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REPORT ON THE BACK CREEK GOLDFIELD, COUNTY OF DORSET.

Geological Surveyor's Office, Launceston, 15th August, 1894.

SIR,

I HAVE the honor to forward to you the following Report on the Back Creek Goldfield, of which a somewhat detailed survey was made by me in January and February last. Owing to pressure of work requiring immediate attention it has not been possible for me to send you the results of my examination until now, and consequently the present Report is not quite up to date, but deals with the state of the field as seen in February; in one or two mines it is understood that considerable progress has since then been made.

The Back Creek field lies about six miles north-east from Lefroy, and is reached from there by a fairly good cart road. The principal workings hitherto have been on the west side of the Back Creek, on spurs running from a low range—the Fourteen-mile Bluff Tier,—which separates the basin of the Back Creek from that of Currie's River, but the Major (formerly Leura) and West Major mines are on the east side, on the ridge separating the Back Creek and Piper River basins. Herewith are sent plans of the field, one showing the position of the various workings, and another to a smaller scale the basaltic country along the course of the Back Creek. A plan of the Major and West Major workings also accompanies this Report.

The main geological features of the whole district from the Forester River westward to the Asbestos Ranges on the west side of the Tamar are very clearly shown on the late Mr. C. Gould's map of the Den goldfields and Ilfracombe iron deposits (1866), though numerous details made clear by the mining work that has since been done have, as might be expected, been omitted. It is there shown that the Lefroy and Back Creek goldfields are only portions of a large area of older Palæozoic, probably Lower Silurian formation, which extends from Lefroy eastward to the granite country round Scottsdale. The Denison and Golconda goldfields are also in this formation, and it is again met with in the Waterhouse, Warrentinna, Mount Victoria, and Mathinna fields. Towards the coast the older rocks are much covered with sand and quartz gravel of Tertiary age, which conceal any reefs and auriferous leads that may exist there; they also often conceal flows of basalt which exist along the valleys of the Nine-mile Creek at Lefroy, Back Creek, and the Piper River; these are not by any means always covered, however, and are well seen at various points in the Lefroy field and all along the courses of the Back Creek and the Piper River, often forming small stony hills. Along the coast the basalt is well seen at Weymouth, and again at the Black Rock; at Weymouth it has a very well marked columnar structure, and the columns are broken by numerous horizontal joints, so that the whole mass has the appearance of being built up of layers upon layers of hexagonal and polygonal cakes. At Lefroy and Back Creek borings with diamond drills have shown the existence of Tertiary alluvial gravel under the basalt and between successive flows of it, and it seems likely that the lavas were poured out at intervals during the long subsidence which prevailed throughout this island during the Palæogene period. These basalts would, then, be somewhat older than those of Derby, Branxholm, Scottsdale, and Campbell Town, which appear to mark the termination of the period of subsidence and the beginning of the movement of elevation which has prevailed during Neogene times.

The runs of basalt, no doubt, indicate the position of ancient valleys along which the molten lava flowed, and thus serve to show us where we may expect to find "deep leads." These valleys were cut by the erosive action of prehistoric streams deep into the Silurian bedrock; and any gold that this may have contained in the veins and reefs traversing it has, no doubt, been largely concentrated in the old beds of these streams. The gradual accumulations of gravel in the channels, due to the movement of subsidence setting in, and the flows of basalt from time to time, have filled up the old valleys, and more or less diverted the streams from their original courses. In order to get to the gold-bearing gravels in the deep channels or "gutters," it is therefore necessary to penetrate right through these later deposits and find the old watercourses. When the old rivers have traversed districts known to contain auriferous veins and reefs, there is every reason to expect to find gold in their channels: we should therefore be likely to get it in the "deep leads" under the basalt at Lefroy, where the streams must have cut across the outcrops of a series of known auriferous lodes, and at Back Creek, where some at least of the country has been proved gold-bearing, and several shallow alluvial "leads," formerly very productive, have been found to dip under the lava sheets. The leads under the long runs of basalt in the valleys of Piper's River and

|| Columnar
basalt

|| Two basalt
flows.

Piper's Brook do not seem quite so promising for gold; for, except an alluvial deposit derived from the Leura reef, which falls towards the Piper, there have been no important discoveries of gold made along their courses; and the presumption is, according to present knowledge of the country, that the region traversed by them is not richly auriferous. As the Silurian formation prevails throughout their basins, however, it is not at all unlikely that good reefs may yet be discovered in them, in which case these leads also would be worth attention from miners.

The run of basalt in the Back Creek Valley commences almost at the head of the stream, being seen on the road from Lefroy to the Piper, near Batten's saw-mill. In the Den Ranges, close to this point, gold has been found on both sides of the watershed between Back Creek and the Fourteen-mile Creek; and right on the head of Back Creek, near the old Native Industry mine, there is a hill deeply covered on one slope with alluvial matter, in which some gold is obtainable. Between this point and the Back Creek Goldfield proper I have not heard of any quantity of gold being found, though the whole country seems very favourable. From Batten's mill the basalt run follows the course of the creek pretty closely, passing through Horne's and Gillespie's freeholds. About a mile north of Gillespie's, two narrow branch runs of basalt join the main one on opposite sides, no doubt indicating ancient branch creeks joining the principal stream. Still lower down we find several other branches: one very wide run coming in on the west side being that in which the diamond drill borings of 1882-83 were situated, and under which the "Old" or "Back Creek" and the "Cardigan" leads disappear: another smaller one further north being that which covers the continuations of the "Red" and "White" leads, and which was bored through with No. 2 Diamond Drill in 1889. On the east side a branch is crossed by the road from Back Creek to the Piper, and another wider one heads from near the Major Mine. These two flows are somewhat different in character from those on the west side, in that the latter occupy quite low ground, while these run from the top of the watershed down the hill slopes to the bottom of the valley. It seems probable that the basalt issued originally near the watershed, and that these two runs on the east side of Back Creek are simply lava flows poured down the sides of the hills, in which case it would not necessarily happen that any alluvial matter would be covered by them. Under these, therefore, we cannot feel at all certain whether we should find old watercourses likely to contain alluvial gold. From the point near the Major Mine, on the watershed whence, as just said, one of these runs commences, another flow of basalt can be traced towards the Piper River, and the alluvial gold found in some quantity in the Major Company's eastern section seems to become covered by this. As the run of basalt is quite narrow near the watershed, with the Silurian strata visible on each side of it, I cannot agree with Mr. Thureau's opinion (Report on the Back Creek Goldfield, 1882) that this "would most probably constitute the outlet for the Back Creek ancient river, or diluvial gravel system." A very much wider outlet would be required for a valley so deep as the Back Creek one has been proved by boring to have been. It is much more likely that the basalt has issued from a small cone on the watershed and has poured down the slopes on each side towards the Back Creek and the Piper River. From this point northwards a ridge of Silurian strata can be traced to the head of the estuary of the Piper River, making it clear that the ancient valleys of the Back Creek and Piper River could not have sooner joined one another. Not having examined the country on the east side of the Piper, I am unable to say with confidence where the old junction was, but from the information received from residents, it seems probable that the old Piper channel runs off to the eastward from near the junction of the present stream with Yarrow Creek to join with Piper's Brook instead of Back Creek. In Mr. Gould's map the Piper basalt is shown as joining the Back Creek run to the north west from the Yarrow Creek junction; but, as above mentioned, there is an intervening ridge of the bed-rock. On the plan herewith the position of the Back Creek basaltic run is shown as accurately as I can lay it down without actually surveying the boundaries, and it is pretty certain that it does not unite with the Piper basalt further south than the head of the estuary. The largest area of basalt is seen to be in the vicinity of Thos. Adams' 99-acre section, and from the vesicular nature of the stone there, and the shape of the ground, it seems rather likely that this was a central point of eruption. Opposite to this, on the west side of the creek, there is a branch run of basalt for some distance up Paddy's Creek.

The Back Creek Goldfield was at one time one of the most important in the Colony, affording employment to some hundreds of men. Accurate returns of the gold obtained are not procurable, but, according to the best information I have been able to get, it may be estimated that some 9000 ounces of gold were taken from the alluvial workings on the several leads. The gold being of high fineness, sold for 82 to 83 shillings an ounce as a rule. The deposits, being shallow, were soon worked out, and the field has for many years past been almost deserted by alluvial miners, only a few working on it now and then, going over the old ground. Several companies, however, have done a good deal of work from time to time endeavouring to discover reefs from which the alluvial gold may have been derived. These will be dealt with later on, the alluvial deposits being first considered.

