

167

1901.
—
QUEENSLAND.

THE KANGAROO HILLS MINERAL FIELD.

(REPORT ON, BY WALTER E. CAMERON, B.A., ASSISTANT GOVERNMENT GEOLOGIST)

[With 1 Map and 9 Plates.]

Presented to both Houses of Parliament by Command.

THE HONOURABLE THE MINISTER FOR MINES.

Geological Survey Office,
Brisbane, 24th October, 1901.

SIR,—I have the honour to forward herewith a Report on the Kangaroo Hills Mineral Field, with one map and nine plates, by Walter E. Cameron, Assistant Government Geologist.

I have, &c.,
WILLIAM H. RANDS,
Government Geologist.

CONTENTS.

	PAGE.		PAGE.
I.—INTRODUCTION	1	V.—COPPER AND SILVER MINING	6
II.—GEOLOGY	2	The Mount Thekla Mine	6
III.—PROGRESS OF MINING DEVELOPMENT	3	The Macaulay Creek Mines	9
IV.—TIN MINING	3	<i>The Western Mine</i>	9
The Waverley Group of Leases	4	<i>The Prospecting Area</i>	9
The Planet Ditto	4	<i>The Mount Long Mine</i>	10
The Douglas Mine	5	<i>The Copper Knob Mine</i>	10
The Kangaroo Hills Tin-mining Company's	5	The True Blue Mine	10
Freeholds	5		
The Hidden Valley Lode	6		

I.—INTRODUCTION.

The Kangaroo Hills Mineral Field lies in country drained by Oaky Creek and the Running River, tributaries of the Burdekin. These streams rise on the south-western slopes of the coast range, which forms the background to the flat alluvial sugar lands at the mouth of the Herbert River. Their sources are some 6 or 7 miles apart, and they flow south-westerly to join the Burdekin, some 25 miles lower down, their junctions with that river being only some half-a-mile apart. The mineral field covers an area of about 30 miles in length by 12 miles in breadth. The local sketch attached to the accompanying geological map of the field shows its position relative to the coast and the coast range. The map shows the topography of the field as accurately as it is known at present without detailed surveys.

The prospecting, in 1892, of the old silver and tin lodes lying between the Running River and Oaky Creek near their junctions with the Burdekin, and the formation of the Running River Mining Company, led to the surveying of a township at Ewan. This township is now represented by two houses, owing to the failure to sell the mines to a southern company and their consequent abandonment. The recent discovery of lode tin a few miles further north, on Oaky Creek, and the formation of the Waverly and other tin-mining companies, has led to the opening of a post office at Kallanda, some 8 miles due north of Ewan, and the reserving of an area for a township of that name.

The coast range forms the boundary of the mineral country on the north-east. It presents an abrupt front to the sea at a distance of from 8 to 30 miles from it, and has a general elevation of nearly 2,000 feet above it. It is at present impracticable for vehicles wherever it is approached from the mouth of the Herbert River, and all conveyance to the field from the coast at this point has to be undertaken by means of horses. There is a fall from the summit of the range to the Burdekin of about

1,000 feet. As in ordinary seasons there is a good rainfall on the range, the main streams are generally kept well supplied with a permanent flow of water. The country from the range to within a few miles of the Burdekin is rough and hilly, and this fact combined with the abruptness of the range front has formed one of the chief difficulties to be overcome in the opening up of the field owing to the difficulties and expense of finding passable roads. At present all material that cannot be packed on horseback comes by team from Townsville, crossing the range at Thornton's Gap—a difficult pass over the range some 40 miles south of the track over the Herbert River. This road, after passing Thornton's Gap and the Argentine, crosses the Burdekin at the Continong, and again higher up at its junction with Oaky Creek, the latter crossing being about 100 miles from Townsville. It then reaches Kallanda and the tin mines by a circuitous journey of some 35 miles. A much shorter road could be found from the Burdekin *viâ* Ewan, the Douglas Mine, and the Waverley Battery up Oaky Creek were it not for the abrupt banks of the creek between the two latter places. The construction of a road between these two places would involve about a mile of expensive cutting and forming along the left bank of Oaky Creek.

The Ingham Divisional Board tramline up the Herbert River runs from Lucinda Point near the mouth of the river to the foot of the range at the head of the Stone, a branch of the Herbert, a distance of about 35 miles. From the head of the Stone a road has been surveyed to the crest of the range by Mr. Callendar, C.E., which rises 1,752 feet in 2 miles 57.9 chains, giving an average ascent of 1 in 8.2. From the top of the range at this point to the Waverly Battery is about 18 miles over a good road; and to Ewan, *viâ* the Douglas Mine, another 6 miles, making about 21 miles from the battery, and about 27 from Ewan to the head of the Stone and the tramline terminus. If, therefore, a practicable road could be found over the range at the head of the Stone, the road distance from the Waverly Battery to easy communication with a port would be shortened from 130 miles to about 20; and if in addition a good road could be constructed from the Waverly Battery, past the Douglas Mine, along Oaky Creek, the tin mines near Kallanda would have easy access to the well-grassed country of the Burdekin, and the distance from Ewan to communication with a port would be shortened by about 80 miles.

The construction of a road up the range behind Ingham has been reported on by three engineers. That surveyed by Mr. Callendar, B.E., as mentioned before, rises 1,752 feet in 2½ miles, and involves very steep grades over almost the whole of the way, the average for the last mile and 10 chains being 1 in 4.6. These can hardly be considered suitable grades for wheel traffic, notwithstanding the fact that the grades over Thornton's Gap, as found by Mr. Greensill, L.S., are almost as steep. Mr. Greensill found the following grades on the road over Thornton's Gap:—

1 in 6	for 9 chains
1 in 4	for 7 "
1 in 5	for 4 "
1 in 4	for 4 "
1 in 3½	for 4 "

This road over Thornton's Gap was the main road to the Etheridge and Gilbert Gold Field for many years, and over it most of the heavy machinery for the mines at Goldsmith's Creek, Castleton, and Charleston was conveyed. It is still the most direct road from the eastern seaboard to the Gilbert, Einasleigh, and Upper Burdekin Rivers, and in default of any better road is still in constant use by teamsters. As Mr. Greensill points out, however, in his report, the steep pinches over the gap are only surmounted by double-banking and frequent resting of teams.

Mr. Adams, C.E., in his report claims to have found a spur leading up to the crest of the range behind Ingham, between the two branches of the Stone River, which would give a road with grades of from 1 in 15 to 1 in 10, and estimates the cost at about £5,000. The Ingham Divisional Board do not feel justified in spending that amount of money on road-making. As to whether it would pay them to spend between £2,000 and £3,000 in building the cheaper road surveyed by Mr. Callendar, and by so doing bring freight to this tramline, it must be remembered that the prospects of the mines turning out regular producers are as yet hardly sufficiently firmly established to warrant any very great increase of traffic being counted on, as the output would need to be considerably larger and more regular before such a road could be expected to pay for itself in freight brought to the tramline, even if the heavy grades were found suitable for wheel traffic.

Below are the yearly returns of dressed tin ore despatched from the Kangaroo Hills Field since the year 1895, as given in the Annual Reports of the Department of Mines, together with the return for the first three quarters of 1901:—

Year.	Tons cwt.			Value.					
				£	s.	d.			
1895	...	...	...	55	10	...	1,665	0	0
1896	...	...	...	43	0	...	1,080	0	0
1897	...	...	...	19	0	...	570	0	0
1898	...	...	...	10	0	...	250	0	0
1899	...	...	...	22	0	...	1,203	0	0
1900	...	...	...	61	0	...	4,555	0	0
1901	{ First quarter	...	...	34	19	...	2,220	10	0
	{ Second quarter	...	...	57	16	...	3,656	0	0
	{ Third quarter...	...	...	31	3	...	1,869	0	0

II.—GEOLOGY.

The Kangaroo Hills Field covers an area occupied by altered sedimentary rocks and granite. The former occur in a belt extending along the lower valleys of the Running River and Oaky Creek as far as their junctions with the Burdekin. They are surrounded by granite on all sides, except on the west, where a newer series of sedimentary rocks overlies both them and the granite on the western side of the Burdekin River. The accompanying map shows approximately the boundaries of the granite and older

sedimentary rocks. The boundaries are only roughly sketched; the topography of the district being very imperfect. Numerous smaller patches of the older sedimentary rocks are found in the granite east of where the boundary line is drawn. Dr. Jack reported on the lodes of the Kangaroo Hills Silver Field in 1892*, and thus describes the character of these sedimentary rocks:—

“The country rock of the whole of the mining district (as then being exploited) consists of alternations of mica schists, talc-schists, greywacke, grits, conglomerates, quartzite, and limestones. The schists and quartzites are frequently interspersed with minute garnets, which are at times so numerous that for practical purposes I have designated them ‘garnet rock.’ The whole of these rocks are highly inclined, frequently vertical, and so much broken up by faults, that it is impossible to trace any individual bed for more than a few chains. Beds of limestone are met with along the south-west and north-east belt of mineralised country already referred to in a previous paragraph as well as among the Mount Brown Group of Mines. As these limestones have been described by various writers as having been traced for many miles, I have laid them down on the map (accompanying the report) wherever they are visible, and it will be seen that not one of them is traceable for any distance. On the contrary the outcrops of the limestone not only prove that they, as well as ‘the adjacent sedimentary rocks,’ have been tilted up, contorted, and literally chopped up into pieces by faults, but also that the limestones themselves were originally isolated deposits, probably coal reefs.

“The limestone beds vary considerably in character, but all have suffered a great amount of alteration. The prevailing type is a white crystalline or saccharine marble. It is generally free of silica, but, on the other hand, some beds, having originally been charged with siliceous sand, now present little more than a skeleton of silica, the calcareous portions having yielded more to denudation. Sometimes, in the comparatively pure limestone or marble, the segregation of siliceous matter has formed a network of veins. In a limestone so highly metamorphosed it is not surprising that distinguishable organic remains are sought for in vain. I have indeed seen a few fossils which could be recognised as corals, although but slight traces of their outlines or structures were preserved.

“The age of the stratified rocks must for the present remain an unsettled question. Mr. Maitland doubtfully refers them to the ‘Burdekin Bed’ (Middle Devonian), believing them to be continuous with them, as they are developed lower down the Burdekin Valley, where they afford an abundance of characteristic fossils, as well as to be similar in lithological character. But it must be confessed that there is little evidence either for or against this view.

“The stratified rocks are pierced by masses, of limited extent, of intrusive acidic ‘felstone’ or felspar-and-quartz porphyry, a rock composed of orthoclase felspar with blebs of quartz.”

Wherever the boundary between the granite and sedimentary rocks is well exposed, the intrusive nature of the granite, and consequently its later age, is made clear. A good example of this is seen on the left bank of the Running River, on the track between Ewan and the Macaulay Creek Mines. At this point a gully coming out from the granite hills exposes the upturned quartzites of the sedimentary beds in contact with the granite, with tongues of the latter passing into them. The sedimentary beds are thus seen to be older than the granite, but further than this no evidence was forthcoming as to their stratigraphical position. The granite is perfectly normal in character, being composed for the most part of pink or white orthoclase with quartz and biotite mica. Intrusive dykes of diorite and also of eurite were observed at Macaulay Creek and Hidden Valley.

III.—PROGRESS OF MINING DEVELOPMENT.

Practically no work has been done on the lodes near Ewan described by Dr. Jack since the time of his visits. The only exception is a little development on the True Blue Lode. Alluvial tin was discovered some years ago by the first prospectors for that metal in the district, Messrs. Naven and Regner, at the junction of Prospectors and Sandy Creeks. Since then some 300 tons of stream tin have been sent away. Of late years the profitable working, by windlass and dolly, of rich shoots of lode tin, some 12 miles further down the creek, on the Rob Roy Lode, has led to more systematic prospecting for lodes of that mineral. Several companies have been formed with the object of acquiring tin lodes and mining and dressing the ore on a large scale. Of these the Waverley Tin Mines, Limited, has erected a 10-head battery on Oaky Creek, with rock-breakers, mills, jigs, Wilfley tables, Frue vanners, and buddles, capable of treating 300 tons of ore a week. The Planet, Douglas, Kangaroo Hills, and other groups of properties, although they have in some cases raised a considerable quantity of ore, are at present for the most part doing little mining, awaiting the raising of capital to begin systematic work. At Mount Benham, near the source of the Running River, a small 3-head Park and Lacy prospecting battery has been erected by a party of working miners who have opened up a few small lodes in that locality.

