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The Golconda Gold Mining District

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Summary

LISLE, the most important field of this district, was the centre of gold-mining 50 years ago. Today it is deserted by all save a few timber-getters, who occasionally give a little time to prospecting for the source of the free gold found in the creek-bed and on the sides of the valley. As the deposits of Lisle are typical, more attention is given to the description of those than to others in the district.

Ordovican slates, sandstones, and tuffs have been intruded by syenite granite of Devonian age. Along the lines of contact the sediments and tuffs have been greatly affected by the action of mineralisers from the magma of the intrusive rock. It is in such places where metamorphism is so noticeable that the richest deposits of gold are found. Veins or fissures in these altered sediments have been filled with quartz, sulphides and sulpharsenides, and gold-carrying silver. Quartz, almost barren of gold, was the original and sole occupant of the veins. In the crystallising quartz vein-mass shrinkage cracks were formed which afforded a locus for the deposition of the last products of the mineralising solutions, the sulphides, sulpharsenides, and gold. Oxidation of the sulphidic cementing material resulted in the disintegration of the quartz vein-mass, and brought about the dissolution of part of the gold which, carried away in solution, was deposited on the sides of the valley. Some of the gold has been concentrated in creek-beds; some remains on the valley sides underneath a great mass of talus material associated with almost barren vein quartz. From these deposits nearly £1,000,000 worth of gold has been obtained by sluicing methods. The great depths of detritus and talus on the summit and eastern side of Lisle basin add to the difficulties of exploration. A number of quartz veins have been found, but very little gold has been found in the quartz, and the prospects have been abandoned therefore. As the gold is contained in the interstitial or cementing materials, prospecting should be contiued to depths below the zone of oxidation.

In the Golconda, Panama, Lebrina, and Denison areas the sulphidic accessory minerals appear at or near surface, and the veins are, in consequence, easy of exploration. At Cradle Creek and at Myrtlebank gold-impregnated sandstones are the most important of the known orebodies, and can be easily and cheaply explored. At Lisle oxidation of the ores has extended to water-level, and the veins are, in consequence, more difficult of exploration and development. Here almost all the alluvial gold, and that found below the talus material, is of secondary origin.

The Golconda Gold Mining District.

I.—INTRODUCTION.

This report deals with the district of Golconda, which includes, in addition to the small goldfield of that name, the more important Lisle field and the Cradle Creek, Lebrina, Panama, Lone Star, Denison, and Myrtlebank areas. From the mining viewpoint, all of these areas are pre-eminently potential sources of gold. No other metal in important natural concentrations has been found there; but the associated arsenic and copper ores, saved as secondary products in the treatment of the gold-bearing rock, may prove of commercial value if they can be obtained in sufficient quantities to be marketed.

Shortly after the gold discovery in the seventies the district became one of great mining activity, but one area (Lisle) only has thus far been productive of good results. During the period of its prosperity it is estimated that over a million pounds' worth of gold was unearthed from the beds and banks of Main and Bessell Creeks at Lisle. As development proceeded the miners gave more and more attention to the search for the source of the metal. All the exploratory works were fruitless, however, and after the alluvial ground had been deprived of its gold the field was abandoned. Spasmodic attempts have since been made to discover the source, but without success. At this stage it was decided to make a thorough geological investigation of the district. The following account gives the results of that work, which, it is hoped, will prove of considerable help to those interested in the development of the gold-mining industry in the district, and particularly to those engaged in the search for the source of the free gold already obtained.

II.—PREVIOUS LITERATURE.

Three official examinations of Lisle area have already been made, and two of Myrtlebank and Golconda. The more thorough are those of Lisle area, namely:—

Thureau, G.: Report on Lisle Goldfield, House of Assembly Paper, 1882.

Montgomery, A.: Report on Lisle Goldfield, 1894.

Twelvetrees, W. H.: The Lisle Goldfield, Geological Survey Bulletin No. 4, 1909.

Reid, A. McIntosh: Report on Golden Crest Mine, Golconda, 1917.

Hills, Loftus: Reports on Little Mollie Prospect, Myrtlebank, and Lisle Alluvial Deposits, 1921.

III.—PHYSIOGRAPHY.

Topography.

The configuration of the area as it appears to-day is largely the result of Tertiary development, modified in detail by the action of erosion agents during Recent time. The three contributing factors are:—

(1) The varying nature and character of the rock of each formation.
(2) The effect of igneous intrusives.
(3) Earth movements.

Weathering of rocks is due to the chemical and physical forces exerted by atmospheric agents. The relative effects of these forces depend on the power of resistance to chemical change and hardness of the materials. Those most readily affected by chemical action or decomposition are the first to succumb. If one or more only of the component minerals is attacked, physical forces are sufficient to complete the process of disintegration and ultimate destruction as a composite body. One of the first to suffer decomposition and disintegration was the granitite of Lisle, Panama, Golconda, and Lone Star basins. Its soft nature allowed of its rapid removal from the more stable rim rocks of the basins, the floor of which, in one of them, has been cut to a depth of 1000 feet below the outer rim of hardened metamorphosed sandstone and slate. Basalt, likewise, has succumbed to the persistent attack, and has been converted into rich chocolate-coloured soils. The diabase crown of Mt. Arthur, on the contrary, having greater powers of resistance, presents a bold rugged outline, and is the most prominent feature of the area.

The basalt overflow has formed a protective covering to a large portion of the Ordovician formation, the surface of which in the unprotected parts has been greatly reduced in altitude, as in the country between Lisle and Bridport, for instance. The intrusion of diabase during the Upper Mesozoic period was responsible for the uplifting of the Permo-Carboniferous and the tilting of those strata and the underlying Ordovician sediments in a north-easterly direction.

The northern section of the district forms a small part of a low-level plateau extending to the coast-line. This plateau is covered in places with shallow deposits of Tertiary age. The southern part, on the contrary, is hilly and even mountainous, and is deeply dissected by many north-flowing streams. Denison River and its numerous tribu-

taries drain the eastern side, and Little Forester River the western side, of the district. Between these Lisle, Panama, and Lone Star Creeks are important streams. The southern part of the district forms the division or watershed between St. Patrick's River on one side and Little Forester River on the other.

The hills circumjacent to Lisle rise from 1400 to 2300 feet above sea-level. They form part of an old, minutely dissected plateau. At the south-west corner of the district Mt. Arthur, crowned with diabase 700 to 800 feet thick, rises to a height of 3668 feet, and is the outstanding feature of the district. Striking features of the topography are the deep basins of Lisle, Golconda, and Panama. These depressions, or hollows, mark the points of highest projection of the granitic rock, and, incidentally, the places where the richest deposits of gold are found. Their formation may be explained as follows:—Syenite granite, under the action of mineralising solutions and meteoric waters, is readily decomposed—the felspars and hornblende being most susceptible to attack—and the resulting soft decayed rock is rapidly removed by agents of erosion. In this way have been scooped the deep hollows, or basins, of Lisle and elsewhere. On the sides of the basin—the east in particular—is an accumulation of talus or hill debris, 50 to 80 feet thick, which has broken away from the harder wall and rim rock. One of the contributing factors to the extraordinary accumulation on that side is the north-easterly dip of the strata and their hardness; another cause is that erosion has been more rapid there. The heavy overburden of this mountain debris presents the chief difficulty to the exploration of the veins on the east and north sides of the basin. As Tertiary basalt lies on the rim rock and none is found on the floor, it is certain that the basin has been carved since that time.

IV.—GENERAL GEOLOGY.

(1)—Geological Map.

The geological map covers the whole district included within the Golconda mineral chart. On this are shown the geological boundaries, level contours, roads, railways, townships, goldfields, and mines, streams, and other physical features, and the strikes and dips of strata. The geology of the south-west corner was taken from the Lilydale map prepared from a survey by P. B. Nye.

Myrtlebank area referred to in this bulletin is not shown, because it lies outside the boundaries of the mineral district.

(2)—Geological Summary.

Golconda district is almost exclusively an area of Palæozoic rocks. The sediments most abundantly developed consist of slates and sandstones with intercalated beds of tuff of Ordovician age. They were intruded by dykes of rather basic nature belonging to the porphyroid division, and in Devonian time by syenite granite and biotite granite and porphyries in the forms of stocks and dykes. Resting on the upturned edges of the Ordovician rocks are almost horizontally disposed Permo-Carboniferous strata, consisting of conglomerates, mudstones, shales, and sandstones. Intruding the Permo-Carboniferous are dykes of diabase of Upper Mesozoic age, and overlying it are sills of the same rock. In the middle Tertiary local volcanic vents supplied a cover of basalt lava, remnants of which still remain. Quaternary and Recent alluvial deposits occupy the floors of basins and valleys.

(3)—Sedimentary Rocks.

A.—ORDOVICIAN.

The oldest rocks in the district are slates and sandstones, with intercalated beds of tuff and lava. This formation, it is considered, is contemporaneous with the Dundas slate series, and as such is ascribed to the Ordovician. There is a distinct variation in the nature of the sediments between the Dundas and this series of rocks, yet there are many points of resemblance, and they occupy a similar stratigraphical position relative to older and younger formations.

At Lisle these rocks trend in a direction 30 to 60 degrees west of north, and the dip is north-easterly at 35 to 65 degrees. In the neighbourhood of Wyena and at Denison the strike is N. 50° W., and the dip is south-west at 30 to 70°. East of Golconda Station dips to the north-east and south-west indicate the approach to the axis of a fold.

The sandstones are in places thin-bedded, especially the siliceous ones. Others, containing much felspathic material, are found in beds exceeding 100 feet in thickness. All are fine and even-grained, and made up of subangular particles. Secondary mica of the sericite variety is common to all, but more prominent in the felspathic sandstone.

Slates of various hues (grey, bluish-black, pink, greyish-green, &c.), thinly laminated and thin and thick-bedded, are intercalated with the sandstones.

Another member of this formation is a tuff of mottled appearance, the colours being brick-red and light-grey. The coloured components are of equal proportions and of very irregular outline. Probably the brick-red colour is due to iron oxide. This rock is fairly soft, but is well preserved. It is found in beds of considerable thickness, varying in the one bed from 20 to 200 feet, and is unlaminated. Analysis Nos. 618 and 620 are given in Table II.

Associated with the tuff is a lava of similar materials which emanated from the same source.

B.—PERMO-CARBONIFEROUS.

Rocks of this system occupy the south-west corner of the district. They consist of basal conglomerates, mudstones, shales, and sandstones. The gravelly nature of the basal member was regarded by prospectors as an indication of alluvial deposits of gold. Tests of these consolidated gravel beds soon dispelled the idea.

C.—QUATERNARY AND RECENT.

Alluvium and recent gravels are found along the rivers and their tributaries. Almost all the gold won here came from such deposits.