On the map of the field herewith the leads are shown in their true positions, having been each traversed and surveyed. They are known as—(1) the White lead, (2) the Red or Albion lead, (3) the Old or Back Creek lead, and (4) the Cardigan or Prince of Wales lead. There is also a small lead on the ridge between the Leura and Piper roads.

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The White Lead lies on the northern slope of a small spur running south-easterly from the Union Company's section. For as much as three chains in width in parts the ground is riddled with diggers' shafts, from 10 to 14 feet deep; from these the gravel was taken out and washed in boxes. The upper wash is mostly sandy clay with a good deal of angular and sub-angular quartz through it; the lower gold-bearing layer seems also, from the stones thrown out of the boxes, to have been largely made up of angular quartz. The name of "White" lead is due to the fact that there was much white clay in this wash. The gold obtained was very angular, and often attached to quartz, so it does not appear to have come far from the original matrix. At the boundary of Sections 628-87G and 931-87G the lead is cut through by a small modern water-course, and has not been found any higher. It is noticeable that this water-course has cut a new channel in the bed-rock parallel with the old lead, and has not scoured out the old one, as might have been thought likely. At the east end of the lead the ground rapidly gets deeper, and basaltic clay and basalt begin to be met with, and in the low-lying flat ground the continuation of the lead is deeply covered with lava flows.

The Red Lead gets its name from a reddish colour in the wash due to much oxide of iron. The gold in this also often had much oxide of iron attached to it. Like the White Lead it consists of a strip of clayey alluvial drift, lying for the most part on the northern slope of a low spur running south-easterly, but towards the eastern end it crosses the spur; it is generally from 2 to 3 chains wide, and has been worked by innumerable holes 10 to 15 feet deep. About half-way up it a small branch lead joins it from the head of the Old Lead; this looks to me like a more modern deposit consisting of material re-sluciced from the head of the Old Lead. At the eastern end, like the other leads, this plunges under the basalt, and the bed must get very suddenly steeper, for we find that in the Grand Junction Company's working shaft the slate bed-rock was met with at about 15 feet, while 110 feet E.N.E. from it another shaft went down 80 feet without reaching bottom.

The Old Lead runs a more southerly course than the above-mentioned, and is a somewhat deeper and larger deposit; the upper portion has been worked by shallow pits, but lower down a large open excavation has been sluiced out, and the ground is seen to be from 18 to 25 feet deep. The bottom is a softish slate; on this was found from three to seven feet of a layer of heavy well waterworn quartz boulders and waterworn lumps of slate and sandstone containing waterworn gold; on this again we find sand and clay in horizontal layers, succeeded by 3 to 6 feet of sandy drift with much angular quartz. Owing to want of fall for the tail-race it is only in the upper part of the excavation that the gutter has been accessible; in the lower parts it dips rapidly under foot under a false bottom made up of large lumps of waterworn slate and sandstone with occasional quartz boulders, all set in sandy clay. A good deal of gold was got on this false bottom by the old Back Creek Company. In later years Mr. L. Schade has worked here a great deal, and in taking up the old tramway he cut down through the false bottom at the top edge where it rests on the bed-rock and got a nice patch of gold on the latter, thus showing that the gold goes below the false bottom as well as over it. In the lower part of the excavation a shaft, known as Moore's, was sunk 50 feet through the false bottom before reaching the slate bed-rock. "Colours" of gold are said to have been obtained through the false bottom and a little gold on the slate, but no driving was done. About 380 feet south of this, near the junction of the Lefroy and Piper roads, a shaft was sunk 100 feet; Mr. Thureau mentions this in his Report of 1882 on the district, and says: "A new shaft could not reach bottom whilst sinking on account of a heavy influx of water, but in the last five feet of gravel very good prospects of gold were obtained, and the following strata were passed through, viz:—clay, with heavy round gold; white and black slate, lying flat; and then the wash, furnishing good prospects of gold in the pan." As there is shallow ground to the east of this shaft it is clear that the lead must run southward into the basaltic flat in which are the 1882-83 diamond-drill bores.

The Cardigan Lead is a very short one, right on the top of a small spur. The workings, which have honeycombed the top of the spur, are quite shallow until we come near the Lefroy road, where they rapidly become deeper, and begin to show layers of basaltic clay (volcanic ashes). The principal shaft was that of the Cardigan Company, which was 52 feet in depth, and reached sandstone bottom. The bottom was found to dip 1 in 2 to S. 30° E. The wash on the bottom was much cemented with oxide of iron, and contained a good many smooth sandstone boulders: it yielded about 1 dwt. of gold to the load, which was not payable. The gold is reported to have been very shotty and rounded. On the east side of the road, opposite the end of the Cardigan spur, we find two shafts 30 and 34 feet deep, which came upon solid basalt, and were abandoned; and further north one 80 feet deep, bottomed on blue slate. In this there were about 12 feet of basaltic clay. The wash contained round sandstone boulders, but I could get no information as to whether there had been any gold found.

In the Cardigan Lead, especially on the north side of it, there is a great deal of hard quartz breccia, or rather angular conglomerate, often in heavy well-rounded blocks, some of them several tons in weight. They are very hard, but appear to me to be formed *in situ*, not mechanically transported, as they are composed of exactly similar material to the surrounding and often underlying loose wash. A little of this conglomerate is seen at the edge of the deep ground at the

eastern end of the White Lead also, on the spur west of the 70-foot shaft shown on the plan; and it is also seen every here and there along the boundaries of the basaltic country. Mr. Thureau, in his report on the Goldfield in 1882, noticed this rock, and drew from it a conclusion which seems to me unwarranted, and which might be misleading to anyone wishful of opening up the deep leads. He says:—"All these auriferous runs of diluvial gravels demonstrate an immense force of water running in swift torrents in self-eroded channels in prehistoric times, as evidenced by the rounded and semi-angular boulders of a hard silicious breccia, one of which was found imbedded in a reddish clay, and which measured 15 feet across by a thickness exceeding four feet, having evidently travelled over a considerable distance, as I could not discover any similar rock in the district." While agreeing with Mr. Thureau in believing that the streams which laid down these gravels were much larger and more powerful in carrying stones than the existing watercourses, I do not think that there is any necessity to assume the existence of rivers powerful enough to move such a huge rock as that quoted. The explanation of the occurrence is well shown in a section at the west end of the beach at the mouth of the Piper River, where a sheet of this same conglomerate is seen lying between a weathered basalt stream and the Silurian rocks. It is evident that the conglomerate is a quartz gravel cemented together by silicious matter,—the result being most probably brought about by the hot water and steam from the lava flows. The occurrence of the conglomerate only along the edges of the basaltic areas seems to me to bear out this view. The rounding of the boulders of conglomerate was probably due to a later water-action, perhaps during the erosion of the existing water-channels, which must be all much younger than the leads on the spurs.

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While on the subject of the alluvial gold deposits of this district, mention may be made of two other occurrences which have some significance. On the western edge of the basaltic country in the flat N.E. from Mr. W. L. Parry's house there is some quartz wash containing "colours" of gold; and perhaps a quarter of a mile further north, in the same flat and on the same edge of the basalt, a small shaft has been sunk in wash 10 feet to slate bottom, and in this a large speck of gold weighing 10 or 12 grains was found. From this it is to be gathered that here too we have auriferous gravels dipping under the basalt. The other case is that of the alluvial workings on the eastern block of the Major Company's ground. Here several shallow shafts have been sunk, and a good deal of gold has been obtained; but going northward the ground becomes deeper, and gets covered with basaltic clay and basalt. The gold here seems evidently derived from the Leura or Major reef, and the fall is to the Piper River; but if the reef is shedding gold on this side of the hill, it is also likely somewhere to yield gold to the Back Creek lead also, as it runs across the dividing ridge. Should it continue westward any distance, it must have been greatly broken away during the erosion of the Back Creek Valley. This case is probably not singular either, as there is a strong probability that the old lead running about north and south must have cut numerous reefs, as these in this district seem to have a somewhat east-and-west course.

