Tasmania

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BULLETIN

No. 4

THE LISLE GOLDFIELD

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Issued under the authority of the Hon. D. C. Urquhart, Minister for Mines

Hobart:

JOHN VAIL, GOVERNMENT PRINTER

1909

B23136

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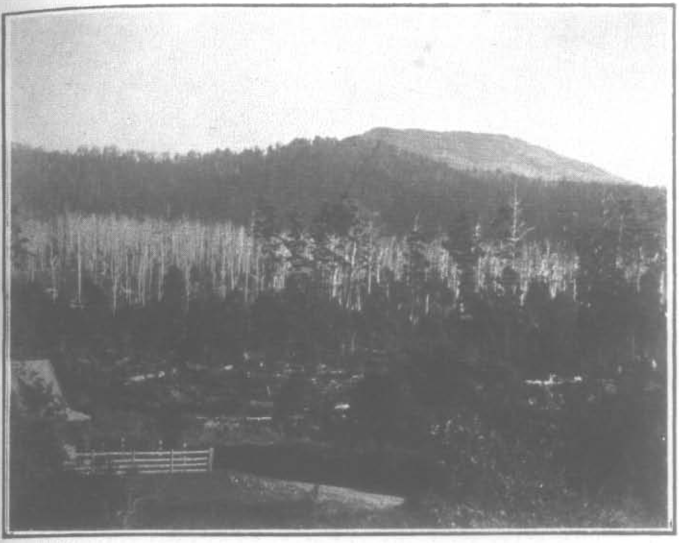

LISLE VALLEY. [Twelvetrees.

PLATE 4

LISLE VALLEY. [Twelvetrees.

PLATE 5

THE LISLE GOLDFIELD.

[Five Plates.]

I.—INTRODUCTION.

The small township of Lisle is situate by road 7 miles south-west of the Lisle-road station on the Launceston to Scottsdale railway, and 8 miles due north from Patersonia. Cart traffic is mostly by way of Lisle-road, but the mail-horse route is *viâ* Patersonia. The few homesteads and surviving cottages are on the floor and basal slopes of a broad valley, about 2 miles in length, running in a north and south direction, and forming a triangular or sub-elliptical area between the Main and Bessell's Creeks. The confluence of these two creeks takes place at the northern end of the valley, where the hills close and a rocky gorge is formed through which the Lisle Creek flows northward to join the Little Forester River.

About a couple of dozen men are now occupied in sluicing the gravels for gold. The sawmill, which supplies timber for the builders' use in town, gives employment to several men. These, with the inhabitants of a few homesteads, make up the present population of the valley. Scrub has grown up again on the flat land which many years ago was cleared when mining was in full swing in the valley. Some of the purchased land in the centre of the valley and on the eastern slopes is cleared, but the rest is closely timbered for the most part. Tall gum forest clothes the hill sides, with a thick undergrowth of dogwood, musk, and cathead fern. The soil in the valley and on the lower slopes is clayey with a granitic bottom, and the land is well suited for grazing purposes. Fruit also does well. Mr. Furlonge has an orchard which produces apples admired in the London market.

The goldfield and the land surrounding it have been withdrawn from selection for many years, but 1400 acres in the south-western portion of the reserve have recently been proclaimed available for purchase, though in deference to indications of renewed mining activity on the field no sales have as yet been sanctioned.

II.—PREVIOUS LITERATURE.

The Government has caused two official examinations of the Lisle field to be made previously to the present one. The first report was by Mr. G. Thureau, Geologist to the Government of Tasmania, and was published as a House of Assembly Paper (No. 46), in 1882. The following extract will serve to show the conclusions then arrived at:—

"At the junction of the metamorphic schists with the syenitic granites, not only are there narrow quartz veins accompanied by granitoid vein matter, mica, hornblende, &c., but distinct, though small, veins of this granitoid rock protrude and traverse the schists for a considerable distance from the main body . . . .

"Bearing in mind that the whole of the granitoid formations are traversed by attenuated quartz veins charged with very fine gold, it may be inferred that if any vein matrices with coarse gold exist the probability is that they occur at or near the points of contact of the granitoid with the metamorphic or other schists on the Lisle Divide and in the eastern foothills of Mt. Arthur."

The second Government inspection was by Mr. A. Montgomery, M.A., who reported on certain portions of the Lisle goldfield, on 13th September, 1894. This report was not printed. The following is extracted from it:—

"The Lisle workings lie in a somewhat wide valley, which contracts to a gorge lower down the creek. The bottom of the valley has been worked for some 500 or 600 feet in width, from which it would appear that the auriferous material could not have been confined to one narrow lead, but must have spread over some distance. Round the edges of the flatter ground at the foot of the slopes of the surrounding hills there are large terraces of alluvial material, some of which has been successfully worked. It seems rather likely that at one time the detritus from the surrounding slopes was brought down into the flat part of the valley faster than it could be discharged through the gorge at the outlet, and consequently large accumulations took place, especially at the bottom of the hill slopes. In one claim I noticed traces of the former presence of still water, there being a layer of finely laminated clay and sand lying horizontally upon the bottom gravel, and in the clay were numerous lignitic impressions of leaves . . . The gold from this field is very fine in grain, nuggets being quite rare, and is said to be very seldom found with quartz attached to it. The wash is of a clayey nature in the terraces, with not a great deal of stone through it. The stones are but little waterworn, and consist of metamorphic sandstones from the surrounding hills, chalcedony from veins in the granite, and only a little quartz that seems likely to have been derived from reefs. In parts we find veins and patches of quartz wash, but on the whole it does not seem very plentiful. In some of the claims towards the head of the valley there is much less clay than in the terraces near the township, and faces of 6 to 15 feet in depth of coarse sandstone gravel are seen in the workings. In these the stones are more waterworn, and the wash appears to be richer in gold. . . . The veins on Titmus and Dodgshun's sections are said by some to be the only ones yet found carrying gold on the Lisle field, but I have also been informed that similar ones were not infrequently met with in the bedrock by the alluvial diggers. It seems very possible that much of the gold in the valley has been derived from similar veins, but I am more inclined to think that the sandstone country, and particularly the belt along the contact between the granite and the sandstone, will in time prove to be the source of the gold."

Mr. Charles Bessell (the Bessell Bros. were the discoverers of Lisle) wrote a report for a proposed hydraulic company in 1894, and the following extracts are taken from it:—

"Payable Ground Available.—This, I may say, is practically unlimited. In my opinion there are three distinct deposits of gold in the field, and it is also my opinion the sources are all within the Lisle valley, and have yet to be found. However, I can, I think, safely state that there are 500 acres averaging 12 feet in depth. This ground may be equally divided into old ground or ground that has been worked in the early days, and new or sound ground; part of this is not rich enough to pay by the slow process of pick and shovel. As to the old ground, in my opinion this would pay well, for personally I prefer to work good old ground than new poor ground. As to the probable yield per cubic yard, this is rather a difficult question to deal with, as in some places the gold is distributed through the ground from the surface to the bottom, while in others it is confined to the wash on the bottom, which varies from 1 foot to 5 or 6 feet. I have worked ground here with a payable prospect from the surface to the bottom 15 feet in depth. I have also worked ground the same depth with no gold except in the bottom 2 feet with equally payable results. However, I believe I shall be well within the mark if I say the whole of the ground referred to will average from 4 to 6 grs. to the cubic yard—this is independent of rich patches, which will probably go several pennyweights to the yard, and I feel quite confident that many of these will be met with as work proceeds. I may state that there are many indications of false bottoms existing on the terraces; in fact, Cashman and party are at present working under 2 feet of false bottom, and again, it can be seen where I am now working at the camp, but how far it extends into the hill has to be proved. With reference to the quantity of gold obtained here I have heard many estimates, but being connected with its discovery 15 years ago, and having an object in endeavouring to ascertain the yield for the first years, as the Government of the day offered great inducement to prospectors in the shape of a large reward for the discovery of a payable goldfield, during the first year I obtained certificates from some of the gold-buyers that they had bought about 15,000 ozs. This, however, does not represent the total yield, and I have heard that Mr. Bernard Shaw, who was then Commissioner of Mines, estimated that not one-third of the gold won was sold in the country. In this I quite agree with him, as a very large number of the 2500 miners then on the field came from Victoria, and I know many of them took the gold there periodically. It must also be remembered that during the first year the men had all their dead work to do in opening up their claims, consequently were not getting gold the whole time, and one of the buyers referred to told me he had bought more gold the first half of the third year than he did during the whole of the first year. Taking all this into consideration, I believe I shall be near the mark by estimating the total yield to be 250,000 ozs., or in round numbers £1,000,000 worth; but I have heard some estimate the yield to be considerably over that amount. With reference to the yield of individual claims, this is a difficult matter to get at, as miners are generally very reticient on this subject. However, I have heard the yield of some of the claims from reliable authority. The best yield I have heard of was from Clare Brothers, who obtained over 1000 ozs. from two men's ground. This claim was on Bessell's Creek, and may be taken as an average. Donnelly and party, I am told, got considerably over 1000 ozs. from their claim. There were several good claims on the terraces, the wash-dirt varying in thickness from 1 foot to 4 feet., and yielding from 5 dwts. to over an ounce to the load. The first claim in which I was interested yielded nearly 500 ozs. from four men's ground. This claim was on Bessell's Creek*, and may be taken as an average of all the claims on it for a distance of nearly 2 miles in length. Shillady and party have, I believe, won over 2000 ozs. from their claims. Cashman and party are reported to have had very good results all through, and I am informed that the last six months' washing resulted in nearly £200 per man."

In 1899 the Lisle Dredging Company was formed to work the deposits in the Main Creek, and published some reports with its prospectus. One of these reports was by Mr. Thomas Kelly, who has worked on the field for many years, and the following is a copy of same, omitting purely commercial references:—

"I here submit my 20 years' practical knowledge of the field. The ground held by your syndicate is known as the Main Creek, embracing some 2 miles of the same; also some terrace ground at the head of the creek which is supposed to be the source of the shed of the gold into the valley of the Lisle. I have not the slightest doubt of the 2 miles of creek being payable; that is, by treating it on a large scale. There have been several syndicates formed, and the required capital subscribed, to work this same ground. They estimated that the tail-race would cost £5000, but when levels were taken they could not obtain sufficient fall to sluice the washaway. In my opinion the only way the ground can be treated is by dredging it. The richest of the veins were on the course of this Main Creek, and therefore wet claims to work, and when they are wet there is always a loss of gold. For instance, myself and party worked ground known as Donnelly and party's. We worked the claim out for a yield of over 2000 ozs. It being situated on the terrace we brought water on to it, and it was ground-sluiced away for a return of over 700 ozs. of gold; that made the yield of gold from four men's ground over 3000 ozs. As to the probable loss of gold in the Main Creek, there is no doubt they were mostly all rich claims, and I can safely put the loss down at one half of the return we obtained by ground-sluicing Donnelly and party's claim, say, 350 ozs.

* The present Main Creek used to be called Bessell's Creek.

to the acre. Your syndicate holds, say, 2 miles of the creek, and without a doubt there must be in the old ground alone, to say nothing of the solid blocks that have not been worked, some thousands of ounces of gold, as the diggers in the early days looked for 2 or 3 grains to the dish, and anything less was thrown away. Regarding the upper portion of your ground—that is what is known as the deep ground, which is supposed by many practical miners to contain the source of the gold which was worked in the Main Creek—there have been many parties formed to test it, but owing to the ground being too deep and wet they had to abandon it, so I cannot say much about it, only that the ground was payable up to it. This field was the richest alluvial field opened in Tasmania; the yield of gold settles that point. The return from here is roughly estimated at 300,000 ozs., and the greatest portion of it was obtained in the main creek and terraces on each side of the creek. The dirt is of a friable nature, easily treated; and the bottom is a decomposed or soft granite. The water the creek carries in the summer season is about 4 sluiceheads, in the winter months from 20 to 25 heads."

III.—PHYSIOGRAPHY.