(4).—Igneous Rocks.

Igneous rocks of four ages are known in this district, namely:—

Members of the porphyroid series of Ordovician intrusives.
Devonian syenite granites, and biotite granites.
Upper Mesozoic diabase.
Middle Tertiary basalt.

A.—PORPYROID SERIES.

Representatives of the so-called "porphyroid" series of intrusives outcrop near the Just-in-Time Prospect, between Lisle and Myrtlebank. They are porphyritic and of acidic composition, but their true character and nature are masked because of their decomposed condition. A microscopic examination has not been made of them.

Another more basic, or less acidic, type outcrops on the west side of Denison River, near Wyena, and again on the north side of the Lilydale-Patersonia road, on the northern foothills of Mt. Arthur.

B.—SYENITE GRANITE OR HORNBLENDE GRANITITE.

Occupying the valley floors at Lisle, Panama, Lone Star, Golconda, Nabowla, and Blumont is a coarse, even-grained rock of granitic type. It consists of dark magnesia mica (biotite), hornblende, quartz, lime-soda felspars, and occasionally a little orthoclase, the components varying greatly in relative proportion at different points. The accompanying table of analysis of samples from widely separated parts clearly indicates the quantity variation of the component minerals. In the valley floors the rock is very soft, the agents of decomposition having effected a complete change in all but one (quartz) of the minerals. In its weathered condition it is variously coloured from yellowish-white to deep brick-red, the colouring matter evidently being derived from hornblende. The biotite is generally bleached golden yellow, and because of its brilliant lustre is conspicuous to the eye. Hornblende is almost everywhere prominent, and in some parts abundant. Biotite is a constant and important component. Quartz is subordinate to the others.

The rock belongs to the type known as hornblende granitite, and is sometimes called syenite granite. It is the rock common to the gold belt in Tasmania.

A less basic type, in which oligoclase and orthoclase are prominent, may be seen near the south end of Lisle basin, where it is accompanied by a little cassiterite, molybdenite, gilbertite, and black tourmaline. On the bank of Lone Star Creek, near the Enterprise Mine, quartz-tourmaline veins, with much molybdenite, traverse the granite, which here likewise is less basic than the main body.

C.—DIABASE.

Diabase of Upper Mesozoic age is prominent in the south-west corner of the district, where it forms the summits of Mt. Arthur and some of the foothills. It outcrops again at the southern end of Lisle, on A. Deane's property, in the form of a narrow westerly-trending dyke. The rock conforms to the general type of this age, being of medium texture, and consisting essentially of labradorite and augite.

Its exposure has been due to the removal of the upper beds of the intruded rocks, chiefly those of Permo-Carboniferous age, which occupy the base of Mt. Arthur.

Diabase is in no way associated with the deposition of ores in commercial quantity. In places a little gold accompanies this intrusive, where pyrite is a prominent accessory component, and hematite, an ore of iron (though not in large concentrations), is usually associated with it.

Here it has penetrated the Permo-Carboniferous in sills, cut through them in narrow dykes, and at one part of Mt. Arthur is transgressive in large bulk.

D.—BASALT.

The highlands of Myrtlebank and neighbourhood, and a ridge extending from Forester River, past Nabowla to Ferny Hill, are crowned with basalt lava of Middle Tertiary age. No trace of the vents through which it poured have been found, the ash long ago having been reduced to soil with a large part of the lava. The rock is the olivine-rich variety common in the north-eastern districts. That the lava was not extensive here is evinced by the fact that on the northern side it is confined to a narrow strip between Lisle and Bridport. This strip, evidently, marks the course of a Tertiary valley, although the basalt now forms the crest of a ridge. South-east of Lisle, at Myrtlebank, the lava rests on Ordovician slates and sandstones.

TABLE I.

Rock Analyses.

Reg. No.	Nature of Rock.	Silica.	Ferrous Oxide.	Ferric Oxide	Alumina.	Lime.	Magnesia.	Soda.	Potassa.	Titania.
710	Hard biotite granite	61·60	2·97	7·00	14·71	4·89	2·68	4·05	1·72	0·20
720	Soft red granite	62·10	...	5·15	22·35	...	1·08	...	...	0·30
706	Soft yellow granite	57·00	1·55	9·15	21·83	0·08	0·29	...	...	0·30
708	Soft granite	60·20	1·29	3·00	25·17	0·20	0·29	...	...	0·40
621	Hard biotite granite	65·80	...	6·29	17·91	4·60	1·66	2·65	2·59	0·20

TABLE II.

Rock Analyses.

Reg. No.	Nature of Rock.	Silica.	Ferrous Oxide.	Ferric Oxide.	Alumina.	Lime.	Magnesia.	Titania.	Potassa.	Soda.	Ignition Loss.
712	Bluish quartzite	68·80	0·19	8·79	17·20	0·60	2·75	0·20	...	...	1·50
744	Argillaceous sandstone	64·10	...	7·87	19·13	...	1·81	0·40	4·09	1·05	2·30
618	Tuff	43·72	...	8·72	34·79	trace	2·98	1·45	1·68	0·45	7·42
620	Tuff	55·00	...	11·87	19·53	trace	7·97	0·20	...	...	6·80
769	Mica-quartz metamorphic rock	87·20	...	2·00	7·30	...	1·09	0·30	...	...	1·40
803	Felspar porphyry	49·80	...	2·57	33·63	...	1·09	0·40	5·08	2·12	6·10
772	Felspathic tuff.....	60·60	...	6·86	21·84	...	1·10	0·30	2·03	1·50	6·50
616	Mica-quartz porphyry	69·60	...	6·32	20·56	0·60	2·56	0·80	...	...	...
617	Mica-quartz rock	67·94	...	7·06	19·09	trace	2·82	0·85	2·52	1·20	...
619	Yellow granitite.....	61·60	0·25	6·58	23·42	trace	0·57	0·30	2·14	1·54	...

V.—STRUCTURAL GEOLOGY.

The general trend of the Ordovician sedimentary rocks is north-westward, and the dip is north-eastward at angles varying from 50 to 80 degrees. In the north-west quarter the dip is generally to the south-west, and beyond a north-east line of torsion sharp crumpling of the strata is noticeable. In conformity with the great structural lines, the granitic rocks and their apophyses also bear north-westward, and the dykes dip north-eastward. In contradistinction the veins and ore-bodies, with one or two exceptions, course north-east and dip south-east, almost at right angles to the main lines of structure. At the south-west corner the Permo-Carboniferous strata also dip north-eastward, probably influenced by the great intrusive diabase mass of Mt. Arthur.

Another striking feature is that metamorphosis is prominent on the north and north-east sides of the granitic intrusives only; in fact, contact effects are not particularly noticeable in any other part. From this it is apparent that the outcrops of syenite granite represent narrow projections from the underlying batholithic mass, and that the form of intrusion was influenced to some extent by pre-existing structural lines.

VI.—METAMORPHISM.

Metamorphic effects are noticeable in—

(1) The granitic rock:

(*a*) Silification;

(*b*) Decomposition: and

(2) In the sedimentaries and tuffs along certain sections of the line of contact.

(1) Granitic Rock.—(*a*) In the north-eastern section of Lisle basin along the line of contact between the syenite granite and the tuffs, slates, and sandstones, the igneous intrusive has been completely replaced by quartz in granular form and secondary mica, the latter probably having been derived from original felspars.

(*b*) The metamorphism of the hornblende granite or syenite granite by agents of decomposition is remarkable. Everywhere this rock is in a condition of extreme decay, one original component (quartz) only in many places being recognisable. Felspars and hornblende have completely succumbed, and biotite has been bleached a golden yellow colour where not destroyed altogether. The barren biotite granites in contradistinction are quite fresh.

(2) Felspathic sandstones and slates on the eastern (gold-bearing) side have been transformed into hard quartzite, but are recognisable. The tuffs, however, have been converted into hard basalt-like rocks, which have little semblance to the original, except where affected by agents of decomposition. They are very dense, fine-grained rocks, hard and brittle, and of bluish-black colour on unweathered surfaces. They break with conchoidal fracture into curved blade-like pieces, having sharp cutting edges, and when struck with a hard instrument emit a sharp metallic sound. In some places mineralising solutions have converted the felspars of this rock into yellowish green and black micas. These changes are conspicuous in the areas of greatest mineralisation, where the gold deposits are richest.

VII.—ECONOMIC GEOLOGY.

One metal only is found here in commercially important deposits, namely, gold. Compounds of arsenic and copper, in the forms or arsenopyrite and chalcopyrite respectively, are associated with gold, and may become valuable by-products in the process of its separation, but large deposits of these minerals are not known, and are not likely to be found. A little molybdenite is associated with the biotite granite.

(1)—The Origin of the Gold.

All the gold, whether mixed with alluvial and detrital materials, or contained in the quartz and sulphidic ore fillings of veins, is genetically related to the granitite intrusive with which it is invariably associated. At Lisle, Lone Star, Panama, Golconda, and Cradle Creek granitite, or its offshoot, felspar porphyry, outcrops at surface. Although not exposed in Denison area, the rock doubtless lies at no great depth, as it crops out again at Bridport. This association is constant throughout the district and in all other districts of the gold belt in Tasmania.

Reticulating series of quartz veinlets, some of them gold-bearing are common in the granitite of Lisle basin and other areas. This and other evidence goes to show that the gold deposits in veins, either in the granitite or in the intensly metamorphosed contact rocks, had its source in the granitite magma. In some places the fillings of the vein-fissures, particularly in the altered sedimentaries, represent the end-stage products of magmatic differentiation; in others, such as Denison, the vein materials represent deposits from solutions expelled from the granitite a little later.

It is a noted fact at Lisle that very little gold is found in association with the unaltered slates and sandstones fringing the western and southern edges of the basin. All the rich deposits fringe the highly metamorphosed sedimentaries and the decomposed granitites. Where the soft syenite granites give place to hard biotite granite gold is in small proportion, and a little tin ore and molybdenite is found. Abundance of hornblende is indicative of gold, and not of tin or molybdenum. For instance, the hornblende-poor biotite granite of Little Forester River, Nabowla, Blumont, Lisle, and Golconda is almost barren.

(2)—Nature of the Deposits.

The gold deposits of the district may be placed in two divisions namely, primary and secondary. They may be further classified in groups acording to their mode of formation and their composition, as outlined hereunder:

A. Primary—

(*a*) *Veins.*

Quartz.
Quartz-pyrite.
Quartz-arsenopyrite-chalcopyrite.

(*b*) Impregnations.

B. Secondary—

(*a*) Chemical.
(*b*) Detrital.
(*c*) Alluvial.

A.—PRIMARY DEPOSITS.

