not been followed.

Never-Go-Bung and Kitto Chum Reefs.—The Never-Go-Bung reef was first worked by the New East Chum Extended Company, and, as the name indicates, it was thought to be on the Chums line of reef. After this mine had closed down for some time, the reef was traced westwards, and given the name of the Never-Go-Bung reef.

New East Chum Extended Company.—These workings are on the east end of the line of the reef, which passes underneath the basalt immediately to the east of the workings. The following particulars were taken from Mr. Montgomery's report, and were given to him by the mine manager, Mr. Williams:—The main shaft was sunk 150 feet, and the reef, carrying gold, was cut 20 feet south from the shaft. After driving east for 40 feet the reef became 1 foot wide, and for 30 feet further gave splendid prospects. The drive was continued for 105 feet, but from the description the lode had evidently broken up into strings. The shaft was then sunk deeper to 200 feet, and the reef was cut 24 feet south of the shaft, showing that at this point the reef dipped to the south at 8 in 100. After driving east at this level for 40 feet, the reef widened to $1\frac{1}{2}$ to 2 feet, but the water then became too heavy for the small pumping plant, and the mine closed down. The shoot of rich stone in this mine pitched to the east.

To the west of the New East Chum Extended shaft the reef has been worked in a number of small shafts, the Never-Go-Bung main shaft being almost on the western end of the length of reef which has been traced on the surface.

Never-Go-Bung Company.—The reef here is about 4 or 5 inches in width, and averages about 1 oz. per ton, the values, however, not continuing below 40 feet from the surface. A shaft was sunk to 80 feet, and a little driving was done; but the reef was unpayable at this level. Another level, 30 to 40 feet from the surface, was driven, and most of the payable stone was obtained above this.

Kitto Chum Reef.—This is probably the western continuation of the Never-Go-Bung reef, on the other side of the deep gravels around Chum Creek. This was discovered in 1908 by Mr. T. Kitto, who sank a shaft to 70 feet and took out a crushing. A company was then formed, and a shaft, 200 feet deep, was sunk about 75 feet west of the prospecting shaft. After driving east Kitto's original workings were connected with these by means of a rise. The gold values, however, did not extend below 80 feet. The reef has been cut on the surface by some trenches.

Chums Line of Reef.—This line of reef is one of the longest in the field, and, unlike the majority of the long reefs, it consists of solid quartz, not having been broken up by repeated movements along the fault-plane. It starts below the gravels near Chum Creek, and passes to the high ground on the west of this stream.

East Chum.—In this mine there are three reefs. The northern one is probably the Kitto Chum, but the gold values are small. The main reef is at the main shaft, and Williams' reef is on the south. Although the main reef is still big, it shows a tendency to split up into several branches. The main shaft was 413 feet deep, the bottom level at 400 feet not being shown on the plan. There were three small lodes cut in the south crosscut. The country consists of slates and sandstones, striking north-west, and dipping to the south-west at 15 to 30 degrees. Some of the stopes of the East

Chum mine near the western boundary dip to the north, while in the adjacent New Chum mine there is a southerly dip. Up to 1883, 331 oz. 5 dwt. of gold had been produced, but the mine had never paid dividends.

Chums Proprietary Mine.—This includes the New Chum, West Chum, West Extended Chums, Our Boys, and the West Extended Pinafore Company, which, however is on the Pinafore line of reef. In 1897, when Mr. Montgomery made his report upon the field, the mine had been closed down for some time, the total value of the gold obtained by the first company being £108,036, and £58,250 being paid in dividends.

The main shaft of the Chums Company was that which had been sunk by the West New Chum Gold Mining Company, but since the days of this company it had been unpayable. Gold was first obtained 62 feet from the surface, the reef being from 1 to 3 feet wide, and of which a crushing of 41 tons gave 6 oz. 13 dwt. per ton. Thureau in 1883 gave the total yield of the mine as 13,939 oz. and dividends as £21,000.

In these mines the reef generally consisted of solid quartz, which had not been broken up, with a good deal of pyrite and stibnite. In many places the reef divided into two or more branches, which were more or less parallel, with sometimes gold being absent in one branch and present in the other. At the west end the reef appeared to be showing an increased tendency to split into branches.

Two very old shafts, known as the Our Boys shafts, were sunk on the line of reef west of the New West Chum shaft. Thureau states that the old shaft was 200 feet deep, with a level at 250 feet. Gold-bearing stone, 6 to 8 inches wide, was found at the 100-foot level, and at that time they were unsuccessfully trying to find the shoot of gold in the new whim shaft.

Unity Mine.—This was formerly called the United Chum. The workings are shown on the accompanying plan. The Pinafore reef, which was cut and driven on at the 270-foot level, proved disappointing. Thureau in 1883 gave the amount of gold

obtained from the mine as 1392 oz., but some has been got since that time.

The very old shaft of the Ryhope Gold Mining Company is further west, but there is no record of a lode being cut in the workings.

Pinafore Line of Reef.—This is a wide, soft reef, very much broken up, and consisting of several veins of quartz in a shear zone. It runs practically throughout its course underneath basalt or deep gravels, so that it cannot be traced on the surface. The course of the reef marked on the plan is taken from Mr. Montgomery's plan, in which it was compiled from mine plans.

East Pinafore Mine.—The first 236 feet of the main shaft of this mine were sunk through basalt and Tertiary deposits. Levels were opened from the shaft at 240, 263, and 343 feet, and some driving was done on the last two levels. A long cross-cut, 240 feet north and 180 feet south, was driven at the 263-foot level, and a small lode was cut 130 feet north of the shaft, and the main Pinafore reef 80 feet south of the shaft. In the 343-foot level the main lode was cut at 110 feet south of the shaft, giving a dip of 38 in 100 to the south. The reef was very broken and mullocky. The mine had little success, and it was closed in 1896.

New Pinafore.—The workings of this mine are shown in the accompanying plan and section. Near the surface the reef had good gold values, and this was stoped out. When this was worked out it was decided to test the reef in depth, and work at lower levels was commenced. At the lower levels it was seen that the reef split into branches in depth, and at 800 feet there were three branches of the main lode, which were called the "footwall," "intermediate," and "hanging-wall" reefs. Before cutting the "footwall" reef several small leaders, some carrying gold were cut. The reef was from 3 to 4 feet wide, and very brecciated, in the west drive along the "footwall" reef, but it carried no gold. In the east drive there was a little gold, and the pyrites in the reef contained 1 oz. 13 dwt. of gold per ton. Between the "footwall" and the "intermediate" reef the country was hard and not dis-

turbed. The "intermediate" reef appears to be along the fault-plane along which most of the movement has taken place, and it is a wide mullocky reef, in which there is a little gold, but it was not payable. The "intermediate" reef was then tested at 1081 feet by sinking a winze and driving along it, and a little gold was obtained here. The shaft was then sunk to 1200 feet, and a great deal of driving and crosscutting was done at this level. The drive on the south "hanging-wall" reef was extended west for 500 feet, the reef being in places 20 feet wide, with an occasional pennyweight or two of gold. There is a report that there was a small patch of rich stone found at this level; and there was a little stoping done. A long crosscut was driven north, and five reefs were cut, along which some driving was done; but all were unpayable.

Up to the 22nd October, 1896, 46,032 tons had been crushed for 42,212 oz. of gold. Later, whilst the exploratory work at the deep level was carried out, the battery tailings were cyanided to help to carry on the work. When the mine closed in 1904 it had produced 50,506 oz. of gold, and £71,500 had been paid in dividends.

West Pinafore Mine.—This adjoins the workings of the New Pinafore Mine on the west. The main shaft levels were at 143, 206, 306, and 450 feet. All the stoping was done on the shoot of ore pitching west from the New Pinafore workings, and there was none done below the level corresponding to the 278-foot level of the New Pinafore Mine. Up to 22nd October, 1896, there had been 6709 tons of ore crushed, for 4551 oz. of gold.

West Pinafore Extended Company.—This company sank a shaft with a level at 170 feet, and the reef was cut about 290 feet north of the main shaft. The reef here was a wide mullocky formation, containing hardly any gold.

Golden Era Reef.—The Golden Era reef can be traced on the surface by trenches and prospecting shafts, and has been worked from main shaft along its length. The most easterly of these are two which were sunk by the East Golden Era Company, and

are 200 feet and 206 feet deep. Higgs' shaft, northwest from the latter, was sunk to work a small but rich leader, called Higgs' leader. The leader, was about 1 foot wide, and 29 tons of quartz, obtained between 40 feet and 70 feet, gave 93 oz. of gold.

Amalgamated Golden Era Company.—The particulars of this mine are taken from mine reports compiled after the mine had closed in 1896. The shaft was 250 feet deep, and at 240 feet a cross-cut was driven 93 feet north. At 16 feet a small unimportant leader was cut. At 67 feet there was another dipping to the north, with a bearing of 80 degrees, this being followed for 30 feet east and 15 feet west. It was small, but contained gold. The main lode, where it was cut, was 2 feet 6 inches wide, but the width varied along its course. It was followed for 80 feet east and 15 feet west, and rich stone was obtained at 60 feet in the east drive, where the reef was 18 inches wide. The rich stone passed down beneath the floor of the drive, but did not rise above the back of the level. The large amount of water and want of capital caused the mine to close.

Clarence Reef.—This reef is one of the "soft" reefs which have been broken up by faulting subsequent to the formation of the reef, and which lies in a shear zone, or lode-channel. The reef consists of two main branches, the North Clarence and South Clarence reefs. Montgomery considered that the two branches were identical, and that the western portion of the reef had been heaved to the north by a fault. He states that the western and northern portion dies out suddenly going eastward, and had not been cut in any branches or shafts; and, on the other hand, the eastern and southern portion dies out just as suddenly when going west. He considers that the reef worked in the East Clarence is the south reef, but from the surface mapping, and allowing for the steep slope at this spot, it is more likely that it was the north reef. The surface workings of the South Clarence reef can be traced for only a short distance, and it cannot be seen from these whether the reef con-

tinues to the East Clarence or dies out before it reaches there. However, I am inclined to the view that it is the North Clarence reef that has been worked in the East Clarence Mine, and that the South Clarence reef is a branch of the main reef.

New Golden Heart Company.—This company has worked the reef furthest east, and the shaft was sunk through basalt. The shaft was 220 feet deep, and gave the following section:—

	ft.	in.	Total.
			ft. in.
Basaltic clay	30	0	30 0
Strong basalt	41	6	71 6
White silt	8	0	79 6
Dark soil	1	6	81 0
Sandy clay	10	0	91 0
Waterworn wash	10	0	101 0
Slate and sandstone	119	0	220 0

A crosscut was driven north at the 200-foot level, and at 13 feet from the shaft a small reef was cut, 6 to 8 inches wide, and running 93 degrees, and dipping 68 degrees south. Another reef, 6 to 8 inches wide, running 85 degrees, and dipping at a steep angle to the north, was cut at 44 feet, and some good gold was obtained from this. The reef was cut in the centre of the crosscut by a fault running at 140 degrees, and dipping at 3 in 2 to the south-west. The country through which the crosscut was driven contained numerous small vertical veins of quartz from $\frac{1}{8}$ to 2 inches in thickness, and running more or less east and west. The main Clarence reef was cut at 120 feet from the shaft, and was driven 25 feet west when the mine closed down. It was reopened in 1913 by the Golden Crest Company, which unwatered the shaft, and started driving east and west on the 190-foot level. One hundred and eighty feet were driven west, and a little gold, but nothing payable, was found; and at the end of the drive a crosscut was driven 30 feet north, and a rise put up 30 feet to connect with old workings from the East Clarence shaft. The eastern drive was continued along the course of the reef, which carried a little gold, and at 282 feet from the crosscut some alluvial matter, consist-

ing of sand, silt, and fossilised wood, appeared. The drive was continued through the alluvial matter for 185 feet, and bedrock again appeared, and, after driving another 20 feet, crosscuts were driven north and south to pick up the Clarence reef, without success.

To test the gutter a blind shaft was sunk 60 feet east of the western bank. Sand and alluvial matter were passed through for 17 feet, and then heavy, waterworn wash was met with, and this continued for a further 18 feet down to bedrock. The blind shaft was then sunk a further 14 feet, making a total depth of 49 feet, and a drive was extended east for 45 feet, principally through waterworn wash, all of which carried gold. As the bedrock had again passed underneath the floor of the drive, another blind shaft was sunk, and it reached the bottom at 6 feet, which made a total of 50 feet from the main drive and 230 feet from the surface. The wash from the bottom of the shaft gave 13 dwt. of loose gold, and besides this there was some in the quartz. Work was then suspended from this point, and a shaft, 12 feet by 4 feet, was put down to test the gutter. There is no further record of these operations, so evidently operations ceased before bedrock was reached, or else the wash proved unpayable.

East Clarence Mine.—The main shaft of this mine is 230 feet deep, with levels at 100 feet, 160 feet, and 220 feet. At the 100-foot level the lode is 43 feet north of the shaft, and has been followed 55 feet west and 95 feet east. The reef underlays to the south, and is 3 feet wide, lying in a much wider lode-channel. In the main crosscut a hard footwall is 8 feet past the lode. Gold was found in the floor of the drive at 14 feet east of the crosscut, and stoping began in the roof at 30 feet. At the 160-foot level the reef was 22 feet north of the shaft, and drives were extended 240 feet east and 143 feet east. The shoot of gold at this level was to the west of the shaft, and apparently pitching to the west at a flat angle. Several good crushings have been taken from the mine.

Clarence Mine.—The Clarence main shaft was 209 feet deep, and levels have been opened at 80 feet and 194 feet. At 194 feet a crosscut was driven 177 feet in a south-south-easterly direction, and at 45 feet from the shaft it cut the north lode, which was driven upon east for 284 feet. The lode-matter consisted mainly of soft mullock, with some crushed quartz. For 60 or 70 feet in the east end of the drive some gold-bearing stone was obtained, and a little stoping was done, but the quartz was much shattered and crushed. In the crosscut to the north of the reef it was seen that the country was very shattered, and the faulting on this reef seems to have formed a fairly wide shear zone. At 160 feet in the crosscut a small drive was put along a "break" in the country, and which may represent the South Clarence reef. In the 80-foot level a similar "break" was seen.

In the 80-foot level the reef was cut 23 feet north of the shaft, and was represented by a shear zone, 4 feet wide, of pug and shattered country and fragments of quartz. A drive was extended 256 feet east, and in the last 63 feet, where the quartz had not been carried away by faulting, a little gold was found. This occurrence corresponds to the portion where the ore was stoped from the lower level. The north lode passed through the shaft between 113 to 125 feet, where it was from 3 feet to 3 feet 6 inches wide. It contained no free gold, but a great deal of pyrites, which is reported to have assayed 12 oz. 15 dwt. and 22 oz. 8 dwt. on two occasions.

The reef has been traced for some distance east of the Clarence shaft by means of trenches and small prospecting shafts.

Welcome Reef.—This reef occurs on the east side of the basalt of the deep lead. Montgomery considered that the Welcome reef is the continuation of the Morning Star reef, but the mapping indicates that the Welcome reef is too far north for this, and it does not appear to have any equivalent on the other side of the basalt. The country-rock consists of soft, white sandstone, unlike the rather

schistose rocks of the central part of the field. From the east the reef has been traced by some trenches and prospecting shafts to the main shaft of the Welcome Mine.

Welcome Mine.—The main shaft was sunk 186 feet, and a crosscut was driven 34 feet to the north. The reef was cut at 20 feet, and consisted of a 3-foot width of rubbly quartz, but with no gold. A drive was extended 28 feet east, and work was abandoned at that level. A level was opened at 100 feet, and the reef was cut 50 feet north of the shaft. The reef here was 4 feet wide, and contained a little gold, but it was not payable. The mine closed when the water became too heavy for the small engine used.

The reef passes westward underneath the basalt and alluvial matter of the deep lead.