As the shallow leads dip under the basalt it is plain that they must be older than it, and belong to the system of watercourses existing before the volcanic disturbances. Their peculiar position on the tops and slopes of spurs may be accounted for as follows:—When the streams that laid down the auriferous gravels were running the present leads were in the bottoms of their valleys; these, during the long period of subsidence which can be shown to have prevailed in Palæogene times in Northern Tasmania, became filled with drift deposits; later on the streams cut down again through these upper drifts, but not exactly in the old channels, and have now cut fresh beds in what were formerly the sides of the old valleys, leaving the old gravel deposits on the slopes and tops of the spurs.

The borings made in 1882-83 and in 1889 with diamond drills gave very important information as to the deep ground in the Back Creek Valley. The positions of the bores of the first series are marked on the gold-field plan A1, A3, A4, A5, A6, and A7, and of the second series, B1, B2, B3, and B4, the figures being the progressive numbers of each set. Unfortunately, no record can be found of the relative positions of the first lot of bores, and in assigning numbers to them I had to go by the information given to me by Mr. W. L. Parry, who has resided in the district for a long time. The positions of Nos. 1, 4, and 7 bores are pretty certainly correct, but it is not certain if the right numbers have been assigned to Nos. 3, 5, and 6, and no trace at all could be found of No. 2 bore, though Messrs. Parry, Schade, and myself searched very thoroughly for it for half a day. The sites of the bores are easily recognisable by the pits sunk for water for the engine, piles of cores, and so on, but there is nothing to show the order in which they were put down, the posts left to mark them having been burned by grass fires. The following sections are compiled from the foremen's weekly reports:—

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FIRST SERIES OF BORES WITH No. 1 DRILL 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.

	ft. in.		ft. in.	
	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.

	ft. in.		ft. in.	
	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
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.

	ft. in.		ft. in.	
	ft.	in.	ft.	in.
Clay	16	0	16	0
Sandstone	24	0	40	0

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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

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

	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

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

	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

I have not been able to find any record which would show if any gold was found in the bores, nor to ascertain if No. 1 bore reached the bedrock. A strong stream of water issued from this bore for some years, and even yet there is a little flow from it. The surface heights of the bores have

only been approximately measured (with aneroid barometer), but should not be far from correct. Taking them into account, we get the levels of striking the bed-rock as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Height of surface above sea level...	204 0	?	212 0	177 0	212 0	210 0	208 0
Depth of striking bed-rock.....	218 4	90 6	203 3	16 0	214 0	239 0	221 0
Level of bed-rock in bore	14 4	?	8 9	161 0	2 0	29 0	13 0
	below sea level.		above sea level.	above sea level.	below sea level.	below sea level.	below sea level.

No. 4 Bore is quite off the deep ground, and No. 2 is also comparatively shallow. Comparing the sections of the remaining bores, it is seen that the lower flow of basalt seen in Nos. 3, 5, and 6 is not met with in No. 1, and is only represented by a bed of basaltic clay in No. 7. No. 6 is actually the deepest bore, but does not seem to have got into the gravels likely to lie in the gutter, and no water seems to have risen in it as in No. 1; the latter, though not quite so deep as No. 6, is nearer the ranges, or further up the old stream, and has probably been more nearly on the old lead than any of the others. No. 7 bore must be on the east side of the gutter, as the bottom rises from No. 6 towards it. The old channel probably lies near No. 1 bore and a little to the east of No. 6, but is likely to be some little distance west of No. 7.

The positions of the second series of bores made with No. 2 Drill in 1889 are fortunately not at all in doubt, like some of those above, and are shown on the plan at points B 1, B 2, B 3, and B 4, the figures denoting the consecutive numbers of the bores. Close to these bores a shaft had been sunk 100 feet without reaching bed-rock; it is said to have gone through a lot of basaltic clay, and in the last 20 feet to have met with, first, boulders of basalt, and then solid basalt. Encountering this hard rock, and the water proving too much for the small engine employed, caused the sinking of the shaft to be abandoned. The sections of the bores are as follows:—

SECOND SERIES OF BORES: WITH No. 2 DRILL, 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.

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.

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	183 4

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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

As basalt is seen on the point of the spur west of No. 1 Bore, and again on that south of No. 4, it seems likely that there was a higher flow of basalt all over the valley in which the bores lie, which has been partly removed by denudation. There is not very much difference in the surface heights of the four bores, but taking it into account we get—

	No. 1.	No. 2.	No. 3.	No. 4.
Height of surface above sea level.....	125 ft.	129 ft.	127 ft.	123 ft.
Depth of striking bedrock.....	177 ft.	191 ft.	176 ft.	205 ft.
Level of bedrock where struck below sea level.....	52 ft.	62 ft.	49 ft.	82 ft.

Nos. 2 and 4 Bores seem likely to be near the old gutter, and contain considerable bodies of quartz wash lying on the bed-rock: they may well be nearly on the continuation of the Red Lead, but are probably to the south of the White Lead.

Neither of these two series of bores has, to my mind, been well located,—the endeavour seemingly having been to drop on the gutters by a random shot instead of by carrying out a systematic search. As seen on the plan, both sets of bores are on branch leads running into the main Back Creek Valley lead; and there can be no doubt that the basalt indicates approximately the position of the old valleys into which it flowed. Had a survey been made of the boundaries of the deep ground, it would have been seen at a glance that there are narrower parts of the old valleys lying a little to the east of both sets of bores, where a complete cross-section of the leads could have been made with the same amount of boring, or even less. It should be remembered that the proper use of a diamond drill in searching for deep leads is to locate the deepest ground, not to find gold,—the sample of gravel taken by the drill being so small that the richness or otherwise of the wash cannot be correctly judged by it. For example, in a recent bore in the East Pinafore mine the drill passed through quartz wash lying on the slate bottom under a basalt flow, but no gold was found in the sample brought up; yet, when the shaft was sunk to this point, it was found that there was a good deal of gold in the wash. In boring for a lead the holes should be put down in regular lines across its supposed course, and the dip of the bottom from bore to bore noticed, so that it can be found between which pair of bores the deepest ground must lie: then other bores should be put down between this pair, at short distances apart, if it is required exactly to locate the gutter. This being found, the further testing of it, to be in any way conclusive or satisfactory, must be done by regular mining, independently of whether the drill has brought up gold in the cores of wash or not.

The bores make it quite clear that there is a very deep old lead under the basalt of the Back Creek Valley. Taking into consideration the number of auriferous branches that have been actually worked successfully, the favourable nature of the whole of the formation through which the valley has been eroded, and the great probability that unknown reefs have been cut through during this erosion, I am of opinion that there is a very great probability that the main lead will prove more or less payable when opened for mining. Mr. Thureau, in his Report of 1882, expressed a similar opinion. Inspection of the plan shows that the lead is narrow almost opposite Mr. W. L. Parry's house, and that this narrow place is only a short distance below the junction of the branch from the White and Red Leads with the main valley, and not far below that from the Old and Cardigan Leads, while on the other side there are two branches of basalt coming in which may perhaps cover other leads fed from the Major Reef. Not to go too far from the known gold, I should recommend a trial of the lead in Mr. Parry's 16-acre block. A line of bores along an east and west line through the easternmost corner of this section would prove the depth of the ground, and show the position of the gutter, and depth and character of wash contained in it; they would also show how near to the gutter it would be possible to sink a shaft in reasonably firm ground which would not move and destroy the shaft when blocking out the wash should commence.

It must be anticipated that water will prove a serious difficulty in opening and working this ground. The No. 1 Bore of 1882 has shown that there is water in the deep ground under pressure sufficient to send it to surface, and as the outlet of the old valley must be now a long way below sea

sea-level, it must be expected that it practically forms an underground reservoir which will have to be pumped dry. It is shown above that the deepest ground reached by the bores is already below sea-level on what are only branches of the main lead, and it is quite conceivable that at the point recommended for trial the gutter may lie from 150 to 200 feet below the sea. This is quite in accordance with the evidence obtained in recent borings at Lefroy, which show that there too the bottoms of the deep leads run a long way below sea-level, with that of the Beaconsfield deep lead, which lies some 270 feet below tide-marks, and with the fact that the old channels of the Ringarooma and George's Rivers are much deeper than the existing ones. There has been a great subsidence of the land since the times when the streams ran which eroded these channels.