(*a*) *Veins.*

Quartz veins are found in metamorphosed sediments and in granitite. Nearly all are barren of gold, but a few, including some in granitite, contain the metal in fair proportion. Those in granitite are very narrow (two to six inches); those in altered sediments are found two and three feet wide. Nearly all the veins in the sedimentary or, more strictly, the rocks of stratified formation are prominent only in the sandstone member, the tuff and slate members not being favoured to a like extent.

The veins in the intensely metamorphosed sediments represent original "crush zones" filled with quartz, sulphides and sulpharsenides. They are of the vein-dyke type of deposits, in which the quartz is quantitatively the most important representative of the end-stage products of differentiation from the cooling granitic magma, and the later ore minerals the most important commercial representatives. These veins are prominent near the line of contact between granitite and altered sediments, and intersect both formations, but are wider and richer in the latter. In some places, as at Golconda, for instance, the veins lie parallel to the line of contact; in others they are nearly at right angles to that line.

During the process of cooling, the crystallising quartz vein-mass, under contraction stresses, becomes closely and

minutely fissured. The main line of fissuring is parallel to the walls of the veins, with transverse fissures connecting them the whole body being completely dissected. Very little gold is found in the quartz: it almost invariably is contained in the chalcopyrite and arsenopyrite filling of fissures that cut the quartz. By oxidation of the sulphidic ore-cementing material the gold is set free and the vein-mass breaks into disconnected particles. The oxidised cementing minerals contain, as a rule, a fair proportion of gold; the whole, however, is greatly reduced in value by the relatively large amount of almost barren quartz. In some places the chalcopyrite and arsenopyrite ore minerals are found in the forms of blebs and bunches in the quartz matrix, but in a minor degree only, the greater part having been deposited subsequent to the formation of the quartz vein-mass. A few of the many narrow veins contained in granitite exhibit free gold, and these are barren of sulphidic minerals. Chalcedony veins in granitite, on the contrary, are not carriers of gold, the material of which they are constituted having been formed under conditions inconsistent with the process of gold deposition. The gold quartz veins of Denison differ in some respects from those of Lisle, Panama, and Golconda. They were formed at a lower temperature, consequently more gold is contained in the quartz here than there, and pyrite takes the place of arsenopyrite and chalcopyrite as the most prominent accessory ore mineral. Where the effect of metamorphism is most pronounced, the proportion of gold in the wall-rocks of the vein-dykes is largest. Galena, another accessory mineral, is regarded as a favourable indication of gold, not because it contains a large proportion in itself, but because where it is present more gold is found in the quartz. This is accounted for by the fact that galena is an active precipitant of gold.

The chalcopyrite-arsenopyrite quartz ore of the Golden Crest Mine is typical of its kind. The quartz is minutely and intricately fissured, and the fissures are filled with these sulphidic gold-bearing minerals. In this vein however, part of the gold is contained in the quartz.

(*b*) *Impregnations of Sandstone.*

Beds of siliceous sandstone at Cradle Creek, Myrtlebank, and at Lisle have been impregnated with gold to a varying extent. Into these porous rocks mineral-bearing solutions found easy access. These rather friable sandstones are of fine grain size, and are from white to light-brown in

colour. Thermal metamorphism is responsible for the formation of spots of incipient chiastolites, which stand out prominently by reason of their deeper shade of red or brown. Sandstones so altered and discoloured contain, as a rule, a larger amount of gold than the unstained and unaltered ones. In places the iron oxide stain extends over and through the rock, giving it a light-brown colour. The gold in this rock, as might be expected, is very fine, and is very unevenly distributed.

A white and argillaceous sandstone stained light-brown on joint faces also contains fine gold. In this the only evidence of metamorphic processes is the presence of sericite. The rock is soft and friable, and apparently unaffected by the percolating solutions.

These particular beds of sandstone, wherever they appear in the zone of metamorphism, are bearers of gold, generally, however, in small proportion. Although individual assays of samples have been received showing a gold content between 10 and 27 dwt. per ton, the average of a very large number of samples taken from the several seams is less than 2 dwt. per ton.

B.—SECONDARY DEPOSITS.

(*a*) & (*c*) *Alluvial and Chemical Deposits.*

The alluvial gold here is very fine in grain, and that found on the hillside has not suffered the moulding effect of moving water. Nuggets are rare, and gold-quartz specimens conspicuously so. The matrix is a yellowish-grey clay, with well-worn stones of quartz and sandstone interspersed through it. Over this is a bed of rounded metamorphosed sandstone pebbles and boulders 5 to 20 feet thick. Between the two beds the richest gold deposits are found. Over these beds is a great depth of talus almost barren of gold.

Generally, both metamorphosed sandstone and vein-quartz are barren, but some pieces of quartz contain a little gold, and occasional specks are found in the sandstone. The fact that gold is found in association with quartz and altered sandstones suggests the idea that it originated in quartz-veins contained in sandstone. Moreover, the coarsest gold is found high on the hillsides, near the edge of the granitite mass, and not in that rock.

The following is a summary of the evidence:—

(1) All the gold at Lisle has been won from alluvial, detrital, and chemical deposits.

(2) The free gold is almost pure; that locked up in quartz contains a high proportion of silver.

(3) Except that found in creek-beds, the surface of the gold is rough.
(4) The gold is generally of fine to medium grain, pennyweight nuggets being rare.
(5) Gold-quartz specimens are conspicuously rare.
(6) Gold is everywhere found in association with quartz.
(7) The quartz, except one or two veins in granitite, is barren, or almost barren.
(8) Sulphidic ore minerals, such as arsenopyrite and chalcopyrite, commonly associated with gold at Panama, Golconda, Denison, and Lebrina, are not known at Lisle.
(9) Gold is found associated with vegetable matter and charcoal underneath talus material all the way up the hillside on the east side of Lisle Creek.
(10) Very little gold is found in the talus material.
(11) Gold is found on the east and north sides only of Lisle basin where metamorphism has been most intense.
(12) Almost all the gold has been derived from veins in the contact rocks.
(13) The granitite, even along the more acidic fringe where it has been affected by the agents of metamorphism, is barren, or almost barren.
(14) That section only from the outlet of the gorge to a point 1½ mile upstream is known to contain gold in profitable proportion.
(15) Very little gold is found in the beds of creeks outside the basin.

With regard to item 7, it is interesting to note that very little gold is found in the talus material, but a comparatively great quantity is found underneath it associated with organic matter, such as decomposed vegetation and charcoal The fact opens the way to another line of research worthy of further pursuit: that is, deposition from gold-bearing solutions.

Oxidation of the sulphidic components of the ore kept pace with the very rapid erosion of the valley floor, and probably has proceeded nearly to that depth. Now, in the process of oxidation, natural solvents of gold were formed from the associated sulphides, and probably percolating waters contained other solvents, such as chlorine and chlorides. It is well known that solutions of alkaline

sulphides are effective solvents of gold, and ferric salts, such as ferric sulphate and ferric chloride, are likewise active agents in the process.(1) Cupric chloride dissolves gold easily at 200° C. Ferric sulphate does not dissolve gold unless chlorides are present. In the presence of manganese dioxide gold is readily soluble in weak hydrochloric acid. Gold is thrown out of solution by organic matter of any kind, by ferrous salts, by galena, and many other sulphides.

At Lisle and at Panama the talus materials are stained black with manganese oxide, especially near the base, and is prominent also 10 feet above that level. Moreover, chlorine solutions have been active agents in the decomposition of the granite rock, as evinced by the bleaching of the biotite component and by the presence of chlorine in waters even now issuing from the contact rocks. In support of the idea that chlorine has been largely responsible for the decomposition of the granite where gold deposits are prominent, it is a noteworthy fact that immediately outside the gold-bearing area the rock is hard and fresh and rises to a high level. Some specimes exhibit the phenomena of secondary gold. If the gold had been shed from veins by the ordinary processes of disintegration a larger amount would have found its way outside the basin, and would now be contained in the alluvial gravels of Lisle Creek between the outlet and Peddles' Mill. All this goes to show that the gold has been accumulated since the Tertiary and probably during the late Quaternary and Recent times. Moreover, the free gold, unlike that contained in the quartz-veins, is almost pure. The conclusion is arrived at that almost all the gold won from detrital and alluvial deposits is of secondary origin.

It is possible that a small portion of the gold in the detrital and alluvial deposits represents the waste of so-called segregation deposits in the more basic differentiate of the granite magma, but there is no direct evidence of this.

(*b*) *Detrital Deposits.*

Detrital deposits are nowhere important. Small concentrations are found at Panama and at Golconda, but none is of commercial value. At Lisle in some places detrital materials have added to the alluvial deposits, not however, in any marked degree.

(1) Clark, F. W.: Data of Geochemistry, pp. 557-8.

VIII.—THE MINING FIELD.

(1)—Lisle Area.

In the seventies and early eighties more attention was paid to the search for gold than for any other metal or mineral in Tasmania. Many discoveries resulted from the early explorations, but few only of commercial importance, Lisle was one of the more important fields, and for long provided lucrative employment for a large number of men. Unlike other fields, the deposits were largely of alluvial and detrital natures, no rich vein or lode having been found in the subsequent search for the source of the metal.

A.—GENERAL FEATURES.

Lisle is a pear-shaped basin occupied by soft decomposed syenite granite, and surrounded by sharp ridges of slate, tuff, and sandstone. The basin is 3 miles long, 2 miles across the centre, and it tapers to a point at the south end. Main or Lisle Creek, which is responsible for the corrosion of the valley floor, rises at the south end, and discharges at the north end through a deep narrow gorge in altered sandstone. Numerous east and west tributaries have contributed largely to the shaping of the basin. Erosion is greatest in the eastern half, where, also, metamorphism is greatest, and where the richest deposits of gold are found. By the very rapid erosion of the soft syenite granite on the eastern side the harder wallrock became undermined and collapsed. This material in successive slips now extends to the floor of the basin, completely covering the old erosion surface.

The absence of high-level terraces has often been remarked. As the degradation of the valley floor was continuous to the 850-foot contour, and as the sides of the valley were very steep, not a remnant of one high level terrace survived. At the 850-foot contour on all sides of the basin are remnants of a terrace that mark the surface of a lake-bed 10 to 20 feet thick. The formation of the lake-bed followed a sudden subsidence of the ground floor. The bed consists of white, grey, and bluish-grey clay overlain by gravels of quartz, chalcedony, and metamorphosed sandstone. Although the valley has been trenched 100 feet below that level, the alluvial bed has been preserved on the sides of the valley by a great depth of talus material. The

greatest depth of talus is found over the old gutters of the numerous early Quaternary tributaries of Lisle Creek, where the most important accumulations of gold have been formed. At almost all points the talus cover is barren of gold. In some places, however, especially near the surface, gold is found in association with quartz, and a little is found occasionally in the altered sandstone boulders of the talus, and which probably represent the broken wall-rock of veins. In the underlying clay bed are numerous impressions of leaves and branches, and in places charcoal is particularly abundant, especially where gold is in large quantity.