The discovery of copper-ore of good percentage and high silver value in the True Blue Lode and Mount Thekla Mine at Ewan, and at Macaulay Creek, have turned attention to that mineral, and hold out good prospects of an attempt to smelt the ores on the ground. Messrs. Lennox and Rannie estimate that they have raised, at the True Blue Mine, 70 tons of ore, estimated to carry 20 per cent. of copper and 60 oz. of silver to the ton, and about 300 tons of seconds, estimated to carry from 12 per cent. to 14 per cent. of copper and 25 to 30 oz. of silver per ton; and at the Mount Thekla Mine about 200 tons of ore which they were then bagging for cartage to the smelting works. At the Macaulay Creek Mine, Mr. Alex. Harper estimates that he has raised over 1,000 tons of copper and silver ore which will pay for smelting on the spot.

IV.—TIN MINING.

All the tin lodes at present being worked occur in granite country. The two main centres of prospecting are:—Firstly, the lodes in the neighbourhood of the proposed township of Kallanda, about 12 miles up Oaky Creek from the Burdekin River; and, secondly, the lodes in the ranges at the sources of the Running River. The former comprise the properties of the Waverley, Planet, Kangaroo Hills, and

* The Kangaroo Hills Silver and Tin Mines, by R.L.J. Brisbane: By Authority, 1892.

Douglas Tin Mining Company, with various minor shows. The latter are still held by parties of working miners, having not yet reached the company stage. On one lode only has machinery as yet been employed, none of the workings being over 100 feet in depth.

THE WAVERLEY LEASES.

The majority of the leases taken up by this company are grouped together within a distance of a mile or so from the right bank of Oaky Creek. The Rob Roy and Red Gauntlet Leases are about a mile further west, and the Monastery and Lammermoor Leases about the same distance to the north-west and north respectively. The bulk of the work has been done on the Guy Mannering Lease.

Appended is a plan (Plate I.) of the work done, kindly furnished me by Mr. Dunn, the manager. The lease is intersected by a gully down which the road to the battery runs. The lode which strikes east and west crosses the road and gully at right angles. On the western side of the road the lode has been exposed as a face of about 6 feet of chloritic material standing vertically between granite walls. No. 2 Tunnel has been driven westerly from the level of the road along this lode, as shown on the plan, for a distance of about 76 feet. At this point the lode cut out on a granite floor. Five feet from the end of the tunnel crosscuts have been driven N. 30° W. for 41 feet, and South for 11 feet, but failed to pick up the lode. At 38 feet, in a rise from the tunnel to the surface is in good ore, which is being stoped on a face of about 6 feet, and is estimated by Mr. Dunn, from previous crushings, to carry 5 per cent. of tin. No. 2 Shaft, 90 feet further west, is 26 feet in depth, and shows at the bottom 18 inches of chloritic lode estimated to carry 18 per cent. of tin. Cundy's Shaft, 30 feet further west, is 75 feet deep, and as the surface here is 75 feet from the tunnel level the bottom of the shaft is on a level with the tunnel. The bottom was full of water, and inaccessible. At 25 feet the lode passes out of the shaft to the north, and has been broken into by a crosscut, which shows about 2 feet 6 inches of lode estimated to go about 22 per cent. of tin. Judging from these exposures, this lode is exceedingly irregular and hard to follow. The ore body exposed in the No. 2 Shaft should be followed down to the tunnel level, and then driven on towards the tunnel. The position of the lode lost in the tunnel would thus be determined, and any shoots of ore between the shaft and the tunnel picked up. Driving on the lode to the west from the shaft at the same level could then be commenced if the results in the easterly driving from No. 2 Shaft warranted it.

On the eastern side of the road the lode has been opened up by a tunnel (No. 2) on the same level as No. 1, but driven at right angles to the lode from a point 129 feet to the south, as shown in the plan. The lode has then been driven on both east and west for 120 feet from this point. Mr. Dunn informs me that no ore of any consequence was found in the eastern drive. In the western a strong lode was followed all the way, but the ore was poor. The No. 2 Tunnel cut a parallel lode at 60 feet from the entrance which has been followed by a drive (No. 1A level west) going in 60 feet. The ore was poor, but a cross vein of ore occurred at about 20 feet along the level which, on being driven on, led to another parallel lode. This was "risen on" to the surface, and a considerable amount of ore stoped out to the east of the rise to the surface. The plan shows the position of these stopes. The tunnel has been continued across the country for a distance of 160 feet past the main lode. At 90 feet a small vein of ore was driven on for 35 feet to the west, but nothing else of any significance appears to have been met with. Judging from the character of the work done on this lode and the exposures that can at present be seen, it is patchy in character though rich in places. The runs of ore are difficult to follow, and have led to the prosecution of a considerable amount of dead work without as satisfactory results as were expected. This is evidenced by the comparatively small amount of ore that has been obtained for the relatively large amount of work done. Up to the time of my visit the battery had crushed 980 tons of ore for 49 tons 1 cwt. of black tin running about 65 per cent. metal. This gives a value for the ore treated of about £3 8s. per ton, with tin at 21s. per unit. A great portion of this ore I understand came from the Guy Mannering Lease, though a considerable portion was collected from material raised from other shafts before the present company took over the property. The value of the ore crushed from all sources has been under £3,500 for a considerable amount of development work. The work on the western side of the road appears to have exposed the best ore, and is certainly worth further development.

The Guy Mannering Lease was the only one on which work was being done at the time of my visit. The Magazine Shaft and Whiting's Shaft, on the *Ivanhoe Lease*, were inaccessible, so that I could see nothing of the workings there. On the *Rob Roy Lease* is the lode originally worked by the prospectors. The workings here were also inaccessible. The prospectors' shaft on this lode followed down a shoot of tin dipping to the west in an east and west vein. A block of ore about 80 feet in depth and from 30 feet to 40 feet in length has been stoped out on this shoot. The ore is said to have been rich ruby tin-ore in chlorite. A second shaft about 18 feet to the south-east of the prospectors' shaft is about 75 feet in depth, and crosscuts from the bottom have been driven 48 feet north and 30 feet south. Short levels were then driven east and west from the ends of these crosscuts, apparently on ore veins; but no stoping appears to have been done.

The Aberfoyle Shaft, on the same lease, is about 80 feet due north of these two latter. It is 65 feet deep on a wide but poor lode striking east and west and dipping to the north. No stoping appears to have been done. I could obtain no reliable information as to the value of the ore obtained from these workings. Apparently the ore was rich in places, but patchy, and though it paid the prospectors to follow the shoots down for some distance, as soon as haulage became too arduous they were abandoned.

THE PLANET GROUP OF LEASES.

The accompanying map shows roughly the position of the ground taken up by this company. Mr. Dunn, Manager for the Waverley Company, kindly accompanied me over the ground, in the absence of the Planet Company's Manager, and gave me all the information he could. The information is, therefore, all second-hand. No work was being done at the time of my visit, and most of the shafts were inaccessible.

On the Jupiter Lease, the *Jupiter Shaft* is 85 feet in depth on an east and west lode. The shaft was inaccessible. A heap of ore at the surface is estimated to go from 10 per cent. to 20 per cent. black tin.

The *Minerva Shaft*, which is 102 feet deep, is situated 3 chains from the northern boundary, and 2 chains from the eastern boundary of the lease; it is on a second lode, running east and west, well defined, and from 1 foot to 4 feet in width. Levels have been driven at the bottom 12 feet east and 35 feet west. The shaft was accessible to the water, about 60 feet, and showed a lode, with well-defined granite walls, 4 feet apart, underlying steeply to the north. The ore heap at the surface is estimated to bulk about 200 tons, and to carry about 5 per cent. of black tin.

On the northern boundary of the *Altair Lease*, a trench on the *Ladysmith Lode* running east and west, 6 feet deep and 50 feet long, exposes a chloritic lode running up to 3 feet in width. About 30 tons of ore, estimated to carry 5 per cent. black tin, are stacked. Four chains south a trench on the *Kimberley Lode* runs east and west for 165 feet. A shaft near the western end is 165 feet deep, but was inaccessible. The lode runs up to 4 feet in width. About 100 tons of ore have been raised, estimated to carry 5 per cent. of tin.

On the *Mars Lease* there is an open cut on the south-western corner of the lease on the side of the hill, and a pit about 14 feet deep. The lode is about 1 foot in thickness, between granite walls. About 12 tons of ore, estimated at 10 per cent., have been raised. A shaft on a second lode on the brow of a hill overlooking Oaky Creek is 72 feet deep with a level going west 32 feet along the lode to catch the dip of the shoot of ore. About 70 tons of ore, estimated to carry 10 per cent. of black tin, have been raised.

A pit sunk on a third lode called the *Lyddite Lode* is 6 feet deep, and shows about 2 feet 6 inches of chloritic lode matter with regular walls.

On the *Saturn Lease* are several trenches and shafts. The most easterly is a trench exposing a thin vein of lode material from which a few tons of ore have been raised. About $2\frac{1}{2}$ chains further west is a shaft 20 feet deep on the same lode about 2 feet 6 inches wide. Further west a shaft 40 feet deep, and a trench 200 feet long, exposed a lode about 8 inches thick showing good tin in places. About 50 tons of ore, estimated to carry 5 per cent. black tin, are stacked. About 3 chains further west a shaft 45 feet deep, and a trench about 11 feet long, expose another lode about 2 feet wide, estimated to go 7 per cent. black tin. Several parallel veins are here opened out by surface trenching, on one of which is a second shaft 50 feet deep. On the *Satellite Lease* is a shaft 50 feet in depth connected at the bottom with a tunnel driven from a gully in an easterly direction along the lode. Payable tin was found at the bottom of the shaft and at the mouth of the tunnel, but the remainder of the tunnel was in barren lode material. About 100 tons of ore, estimated to carry 8 per cent. of black tin, have been raised.

It will be seen from the above details that a considerable amount of prospecting work has been done within a comparatively small area, and according to the figures given a considerable quantity of payable ore has been raised. The company are waiting for capital to further develop their lodes.

THE DOUGLAS MINE.

The Douglas Mine lies about a mile below the Waverly Battery, on Oaky Creek. Between the battery and the mine the creek runs through rough hilly country, and the nearest wheel road between the two makes a detour of some 35 miles round. It is estimated that a road could be made up the creek for about £1,800. This would bring the Waverly, Planet, and Kangaroo Hills Mines into easy communication with Ewan and the Burdekin country.

Plate IX. shows the work that has been done on the lode. It was idle at the time of my visit. The lode crops out on the side of a steep hill, which comes right down into the creek. It strikes east-south-east, and dips steeply to the north. A tunnel driven from the bank of the creek in a north-easterly direction cuts the lode in 148 feet, and a shaft from a point on the lode 33 feet vertically above the tunnel goes down on the lode and meets the tunnel. The plan shows the remainder of the work. The outcrop above the shaft has been broken down in a face 7 feet across of green chloritic lode material. The lode lies under a well-defined hanging-wall of granite to the north, but the footwall is not exposed. The first 4 feet under the hanging-wall is estimated to carry from $2\frac{1}{2}$ to 3 per cent. tin, and the second 3 feet to carry about 12 per cent. of tin. The drive under the outcrop passed through good ore, but shows the richer band pinched in the face. About 60 tons of ore taken from the outcrop and the drive is stacked at the mouth of the tunnel, and is estimated to go about 12 per cent. of tin.