Morning Star Reef.—This reef has been traced eastwards just over the Back Creek-road. It has been worked in old shafts from here across Demijohn Flat, down to the flat by Sludge Creek, but no particulars can be obtained about these workings. In 1912 the King Prospecting Association carried out some work on this flat, mainly for alluvial gold. A shaft was sunk 60 feet, and the lode was followed into the alluvial gutter, which was 40 feet wide. At the gutter the lode was faulted, and heaved 45 feet to the north. A winze was sunk a further 40 feet, and the gutter was bottomed, but no gold was discovered either in the lode or the alluvial. Across Sludge Creek the reef rises into higher ground where the Morning Star shaft is situated.

Morning Star Mine.—The particulars of this mine were supplied to Montgomery by Mr. W. H. Stubs. From the old shaft, several crushings, taken from the surface to 70 feet, yielded from 4 dwt. to 17 dwt. per ton, the reef being from 2 to 10 feet wide. In the main shaft the No. 1 level was at 150 feet, and a drive was extended 150 feet east, and the reef stoped up to the 70-foot level, the ground being payable all the way. At the No. 2 level, 230 feet, a distance of 210 feet was driven

along the reef, which was from 2 to 4 feet wide and similar to the upper level. At the No. 3 level, 320 feet, a drive was extended 100 feet east on poor stone, but the values improved in the west drive, and the first crushing gave 12 dwt. per ton. The level was driven 300 feet, the first 200 feet being on payable ore, and good stone was encountered when stoping up from this level, one crushing of 400 tons giving a little over 400 oz. of gold. No. 4 level, 420 feet, was then opened, and 250 feet was driven along the reef west, which was 3 feet wide, but proved unpayable, except for one small patch of stone. The mine was then let on tribute, but soon closed down. It was unwatered in 1896 by the Amalgamated Morning Star Gold Mining Company, but was closed again almost immediately afterwards. The plans show that the reef had a steep dip to the south, with a shoot of ore pitching to the west.

Bendigo Mine.—The particulars of this mine were supplied to Mr. Montgomery by Mr. W. H. Stubs. The Reliance Company did some work about 1876, but soon closed down. In 1885 Stubs and Keys found a small, rich leader, upon which they sank a shaft 40 feet, the width of the vein varying from 1 inch to 12 inches. At the 40-foot level the vein widened for about 30 feet along the drive to 3 and 4 feet, with good gold at times, but it did not maintain this size either above or below the level. Another shaft was sunk to 70 feet, and 200 feet were driven along the reef, and although small, very rich patches were encountered, the reef was too small and patchy to be payable. Another shaft was sunk to 100 feet to strike the reef at the place where the best gold was obtained, but it proved valueless, and work ceased. The Young Bendigo Company then sank a shaft a further 70 feet, and the reef was cut and thoroughly prospected, proving to be of no value. The New Bendigo Company then sank the same shaft a further 60 feet, giving a total of 230 feet from the surface, and drove 60 feet west and 65 feet east along the reef. The vein proved extremely small and of no value, and the ground was very hard and expensive to work, and the mine closed.

Nugget Reef.—This reef has been traced in shafts and trenches from near the cemetery westwards to the Nugget shaft.

Nugget Mine.—The shaft was sunk 150 feet, and a crosscut driven 55 feet south, the reef being cut at 20 feet. A drive was extended 150 feet west, and then passed into basalt, when work was discontinued. No stoping was done on this mine, the reef proving unpayable.

The reef, since it passed through the residential part of the township, has been traced by sinking shafts and driving from these to cut the reef. By this means it has been followed over to the bridge where the Currje River-road crosses Sludge Creek. Here there was some work done on the reef by the Pinafore Company in 1909, and a shaft was sunk to 70 feet, and the reef driven upon for 600 feet, but nothing payable was found.

New Native Youth Reef.—The mines on this reef, from east to west, were the City of Launceston, New Native Youth, and the Excelsior. The reef dips to the north, which is contrary to most of the Lefroy reefs, and has not been broken by subsequent faulting movements, being a reef of solid quartz. The mine workings, taken from Mr. Montgomery's report, are shown on the accompanying plan.

The total yield of gold from the City of Launceston Mine was of the value of £10,000, and that from the Native Youth £95,589.

New Native Youth Mine.—Mr. W. H. Stubs worked this mine on tribute from 1887 to 1889, being the last to work the mine, and he supplied the following information to Mr. Montgomery:—

At the 800-foot level, 132 feet was driven west, the width of the reef being 3 feet 6 inches at the start, but it became very small and the country hard, and there was no gold. From 125 feet east from the crosscut the drive was continued, the reef being very small at first, but improving in size and appearance as the driving continued. A few colours of gold were found, and a rise was put up to test the values, but no more could be obtained.

At this level the walls were very hard and clean, and there was a slight dip of the reef to the south.

At the No. 3 level, 320 feet, there were two branches of the reef, which seemed to form on each side of a shear zone. Of these, the north, or "hanging-wall," reef was the smallest, averaging about 12 inches in width. The main reef was 17 feet 6 inches from the other. Some patches of payable quartz were found in each branch, but the reef appears to be rather patchy.

The reef is rather difficult to trace on the surface, since it passes right through the township of Lefroy, and consequently the old shafts and trenches have been filled in. However, there are a few shafts which show the general line of the reef. On the west of the Native Youth shaft the reef passes underneath the dam, and on the other side it can be traced in the workings near the Excelsior shaft. It has been traced up to the top of the hill on which the trigonometrical point E is situated.

Hit or Miss Reef.—This is a small line of reef, and does not appear to extend far east and west. It was last worked by the New Hit or Miss Gold Mining Company, and the following description includes the work up to September, 1896; the mine closed shortly after this date. It was later worked by the New Pinafore Company from the Golden Crown shaft. In this mine cross-courses are very numerous, but they do not appear to displace the lode appreciably. However, they appear to have a great effect on its size and value, as the quartz is gold-bearing on one side of the cross-courses and not on the other. The shaft was 272 feet deep, with levels at 185 feet and 263 feet. At the 185-foot level a crosscut was driven east and cut the shaft at 50 feet, and then 182 feet was driven along the reef. The last 94 feet of the reef was on a course bearing 60 degrees, and the reef became broken up into three parallel veins with only a $\frac{1}{4}$ to 1 inch of quartz in each. At the bend in the reef a crosscut was driven 108 feet to the south-east, following a smooth divisional plane in the country which dipped north-east at 63 degrees, and which has a strike parallel

to the bedding at this point. The beds dip at 40 degrees to 45 degrees to the south-west, so that the divisional plane cuts them almost at right angles. There is a little quartz along this plane, but little faulting seems to have occurred along it. Further back towards the shaft a cross-course occurs, but does not appear to have given any perceptible heave to the reef. On the east of the cross-course a rise was put up 50 feet on gold-bearing stone, and at 40 feet up the lode was followed east for 20 feet, but it became poor and small. To the west the cross-course was cut through, and proved to be 4 feet wide, but the reef became very small. The gold-bearing stone was confined to a few feet on the east side of the cross-course.

North of the shaft at the 185-foot level, the reef was cut at 9 feet and followed 26 feet easterly and 24 feet westerly. At the west end of the drive there was a fault 6 to 15 inches wide filled with quartz veins, pug, and mullock, with fairly defined walls, bearing 275 degrees, and dipping north. At the east end of the drive a rise was put up 50 feet in lode-matter, and a winze was sunk to the bottom level. In the chamber and shaft there was a seam of pug, 18 inches wide, running north-westerly, and dipping to the south-west. This cuts the lode in the workings from the winze, but does not leave it more than its own width.

At the 263-foot level the reef was cut 35 feet north of the shaft, giving a dip to the north of 1 in 3. The lode was followed 45 feet west and 33 feet east, the quartz being from 8 to 12 inches wide in a lode-channel of sheared country, with 1 to 4 feet between the walls. At this level the reef has smooth, hard walls, and is much more distinct than in the No. 1 level.

New Golden Point and Crown Reef, and Bain and Richards' Reef.—Both these reefs have been worked in the New Golden Point and Crown Mine. The shaft to the south-west belonged to the Golden Point Mine, and that to the north-east was the Golden Crown Mine, both the mines later being held by the New Golden Point and Crown Company, and still later by the New Pinafore Company.

Plans of the workings, compiled from plans furnished to the Inspector of Mines, are shown, but they are not complete. The Golden Point reef is the only reef in the field which has a course varying from the more or less east-west direction of the remainder of the reefs. The reef runs in a north-easterly direction, and is only a short reef. The country-rock appears to be much shattered, and it is probable that this reef formed along an oblique fissure formed by excessive local shattering of the country-rock whilst the normal east-west fissures were being formed. The longitudinal section seems to indicate that there are two short shoots of ore which are almost vertical. The reef dips to the north-west.

The Golden Point main shaft was 180 feet deep, and considerable work had been done above the 100-foot level. At the 100-foot level the reef was cut 30 feet south-east of the shaft, and was followed north-easterly for 116 feet, where it divided into two branches, the eastern one keeping on the old course of the reef, while the western ran on a bearing of 168 degrees, the former being followed for 21 feet and the latter for 49 feet.

On the No. 1 level in the Golden Crown shaft, a lode 3 to 5 feet wide, running east and west, was cut at 105 feet from the shaft. A little stoping was done, and three winzes were sunk. A cross-cut, 88 feet long, passed to the north of the shaft through disturbed country, with occasional strings and bunches of quartz. At 78 feet in this cross-cut an irregular break in the country was followed north-westerly, and after 24 feet the Bain and Richards reef was cut. In this level the country to the south of the shaft is undisturbed, but on the north it appears to be very shattered. No ore of any value was found on this level.

The Golden Point reef passed through the shaft at 145 feet, and was from 2 to 8 inches wide, and contained gold. At the 190-foot level a crosscut was driven 75 feet north, and for the first 37 feet it passed through a shear zone with several veins of quartz, and then it passed into more undisturbed country, but still containing numerous leaders. Good

values in the stone were obtained in this level, but the quartz was very faulted, and consequently very difficult to follow. In an intermediate level at 236 feet there was a good body of quartz, but there were also several veins carrying gold running in quite haphazard directions.

At the 270-foot level a crosscut was driven south through hard black slate. This was sometimes twisted, and probably it was still in the shattered zone. The lode was cut at 26 feet from the shaft, and the crosscut passed through rock full of quartz leaders, till at 72 feet a hard wall was struck. The wall was followed north-easterly 48 feet and south-westerly 13 feet, and there is about 3 feet of broken lode-matter on it, with a little gold. The strike of the wall corresponds better with the Golden Point reef than the Bain and Richards. At 329 feet in the shaft a leader carrying payable gold was cut.

The old Golden Point Mine yielded £15,000 worth of gold, and up to November, 1896, the New Golden Point and Crown Mine had crushed 1390 tons of quartz for 1210 oz. 6 dwt. of gold. The mine closed soon after this.

In 1901 it was reopened by the New Pinafore Company, which did some more stoping, and did some exploratory crosscutting and driving on the Hit or Miss and the Richards and Bain reefs. The mine again closed in 1903.

The Bain and Richards reef was worked in the New Golden Point and Crown Mine, as shown on the plan. For about 4 chains to the west of the main shaft the reef has been traced in trenches and a prospecting shaft, and then it passes underneath the deep alluvial deposits near Sludge Creek. The reef has been traced up the hill on the other side of the creek by trenches, most of which are now filled in. On the ridge at the west end of the line there are numerous prospecting shafts, which were sunk to find the origin of some rich surface deposits which were found to pass up to this ridge. No source of these deposits could be found.

Australasian and McIvor Reef.—This reef has been traced westwards from the Launceston-road to the McIvor shaft by means of trenches.

McIvor Mine.—The reef was rich on the surface, and a shaft was sunk to 100 feet, and a crosscut was driven 42 feet to strike the reef, along which 70 feet was driven. A little quartz was taken out at the surface.

In this mine McIvor's reef dips to the north, and the other (the North Reef) dips to the south.

Just to the west of this mine the reef passes under a deep alluvial flat, and has not been traced. On the other side of this the reef has been traced in some shallow prospecting shafts, and the Bluejacket and Australasian shafts had been sunk on the reef.

Australasian Mine.—Some good gold had been found in the surface trenches around this mine. A shaft 110 feet deep was sunk, and a crosscut 55 feet south was driven, the lode being cut at 45 feet. The lode at this place was 6 inches wide, and of no value. A drive was extended east for 48 feet, the reef varying from 3 inches to 20 inches in thickness, and having a large amount of pyrites. At the end of the level a rise was put up to one of the small prospecting shafts where the reef had already been cut, and, except for the capping of the lode, hardly any gold was found. The mine was closed before 1896.

Bluejacket Mine.—The shaft of this mine is about a chain east of the Australasian main shaft, and some rich stone was taken out near the surface, one crushing of 5 tons giving a little over 10 oz. of gold. The old Australasian main shaft was unwatered and the reef cut about 50 feet north of the shaft, and a drive extended about 70 feet to the east. Very little gold was found on this level. There is some doubt whether the drive was carried far enough to intercept the shoot of stone found in a prospecting shaft east of the Australasian main shaft. The mine closed when funds were exhausted. This reef dips to the north.

Prince of Wales Reef.—On the east this reef runs underneath the deep alluvial ground of Poverty Flat, where some alluvial work has been done. The East Prince shaft has been sunk through the alluvial ground about 2 chains from the edge of the flat, but no records are available of the workings. The reef has been traced in trenches towards the Prince of Wales shaft.

Prince of Wales Mine.—The only information about this mine was supplied in a letter, dated 5th November, 1896, to Mr. Montgomery by Mr. G. Beedham:

“About 17 years ago 10-acre Section 234-93G was opened by sinking a shaft 50 feet, and 50 tons of stone were crushed at the Native Youth battery from a well-defined lode at the 50-foot level, 5 feet wide, which gave 19 dwt. to the ton. At 75 feet a still better crushing was taken out. At 100 feet the lode was struck again, but broken up, and impossible to get a crushing out on account of the great influx of water. The lode underlays south.”

The Prince of Wales Prospecting Association has just lately been formed to reopen this mine.

Brisbane Reef.—This appears to be the westward continuation of the Prince of Wales reef, but the reef has not been traced in the central part. The reef has been traced westwards by trenches to the Brisbane main shaft. The main shaft is believed to have been 150 feet deep, but the reef was very small. One crushing is said to have given a payable return, but the reef was too small to be worked profitably.

To the west of the main shaft a fair amount of prospecting has lately been done, about five prospecting shafts having been sunk.

Wallis Mine.—On the east side of the Launceston-road, entering the township, a shaft has been sunk on a small leader, 1 inch wide, running east and west, and on driving east and west this soon cut out. The material lying on the mullock-heap shows that the shaft passed through a fault, which evi-

dently dipped at a flat angle, and it is reported that the shaft passed into good sandstone country. A crosscut was driven 50 feet to the north and 125 feet to the south, but no reefs were cut. The shaft was 90 feet deep.

Tablier Reef.—The Tablier reef is one of the long, wide, mullocky reefs characteristic of the field, but, although it has been traced for a long distance, only two mines have been working on it, and neither of these has been successful. From the east the reef has been traced in trenches and prospecting shafts to the Tablier main shaft. This was said to be 100 feet deep, and the reef was supposed to be 3 feet wide, but with no gold.

Between the Tablier shaft and the Princess Alice shaft Mr. T. Kitto and party have been carrying out a good deal of prospecting in shallow shafts, in some parts passing through wash to reach the reef. The Princess Alice shaft is 100 feet deep, and some driving was done, but without obtaining any gold. The lode is said to average 2 feet in width, and dips south. The lode has been traced some distance west, but nothing of value has been found.

Monkland Reef.—This appears to be the continuation of the Windermere reef, since it agrees very well on the plan. The main shaft of the New Monkland Gold Mining Company was 110 feet deep, with a level at 95 feet. The lode was cut by a crosscut 43 feet north from the shaft, and was then followed 5 feet east and 65 feet west. The reef was very poor, being almost barren. The reef had been worked before this company was formed, a shaft being sunk 150 feet, and some stoping was carried out. About 100 tons of stone was obtained from some small shafts sunk on the reef, and this was crushed in small lots, yielding from $2\frac{1}{2}$ dwt. to 6 dwt. per ton.