B.—DEVELOPMENTS.

An area of ground 200 yards wide and 1 mile long has been worked along Lisle or Main Creek, and ground about half that extent has been worked along Bessell Creek. The richest ground formed the beds and banks of the streams, but profitable dirt was found also high up the eastern and northern hillsides in old tributary gutters of the two streams beneath a great depth of talus material. The terrace stones are angular, and water-worn only in the beds and banks of the streams. Gold is generally found in the bottom wash where concentration by water action has been greatest. In the banks and beds of streams it is well rounded, but on the hillside it is rough and jagged, with occasional acicular points. The metal is remarkably rich, the mint value being £3 18s. per ounce. That contained in quartz on the contrary is alloyed with a high proportion of silver. Almost all of that obtained in sluicing was free; a little, however, was attached to quartz. At Callaghan Creek very small gold quartz specimens were not uncommon. Associated with the gold are small sapphires and rubies, pleonaste (iron-magnesium spinel, locally termed "black-jack"), chalcedony, occasional small pieces of black tourmaline, and much limonite. A few narrow veins of pyrite have been noted in the granitite, and occasional blebs have been seen in the porphyritic varieties, but no other sulphide has been observed except molybdenite in small scales on joint faces of hard biotite granite.

In the seventies and eighties the method of working was by ground sluicing, with or without the aid of a nozzle of water under light pressure. During recent years hydraulic elevators and nozzles have come into general use. All the rich ground has been worked; that remaining is

of small account. Future exploration should be confined to the eastern and northern ridges where veins traverse the altered sandstones. The positions of these veins, which are not well exposed at surface, but are almost hidden under cover of loose wall-rock and soil, may be traced by following the loose vein-quartz into the metamorphic sedimentary rocks from which it was shed. It should be noted that the veins near surface will appear broken and narrow owing to the collapse of the hanging-walls following the removal of the sulphidic ore components and the consequent disintegration of the vein material. The gold that accompanies the barren vein-quartz represents that which remained with the oxidised interstitial ore minerals, the greater part having been carried away in solution and precipitated lower down the side of the valley.

C.—PRODUCTION.

The official record of the output of this field is 88,000 ounces, but there is reason to believe that the total product is more than twice as much. At one time more than six hundred miners, most of then from Mainland States, were employed on this field, and its is known that a large proportion of the gold was taken away by them to Victoria and New South Wales. It is estimated by one of the discoverers, C. Bessell, that the yield was about 250,000 ounces.

Present production is about 100 ounces per year. If the exploratory works are successful, the field as an important producer will again come into prominence

D.—MINES.

(*a*) *The New Bonanza Gold Mining Company No Liability.*

This is a Hobart company formed a few years ago expressly to work the alluvial ground on the right bank of Lisle Creek. After several years of unsuccessful effort the company ceased operations, and the mine was let to a local party on tribute. The holdings of the company include part of the ground that a Launceston company attempted to dredge about 20 years ago.

Area.

The company has leased the following areas from the Crown:—64P, of 56 acres; 66P, 91 acres; 1561G, 3 acres; 68P, 27 acres; 69P, 29 acres; 1565G, 2 acres; 71P, 26 acres; 72P, 40 acres; 79P, 10 acres; 78P, 40 acres; and Water-rights 210G, 206G, 205G, 14G, 209G, and 213G.

The Ore-Bodies and Their Development.

The greater part of the ground was worked out in the seventies and eighties by sluicing direct or by panelling and sluicing. Almost all the rich ground was thus removed by the early operators.

Opposite that section of the creek wherein the dredge was operating some years ago, a deep cut has been made into the hillside by means of a nozzle and a 4½-inch hydraulic elevator. The lower part of the cut is 100 feet north-east of the road, and it is 170 feet long and 120 feet wide. Here 2 to 4 feet of gold-bearing wash overlain by 15 to 20 feet of barren sandstone talus and yellowish-red soil. One hundred feet east of the end of this cut the granitite bed-rock rises steeply to surface, and southward so many shafts dot the surface that it is evident very little ground remains to be worked in that direction.

About 200 feet to the south-east is a large irregularly shaped cut exposing 10 feet to 15 feet of overburden resting on a thin bed of gravel. All profitable ground has been removed except a little in a narrow gutter leading northward.

Continuing southward the next cut shows 15 to 20 feet of sandstone talus reposing on a bed of yellow sandy clay which covers a few feet of wash. This work was started by Kinnaird and Gunner, and has been continued by the company to the end of the rich ground. The following section is exposed: pink and yellowish-white decomposed granite floor; one foot of sub-angular quartz gravel with occasional rounded stones and a little gold; 4 feet of grey sandy clay containing a little very fine gold; 3 feet of almost barren, fine, yellow, sandy clay with occasional water-worn pebbles; 17 feet of barren felspathic sandstone talus discoloured by manganese oxide.

The next is a small cut bounded on all sides by granitite. Very little wash remains, and that is contaminated with clay and is poor. Limonite and pleonaste are prominent.

Donnelly's workings nearby opened one of the richest and most extensive gutters of the field. The company

extended these workings to a point 300 yards up the hillside from the road where pennyweight nuggets were found. On the east or hill side the 4 feet of blue clay cover of the wash rises with the slope of the old land surface. In and on this bed is much organic matter, including leaves and limbs and stems of trees. Towards the end the gutter becomes narrow, the wash is thin and contains a little fine gold only, and the talus cover is 20 to 30 feet deep. A little gold is found in the talus here where quartz is prominent. Limonite and pleonaste are common in the wash. The floor of this cut is now covered with hydrous oxide of iron sediment, and manganese oxide stains the overlying slip-stone. Granite approaches the surface on all sides.

Another large cut lies a little farther south where an old gutter once led from the hillside. Here the gold-rich quartz wash has petered out, and the section shows 6 feet of greyish-blue clay resting on grey granitite and and is overlain by 25 feet of talus. A hole farther up the hillside is in clay at 70 feet. The lower part of the wash of well-worn stones contained a high proportion of gold; the upper part was poor. Manganese oxide stains the loose beds and with quartz is found in veinlets cutting the granitite in a direction north 70 degrees east.

A small cut exposes a thin bed of sub-angular quartz between 10 feet of sandstone talus and soft reddish-brown granitite bedrock. A half-inch seam of limonite separates the wash and granitite which here is veined with oxide of manganese.

Furlong Creek bed has been worked to its source; Gunner's Creek, Callaghan Creek, and Griffiths Creek likewise have been worked to their beginning. Lockwood and Bessell's ground near the main creek yielded over 1000 ounces of gold and the same run up hill worked in turn by Wheeler, Watts, and the company gave high results for the work performed.

Watt's No. 2 workings a little to the south were continued by the company and about 200 oz. were obtained from a narrow gutter. A little gold is contained in the thin bed of wash remaining, but the deep cover (30 feet) of talus is a serious obstacle to development. The gold here is generally jagged, and the so-called wash consists of angular quartz stones. A little gold is found with loose quartz in the upper part of the talus. Underneath these surface workings three adits have at various times been

driven to the north-east from the low ground of the creek bank. One 600 feet in length passed through 195 feet of soft granitite, an unknown but considerable width of alluvial material, and again entered granitite. Another adit 290 feet in length ended at a point 130 feet from the mouth of long adit, and was in granitite all the way. The third adit is 545 feet in length and close to, though 8 feet lower than, the first mentioned. Soft granitite shows for 320 feet, then 85 feet of alluvial ground, and 150 feet of soft granitite. Faults of small displacement in these Recent sediments are recorded by Montgomery. The rising gutters mark the pre-talus surface of granitite and the positions of old obliterated mountain streamlets in which a large amount of gold was concentrated and later held by the cover of talus material. This portion of the lead is to be reopened by tributors in the expectation of finding gold in profitable proportion. The removal of overburden to effect this is a work of such magnitude that it is doubtful whether it can be accomplished successfully.

On the hillside east of these workings a large number of pits 30 to 80 feet deep have been sunk to bedrock. In some a little gold was found in the talus; in others a little at the base of the talus rock; and a few were unproductive. Not one revealed concentrations of importance.

In addition to sluicing, a considerable amount of exploratory work has been performed, such as shaft-sinking and adit-cutting. The whole of the company's leases, in fact, have been explored to the bottom of the talus by means of shafts. These works have clearly shown that the richest concentrations lay between the 800 and 1000 foot contours and that the narrow leads become poorer and poorer as the workings expose the beds at higher and higher levels.

Several abortive attempts have been made to unearth the lodes from which the gold was derived. Prospectors Donnelly, Titmus, Searle, and others cut drives through the granitite into the metamorphosed sediments, but everyone failed in his search.

Donnelly's Adits.

Near Donnelly's workings the denuded granite shows a number of gold-bearing veinlets ($\frac{1}{2}$ to 2 inches wide) coursing 76° and dipping at an angle of 80° on a bearing of 346°. These veinlets lie close to one another in a belt 5 feet wide and retain their regular course over 400 feet in length. The belt has been traced to the edge of the

cuttings in the talus. Two short adits (50 and 60 feet) have been driven on the veins. A little gold can be separated from the crushed material by panning, and the soft granitite in which they are contained yields a little gold also. The quartz of the veinlets is accompanied by oxide of manganese which in some places stains black the granitite six to eight inches on both sides.

Titmus Adits.

Two adits were driven through soft granitite near the line of contact, at points near head of Callaghan Creek, by Titmus and party many years ago. The object in view was to discover the source of the gold found in the creek and tributary streamlets below. These adits were driven across the lie of contact on bearings 65° and 70° and entered the metamorphosed sandstones not far from their entrances. In the open cutting of the lower adit the metamorphosed sandstone is traversed by irregular quartz-veins and granitoid vein-matter. A few feet farther in a band of red felspathic material dips westerly at an angle of 45° and is succeeded by another band of similar material, stained black with ferro-manganese oxides, dipping easterly at 45°. This latter band of vein-matter is gold-bearing, but in small proportion. The adit was driven a distance of 124 feet beyond the hanging-wall through barren rock.

These adits do not intersect any important gold-bearing formation. Apparently it was surmised by the operators that the vein or lodes lay along the line of contact or closely parallel thereto; actually they are disposed obtusely to that line.

Searle Adit.

At the head of Donnelly Terrace an adit crosscut of unknown length was driven by B. Searle through granitite into altered sandstone and tuff to test the contact country. The adit courses N. 28° E. and is over 70 feet, but is now inaccessible owing to the caving of the roof. The stone on the dump is mostly altered tuff in which is devoloped secondary mica and kaolin.