As the deeper parts of the Back Creek lead must be full of water, it will be necessary for any company attempting to work it to provide very powerful pumps, and to be prepared to go on pumping steadily for a long time until the underground reservoir is emptied: after that the influx of water could probably be controlled easily enough. If there is much of the clayey tight material seen in the bores in the main lead also, the water may not be a very formidable difficulty after all, as it will be mainly confined to the gravel layers. The proposed diamond-drill bores would give very useful information on this point.

Turning now to consideration of the sources of the alluvial gold in the various leads that have been worked, we find that though a great deal of search has been made, and a good many gold-bearing veins of quartz discovered, no really well-defined and permanent-looking reefs have yet been laid bare. In saying this, however, I do not refer to the Major or Leura reef, on the east side of the field, which, though small, is persistent on a straight course for quite a quarter of a mile, and has every appearance of permanency. In the workings of the White and Red Leads a great deal of the gold had quartz attached to it, and was angular and crystalline, showing little abrasion by being transported along the beds of the streams. Though numerous veins of quartz were found in the bedrock, they rarely carried gold; and it has long been a matter of much concern to those interested in the district that no reefs capable of supplying the leads have yet been discovered. When we have described the discoveries made up to the present, we shall be in a better position to discuss the matter, and form an opinion as to whether it is likely that the alluvial gold has been shed from sources now known, or whether the parent reef has yet to be found.

All over the field we come upon considerable outcrops of barren quartz, usually loose and broken from the solid reef, which no doubt lies close by under the soil. In some cases trenches and holes have been sunk on these outcrops, and the solid reefs been found. None of these large bodies have as yet been found to contain payable gold, and the quartz is generally of a very hard and "unkindly" nature. They no doubt supply a large quantity of the barren quartz found so plentifully in the alluvial deposits. One of the largest of these reefs is found on the top of the high hill to the north of the Australasian Slate Quarry, running south-easterly, but gradually bending down to a southerly course. There is a great amount of quartz about the surface, but no mining work has been done that I could find traces of. Possibly this reef is connected with another one seen running along the top of a spur in Sections 931-87G and 628-87G on the north side of the head of the White Lead. Here, too, there is much loose quartz similar to that on the first-named occurrence. A number of trenches have revealed the underlying reef, and shown it to be a large body of quartz, up to 6 feet in width, much mixed with country rock: I have not heard of any gold having been found in it. On the next parallel high spur to the north east there is again some very similar quartz. On the tops of two other spurs running from the hill to the south of the saddle on the road to the slate quarry, we again find large quantities of barren quartz, and in Section 635-87G a trench shows a big reef. In this same section there is an old tunnel, now fallen in, which is said to have been driven about 150 feet to cut this reef, but without finding it, though several large bodies of quartz were met with. The reef along this spur is pretty well parallel to that on the hill north of the slate quarry, and to the one that traverses Section 931-87G, and all three are not far from parallel with the strike of the country strata. The reef coming southerly towards the northernmost corner of Section 840-87G, is again pretty parallel to the branch running south from the hill to the south of the saddle on the road. Where this southern branch meets the south-easterly one which runs towards Section 635-87G, a big outcrop of mixed ironstone, country slate, and quartz is met with, which can be traced to the north west along the spur, as shown on the plan. Similar ironstone is found close to the westernmost corner of Section 83-87G, and in the old Sir John Franklin mine (Section 840-87G.) In the north corner of Section 83-87G there is a strong outcrop of quartz, which has been taken to be part of the Hidden Treasure reef worked in Section 1022-87G: as seen on the plan it strikes nearly straight for the old Hidden Treasure shafts. Two trenches cut across it show a mass of quartz from 3 to 4 feet wide, not known to contain gold.

At the time of my visit to the field, the only mines that were being worked were the Union and the Major, but I was also able to inspect some of the old workings in Section 840-87G. The information I have been able to gather as to the other old mines has been mostly given to me by Mr. W. L. Parry, whose long residence in the district has given him every opportunity of watching its progress. It is not to be supposed, however, that figures as to depths of shafts, lengths of drives, and results of crushings, from memory, however good, can always be strictly accurate; and in

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reading the following description of the work that has been done, it must be borne in mind that the information given is from hearsay to a great extent; and, while correct in the main, cannot be guaranteed to be free from occasional errors. As particulars of the old workings must become from year to year more and more difficult to obtain, I shall place on record such as I have been able to get, in as brief a form as possible, in the hope that by doing so the necessity for repeating old work in the future may be as far as possible avoided.

Try-again Shaft.—On White Lead, about $6\frac{1}{2}$ chains east of southernmost corner of 628-87G. Sunk 50 feet in black slate: drives from bottom 70 feet to south and 20 feet to north: nothing of value found.

Hold-fast Shaft.—About $1\frac{1}{2}$ chains east of southern corner of 628-87G: sunk 45 feet: about 70 feet of driving done from the bottom, in which a number of small leaders were cut, but no gold obtained.

Hold-fast Shaft.—On north side of White Lead in Section 628-87G: 70 feet deep: about 35 feet driven north and 35 feet south: leaders cut, but no gold.

Union Mine. Section 643-87G.—The workings of the Union Company are situated at the head of the gully in which the White Lead lies. The main shaft at the time of my visit was 88 feet deep, and levels had been opened at 80, 63, and 30 feet. To the north east of the main shaft are three small ones, from which older workings were made: these communicate with an old north-easterly drive from the main shaft at the highest level. There is no regular lode in the mine,—the gold being found in a white sandstone traversed by numerous small quartz veins. At No. 1 and No. 2 levels this auriferous rock forms the hanging wall of a vein of quartz from 6 to 12 inches wide, accompanied by from 18 inches to 2 feet of broken wall-rock or "mullock:" this vein strikes about N. 65° W. and dips to the S.W. After passing through it no gold is found. At the bottom level the same vein is again met with, but smaller, and towards the south-east end much broken into leaders: here, too, the gold is found mostly on the hanging wall of the quartz vein. At this level, however, a drive to the north east towards the old shaft got some gold almost under the old workings. The gold in these appears to have been in white sandstone, with fine quartz veins through it, lying on the hanging wall of a group of small 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 of veins seen running towards one another in the top level were coming into one course down below. Throughout the mine there are sudden changes of country from white clayey sandstone to black soft slate and soft white slate; and these latter beds, which appear often to lie in flattish layers, do not appear to carry gold like the more porous white sandstone. As will be seen later on, there is reason to believe that the strata of the country in this district have a north-westerly strike and a rather high angle of dip; and this makes it probable that these apparent beds of black and white slate and sandstone are not true members of the series of stratified rocks forming the general country rock, but are altered parts of one or more of these strata, differently acted upon by the solutions that have deposited the gold. The more permeable sandstone strata would have a better chance of being impregnated with gold than the less pervious slates. Be this as it may, we have in this mine an instance of the country rock in the vicinity of a quartz vein containing enough gold to be worth crushing. The width of the gold-bearing zone seems to vary in the different levels,—being about 10 feet wide in the No. 2, and over 15 feet in the top and bottom levels, but not by any means all of it is worth crushing; and in the present state of development of the mine, it is hard to say where to look for the best portions. From the old workings near the surface gold is reported to have been obtained by roughly crushing and cradling the auriferous sandstone: from No. 1 level a crushing is said to have yielded about 15 dwts. to the ton. Samples taken by me from the bottom level gave very little gold, but small prospects were obtainable from the paddock of stuff that had been saved. According to *The Daily Telegraph* of March 4th, 1894, a crushing of 6 tons yielded 1 oz. 16 dwts. of gold, or at the rate of 6 dwts. to the ton.

Since my visit a small battery of five stamps has been put on the mine, so that it will be possible to test it thoroughly. The auriferous sandstone is easily crushed, and the zone of rock containing gold seems pretty wide, so there seems some hope that a very low return may be made to pay, say $2\frac{1}{2}$ to 3 dwts. to the ton. It would of course be necessary to crush large quantities of stone in order to be able to make any profit out of rock of such low value, and at present it cannot be said that there is material in sight that would justify the erection of a large crushing-plant. Nevertheless, the formation is auriferous, and sufficiently promising to deserve continued prospecting, the small battery being used to ascertain the value of the rock coming to hand from time to time. There is a possibility of a more defined body of quartz being found at greater depth, and I should recommend sinking a fair-sized main shaft instead of the small prospecting one now used, to try for gold at lower levels.