Enclosed by high hills, Lisle is an upland valley, the floor of which is from a mile to a mile and a half in width. Its approximate height, according to aneroid readings, is between 700 and 800 feet above sea-level. The railway-station at Lisle-road is 341 feet above the sea, so that the Lisle township is about 400 feet above the railway line. For notes on the determination of heights, see appendix to this report.

The crests of the hill ranges on either side of the valley are about 3 miles apart east to west, and the valley is closed in at its head to the south by a broad divide 1200 feet above the township. On the southern side of this divide is the fall to the Scottsdale-road, and a couple of miles south-easterly the high land rises to the summit of Mt. Arthur, formerly called Row Tor, 3895 feet above sea-level. The two sides of the horseshoe thus formed flank the Lisle Valley as high narrow ridges, 800 to 1000 feet above the township. The eastern ridge separates the Lisle Valley from the deep basin of the Little Forester River, and the western ridge overlooks on the west the valley of the Lone Star Creek, and the head of the eastern branch of the Denison River.

The configuration of the valley shows that its age is considerable. The flat floor has been gradually widened and the steep sides pushed further and further apart. The north-easterly dip of the strata has contributed powerfully to the downward creep of the hill debris, which everywhere thickly covers the surface of the bed-rock and accumulates towards the foot of the hills on the east side of the basin in large terraces of angular stones. On the west side the terraces are not so numerous, owing to the different conditions caused by the dip there. The Main Creek hugs the base of the range on the eastern side, and Bessell's Creek does the same on the western side. Stony Creek and Thomas' Creek, which flow down from the western mountains, add to the volume of water carried off through the gorge. The ground is flat, and possibly at one time the rainfall was such that there was more water than could get away easily through the narrow outlet at the gorge. At present, notwithstanding the steep grade of the hills, floods are not complained of, and though the encircling ranges are chiefly narrow divides with small catchment areas, the rainfall as a rule is sufficient, though last summer, as elsewhere, was dry. There is no meteorological station here. The nearest are Scottsdale and Patersonia. The rainfall at Scottsdale, from 1st October, 1906, to 30th September, 1907, was 47.25 inches on 155 wet days. At Lisle it is probably in the nighbourhood of 40 inches. The clouds often pass over, following the mountain crests. Although, owing to the high hills surrounding Lisle, the winters are cold, the climate is milder than that prevailing on the south side of the divide, where the influence of Mt. Arthur and Mt. Barrow is more distinctly felt. Snow falls in the valley very seldom.

The prospector for reefs experiences great difficulty from the heavy overburden of surface debris which has slowly accumulated on the mountain slopes. I was shown one place up the hill where the granite bed-rock had been exposed in 3 feet of sinking, but a few chains away no bottom had been reached in 70 feet. This gradual uninterrupted process of accumulation interposes a serious bar to costeaning. That reefs of some sort are present in these hills is evident from the profusion of stones of quartz present in the terraces, which have been worked by the miners, and here and there barren veins are known, but the reefs which have shed the bulk of the unproductive stone found in the workings have not been uncovered owing to the thickness of loose stony débris or clayey soil covering the surface.

The main reefing lines in the sandstone strata are likely to run more or less parallel with the north-westerly strike of the strata, consequently, roughly parallel with the long axis of the valley. The little creeks which flow into the Main Creek from the eastern side of the valley run over the granite zone, taking their rise for the most part near the junction of the granite and sandstone. Hence their value for intersecting reefs in the sandstone country is nil.

IV.—GEOLOGY.

The rocks which occur in the district fall into the two divisions of eruptives and sedimentaries.

(1.)—The Eruptive Rocks.

There are three groups or varieties of these, viz., granite, diabase, and basalt. Of these, the granite is the most important in every way, as the diabase and basalt have never been found in Tasmania to bear any relation to the process of deposition of the more valuable metalliferous ores or metals.

A.—*The Granite of the Lisle Valley.*

Below the alluvial of the creeks and the surface deposit of clay which covers the valley plain is the granite bed-rock. This is very generally concealed by the waste from the hills, but undoubtedly forms the solid floor of the valley and rises up the flanks of the mountains to a height of between 400 and 500 feet, when it junctions with Ordovician sandstone and slate. The exact line of the junction is hidden by the hill waste, but it is roughly traceable on the eastern side by the top of the granite forming a fringing shelf from which the sedimentary strata rise at a steeper angle of slope. The granite rises towards the south till it attains a height of about 700 feet, when it apparently passes under the divide in a south-easterly direction, reappearing, I am told, on one of Millwood's sections, and certainly exposed again beyond St. Patrick's River at Diddleum. The same belt comes to view again in Lone Star Creek and at Panama.

In the Lisle workings the granite is soft and decayed. At three places in the lower part of Main Creek loose boulders of the hard unaltered rock are seen in positions which indicate the rising to surface of the solid granite mass. The rock itself is not dyke rock, but the normal granite of the belt. Higher up, at the head of the valley, on W. Kerr's land, is a knob of hard granite of the same type. At the north end of the valley, at the gorge, the granite sinks to the level of the creek, and disappears below the micaceous sandstone which forms the hill to the west.

To the naked eye it is of a finer grain than the familiar granite of the North-East Coast, and has a characteristic appearance, owing to dark magnesian mica (biotite) with some hornblende being present in great abundance. Quartz, though present, is subordinate. The type is the well known one of hornblende granitite. Rosenbusch defines granitite as follows:—*

"It is distinguished from granite, not only by the absence of muscovite, but is nearly always richer in lime-soda felspars, coloured constituents, and iron oxides, though on the other hand poorer in quartz than granite proper, in the restricted sense of the word . . . . The normal type of granitite takes up hornblende readily, and in this way the variety of hornblende granitite is formed (in petrographical literature often called syenite-granite)."

This rather basic, or, more strictly speaking, less acid variety of granite appears to be characteristically associated with gold rather than tin ore. The same type prevails all along the gold belt, at Diddleum, Lisle, Golconda, and where it is dominant it is safe to say that gold, and not tin, will be the metal that should be sought, as far as this part of the island is concerned. This is not affected by the circumstance that a little tin has been reported as found with the gold at Lisle.

B.—*Diabase.*

On the south divide, on T. Faulkner's (now A. Dean) 100 acres purchased land, and about 5 chains south of the north boundary, is a line of boulders indicating an outcrop of this rock running towards the west. It is the same rock as that which forms the summit of Mt. Arthur, consisting of a mixture of felspar and augite. The felspar is labradorite. The rock is of medium texture. It is too well known to need here a recapitulation of its microscopic characters. It intruded in the older sandstones and

* Mikroskopische Physiographie der massigen Gesteine, 1907, I. pp. 61-62.

the overlying Permo-Carboniferous strata, which latter have since been denuded, resulting in the exposure of the intrusive rock. Its age is approximately that of the close of the Mesozoic, consequently younger than the granite and older than the basalt. It is not connected in any way with the deposition of ore, and the only use apparently to which it can be put is in making foundations for buildings and bridges and metalling roads. For the former, it is strong and durable, but does not dress easily; and for the latter purpose it is not quite an ideal stone, being too tough to powder sufficiently to supply its own binding, and rather hard for horses' feet.

c.—*Basalt.*

In the eastern part of the preceding section and the one adjoining it on the south the rich soil of the farm land proclaims the presence of the basaltic lava sheet, 1800 feet above sea-level. This volcanic sheet is pretty well continuous to the south-east as far as and beyond St. Patrick's River, but it is often reduced to a thin covering of decayed rock or is even completely broken down into its characteristic soil. The ash cones of the Tertiary volcanoes have long since disappeared, and the former vents have not been located.

There are grounds for believing that in early Tertiary times the land in Northern Tasmania was even higher than it is now, but that a period of subsidence set in, which came to an end with the outpouring of the basalt lavas in the Middle Tertiary, since when an elevatory movement has taken place. and the present Lisle Valley and gorge have been excavated.

The rock is the olivine-basalt, of which there appear to have been numerous outpourings in Tasmania at the close of the Lower Tertiary or Palaeogene period.

(2.)—The Sedimentary Rocks.

(1.) These consist of slate and sandstone strata, which have a very regular strike of N. 30° W., and a north-easterly dip. They are traceable without interruption to south-east of St. Patrick's River, and the prolongation of their bearing in a north-westerly direction would approximately follow the course of the Little Piper River. The same strike and dip continue as far as to the west of the Piper River and Back Creek, but there is a change of dip to the south-west within a few miles of Lefroy. As a north-easterly dip prevails on the west side of the Tamar at Beaconsfield, that river is apparently either in a synclinal valley or, as is more probable, on the line of a fault which affects the older strata. In support of the latter theory is the negative fact of non-discovery on the east side of the river of any exposure of the Beaconsfield series.

The sandstone and slate strata form a belt on the east side of the Lisle Valley, while slate also skirts the west side. Another belt of slate comes in on the east on descending the range into the basin of the Little Forester. The sandstone and slate on the eastern ridge are metamorphosed to a hard, dark, bluish rock, with splintery and conchoidal fracture, and have been frequently mistaken for basalt. The rock has no doubt suffered from the granite contact. Where not altered, the sandstone is a soft brown micaceous rock. Another phase of alteration is also shown by the sandstone, which is slightly argillaceous, and under the microscope shows nodular segregations approaching the nature of incipient chiastolites.

Some obscure nodular forms are seen in sandstone to the west of the track on the top of the hill south of Lisle. It is rather doubtful whether these are organic.*

These stratified formations are with probable correctness placed in the Ordovician system. This conclusion is reached partly by the application of negative criteria and partly by connecting the stratigraphy with that of neighbouring belts of country. It has not been possible in Tasmania as yet to divide the Ordovician into Lower and Upper divisions.

(2.) Apart from the consolidated rocks is the heavy covering of hill débris and clay which clothes the hill slopes and is spread over the floor of the valley. This débris consists of angular and subangular stones of white quartz, sandstone, granite, chalcedony (from veins in the granite), and quartzite. The creeks contain waterworn stones of the same nature. There is some evidence of alluvial ground along the course of an older stream to the east of the present Main Creek on a higher parallel; † but there is no evidence of there ever having been any other drainage outlet to the valley than at the gorge end. There is a theory which is entertained by some on the

* The earlier reference to graptolites, found at Lisle by Mr. Thureau, may be disregarded as based on a misapprehension.

† This was in all likelihood the ancient bed of the present Main Creek.

field that a stream once passed north-west over or through the hill into the Lone Star Valley. I examined this divide, and came to the conclusion that no outlet could have existed in this direction. The dividing crest is solid sandstone, rising to 800 feet above the valley, and shows no indications of any alluvial covering which could mark a former channel.*

It is this unconsolidated mantle which has yielded all the gold which has been won from the field.

(2.)—*The Geological Sequence.*

This arranges itself as follows, reckoning from the earliest to the most recent places of the succession:—

(1) The deposition of the Ordovician sediments.
(2) The folding of these strata.
(3) The eruptions and consolidation of the granite.
(4) The period of the deposition of gold.
(5) The intrusion of the diabase.
(6) The outpouring of the basalt lava.
(7) Late Tertiary and recent sedimentation.

These periods cover the events which make up the geological history of Lisle so far as it can be deciphered from the rocks.

(1.)—*The Deposition of the Ordovician Sediments.*—This is the oldest geological process which we can here recognise. The more ancient rocks upon which these strata were laid down are nowhere exposed in the neighbourhood. The nearest reported occurrence of the older platform is near Glengarry, west of the Tamar, where crystalline mica schist indicates one of the Pre-Cambrian groups. The changes from sandstone to slate, and *vice versâ*, indicate frequent alternations of sediment from sand to clay when the Lisle beds were being formed.

The coast-line of this ancient sea is necessarily conjectural, but it may well have run along the Pre-Cambrian axis of what is now called the Asbestos Range, which stretches west of the Tamar all the way to Badger Head. How uncertain, nevertheless, such speculations are is exemplified by the microscopical examination of Ordovician slate at Mathinna, revealing, as it does, as constituents of the rock, minute fragments of granitic felspar,

* The comparatively recent cutting of the channel through the Gorge leads one to search for another outlet, and a north-westerly one is the only other direction which is reasonable. If any convincing evidence could be obtained, one would have to resort to this supposition.

evidently derived from the waste of granite ranges long since vanished without leaving a trace behind.