Gruber's Adit and Shaft.

On C. H. Falkiner's ground, about 25 chains from Searle Adit, another adit crosscut has been cut to prospect the country near the line of contact between granitite and sandstone. This adit, now caved, bears 60° a distance

of 100 feet, and is wholly contained in decomposed granitite. Thin veins of barren quartz were intersected. Near the entrance to this adit, a shaft has been sunk on a vein of gold-bearing quartz to a depth of 40 feet.

(b) Watt's Prospect.

On the hill at the north-east end of Lisle Basin two quartz-veins, coursing N. 50° E. and dipping south-east at 70°, have been exposed in two shafts 30 and 35 feet deep. These veins are not prominent at the surface, yet a few feet down they are two feet in width, and are contained between two sharply marked walls. The material composing them is largely of barren quartz which appears as irregularly-shaped disconnected pieces, 1 to 3 inches in diameter. Clayey limonite, constituting the interstitial material, contains gold in fair amount. This limonitic matter is the oxidation product of the original sulphidic ore that formed the filling of the shrinkage cracks developed in the quartz vein-mass during the progress of cooling. The deposit is probably typical of those from which the greater part of the gold found in Lisle Creek and valley has been shed. In the talus and alluvial materials there, barren vein-quartz is invariably associated with the gold. This phenomenon has been the cause of much speculation among the miners. Its explanation should remove one of the chief obstacles to be overcome in the search for the source of the loose gold.

The south-westerly extension of these veins would carry them underneath the ground, at present being sluiced by the New Bonanza Gold Mining Company, on lease 64P-G, in which large boulders of limonite are found. It is probable that this limonite has been shed from veins of the type described.

(c) Lisle Hydraulic Gold Mines No Liability.

This is a Hobart company formed to work a large area of alluvial and detrital ground at the northern end of the Basin. At the eastern end of the company's leases near the confluence of Bessell and Lisle Creeks, the company performed extensive operations, which, however, were commercially unsuccessful. Since that failure attention has been confined to the southern detritus deposits. The gold won has been obtained mainly by tributers.

Area, &c.

The properties of the company consist of:—Consolidated leases 1657G, of 108 acres; 6301G, of 78 acres; and 1663G, of 32 acres; leases 163G-w, 119G-w, 96G-w, 121G-w, and 174G-w. The first lot refers to leases of mineral lands, the second to water-rights.

The Deposits.

The gold-bearing grounds are of two classes, namely:—

(1) Alluvial: and
(2) Detrital.

(1) Alluvial deposits occupy the low lands in the bed and banks of Bessell Creek. They are 3 to 6 chains in width, half a mile in length, and 5 to 20 feet in depth. Careful tests of the alluvial ground by Canning and others show that the rich "run" is worth one shilling per yard. This estimate has been confirmed in actual operation by means of a stationary steam-driven suction plant. South of the alluvial workings, H. Roach drilled two lines of holes, 3 and 5 chains apart, across the ground. The prospects obtained did not lend encouragement to further work. A good section of the wash-dirt is exposed in the old workings where it is seen to consist of well-worn stones, generally 2 to 6 inches in diameter with clay interstitial material. The bed upon which this ground rests is a soft granitite.

(2) Detrital deposits occupy the valley sides up to the 900-foot contour. The terrace ground has been worked by a number of parties with considerable success. West of the hydraulic workings Marshall Brothers, and south of their workings Grant, pannelled large blocks of hill-slope ground. Lately Lockwood opened a sluicing face there, but found that the first miners had removed almost all the gold. That portion of the terrace known as Lockwood's was highly productive. The section is 10 feet of sandstone rubble, overlying 10 feet of yellowish clay resting on 2 feet of gold-bearing wash. This ground was tunnelled and pannelled by Lockwood, and later was sluiced by A. Watts. The wash-dirt consists of boulder-quartz, sandstone, and slate. Engineer Curtin who on behalf of an English company, recently drilled the detritus at the head of these workings, found that the gold is confined to a very narrow gutter, and that the proportion is too small to allow of profitable operation.

Hawson's workings are in the north-west side of the property. They represent the latest work performed here. Neither the Company nor the tributers who operated there last was successful and as there is no prospect of improvement with development, this part of the property is not likely to receive further attention. The conditions under which the gold is found here are similar to those prevailing in the New Bonanza Company's workings. Here also the richest ground lies at, or about, the 850-foot contour and the bed of greyish blue clay marking that level on the eastern side of the basin is represented by similar material.

The main open-cut, 300 feet long, 130 feet wide, and 22 feet deep, reveals the following section:—soft granitite floor; 5 feet of gold-bearing gravel and detritus; 10 feet of grey clay; and 17 feet of talus material, consisting largely of metamorphosed sandstone and slate and tuff, quartzite, and boulder-quartz. The gold-bearing bed consists of rounded sandstone pebbles, blue slate, quartz, and fine-grained granitite, the whole firmly cemented by iron-stained clayey matter. Veinlets of limonite permeate the talus stones; seams of it separate talus and clay beds and clay and gravel beds; and veins fissure the upper portion of the basal granitite. In the sandstone talus black tourmaline and gilbertite are prominent secondary minerals. The gold is found from fine grains to nuggets weighing 5 pennyweights. It shows no sign of the moulding action of the moving water and is of high quality.

The granitite varies locally from deep magenta, brick-red, to brownish-yellow, and greyish-yellow. In the face of the cut the coarse-grained granitite is traversed by a narrow dyke of aptite consisting largely of oligoclase, quartz, and muscovite.

On the south side another opening has been cut into the gravels by the company. This is 150 feet long, 70 feet wide, and 30 feet deep at the end. The section here is identical with that in Main Cut, but the cemented gravels are poor. Limonite in ½-inch seams is conspicuous, and here barren quartz forms a large proportion of the gravel. Marshall and Langley were the early operators.

Two chains eastward of main cut are Marshall and Langley's workings. These are 150 feet long, 70 feet wide, and 30 feet deep. In every respect the conditions here are similar to those of the main workings. The proportion of barren boulder-quartz in this cut is very large, and black tourmaline and gilbertite are conspicuously prominent.

Results of boring performed by H. Roach on behalf of the Arba Tin Mining Company in 1918:—

Line of Bores.	Remarks.	No. of Hole.	Grains of Gold per cubic yard.	Depth of Gravel in feet.
A	North end of Lease	1	Colour	14·00
	East to West	2	1·60	14·50
		3	Colour	10·50
		4	2·20	8·50
		5	1·93	8·50
		6	1·00	16·50
		7	4 10	18·00
		8	3·60	21·50
B	West to East	9	0·58	18·00
		10	Colour	9·00
		11	0·30	21·00
		12	1·80	29·00
C	West to East	13	4·10	11·00
		14	Nil	11·50
		15	Colour	14·00
D	East to West	16	2·30	17·50
		17	Colours	16·50
		18	0·90	22·00
		19	Colours	20·00
E	West to East	20	Nil	14·00
		21	Colour	10·00
		22	Nil	8·00
F	East to West	23	2·40	15·00
		24	...	...

These bore holes are spaced 5 chains apart east to west and 7 chains apart north to south.

(*d*) *Lisle Creek Workings.*

A few years ago an English company acquired the mining rights of a large area of alluvial and detrital lands in Lisle Basin. Some of the sections included that portion of the stream bed worked many years ago by means of a dredging plant. The early operators dredged the 10 to 12 feet of wash from the entrance to the gorge to a point opposite the school house. This work was greatly impeded by log obstructions and was commercially unsuccessful. It is quite evident that the re-working of this ground would have proved an unprofitable undertaking.

Other sections at one time leased by this company are likewise of poor ground.

(*e*) *Old Lease* 1455-G.

On the northern boundary of this section an adit crosscut bearing 285° was cut 120 feet by Chas. Bessell many years ago. The adit is wholly in soft coarse-grained syenite granite. Perhaps the objective was a north-west trending dyke of iron-stained porphyry 1 foot wide and a 4-inch vein of glassy quartz asociated with it. The narrow dyke rock consists largely of white mica and altered felspar. Quartz veinlets with gilbertite are developed in the adjoining beds of soft and hard sandstone.

(*f*) *Dunn Adit.*

On behalf of an English company an adit crosscut bearing 225° has been cut 30 feet in decayed syenite granite, on a section near the north-west end of the basin, lately leased by one F. Wardle. The objective of this crosscut is not known. Perhaps it was aimed to explore the contact country at this point.

(*g*) *Between Lisle and Peddles' Mill.*

Between the gorge at the outlet of Lisle basin and Peddles' timber mill are rather extensive flats covered with alluvial gravels and sand containing gold. These beds of gravel formed by the waters of Lisle Creek, are 3 to 10 chains in width and 6 to 12 feet in depth. By inquiry it is learnt that they have not been explored for gold, yet, as so much was obtained upstream in the the basin, it is reasonable to assume that it should be found here in profitable proportion.

The supply of water is ample for sluicing purposes.

(h) Deposits North of Railway Line.

The flat country near the point of confluence of Lone Star and Lisle Creeks has been tested for gold by boring to bedrock. In the material from all holes drilled there gold was obtained, but in small quantity only. The area of alluvial ground is over 100 acres and the depth is 15 to 30 feet.

(i) Hayes' Leases.

In the flat country east of the Lisle Hydraulic Company's holdings are 3 leases chartered in the name of C. L. J. Hayes. This ground was formerly leased by F. K. Fairthorne of Launceston. The leases are:—1685G, of 20 acres; 1686G, of 20 acres; and 1687G, of 5 acres.

The alluvial bed, 15 to 20 feet deep, has not been thoroughly explored. Two or 3 holes sunk to bedrock showed a little fine gold, not, however, in payable proportion. A small watercourse leading from the property to Lisle Creek yielded fine gold in fair amount.

The prospects of gold in this ground are not encouraging.

(j) Thomas Creek.

Between the two water-races near the head of Thomas Creek and above the dam, a shaft has been sunk 20 feet into grey clay. A little gold was found.

In this quarter of the field the prospects of finding an extensive body of gold-bearing country are not favourable.

(k) Hill Range East of New Bonanza.

This range is occupied by altered slates, sandstones, and tuffs, which are traversed by narrow, almost barren veinlets of quartz. The stratified rocks have been converted into hard quartzite-like rock which breaks into hard conchoidal splinters at first glance resembling basalt. The country hereabouts is very poor, and very little gold is found in the creek bed below it. A noteworthy feature of the granitic rock here is the paucity of hornblende and the increase in the potash-felspar. The rock is hard and fresh, and in places the joint planes are coated with molybdenite, tourmaline, and gilbertite.

In the beds of Sweeney and Downie Creeks a little gold is found, and towards the source of Lisle Creek gold-quartz specimens are not uncommon.