Section 840-87G (formerly Sir John Franklin Mine).—This old mine is at the head of the gully in which the Red Lead lies, having a similar relation to this lead to that held by the Union Mine with respect to the White Lead. There is also a considerable similarity in the occurrence of

the gold in the two mines, it being found in connection with groups of quartz veins in sandstone country rather than in regular reefs. The workings from the Sir John Franklin engine-shaft are not now accessible, being full of water, but the tunnel and eastern shaft may still be entered. The engine-shaft is said to have been 170 feet deep, and at that level a cross-cut was put in to the westward a distance of 50 feet, from the ends of which drives were made north and south, each 15 feet, the southern one connecting with a winze from another level at 100 feet, which in turn was connected with the tunnel by a winze. Some gold-bearing leaders and bunches of quartz are said to have been cut in the shaft between 90 feet and 130 feet. The positions of the tunnel and various shafts are shown on the plan of the field. The 60-foot shaft to the west of the mouth of the tunnel is said to have at the bottom a drive 12 feet to the south, which cuts a likely-looking lode-wall running east and west and underlying to the north, but with only a little rubble and flucan upon it. The 80-foot shaft north-west from this has in the bottom a leader of quartz, some 10 inches thick, striking about N. 80° E., which has been followed 30 feet east and the same distance to the west. It is said to have carried gold all the way, but to have become small when followed. About 15 tons of quartz are reported to have been raised and roughly crushed by hand, as much as 3½ ounces having been got from specimens. North-east from this shaft is one 35 feet deep, which cut a small vein carrying gold some ten feet from the surface. No driving has been done on this. Between it and the engine-shaft a lode of quartz, ironstone, and slate is cut in a trench, which agrees in position and direction with a similar vein met with in the tunnel, and picked up again close to the 70-foot eastern shaft. No gold is known to have been got from this. The tunnel is 233 feet in length, and runs a little to the west of north. For the first 140 feet yellowish sandstone is passed through without noteworthy features, but the remainder of the distance is remarkable for the very large number of small parallel quartz veins which are cut through. These strike N. 45° to 50° E., and underlay to the north 1 in 5. Some short drives have been made along the course of some of the largest veins. The quartz is much ironstained; 10 tons of it from this level are said to have yielded gold at the rate of 6 dwts. to the ton. The winze to the 100-ft. level of the engine-shaft is about 55 feet deep, and is connected with it by a crooked drive. The winze from the 100-ft. level to the 170-ft. is some 30 or 40 feet nearer the engine-shaft than the bottom of the upper winze. Thirty tons of stuff from this lower winze are stated to have yielded 22 ounces of gold on crushing (equal to 14 dwt. 16 grs. per ton). About 38 feet from the end of the tunnel the ironstone lode seen on surface is cut through, striking N. 50° W. and dipping 70° to the N.E. It is from one to two feet thick, but is said not to have been met with at the lower level. It runs almost square across the group of small gold-bearing veins. The eastern shaft has two levels, one at 70 feet the other at 43 feet, only the upper one being now accessible. In this we see a number of veins quite similar to those in the tunnel, running about N. 60° E.; in 12 feet driven to the south-east no less than 13 of these little veins are cut through. The country is a soft clayey sandstone, much ironstained, and the quartz veins are also usually brown from oxide of iron. A drive runs to the north-east 33 feet along a group of six small leaders, half an inch to three inches thick, which have been stoped out above the level for about 15 feet in height, 30 tons of the mixed sandstone and quartz being reported to have yielded gold at the rate of 6 dwts. to the ton. At the end of the drive the ironstone lode is met with, running about S. 60° E., and underlaying 1 in 3 to the north-east; it is about two feet in width, and consists of quartz, oxide of iron, and ironstained slate. It does not fault the little north-easterly veins, which continue on the other side of it without dislocation. A winze has been sunk on the ironstone lode to the 70-foot level, and continued below it some 35 or 40 feet, and at the lower level this lode has been driven upon 35 feet to the north-west and 40 feet to the south-east.

The run of gold-bearing veins seen in this shaft cannot be the same as is seen in the tunnel, but must be a nearly parallel set. In the stuff paddocked at the mouth of the shaft small prospects of loose gold can be obtained, and in bulk it is probably worth 5 to 6 dwts. to the ton. If this return could be relied on to continue a payable mine might be opened up, but further prospecting must be done before a reliable opinion can be formed. Both this set of veins and the one in the tunnel might be mined very cheaply, and if explored and laid open by drives so as to expose large quantities of auriferous material it might be worth while to erect a large battery for crushing. As in the case of the Union mine, the probability is that the bulk of the stuff is too poor to pay for crushing on a small scale, but might perhaps yield a profit if handled in large quantities: it is therefore necessary to find out if the mine can supply the amount of material required to keep a large battery steadily at work. At the same time it would be advisable to sink a deep shaft to try if the veins come together in depth: should they do so there seems to be a good chance of a payable lode being found.

Never Mind Mine.—(Australasian Slate Quarry Company's Freehold, Lot 6879, 15 acres.) On the opposite side of the head of the Red Lead gully are a number of shafts and workings belonging to the old Albion and present Never Mind mines. The most easterly shaft shown on the plan is the new one not long ago put down by the Never Mind Company: it is 100 feet deep. At the bottom a drive put in 15 feet to the southward cut some quartz near where the Albion reef was expected, but men familiar with the character of the stone say that it is not the same. The shaft was inaccessible at the time of my visit, so I am unable to give any opinion of my own on this point. The two shafts close together near the centre of the section were put down many years ago by the Albion Company: the more southerly is vertical for about 15 feet, then follows the

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underlay of the reef on which it was sunk. This appears to have been very irregular, being vertical for about 15 feet at surface, then with an underlay to the north-east for some distance, then again vertical, and in the bottom of the shaft once more underlaying to the north-east. The more northerly shaft is a vertical one 100 feet deep which broke into the bottom of the underlay shaft. The reef as far as can now be learned ran a south-easterly course, and at times contained good gold, but appears to have been broken and irregular: it would probably be best to sink still deeper in the new shaft before making much search for it. To the north-west from the Albion shafts there is another old shaft, 70 feet deep, on a somewhat broken quartz vein running east and west: some gold is said to have been got in the surface workings for a short distance each side of the shaft. At the bottom of the shaft a drive was put in to the south 150 feet, and at 20 feet this cut a broken-up body of quartz without walls. From its position the gold-bearing reef found here on surface may have something to do with the run of auriferous veins seen in the Franklin eastern shaft.

New Hidden Treasure.—(Section 1022-87G). In the north-eastern portion of this section there are several old shafts in which gold-bearing stone is said to have been found: they were not able to be entered at the time of my visit. The reef is said to have been somewhat flat at surface and about three feet in thickness, running a more or less east and west course and underlaying to the north. The middle one of the three shafts marked on the plan as lying close together was the principal one: it was 45 feet deep. The quartz in it is said to have averaged from 6 to 8 inches in thickness, but been at times as much as 18 inches; it became thinner at each end when driven on. In the bottom of the shaft the stone was one foot thick, but barren. Seven tons from these workings yielded 28 oz. 18 dwts. of gold on crushing, or at the rate of 4 oz. 2 dwts. 14 grs. to the ton: the shoot of gold, however, appears to have been quite short. About 17 feet north-west of this shaft another one 40 feet deep was sunk to cut the reef on its underlay: some leaders and bunches of quartz were found, but no gold: a drive connects this with the main shaft. Fourteen feet to the south-east of the main shaft is another shaft sunk 45 feet, in which some bunches of quartz containing some gold were found: the water became so heavy in this that sinking had to be discontinued. The country sunk through in these three shafts was white clayey sandstone like that in the Union mine, but is more likely to be a parallel belt than the same one. Still another shaft has been sunk 59 feet south-east from the main shaft: its depth is about 22 feet: from the bottom drives were made both to north and south, about 50 feet in all: several leaders were cut, underlaying to the north, and containing occasional traces of gold. To the westward from the above workings several shafts have been put down, prospecting for the westward continuation of the reef, but without success: they show the belt of white sandstone to have a north-westerly course, with reddish shaly sandstone and slate on the western side of it. Some leaders running east and west, and with a little gold, were found in a shaft 18 feet deep lying about 160 feet north of the north-east corner of Section 635-87G.