Windermere Reef.—This reef is small, and dips to the south. It has been followed by trenches and shafts for most of its length, and at its western end are the workings of the New Windermere Gold Mining Company. These workings are very old, and Mr. Montgomery reports that when he visited

the field in 1896 the main shaft was full of water, and he could obtain no particulars of the workings. There is a tunnel which can be visited at present, driven about 100 feet into the side of a hill, and which has cut the lode and followed it east and west. At about 100 feet along the eastern drive there is a winze sunk about 30 feet, and from which some good gold was reported to have been obtained. This winze was baled out by the Wallis Gold Mining Company, but proved unfavourable, and no further work was carried out. What I could see of the reef in this tunnel was very irregular, never being more than 8 or 9 inches wide, and sometimes represented by about 2 inches of pug.

Rifleman Reef.—This reef is away to the west of the main belt of reefs, being on the east side of Slaty Creek, downstream from the George Town road-bridge. The reef had been cut in some prospecting shafts when I visited the locality; it is about 9 inches wide, and occurs in a fault-plane. The country-rock consists mainly of slates. A number of shafts have been sunk, but no information about the workings can be obtained.

Leefloyd Mine.—This reef was discovered in the year 1931, and near the surface some very rich stone was taken out. The reef dips to the south. Several shafts have been sunk, the deepest being 75 feet deep. At 50 feet from the surface the reef was cut 6 feet from the shaft, and proved to be 18 inches wide and carrying 1 oz. of gold per ton. On driving along the reef, it was found to get small, and pinch almost to nothing. The shaft was then sunk a further 25 feet, and the reef cut 70 feet from the surface. The reef here is also small, and no driving was done at this level.

Specimen Hill Reefs.—Specimen Hill is a hill to the south of Lefroy, and is so called from the number of gold specimens that were found there in the early days of the field. Numerous small reefs have been found in this hill, having no particular dip, and it is probable that they represent the upper or lower portion of a big lode which has split up. If they represent the lower portion, of course, the

main lode would have been worn away, but, on the other hand, if they represent the upper portion, they would coalesce into a big reef at depth. The sinking of a deep shaft to test this could not be recommended as a commercial venture, since the depth at which they would coalesce, if at all, is indefinite, and would probably be beyond the depth at which surface enrichment is effective. Since this seems essential to make the reef payable in this field, it is unlikely that the reef could be profitably worked.

The northern lode shown on the plan is called the Golden Crest reef. This was worked at shallow depths, and then the Reward shaft was unwatered and the reef cut from there; but driving along the reef showed it to be unpayable.

Mr. Montgomery describes the following reefs in the vicinity of the Reward main shaft:—A vein dipping north has been worked in an underlay shaft 50 feet deep, 60 feet north of the main shaft; another small lode dips north in a small shaft west of the main shaft; and another lies about 68 feet south of the main lode.

The main shaft of the Reward Mine has levels at 108 feet and 250 feet. In the upper level a cross-cut was driven north 159 feet, and veins were cut at 6 feet, 66 feet, and 113 feet, the first dipping to the north and the other two to the south. The first was followed east 16 feet and west 64 feet, and the second for 40 feet to the west. At the bottom level the first lode was 6 feet from the shaft, and was followed 23 feet east and 64 feet west, the lode being from 2 inches to a foot in thickness. A rise was put up 40 feet, and the lode was followed on the south side of the shaft. Some rich gold was taken out here, but it proved to be only a small patch. In the same crosscut a lode of 12 inches of quartz and soft-lode matter was passed through 80 feet north of the shaft, and at 160 feet some threads of quartz were cut. These lodes do not appear to fault the country, and Mr. Montgomery considers that they resemble the Hit or Miss reefs in many respects.

The next reef marked on the plan is the Gift reef. This was discovered in 1909, and a whip shaft was sunk 100 feet, and the reef cut at 60 feet and 90 feet. One crushing of 11 tons gave about 5 oz. per ton. The Reward shaft was then unwatered, and the reef was cut at the 250-foot level. The reef at this point, and for some distance west, was of no value. A little prospecting with rises and winzes was done at shallower levels, but with poor results. Some of the parallel reefs were examined, but proved unpayable. Some more prospecting was carried out later by the Golden Crest Company, but the results were not satisfactory.

Queen's Birthday Reef.—This reef lies on the south side of Specimen Hill, and passes across the head of Specimen Gully. The Queen's Birthday shaft was 140 feet deep, and a little driving was done to the east on what was described as a soft "formation," the reef evidently having been broken by subsequent faulting movements.

The Reward Company sank a shaft east of that above, and at 70 feet cut the reef 20 feet south of the shaft. It consisted of 3 inches of quartz, but no gold. The company also drove 200 feet north, but cut no recognisable lodes.

Land-o'-Cakes Line of Reef.—This line of reef has been traced for the longest distance of all the reefs in the field. It is a wide, broken reef, showing numerous signs of repeated movement. A plan of the reef, copied from that given in Mr. Montgomery's report, is given, so that the workings will not need to be described in detail.

Mole Creek and Zeehan Mine.—The main shaft is 100 feet deep, the upper part being sunk through Permo-Carboniferous material. The shaft cut the lode at 80 feet, and reached the footwall of the "formation," or lode-channel, at the bottom of the shaft. A crosscut was driven 10 feet south, and then a drive was extended for 30 feet east on the hanging-wall. The lode-channel consisted of 10 feet of mullock and rubbly quartz, with smooth and regular walls. A few "colours" of gold were obtained, but nothing payable.

Admiral Mine.—Near this mine there are two branches of the reef, known as the Admiral north and south lodes. The south has been cut by shafts and trenches, and is a wide rubbly "formation," in which hardly any gold has been found. The north lode is of no importance, and seems to be dying out going westward.

Clansman Mine.—At this mine the south lode was of no value, and has been cut in only one or two workings. The north lode has been traced by a number of shafts, in an underlay shaft being a 12-foot lode-channel, but with no gold. In the Peden Prospecting Association prospecting shaft, east of the main shaft, the reef is 2 feet wide, and 175 tons were crushed, giving 10 dwt. per ton. From the Peden Prospecting Association whip shaft, east of the prospecting shaft, 20 tons of quartz were crushed, at 12 dwt. per ton.

Caledonian Mine.—At the 80-foot level there was no quartz in the lode-channel, and 116 feet had to be driven west before any gold was met with. At the 180-foot level the north crosscut cut the lode, whose walls were well defined, but running a little to the south of east. This may be due to the junction of the north and south lodes, seen in the Admiral and Clansman workings, occurring at this point.

The best gold was obtained from a prospecting shaft north-west of the main shaft, on a branch of the main lode. Ten tons of ore gave 24 oz. of gold, and another crushing of 40 tons yielded 9 dwt. 2 gr. to the ton. Deeper in the shaft there was very little quartz, in about 6 to 8 inches of lode-channel.

New Waverley Mine.—The workings on this mine are shown on the plan, with notes on the occurrence of gold.

Land-o'-Cakes Mine.—This was the best mine on the line of reef, a large amount in dividends having been paid. The last owners, the New Land-o'-Cakes Gold Mining Company, sank the main shaft to 400 feet, and crosscut to the lode; but it proved to be

valueless. The crosscut was driven south to cut the Volunteer lode, and the country in between the two lodes was found to be very disturbed.

Fortune of War Mine.—The company sank a shaft 50 feet deep, and cut a large mullocky lode-channel, but did not get any gold.

Rob Roy Mine.—In this shaft the footwall of the lode-channel was cut 70 feet from the surface. At the bottom level, 200 feet, the hanging-wall was cut 180 feet south of the shaft, the lode-channel being from 70 to 80 feet wide. A drive was carried along the footwall, where there was a little quartz. On the hanging-wall there was no quartz, only some pug being present. No gold was obtained from this mine.

Bannock Mine.—The Bannock shaft was said to be 190 feet deep, and has two levels driven north at 100 feet and 180 feet, but it was reported that the lode-channel had not been cut. On the other hand, in the long crosscut from the Captain shaft the Land-o'-Cakes lode-channel had been cut almost at the Bannockburn shaft, so that the latter must have cut it either in the shaft or when driving north. However, the lode-channel is slaty, and in the Bannock workings it may not have been recognised as lode-channel material.

To the east of the Bannock shaft are the Bannockburn and Specimen Hill shafts, and east of the latter a tunnel was driven on the lode, and at this point a good deal of gold was reported to have been found.

At the end of the line of reef there is a shaft sunk by the Digney Prospecting Association, but I have no particulars of the workings.

The Land-o'-Cakes lode, on the whole, has been a poor one. It is a large lode-channel, but without much quartz. Small payable patches were found in the Clansman, New Waverley, and Specimen Hill workings, and there was a good large shoot of ore in the Land-o'-Cakes Mine, but as a rule the gold values have been poor.

Golden Crest Reef.—This is a small reef in between the Land-o'-Cakes and Volunteer, and has been worked in a number of prospecting shafts. The reef is small, and has never been worked past the prospecting stage.

Volunteer Line of Reef.—The plan and sections of the workings of the mines on this reef are copied from Mr. Montgomery's report, with additions of later work in some cases.

The New Waverley sank a shaft 50 feet, and drove north to cut the footwall. The lode-channel was about 15 feet wide, with a little quartz, but consisting mostly of mullock. No gold was found here.

In the south crosscut from the Land-o'-Cakes shaft at the 400-foot level, the footwall of the lode-channel was cut 397 feet from the shaft, and was driven across for 42 feet without cutting the hanging-wall. They drove 20 feet east on the footwall on 2 inches of stone, with no gold. The stone widened out to 10 inches, which, however, was "not solid," but contained a little gold, in a drive carried 12 feet west along the same vein.

Captain Mine.—At 200 feet in the main shaft, the hanging-wall of a large lode-channel was cut dipping 55 degrees south, and this was driven on to the west for 17 feet. Mr. Montgomery considered that a lode, perhaps the branch seen in the West Volunteer and West Volunteer Extended, was to the south of the main shaft, since between the shaft and the hanging-wall of the above lode-channel the country was much disturbed, as if it were between two adjacent lines of faulting. The lode-channel in the north crosscut was 123 feet wide, consisting of very broken country-rock with a fairly well defined and smooth hanging-wall. The channel was followed east and west, but gave little quartz and no gold.

At 421 feet in the crosscut a small lode, consisting of 3 to 18 inches of soft material between smooth walls, dipping at about 1 in 1 to south, was cut, and Mr. Montgomery considered that this was

probably the Cadet reef. The Land-o'-Cakes lode-channel, which was cut in the crosscut, was 78 feet in width, with 15 inches of quartz on the footwall, but no gold.

West Volunteer Extended Mine.—This company decided to sink a deep shaft to cut the shoot of stone which was pitching to the west from the West Volunteer Mine. The shaft was sunk 750 feet before a level was driven, and the lode was cut 27 feet from the shaft. The crosscut was extended, but not far enough across the lode-channel to cut the footwall. The hanging-wall was followed east and west, but it did not yield any gold-bearing quartz. Then a crosscut was driven south to cut a lode which had branched from the main reef in the West Volunteer Mine, and two lodes were cut. The first was cut at 48 feet, and was small, and did not fault the country, being 2 to 6 inches of soft lode-matter between smooth walls, dipping at 78 degrees south. At 107 feet another lode was cut which corresponds very well with that worked by the West Volunteer Company; this lode, which does not appear to fault the country, was followed east and west, but carried no gold. At the time of Mr. Montgomery's report a level was being opened out at the 400-foot level, but no record of the workings at this level can be obtained. The mine closed down fairly soon after this, so not much work could have been done.

West Volunteer Mine.—The workings of this mine are shown on the plan of the reef. Looking at the plans of this mine and the Volunteer adjoining it, it is seen that the workings in the West Volunteer Mine turn to the south, and this has been found to be due to the fact that the channel has sent off a branch to the south which gradually leaves the lode-channel and enters solid country in the hanging-wall. At the lower levels of the West Volunteer Mine the lode becomes small, and resembles its occurrence where cut in the West Volunteer Extended Mine. Where it joins the main Volunteer reef, however, it becomes a strong reef, and appears to fault the strata. In the Volunteer Mine, all the gold was taken from the footwall of

the lode-channel, which was 30 to 60 feet wide. Working west the gold was lost. As the workings of the West Volunteer approached their eastern boundary, it was seen from the plan that they did not correspond with those of the Volunteer. A crosscut was then driven to the south by the Volunteer Company, and the gold-bearing quartz was again picked up and worked back east to the point where they had lost the gold. Thus at this point the quartz is seen to leave the footwall and cross to the hanging-wall, finally passing into the solid country of the hanging-wall. The country between these two reefs close to their junction is very disturbed, but on passing west it becomes more settled. The Cadet lode, shown as worked in the chamber of the No. 3 level, Mr. Montgomery considers to be identical with the footwall stone of the Volunteer Mine and the soft lode-channel cut north of the West Extended Volunteer shaft at the bottom level.

At the time of Mr. Montgomery's report 2589 tons of quartz had been crushed at this mine, for 11,252 oz. of standard gold, and £22,750 had been paid in dividends.

Volunteer Mine.—The particulars of this mine are taken from a report made by Mr. Twelvetrees in August, 1899. The main shaft had been sunk to 628 feet, and from there an underlay shaft had been sunk to 1250 feet. Above 105 feet the ground was payable, and between 105 feet and 164 feet it was patchy, with a great blank, which is probably due to the reef being cut off by a slide; between 164 feet and 225 feet the stone was poor, but between 225 and 364 feet it was the best in the mine. Below 298 feet the reef became poorer, until below the 463-foot level it practically ceased to be auriferous.

Mr. Twelvetrees paid particular attention to the question whether a wide channel, or "formation," existed, being a sheared zone of country, in which the reefs were to be found probably on either of the walls, and sometimes in the middle, the rest being filled with shattered country. In the crosscut south in the 364-foot level there was a vein of "soft, black, and calcareous looking stuff" at 40 feet from the

hanging-wall of the lode. The country between the lode and this vein was slate and hard sandstone, traversed by veins of "buck" quartz, which evidently filled cracks in the rocks. In the 463-foot level at 102 feet a small pug vein was cut, and the country along the crosscut was undisturbed, but veined with buck quartz. Mr. Twelvetrees concluded from his observations that the idea of a sheared zone constituting a lode-channel with well-defined walls may be dismissed. It is possible, however, that his conception of a "formation" may have been a channel in which the country has become entirely broken up and displaced. From his descriptions of the country-rock being veined by "buck" quartz, it seems that the country had been subjected to a certain amount of strain, and it is possible that it may be in a shear zone. Not having been able to make a personal observation, I am unable to state a definite opinion upon this subject.

At the 1018-foot level an exploratory crosscut was driven north in search of parallel lodes. It passed through undisturbed country, and did not cut any lodes.

At 628 feet the walls of the lode were from 5 to 7 feet apart, the footwall being very well defined, and with a very smoothed surface. The space between the walls was filled with mullock. At the 750-foot level the reef was similar in its occurrence to the 628-foot level.

At the 1250-foot level the walls of the reef were from 2 feet to 7 feet apart, filled with broken slate and sandstone, bunches and strings of quartz, with pug on smooth walls. Some very small quantities of gold were found at this level. The mine was closed soon after Mr. Twelvetrees made his report.

The mine was later worked by the Digney and Casey syndicate in 1902, when ground above the 300-foot level was worked with profitable results.

East Volunteer Mine.—This was one of the earliest mines worked on the field, being originally called the Shamrock Mine, and it was reported to have yielded a fair amount of gold. The East

Volunteer Company did a large amount of prospecting on a large reef on the footwall of the channel, but no gold was found.

From this mine the reef has been worked towards the east in the Adjutant, Colonel, Marshal, and Brigadier Mines, but they do not appear to have produced any gold. Some prospecting has lately been done near the old Adjutant Mine.