The granitic rock here is like that of Little Forester River Valley, namely, normal biotite granite. Gold is not associated with this rock here nor in the gravels of the river mentioned.

(2)—Lone Star Creek.

A.—ALLUVIAL DEPOSITS.

From the road bridge to Jarman's property the bed and banks of Lone Star Creek have been sluiced for gold. Some of the claims were highly productive, some were poor. The lead from Jarman's follows the course of a small stream towards a saddle on the dividing range between Lone Star and Lisle.

The wash-dirt consists largely of water-worn quartz and friable white sandstone and rests on soft decomposed granitite. A shaft sunk by Bessell and Arnold near the boundary of Jarman's property did not reach the bottom rock at 50 feet.

Here the gold is much coarser than the generality of that at Lisle. Pieces up to one pennyweight are found. On the opposite side of the range, at the north-western end of Lisle basin, the coarsest gold of that area is got below a deep cover of talus. It is intersting to note that the gold is closely associated with white sandstone which is suggestive of its origin from beds of that rock, and similar beds appear on the dividing ranges above Marshall and Falkiner's workings.

It is reported that in an adit near the end of Lone Star Gorge one Everett cut a body containing gold in profitable proportion. This report is generally discredited.

B.—VEINS.

(*a*) *Fairthorne Prospect.*

At the Northern entrance to Lone Star Basin a gold-bearing quartz vein was unearthed many years ago by one Kelly. A syndicate was formed by F. K. Fairthorne to develop this body and ascertain its value. The works performed by the syndicate revealed an 8-inch vein of quartz with pyrite chalcopyrite and arsenopyrite coursing 75° west of north and dipping southward at an angle of 72°.

An adit crosscut bearing 115°, then 90°, cuts the vein obliquely and then follows along its course. The vein is sharply defined and adheres strongly to the slate wall-rock. The end of the adit connects with an underlay shaft where the vein consists of 4 inches of quartz and 4 inches of selvage.

The material is not of high quality nor is it likely to improve in other sections of the vein.

(3)—Golconda Field.

This field, from which the district receives its name, first attracted attention in the early seventies. Since then spasmodic attempts have been made to develop some of the more important veins that have been unearthed from time to time. Owing, however, to the erratic distribution of gold in these veins, the operations of the several companies have been unsuccessful. The last sustained attempt to exploit them was made by the Golden Crest Company about seven years ago. The field has since been abandoned save by a few itinerant prospectors who spent a little time in search of richer shoots of ore.

Veins.

(*a*) *Golden Crest Mine.*

This mine is enclosed within the boundaries of mineral lease 1605G, of 10 acres, charted in the name of H. E. Larner.

The gold-bearing vein was discovered nearly 40 years ago. It has been worked on a small scale by several parties, the first known as the Queensland Gold Mining Company and the last in 1918 by the Golden Crest Company of Launceston. The operations of the several companies have not been productive of satisfactory results.

The property lies one mile south-east of Golconda railway station, and is easily accessible by way of the Lone Star road.

The Ore-Bodies.

The gold-bearing vein, which is contained in hornblende granitite near the contact with sandstone, consists largely of quartz with the accessory sulphides arsenopyrite, pyrite, and chalcopyrite in that order of quantitative importance. This belongs to the vein-dyke type of deposit. Fractures in the quartz of the vein-dyke were filled by sulphides, sulpharsenides, gold, and silver. Very little gold is found in the unmineralised white opaque quartz—almost all with the minerals filling the little fissures that cut the quartz, and of these arsenopyrite seems to be the most favoured. These fissures were shrinkage cracks in a crystallising quartz vein-mass.

Development.

No. 1 adit represents the work of the Queensland Gold Mining Company, and is generally referred to as the old workings. The vein has been driven on 120 feet, and over 300 tons of ore has been removed.

No. 2 adit workings consist of a crosscut 544 feet, and a south-east drift of 70 feet on the vein which along its course varies from 4 to 24 inches in width. In both ends of this drift the solid material abruptly terminates, the continuation of the vein being marked by a large number of irregular veinlets of quartz in the wall-rock. As might be expected in a vein-dyke formation the ore is barren at these points. Above this adit, 60 feet below No. 1, the shoot of ore has been almost entirely removed.

From a point half-way along the drift at No. 2 adit level, a winze has been sunk a few feet on a body of rich ore. It is reported that ore showed a decrease in width from 2 feet to 2 inches in a depth of 10 feet.

In addition to the aforementioned, two adit crosscuts have been driven to intersect a vein outcropping about 500 feet south-east. These works expose a narrow vein of poor material only, and the prospect of its improvement is not bright.

General Remarks.

The veins on this property consist of short, narrow shoots of ore in almost barren quartz. None is sufficiently rich to justify the heavy expenditure necessary to provide milling and concentrating machinery, and the material is too poor to allow of long transport. The results of the exploratory and developmental works thus far performed cannot be regarded as satisfactory.

The Value of Ore.

The gold in this lode is every unevenly distributed and the average content is not high, although occasional bunches of very rich ore have been found. An approximate estimate of the value of the ore may be obtained from the assay results of samples taken at various points in the mine openings. The subjoined table contains the desired information.

No. of Sample.	Place taken from.	Width of Vein.	Gold.			Silver.		
		inches.	ozs.	dwts.	grs.	ozs.	dwts.	grs.
1	No. 1 Adit, 57 ft. N. of winze	6	0	5	16	0	13	2
2	No. 1 Adit, 47 ft. N. of winze	10	0	4	12	0	13	1
3	No. 1 Adit, 37 ft. N. of winze	12	0	3	17	0	9	19
4	Intermediate level	18	0	14	17	1	7	18
5	Ditto	8	0	10	7	2	5	17
6	Ditto	15	0	17	16	1	11	8
7	Ditto	24		Trace		0	2	10
8	Ditto	12	2	2	11	3	12	0
9	Main adit, winze 8 ft. deep	10	1	1	5	1	6	3
10	Main adit, winze 3 ft. deep	12	0	13	2	1	6	4
11	Intermediate level	10	0	9	19	0	16	8
12	Main adit, north end	4	0	2	5	0	2	8
13	Tailing, sand from creek	...	0	2	5	0	6	13
14	Tailing, sand from dump	...	0	3	12	0	16	17

The samples from No. 1 adit were taken from partly oxidised ore containing sulphidic minerals in such small proportion that the value of concentrate obtained is sufficient only to offset the loss of gold and silver in the tailing, and, therefore, may be eliminated from the calculation of actual value. The average grade of this ore then is 4½ dwt. of gold and 12 dwt. of silver per ton of material, or a gross value of 21s. 6d. per ton. It is apparent that the ore in No. 1 adit workings is unprofitable. The average gross value of the ore in the short shoot opened in the slopes above No. 2 adit is 62s. per ton. As the critical worth, below which mining at a profit cannot be counted on, is 50s. per ton, ore of this grade is of value 12s. per ton. In arriving at the critical value, allowance is made for the inclusion in the material treated of 25 per cent. by weight of wall-rock, which acts as a diluent reducing the average grade of the ore in that proportion. These remarks are applicable only to the workings between Nos. 2 and 1 adits. The cost of mining ore from the winze workings is 25 per cent. greater. If the last sample taken from the winze is truly representative of the average quality there, the continuance of that exploratory work is warranted. The ore contains:—

Gold.—1 oz. 1 dwt. 5 gr. per ton.
Silver.—1 oz. 6 dwt. 3 gr. per ton.
Arsenic.—3·5 per cent.
Copper.—1·7 per cent.

The vein in the winze is becoming thinner.

It has been suggested that the loss of gold in the tailing from the milling and concentrating plant was heavy because the quantity saved was not in proportion to that in the ore as determined by assay. The discrepancy is accounted for by the inclusion of a large quantity of wall-rock broken with the ore and sent unsorted to the treatment plant.

The total quantity of ore treated by the Golden Crest company amounted to 773 tons from which 92 oz. 5 dwt. 16 gr. of gold valued at 57s. 6d. per oz. and 23 tons 18 cwt. 7 qr. of arsenopyrite and chalcopyrite concentrate valued at £20 per ton net were obtained. According to this statement the actual value of the crude ore is less than 20s. per ton, whereas the assay results of bank samples indicate a value of 62s. per ton, thus clearly proving that the material sent to the treatment plant contained two parts of barren wall-rock to one of ore.

In connection with the sale of the ore, it may be stated that the buyers would pay for the gold and copper or gold and arsenic but not for the three products.

(b) Enterprise Mine.

No fewer than six gold-bearing veins have been exposed on this property by one and another of the companies formed to develop them. Not one of the several companies operating here was successful. The last, a Victorian syndicate, performed a considerable amount of development work about seven years ago.

The Ore-Bodies and Their Development.

The materials of the narrow 6-inch veins consist of quartz with the metallic minerals pyrite, arsenopyrite, and chalcopyrite as blebs and veinlets. Few of the ore shoots are longer than 100 feet and one or two are not as extensive. The average gold content of the vein is at the rate of 6 dwt. per ton.

Four of the veins have been opened in shafts 60 to 80 feet deep and two in adits. In these workings the material improves neither in value nor in extent. Many years ago a small battery of stamps and a concentrating plant were erected to treat the stone mined in the several openings. The material was of such low average grade that the value of the gold won was insufficient to defray the cost of treatment.

These prospects are so poor as to be of no commercial value.

(c) Kelly Prospect.

On the side of the road between Golconda and Lone Star a quartz vein has been opened at a number of points in shafts and trenches. These works reveal an ore shoot over 200 feet in length between the road and Lone Star Creek. The vein courses N. 85° W., and dips in a southerly direction. Its materials consist of quartz, pyrite, arsenopyrite, and chalcopyrite, the last two being subordinate to the others. The sulphidic minerals are distributed in bunches and veinlets through the quartz matrix. In this ore gold is very unevenly distributed. One sample contained gold in the proportion of 27 dwt. per ton; others contained 13 to 18 dwt. per ton; and some traces only. Many years ago a five-ton lot sent to Lefroy for treatment yielded 2½ oz. of gold. This was obtained from an old shaft 17 feet deep sunk between 40 and 50 years ago. In Dormer's

shaft (12 feet deep) near Lone Star Creek the vein is 18 to 24 inches wide and of fair average quality.

On the other bank of the creek the vein is covered with slip stone from the hill on the other side of which, however, it appears again. Here it is opened 40 feet in an adit, but the material of which it is composed is poor.

(*d*) *Bessell Reward Prospect.*

History.