At the tunnel level the east drive goes along the hanging-wall, and the west drive along the footwall of a strong lode, which, however, does not carry payable tin over this portion. Mr. Lennox, one of the proprietors of the mine, accounts for this by supposing that the shoot of ore found on the surface above the shaft dips to the east, and that the east drive at the tunnel level is not in sufficiently far to catch the shoot. I have no doubt that his supposition is correct, and it could no doubt easily be tested by continuing either the second or tunnel level further to the east. The work in the shaft and western drive at the tunnel level should have shown whether the shoot dips to the west if it continues any distance below the mouth of the shaft.

THE KANGAROO HILLS TIN-MINING COMPANY'S FREEHOLDS, NOS. 166 AND 198.

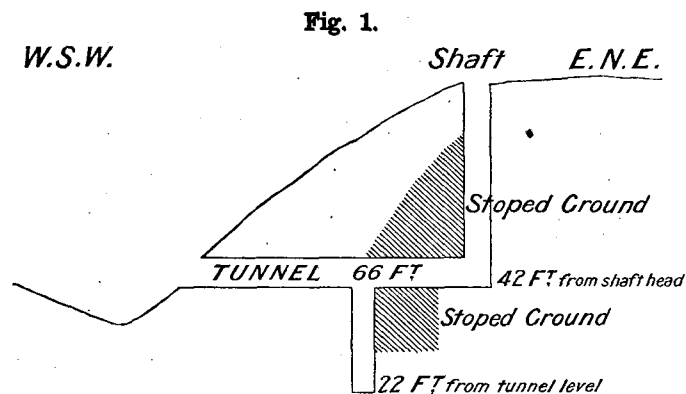
These freeholds lie in granite country north of Oaky Creek. They had afforded a considerable amount of alluvial tin to their original owners, the prospectors of the field, Messrs. Naven and Regner.

On *Freehold No. 166* two shafts have been sunk on what is apparently the same lode running east and west through the property. They were 55 feet and 58 feet deep respectively, and about 6 chains apart. Both had water in the bottom. At the eastern shaft, 55 feet in depth, about 120 tons of ore were stacked, showing good tin in quartz. At the western, 58 feet in depth, 5 tons of ore ready for bagging were stacked, and about 30 tons of much poorer stone. At the bottom of the shaft levels had been driven 40 feet east and 30 feet west along the lode, but they were inaccessible. The tin ore here occurs in a different manner to that generally found near Kallanda, being associated with narrow veins of quartz, being coarser in grain, and bearing a considerably greater ratio to the mass of the gangue stuff. The lodes, however, though rich in places, are apparently small and patchy.

On *Freehold No. 198* a shaft full of water and an open cut further west show coarse tin with quartz. Further west a tunnel into an outcrop on the side of the hill shows coarse tin associated with galena and copper pyrites, which is reported to occur in a large body in the end of the tunnel. The tunnel was inaccessible owing to flooding by surface water.

THE HIDDEN VALLEY LODES.

In the hills about the sources of the Running River several small tin lodes have been found, and a party of miners have erected a three-head Park and Lacy prospecting battery with hand buddle. For the months of February March, and April this battery crushed in all 70 tons of ore from various lodes for a return of 11 tons of black tin. The country rock is for the most part of granite, but patches of mica schist and sandstone occur, and intrusive dykes of diorite and of elvan were observed. Stone was being obtained from one lode only on the *Lord Roberts Lease No. 93*. This lode is vertical and strikes N. 65° E. The lode occurs as veins of quartz and chloritic material between well-defined granite walls, the tin occurring in streaks through the quartz. The lode runs up to 2 feet in thickness in places. The shoot is apparently a short one, some 20 feet long at the tunnel level, and dips steeply to the west. It has been opened up by a shaft 42 feet in depth, and a tunnel 66 feet in length, as shown in the accompanying figure. From the tunnel a winze has been sunk a further 22 feet on the shoot of ore.



PLAN OF WORKINGS ON THE LORD ROBERTS LEASE—SCALE, 40 FEET TO AN INCH.

Thirty-one tons of stone have been obtained from this shoot of ore for a return of 5 tons 11 cwt. of black tin, of 65 per cent. metal, giving a value of £360 15s. with tin at £100 a ton. Heavy water has prevented further sinking on the lode. A second shoot of ore occurs about 80 feet east of that worked in this shaft. It has not as yet been opened up.

Several other small lodes have afforded small crushings, but none have been rich enough to encourage further work. On Lease No. 111 a large quartz lode or reef some 16 feet across occurs, which has been opened on a face on the side of a gully. A portion of this, about 4 feet in width on the northern side, is softer and more chloritic looking than the rest. A small trial crushing from this portion was being put through at the prospecting battery at the time of my visit. I have since been informed that it went 4 per cent. black tin.

At Mount Benham, on the crest of the range, good lodes are reported to have been found. These lodes had been abandoned for some time at the time of my visit to the field, awaiting the raising of capital to further develop them. As they were reported to be heavy with water, and so inaccessible, I did not visit them. Since that date a company, called the Mount Spec Tin-mining Company, has been formed to develop them.

V.—COPPER AND SILVER MINING.

Of late years, owing to the increased price of copper, a considerable amount of prospecting for this metal has been done in the district. The most important results of this work have been the developments at the Mount Thekla Mine, on Oaky Creek, about 8 miles up from its junction with the Burdekin, and at the Macaulay Creek Mines on Macaulay Creek, another tributary of the Burdekin, a few miles south of the Running River. The Old True Blue Lode, reported on by Dr. Jack, has also received some attention. The feature of the copper ores is the high percentage of silver they carry. A rough sample taken from the sulphide ore on the ore heap at the Mount Thekla Mine gave a return of 10 oz. of silver per unit of copper. The average monthly assays made by Mr. Harper, Manager of the Macaulay Creek Mines, taken from his record book kindly placed at my disposal, show returns of from 3 to 10 oz. of silver per unit of copper. A sample of copper glance, taken by myself from the ore heap of the Western Mine, one of the Macaulay Creek Group, gave a return of 38.75 per cent. copper and 120 oz. of silver per ton. Zinc also enters into some of the ores in considerable proportion, but hardly in sufficient degree to interfere very seriously with smelting.

THE MOUNT THEKLA MINE.

The Mount Thekla Lode lies about 4 miles due north of Ewan, about half-a-mile across Oaky Creek. It occurs in upturned sedimentary rocks which strike in all directions, dipping generally at steeply-inclined angles. A few chains north of the mine granite occurs, and the junction between the two formations can be followed with the eye across the hills by the rougher character of the country, and the browner appearance of the vegetation, on the granite side of the line. The lode crops out strongly up the brow of a hill, facing to the north, and situated at the head of a gully, which leads down into Oaky Creek and gives a good outlet for traffic on to the more level country round Ewan. The outcrop shows green carbonates of copper and oxides of iron in a felspathic and sandy matrix, merging into a fine pebbly conglomerate. It can be followed nearly to the top of the hill, where the outcrop of the shoot

of ore apparently ends. The conglomerate is seen on the surface, and with greater clearness in the workings, to be interstratified with a bed of clay shale on the west and one of hard compact quartzite on the east. These beds strike almost due north and south, and dip steeply to the west. The conglomerate consists of well-rounded quartzite pebbles in a felspathic and sandy matrix, and is about 30 feet in thickness from the clay-slate hanging-wall to the quartzite. Near the clay-slate it is finer in grain and approaches more to a felspathic sandstone in character. The lode material occurs along the junction plane between the clay-slate and the conglomerate and impregnates the latter to a varying distance from this junction plane, the impregnation fading off more or less suddenly as the conglomerate becomes coarser.

The clay-slate thus forms a well-defined hanging-wall to the lode, the footwall lying in the conglomerate itself and being much less definitely marked. Plate II. is a vertical section across the lode and enclosing rocks. The lode varies from 3 or 4 feet to 10 or 11 feet in thickness and shows an average of probably about 6 feet of the richer ore. Near the surface, where it has been altered by atmospheric agencies, it shows earthy carbonates and oxide of copper and iron. Lower down bornite, black oxide, pyrites, and galena make their appearance, while in the lowest level the lode is an intimate mixture of copper pyrites, galena, and blende, with some earthy material through it.

The lode has been worked along three levels as shown on Plates II., III., and IV. The upper tunnel, about 24 feet in length, was put in across the strike of the lode in a direction bearing E. 25° S. After exposing the junction of the clay-slate and lode it passes diagonally through a thickness of about 6 feet of the latter, showing carbonates and oxides of copper in an earthy and sandy matrix. For the rest of the way it is in barren conglomerate. A drive was then made along the lode keeping the clay-slate wall on the right for a distance of 42 feet. It is finished off at the end by a crosscut going east into the footwall for about 13 feet from the hanging-wall. The roof, left-hand side, and end of this drive show evidence that the lode has been ore-bearing right along. The crosscut at the end exposes from 6 feet to 8 feet of lode. Messrs. Lennox and Rannie, the owners of the mine, informed me that about 40 tons of ore were obtained from this tunnel, which they estimate from numerous assays to carry, on the average, 26 oz. 12 dwt. of silver per ton and 22 per cent. of copper. This ore was stacked at the mouth of the tunnel. If the above estimates are correct it represents a value of £720 worth of ore from 42 feet of driving. In addition to this there still remains a considerable amount of ore not yet broken down on the left-hand wall of the tunnel.

A second tunnel has been put into the outcrop about 24 feet below the former, and goes diagonally across the lode on a S. 28° E. bearing for 43 feet. The tunnel shows a little ore at the entrance, but soon passes into barren conglomerate. A crosscut at the end goes east and meets the quartzite footwall rock in 12 feet. A diagonal crosscut towards the hanging-wall goes on a bearing of W. 40° S. and meets the clay-slate hanging-wall in 20 feet. The width of the conglomerate and lode at this point between the clay-slate and quartzite is almost exactly 30 feet. The lode shows about 7 feet in width in the westerly crosscut against the clay-slate hanging-wall. It has been followed by drives keeping to the the clay-slate hanging-wall to the north for 23 feet, and to the south into the hill for 44 feet. A crosscut from a point 24 feet along the southerly drive into the footwall is in 11 feet from the hanging-wall, and shows about 9 feet of lode material. Plate IV. shows a horizontal section through the lode at the level of this tunnel.

A shaft has been sunk on the outcrop of the lode from the level of the lower tunnel and from a point 23 feet in a north-westerly direction from it. It is 20 feet in depth, and passes through the clay-slate hanging-wall rock till it meets the lode-bearing material near the bottom. A little ore is seen here and on the sides of a drive going E. 37° S. diagonally across the conglomerate bed, from the bottom of the shaft. The drive takes this bearing for 13 feet 6 inches, then goes S. 22° E. for 12 feet, and finally W. 35° S. for 16 feet, when it meets the clay-slate hanging-wall. The ore body is here about 12 feet in thickness. A drive on a bearing S. 22° E. from this point goes through sulphide ore to meet a winze from the upper tunnel level in 30 feet. As the winze starts on the hanging-wall, and is vertical while the lode is dipping east, this level did not quite keep to the hanging-wall. The latter, however, was subsequently broken into along the level, and a width of about 10 feet of lode material is then exposed at the winze. The ore here consists of copper pyrites, galena, and zinc-blende, with some bornite and black oxide, showing comparatively slight alteration.

Messrs. Lennox and Rannie gave me the following estimates of ore taken from the lower tunnel and shaft workings. This ore was stacked at the shaft head, and the best of it was being got ready for bagging and conveyance to smelting works.

Forty tons sulphide ore from the bottom level, estimated by sampling and assaying to carry—

	1st Sampling.	2nd Sampling.
Silver	86 oz. 17 dwt. per ton	121 oz. per ton.
Copper	21.375 per cent.	22 per cent.
Lead	8.65 "	
Zinc	4 to 5 "	

Thirty-five tons of carbonate ores from the lower tunnel, estimated by sampling and assaying to carry—

Silver	22 oz. 17 dwt. per ton.
Copper	21.385 per cent.
Zinc	4 "
* 200 tons seconds, estimated to carry	{ silver, 20 oz. 18 dwt. per ton. copper, 15.75 per cent.
* 5 " " " "	{ silver, 10 oz. 15 dwt. per ton. copper, 10 per cent.
* 80 " " " "	{ silver, 20 ozs. per ton. copper, 18 per cent.