It is seen that the only gold in the Volunteer reef has been practically confined to the Volunteer and West Volunteer Mines.

Monarch Reef.—This was originally known as the Bugler reef. A shaft 127½ feet was sunk, with levels at 60 feet, 72 feet, and 115 feet. At the 115-foot level the lode was cut 5 feet south of the shaft, the crosscut being continued for 40 feet. The lode was followed 30 feet east at the 72-foot level, and some stoping has been done to the surface from 30 to 40 feet east and about 35 feet west.

The workings in this mine passed down on to a fault, which had a low angle of dip. The reef was lost in the Bugler Mine, and found again in the New Monarch Mine, and, as is often the case, the values in the New Monarch Mine lying underneath the fault were better than in the Bugler, which lay on the top. The plans of the New Monarch Mine have been compiled from plans supplied to the Inspector of Mines, but they are not complete, since the plans of the later workings at the 400-foot level were not supplied. Several crushings were taken from between the first and second levels, but the reef became unpayable between the third and fourth. At the 400-foot level the reef was followed east for about 400-feet, and gold was taken from rises put up to where the reef became payable. The country to the west was disturbed by a fault, and no driving was done in this direction. At 300 feet a crosscut was taken for between 300 and 400 feet to the south to cut the Orlando reef, and a reef was cut, but it was not certain whether it was the Orlando reef.

Orlando Reef.—This reef occurs about 7 chains south of the Monarch reef, and no particulars of the workings are available, except that the lode

was cut by some fairly deep shafts and a tunnel, and some fairly good stone was said to have been obtained from it.

Londonderry Reef.—No particulars are available of the workings of this reef. In the Wanderer Mine a vein of auriferous stibnite was found. Some of the shafts near the Londonderry shaft are sunk into Permo-Carboniferous material, which evidently represents an old watercourse at this spot.

New Industry Reef.—About 2 miles a little to the south of east of the Londonderry reef there is a reef upon which a number of shafts have been sunk, and which has been followed in a tunnel. A fair amount of payable gold is reported to have been taken from the tunnel.

VIII.—RECOMMENDATIONS.

The most promising mining venture which could be carried out on the Lefroy field seems to be the exploitation of the sub-basaltic deep lead deposits. A discussion of this is to be found in the section dealing with the alluvial deposits.

Apart from this, the future development of the field depends on the discovery of new reefs. The most likely place for future prospecting seems to be between the Den Creek and Lefroy. At the Den Creek a fair amount of alluvial gold has been obtained, some of it very ragged and with adhering pieces of quartz, but no reefs have been found. The country between here and Lefroy consists of the usual slates and sandstones, and "reef" quartz (with traces of gold) has been discovered.

In any future mining development the effects of surface enrichment should be borne in mind. The history of the field has shown that small veins very rich near the surface are apt to lose practically all their value less than a hundred feet beneath the surface. In any case the values always fall to unpayable amounts at about 400 feet in depth, and provision should not be made in this district to develop a mine below this level.

BACK CREEK

I.—INTRODUCTION.

The survey of the Back Creek field was carried out at the same time as that at Lefroy, about a week being spent on the survey after that of the Lefroy field had been completed.

II.—PREVIOUS LITERATURE.

Previous reports dealing with this district are:—

Thureau, G.: Back Creek Goldfield. (House of Assembly Paper No. 45, 1882.)

Montgomery, A.: On the Back Creek Goldfield. (Report of Secretary for Mines, 1893-4.)

Twelvetrees, W. H.: Report of Secretary for Mines, 1907, p. 11.

III.—HISTORY.

A list of the goldfields of Tasmania published in 1869 does not include Back Creek; but in 1879 it was stated that there had been several hundreds on the field, though it was then almost deserted. This shows that gold was probably discovered about the end of 1869. The reason for the desertion of the field was that most of the ground was held under large leases, and most of the miners had gone to Mathinna. On the discovery of gold there must have been a rapid migration to the field, and

it must have become deserted almost as quickly when gold was discovered at Mathinna. In 1871 there were 400 oz. of gold produced; in 1872 the amount had fallen to 25 oz.; and after this the returns from the field were grouped with those from Lefroy. In Mr. Thureau's report on the field in 1882 the four leads are described, and also the Franklin, Albion, All Nations, and Moonlight reefs. In 1884 it was reported that the field, having been twice abandoned, was again reviving, and several parties were obtaining gold. There were no further reports until 1907, when it was stated that the total production of the field till that date was between 9000 and 10,000 oz. In 1912 the Back Creek Alluvial and Quartz Syndicate, with a capital of £295, started work on the alluvial deposits, and obtained 13 oz. 12 dwt. of gold. In 1915 the Back Creek Deep Leads Gold Mining Company commenced operations, and continued working until 1917, being assisted with a Government grant of £1000; but the work never got past the prospecting stage. In 1920 Gillam found 50 to 60 oz. of rough, ragged gold in the White Lead, but was unable to find the source of the gold.

IV.—GEOGRAPHY AND PHYSIOGRAPHY.

(1) LOCATION AND ACCESS.

The Back Creek field is situated 6 miles in a north-easterly direction from Lefroy, from which there is a fair road.

(2) TOPOGRAPHY.

The whole of the area is drained by Back Creek, which flows in a general northerly direction, the principal workings being situated on the west side of the stream. The major workings are on the west side, on the ridge between the Back Creek and Piper River basins. Back Creek is a good stream, with plenty of water, but its tributaries are usually dry watercourses, becoming wide flats at their lower ends. The slopes are not steep, and at the lower ends of the spurs they are very gentle. Generally, the area is one of gentle relief.

V.—GEOLOGY.

(1) SUMMARY.

The geology of Back Creek is identical with that of Lefroy, with the exception that there are no Permo-Carboniferous deposits.

(2) ROCK SYSTEMS.

(a) Cambro-Ordovician.

These consist of a mixed series of slates and sandstones, which are not as altered as the Lefroy rocks. The sandstones are often soft and white, as in the bed of the White Lead, and there is no sign of any development of mica. The sandstones are the most abundant types in the mining area, but some good slate types occur in the locality. These were worked in the Australasian Slate Quarry, and seem to have been of fair quality.

The strike of the beds is the same as at Lefroy, about 320 degrees, and the most general dip is between 65 degrees and 70 degrees to the north-east, but this sometimes falls to about 35 degrees.

(b) Tertiary and Basalt.

These two are discussed together for reasons which will become apparent later. The Tertiary deposits are the wash and alluvial material which occurs underneath the basalt or between the basalt flows. Three sets of bores have been sunk, and their records are given. Unfortunately no survey was made of the first set at the time of boring, and in assigning numbers to them on the plan Mr. Montgomery had to rely on hearsay evidence, thus introducing a great element of uncertainty into their correct position. The third set was made recently, across the neck of basalt which occurs along Back Creek to the north of the area, but no survey was made of the position of the bore. The following information is available about them:—The position of the area tested is approximately 60 chains north-easterly of the White Lead workings. No. 2 bore was $6\frac{1}{2}$ chains north-west, and No. 3 bore 4 chains south-east of No. 1 bore. The boring records show

a fairly steep dip of the bedrock to the south-east and probably the centre of the gutter had not been reached.

FIRST SERIES OF BORES IN 1882-3.

No. 1 Bore (A1 on plan).—Commenced 9th September, 1882;
finished, 10th October, 1882.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	9	0	9	0
Sandy clay and soft brown rock	11	0	20	0
Bluestone (basalt)	41	0	61	0
Basaltic clay	12	0	73	0
Gravelly wash	7	0	80	0
Brown sandy clay with decayed wood	51	0	131	0
Black sandy clay with wood	10	0	141	0
White clay	6	0	147	0
Black clay with wood	4	0	151	0
Conglomerate	0	6	151	6
Black clay, wood, and gravel	5	6	157	0
Gravelly wash	8	0	165	0
Cemented sand and gravel	25	0	190	0
Gravelly drift	5	0	195	0
Cemented sand and gravel	14	0	209	0
Drift	5	6	214	6
Gravel	3	10	218	4

No. 2 Bore (A2).—Commenced 27th October, 1882;
finished, 6th November, 1882.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	8	0	8	0
Clay	8	0	16	0
Soft brown rock	10	0	26	0
Bluestone and honeycombed basalt	36	0	62	0
Basaltic clay	12	0	74	0
Gravel	6	0	80	0
Clay	10	6	90	6
Slate and sandstone, with thin quartz veins	24	6	115	0

No. 3 Bore (A3).—Commenced 18th November, 1882;
finished, 29th November, 1882.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	8	0	8	0
Sandy clay	3	0	11	0
Gravel	1	0	12	0
Clay	12	0	24	0

No. 3 Bore—continued.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Soft brown rock and honeycombed basalt	5	0	29	0
Bluestone (basalt)	47	6	76	6
Honeycombed basalt	5	0	81	6
Basaltic clay	15	0	96	6
Gravel	6	0	102	6
Brown and black sandy clay, with wood	27	9	130	3
Conglomerate	0	6	130	9
Brown and black sandy clay, with wood	35	6	166	3
Conglomerate	3	2	169	5
Bluestone and honeycombed basalt	21	0	190	5
Light-coloured sandy clay	9	10	200	3
Brown sandy clay and gravel	3	0	203	3
Soft slate and sandstone	37	3	240	6

No. 4 Bore (A4).—Commenced 11th December, 1882;
finished, 12th December, 1882.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	16	0	16	0
Sandstone	24	0	40	0

No. 5 Bore (A5).—Commenced 27th December, 1882;
finished, 16th January, 1883.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	12	0	12	0
Soft rock	12	0	24	0
Bluestone (basalt)	54	0	78	0
Honeycombed basalt	5	0	83	0
Basaltic clay	9	0	92	0
Brown and black sand and wood	3	0	95	0
Gravelly wash	3	0	98	0
White clay	2	0	100	0
Brown and black sandy clay, fine gravel, and wood	60	0	160	0
Honeycombed basalt	4	0	164	0
Basalt (lower part honeycombed)	28	6	192	6
Black and brown clay and wood	5	0	197	6
Clay, wood, drift, gravel, and cement	8	6	206	0
Cement and gravel	2	0	208	0
Sandy clay and gravel	4	0	212	0
Gravel	2	0	214	0
Slate reef and sandstone	24	0	238	0

No. 6 Bore (A6).—Commenced 25th January, 1883;
finished, 9th February, 1883.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	33	0	33	0
Bluestone (solid basalt)	25	0	58	0
Honeycombed basalt and bluestone	5	6	63	6
Bluestone and honeycombed basalt	19	0	82	6
Basaltic clay	4	2	86	8
Clay and wood	4	6	91	2
Gravelly wash and drift	10	0	101	2
Clay	3	0	104	2
Sandy clay with wood	5	10	110	0
Gravelly drift, sand, and wood	18	0	128	0
Brown sandy clay and wood	34	0	162	0
Bluestone and honeycombed basalt	21	0	183	0
Basaltic clay	11	0	194	0
Brown sandy clay, gravel, and cement	16	0	210	0
Red-brown sandy clay	27	0	237	0
Sandy clay and a little gravel	2	0	239	0
Sandstone	15	0	254	0

No. 7 Bore (A7).—Commenced 20th February, 1883;
finished 4th May, 1883.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Clay	8	0	8	0
Gravel	1	0	9	0
Clay	7	0	16	0
Soft rock and bluestone (basalt)	45	0	61	0
Basaltic clay	12	0	73	0
Gravelly wash	7	0	80	0
Brown sandy clay and gravel	10	0	90	0
Black sandy clay with wood and gravel	52	0	142	0
Basaltic clay	6	0	148	0
Sandy clay and gravel	4	0	152	0
Clay with wood and gravel	6	0	158	0
Cemented gravel	7	0	165	0
Cemented sand and gravel, and floating reef	25	0	190	0
Cemented sand and gravel	22	0	212	0
Cemented gravel	4	9	216	9
Gravel	4	3	221	0
Sandstone	2	0	223	0

SECOND SERIES OF BORES, 1889

No. 1 Bore (B1).—Commenced 2nd February, 1889;
finished 2nd March, 1889.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	6	6	6	6
Basaltic clay	22	6	29	0
Blue and black clays with decayed wood and cemented pebbles	44	6	73	6
Hard basaltic rock	90	9	164	3
Basaltic clay	7	8	171	11
Quartz drift and stones	2	0	173	11
Blue clay	1	11	175	10
Quartz wash	1	0	176	10
Soft slate bottom	15	5	192	3

No. 2 Bore (B2).—Commenced 9th March, 1889;
finished 13th April, 1889.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	6	6	6	6
Yellow clay	3	9	10	3
Quartz gravel	2	6	12	9
Basaltic clay	37	4	50	1
Black clay and decayed wood	10	2	60	3
Basaltic clay	9	4	69	7
Hard basaltic rock	99	1	168	8
Basaltic clay	5	8	174	4
Quartz wash	8	4	182	8
Slate and Quartz gravel	8	4	191	0
Black slate bottom	4	0	195	0

No. 3 Bore (B3).—Commenced 20th April, 1889;
finished 18th May, 1889.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	11	6	11	6
Basaltic clay	14	0	25	6
Soft basaltic rock	21	7	47	1
White sandy clay and decayed wood	8	8	55	9
Black clay and decayed wood	17	6	73	3
Blue clay	3	0	76	3
Hard basaltic rock	91	10	168	1
Basaltic clay	7	9	175	10
Cemented wash	0	6	176	4
Brown and blue slate	8	2	184	6
Quartz leader	0	6	185	0
Blue slate	3	4	188	4

No. 4 Bore (B4).—Commenced 24th May, 1889;
finished 5th July, 1889.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	11	0	11	0
Rotten basalt	24	0	35	0
White, brown, and black clays, and decayed wood	27	0	62	0
Soft basaltic rock	3	0	65	0
Hard basaltic rock	116	5	181	5
Basaltic clay	12	4	193	9
Clay and decayed wood	5	1	198	10
Quartz wash	5	11	204	9
Black slate bottom	6	5	211	2

THIRD SERIES OF BORES, 1932.

Strata Passed Through.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
<i>No. 1 Bore.</i>				
Clay	7	0	7	0
Hard basalt	81	0	88	0
Slate	10	0	98	0
<i>No. 2 Bore.</i>				
Soft basaltic clay	10	0	10	0
Quartz wash	2	0	12	0
Blue slate	2	0	14	0
<i>No. 3 Bore.</i>				
Basalt, most of it hard	171	0	171	0
Quartz	1	0	172	0
Slate	8	0	180	0

Most of the earlier bores show two flows of basalt, the top of the bottom flow in the various bores being between 45 and 65 feet above sea-level, and the top of the upper flow in the first set of bores being from 177 to 192 feet above sea-level. Between these two flows there are river deposits of wash, gravels, clays, &c., which in the first set of bores are about 70 feet thick, showing that considerable time must have elapsed between the flows. It is therefore unlikely that the leads which have been worked on the surface pass down to bedrock, since for this to be the case the lead deposits would have had to escape being worn away by erosive forces during the whole of the time that elapsed between and subsequent to the basalt flows. This opinion is supported by the fact that the bedrock,

when it passes underneath the basalt, begins to dip at a high angle, showing that the valley had a steep grade and side slopes when it was filled by the basalt flows, the steep slopes not covered by the basalt having been subsequently worn away. At the lower end of Blackman's Lead the gold occurs on a false bottom of large lumps of waterworn slate and sandstone, with occasional quartz boulders, a little gold also being obtained on the bedrock. These facts indicate that there were two sets of leads, the first corresponding to a pre-basaltic stage, when steep slopes prevailed, and the second after the first basaltic flow had occurred, and this, combined with the wearing down by erosive forces, caused flatter grades to develop. Most of the first series, where they have not been protected by a basaltic covering, have been eroded away, but they are probably represented by the stream-course which was found in bedrock underneath the false bottom in Blackman's Lead.

In the Cardigan Lead there are some very big boulders of very hard siliceous conglomerate, which were formed *in situ* from the original gravels in the lead. These were cemented together by the siliceous vapours and waters coming from the basalt which flowed over them. These rocks are thus pre-basaltic, and have been changed by the basalt into their present hard condition.