Nearly two chains east of the Hidden Treasure shaft are some old workings on a small reef running N.E. and S.W. This was stoped from surface for from 12 to 15 feet in depth, and for a length of two chains. There was about 18 inches in thickness of broken rubbly quartz, 10 tons of which gave 25 ounces of gold on crushing, but going downwards the stone became barren. East of this place on the boundary of the section is an old shaft about 22 feet deep, in which leaders of quartz were found, but no gold, and about a chain further east again is another 25 feet deep, from which a drive went S. 20° E. some 40 or 50 feet: some quartz leaders were passed through, but no gold got. This shaft seems to be about the eastern side of the belt of white sandstone country, hard slate being found in the creek to the east of it. It would seem, then, that in the Hidden Treasure ground two small reefs have been found, both containing good gold at surface, one running about east and west, the other about N.E. and S.W. Though good stone was at first found in them, they appear to have become poor going downwards; still the workings have been only very shallow. It seems quite worth trying the ground at greater depth to see if the reefs improve in size and quality. The water, which prevented sinking by manual labour alone, would probably be easily overcome by a small engine.

Sections 157-87G and 190-87G.—In these we find a large number of old shafts, close to the head of the Old Lead, which belonged in past years to the Lady Emily, All Nations, and Moonlight mines. Most of these shafts are in white sandstone country, like that in the Hidden Treasure and Union mines. The shaft furthest west on the plan in Section 157-87G is one of the old Lady Emily shafts, sunk in white sandstone; it does not appear to have struck the reef. East of it a little more than a chain is another of the same Company's shafts, 50 feet deep, on a reef 18 inches to two feet wide, running apparently easterly, and underlaying north. This was followed some 25 or 30 feet to the westward, and 55 to 50 feet eastward, but though some gold was found it was not payable. The same reef is again cut in the All Nations shaft, which lies about 40 feet south-east from the S.E. corner of section 1022-87G, and in another one about a chain south-east from it. The latter is some 22 feet deep, in soft whitish sandy slate; the reef in it was about 12 inches thick, but barren. The All Nations shaft was 60 feet deep, in soft micaceous sandy slate. A cross-cut was put in 30 feet to the southward and cut the reef, 18 inches thick, but with no gold. In this shaft there was a very heavy inflow of water, apparently from the north.

About a chain and a half from the north-east corner peg the eastern boundary of Section 157-87G is crossed by another line of reef, running about E.S.E., on which there are seven small shafts. Numbering these from west to east will serve to make the following particulars more easily understood:—No. 1, sunk 30 feet in bluish sandy slate; 15 feet driven to south, and 5 feet to north; reef a mass of small leaders. No. 2, about 30 feet deep; quartz 6 inches thick; no gold. No. 3, about 30 feet deep; reef split up; no gold. No. 4, 20 feet deep; quartz 12 inches; reef cut 12 feet from shaft; no gold in the stone, a trace in the rubble. No. 5, 20 feet deep; reef 2 feet, barren; drives put in 50 feet to north and 30 or 40 feet to south. No. 6, 25 feet deep, in white sandstone; reef 18 inches to 2 feet wide; no gold. No. 7, 25 feet deep, in white sandstone; quartz over a foot in thickness, poor or barren. In No. 7 shaft we have the intersection of this line of lode with a north-easterly one, the Moonlight reef; the latter is heaved about a foot by the passage through it of the easterly lode. To the south of the above seven shafts is another one, about 60 feet deep, in dark sandy slate. In this there is an east and west reef 3 feet wide at surface, but with no gold; at the bottom drives were made 40 feet north and 40 feet south. This reef is probably really part of the same line as the parallel vein to the north of it, and may also be connected with an east and west vein of stone 10 inches wide, which carries a trace of gold, found in a 25-foot shaft three chains further west. This vein, however, does not seem to have been cut in a shaft 30 feet deep, half a chain east of the last-named, or in the drive from it towards another 20 feet deep lying to the south.

The Moonlight line of reef has been traced about 200 feet to the south-west from the main whip-shaft, marked on the plan. This was 70 feet deep, and at the 60-foot level a crosscut was put in to the reef 20 feet, and this was followed for 60 feet. The reef consisted of about 18 inches of loose rubbly quartz and broken country rock, without gold. A good deal of water was met with, and proved troublesome. A little east of the whip-shaft a shaft went down 30 feet on the reef, and from this a drive went north 15 feet. Some very rich gold was got here, as much as 7 dwts. having been washed out in one dish of stuff, but there does not appear to have been any quantity of payable stone. Another east-and-west reef is said to come in at the bottom of this shaft. Between this point and the shaft above called No. 7 there is another shaft 40 feet deep on the reef, which is here 15 inches thick; no gold was found in the bottom, but there was a little at a depth of 20 feet. Going southward another reef running south-easterly is met with, and after passing through this the reef has not been further traced. The cross reef is barren, and runs some distance down the spur to the south-east as a large outcrop of quartz. It seems likely that this reef and the other cross-reef further north may be connected with the big barren reef seen on the top of the spur in Section 635-87G. It may be noted that the Moonlight reef, the eastern one of the Hidden Treasure reefs, the Franklin veins, and some of the Union leaders, all have a more or less north-easterly course. Kennet and Hackett's reef, next to be mentioned, and the Leura reef, also run between north-east and east, and it would therefore seem throughout the district that a strike between east and north-east is rather characteristic of the gold-bearing veins. The gold-bearing veins of the Lefroy district also mostly run much this same course.

Kennet and Hackett's Reef.—This crops out on the spur between the Leura and Piper roads, and a shaft was sunk on it many years ago to a depth of 34 feet. The size of the reef cannot be now seen, but from the stone thrown out it seems likely to be over a foot in thickness. A little gold is said to have been got in it, the stone being estimated to be worth 2 dwts. to the ton. Two or three trenches have been put across the line of the lode to the west of the shaft, and show it to have a north-easterly course, but really very little has been done on it. The stone is striated and laminated, and has many crystal cavities in it, very closely resembling the quartz from the Leura south reef. It is very unlikely, however, that the two are identical, as this one lies a good deal to the north of the Leura line.

Major Mine (formerly known as the Leura Mine).—To save verbal description a plan showing the surface workings of this mine is attached to this Report. The Major Gold Mining Company, No Liability, have secured a lease for mining purposes of two ten-acre sections of ground in Mr. Wm. Ritchie's freehold, lot 970. (This lot bears the name of Keith Jackson King, purchaser, 1000 acres, on the county map.) On the eastern one are the old workings of the Leura mine, which has been abandoned for many years past, but the recent richer stone found by the Major Company is on the western block. 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 deep 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 on Cardigan lead, lying about surface.
- D. Alluvial shaft over 30 feet deep down to white slate bottom.
- E. Said to be from four to five 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, and also big blocks of quartz similar to that from the Leura reef, which has no doubt been cut by a cross-cut 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, mostly through basaltic clay. About 18 inches of cemented quartz rubble on the slate bottom, which gave 3 to 4 dwts. 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.

The alluvial matter raised from the shafts was puddled, and some of the quartz from it also crushed. It seems pretty certain that all this quartz must have come from the adjacent reef. Close to Shaft G there were some open workings in the alluvial right on the outcrop of the lode; the stuff from these and from E was taken through the old tunnel shown on the plan by a tramway to the puddling machines. There seems a good deal of reason for hoping that in the bottom of the sub-basaltic channel to the north-east of all these alluvial workings some good alluvial gold should be found.