The Lisle belt of slate and sandstone continues south to the North Esk River (near which it encloses the Burns Creek reef), and beyond till it is interrupted by the Ben Lomond massif.

The Lefroy-Lisle Ordovicians differ in appearance from the Beaconsfield strata, which are perhaps somewhat older and do not seem to be represented to the east of the Tamar.

(2.)—*The Folding of the Ordovician Strata.*—The alternations of slate and sandstone in meridional belts and in directions parallel to the general laminations of the strata indicate that these partings as a rule conform with bedding-planes. Indications, however, are occasionally to be found showing the latter to be discordant and rather flat in places. These may be seen on the St. Patrick's River-road, past the post office, where the coarse partings of the slate, dipping steeply to the north-east, intersect almost horizontal bedding-lines. But whether the bedding is horizontal or inclined, the cleavage dips throughout are always at high angles. The change of dip between Lisle and the Tamar points to a great fold having occurred, and the anticlinal axis of this seems to be a little east of Lefroy. This is very likely responsible for the development of quartz reefs at that township.

The slaty cleavage is a regional feature, and results from the constituents of the original rock having been rearranged by earth-pressure. The period when this pressure was applied and the folding of the strata also took place has not been defined, but must have been between the close of the Ordovician and the beginning of the Permo-Carboniferous. As in other parts of the island rocks of Silurian age were involved in the process. The time was probably late Silurian or Devonian.

(3.)—*Irruption and Consolidation of the Granite.*—As has been remarked over and over again in our geological reports from Mr. A. Montgomery's time onwards, the granitic intrusions in Tasmania occurred between late Silurian and Permo-Carboniferous, and have generally been referred to the Devonian. Reference to this age will explain its presence in the Ordovician strata. It has invaded these in an axial line N.W.-S.E., through Panama and Golconda, Lisle, Diddleum, and so on, towards the North Esk. This line of outcrop lies several miles west of the large granite mass in the Scottsdale district, of which it is probably a differentiated marginal portion. The two outcrops are of different types of granite, but are doubtless connected in depth. It is to be noted that the main mass consists of granite of medium acidity, while the outlying Lisle-Golconda exposure is distinctly more basic.*

After the invasion of the ancient sediments by the granitic magma at an undetermined but great depth, the elevation of the land, throughout a long period resulted in the erosion and removal of the superincumbent strata, exposing the underlying granite. In some parts of the country, *e.g.*, on the Blue Tier, Ben Lomond, and in the St. Paul's Valley, the granite was exposed already in Permo-Carboniferous times, for sediments of that system are noticed reposing on the granitic platform. At Lisle the wearing down of the overlying strata to granite level apparently took longer time.

The intrusion of the granite produced profound effects upon the surrounding strata—effects which are noticeable to a distance of several hundred feet from the known contact line. The adjoining slate has been silicified, and a good deal of mica has been developed in it, with a production of incipient chiastolitisation. The sandstone, too, has been converted into a highly micaceous quartzite. These metamorphosed rocks form an aureole surrounding the intrusive granite mass. Their alteration has proceeded so far as to effectually mask their real nature and to deceive the casual observer as to their original character.

(4.)—*The Period of the Deposition of Gold.*—Under this head I do not refer to the redistribution of gold which has taken place in the present Lisle Valley, but to the deposition or precipitation of the metal in the veins or other sources which have supplied the alluvial or quasi-alluvial of the diggings.

There is nothing to urge in favour of a theory that the present alluvial gold is a concentration of older alluvial gold belonging to the Ordovician sandstone. The fact

* See E. Weinschenk. Grundzüge der Gesteinskunde, 1907, II. p. 40.—"Granitic stocks often show that the core of the massif is composed of a two-mica granite, which gradually loses its muscovite contents in an outward direction. Biotite granite is thus formed, and to this hornblende is added: the plagioclase contents become more and more important and finally genuine plagioclase rocks, diorites, even gabbro, represent present facies of the granite."

that here and there some gold has been found in quartz veins shows that the Lisle gold must be referred to the granite magma. Consequently, wherever the gold appears along this line—Diddleum, Lisle, Golconda—granite appears also. There is a genetic relationship between the two. The formation of the one has been accompanied by the birth of the other. Whether, therefore, the gold was a primary constituent of the consolidated granite (of which there is no proof) or was deposited in veins either through the granite, or proceeding from it, or in solutions expelled from the granite magma, its approximate age is that of the granite, *i.e.*, Devonian. Its distribution through the unconsolidated formations which have been worked by the miners was effected long subsequently—in late Tertiary and Quaternary times.

(5.)—*The Intrusion of the Diabase.*—Although a few stones of diabase may be gathered in the soil of the valley, it is, strictly speaking, an outside rock, and certainly had nothing to do with the deposition of gold. Mt. Arthur and Mt. Barrow are crowned with it, and on their flanks are the Permo-Carboniferous fossil-bearing strata, which it has pierced, or between the beds of which it has forced its way. In either case the gradual erosion of the overlying measures has exposed the igneous rock on the present summits. The Mesozoic sandstones in this district seem to have been completely denuded, and thus proof is wanting here of the uppermost limit of the diabase, but elsewhere, wherever the upper coal measures survive, there is decided evidence of their penetration or disturbance by this igneous rock. Its intrusive character explains the widely different positions which it occupies in relation to the sedimentary strata in various parts of the island. In the south, section after section may be seen, showing it capped by the Permo-Carboniferous mudstones, while in the north, the relative position is reversed, and the summits of the mountains are occupied by the diabase.

As might be expected, its contact effects on contiguous strata are never extensive. A development of iron ore, calcite, or chalcedony in the strata passed through is frequently observed for a few feet from the contact. Shales at the contact are hardened into chert or adinole, and it is not certain that the opal occurrences at Bothwell are not due to the influence of this intrusive rock.

(6.)—*The Outpouring of the Basalt Lava.*—Although the basalt on the farms overlooking the Lisle Valley reaches a height of 1800 feet above sea-level, it was probably much lower when it first flowed over the land. We know that at that time (Middle Tertiary) Northern Tasmania was undergoing a movement of slow subsidence, during which the Launceston Tertiary basin was filled with clay and sand sediment to the depth of 1000 feet, so that most likely the basalt which is now on the high divide was then flowing at somewhere near the level of the present Lisle township, or not far above it, for the subsequent elevation was perhaps not quite so great as the previous subsidence. There is no clear evidence that the basalt ever flowed over the ground which has been removed to form the Lisle Valley. It seems rather to have followed some depression of the surface towards the north-east in the direction of the Little Forester River.

(7.)—*Late Tertiary and Recent Sedimentation.*—With the rising movement of the land after the lava flows alluded to above, the process of valley excavation at Lisle began, and has continued to the present day. The principal water-channel, with its tributary creeks, carved its channel deeper and deeper, cutting down through the sandstone and slate strata which once stretched right across the valley, and eventually laying bare and entering the granite foundation. This slow, resistless process has been at work for ages, assisted by rains and weather, breaking up the solid rock, releasing the quartz from veins, pounding it unceasingly to sand, draining off sand and water to the sea, collecting the residual gold. After Nature's slow, tireless toil, man appears on the scene, an army of miners descends upon the valley with box and cradle, and after a short period of feverish industry depletes the accumulated store of metallic residues and departs. The history of the invasion may be told in a few words.

V.—HISTORY.

The brothers Bessell discovered the field at the end of 1878, but it was not until January, 1879, that the rush took place. On the 11th January 14 ozs. of gold were brought to Launceston, and by the end of the month there were a hundred diggers on Main (then called Bessell's) Creek, working ground 4 to 10 feet deep, with 15 to 18 inches of wash-dirt. On the 12th of March His Excellency Governor Weld visited the spot and named the township Lisle, in memory of the name of Mrs. Weld's family, which was De Lisle. By the end of that month a thousand men were working on claims extending for over a mile, and bringing in from £2 10s. to £15 per week per man. The reports of that year show that the population increased to 2500. The yields seem to have ranged from £4 to £12 per week per man for the most part. In some cases the highest figure exceeded this, while many only earned a living. By the end of 1879 the place had settled down to steady work. The reported yield of the field was then about 400 ozs. per week. The field was a very active one for three or four years, but after a rush which took place to Temora, N.S.W., work fell off considerably.

Mr. Charles Bessell has furnished me with much interesting information relating to the produce of the field in the early days. The best shows were:—(1) Donnelly's terrace (at these workings 1000 ozs. were got from 1000 loads). (2) Lockwood's terrace, where 600 ozs. were got in one year. (3) The Main Creek, all along which from £4 to £10 or £12 per week per man used to be made. The sides would yield an ounce per man, while the centre was much richer. A little to the west of the creek one man cleared £2500. In the creek opposite the post office 550 ozs. were won; and higher up the creek, at the Red Cliff, a couple of hundred ounces have been won from less than ¼-acre; and below this, 600 ozs. came from ground not exceeding ½-acre in extent.

The terraces were very rich in patches, Donnelly's being remarkably rich, but the creek was good all the way up, with hardly a "duffer" claim on it.

The total output of the field cannot be stated precisely, as only a small proportion of the gold won was sold in Tasmania. The Government returns show about 84,000 ozs., but there is reason to suppose that this is less than one-half of the real produce. Mr. C. Bessell, who took the trouble to obtain as many certificates from buyers as he could, and made numerous enquiries in reliable quarters, with a view of getting as near to the true yield as possible, is of opinion that it is in the neighbourhood of 250,000 ozs. Some have named still higher figures.

The present output as reported to the Mines Department is from 30 to 40 ozs. per month, but there is reason to believe that it is actually slightly in excess of this.

VI.—MINING.

The ground which has been worked, and some of it reworked, forms a belt of 500 or 600 feet in width along the Main Creek, and also a belt on the western side of the valley along Bessell's Creek. The tributary creeks have also been sluiced. The large terraces at the foot of the hills on each side of the valley have likewise been worked with great success. The occurrence of the gold seems to follow no regular rule, being sometimes distributed irregularly through the deposit from top to bottom, and in other places being won from a foot to 6 feet of wash lying on the soft granite bottom. The deepest ground on the creek is perhaps that near Langley's—16 feet. The ground forming the terraces is now spread out fan-like at the foot of the hills, and the small creeks have intersected it. Displacements of it have apparently occurred, and any tunnelling into the made ground is uncertain. Tertiary faulting is supposed to have taken place, disturbing the clay deposits, and interfering with some of the mining operations. The terrace stones are distinctly angular, and waterworn only in the bottom wash, while in the creeks they are rounded. A low ridge of soft granite separates the gold-bearing ground on the east side from that on the west side, and the miners say that they recognise differences in the appearance of the gold won from the different sides of the valley, and that the western gold realises about 10d. per ounce less than that from the eastern part of the field. The mint value of Lisle bullion is about £3 18s. per ounce.

The claims at present being worked on the field are as follows:—

(1) W. Kerr, in the upper part of Main Creek.
(2) Bailey's claim, also up the creek.
(3) Watts and Langley, under the cliff.
(4) Marshall and Faulkner, a little lower down.
(5) Marshall, also in the creek below the preceding.
(6) C. Bessell, in Main Creek.
(7) E. Bessell, in Main Creek.
(8) Jno. Kerr, in Main Creek.
(9) Watts' claim, in Donnelly's Creek.
(10) Watts Bros.', in Main Creek (lower part).
(11) Schlobohm, up Bessell's Creek.

(12) Lockwood's terrace, Harmansen's claim.

(13) H. Faulkner and Marshall, on Thomas' Creek.

These give employment to 23 men, all of whom are making a living, so that the field cannot be properly described as worked out.