(c) *Pleistocene and Recent.*

These are the deposits formed in the post-basaltic stream-beds. In this area many of the streams have formed flats up to 5 chains wide, and one of these flats has cut off the lower end of Blackman's Lead. The old leads now occur on the spurs between the present watercourses, and have roughly a parallel course to them.

(3) STRUCTURAL GEOLOGY.

(a) *General.*

The structural geology is very similar to that of Lefroy, the rocks having the same strike, and the reefs occurring in more or less parallel fissures, which, however, are not as large or as regular as those at Lefroy.

(b) *Folding.*

The rocks have the same strike—about 320 degrees—as at Lefroy, and dip to the east at angles generally about 67 degrees, but the angle sometimes decreases to about 30 degrees. Since the dip is opposite to that at Lefroy, there must be at least one anticlinal axis between Back Creek and Lefroy. The folds seem to be very open, since over the whole of the Lefroy field the beds dip to the west, and over the whole of Back Creek they dip to the east, and no axes are found on either field. Since faulting seems to be so prevalent, the open folding does not necessarily mean that great thicknesses of rock are exposed.

(c) *Faulting.*

Faulting does not seem to be so prevalent as at Lefroy, and the reefs seem to lie along fractures along which little or no faulting movement has taken place. There are no records of the reefs being displaced by cross-faults, the only instance being possibly the case of the Never Mind reef, where on the plan it appears as if one portion of the reef has been displaced relative to the other.

The auriferous reefs have a general direction the same as those at Lefroy, except that they are a little more to the north of east than the latter. They are not quite so regular, however, and seem to vary in direction more than the Lefroy reefs.

The reefs lie along a belt running in the same direction as Lefroy, corresponding with the strike of the Cambro-Ordovician rocks.

VI.—ECONOMIC GEOLOGY.

(1) REEFS.

The reefs, as explained in the previous section, lie along parallel lines similar to those at Lefroy, but the modes of occurrence of some of the reefs are not the same. In the Franklin Mine there are a series of small gold-bearing veins up to 2 or 3 inches thick, and probably numbering about twenty. In the Union Mine the gold is found in a white sandstone, traversed by numerous small quartz veins, in the hanging-wall of a vein of quartz from 2 to 3 inches thick. The width of the gold-bearing zone varies from 10 feet to 15 feet. The other reefs are similar to those at Lefroy, but there are no wide mullocky lodes like the Pinafore, Volunteer, &c.

(2) SECONDARY ENRICHMENT.

The reefs in the district seem to have undergone surface enrichment similar to those at Lefroy. The greatest depth mined was at the Franklin Mine, where a crosscut was driven at 170 feet. From a winze connecting the 100-foot and 170-foot levels 30 tons of ore are said to have given 22 oz. of gold (14 dwt. 16 gr. per ton). Many of the reefs, however, seem to be very rich near the surface, but rapidly fall off in depth, till at about 50 feet from the surface they are unpayable.

(3) ALLUVIAL DEPOSITS.

The alluvial deposits have probably been formed during three periods, and may be termed correspondingly pre-basaltic, intra-basaltic, and post-basaltic. The formation of these alluvial deposits, as at Lefroy, is intimately connected with the earth-movements and basalt flows occurring in Tertiary time, and has been discussed in the section dealing with the Tertiary deposits. The course of the pre-basaltic streams is indicated by the position of the basalt, and there appear to have been two main tributaries, which are now shown by the tongues of basalt on which the two sets of bores have been placed. The

bore record shows that the bedrock near the edge of the basalt has a very steep slope, but it is quite probable that this represents the side slope of the valley, and not the grade of the stream-bed. Should further boring prove that a steep grade on the stream-bed does exist, it is unlikely that much gold would have become concentrated there, and it is more probable that gold would be found further down the sub-basaltic section. However, further boring is necessary before any statements can be made. In Blackman's Lead gold has been found on the bedrock beneath a false bottom, showing that gold was becoming concentrated in the streams at this period, so that the pre-basaltic deposits beneath the basalt would almost certainly carry some gold.

The leads which have been worked on the surface the writer believes, for reasons previously given, to belong to the intra-basaltic system, i.e., to lie between the two basalt flows. It is unlikely that the alluvial material on top of the lower basalt flow could be profitably mined, since little chance of concentration in a definite stream-course would occur.

The origin of the gold in these leads is puzzling. In the White and Red Leads the gold was angular and crystalline and often attached to quartz, but in the Cardigan Lead it was often shotty and rounded. In the two former leads the gold could not have travelled far, yet no reef has been found of sufficient size to supply all the gold that has been won from the leads. The most probable explanation is that the gold has been supplied from small, rich leaders which have not had any great vertical extent, and which have now been eroded entirely away. Two other possibilities can be considered. The first, which is a probable explanation for the derivation of the gold in the Blackman's and Cardigan Leads, is the reconcentration of the gold from one of the old pre-basaltic leads. The tongue of basalt on which the first series of bores were situated suggests that an old stream ran about north-north-west, a course which would take it past the heads of the existing leads, and thus it could have acted as a source for the gold. However, the unworn nature of the gold makes this possibility unlikely

in the case of the Red and White Leads, although it is possible for the other two where the gold is worn.

The other possibility is the introduction of the gold in solution into its present position in the leads, such as A. M. Reid considered to have happened at Lisle.* This does not seem likely where the gold is adhering to the quartz, although the gold on the quartz may have acted as a precipitant for further solutions. It seems improbable that gold could move far in this manner. The possibility, however, provides an explanation for the occurrence of rough and crystalline gold in the leads, since waterworn gold lying in the wash may be dissolved and redeposited, giving a rough appearance, unlike its former waterworn condition. The purity of the gold, to be discussed later, may be a result of this process.

(4) QUALITY OF THE GOLD.

The gold from this field is very pure, having a fineness of about 980. It is unlikely that the primary gold has its purity, and it has probably been refined in some manner. Unfortunately there are no records of the relative quality of the gold obtained from the reef and from the alluvial deposits, so that it cannot be stated whether the greater part of the refining of the gold occurred in the reef during the process of surface enrichment or in the alluvial deposits themselves. The process of refining is the removal of the relatively soluble silver in solution, leaving the gold; or sometimes the gold may be taken into solution as well and reprecipitated. The latter process is undoubtedly important in the enriching of reefs, but the general opinion seems to be against its importance in alluvial deposits, although most people agree that it does act to a certain extent. A. M. Reid considered that all the gold in the detrital and alluvial deposits at Lisle was of secondary origin. Without definite data no statements can be made on the origin of the gold at Back Creek.

* Bull. Geol. Surv. Tas. No. 37, 1926.

VII.—THE LEADS.

(a) *White Lead*.—This is the most northerly of the four leads, the name coming from the whitish character of the bedrock and the occurrence of white clay in the leads. The upper part of the wash is mostly sandy clay, with a good deal of angular and sub-angular quartz, and the gold-bearing layer also seems to have a fair amount of angular quartz in it. The lead runs for the most part parallel and on the south side of a modern watercourse, and at its lower end it passes underneath the basalt. The ground was worked by shafts, and later some sluicing has been carried out at the lower end of the lead.

(b) *Red Lead*.—This gets its name from the reddish colour of the wash and bedrock, due to staining by oxide of iron. It lies for most of its course on the northern slope of a low spur running south-easterly, but towards its bottom end it crosses this spur. At its bottom end the bedrock dips very suddenly underneath the basalt, since in the Grand Junction Company's old shaft the bedrock was about 15 feet beneath the surface, while at a spot 115 feet east-north-easterly from here a shaft was sunk 80 feet, and did not reach bedrock. This lead was worked from shafts 10 to 15 feet deep, and in parts has been sluiced.

(c) *Blackman's Lead*.—This is also known as the Old or Back Creek Lead. In the middle part of the lead a large amount of ground has been sluiced away, and the wash is seen to lie from 18 to 25 feet beneath the surface. The bottom was a soft slate, with 3 to 7 feet of heavy, well waterworn wash, with sands and clays on top of this. On top is 3 to 6 feet of drift, with angular quartz. In the lower part of the excavation the bedrock dips underneath a false bottom of large pieces of waterworn slate and sandstone, with occasional quartz boulders, all set in sandy clay. A good deal of gold was obtained from this false bottom by the old Back Creek Company. Later Mr. L. Schade, whilst taking up an old tramway, found gold on the bedrock underneath the false bottom. In the lower part

of the excavation a shaft was sunk 50 feet before striking bedrock; colours of gold were reported through the false bottom, and there was a little on the bedrock, but no driving was done. A flat cuts off the lead at its lower end, and it has not been traced past there. There is a belief in the district that the lead passes down to the "Junction," the spot where the Red Lead passes underneath the basalt, but any gold by which it would have been traced down to there would have been resorted in the modern watercourse from the old lead. Mr. Montgomery's view that it passes south under the tongue of the basalt on which the first series of bores were located seems to be the most probable. In either case the lead would be cut off by the flats along the watercourse.

(d) *Cardigan Lead.*—This is a very short lead, which is very shallow until it nearly reaches the track to Lefroy, when it rapidly becomes deeper, and begins to show layers of basaltic clay. The Cardigan Company sank a shaft 52 feet deep on to the sandstone bottom, which was found to dip at 1 in 2 on a bearing of 150 degrees. The wash on the bottom was much cemented with iron oxide, and contained a number of smooth sandstone boulders; the value of the wash was about 1 dwt. to the load, and was not payable. This lead is also thought to run towards the "Junction" and to pass over the basalt. The evidence of the old reports shows that it passes underneath the basalt where shown on the plan, and the other idea probably arises from confusion with the resorted gold in the modern watercourses.

In this lead the boulders of cemented breccia, previously described, occur.

(e) *Back Creek Deep Leads Gold Mining Company.*—In 1915 this company sank a shaft 260 feet, and a level was opened out at 245 feet. During this work a 10-inch draw-pump proved inadequate, and a 14-inch plunger-pump was installed. The main reef drive was extended north to tap the wash at the No. 1 diamond drill bore, about 535 feet from the main shaft. A rise was put up at this point,

and the wash was tapped 28 feet above the floor-level of the main drive. The wash consisted of 7 feet of coarse sub-angular reef quartz and sandstone, tightly cemented together beneath a top layer of white sediments. Fair prospects were obtained from the wash, but it was not payable. The bedrock at this point dipped to the south-east. The drive at the top of the rise was extended for 57 feet in the full face of the angular wash, which was unpayable. The main drive was then extended 850 feet to the No. 4 bore. At 750 feet a bore was put up through the back of the drive, and at a height of 4 feet it entered and bore into 2 feet 6 inches of hard wash carrying traces of gold. The work was then continued through to the face, but the results were discouraging. It was then decided to drive west to locate the White Lead, but after driving 39 feet money ran out, and work was discontinued.

The record of the operations of this mine shows the great waste of money and effort which can result from starting a deep lead enterprise without sufficient boring having been carried out to locate the course of the gutter. The information obtainable from the four bores at this point is quite inadequate for the purpose, and as a result the mine operations became a haphazard wandering in the hope of striking the gutter.

VIII.—THE MINES.

Sir John Franklin Mine.—A number of shafts have been sunk to cut the reef at this mine, and a tunnel has been driven. The tunnel is 233 feet in length, and a winze about 55 feet deep connects it with the 100-foot level of the main shaft. The main shaft is 170 feet deep, and a winze, 30 or 40 feet nearer the shaft than the other, connects the 100-foot and the 170-foot levels. From this winze 30 tons of material, on crushing, gave 22 oz. of gold. The rock in the tunnel for the first 140 feet consists of sandstones, which for the remainder of the distance along the tunnel carry a series of small parallel quartz veins, none of which are more than 2 or 3 inches thick. These have a strike of about 50 degrees, and dip to the north at about 1 in 5, the quartz being much ironstained, and having a value of about 6 dwt. per ton. Some short drives have been extended along the biggest of these veins. About 38 feet from the end of the tunnel an ironstone lode 1 to 2 inches thick, which had been cut on the surface, was cut dipping 70 degrees to the north-east, with a strike of 50 degrees. This cuts across the small gold-bearing veins, but does not displace them. In the main shaft some gold-bearing leaders and bunches of quartz were cut between 90 and 130 feet. At the foot of a 60-foot shaft, 330 links south-south-west of the main shaft, a lode wall was cut in a drive 12 feet south. This wall runs east and west, and dips to the north, but there is only a little rubble and pug on it. At the foot of a shaft 80 feet deep, 270 links south-west of the main shaft, a leader 10 inches thick, with a strike of about 80 degrees, has been followed, and is reported to have contained some rich patches. A shaft 70 feet deep lies 480 links south-east of the main shaft, with levels at 43 feet and 70 feet. In this shaft there are a number of veins similar to those in the tunnel running at about 60 degrees. In one place thirteen of these were cut in driving 12 feet. A drive has been extended to the north-east along six small leaders, on which some stoping has been carried out, and 30 tons of mixed sand-

stone and quartz is reported to have yielded 6 dwt. per ton. At the end of the drive the ironstone lode is met, dipping at 1 in 3 to the north-east, with a strike of 60 degrees; it is about 2 feet wide, and consists of quartz, iron oxide, and ironstained slate. A winze on this has been sunk to the 70-foot level, and continued about 40 feet below it; and here about 80 feet of driving has been carried out.

It is seen that the peculiar feature of this mine is the occurrence of the gold in a series of narrow veins. This meant that a greater quantity of ground had to be broken to obtain a certain amount of quartz than if it were all in the one reef, and caused a corresponding dilution in values. These factors make the possibility of economical mining rather remote.

Never Mind, or Albion, Reef.—This reef is shown in two sections on the plan, and it appears to have been faulted. It has been worked in a number of shafts, one underlay shaft showing the dip to be very irregular. The reef can be seen near the top of this shaft, and appears to consist of between 1 and 2 feet of quartz. This reef was originally worked by the Albion Company, and later by the Never Mind Company, but few particulars of the workings can be found.

Union Mine.—At the time of Mr. Montgomery's visit in 1896 the shaft was 88 feet deep, with levels at 80, 63, and 30 feet. The peculiar feature in this mine is the occurrence of the gold, not in a defined vein or veins, but throughout white sandstone with fine quartz veins passing through it. In the No. 1 and No. 2 levels this occurred on the hanging-wall of a vein of quartz 6 to 12 inches wide, with 18 inches to 2 feet of broken wall-rock, and with a strike of 295 degrees and a dip to the south-west. The same vein is encountered in the bottom level, but it is smaller, and towards the south-east it becomes much broken up into leaders. At this level, however, gold was obtained to the north-east, almost underneath an old shaft, the gold occurring in a similar fashion in white sandstone on the hanging-wall of a group of quartz veins striking to the north-east. In the bottom level there

are numerous small leaders running about east and west, as if the two sets above had joined together at this level. The width of the auriferous zone in the sandstone varies from 10 feet in the No. 2 level to 15 feet in the top and bottom levels; but some of this is very poor grade. Mr. Montgomery noticed that what was apparently beds of soft, white and black slate did not conform to the general bedding, and he concluded that these were formed by the alteration of the original sandstones by the gold-bearing solutions.

Lady Emily Reef.—The two old Lady Emily shafts are the furthest west on this reef, one being sunk 50 feet on a reef 18 inches to 2 feet wide, running east and dipping to the north; this was followed, but was found to be unpayable. The reef was cut again in a crosscut 30 feet south in the All Nations shaft, which was 60 feet deep and 160 feet east of the latter, and was 18 inches thick, but with no gold. In this shaft there was a heavy influx of water.

About 4 chains to the east of the All Nations shaft Mr. Montgomery described a small reef with a number of small shafts, but no sign of them can be found at the present time. The vein seems very irregular, being up to 2 feet in width, and frequently splitting up; and it contains only traces of gold.