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 further traced through the next section by a number of shafts and trenches. It is said also to have lately been found in the adjoining section, 12-93a, 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 seems 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 appear to 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 P.A., which has been kindly 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 surface, and "all proved payable." The main shaft was 100 feet deep, and a cross-cut 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 plan yielded some good golden stone, 9 tons returning gold at the rate of 3 oz. 8 dwts. to the 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 ounces 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 through 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 shaft T, which is now rather deeper than when I saw it, yielded on crushing, 18 ozs. 15 dwts. of gold, or at the rate of 9 ozs. 7½ dwts. 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 cross-cut 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 being done, and the reef was followed for only some 30 feet or so. 30 tons of stone from it yielded gold at the rate of 19 dwts. 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 shallow one, marked U on

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 two feet in width, showing laminated structure and striations 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 feet shaft, b, now filled up, and another, c, 47 feet deep, from which a cross-cut 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 six feet: it contained gold, but not payable, and had an underlay to the south, that is in the 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 ends of the cross-cuts from shafts 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 ozs. 9 dwts. of gold, or, say an average of 2 ounces to the ton. Though the reef is small at surface it seems to be widening out going downwards, and in the east end, in the Leura workings, it is a fair size. Very good stone has been got in shafts T. and S., and in shaft Q., while good quartz is reported from the West Major workings, shaft Z. on the south reef, and the whip-shaft, also from the old whip-shaft of the Leura, N. The gold in the alluvial workings at the east end makes it probable that there is another auriferous shoot in the reef in this direction also. Gold having been traced over such a distance along the strike of the reef there is every expectation that, when opened up extensively, numerous gold-bearing shoots will be found in it, and if these are nearly as good as the parts crushed by the Major Company the mine should have a very successful future. The reef as shown on the plan preserves a fairly straight well defined course, and cuts across the strata of the country, so there is a great likelihood of its proving a permanent fissure in depth. With the exception of some hardish blue slate seen in the old Leura tips and the hard belt existing in the West Major shaft the country is soft and "kindly" for the existence of the reef. Both north and south reefs deserve attention, and in my opinion there is very great hope that both will prove valuable mines. As there is a good deal of water to be overcome, as seen in the Leura main shaft and Major whip-shaft, it will be necessary to sink a new main engine shaft in order to work the lodes to advantage; the water raised from the mine will probably be all required for the battery.

The laminated quartz found in this mine is noteworthy from the point of view of the student of mineral deposits and their mode of formation. The reef is often made up of a number of small curved and corrugated slabs of quartz,—the ridges of one piece fitting into the hollows of the next one. The surfaces of the slabs are much smoothed and striated, but both the striations and the main corrugations of the slabs lie horizontally in the reef. A downward movement of either wall of the fissure could not produce these markings,—on the contrary, it would obliterate them, and tend to shear off the interlocking corrugations. The disposition of the stone may be compared to that of the sheets of corrugated iron as packed for transport,—the case being supposed to rest on its longer edge. On the theory of the striations having been produced by movement of the walls, it would be necessary to suppose that there had been a movement in a horizontal plane. At present it is best to wait for more light to be thrown on the subject by future mining work than to attempt an explanation.

Having now described the various reefs that have been found throughout the Back Creek district, we may revert to the question as to whether they account for the gold found in the leads, or whether it is likely that the main sources of this are yet undiscovered. Though the Union, Franklin, Never Mind, and Hidden Treasure reefs are much broken and irregular, it is possible that higher portions of them now worn away were richer than those we see, and that they may have supplied most of the gold. We do not, however, know of any reef from which the Cardigan lead might have been fed. It seems to me most probable that there are many gold-bearing reefs yet to be discovered, and that those at present known are not likely to be the main sources of the gold. From what is known of the gold-bearing veins along the courses of the leads there is a certain amount of fear that the unknown veins will prove to be similar irregular bunches of auriferous leaders, very rich in parts, but often dying out in quite short distances: a great deal of gold might

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be shed from such veins. The example of the Major reef, however, encourages us to hope for more defined lines of lode to be yet discovered, and though, with all the work that has been done on the field, it might seem difficult for any extensive lode to have remained hidden, still numerous instances are on record which show this to be quite possible. Continued prospecting of the gold-field is therefore to be recommended. If the deep leads ever come to be extensively worked there is much hope that, as at Ballarat, auriferous veins will be found in the bedrock beneath the wash.

Strike of Strata.—The beds of the Silurian country rock throughout the gold-field consist of slates and sandstones varying in colour and hardness. It is probable that it will be found that some of the strata are more favourable for gold than others, and consequently it becomes a matter of some importance to the miner to know the direction in which the various belts of country are running. This is not so easily made out as usual, for the strata, especially the slates, show very frequently a distinct lamination, probably the result of former crust-pressures, along approximately horizontal planes, whereby the original bedding planes are obliterated. The strata therefore appear at first sight to be lying almost horizontal, a feature also seen in the Lefroy field. On the coast at the mouth of the River Piper, and in the splendid section afforded by the Australasian Slate Quarry, however, it is clearly seen that the lamination is transverse to the true stratification, and that the strata really are inclined at high angles of dip. In the exposure on the sea beach to the west of the Piper mouth the strata are seen to vary somewhat in their strike, but average about N. 52° W. and dip to the N.E.; in the Australasian Slate Quarry they run N. 40° to 55° W. and dip N.E. about 55°; and on the east side of the Piper River Mr. Gould has marked on his map the strike N. 35° W. On the whole, therefore, the strata of the Silurian formation may be taken as striking N.W. and S.E. in this part of the country. This is much the same as the strike of the auriferous series at Beaconsfield. The principal spurs on the Back Creek field run south-easterly from the main range, and probably indicate the outcrops of harder belts of country: the spur in which the slate quarry is situated, for example, may be traced south-easterly through Section 918-87G in which is an old tunnel made for getting slate, and down between the Red and White Leads. The ridge to the north of the White Lead also seems to be hard slate, and it seems quite possible that the hard country in the West Major shaft is part of the same belt. In the excavation on the Old Lead the stratification is very indistinctly seen, but is to the west of north somewhat. The belts of soft white sandstone country that have hitherto proved the most favourable for gold throughout the field may therefore be expected to run a more or less north-west and south-east course.

Australasian Slate Quarry.—No description of the Back Creek district would be complete without some mention of this quarry, though no work has been done in it for many years. It is a huge excavation, and is shown to scale on the plan, and all round it the ground is covered with the spoil banks where the waste material has been tipped. The best slate appears to have been confined to one or two comparatively thin beds, dipping at an angle of about 55°, consequently a great deal of useless rock had to be removed to get at it. In the bottom of the quarry underground mining was resorted to, but a great slip of the hanging wall covered up the workings, and operations have never been resumed. A very large capital was sunk in opening this quarry, making a tramway to Tam o' Shanter Bay, and constructing a jetty there, but the enterprise never became profitable, the slate costing more to raise than it was worth. The slates obtained were of very fair quality, dressing and working well, but the larger ones show a tendency to curve, and are somewhat twisted, which is a serious defect. It seems just possible that by underground mining, the slate in the best beds could be extracted at a less cost than by open working, but in the absence of figures as to percentage of marketable slate obtainable from a given mass of the rock, I can express no opinion as to whether it is likely that work could ever be profitably resumed. The fact that good slate has been found in the district should, however, be borne in mind, as it is quite possible that someone may yet discover it under more favourable conditions for working.

In the old quarry tunnel in Section 918-87G there is a good deal of sulphate of copper found as incrustations on the walls, and seams and veins of copper pyrites are said to have been cut through while driving it. Mr. Thureau also figures a section in the main quarry showing nodules of copper pyrites.

Another interesting mineral occurrence at this quarry is that of the mineral *Wavellite* (phosphate of alumina), which is found in radiated bunches in some of the joints of the slate.

Basalt Quarry.—Near the mouth of the Piper River a quarry has been opened in the basalt rock, and some very fair stone obtained. The place is not very easy of access, or this stone would most likely be used a good deal for building and paving purposes.