* Obtained from different parts of lower tunnel and bottom levels.

A rough sample of the ore taken by myself from the 40-ton heap of sulphides, and analysed at the Government Chemical Laboratory, gave the following result:—

Silver	163 oz. 17 dwt. per ton
Copper	16.90 per cent. "
Lead	18.50 " "
Zinc	10.10 " "
Iron	7.60 " "
Silica and insoluble	5.05 " "
Sulphur	22.38 " "
Undetermined	19.47 " "
	100.00 " "

Owing to the pressure of work at the Government Laboratory, I was unable to have the complete analysis of the ore determined in time for this report: The above analysis, however, gives a fair idea of the complex nature of the ore as well as of its value in minerals.

The following are analyses of ore from the Lake George Copper Mines, Captain's Flat, New South Wales. They show that the two ores are comparable in many respects. The analyses are taken from "The Copper Mining Industry of New South Wales, by J. E. Carne, F.G.S., Geological Surveyor, page 127":—

	Bulk Ore.	Silver Ore.
Silver	1.15 oz. per ton	3.03 oz. per ton
Gold ... ..	.04 "	.06 "
Copper	1.25 per cent.	.94 per cent.
Lead	9.70 "	8.05 "
Zinc	13.26 "	14.28 "
Iron	22.26 "	15.19 "
Silica	21.55 "	26.48 "
Sulphur	29.50 "	27.50 "
Lime	1.60 "	—

Speaking of the smelting of this ore Mr. Carne says (*loc. cit.*)—

"Under the new method of reduction (by pyritic smelting in blast furnace) the matte is brought up to a marketable grade—30 to 35 per cent. copper—in one operation, thus avoiding the previous extra cost of concentration in attaining this grade.

"The composition of a recent consentment can be judged from the following partial analysis, the gold and silver contents not being stated:—

Copper... ..	34.01 per cent.	} Gold, 1.63 oz. per ton. Silver, 60.00 oz. "
Iron	20.85 "	
Zinc	9.90 "	
Lead	11.75 "	
Sulphur	22.00 "	

"Naturally, the proportions of the furnace charges (which are varied to suit the idiosyncrasy of each furnace) are matters of commercial secrecy. The constituents, however, are about 12 cwt. of sulphide ore, with variable quantities of limestone, ironstone (from the Commodore Mine), and slag from the fire-hearths and separators. About $3\frac{3}{4}$ to $4\frac{1}{2}$ per cent. of carbonaceous fuel (coke) is added to each charge.

"Limestone is procured about 3 miles from Captain's Flat, along the Bungendore road.

"The silica in the ore is just about sufficient for fluxing requirements.

* * * * *

"Barring-down is performed about every fifth day to remove the crust formed, chiefly of oxide of zinc. The operation requires about three hours to complete.

"The Lake George Mines furnish an instructive and valuable object lesson on the possibilities of pyritic smelting."

As far as can be seen at present, the Mount Thekla Ore compares very favourably with the above as a smelting problem. The valuable contents—silver and copper—are very much higher, the percentages of iron and ~~silver~~ ^{silica} are in much the same proportion in either ore; the sulphur percentage is not very appreciably less, while that of zinc is 3 or 4 per cent. less.

Messrs. Lennox and Rannie informed me that since my visit they have despatched 125 tons of ore to the Aldershot Smelting Works, with the following results:—

115 tons returned at the rate of 35 oz. silver per ton, $21\frac{1}{2}$ per cent. copper, and 10 per cent. lead.

10 tons gave $181\frac{1}{2}$ oz. silver per ton, 29.2 per cent. copper, and 10 per cent. lead.

The percentage of zinc was not given.

There is no doubt that this mine, if it continues to develop at a depth and when followed into the hills as it has in the shallower workings, will in the near future turn out a profitable producer. Judging by the indications on the surface the shoot of ore is not a very long one, and the first thing to be determined is the length of the shoot and the possibility of picking up others. In depth it may perhaps decline considerably in metal contents, but it shows every likelihood of being a permanent lode, and its high contents in valuable metal will stand a very considerable reduction before the ore can be considered a poor one.

THE MACAULAY CREEK MINES.

The lodes at Macaulay Creek occur in granite country in association with dykes of quartz-felspar, porphyry, and dolerite. The granite is made up of pink orthoclase, quartz, and a massive green amorphous mineral, no doubt an alteration product of muscovite. The dykes trend east and west. The ore deposits at the Copper Knob Mine and the Prospecting Area are associated with elvan, while those at the Western Mine and Mount Long are associated with dolerite. The ore occurs in irregular masses and pipes in an altered "formation" rock. This "formation" is composed mainly of quartz and a greenish amorphous alteration product, probably of some felspathic mineral. It has slickensided faces running through it, showing evidence of movement and crushing. It does not occur with well-defined walls dividing it from the granite, but passes more or less rapidly into the granite along fairly easily recognisable lines. It has apparently been formed by the alteration of the granite along certain fissure planes which have allowed of the alteration of the felspar and other silicate minerals of the granite by means of percolating waters. The ore consists of sulphides of copper, lead, and zinc, and besides occurring in larger masses and pipes is also found scattered through the formation in proportions too low to form payable ore.

The general composition of the ores is shown in the following average analyses of samples from the four mines, kindly given me by Mr. Harper, the manager :—

AVERAGE ANALYSES OF ORES FROM THE MACAULAY CREEK MINES, KANGAROO HILLS.

	202 Tons from the Western Mine.	284 Tons from the Prospecting Area.	465 Tons from Copper Knob Mine.	124 Tons from Mount Long Mine.
	Per cent.	Per cent.	Per cent.	Per cent.
Copper	12.50	4.00	3.65	2.45
Lead	12.00	8.80	7.17	6.50
Zinc	6.78	2.60	3.10	2.89
Silica (SiO ₂)	38.25	55.63	51.87	54.70
Iron (FeO)	5.51	Traces	Traces	1.66
Alumina (Al ₂ O ₃)	12.72	17.40	22.70	19.53
Lime (CaO)	4.16	7.14	8.12	7.00
Sulphur	6.03	Traces	Traces	Traces
Undetermined	2.05	4.43	3.39	5.27
	100.00	100.00	100.00	100.00
Silver	133.17 oz. per ton.	13 oz. per ton.	26 oz. per ton.	14 oz. per ton.

The Western Mine.—The accompanying plan, Plate V, shows the work that has been done on this mine. The shaft A was sunk to a depth of about 30 feet, on an outcrop of copper ore, by the prospectors. It gave a quantity of rich ore which was bagged and sent away to smelting works, and gave a good return for both silver and copper. A second outcrop of ore was found by the present owners at C, about 50 feet further south, and the lode being judged to run from A to C, and to dip to the west, a shaft was sunk at B to intersect the lode to the dip. It was stopped at a depth of 52 feet. The shaft A was thus 32 feet deep in poor ore. On further sinking, rich ore consisting principally of bornite was met with, carrying a high percentage of silver. A sample of this bornite, assayed at the Government Chemical Laboratory, gave a return of 38.75 per cent. of copper and 120 oz. of silver per ton. The shaft was carried down to 52 feet, when it met with a floor of granite, dipping steeply to the west. This floor was followed down on the underlie for another 18 feet. The ore in this shaft occurs in the "formation" rock described above. This formation apparently runs in a S.E. and N.W. direction, as shown on the plan, for a crosscut put in across the apparent run, as indicated by the granite wall met in sinking the shaft, passed in a foot or two again into granite. The ore body apparently occurs as a pipe in this "formation," for on driving along the formation S.E. and N.W. the ore body was left behind in a few feet from the shaft. I was unable to see the bottom of the shaft, which was full of water. The crosscut starts at a depth of 56 feet. At about 22 feet formation rock of similar character to that found in the shaft is again met with on the right-hand side of the crosscut. This formation shows slickensiding, and carries a little mineral through it. Under the microscope it shows grains of quartz bound together by a semi-opaque green alteration product. The formation rock comes in on the left-hand side of the crosscut at about 28 feet in. At 31 feet in, the formation is intersected by a belt of soft decomposed rock, apparently an altered dolerite dyke. It is some 7 feet across, and cuts across the crosscut at right angles, forming well-defined walls, with a clayey selvage with the formation. On passing again into the formation, a second ore body was met with, and was opened out by a chamber some 8 feet across and 15 feet or 16 feet long. A drive from this chamber towards the shaft B soon passed out of ore, but continued on in "formation," carrying a little ore scattered through it. The granite was again met with at the bottom of the shaft. A second drive following the northern wall of the formation in a south-easterly direction met the southern wall in about 28 feet from the centre of the crosscut, the formation having narrowed considerably in this direction. At 22 feet in, the end of the drive shows the walls of granite and of altered dolerite to be about 2 feet 6 inches apart, the formation being represented by a clayey pug. The ore body at C apparently also occurs in the form of a pipe reaching up to the outcrop on the surface. Mr. Harper informs me that he has taken 175 tons from the shaft at A, and 27 tons from the chamber at C, the average analysis of which is shown in the table above. In addition to this he has obtained 130 tons from shaft A, and 40 tons from shaft B, which he classes as seconds, estimated from average assays to carry 28 oz. of silver, 4.93 per cent. of copper, and 4.4 per cent. of lead.

The Prospecting Area.—This mine lies some half-a-mile east of the Western Mine. The lode outcrops on the western face of a hill, and the "formation" can be traced in a north-easterly direction over the brow of the hill, and then in a south-easterly direction down the other side into a gully, the whole length of outcrop being about 8 chains. Plate VI. shows the disposition of the

workings. An open cut has been put in near the outcrop on the western face, and passes from granite into the footwall of the lode, as shown in the figure. A shaft sunk at this point follows down a distinct wall, dipping south at a steep angle to a depth of about 30 feet. Drives going east and west about 30 feet follow a clean footwall in a soft clayey dig, some 3 or 4 feet in thickness. Little or no ore has yet been met with in these drives. Mr. Harper gives me the following details of the ore taken from the open cut and shaft:—

19 tons assaying	{ 17 oz. silver. 5.23 per cent. copper. 6.3 per cent. lead.
50 tons assaying	{ 45 oz. 14 dwt. silver. 7 per cent. copper. 13.84 per cent. lead.
20 tons assaying	{ 63 oz. 14 dwt. silver. 8.6 per cent. copper. 15.3 per cent. lead.

The outcrop of the lode appears to be broken and faulted as the east cut is approached,* as shown in the plan. The outcrop does not give much indication of being richly copper-bearing on the surface. At the eastern cut another outcrop was opened out, and the ore followed down by a shaft on the floor of the cut, as shown in the plan. The shaft met with granite in a few feet from the surface. Mr. Harper estimates that he has 284 tons of ore from this open cut and shaft, the average analysis of which as obtained by him is shown in the table above.

The lode outcrops again strongly on the bank of the creek some 7 or 8 chains from the open cut, and looks well for copper. It is at present being broken down on a face from the bank of the creek.

* *The Mount Long Mine.*—This mine lies to the north of the Copper Knob, on the crest of another hill. Plate VII. shows the plan of the ore outcrops and workings. Outcrops of "formation" carrying copper are seen running in a north-easterly direction up the side of the hill. A tunnel has been driven into the hill on a north-easterly bearing about 200 feet from the summit of the hill to follow the lines of these outcrops. It met with formation carrying ore at about 16 feet in. The tunnel goes in 72 feet, the last half being in solid granite. A short crosscut at 52 feet and another at the end, cut across an ore-bearing formation, which is apparently a continuation of that found in the tunnel. The second crosscut met formation again further on, and a winze was sunk on poor ore. The ore seam was followed in the granite till a distinct wall of a second formation was next met with, which was driven through to the further wall, giving the formation a nearly east and west direction. This formation was followed on the northern wall for some distance, and ore was met at 25 feet, and a winze sunk a few feet on it. In another 25 feet a dolerite appears on the right-hand wall, and this was pierced by a cross drive for 10 or 12 feet. Plate VII. shows a shaft at the top of the hill almost immediately above the end of this drive, from which about 60 tons of ore were obtained, which gave an average assay of 66 oz. 18 dwt. of silver per ton, 8.6 per cent. of copper, and 22.89 per cent. of lead. From the tunnel 124 tons in all were obtained, the average of analyses of which are given in the table above. The shaft is 25 feet deep, and shows the ore formation, which is from 3 to 4 feet wide at the surface on a well-defined wall of granite pinched to a few inches at the bottom. The formation has an east and west trend, and is probably connected with that met in the tunnel below.