The Moonlight reef crosses this reef, and is displaced about a foot by it. The main shaft was a whip shaft, about 7 chains east of the All Nations shafts, and the reef was traced 200 feet south-westerly from here. Some very rich patches were obtained from this reef, Mr. Montgomery reporting that 7 oz. had been obtained from one dish. This reef is crossed by another east-west reef, but this is barren.

At the present time these individual reefs cannot be traced on the surface, and on the plan a single, more or less straight, reef is shown. This is the longest line on the field, and can be traced by shafts and trenches along its course. This may represent a persistent reef, but from Mr. Montgomery's

description it is probable that it is a series of more or less east-west reefs, with cross-reefs, producing a more or less linear trend to the series.

Kennet and Hackett's Reef.—This is the most southerly reef shown on the plan. A few shafts have been sunk along its course, and from the size of the pieces of quartz lying on the surface it seems to be a big reef, over a foot, at least, in thickness. The quartz was estimated to contain about 2 dwt. per ton.

Major Mine.—A plan showing the surface workings of the Major Mine is attached to this report. The workings of the old Leura Mine are on the eastern block, and the more recent Major workings are on the western. The following extract is taken from Mr. Montgomery's report:

“The old shafts at the east end of the main lode were mostly sunk for alluvial gold. The following notes give such particulars as I have been able to obtain about them:—

A. About 70 feet deep; white slate bottom; wash on slate bottom at about 50 feet, under basaltic clay.

B. About 50 feet to bottom of alluvial stuff; said to be about on the cap of the reef.

C. Alluvial stuff probably over 30 feet deep; bottom dipping to north-east, white slate; quartz conglomerate, as in Cardigan Lead, lying about surface.

D. Alluvial shaft over 30 feet deep down to white slate bottom.

E. Said to be from 4 to 5 feet of wash-dirt in this shaft, including rich gold-bearing stone.

F. This is a deep old shaft, timbered, probably going down 50 or 60 feet. There is white slate on the tip, also big blocks of quartz similar to that from the Leura reef, which, no doubt, has been cut from a crosscut from the bottom.

G. Is a fairly deep shaft, from which fair dirt is said to have been worked.

H. About 12 feet deep, through basaltic clay; white slate bottom.

K. 22 feet 6 inches deep, mainly through basaltic clay. About 18 inches of cemented quartz rubble on the slate bottom, which gave 3 to 4 dwt. of gold to the ton on crushing.

L. 32 feet deep; similar to K.

M. A shallow shaft 6 feet deep; white slate bottom, with a little angular quartz wash upon it covered by basaltic clay.

V. About 32 feet deep, through alluvial matter.

W. About 23 feet deep, through alluvial matter; white slate bottom.

X. About 20 feet deep, through basaltic clay and wash.

“From the open workings the outcrop of the main lode has been followed westward by a trench along it nearly to the boundary of the section, and then traced further through the next section by a number of shafts and trenches. It is said also to have lately been found in the adjoining section, 12-93G, just south of the shaft marked *b* on the plan. There is also, as shown on the plan, another reef, the south reef, which towards the west seem likely to unite with the main one. It has not been traced very far into the east section with any certainty, but it seems likely that the quartz reef seen in Shaft T belongs to it, in which case the lode would have a tendency to run back towards the north reef at this end. In the alluvial workings the main reef is said to have shown two branches, diverging to the westward.

“I have not been able to get any good information as to the work done by the old Leura Company. Mr. P. C. Rasmussen, in a private report to the shareholders of the Major Prospecting Association, which has kindly been placed at my disposal by Mr. W. G. Barker, says that he found good gold going west in the old whip shaft (N on plan), that this shaft was 50 feet deep, and that a drive was made from it along the reef for 147 feet west, from which it was stoped to the surface, and ‘all

proved payable.' The main shaft was 100 feet deep, and a crosscut from it reached the reef, but I have not been able to ascertain what work was done on this. Mr. Rasmussen avers that no stone was taken to the battery from this level, but that he himself saw gold in the solid quartz and got gold by hand crushing. Others who saw the lode have told me that it contained some gold, and ought to have been more thoroughly tested. While we cannot place much reliance on such hearsay evidence, there is reason to believe that the mine was abandoned prematurely. Within the last two years some very promising discoveries have been made on this reef to the west of the Leura workings. The shaft marked Q on the plan yielded some gold-bearing stone, 9 tons returning gold at the rate of 3 oz. 8 dwt. per ton. From here to the shaft R a little gold may be got where the reef is cut by trenches, but there does not appear to be much stone. In R the reef is 14 inches wide, but rather poor, and underlays to the north. From this shaft to the next one, S, most of the ground has been stoped out, and a crushing of 2 tons gave 7 oz. to the ton. S is an underlay shaft, 22 feet deep, from the bottom of which the reef had been driven on 20 feet to the eastward and 28 feet to the westward at the time of my visit. In this level the quartz vein is small, averaging from 4 to 6 inches in thickness; it is laminated and often much striated, the striations running almost horizontally instead of vertically, as is more usual. This is a very peculiar feature of this reef, both here and in the next shaft, T, where the reef is again sunk on to a depth of 12 feet, and is a little larger. In both shafts there was excellent gold-bearing quartz, the gold being both in the solid stone and in seams along the planes of lamination. Very good prospects could be got from the stuff extracted, and numerous very fine specimens had been picked out during the progress of the work. One dish of stuff from the heap gave me quite half an ounce of gold on washing, some of the pieces of metal being very coarse in size. Since my visit Mr. Barker informs me that 2 tons of the stuff taken from the shaft T, which is now

deeper than when I saw it, yielded on crushing 18 oz. 15 dwt. of gold, or at the rate of 9 oz. 7½ dwt. to the ton. The gold sells for 82s. 6d. to 83s. an ounce, being therefore of very high quality. North of Shaft T is a whip shaft, 56 feet deep, from which a crosscut has been made to the reef at the 50-foot level. Here the lode is larger, being from 2 feet to 2 feet 6 inches thick at the eastern end. The amount of water met with prevented much work from being done, and the reef was followed for only 30 feet or so. Thirty tons of stone from it yielded gold at the rate of 19 dwt. to the ton on crushing. The shaft being full of water, I did not see the workings, but was informed that some very rich gold-bearing stone was still in sight when work stopped. To the west of Shaft T is another one, marked U on the plan, in which the reef is again seen, still small, and westward of this it has been traced a considerable distance by trenches, with a little gold in it all along.

“The south reef, where seen in the eastern section at Shaft T, appears to be a big body of stone, over 2 feet in width, showing laminated structure and striation like the quartz of the main reef, and also containing numerous crystal cavities. The shaft is said by Mr. Rasmussen to be 60 feet deep, and he states that the stone ‘all carries gold more or less, but not any of it was ever taken to the battery’; from which we may infer that it was not at all rich. In the western section this reef has been traced a good distance by trenches and holes, in which some nice-looking quartz, occasionally showing gold, is to be seen. A prospecting dishful of the stuff from an old shaft (Z on plan) gave me a nice prospect of gold on washing.

“In the adjoining West Major Company’s section, 12-93G, we find a main shaft 50 feet deep (*a* on plan), from which drives have been put in 50 feet to the south-east and 60 feet to the north-west without cutting the reef. To the north-west of this are an old 30-foot shaft, *b*, now filled up, and another, *c*, 47 feet deep, from which a crosscut has been put in to the south-east. At the end of this drive a reef of quartz 15 inches thick was cut and driven

on for about 6 feet; it contained gold, but not payable, and had an underlay to the south, that is, in an opposite direction to the Major reef, which always underlays to the north. Since my visit I have been informed that the small space between the end of the crosscuts between *a* and *c* has been cut through, and the main reef found in it, containing payable gold. The reef must bend to the northward from where it is last seen in the Major ground to get to this place, the cause of the deviation probably being a hard belt of blue slate in which shaft *a* is sunk. It seems likely that the north and south reefs of the Major have run together before getting to these workings.

"According to the information given to me, 42 tons in all have been crushed from different portions of the Major workings, for a yield of 85 oz. 9 dwt. of gold, or, say, an average of 2 oz. to the ton."

It is possible that near the Major reef further parallel reefs might be found along a line running north-westerly and south-easterly along the strike of the beds. This supposition is purely derived by analogy with the reefs at Lefroy and Back Creek, which lie in echelon along similar directions.

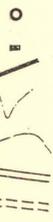
E. BROADHURST, M.Sc., Field Geologist.

Hobart, December, 1933.

GEOLOGICAL SKETCH MAP OF LEFROY GOLDFIELD

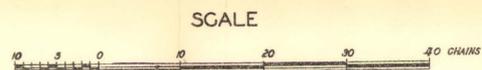
CHARACTERISTICS

- Bore holes
- Shafts
- Reefs
- Contours
- Geological boundaries
- Metalled Roads
- Unmetalled Roads



LEGEND

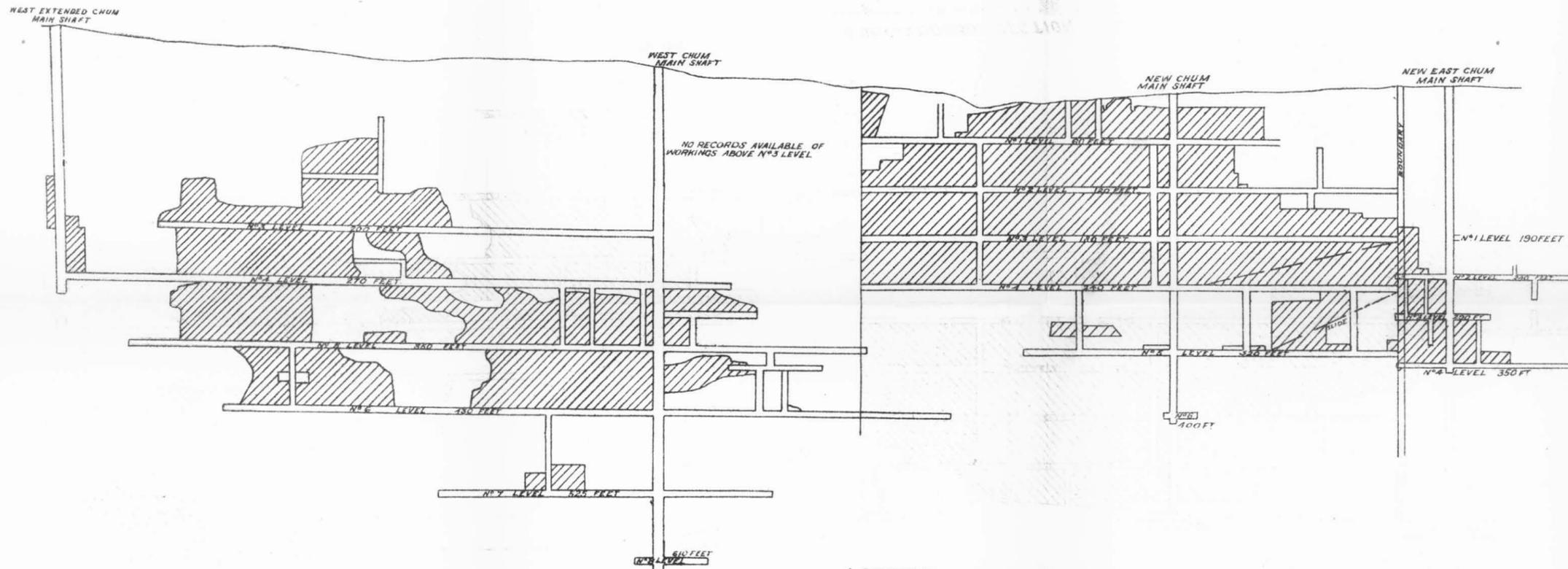
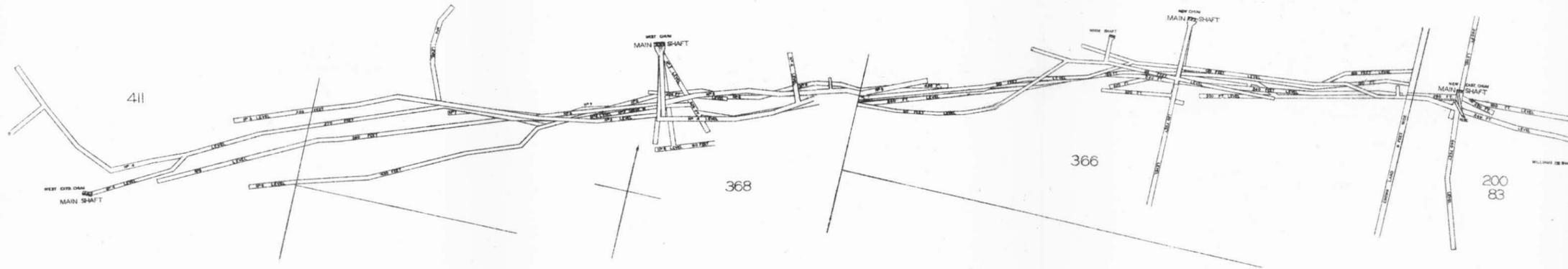
- | | |
|-----------------------|-----------------------------|
| SEDIMENTARY | |
| RECENT TO PLEISTOCENE | Alluvium and gravels |
| TERTIARY | Clays and gravels |
| PERMO-CARBONIFEROUS | Conglomerates and sandstone |
| CAMBRO-ORDOVICIAN | Slates and sandstones |
| IGNEOUS | |
| TERTIARY | Basalt |



A. Goodhurst
Field Geologist
1934

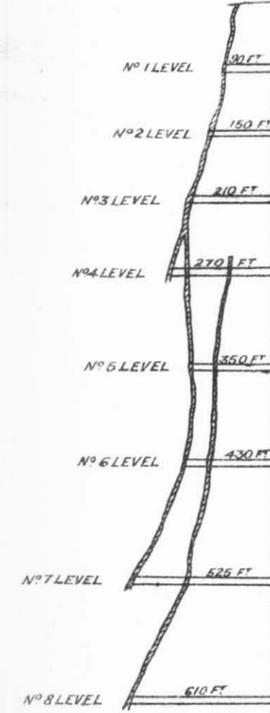
Photo Algraphed by Walter E. Shimmins, Government Printer, Hobart, Tasmania April, 1935.

COMPILED BY MESSRS J. T. STUBS AND H. F. MILES.

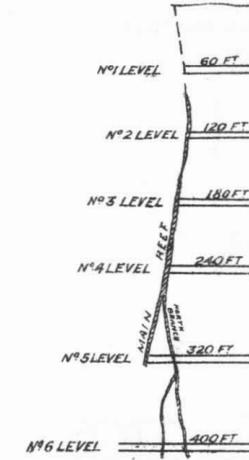


LONGITUDINAL SECTION.
GROUND WORKED OUT SHOWN BY SHADING THUS

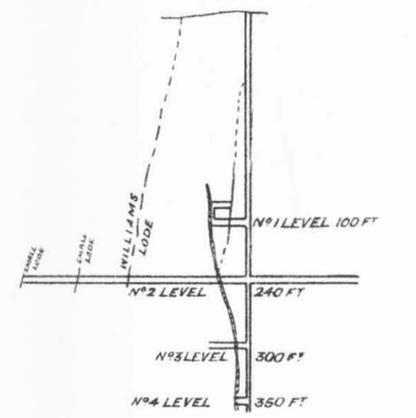
CROSS SECTION THROUGH CHUM MAIN SHAFT.



CROSS SECTION THROUGH NEW CHUM MAIN SHAFT.



CROSS SECTION THROUGH NEW EAST CHUM MAIN SHAFT.