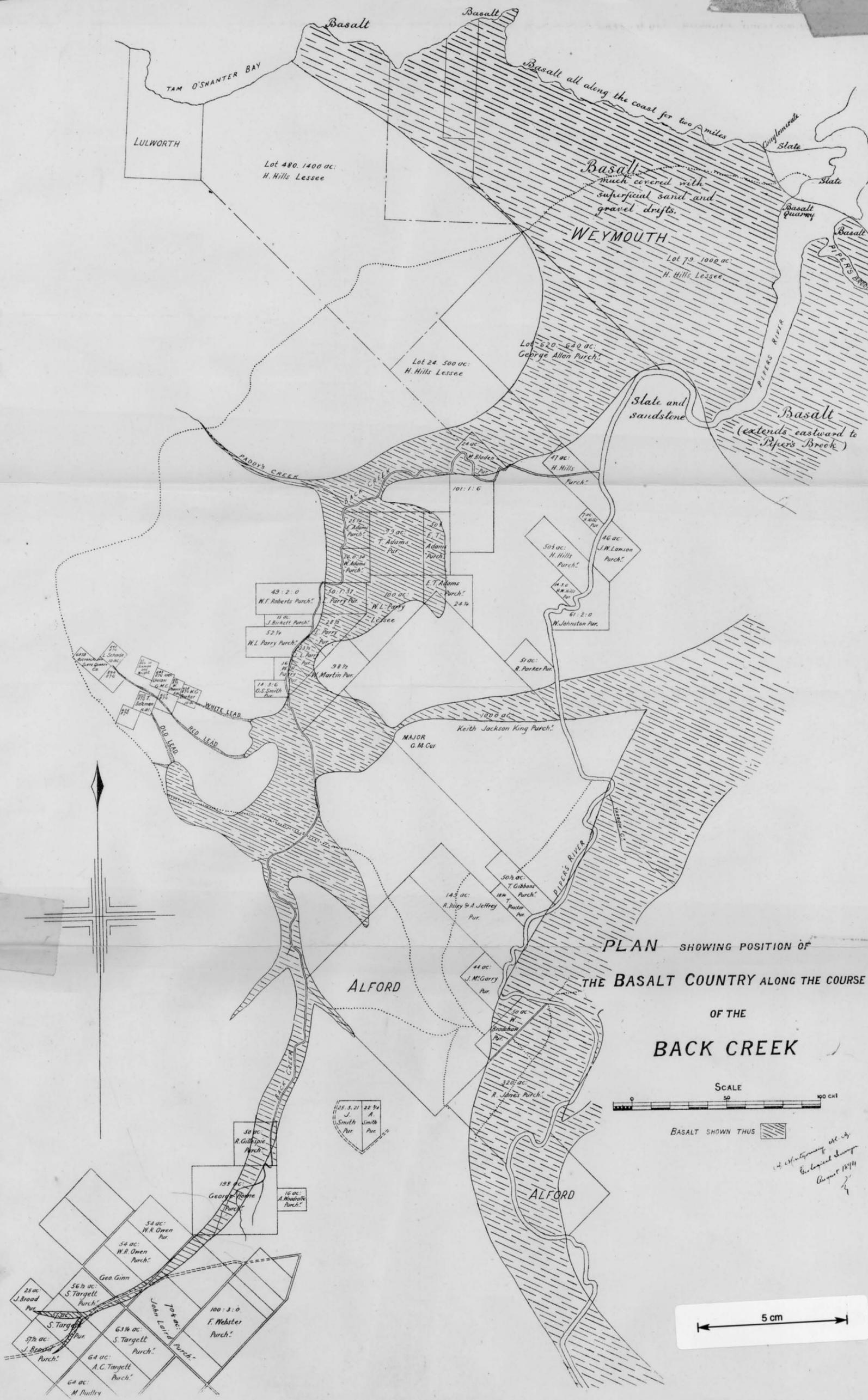
I have the honour to be,

Sir,

Your obedient Servant,

A. MONTGOMERY, M.A., *Geological Surveyor.*

The Secretary of Mines, Hobart.



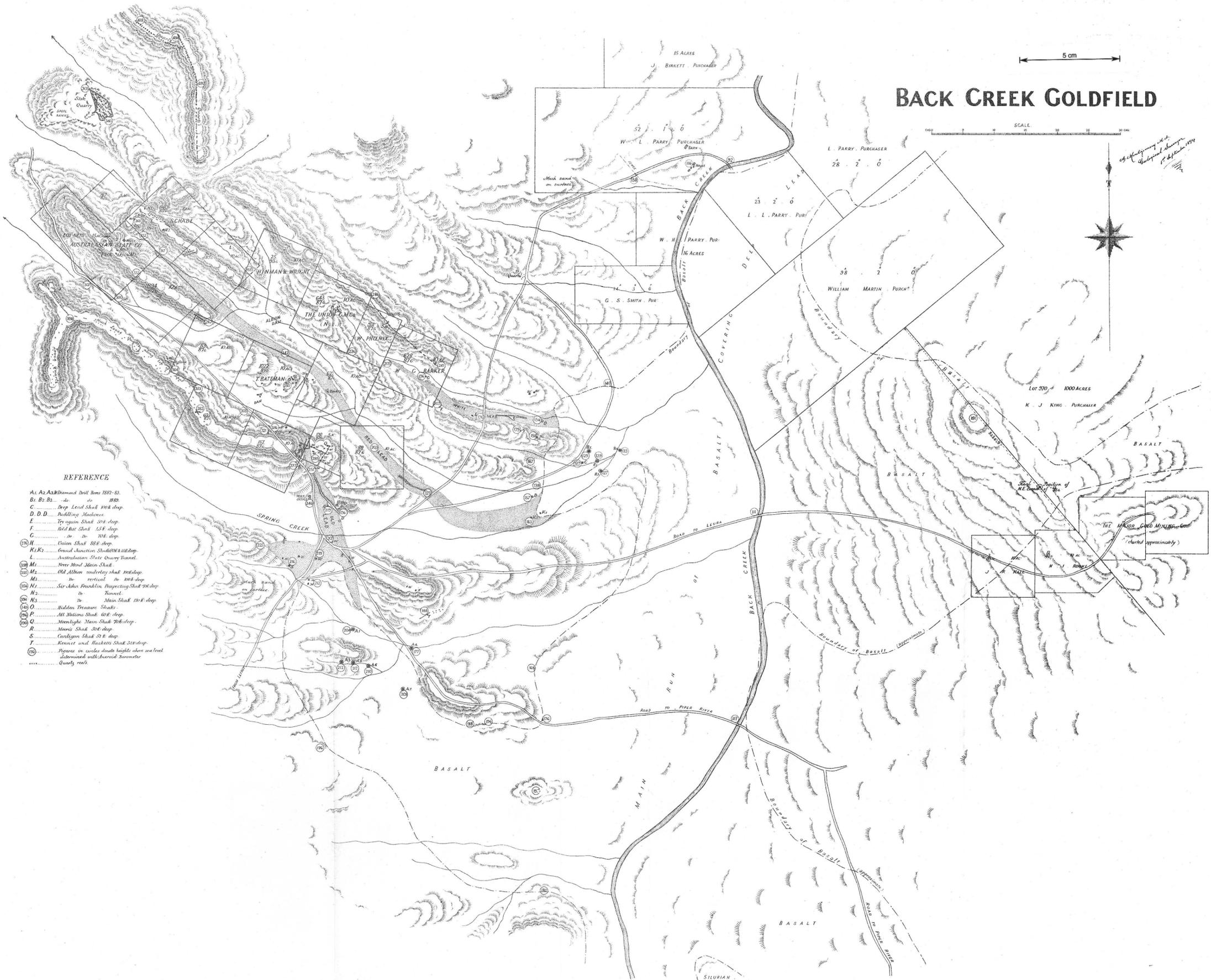
PLAN SHOWING POSITION OF
 THE BASALT COUNTRY ALONG THE COURSE
 OF THE
 BACK CREEK



BASALT SHOWN THUS

*W. H. Murray et al.
 Geological Survey
 August 1874*

(17) 17/18



- REFERENCE**
- A1, A2, A3 Diamond Drill Bore 1887-88.
 - B1, B2, B3, etc. B.S.
 - C. Deep Lead Shaft 1008 deep.
 - D, D.D. Puddling Machines.
 - E. Try again Shaft 578 deep.
 - F. Held out Shaft 158 deep.
 - G. do do 224 deep.
 - H. Union Shaft 828 deep.
 - K1, K2. Grand Junction Shaft 800 x 1582 deep.
 - L. Australasian Slate Quarry Tunnel.
 - M1. New Mine Main Shaft.
 - M2. Old Mine underlay shaft 200 deep.
 - M3. do vertical do 200 deep.
 - N1. Sir John Franklin Prospecting Shaft 208 deep.
 - N2. do do Tunnel.
 - N3. do Main Shaft 708 deep.
 - O. Hidden Treasure Shaft.
 - P. All Stations Shaft 608 deep.
 - Q. Moonlight Main Shaft 708 deep.
 - R. Morris Shaft 308 deep.
 - S. Carleton Shaft 578 deep.
 - T. Rover and Blackett Shaft 218 deep.
 - Figures in circles denote heights above sea level determined with aneroid barometer.
 - Quartz reefs.