The Copper Knob Mine.—The formation carrying the ore in the P.P.A. is lost in the lower ground between that mine and the Copper Knob, but is found again up the slope of the next hill in a series of outcrops stained with copper. Plate VIII. shows the disposition of the workings. At the top of the hill it widens to about 16 feet in thickness, and a shaft has been sunk on the underlie for 27 feet at an angle of 1 in 2.5, which is in formation to the bottom. About 30 yards east of the shaft an open cut was put in on an outcrop of ore. The lode here is about 10 feet or 12 feet across. A considerable amount of ore was taken out. The lode dips to the south, and a shaft sunk on it from the floor of the open cut met a footwall of granite in 7 feet, and was continued on the underlie for 17 feet at an angle of 40 degrees from the vertical. The lode here narrowed, and a drive was made along it to the west for about 52 feet. This driving was abandoned when a horse of granite was met with on sinking and cross-cutting a few feet, the lode having been judged to have cut out. The formation in this drive carried a little ore in places, but not of a payable quality. From the manager I learn that in all 465 tons were obtained from the open cut, the average analysis of which is given in the table above.

The ore deposits at Macaulay Creek, though rich in places, are extremely irregular and patchy. They do not show much indication of turning out permanent ore producers at depths below the water line. The rich patches that have as yet been met with in the surface workings have apparently been brought into existence by infiltration of copper-bearing solutions into the "formation" rock, and by deposition of the copper in segregation masses where conditions were favourable for such deposition. Such redeposition and concentration of the ore cannot be expected to have gone on to any great distance below the permanent water line. Up to the present this water line has nowhere been reached except in the Western Mine, and it was inaccessible at that point, so that I had no means of judging of what character the ore was below it.

THE TRUE BLUE MINE.

Dr. Jack thus reported on this lode in 1892—

"*True Blue (161).*—This lease is at the western end of a large lode which can be traced continuously for $1\frac{1}{2}$ miles in an east 12 degrees north direction. Within the lease, to the east of the gully (one of the heads of the Donnybrook), the main lode has been pot-holed for some distance, and at a shallow depth begins to show carbonate of copper, and a little lower sulphides of copper and iron. A second large lode runs from the north-west corner of the lease across the gully on the north side of the main lode, which it visibly joins in the middle of the adjacent lease to the east (N 184). No. 3 shaft has been sunk on this northern lode, between the gully and the north-west corner of the lease, and shows green and blue carbonate of copper. Between the main and the northern lodes, a *cross lode* is seen

in the gully running north-west and south-east. This lode is at least 8 feet in thickness, and a shaft (No. 2) has been sunk on it to a depth of 25 feet. The face of a short drive south-east of the shaft shows a large body of copper ore, rich in silver; and flakes of native silver are seen on the adjoining quartz. The ore is bornite, or 'variegated,' or 'peacock' ore (sulphide of copper and iron), mixed with red oxide of copper, copper pyrites, and a little galena. The bornite is probably a decomposition product, and I should not be surprised if it gave place at the water level to copper pyrites and galena. . . . About 12 tons had been raised up to 3rd December."

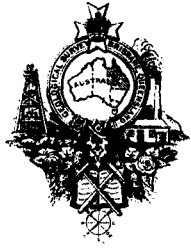
The shaft on the cross lode referred to above has since been continued down to 108 feet, passing through the footwall of the lode at about 25 feet. A crosscut N.E. from the bottom is in some distance, but has not yet met the lode. The bottom of the shaft was inaccessible. The south-east level at 25 feet has been driven 46 feet on the lode to a winze on good ore 2 feet 6 inches wide on the hanging-wall of lode. The winze is down about 50 feet, and has been carried up to the surface to make a continuous shaft 78 feet deep.

Underhand stoping to a depth of 12 feet has been done on ore 2 to 3 feet thick on the hanging-wall from the winze halfway to the main shaft. The level has been continued 18 feet further S.E. on a well-defined hanging-wall which is bearing round to the south. The good ore here has pinched out. The trend of this hanging-wall appears to indicate that this cross lode will cut the main lode a few feet further on. The lode in the level is siliceous with patches of galena and bornite, and, though comparatively poor, is at least 6 feet in thickness at the winze and even wider at the main shaft. Messrs. Lennox and Rannie informed me that they had sent away for smelting about 70 tons of ore from the drive, stope, and winze, the return from which was 20 per cent. copper, and 60 oz. silver per ton of ore. They estimate that they have 300 tons of seconds stacked at the shaft mouth, which, from frequent assays, should yield 12 per cent. to 14 per cent. copper, and 25 oz. to 30 oz. silver per ton.

[No. 167 of the Geological Survey Publications.]

Price 3s.]

By Authority: GEORGE ARTHUR VAUGHAN, Acting Government Printer, William street, Brisbane.



GUY MANNERING LEASE

Waverley Tin Mines

from Waverley Company's Plans

Scale 120 feet to an Inch

To accompany Report on Kangaroo Hills
Mineral Fields

By

Walter E. Cameron B.A.

Assistant Govt Geologist

1901

Fig 1. Plan

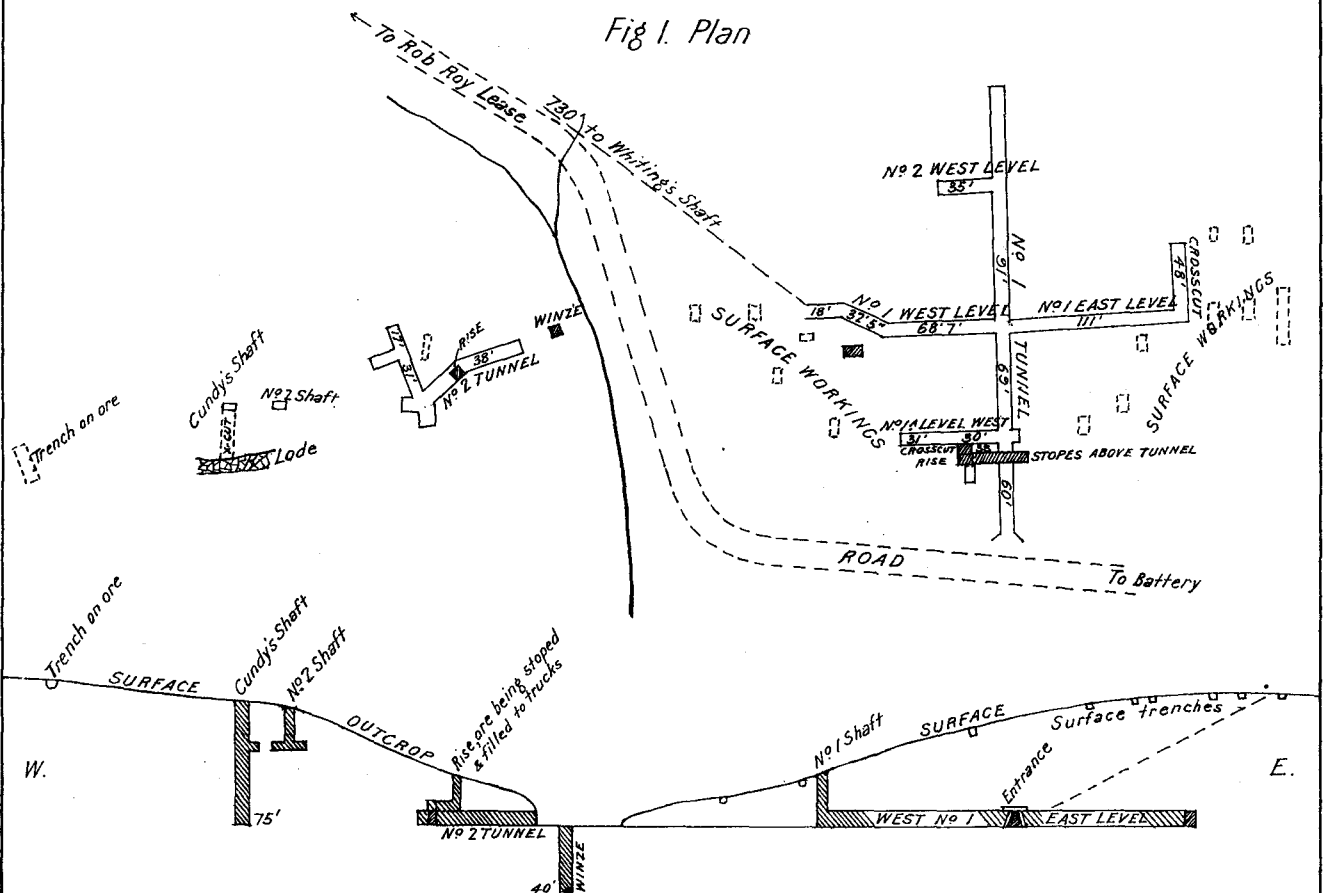


Fig 2. Section through Cundy's Shaft No 2 Tunnel and No 1 West Level in No 1 Tunnel

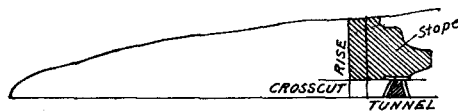
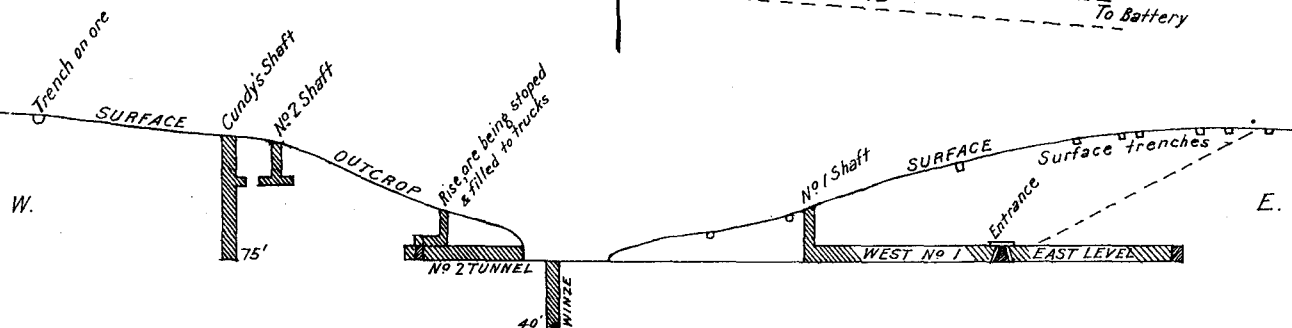


Fig 3. Section Stopes south of No 1 Level West in No 1 Tunnel

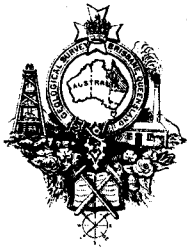


Fig. 1
Vertical Section
M^T THEKLA MINE
Kangaroo Hills
Mouth of upper tunnel and winze
Scale 20 feet to an Inch
To accompany Report on Kangaroo Hills
Mineral Field
By
Walter E. Cameron B.A.
Assistant Gov^t Geologist
1901