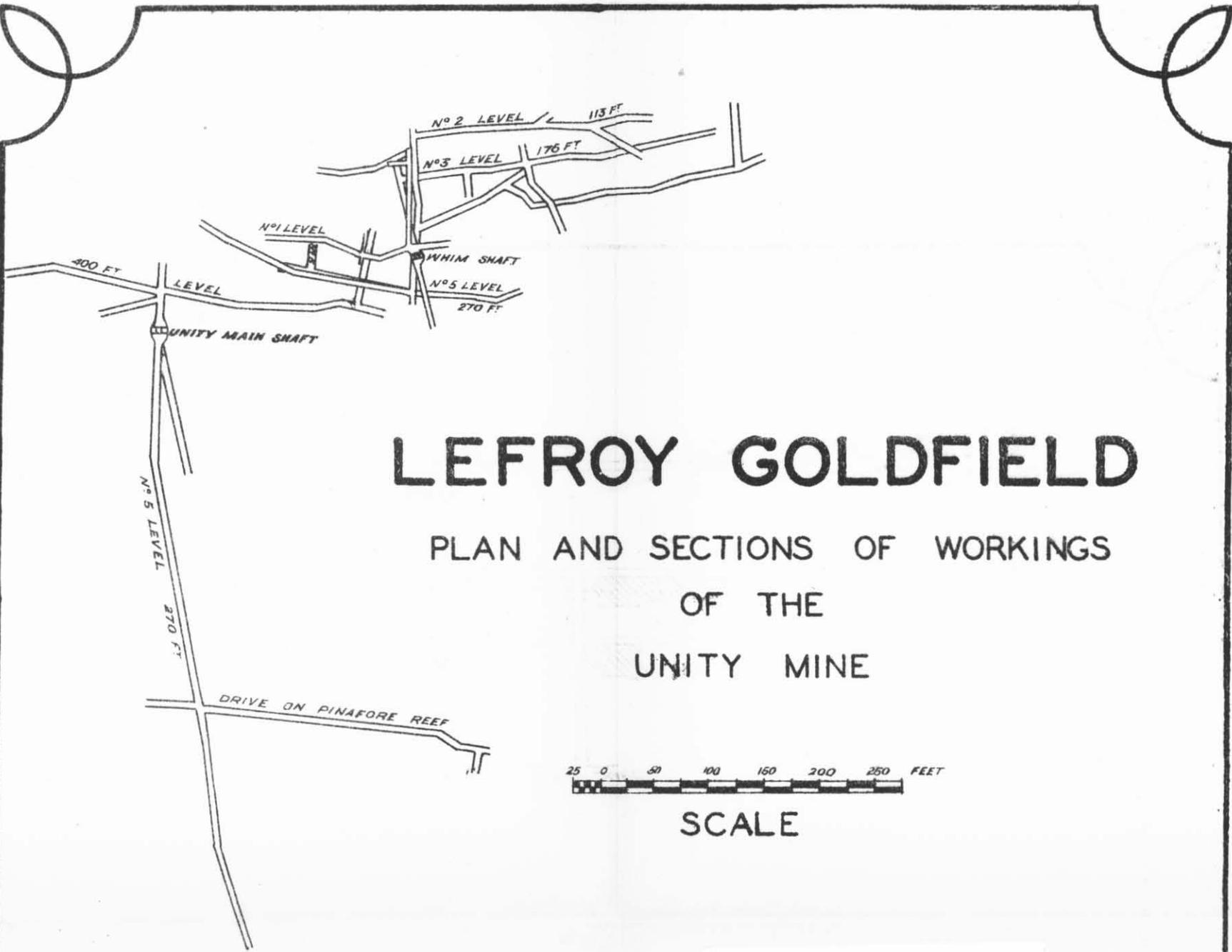
LEFROY GOLDFIELD

PLAN AND SECTIONS OF WORKINGS ON THE CHUMS LINE OF REEFS



SCALE



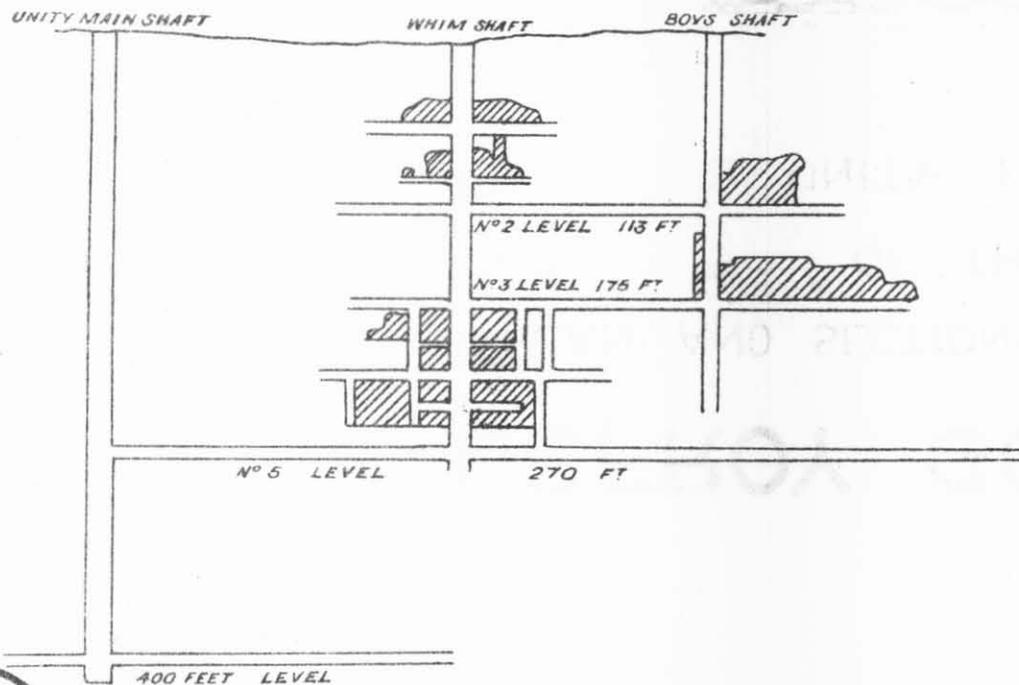
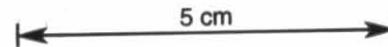


LEFROY GOLDFIELD

PLAN AND SECTIONS OF WORKINGS OF THE UNITY MINE



SCALE



PLAN OF WORKINGS PINAFORE LINE OF REEFS LEFROY GOLDFIELD

COMPILED FROM DEPARTMENTAL PLANS

SCALE



5 cm

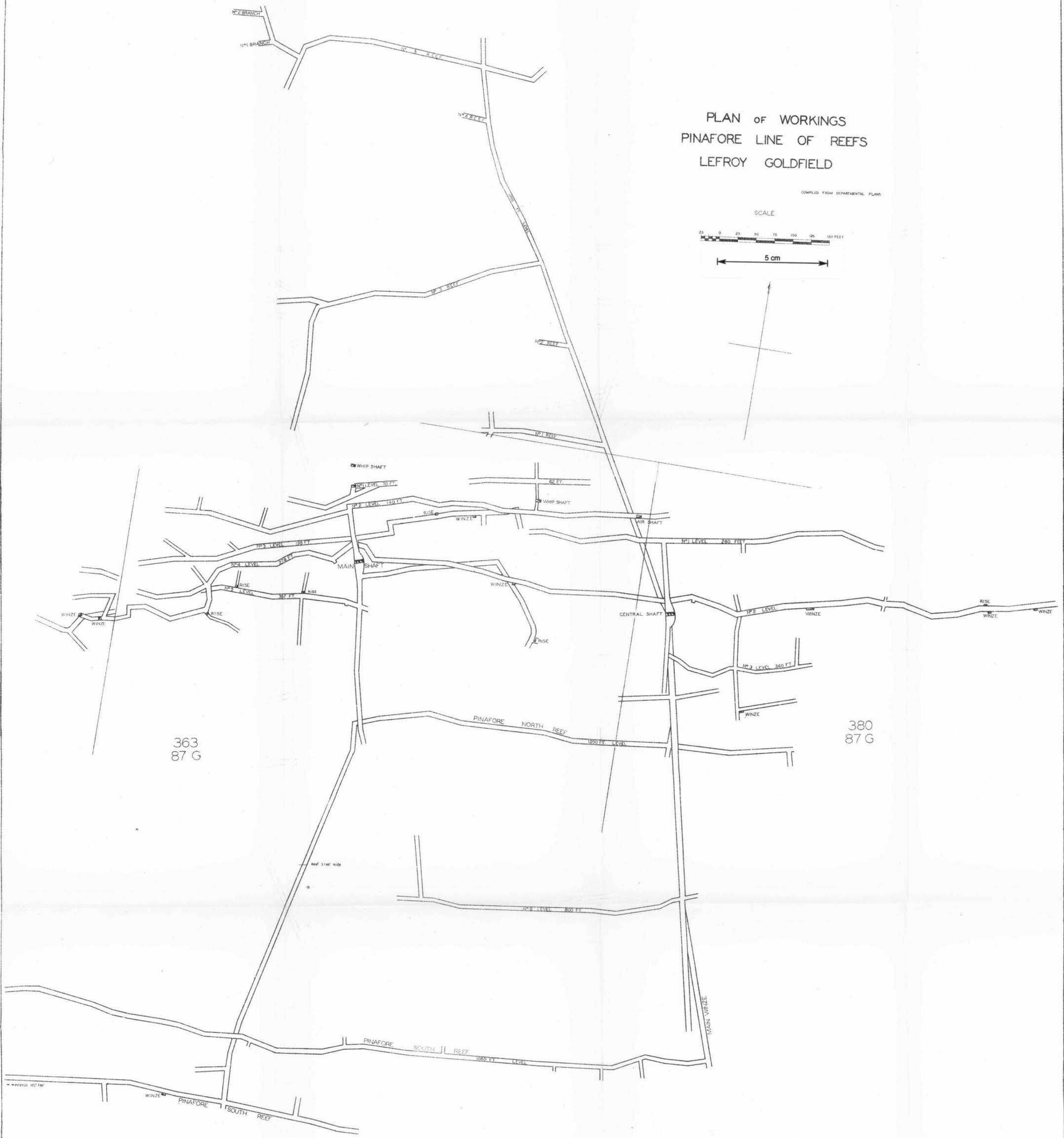
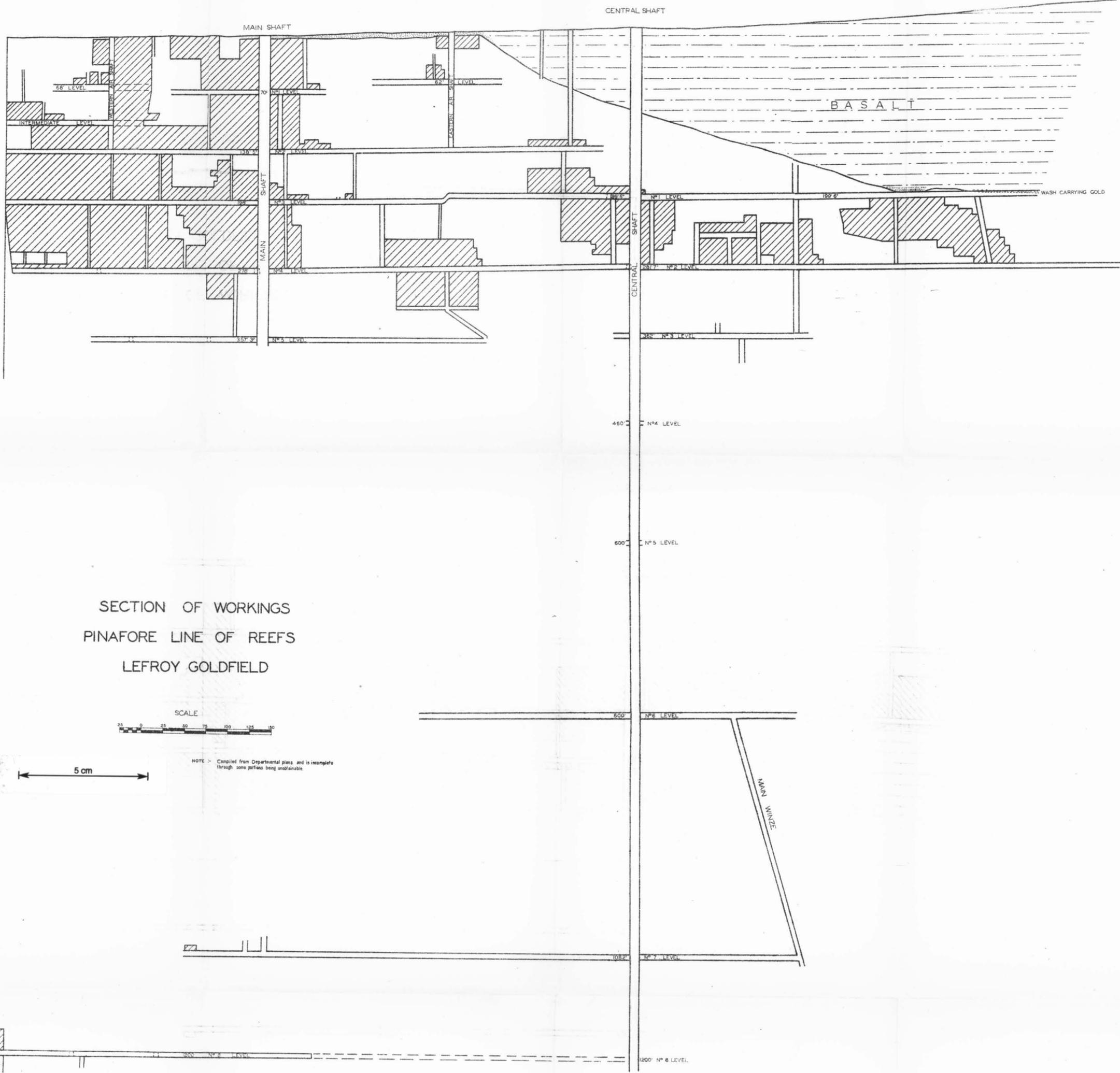
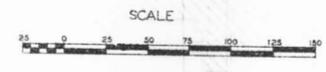


Plate VII 02843



SECTION OF WORKINGS
 PINAFORE LINE OF REEFS
 LEFROY GOLDFIELD



5 cm

NOTE - Compiled from Departmental plans and is incomplete through some portions being unavailable.