Gold was discovered in this area by C. Bessell in the year 1877, eighteen months before he found the more important alluvial deposits of Lisle basin. The discovery was made in the process of sluicing the gravels lying near the headwaters of Cradle and Tobacco Creeks, and nearly 2000 oz. was produced as a result of later operations. The presence in the gravels of gold-quartz specimens gave credence to the idea that the greater part of the gold found in the beds of the streams was shed from the richest of the numerous quartz-veins that traverse the country rock of the area. Early operators with this idea always in mind failed in their search for the source of the metal. Last year R. Bessell of Lisle renewed the search and found that the soft friable sandstones, which have the form of narrow seams intercalated with thicker beds of slate, are the loci of the metal.

Area, Situation, &c.

The property consists of Reward Claim 1649G of 20 acres and a prospecting area of 20 acres north and adjoining it.

Lisle lies 2 miles south-east and Golconda 2 miles north-west. Access from Golconda, Greeta, and Nabowla railway stations is very easy.

Ore-Deposits.

Three types of ore deposits are known on this property, namely:

(1) Alluvial.
(2) Bedded.
(3) Quartz-veins.

(1) *Alluvial Deposits.*—The gold-bearing gravels of Tobacco Creek are 6 to 8 inches in thickness, and are overlain by 6 to 7 feet of clay. They extend in a semi-circle around the south, east, and west sides of the section,

the head of the creek being at the northern boundary. The gravels of this creek, which consist of quartz, sandstone, and slate. have been worked to 20 chains from the head of the stream.

It is stated that the gold obtained from the bed of this creek was much coarser than that at Lisle. Nuggets up to 15 dwt. have been found, but nearly all the large pieces were attached to quartz.

In the bed of Cradle Creek the metal is much finer and the concentrations smaller. Here the gravels consist largely of quartz, but gold-quartz specimens are rare.

(2) *Bedded Deposits.*—These consist of narrow beds of sandstone intercalated with wider beds of purple, grey, and bluish-black slates. The strike is north 50° to 60° west and the dip at high angles to the north-east. They vary in thickness from one to 6 feet, and are uniform both along the strike and dip. Where opened on this property the seams are at every point gold-bearing, but the content varies considerably. A number of samples taken from the several seams of sandstone exposed in the trenches yielded gold in the proportion of 2 dwt. 3 gr. per ton (average of 10 samples), and two in the proportions of 9 and 11 dwt. per ton. One sample of sandstone taken from a shaft 20 feet deep contained gold at 17 dwt. per ton. At the point where Tobacco Creek cuts the seams a development of secondary mica and quartz marks the position of a rich concentration, now exposed in a shaft 50 feet deep.

(3) *Quartz Veins.*—Narrow, persistent veins of quartz (1 to 4 inches) form crosscourses to the gold-bearing sandstones, trending north 45° to 65° east and dipping north-west. The quartz is commonly of the milk-white variety, mineralised in parts, and, as a rule, almost barren. A few rich specimens have been found.

Development.

Lease 1649-G.—Very little work has been performed on the gold-impregnated sandstone seams, but the narrow quartz veins have been thoroughly explored. In their search for the source of the gold occurring in the creek bed, the early explorers by trench, shaft, and adit performed much useful work, although without direct economic results. The recent and more important work of R. Bessell consists of a series of trenches cut along the course of the sandstone beds and a deep trench across them.

On the bank of Tobacco Creek from a point near the south-west corner of the property an adit-crosscut (Titmus') coursing south 70° west has been cut through yellowish-grey slate and two narrow beds of sandstone a distance of 150 feet. At the points of intersection the sandstone is almost barren of gold, but contains a fair proportion of manganese.

Towards the north-west corner the Eastman adit on a bearing north 30° west has been cut obliquely across the strike of the strata exposing a number of transverse veins of quartz-limonite containing a little gold. This adit is directed towards a shaft (35 feet deep) sunk on a 2-inch vein of gold-bearing quartz in sandstone. Some of this material, it is reported, contained gold in the proportion of two ounces per ton, but samples taken by the writer from the dump yielded 2 dwt. only. The main sandstone seam was cut through and departed from near the entrance to the adit. It is poor.

Prospecting Claim.—On the Cradle Creek side of the low hill the rock formations are exposed in two shallow-level adit-crosscuts. No. 1 adit courses south 15° east a distance of 40 feet, thence 17 feet on a bearing south 70° west. This opening exposes a dyke of white to yellow, fine-grained porphyry, now completely decomposed. No. 2 adit, entering the hill near the first mentioned on a bearing south 40° east, passes through the dyke at 137 feet, then penetrates 122 feet into sandstone and slate. Many, almost barren, north-east veins of quartz, one to two inches wide, some in porphyry others in sandstone, were intersected in cutting this opening.

Eastward of the adits are two seams of sandstone: one, containing much limonite, is poor; the other contains gold in the proportion of 3 dwt. per ton at the point where it is opened in a shallow pit.

General Remarks.

Attention should be directed to the seams of porous sandstone which have been impregnated with gold deposited from percolating solutions. Further exploration is necessary to determine the extent and value of gold-bearing sandstone along the strike and dip: this can be performed by crosscutting from Tobacco Creek valley. A crosscut of 400 feet would enter the seams at a depth of 70 feet below tre summit of the hill. In this stone the gold,

though very fine, is free, and the material could be mined and crushed at half the cost of vein quartz. Moreover, the seams are persistent and vary little in thickness. An average recoverable content of 5 dwt. per ton should be sufficient to allow of successful operation.

(e) Cottrell-Dormer Prospect.

West, and adjoining Bessell's lease, two 10-acre leases have been applied for in the name of Cottrell-Dormer. The sandstone seams extend through these sections, and are in places gold-bearing. Although prospects in some parts are encouraging the seams as a whole are very poor. Further exploration here should be governed by the results of developments on Bessell's property.

(f) Brock Prospect.

On a section, now vacant, west of Bessell's prospecting claim, some mine openings have been cut by B. Watts under the direction of H. E. Brock. The main opening is an adit, 250 feet in length, coursing 50°. The object of the work was to intersect a quartz vein exposed on the hillcrest to the north-east. None of these narrow veins of quartz is of any value. Almost all the free gold in the shallow gullies nearby have been shed from bands of friable sandstone which are seen on the hill above and beyond the end of the adit. The gold content of these sandstones is low and erratic in its distribution.

(g) Partridge Creek.

On the Little Forester River fall of the high ridge almost surrounding Lisle Basin, very little gold is found. One of the few places is Partridge Creek the bed of which has been sluiced for gold. Here the gold is shed from beds of porous sandstone similar to those of Cradle Creek.

(h) Falkiner Creek.

This creek cuts porous beds of sandstone of the Cradle Creek series. These beds are impregnated with fine gold, and their waste has produced the small quantity of alluvial material in the banks of the stream.

(4)—Panama Field.

All the early records of developments in this area are lost in obscurity. It is difficult to obtain authentic infor-

mation relating to the operations of any of the early explorers, and their work cannot be examined as most of the older mine openings are now closed. Entering the basin the observer is astonished to see such extensive works and looks for the reason. Many years ago loosened blocks of very rich quartz were unearthed near the outlet of the basin. Their source has been the chief object of search since that time, and has excited the attention of prospectors and investors alike. The rich pieces of ore came from a vein in the soft granitite floor of the basin upon which they lay, having been loosened by the action of the waters of Panama Creek. Neither this vein nor any of the others opened in the many long adits and shafts is of economic importance, and it may be stated here that the field as a whole is poor and not likely to contain one ore-body of considerable value. One or two of these narrow veins, however, are sufficiently rich to allow of profitable operation on a very small scale.

Situation and Access.—Panama area lies 1½ miles south-west of Golconda station, and is accessible therefrom by way of a narrow, ill-formed road.

Physical Features.—In many respects the physiography of this field resembles that of Lisle with which it is often compared. It is a Lisle in miniature: a basin floor with soft, completely decomposed granitite, and walled with hard slates, sandstones, and tuffs. At the head of this oval-shaped basin, Panama Creek has its rise. The waters of the creek are largely responsible for the decomposition of the granitite and its corrosion to a depth of 400 feet below the rim. The steep walls of the basin and its soft granite floor provide favourable conditions for exploration.

VEINS.

(*a*) *Section* 1492-G, 20 *acres.*

(Lessees: W. L. and L. A. Jack.)

This section lies beyond the north-east end of the basin, and is occupied almost wholly by tuffs. An adit has been driven in tuff 100 feet on a bearing N. 42° W. and 80 feet due north on an easterly dipping wall. At 130 feet from the entrance is a westerly crosscut 40 feet in length. This exploratory work was unproductive.

About 100 feet further southward and close to the entrance to the basin, an adit has been driven in tuff on a bearing S. 35° E. The adit has caved near the entrance.

(*b*) *Sections* 1364-G, 10 *acres; and* 1346-G, 10 *acres.*

(Lessees: W. L. and L. A. Jack.)

The north-west corner of the first named section and the whole of the second are in Panama basin. From a point on the right bank of the creek, near the outlet of the gorge, a long adit has been driven in hardened tuff on a bearing S. 12° E. The adit has caved near the entrance and is not accessible. It is reported that the distance driven is 1400 feet. Apparently this work was not productive of good results as quartz cannot be seen on the dump; the tuff is veined with pyrite.

Another long adit crosscut, caved near the entrance, has been driven from the left bank of the creek on a bearing 330°. In this mine a quartz-arsenopyrite vein 8 to 10 inches wide has been intersected and explored north and south in drifts. This vein has been further explored in a shaft, near the mouth of the adit, sunk to a depth of 60 feet.

(*c*) *Lease* 1656-G, 30 *acres.*

This property, now held under lease by R. McKimmie of Launceston, was formerly explored by the late Dr. L. Grey Thompson. The chief development works are six adit crosscuts, five of which intersect the ore-body. No. 1 or uppermost adit has been driven 150 feet on an average bearing of 25° into indurated tuff. This high-level adit did not reach the ore-body.

No. 2 adit was driven at right angles to the slope of the hill through slip material consisting of blocks of quartz and arsenopyrite ore in a matrix of soft decomposed granitite. These ore blocks have broken away from the flat-dipping ore-body which was contained in soft granitite. The slip material is 20 to 40 feet thick.

No. 3 adit is wholly in slip material consisting of large blocks of quartz in decomposed granitite. The quartz is often cellular, studded with arsenopyrite and galena, and is stained yellow with orpiment.

No. 4 adit has been driven due west to 300 feet. It intersects granite and quartz rubble, soft granite, altered tuff, and enters grey slate near the end. From this crosscut at 200 feet a drive courses 20° for 70 feet, 353° for 40 feet, and 315° for 80 feet, exposing soft slickenslided granitite stained black with oxide of manganese. From the end of the crosscut a northerly drive on an irregular vein of white quartz, bearing 5°, has been cut to 110 feet. The dip of this

veinstone (which is poor) is easterly at 45°. It is quite evident that the large blocks of rich quartz passed through in the first section of the adit crosscut are now close to their original position. The vein from which they were derived was contained wholly in granite. Galena, sphalerite, and pyrite are common metallic mineral associates in addition to arsenopyrite which, however, is in greatest abundance.