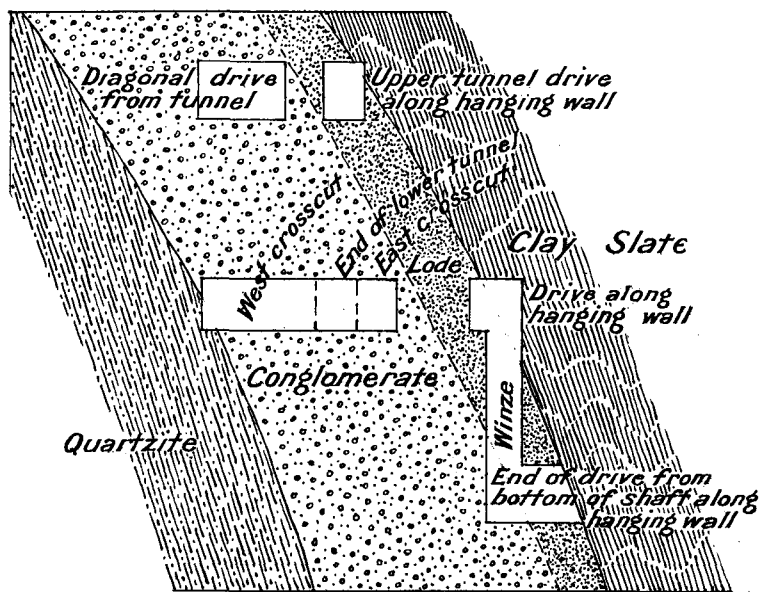


Fig 2
Section along Lode
MT THEKLA MINE
Kangaroo Hills

Shewing Workings on Lode in full lines
and Workings off the Lode in broken lines

Scale 20 feet to an Inch

To accompany Report on Kangaroo Hills
Mineral Field

By
Walter E. Cameron B.A.
Assistant Govt Geologist
1901

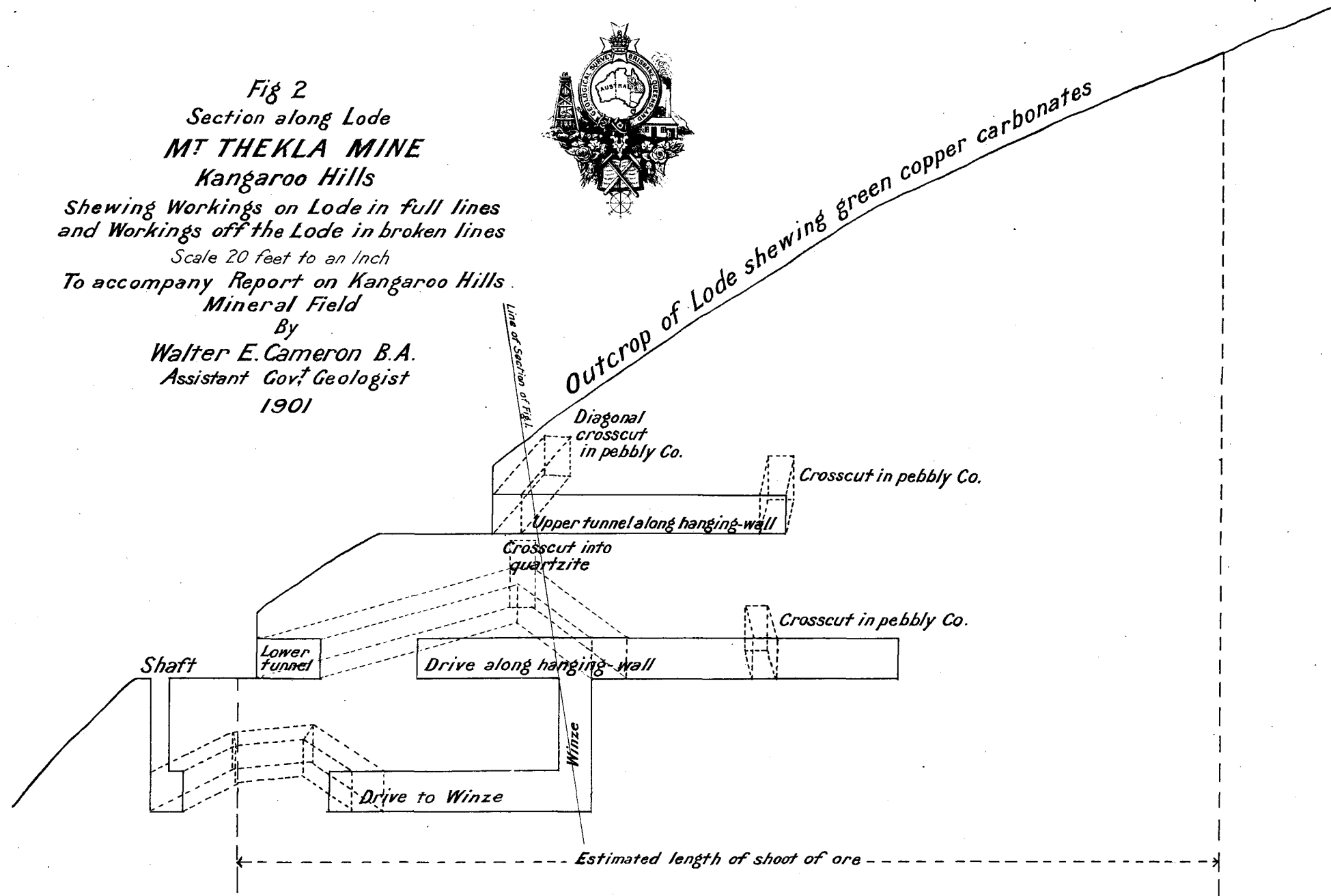
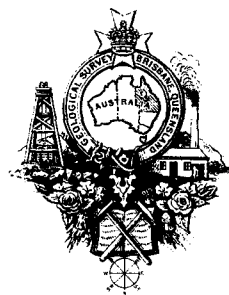




Fig 3
Plan of Workings
MT THEKLA MINE
Kangaroo Hills

Shewing position of Lode and accompanying formations at the lower tunnel Level, upper tunnel and shaft workings in broken lines

Scale 20 feet to an Inch

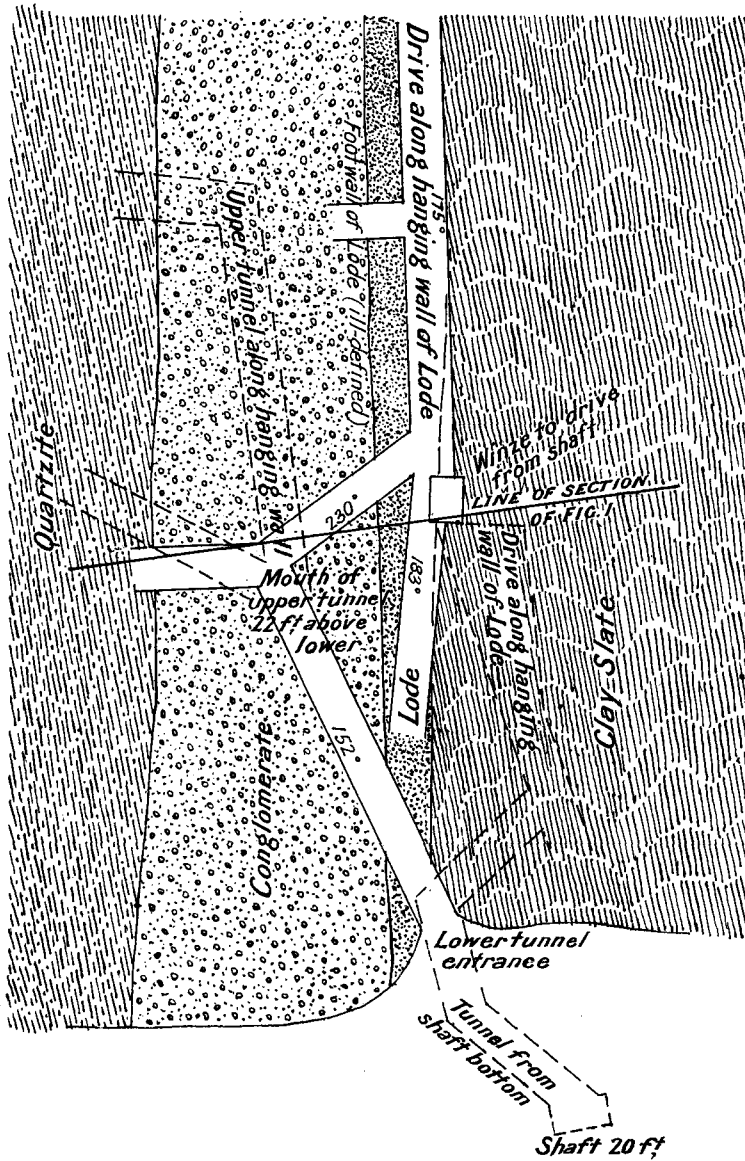
To accompany Report on Kangaroo Hills
Mineral Fields

By

Walter E. Cameron B.A.