Red Cliff.—The Cliff workings are in the part of the field where the old Mt. Arthur P.A. carried on exploratory work. It drove three tunnels into the eastern hill, where deep alluvial ground exists under a spur between two small creeks. Soft granite was driven through, and an east and west alluvial channel met with, filled with boulders and stones of quartz and sandstone. A little gold-bearing gravel was struck, but this cut out, and only broken barren material was passed through after this. The gold which was found is stated to have been angular, and with occasional pieces of quartz attached to it. The lead is supposed to have been dislocated and broken up by faults. However, this may be, extensive landslips have taken place on this slope of the range, and it is now difficult to locate the exact position of the original channel. This point is about 1½ mile up the creek from the gorge, and not much gold has been obtained higher up. The source of the Main Creek gold is therefore practically restricted to the eastern side of the Lisle Valley for 1½ mile in length.

At present the Cliff, or Red Face, is being worked by Watts and party, where there are about 10 feet of overburden overlying 4 feet of wash, which rests on the soft granite. The gold is not much water-worn, and is rather a coarse variety for Lisle. A flat piece, weighing 1 dwt., has been found recently, and several pieces weighing 6, 8, and 10 grains have been obtained. The ground is clean—not scaly; and has the reputation of being the best on the field. A few small sapphires and rubies have been found in the wash.

The most frequent stones in the dirt consist of the dark metamorphic and brown sandstone. Stones of chalcedony are fairly common, some of them containing pyrite. I was informed that a seam of pyrites was once found in the granite bottom; otherwise pyrites is absent. The iron-magnesia spinel (pleonaste), known on the field as black-jack, occurs in the wash, occasionally in large sizes. I saw a crystal of this embedded in vein quartz in Marshall and Faulkner's workings on the western side of the valley. The gold obtained is free, but 2 or 3 grains have been found adherent to pieces of quartz of equal size.

J. Faulkner and Marshall.

A gully just north of the Red Face is being worked by Marshall and Faulkner. The ground consists of alluvial matter with stones of bluish and reddish sandstone. Large boulders of the bluish sandstone are scattered about the wash. Few stones of quartz occur. The wash of water-worn stones rests upon an irregular surface of granite, and has probably been the bed of the old Main Creek, which has gradually worked its way down to its present channel in the flat.

The ground has been worked up towards the head of the gully just below the track, where the last work done was four loads for 11 ozs., and then both gold and wash gave out. Towards the hill among the ferns there is deeper ground, 40 feet, and no bottom. Under Mr. A. Bessell's house the granite is even 70 feet below the surface. It is noteworthy that gold is obtainable here in the surface soil. Up the hill it can be got in the grass over a loose stratum of sand and stones 40 feet deep.

Callaghan's Creek.

The creek called Callaghan's flows into the Main Creek on this side of the valley, and has been worked for gold, but was not considered good ground. It was the highest payable alluvial at Lisle, and the best part of it was up near C. Bessell's house. The knob of ground there has gold at the surface, but this seems to cut out at that spot. Mr. C. Bessell states that it is the only place where he obtained some specimens of gold and quartz. The largest piece of quartz was the size of a pea, and had half a dozen little specks of gold in it.

Kelly's Creek.

Near the post office is another small creek, Kelly's by name, which has also been worked a little. It heads from a little distance up the hill, still in the granite zone.

C. Bessell.

A claim on the Main Creek opposite the township houses is worked by Mr. C. Bessell with fair results.

Cox's Creek.

Near the schoolhouse, Cox's, or Slaughteryard, Creek flows into the Main Creek. Its source is near the contact of the granite with the sandstone. Fairly good gold was won from its lower part, but the creek became poorer higher up. All round the valley is a kind of ledge which marks the upward limit of the granite. The drainage of the hill sinks through to this floor, and from it issue the head waters of the various creeks.

Donnelly's "Terrace."

Further north are Donnelly's Creek and Terrace workings. Close to the road is the rising granite bottom, a point of soft bed-rock on which T. Clare worked 4 feet of terrace for 1000 ozs. per 1000 loads. The old paddocks of terrace stone stretch up the hill to the east on the gently sloping granite floor to the 15 feet of standing terrace face, which has been tunnelled into at the base on the bed-rock. The top part of the terrace for 10 or 11 feet consists of clay and angular stones of reddish sandstone, highly micaceous and ferruginous. These have evidently crept down the hill as superficial detritus, and from their shape it is clear that they have not been moulded by river action. At the same time a certain linear arrangement of the stones seems to suggest that they formed part of shore-beds—perhaps on a lake beach. This rubble-bed passes downwards at one part of the face into a bottom layer of yellowish drift sand and clay 4 feet thick. This layer contains some rounded pebbles, and yielded the heaviest gold. At the same time prospects were obtained from the upper beds, and nearer the road gold was won from all through the deposit, which there consisted nearly entirely of surface clay, with scarcely any stone. I am informed that Donnelly's workings contained a good deal of chalcedony and quartz. The wash evidently had a distinctive character of its own.

Titmus Upper Tunnel.

The highest mining work on the field is that which was done at the Titmus upper tunnel above the Police Reserve and not very far below the crest of the hill. A shaft was sunk on a small leader in soft granite for 60 feet, and afterwards a tunnel was put in a little higher up, apparently on the same vein in sandstone. A good distance was driven without a trace of gold, and work was finally suspended and the drive caved in. I picked up specimens of quartz at the approach, but these on crushing and washing proved to be quite barren. This tunnel is in sandstone country above the granite contact.

Titmus and Dodgshun's Tunnel.

A little lower down the hill Titmus and Dodgshun drove a tunnel 80 feet or thereabouts in soft granite. Mr. Montgomery reported in 1894 that there were five or six small auriferous veins, $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, of quartz and kaolin in the granite, coursing in a direction N. 76° E. Some of the quartz was sent to Launceston to be tested, and returned 3 dwts.

Lisle Dredging Company.

In the latter part of 1901 a Launceston company (the Lisle Dredging Company), commenced working the alluvial gravel in the Main Creek with a suction plant. The ground was estimated as worth 1s. per cubic yard, and the working costs as not over 6d. per yard. It was considered that as the old miners left all ground which yielded less than 5s. a yard, there would be ample margin for profit. However, the buried timber proved a great obstruction, and the number of times that the dredge had to be moved militated against cheap working. The ground, too, turned out to be nothing like so rich as was anticipated, and after three years' struggling with various hindrances—shortage of water, &c.—operations were suspended. The quantity of gold reported to the Government as won amounted to 1605 ozs.

Bessell's Creek.

At the north end of the field Mr. Schlobohm is working up Bessell's Creek. At this end the western and the eastern runs of gold-bearing drift seem to junction. Where Bessell's Creek joins the Main Creek a bar of granite crosses, and the best nuggets found in Lisle came from this locality. The largest one was discovered by T. Bessell, and weighed 15 dwts. The first one found is in the possession of Mr. W. F. Petterd, and weighs 1 dwt. $2\frac{1}{5}$ grs. Several have been found weighing from 1 to 2 dwts.

Thomas' Creek.

Marshall and Faulkner have a 5-acre section (714G) in the western part of the field on Thomas' Creek, where they are working a face by hydraulic sluicing. This terrace shows bedding lines and carries waterworn stones, suggesting former river action. Below the surface is red ironstone gravel for 4 feet, resting on 4 feet of sandy silt. Below this is a stratum of stones of quartz and grey sandstone for a foot in thickness, which rests upon 6 feet of clay and stones of slate. The whole deposit lies on granite bed-rock. In each bed there is gold, but the heaviest gold is on the bottom. The bottom wash contains pieces of granite and purple slate, and granitic mica is a constituent of the sand between the pebbles. The stones of blue metamorphic sandstone, so frequent in the deposits on the eastern side of the valley, are rarely found here. The extent of the auriferous ground has not been proved yet, but apparently its channel has proceeded from the hill to the south-west.

Further south a few colours are found in Stony Creek, and this does not suggest that there is much worth speaking of south of that creek.

Lockwood's Terrace.

North-west of Marshall and Faulkner's workings is the extensive patch of deep ground known by the name of Lockwood's Terrace. This is on a ridge which forms the end of a spur coming down from the western hills, and was worked in a good many places at one time, as many as 500 men being on the ground at one place or another. The deepest ground which has been bottomed is 60 feet. A shaft 60 feet deep was sunk, and 2 grains to the dish stated to have been prospected from the bottom. One, Currie, had a claim and puddled his dirt for 160 ozs., according to report. Lockwood's dirt, too, lower down, used to go 1 oz. to the load. Harmensen's face is 19 or 20 feet deep, with 4 feet of subsoil resting on 3 feet of horizontally bedded clay, which in its turn covers 12 feet of wash on granite bottom.

The drawback to the work on this terrace was want of water, and it is very probable that if water could be brought to it, the ground would still pay to work. The best gold, as usual, was found in the wash at the bottom; still, a little was obtained all through the deposit. Very little of the bluish metamorphic sandstone and slate is found here; the stones of quartz belong to a more kindly variety than that on the east side of the valley, and the gold apparently has not been derived from that side.

Mt. Arthur Properties, Ltd.

In this part of the valley several sections have been taken up by the Tasmanian Consols, Limited, on behalf of the new company, the Mt. Arthur Properties, Ltd., recently registered in London, with a capital of £65,000. A few preliminary bores have been put down in this ground to depths varying from 9 to 26 feet. Layers of heavy wash and boulders made it very awkward ground to test by boring. The holes were deflected, and in most instances the pump could not follow the auger. Notwithstanding this, gold was got in five out of the seven holes. Two holes gave 0·57 and 1·323 grains gold per cubic yard; two gave 1·728 and 2·16 grains; and one gave 8·748 grains per cubic yard. The testing work will shortly be resumed. The company contemplates working this flat, and as it is mostly virgin ground, the difficulties experienced by the Lisle Dredging Company in the worked ground along the Main Creek will probably not recur.

Obsidianites.

Several of those interesting objects known as obsidianites (Australites) have been found in the wash at Lisle associated with the gold. Some recovered by Mr. Bessell were lying together on the granite bottom 17 feet from the surface. The forms known here are the circular button shapes, the dumb-bell shapes, and the beetle shapes. Some of these have been obtained from the gravel below the Red Face workings, so that we can say positively that they could not have travelled far; in fact, it would be possible to circumscribe an area a few hundred feet square within which they must have fallen. The proof of age is not precise, but it would certainly be Late Tertiary or Recent—not pre-basaltic. These obsidianites consist of acid or sub-acid volcanic glass, and not of such glass as would result from the emissions of any Tasmanian volcanoes. The proximity of the basalt sheet at Lisle is an accidental feature which is unrelated to the occurrence of these objects. It is sufficient to call to mind that they have also been found at Cox's Bight in the tin-bearing gravel in the extreme south-west of Tasmania, where there is no basalt whatever, the nearest being in the Huon basin. Their real origin is still a matter of debate, the theory which meets with most favour at present being that the glass is meteoritic.

VII.—THE DERIVATION OF THE GOLD.

Whence all the gold has been derived which has been won in the form of alluvial has long been a mystifying puzzle, baffling the prospector and the visiting expert alike. A quarter of a million ounces have been obtained from a mere fractional portion of an area not exceeding a mile and a half square. The bulk of this has been sluiced from the bed and banks of the Main Creek and from terraces sloping down to it on the eastern side of the valley; the remainder has been won from small creeks on the opposite side of the basin and from terraces above them.

The remarkable feature of the field is that no reefs have been found either in the valley itself or on the surrounding hills. Certainly some quartz veins must exist concealed beneath the mantle of overburden which clothes the hill-sides, because numerous stones of quartz occur in the drift; but this quartz is barren. No gold-bearing quartz has ever been seen in the workings, beyond a minute specimen here and there. Yet nearly everyone who works on the field or who prospects it has in his mind the eventual discovery of a parent reef or reefs which have shed the gold. A little reflection will show how unreasonable such a notion is. Anyone standing on the floor of the valley finds himself in a locked basin, walled all round by hills 800 feet to 1000 feet high, and cannot escape the conviction that whatever may be the source of the gold, the whole of it has been derived from points within the area upon which he gazes. The auriferous overburden which covers the bed-rock has not been brought by torrents from afar. The gold has not travelled. The terraces consist of hill detritus—not of shingly beds. Apart from the bottom wash of the terraces, the only shingle in the valley is that of the creeks or of their ancient beds. The creeks themselves are contained within the valley walls. With these conditions one cannot escape from the conclusion that if the gold has been shed from quartz reefs specimens of auriferous quartz will be found in the workings. But such quartz is absent, and the inference therefore is irresistible that the gold won must have been derived from some other source. This is the starting point from which any intelligent investigation of the phenomena must begin. There may possibly be a few gold-bearing veins in the surrounding hills, but any gold which they may have contributed must have been inconsiderable in amount, and they may certainly be neglected in this inquiry. A useful preliminary in the investigation will be to scrutinise closely the nature of the stones with which the gold in the alluvial workings is associated, as from such scrutiny some definite information will certainly emerge.