HIT OR. MISS REEF

496
87G

65
93G

160
83

64
93G

NORTH REEF

BAIN & RICHARDS REEF

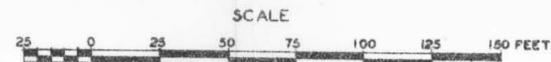
BAIN & RICHARDS REEF

N^o1 LEVEL
POINT & CROWN SHAFT

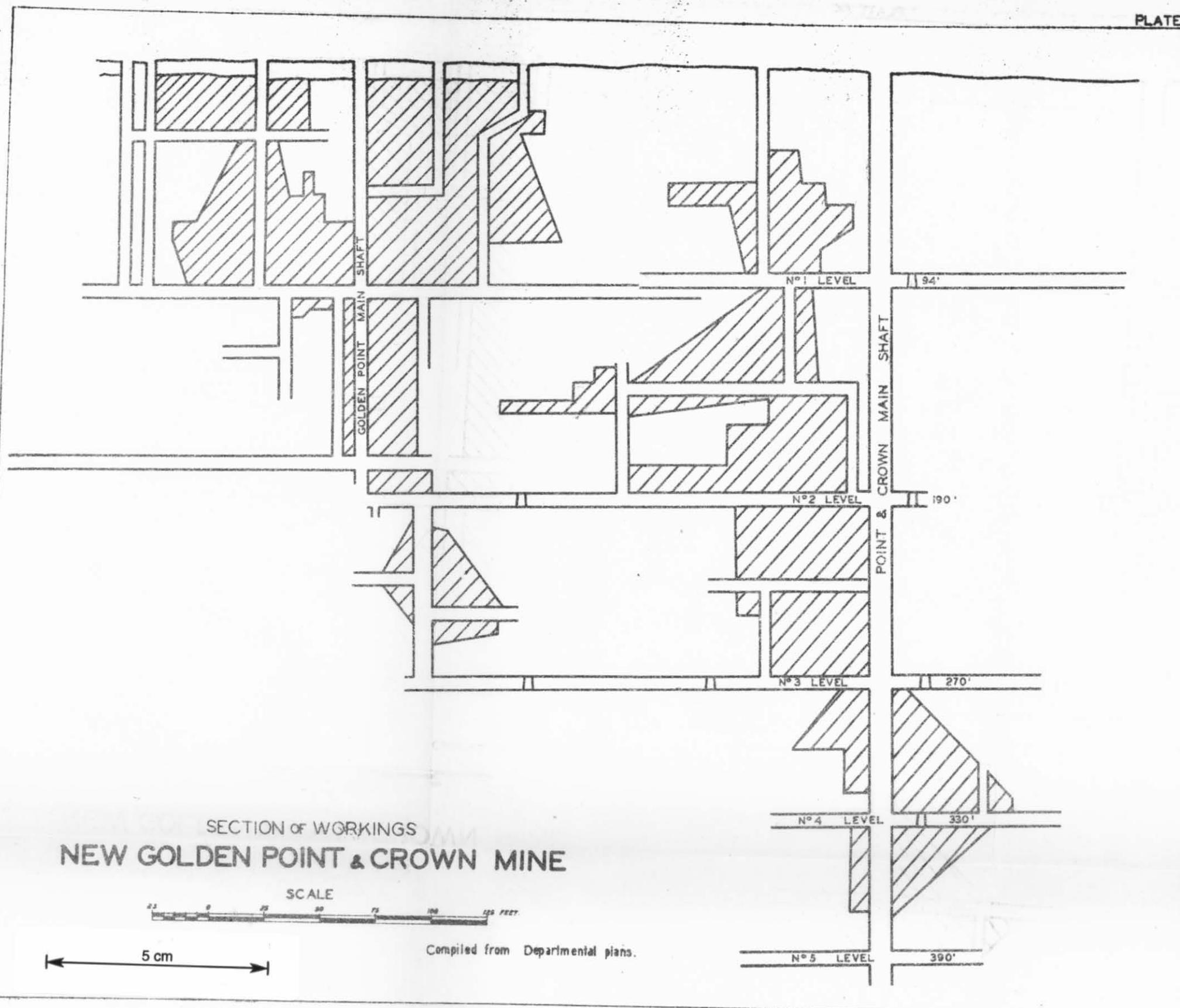
POINT SHAFT
WINZE
WINZE

RISE
N^o2 LEVEL
N^o3 LEVEL

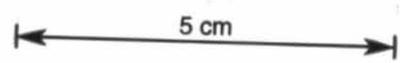
PLAN OF WORKINGS
NEW GOLDEN POINT & CROWN MINE



COMPILED FROM DEPARTMENTAL PLANS.

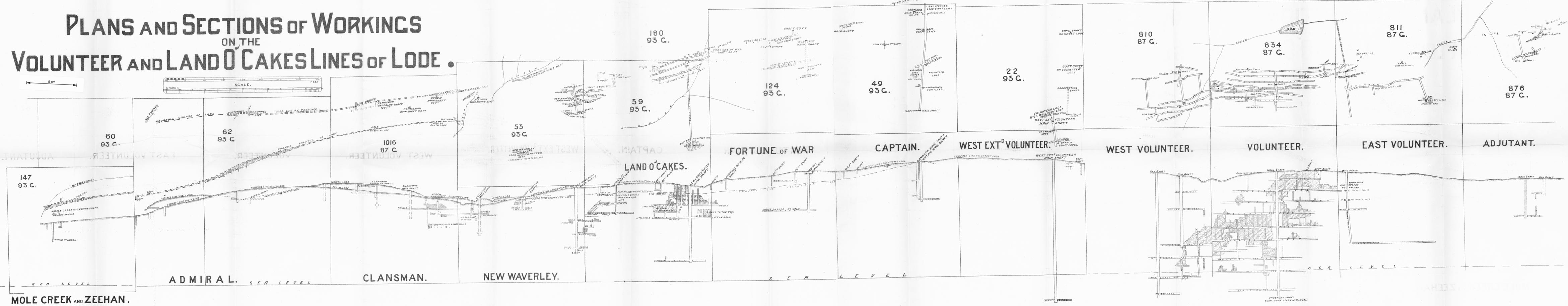


SECTION of WORKINGS
NEW GOLDEN POINT & CROWN MINE



Compiled from Departmental plans.

PLANS AND SECTIONS OF WORKINGS ON THE VOLUNTEER AND LAND O'CAKES LINES of LODE.



MOLE CREEK AND ZEEHAN.

ADMIRAL. SEA LEVEL

CLANSMAN. NEW WAVERLEY.

FORTUNE OF WAR. CAPTAIN.

WEST EXT^D VOLUNTEER.

WEST VOLUNTEER.

VOLUNTEER.

EAST VOLUNTEER.

ADJUTANT.

UNDERLY SHAFT BEING DOWN BELOW SEA LEVEL.

PLAN OF SURFACE WORKINGS
ON THE
MAJOR G. M. CO.'S LODES

Scale of chains

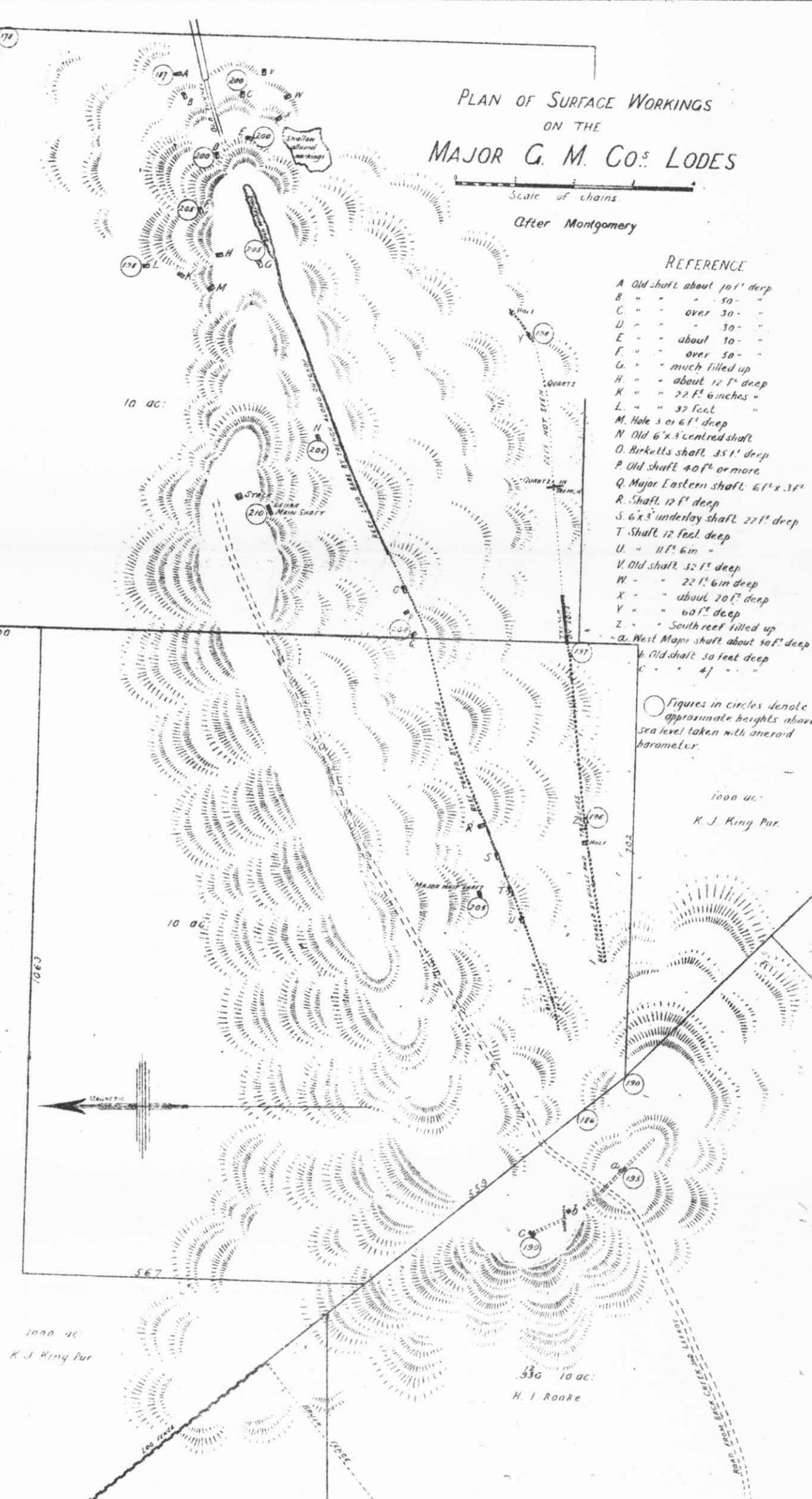
After Montgomery

REFERENCE

- A Old shaft about 101' deep
- B " " " 50 "
- C " " " over 30 "
- D " " " 30 "
- E " " " about 30 "
- F " " " over 50 "
- G " " " much filled up
- H " " " about 12 f' deep
- K " " " 22 f' 6 inches "
- L " " " 32 feet "
- M Hole 5 or 6 f' deep
- N Old 6' x 3' centred shaft
- O Birketts shaft 35 f' deep
- P Old shaft 40 f' or more
- Q Major Eastern shaft 61' x 34'
- R Shaft 12 f' deep
- S 6' x 3' underlay shaft 27 f' deep
- T Shaft 12 feet deep
- U " " 11 f' 6 in "
- V Old shaft 32 f' deep
- W " " 22 f' 6 in deep
- X " " about 20 f' deep
- Y " " 60 f' deep
- Z " " South reef filled up
- a West Major shaft about 50 f' deep
- b Old shaft 30 feet deep
- c " " 41 " "

Figures in circles denote approximate heights above sea level taken with aneroid barometer.

1000 ac.
K. J. King Pur.



1000 ac.
K. J. King Pur.

10 ac.
H. I. Rooke

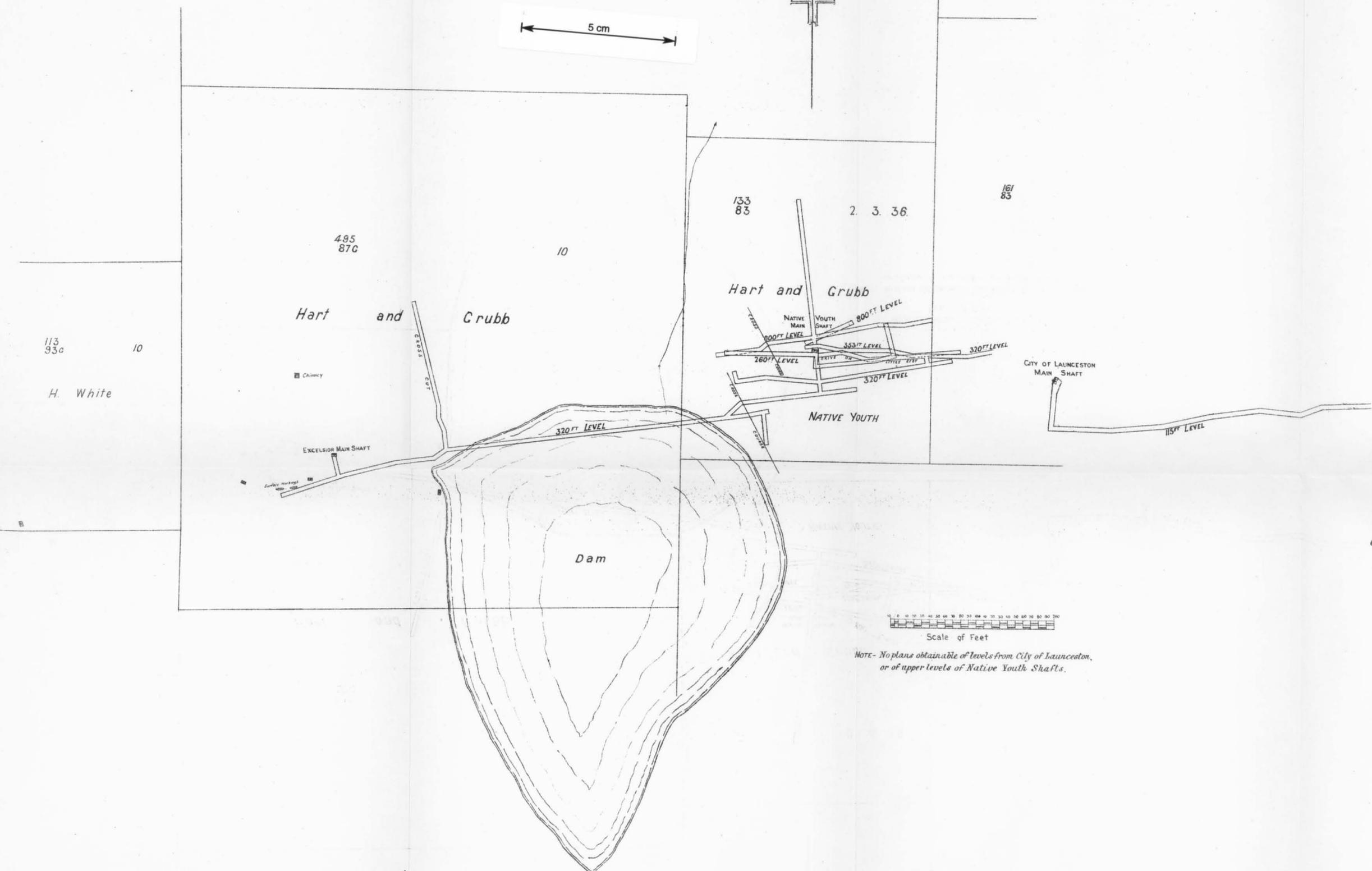
5 cm

14922 IX 310 F

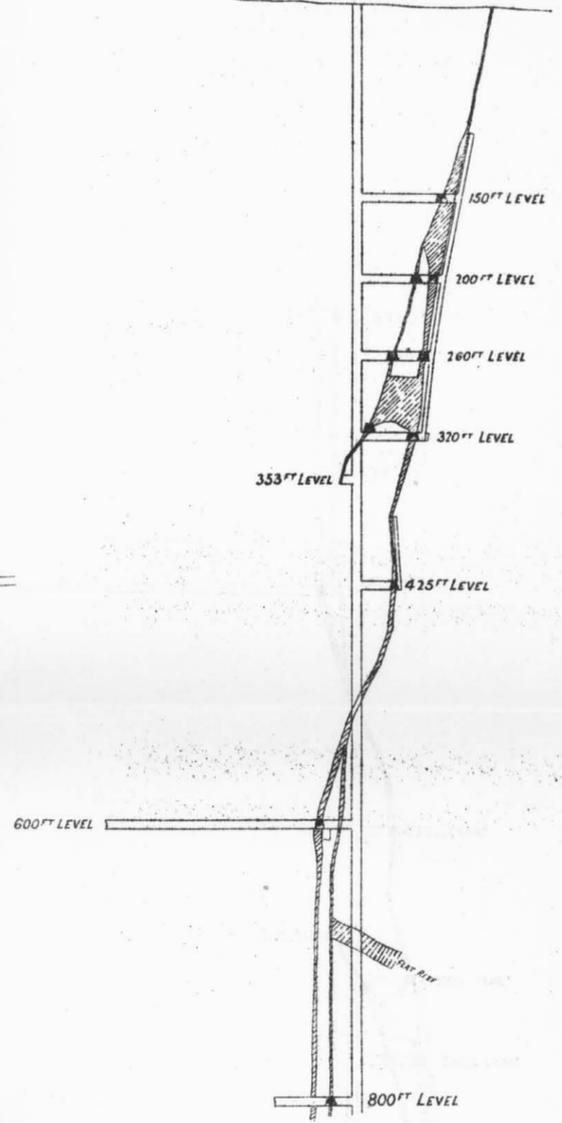
PLATE XII 20849

NEW NATIVE YOUTH MINE
PLAN OF WORKINGS

5 cm



CROSS SECTION
LOOKING EAST
NATIVE YOUTH
MAIN SHAFT



NOTE - No plans obtainable of levels from City of Launceston,
or of upper levels of Native Youth Shafts.