Assistant Govt Geologist

1901





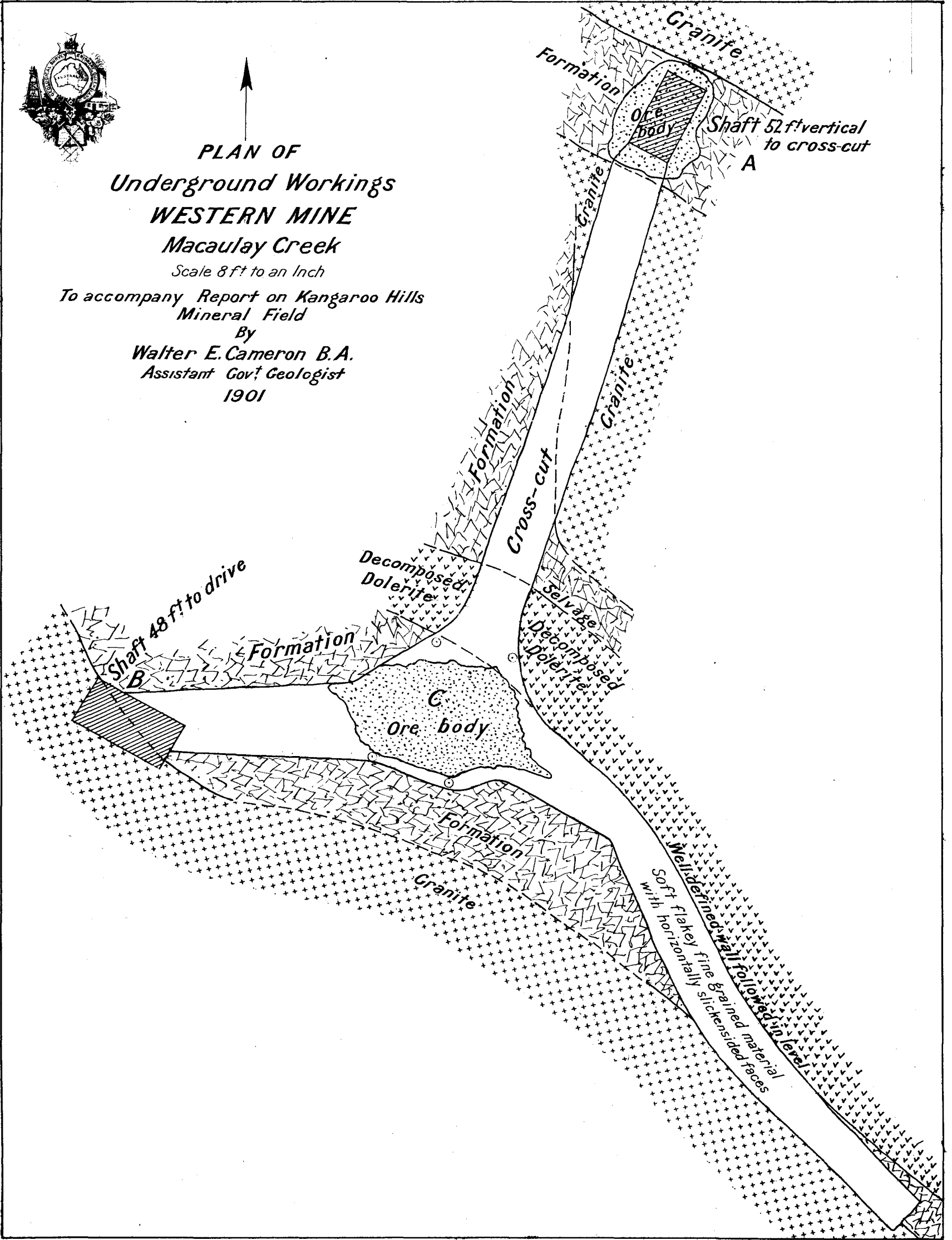
PLAN OF

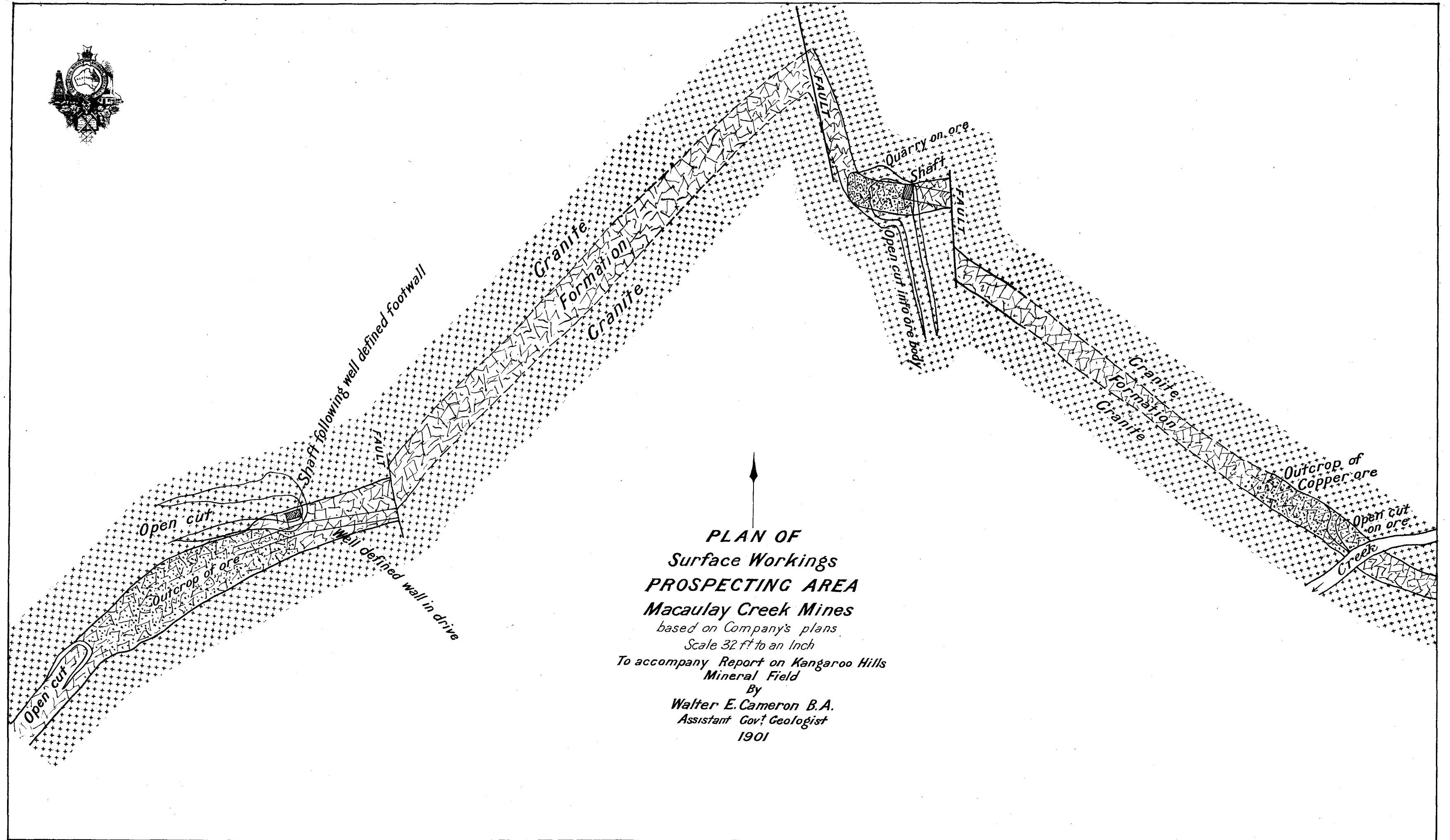
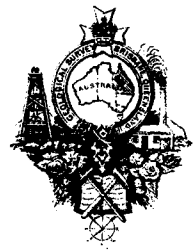
Underground Workings
WESTERN MINE
Macaulay Creek

Scale 8 ft to an Inch

To accompany Report on Kangaroo Hills
Mineral Field

By
Walter E. Cameron B.A.
Assistant Govt Geologist
1901





PLAN OF
 Surface Workings
 PROSPECTING AREA
 Macaulay Creek Mines

based on Company's plans
Scale 32 ft to an Inch
 To accompany Report on Kangaroo Hills
 Mineral Field
 By
 Walter E. Cameron B.A.
 Assistant Govt Geologist
 1901



PLAN OF

Underground Workings

MT LONG MINE

Macaulay Creek

Based on Company's plans

Scale 16 ft to an Inch

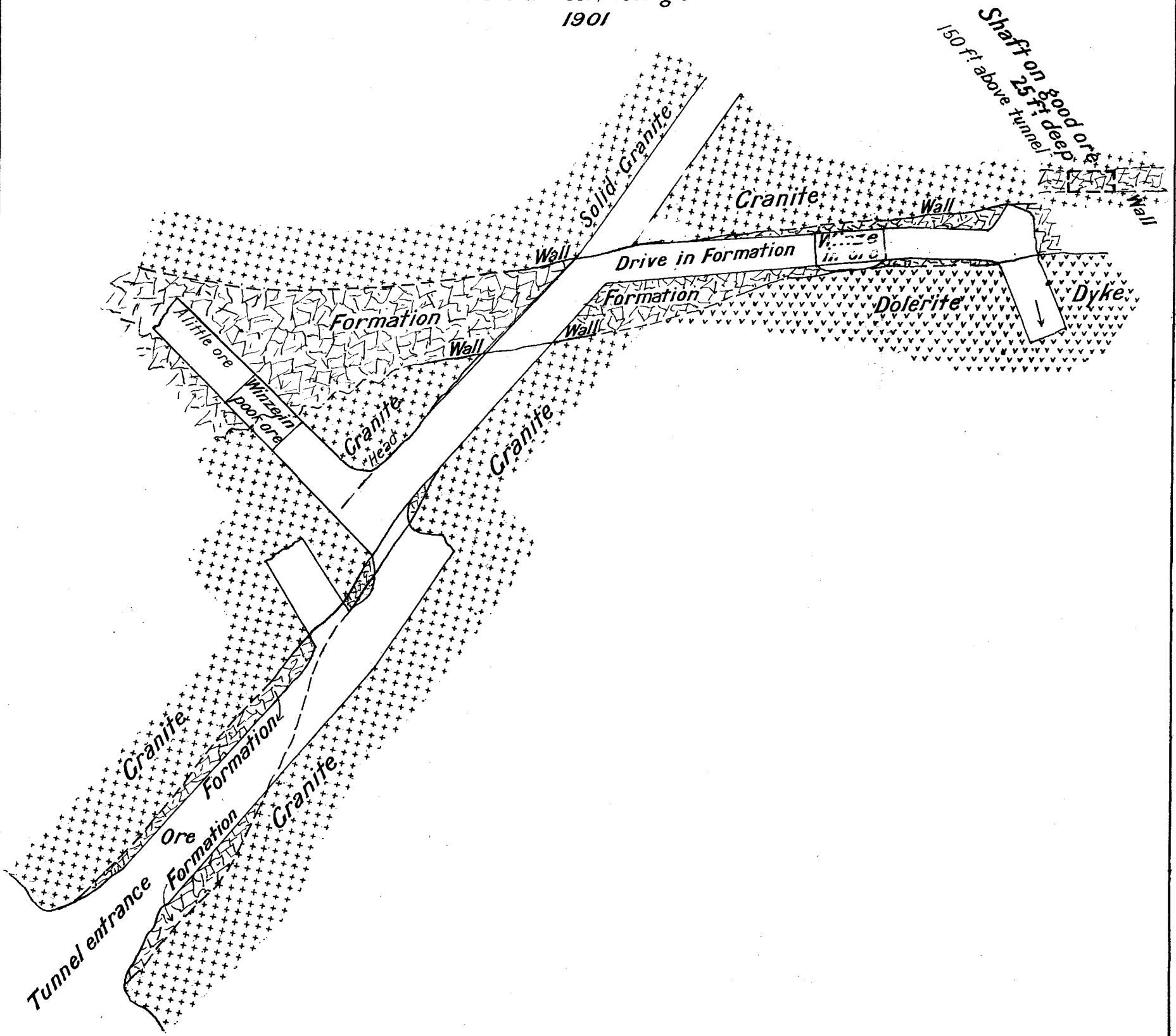
To accompany Report on Kangaroo Hills Mineral Field

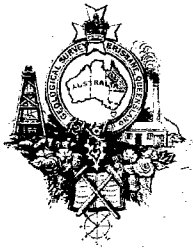
By

Walter E. Cameron B.A.

Assistant Govt Geologist

1901





PLAN OF Underground and Surface Workings COPPER KNOB MINE

Macaulay Creek

Based on Company's plans

Scale 16 ft to an Inch

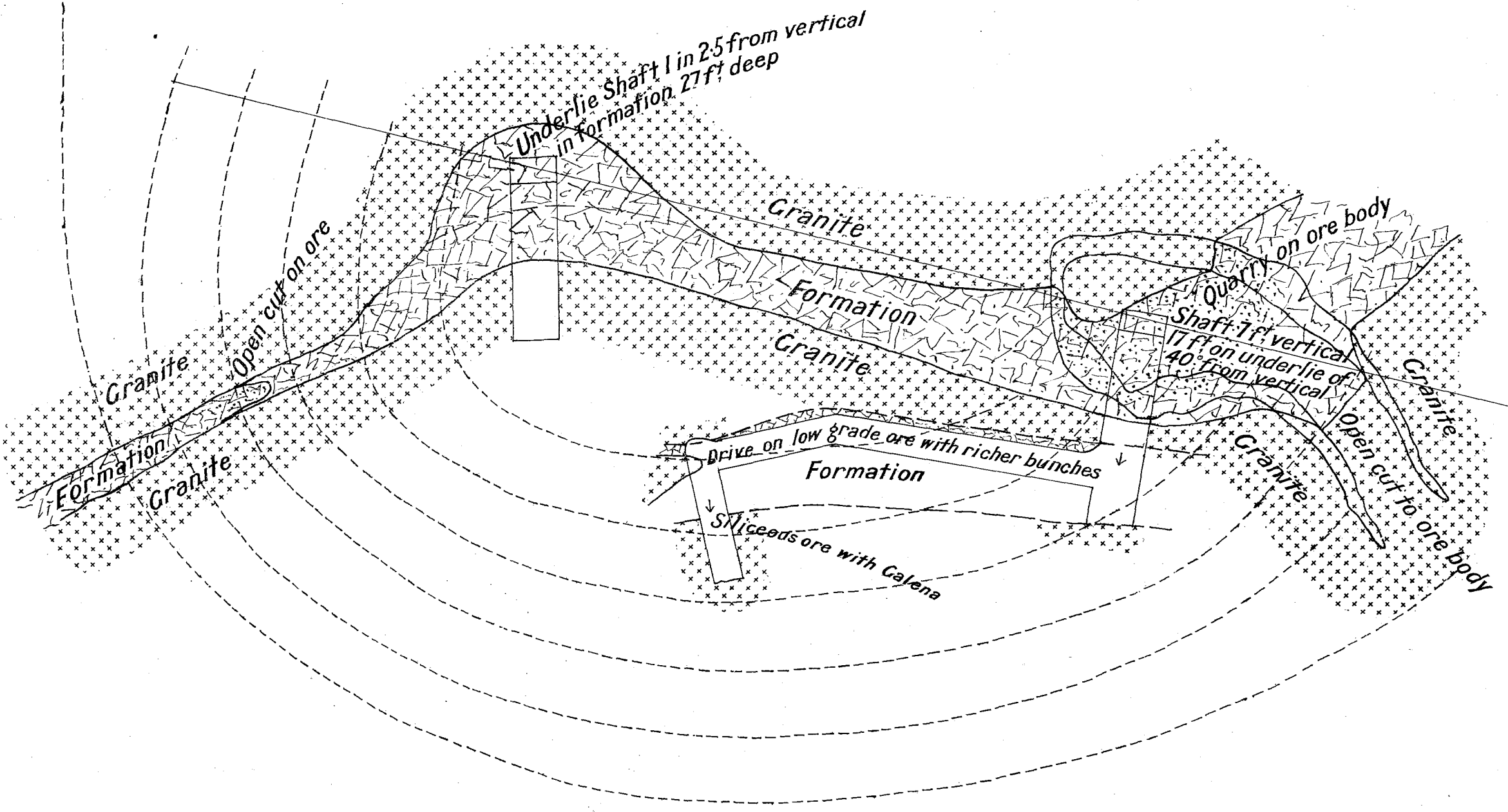
To accompany Report on Kangaroo Hills
Mineral Field

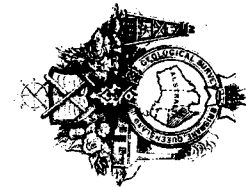
By

Walter E. Cameron B.A.