I confine my remarks first of all to the eastern side of the valley, as the bulk of the gold has come from the Main Creek and the eastern terraces.

1. The stones in the alluvial and terrace ground are mainly metamorphosed sandstone and slate from the hill-side above the granite contact. The most abundant are bluish stones which bear a superficial resemblance to basalt.

Some of them are quartzite or metamorphic sandstone; others, more compact in structure and of argillaceous nature, are altered slates. The rock has undergone intense metamorphism by reason of the influence of the intrusion of the granite. These stones contain a good deal of iron, and have a habit of crustal weathering which proceeds inwards till often only a kernel of the hard blue rock remains in the centre. The miners call this becoming coated with sandstone, and significantly state that it is characteristic of the deposits where gold is found. The importance of this statement will appear later.

Some reddish brown micaceous sandstone also appears in the detritus, and at Donnelly's terrace this is the almost exclusive component of the drift, the dark bluish variety being almost absent there. This is explained by the brown sandstone being *in sitû* on the hill above the terrace. The stones there are highly ferruginous and micaceous. Their mica may be considered as a result of the granite contact and the iron as derived from the decomposition of the ferro-magnesian mica.

The stones, therefore, which form the bulk of the gold-bearing drift have been derived, not from unaltered strata, but from rock which has been strongly modified by contact with intrusive granite.

2. Stones of chalcedony are frequent in the terraces, especially at certain points. A few of these stones picked up in the old workings under the Red Face contained disseminations of cubical white iron pyrites.* The stones have probably been released from veins in the granite and along the granite contact line. Mr. C. Bessell many years ago drove a tunnel in the western hill to the contact line, which he found marked by a vein of chalcedony.

Many of these stones look as if they had been cut or chopped with a chisel on each side, while their substance

* These assayed in the Government Laboratories by Mr. G. Oliver Smith, Government Analyst, yielded a trace of gold.

was in a soft condition. The Germans call this "chopped quartz."* Such stones are common in the tin drifts in granite areas on the East Coast, and have given rise to a good deal of speculation as to their mode of origin. They probably represent veins in the granite, and the gashes are the moulds of crystals of felspar projecting inwards from the vein-walls.

No gold has ever been noticed in any of the stones of chalcedony met with in the workings.

3. The stones of granite which appear in the drift are infrequent. The granite bottom is invariably soft, and consequently it can hardly be expected that the alluvial will contain pieces of the hard rock. No reefs have ever been seen in the granite floor.

4. In places there are large stones of white barren quartz in the wash and detritus. These have not been traced to the veins from which they must have proceeded. It is surmised that such veins must exist in the sandstone. Small veins of quartz have been noticed here and there in the stratified rock, *e.g.*, at Titmus' upper tunnel, and on the western range, but these are unimportant and have no real bearing on the question.

The terraces on the western side of the field have evidently derived their gold from the hill on that side. The blue sandstone is not so common on that range, and the wash contains more slate. The same contact conditions prevail there, the granite bed-rock rising up the hill-side to junction with slate and sandstone.

Coming to the consideration of the derivation of the gold, it is quite possible that some of it may have come from soft pyritous or micaceous veins in the granite bottom, which have gradually worn away with progressive denudation. This, however, is pure hypothesis, and no proof is available. Some source, however, other than hard quartz veins must have existed.

An important clue to the solution of the problem is furnished by the discovery of visible gold in the dark metamorphic sandstone frequently referred to in this report. One of the rock specimens which I brought home showed distinct specks of gold free from gold or pyrite. Unfortunately, I have not been able to observe this in any other specimens, though I have broken hundreds of stones. However, the fact that gold is present in the sandstone is undoubted, and is sufficient to outweigh innumerable negative results.

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* **Zerhackter Quarz.**

The suggestion which I advance is that the bulk of the Lisle alluvial gold has been derived from the wasting away of the impregnated stratified rock near its contact with the granite.

Until we know more about the occurrence it is premature to attempt to range it definitely with other deposits, with which it may eventually prove to have little in common. We do not know yet whether the impregnations in the sandstone are connected with reefs proceeding from the granite, or whether a promiscuous deposition took place from siliceous solutions expelled from the granite during cooling, or some subsequent action took place along the contact line, distributing the gold in the adjoining rock.

In various parts of the world impregnations of gold in stratified rock have been recorded, but these seem always to be connected with quartz veins. One can only surmise that at Lisle the sandstone near its contact with the granite has been saturated with silica from the plutonic mass, and that the gold-bearing siliceous solution has deposited its precious freight in the interstices of the sandstone. The gradual weathering of the rock has liberated the gold, which, together with the detritus and wash (eluvial and alluvial) has found its way down hill to the terraces and creeks. All the facts and features of the field are in harmony with this view.

The impregnation may be irregular, and if so, it will not be easy to find the metalliferous patches. Even when found it does not follow that they will prove payable. The only way to test the occurrence is to remove the overburden on the hill-side and lay bare the bed-rock at the contact. The contact line from Donnelly's to behind Bessell's would be the most likely locality for this work. The task is not easy, as the overburden is heavy, and the position of the hidden line of junction has to be guessed at.

I took grab samples freely from the dark sandstone left in the paddocks from dredging and sluicing along the Main Creek, and these, assayed in the Government Laboratories by Mr. G. Oliver Smith, Government Analyst, yielded a trace of gold. Samples of the red ferruginous sandstone in Donnelly's terrace yielded nil.

VIII.—COUNTRY NORTH OF LISLE.

The Ordovician slate and sandstone continue north of the township to within a mile of the railway, when they are interrupted by granite. On the road opposite the Falls, in the Lisle Creek gorge, the dark metamorphosed sandstone crops out, and on the west side of the gorge near the bar the brown sandstone is extremely micaceous, and has a microscopical structure resembling that of some of the crystalline schists—a structure which has been imposed upon it by the intrusion of the granite.

The general strike of the strata continues throughout the whole of this area, being for the most part about N. 30° W., though in some places up to N. 50° W., and the dip is uniformly in a north-easterly direction. In the bend of the road opposite F. Witte's house the bedding lines can be seen to be horizontal or slightly undulating.

Valentine Creek, which flows into the Little Forester River a mile south of the Lisle-road station, marks the junction of the slate and granite. On the north bank of the creek a surviving fragment of the ancient Little Forester River bed shows itself resting on granite at a good height above the existing river. On this granite ridge the schoolhouse is built, and it trends from that spot in a westerly direction. Northwards it sinks below alluvial gravels, which extend to the railway-line.

The granite is biotite-granite, of much the same type as that at Golconda and Lisle, and as it has also a mantle of slate and sandstone of similar age, its contact line ought to show indications of reefs or mineral deposits. I have not heard that it has been prospected very thoroughly.

Tobacco and Cradle Creeks.

Two miles north-west of Lisle, and on the southern boundary line of the Parish of Shaw, are some mining sections in which Tobacco and Cradle Creeks take their rise. These creeks flow north-east for nearly a mile and then unite, subsequently junctioning with the Lisle Creek. The sections can be reached from Golconda; they are not more than a mile south-east of the New Enterprise Mine. I visited them from Lisle, joining the Lone Star track on the crest of the hill west of Lisle Creek. Stringy-gum and sassafras clothe the side of the range, but at the top stringy-bark country is entered. Near the sections Middle Creek is crossed, a small stream flowing into Tobacco Creek and usually carrying about a sluicehead of water. No gold has been found in this creek.

Mr. C. Bessell discovered Tobacco Creek and gave it its name 18 months before he discovered Lisle. Cradle Creek owes its name to the work which was carried on in it. From these two creeks about 2000 ozs. of gold have been won.

I found an old prospector (Manson) in Tobacco Creek reworking old ground, with about 10 feet of clay overburden and 6 to 18 inches of wash resting on slate bottom. The stones of slate in the wash are angular, and the gold is not waterworn. When pieces of any size are found the gold is usually attached to quartz. The run of gold extends for nearly 20 chains, and has been worked up to the brow of the hill. It keeps at first to the creek, but finally leaves it and turns north-west up the hill. The gold in this creek is coarser than at Lisle, and nuggets up to 15 dwts have been found. The ground has been worked over three or four times, the workings widening each time. At the top of the hill which is between the two creeks a good deal of trenching has been done and some quartz veins have been found, one of which carried gold. A shaft was sunk on it for 25 feet, but the metal died out. A long tunnel was put in from the Cradle Creek side of the divide, but nothing was found past the entrance. On the summit of the ridge is an ironstone reef with a little quartz in it, very similar to many of those which occur near Lefroy. It appears to be conformable with the slate, and is not very promising to look at.

In the lower end of Cradle Creek the gold is extremely fine, and the wash is all quartz.

There seems to be no doubt that the gold won in the two creeks has been derived from the hill which divides them, and has been contained in quartz reefs. There was a rush here of 50 or 60 men some three or four years after work at Lisle began, and it is strange that the veins which shed the alluvial gold were not discovered. The area within which search has to be made is small, and it would seem that there is here a field in which a little capital might be usefully expended in exploration.

IX.—COUNTRY SOUTH OF LISLE.

The Ordovician strata of Lisle are prolonged south-east to Mt. Barrow and the North Esk River. Once removed from the immediate influence of the granite the slate becomes normally a grey greenish and purplish rock, with cleavage-planes having the usual north-westerly strike and north-easterly dip. Already at the head of the Lisle Valley the dark metamorphic slate and sandstone give way to purplish slate. From Faulkner's farm south-east to St. Patrick's River the stratified rocks are covered by a narrow strip of basalt and basaltic soil, which follows the river down to Patersonia and further south to Mt. Edgecumbe and along Distillery Creek.

Several quartz reefs are known between Lisle and St. Patrick's River, but they are white and barren, and have been little prospected.

In the road below the St. Patrick's River post office a reef is exposed striking south-east and dipping north-east. It transgresses the country, and consists of seams of quartz alternating with chloritic and felspathic bands for a width of 1½ feet. It is a persistent reef, for it runs south a good distance on R. Wilson's land. On Warren's land are reefs or dykes of somewhat similar nature. Microscopical examination shows these decomposed greenish formations to be hornblende-granite dykes, and they no doubt have some connection with the hornblendic granite of Diddleum and Camden Plains.

Some boulders of granite-porphyry apparently mark the line of a dyke or other granitic intrusion running north-east on J. Millwood's section, north-west of J. M. Peck's 100½ acres, across the river due west of the reefs just mentioned. These boulders are in slate country, but 10 chains south of them some Permo-Carboniferous mudstone with casts of spirifers is exposed on the road.

On Hart's 228 acres, on the road towards Sullivan's Bridge, is a wide red formation containing decomposed syenitic dyke-rock. The adjoining purple slate has here produced much red soil. No quartz is visible in the formation, but it is stained with manganese.

A little north is Brook's shaft, by the roadside. This was sunk 50 feet by a Launceston syndicate 10 years ago. Rumour says that assays of lead, gold, and silver were obtained. At present nothing can be seen beyond the grey slate thrown out of the shaft and a few stones of white vitreous-looking quartz mottled with specks of greenish slate and manganese oxide.

At Irishman's Gully, running into the basalt zone west of the St. Patrick's River, a little sluicing has been done and some gold obtained, but the quantity is not known. Above the junction of Patersonia Rivulet with the river, where the basalt crosses the former, some paddocks of dirt were opened out and some gold won. It is reported that some precious stones were found here. These were probably sapphires, as some have also been got at Camden Plains.

I did not go on to Camden Plains, which have long been known as a gold-bearing field. I am informed that there 9 to 10 feet of wash rests on the granite bottom. The granite is hornblendic. The gold is excessively fine, and no nuggets are found.

Looking upon this district as a whole I do not anticipate that payable reefs will be found. I suspect that, as a rule, the gold which has been won in small quantities at different places has been shed from the lines of contact of the granite with the stratified rocks, and that though in the aggregate a fair quantity may have been liberated by denudation, it has been distributed by the drainage system over so wide an area that the concentrations of metal at the different points are not likely to be very remunerative.

There is, however, just a chance that some deposit a little above the average may be met with.

Mt. Barrow (4644 feet) is crowned with columnar diabase, and several hundred feet from its summit is fringed with sandstone and Permo-Carboniferous mudstone. The upper beds of the fringe consist of calceous mudstone charged with fossils, and the lower beds comprise sandstone and boulder conglomerate. also fossiliferous. These are about 1100 feet in thickness. They repose in horizontal layers upon the steeply inclined slate strata of the Ordovician system. Down in the St. Patrick's River Valley, at Maclaren's Turn-off, soft Permo-Carboniferous mudstone is again to be seen in the road drain.

A mile and a half further south, east of the main-road, is Bourke's sandstone quarry, with a cliff of freestone several chains long and 30 feet high. The stone is of even quality and grain, and free from iron. It looks as if it would make an excellent building stone. Samples may be seen at Mr. Silvanus Wilmot's stone-cutting yard, Brisbane-road, Launceston.

The diabase which surrounds Launceston plunges beneath the alluvial of the North Esk Valley and crops out in Mr. Fry's paddock on the Elphin-road. It passes below the Tertiary sandstone of the Windmill Hill and below the flat land at the junction of the North and South Esk Rivers. It has been found by boring at the Tamar-street Bridge 55 feet down. Processes of denudation have therefore in the course of ages removed the overlying Tertiary and Permo-Carboniferous strata, and have eaten into the diabase floor itself to a considerable extent. The thickness of the Launceston Tertiary beds may be gauged by the depth of the bore which was put down at Carr Villa—570 feet—before touching the diabase rock below. The old alluvial bottom began already to rise in later Tertiary times and with the new land configuration the North Esk River selected its present channel. The result has been the formation of the Cataract Gorge, certainly not, as is often imagined, a display of volcanic energy, and probably not due to any disruptive force, but simply the carving out of a channel by the ceaseless but irresistible action of running water, assisted by a gradual elevation of the land.

W. H. TWELVETREES, Government Geologist.

Launceston, 10th October, 1908.

X.—APPENDIX.

ON THE DETERMINATION OF HEIGHTS.

The heights on this journey were taken with a 4-inch aneroid and a Casella's hypsometer. and to ensure an approximation to accuracy the calculations are based on readings taken during the last days of the period. It is now well known that aneroids give higher readings during the first few weeks of their stay at upper stations than they do subsequently. After a few weeks, if not used in further ascents, they recover and behave normally, probably increasing their index error in the process.

The results obtained with both of these instruments are inferior to observations taken with a mercurial barometer, but the transport of the latter is extremely inconvenient, requiring, as it does, continual attention and care. In fact, one man ought to be detailed to carry the barometer alone. The least inconvenient form is the portable mountain barometer made by several firms especially for explorers. For transport the cistern screw must be turned sufficiently to force the column of mercury to the top of the tube, and the instrument must then be carried upside down. While in this position loosen the screw half a turn so as to afford a little play to the mercury. If these precautions are not observed the instrument will come to grief. One cause of annoyance is that on mountain tops in a strong breeze the slender tripods supplied with the barometer vibrate unpleasantly and cause unsteadiness.

My boiling-point apparatus on this trip persisted in reading higher than the aneroid by 50 to 100 feet. I have generally used this method as a check on the aneroid with tolerably fair results. Of course it has been proved to be inferior in point of accuracy to the mercurial barometer, but nevertheless, on account of its convenience, it is much used by travellers. In using it, it should be borne in mind that isolated observations are not of much value. At least three observations should be taken with different thermometers and the mean adopted. Thermometers, even by good makers, are not infallible, and as they increase in age they are apt to give too high temperatures, and consequently the calculated height is lower than the actual height. The value of one degree Fahrenheit on the thermometer tube in making the first ascent from sea-level is about 519 feet. It can therefore be readily seen what accuracy is requisite if fractional readings are to be reliable. Moreover, the value of the degree increases with the height above sea-level, so that instrumental errors and errors of observation ought to diminish as the ascent is made, which is not the case. Further, on looking through the literature of the subject, it does not appear at all certain that the barometric pressure corresponding with the various boiling-points has been accurately ascertained, and this adds a new source of possible error. In the earlier forms of the apparatus the purity or impurity of the water boiled affected the results, but in the hypsometers now obtainable, the thermometer, both stem and bulb, is immersed in pure vapour, so that the kind of water used is immaterial. For travellers' use, Casella publishes a set of tables, from which the following figures are taken:—

Boiling point temperature.	Approximate height above sea-level.	Difference for each degree.	Corresponding height of barometer.
degrees.	feet.	feet.	inches.
212	—	—	29·922
211	519*	519	29·335
210	1041	522	28·756
209	1566	525	28·185
208	2094	527	27·623
207	2623	529	27·070
206	3154	531	26·527
205	3686	533	25·993
204	4221	535	25·468
203	4757	536	24·952
202	5295	538	24·445
201	5834	540	23·946
200	6376	542	23·456

* Multipliers for the temperature of intermediate air and corrections for decrease of gravity as per tables given later in these notes must be used when the difference of height between two stations has to be calculated.

Aneroids.

There are many aneroids scattered about the country, and their possessors often suffer illusions in respect of their value for giving heights, and are, besides, inexperienced in their use for that purpose. The aneroid barometer cannot be called a tool of precision, notwithstanding various refinments of scale, verniers, &c. It is unreliable for contours of, say, less than 30 feet. Several unsatisfactory features are attached to its use, and great care has to be taken when employing it for the determination of heights. It is usual to hear travellers justify their determinations of mountain heights by laying emphasis on the fact that their aneroid needle has returned to its original base reading on the completion of their descent. This very fact would furnish grounds for suspicion, because the natural tendency of an aneroid in normal working order is during the ascent to lose or read higher than the true height, and in descending the opposite tendency or one towards recovery prevails. The two tendencies, as Mr. Whymper has shown, counteract each other, and the result is a retarded recovery, so that if a reading is taken immediately on completing the descent it will show less difference of air pressure than was shown by the ascent. Whymper states a rule: "All aneroids without exception lose upon the mercurial barometer when submitted to diminished pressure, and recover a portion of the previous loss when pressure is restored." He adds, that it is exceptional to find the loss exactly balanced by the recovery. The recovery is gradual, and sometimes exceeds the loss. Thus various index errors are acquired. A touching confidence is sometimes reposed in the Kew certificate when this is supplied with an instrument, but this is nothing more than a verification of the behaviour of the aneroid when under specific reductions of pressure in the maker's workshop. It is no guarantee of its behaviour during sustained fluctuations of pressure in the field. The certificate shows that care was taken in the manufacture, but the intrinsic foibles of ordinary aneroids remain unaffected. A clever and effective way of overcoming these disadvantages has been devised in the shape of the Watkin mountain aneroid, in which, by turning a screw at the back of the instrument, the pressure on the vacuum-box is exerted only at the time of taking the reading, and is relieved immediately afterwards.

Observers are advised not to rely upon readings at heights which are at all near the upward limit of the scale. Thus, an aneroid graduated up to 5000 feet cannot be used with safety to determine heights above 4000 feet.

A gentle tap applied to the instrument is often of use in starting the needle, though the motion in walking or riding is usually sufficient to keep it acting freely.

It should be always read in one position, as the indicator will read differently according as the aneroid is held vertically or horizontally. The vertical position is preferable, as it can be suspended freely from the hand by the ring only, and exactly on a level with the eye.

In mountain climbing the pressure in inches should be noted, and not only the mere elevation scale, as the barmetrical pressure will have to be used in the subsequent calculations. The scale of feet, too, may be taken as being less accurate than the divisions for pressure.

Mr. Whymper prefers aneroids of large diameter, to those of watch size. On the other hand, the topographers of the United States Geological Survey use instruments 2 inches to 2½ inches in diameter. My own experience has been favourable to the use of the smaller size, if of the best construction.

The reading should be taken immediately on reaching the summit of a mountain. The height observed will usually exceed the true height by a little. The excess will be found to have increased if another reading be taken a little later. The later reading should be neglected, for it is not the result of sluggish action of the needle, as has been supposed, but is due to the continued low pressure, as mentioned above.

The usual and proper use of the aneroid is in determining relative, not absolute, heights. If heights above sea-level are desired, it is necessary to select a base, or lower station, the height of which is known from other sources. A railway-station, or some point the height of which above the rails have been ascertained, may be chosen as a base. Every opportunity of checking readings by repeated observations should be taken advantage of, for aneroids often behave in an erratic manner, and single observations are unreliable.

If a second aneroid is not kept in camp and read throughout the day by a second observer, it will be necessary to obtain the 9 a.m. and 3 p.m. atmospheric pressure from Hobart or Launceston, and deduct or add the mean of the daily variation. Thus, if at Launceston the barometer reads at 9 a.m. 30·20, and at 3 p.m. 30·10, the mean variation will be ·05. Therefore, deduct ·05 from the reading at field base in order to correct it for comparisons, say, at noon with the reading at the upper station.

To obtain correct temperature at upper and lower stations, use a standard mercurial thermometer made by a good firm. Shade temperature must be observed, and the thermometer should be suspended at least 10 feet away from any vertical rock face or cliff.

Some aneroids are furnished with attached thermometers which are supposed to show the temperature of the instrument, but good aneroids are commonly compensated for this, and the appendage is unnecessary.

In determining heights by aneroid in Tasmania two corrections must be applied to the reading, viz:—

Corrections—

1. Correction for difference of temperature between the lower and upper stations (See Table II.).
2. Correction for decrease of gravity due to height (See Table III.).

The use of these tables may be illustrated by the following example:—

9 a.m.		Launceston. Inches.	Lisle. Inches.		Launceston.	Lisle.
July 15.	Barom.	30·48	29·60	Thermom.	+ 39°	+ 32°
20.	„	29·50	28·75	„	+ 51°	+ 38°
21.	„	29·70	28·80	„	+ 46°	+ 34°
23.	„	30·08	29·15	„	+ 46°	+ 33°
25.	„	30·15	29·25	„	+ 33°	+ 28°
	Average	29·11	29·98		+ 33°	+ 43°
					38°	

Lisle.........	29·11 in.	Table I.	27,916·1 ft.
Launceston	29·98 in.	„	28,685·5 ft.
			769·4 ft.

Table II. Mean temperature 38° = —— 1·0132 multiplied.

769·4 × 1·0132 = 779 ft.

Table III. Decrease of gravity...... 1·94 ft.

Altitude of Lisle .... 780·94 ft.

Table I. must be used by extracting from it the difference of elevation in feet which it shows between the readings at the upper and lower stations.

If the precautions detailed in these notes are observed, aneroids, if of the best construction, will, subject to their natural limitations, give fairly satisfactory results.

Table I.—Guyot's Reductions of Barometric Readings to Feet. (From Smithsonian Miscellaneous Contributions.)