Assistant Govt Geologist

1901



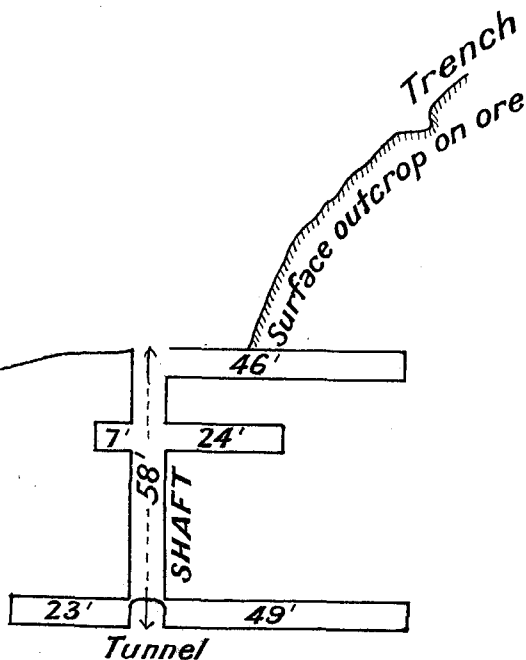


PLAN & SECTION of Workings DOUGLAS TIN MINE.

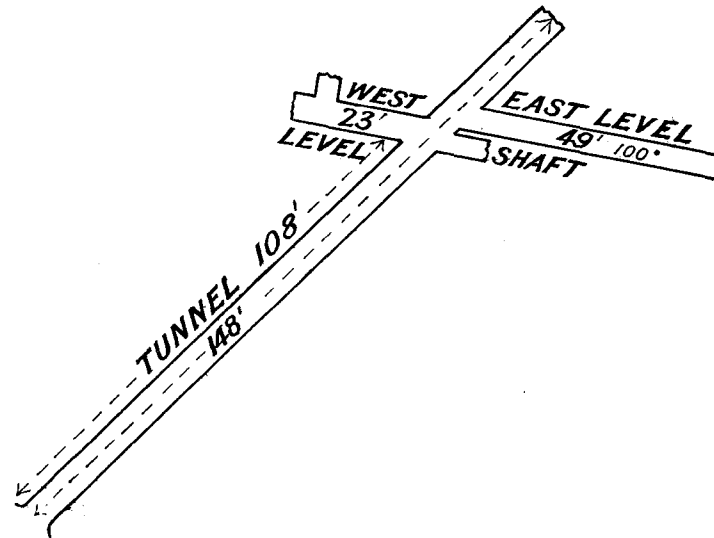
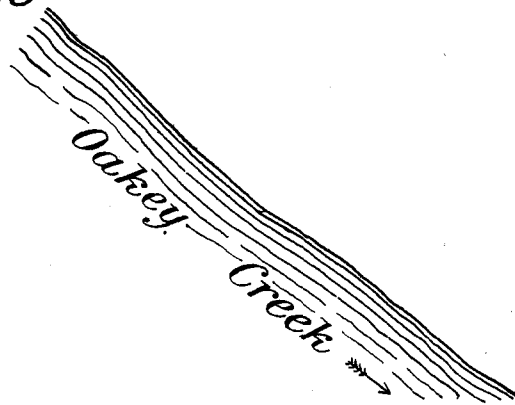
Scale 40 feet to an Inch

To accompany Report on Kangaroo Hills
Mineral Field

By
Walter E. Cameron B.A.
Assistant Govt Geologist
1901



Vertical Section of Workings along Lode



Plan of Workings on Tunnel Level

SCANNED FROM MICROFICHE

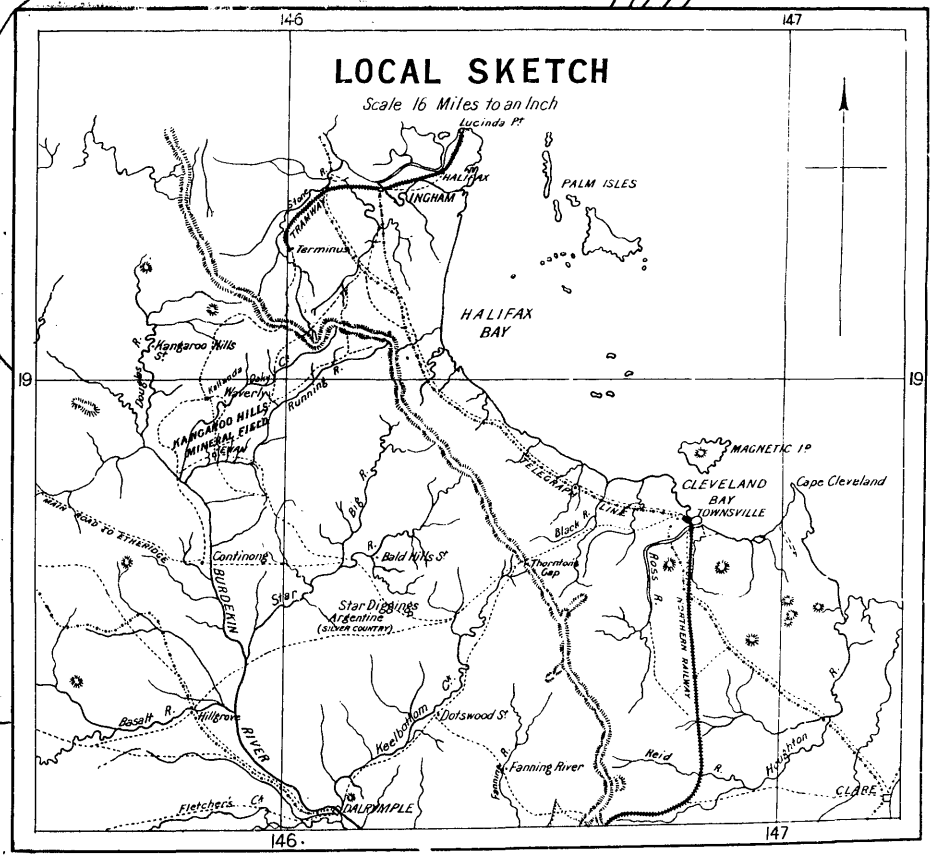
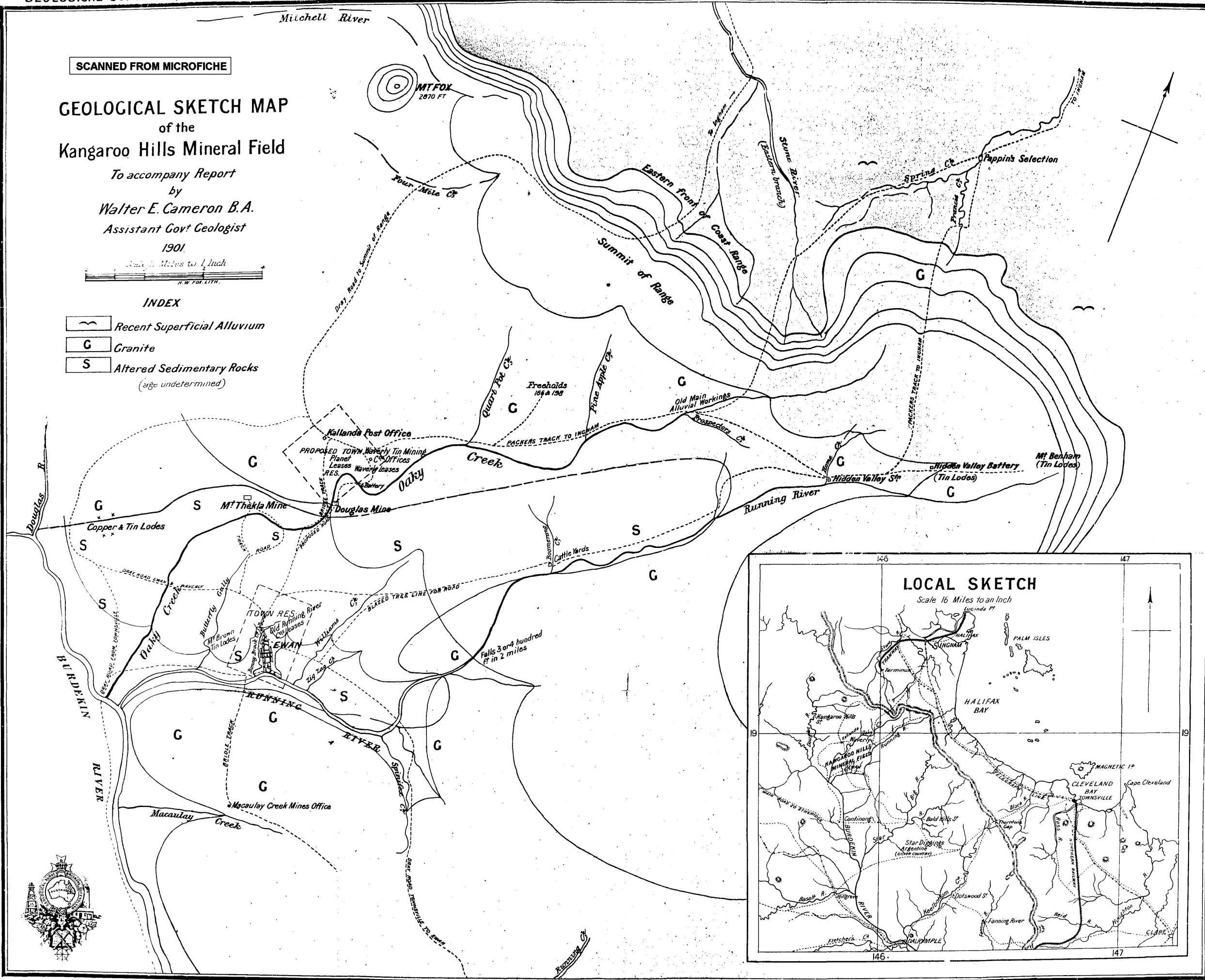
GEOLOGICAL SKETCH MAP of the Kangaroo Hills Mineral Field

To accompany Report
by
Walter E. Cameron B.A.
Assistant Govt Geologist
1901



INDEX

- Recent Superficial Alluvium
- Granite
- Altered Sedimentary Rocks
(age undetermined)



GSQ PUB 167