Barometer in inches.	Hundredths of an inch. ·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Barometer in inches.
24·0	22873·0	22883·9	22894·7	22905·6	22916·5	22927·4	22938·2	22949·1	22960·0	22970·8	24·0
24·1	22981·7	22992·5	23003·3	23014·2	23025·0	23035·8	23046·6	23057·5	23068·3	23079·1	24·1
24·2	23089·9	23100·7	23111·4	23122·2	23133·0	23143·8	23154·5	23165·3	23176·1	23186·8	24·2
24·3	23197·6	23208·3	23219·1	23229·8	23240·5	23251·3	23262·0	23272·7	23283·4	23294·2	24·3
24·4	23304·9	23315·6	23326·3	23337·0	23347·6	23358·3	23369·0	23379·7	23390·3	23401·0	24·4
24·5	23411·7	23422·3	23433·0	23443·7	23454·3	23464·9	23475·6	23486·2	23496·8	23507·4	24·5
24·6	23518·1	23528·7	23539·3	23549·9	23560·5	23571·1	23581·7	23592·3	23602·9	23613·5	24·6
24·7	23624·1	23634·6	23645·2	23655·8	23666·3	23676·9	23687·5	23698·0	23708·6	23719·1	24·7
24·8	23729·7	23740·2	23750·7	23761·2	23771·7	23782·3	23792·8	23803·3	23813·8	23824·3	24·8
24·9	23834·8	23845·3	23855·7	23866·2	23876·7	23887·2	23897·7	23908·2	23918·6	23929·1	24·9
25·0	23939·5	23949·9	23960·4	23970·8	23981·3	23991·7	24002·1	24012·5	24023·0	24033·4	25·0
25·1	24043·8	24054·2	24064·6	24075·0	24085·4	24095·7	24106·1	24116·5	24126·9	24137·2	25·1
25·2	24147·6	24158·0	24168·3	24178·7	24189·0	24199·4	24209·7	24220·1	24230·4	24240·8	25·2
25·3	24251·1	24261·4	24271·8	24282·1	24292·4	24302·7	24313·0	24323·3	24333·3	24343·9	25·3
25·4	24354·2	24361·5	24374·7	24385·0	24395·3	24405·5	24415·8	24436·1	24436·3	24446·6	25·4
25·5	24456·8	24467·0	24477·3	24487·5	24497·8	24508·0	24518·2	24528·4	24538·7	24548·9	25·5
25·6	24559·1	24569·3	24579·5	24589·7	24599·9	24610·0	24620·2	24630·4	24640·6	24650·7	25·6
25·7	24660·9	24671·1	24681·2	24691·4	24701·5	24711·7	24721·8	24732·0	24742·1	24752·3	25·7
25·8	24762·4	24772·5	24782·6	24792·8	24802·9	24813·0	24823·1	24833·2	24843·3	24853·4	25·8
25·9	24863·5	24873·6	24883·7	24893·7	24903·8	24913·9	24921·0	24934·0	24944·1	24944·1	25·9

26·0	24964·2	24974·2	24984·3	24994·3	25004·4	25014·4	25024·4	25034·4	25044·5	25054·5	26·0
26·1	25064·5	25074·5	25084·5	25094·5	25104·5	25114·5	25124·5	25134·5	25144·4	25154·4	26·1
26·2	25164·4	25174·4	25184·3	25194·3	25204·2	25214·2	25224·1	25234·1	25244·0	25254·0	26·2
26·3	25263·9	25273·8	25283·8	25293·7	25303·6	25313·5	25323·4	25333·3	25343·2	25353·1	26·3
26·4	25363·0	25372·9	25382·8	25392·7	25402·6	25412·4	24522·3	25432·2	25442·1	25451·9	26·4
26·5	25461·8	25471·7	25481·5	25491·4	25501·2	25511·0	25520·9	25530·7	25540·5	25550·4	26·5
26·6	25560·2	25570·0	25579·8	25589·7	25599·5	25609·3	25619·1	25628·9	25638·7	25648·5	26·6
26·7	25658·3	25688·1	25677·8	25687·6	25697·4	25707·1	25716·9	25726·7	25736·4	25746·2	26·7
26·8	25755·0	25765·6	25775·4	25785·1	25794·8	25804·6	25814·3	25824·0	25833·8	25843·5	26·8
26·9	25853·2	25862·9	25872·6	25882·2	25892·0	25901·7	25911·4	25921·1	25930·8	25940·5	26·9
27·0	25950·2	25959·9	25969·6	25979·2	25988·9	25998·6	26008·2	26017·9	26027·5	26037·2	27·0
27·1	26046·8	26056·5	26066·1	26075·7	26085·3	26095·0	26104·6	26114·2	26123·8	26133·4	27·1
27·2	26143·0	26152·6	26162·2	26171·8	26181·4	26191·0	26200·6	26210·2	26219·8	26229·3	27·2
27·3	26238·9	26248·0	26258·0	26267·6	26277·2	26286·7	26296·3	26305·8	26315·3	26324·9	27·3
27·4	26334·4	26344·0	26353·5	26363·0	26372·4	26382·1	26391·6	26401·1	26410·6	26420·1	27·4
27·5	26429·6	26439·1	26448·6	26458·1	26467·6	26477·1	26486·5	26496·0	26505·5	26514·9	27·5
27·6	26524·4	26533·9	26543·3	26552·8	26562·3	26571·7	26581·2	26590·6	26600·0	26609·5	27·6
27·7	26618·9	26628·4	26637·8	26647·2	26656·7	26666·1	26675·5	26684·9	26694·3	26703·7	27·7
27·8	26713·1	26722·5	26731·9	26741·3	26750·7	26760·1	26769·5	26778·8	26788·2	26797·6	27·8
27·9	26806·9	26816·3	26825·6	26835·0	26844·3	26853·7	26863·0	26872·3	26881·7	26891·0	27·9
28·0	26900·4	26909·7	26919·0	26928·4	26937·7	26947·0	26956·3	26965·6	26975·0	26984·3	28·0
28·1	26993·6	27002·9	27012·2	27021·5	27030·7	27040·0	27049·3	27059·6	27067·8	27077·1	28·1
28·2	27086·4	27095·6	27104·9	27114·2	27123·4	27132·7	27141·9	27151·2	27160·4	27169·6	28·2
28·3	27178·9	27188·1	27197·3	27206·5	27215·7	27225·0	27234·2	27243·4	27252·6	27261·8	28·3
28·4	27271·0	27280·2	27289·4	27298·6	27307·8	27317·0	27326·2	27355·3	27344·5	27353·7	28·4
28·5	27362·0	27372·0	27381·2	27390·4	27399·5	27408·7	27417·8	27427·0	27436·1	27445·2	28·5
28·6	27454·4	27463·5	27472·6	27481·8	27490·9	27500·0	27509·1	27518·2	27527·4	27536·5	28·6
28·7	27545·4	27554·7	27563·8	27572·9	27582·7	27591·1	27600·2	27609·3	27618·3	27627·4	28·7
28·8	27636·5	27645·5	27654·6	27663·7	27672·7	27681·8	27690·8	27699·9	27708·9	27717·9	28·8
28·9	27727·0	27736·0	27745·1	27754·1	27763·1	27772·2	27781·2	27790·2	27799·2	27808·3	28·9

TABLE I.—Guyot's Reductions of Barometric Readings to Feet—continued.

Barometer in inches.	Hundredths of an inch.										Barometer in inches.
	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	
29·0	27817·2	27826·2	27835·2	27844·2	27853·2	27862·2	27871·2	27880·2	27889·1	27898·1	29·0
29·1	27907·1	27916·1	27925·0	27934·0	27943·0	27951·9	27960·9	27969·8	27978·8	27987·7	29·1
29·2	27996·7	28005·6	28014·6	28023·5	28032·4	28041·4	28050·3	28059·2	28068·2	28077·1	29·2
29·3	28086·0	28094·9	28103·8	28112·8	28121·7	28130·6	28139·5	28148·4	28157·3	28166·2	29·3
29·4	28175·1	28184·0	28192·9	28201·7	28210·6	28219·5	28228·4	28237·2	28246·1	28254·9	29·4
29·5	28263·8	28272·6	28281·5	28290·3	28299·2	28308·0	28316·9	28325·7	28334·5	28343·4	29·5
29·6	28352·2	28361·0	28369·8	28378·7	28387·5	28396·3	28405·1	28413·9	28422·7	28431·5	29·6
29·7	28440·3	28449·1	28457·9	28466·7	28475·4	28484·2	28493·0	28501·8	28510·6	28519·3	29·7
29·8	28528·1	28536·9	28545·6	28554·4	28563·2	28571·9	28580·7	28589·4	28598·2	28606·9	29·8
29·9	28615·7	28624·4	28633·2	28641·9	28650·6	28659·3	28668·1	28676·8	28685·2	28694·2	29·9
30·0	28702·9	28711·6	28720·3	28729·0	28837·7	28746·4	28755·1	28763·8	28772·5	28781·1	30·0
30·1	28789·8	28798·5	28807·2	28815·9	28824·5	28833·2	28841·9	28850·5	28859·2	28867·9	30·1
30·2	28876·5	28885·2	28893·8	28902·5	28911·1	28919·8	28928·4	28937·0	28945·7	28954·3	30·2
30·3	28962·9	28971·5	28980·1	28988·8	28997·4	29006·0	29014·6	29023·2	29031·7	29040·3	30·3
30·4	29048·9	29057·5	29066·1	29074·7	29083·3	29091·8	29100·4	29109·0	29117·6	29126·2	30·4
30·5	29134·7	29143·3	29151·9	29160·4	29169·0	29177·6	29186·1	29194·7	29203·2	29211·8	30·5
30·6	29220·3	29228·9	29237·4	29245·9	29254·4	29262·9	29271·5	29280·0	29288·5	29297·0	30·6
30·7	29305·5	29314·0	29322·5	29331·1	29339·6	29348·1	29356·6	29365·1	29373·5	29382·0	30·7
30·8	29390·5	29399·0	29407·5	29416·0	29424·4	29432·9	29441·4	29449·8	29458·3	29466·8	30·8
30·9	29475·2	29483·7	29492·1	29500·6	29509·0	29517·5	29525·9	29534·3	29542·8	29551·2	30·9

TABLE II.—Multipliers for Temperature of Intermediate Air.

Mean Temperature of Intermediate Air.	Multiplier	Mean Temperature of Intermediate Air.	Multiplier.	Mean Temperature of Intermediate Air.	Multiplier.
32°... ...	1·0000	55°... ...	1·0511	78°... ...	1·1022
33°... ...	1·0022	56°... ...	1·0533	79°... ...	1·1044
34°... ...	1·0044	57°... ...	1·0555	80°... ...	1·1066
35°... ...	1·0066	58°... ...	1·0577	81°... ...	1·1088
36°... ...	1·0088	59°... ...	1·0599	82°... ...	1·1111
37°... ...	1·0110	60°... ...	1·0622	83°... ...	1·1133
38°... ...	1·0133	61°... ...	1·0644	84°... ...	1·1155
39°... ...	1·0155	62°... ...	1·0666	85°... ...	1·1177
40°... ...	1·0177	63°... ...	1·0688	86°... ...	1·1199
41°... ...	1·0199	64°... ...	1·0711	87°... ...	1·1222
42°... ...	1·0222	65°... ...	1·0733	88°... ...	1·1244
43°... ...	1·0244	66°... ...	1·0755	89°... ...	1·1266
44°... ...	1·0266	67°... ...	1·0777	90°... ...	1·1288
45°... ...	1·0288	68°... ...	1·0799	91°... ...	1·1311
46°... ...	1·0311	69°... ...	1·0822	92°... ...	1·1333
47°... ...	1·0333	70°... ...	1·0844	93°... ...	1·1355
48°... ...	1·0355	71°... ...	1·0866	94°... ...	1·1377
49°... ...	1·0377	72°... ...	1·0888	95°... ...	1·1399
50°... ...	1·0399	73°... ...	1·0911	96°... ...	1·1422
51°... ...	1·0422	74°... ...	1·0933	97°... ...	1·1444
52°... ...	1·0444	75°... ...	1·0955	98°... ...	1·1466
53°... ...	1·0466	76°... ...	1·0977	99°... ...	1·1488
54°... ...	1·0488	77°... ...	1·0999	100°... ...	1·1511

Table III.—Correction for the Decrease of Gravity on a Vertical acting on the Density of the Air. This correction must be added:—

(From Smithsonian Miscellaneous Contributions.)

Approximate Difference of Level.	Decrease of Gravity. Positive.	
	0	+ 500
Feet.	Feet.	Feet.
1000	2·5	3·9
2000	5·2	6·6
3000	7·9	9·3
4000	10·8	12·2
5000	13·7	15·2
6000	16·7	18·3
7000	19·9	21·5
8000	23·1	24·7
9000	26·4	28·1
10,000	29·8	31·5

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GOVERNMENT PRINTER, TASMANIA.

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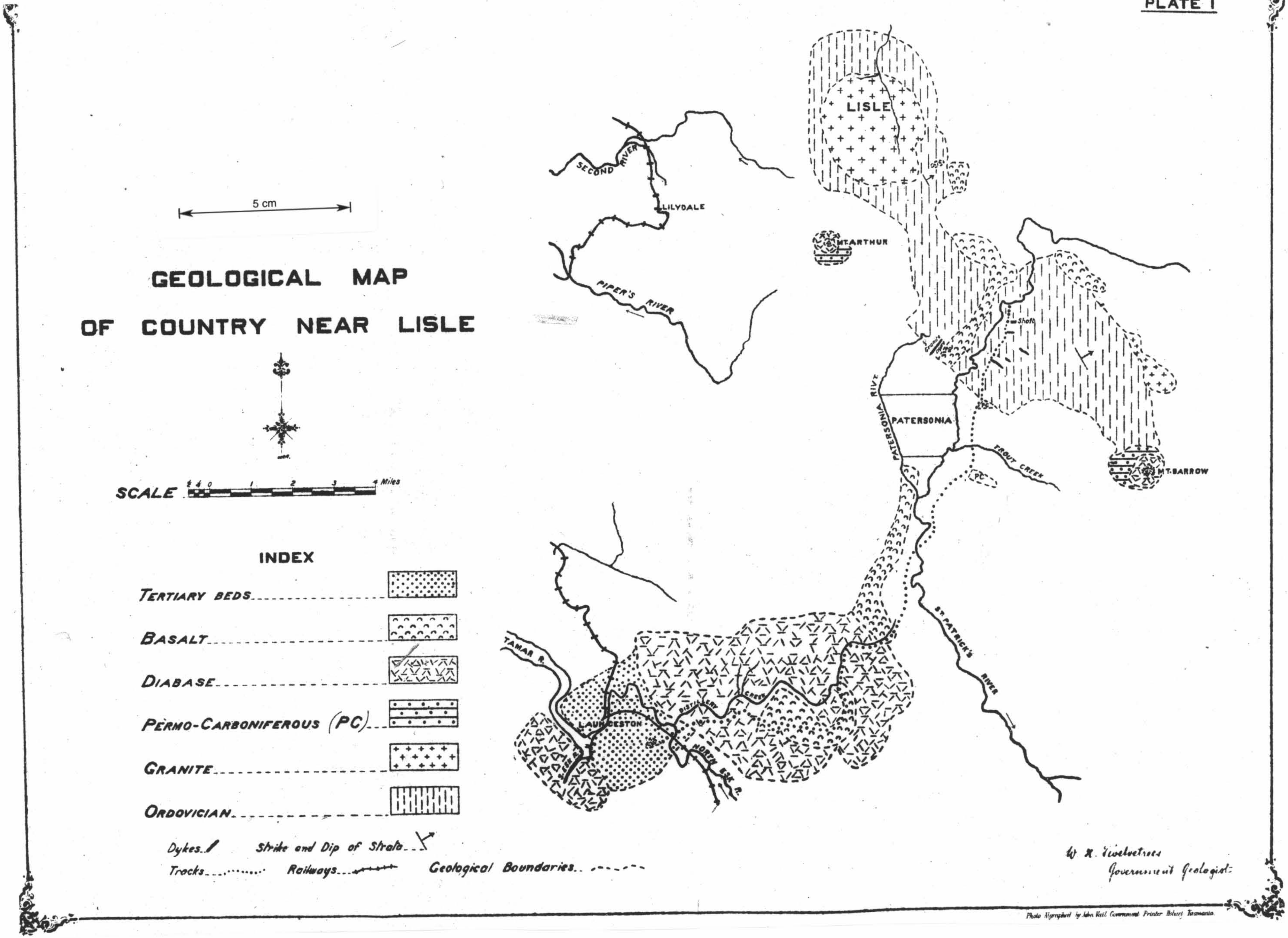
PLATE I



5 cm
GEOLOGICAL MAP
OF COUNTRY NEAR LISLE
SCALE
0 1 2 3 4 Miles
INDEX
TERTIARY BEDS
BASALT
DIABASE
PERMO-CARBONIFEROUS (PC)
GRANITE
ORDOVICIAN
Dykes
Strike and Dip of Strata
Tracks
Railways
Geological Boundaries
LISLE
SECOND RIVER
LILYDALE
PIPER'S RIVER
MT ARTHUR
PATERSONIA
PATERSONIA RIVER
TROUT CREEK
MT BARROW
PC
Shaft
ST PATRICK'S RIVER
TAMAR R.
LAUNCESTON
DISTILLERY CREEK
NORTH ESK R.
W. H. Twelvetrees
Government Geologist
Photo lithographed by John Vail, Government Printer, Hobart, Tasmania.

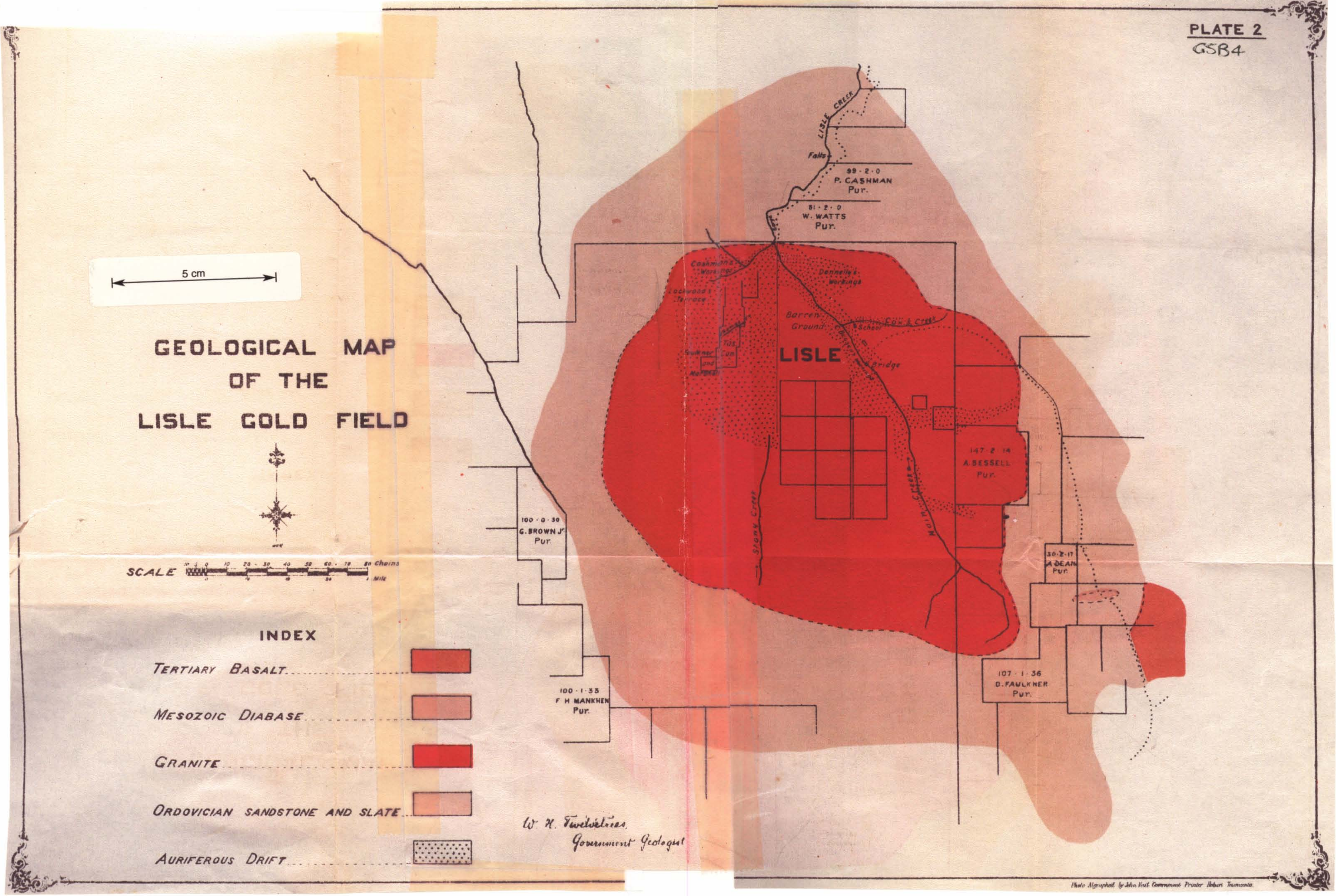
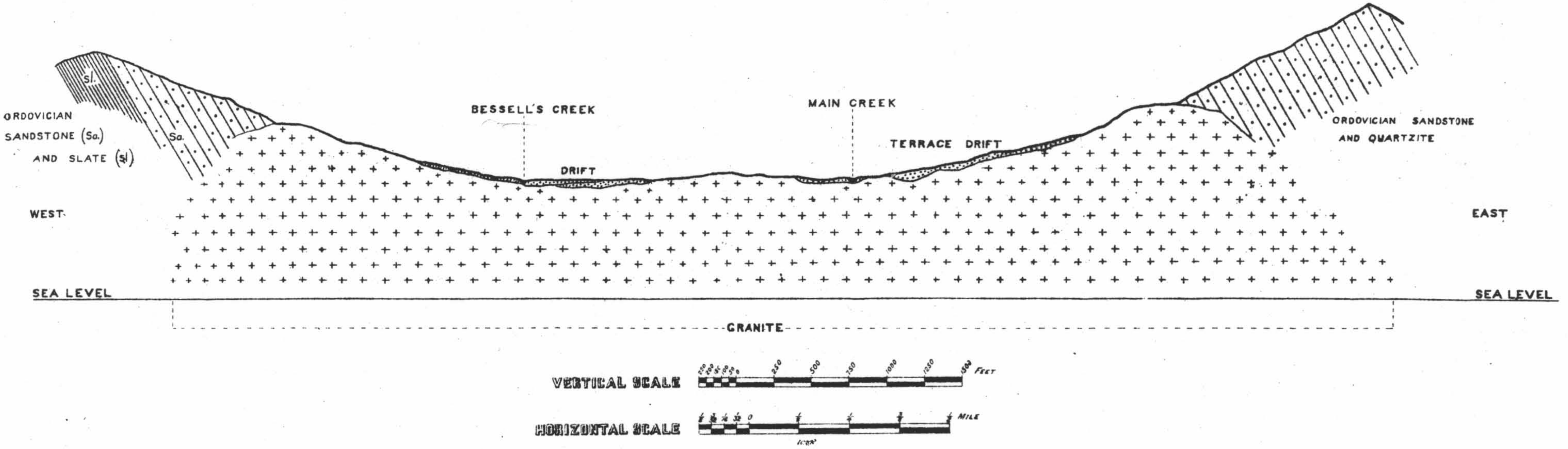


PLATE 2
GSB4
5 cm
GEOLOGICAL MAP
OF THE
LISLE GOLD FIELD
SCALE
Chains
Mile
INDEX
TERTIARY BASALT
MESOZOIC DIABASE
GRANITE
ORDOVICIAN SANDSTONE AND SLATE
AURIFEROUS DRIFT
W. H. Twelvetrees,
Government Geologist
LISLE CREEK
Falls
99 · 2 · 0
P. CASHMAN
Pur.
81 · 2 · 0
W. WATTS
Pur.
Cashman's Workings
Donnelly's Workings
Lockwood's Terrace
Barren Ground
School
Bridge
LISLE
Stony Creek
Main Creek
147 · 2 · 14
A. BESSELL
Pur.
100 · 0 · 30
G. BROWN Jr.
Pur.
30 · 2 · 17
A. DEAN
Pur.
107 · 1 · 36
D. FAULKNER
Pur.
100 · 1 · 33
F. H. MANKHEN
Pur.
Photo Algraphed by John Vail, Government Printer, Hobart, Tasmania.

PLATE 3
GS84'

GEOLOGICAL SECTION OF THE LISLE VALLEY



W. H. Twelvetrees
Government Geologist.

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