No. 5 adit is a very long crosscut but inaccessible owing to the caving of the roof 100 feet from the entrance. This adit apparently intersects the ore-body as there is much gossan-stained quartz in a bin at the entrance. The materials on the dump show that granite, tuff, and slate have been opened.

No. 6 adit is at the same level as No. 5, but 100 feet north of it. Coursing 300° it cuts a quartz-arsenopyrite body (dipping south-east at 30°) at a point 150 feet from entrance. The continuation of this adit 335° exposes slate and tuff. The ore-body is 6 inches to 2 feet wide and contains a fair proportion of galena fringed with arsenopyrite, and much manganese oxide. At the end of the north drive is a 4-inch vein of quartz containing arsenopyrite and pyrite encased in hard sandstone.

The main ore-body exposed in these workings dips at a very low angle. It being a contact deposit the dip of the lode is the dip of the granite body.

Analyses of the ore reveal a gold content varying from 6 to 14 dwt. per ton.

(*d*) *Lease* 1623-G, 10 *acres*.

The ore-body within the bounds of this lease is exposed in three adits and two shafts.

No. 1 adit, now caved, is wholly in granite. Gold-bearing quartz in a bin at entrance suggests that the ore-body was intersected. A sample of this ore yielded gold in the proportion of 11 dwt. per ton.

No. 2 adit, driven south-west from a point 10 feet above creek level, is now caved. This adit did not reach the ore-body.

No. 3 adit, about the same level as No. 2, is not accessible.

A main shaft sunk on the left bank of the creek is in bad repair. A portable steam engine and boiler were used to provide power for hauling and pumping. The company performing this work was not successful.

(*e*) *Lease* 1516-G, 27 *acres*

The country within the boundary lines of this lease has been explored through two openings. These are adit crosscuts of considerable length from which drives explore the veins along their strike.

No. 1 adit, bearing 142°, is 120 feet long and intersects 3 veins. The first is a 2 to 6 inch vein of mineralised quartz, poor in quality, opened in a drive coursing 45° This vein, contained in altered tuff, dips north-west at 60°. A parallel vein, two inches wide, exposed in another drive from a point further in the crosscut. This has been explored in a winze. The quartz contains a little gold, but the prospect does not lend encouragement to further development.

No. 2 adit crosscut, 450 feet in length, passes through three gold-bearing veins of quartz. The first is a 1 to 3 inch vein exposed in a long drive and a winze 20 feet deep. It courses 225°, and dips north-west at a high angle. The second is a parallel vein, 6 inches wide, opened in a drive 100 feet long and a rise. The third is another parallel vein cut at the end of the crosscut and exposed in a drive 100 feet long

The white opaque quartz of these veins is stained yellow in parts from orpiment, and contains sphalerite, galena, chalcopyrite, arsenopyrite, and pyrite in blebs and irregular streaks. The most prominent of the accessory minerals are arsenopyrite and pyrite. These veins are wholly contained in indurated tuff.

The vein material broken during the development operations was treated for its content of gold, the average having been 8 dwt. per ton.

(5)—Lebrina Field.

Lebrina goldfield is a small area traversed by the road leading from the township of that name and the settlement of Wyena. One of the many veins was worked some years ago, but not with any considerable degree of success.

In addition to the main vein others have been exposed in mine openings and in shallow trenches and pits. None of these has proved of economic value.

In nature and composition they are all similar, and none offers sufficient inducement to give encouragement to further development.

VEINS.

Lebrina Mine.

On the road side between Wyena and Lebrina a gold-bearing vein of quartz, 12 to 18 inches wide, is exposed in a number of mine openings, the result of work performed a few years ago by a Launceston company. The vein, contained in blue slate and sandstone, courses 53° and dips south-eastward at 80°. It consists largely of quartz partly crystallised, and contains also pyrite and arsenopyrite in abundance. The gold content is irregular and the average proportion is low. The vein is strong and persistent, and has been opened in a long adit drift (600 feet long and 50 feet below the crest of the hill), and one shoot has been stoped to surface. It is exposed at greater depth in a shaft (11 feet by 4 feet) sunk on the west side of the road to 94 feet. At that depth the average quality of the ore was found to be too low (4 dwt. per ton) to allow of profitable operation.

A small treatment plant (since destroyed by fire) was erected to treat the richer material on hand. In this milling and concentrating plant 200 tons of ore were treated and 40 oz. only of gold was obtained.

At the end of the long adit, hereinbefore referred to, a fault fissure, called Splitter's Reef, intercepts and displaces the ore vein 20 feet to the south-east. Splitter's Reef is three feet wide, and is filled with barren quartz, except in the middle, where a narrow veinlet carries gold.

(6)—Denison Field.

In the seventies and eighties this field was regarded as one of great promise, and for a time was the cynosure of the mining public. As time went on and development was advanced it became evident that the hopes of the discoverers were not likely to be brought to fruition. One and then another company ceased operations until the field was abandoned by all save a few tributors, who remained to remove all the easily accessible rich ore. Many factors contributed to the failure of the companies, the chief of which were: narrow veins; short productive sections; irregular distribution of gold; and interruption of veins by faults.

The conditions for mining are generally favourable.

Situation.—Denison field is distant one and a half mile by road from Golconda station of the north-eastern

railway, and is 33 miles from Launceston. The field is easily accessible by way of the road to Bridport which passes through the centre of the area.

Physical Features.—The evenness of the surface (400 feet above sea-level) is broken by Denison River, which has cut its bed 200 feet below the general level. Slates, sandstones, and tuffs occupy the whole area and outcrop, except where covered by recent gravels.

VEINS.

(a) Sir William Denison Mine.

History and Production.

This mine was worked originally by a Launceston Company in the years 1878-80, but not successfully. A few crushings of small lots in the Leura battery were productive of good results: the average proportion of gold, however, in all lots was found to be too low to allow of profitable operation, and the company abandoned its holdings. The records of some lots are as follow:—

Lot 1—
1 oz. 9 dwt. 6 gr. gold per ton (by amalgamation).
3 oz. gold per ton from pyrite concentrate.

Lot 2—
1 oz. 10 dwt. gold per ton (by amalgamation).
20 oz. gold per ton from pyrite concentrate.

Lot 3—
7 oz. 16 dwt. 6 gr. gold per ton.
10 oz. 9 dwt. silver per ton.

Samples of the material show a great variation at different points along the vein. At one place in the shaft workings, where fault and vein fissures intersect, the relative proportion of gold and silver, is given as 16 dwt. and 70 oz. per ton respectively.

The Veins.

Two veins, coursing N. 65° E. and N. 70° E., have been explored in the mine openings. One is 12 to 18 inches wide, the other is 6 to 12 inches. The component minerals are quartz (in predominant proportion), pyrite, and galena. A large proportion of the gold is contained in the pyrite; very little in the galena, the presence of which, however, is indicative of a high gold content in the associated minerals. (The explanation of this anomaly is that galena acts as a precipitant of gold from solution.)

The small vein opened in a shallow shaft contains gold from 5 to 27 dwt. per ton. In the ore here arsenopyrite is the most important accessory component.

Development.

Developments consist of a main shaft, 9 feet 6 inches by 3 feet 4 inches, and drives east and west from it at 50 feet and 94 feet levels on both veins. No. 2 vein, dipping southerly, has been cut south of the shaft at the lower level, and is there 18 inches wide, and the material is of good quality. No. 1 vein has been opened in drives and stopes east and west of shaft at both levels. From this vein the greater part of the ore treated has been obtained. At a point in the main shaft workings, where a winze was sunk at the junction of two veins, the formation is 3 feet wide with 6 inches of quartz on each wall enclosing 2 feet of slate veined with quartz. Samples yielded gold at 16 dwt. per ton.

No further details of the work performed are available.

(*c*) *Star Mine.*

West, and adjoining the Sir William Denison Mine, is the Star property. A shaft has been sunk near the road on No. 2 vein to a depth of 70 feet, and a little drifting has been performed east and west from 60-foot level. The vein here maintains its average width of 18 inches, but the stone is of 5 dwt. grade only. It is noteworthy that pyrite is the prominent sulphidic component. The prospects, at the level where tests of the stone were made, were not sufficiently encouraging to excite further attention.

(*c*) *Alacrity Mine.*

This mine, situated 400 yards from and on the west side of the road leaving to Bridport, was opened many years ago by a Launceston company. In their operations a shaft was sunk over 200 feet, and the veins were opened at 100, 150, and 200-foot levels. No. 1 vein is 12 to 18 inches wide, and it is reported that the material contains gold in the proportion of 1 oz. per ton. Between the 150-foot and 200-foot levels 400 tons of ore has been left unstoped.

The veins course in a north-easterly direction, and dip north-westward. Their continuity is interrupted by north-trending faults. Pyrite and arsenopyrite are common accessory components of the ore.

(d) Lady Hamilton Mine.

This property lies on the west side of the road, and adjoins the Alacrity leases. A vein, 12 to 15 inches wide, crosses the property in a north-westerly direction. It is evidently one of the two opened in the shallow workings near the road, and, like them, is patchy.

(e) Brooklyn Mine.

This mine opens the northern or No. 1 vein on the east side of Denison River. Here the vein is narrow (6 to 8 inches), and the shoots of ore are short, but the gold content is fairly high (10 to 15 dwt. per ton) and evenly distributed. A few shallow pits and trenches constitute all the works performed thereon. In main shaft a short shoot of 3 oz. stone was revealed. This gave place to stone of only 4 dwt. value, which is representative of the average content of the material as a whole.

(f) Globe Mine.

South-east of Brooklyn is the Globe property through which the No. 2 vein line passes. A main shaft of three compartments intersects the vein at 80 feet, from which drifts expose the ore east and west. The ore here, as in all other mines in the field, is too poor and irregular in its content of gold to allow of profitable production.

(g) Wiangata Mine.

The vein in this property has been opened to a depth of 260 feet in a main shaft and in shallower pits in the vicinity. It is remarkable in its persistency, yet it is only three inches wide. Gold was extracted from several lots in the proportion of 2 oz. 4 dwt. per ton, and was almost pure.

These veins course in a north-easterly direction, but, unlike the Denison group, dip south-eastward.

(h) West Wiangata Mine.

The veins here are wider (6 to 12 inches), but poorer than that opened in the adjoining property. The main one was rich to 45 feet, but very poor at the bottom of the shaft (100 feet). A noteworthy feature is that the veins petered out in the tuff, but were strong and uniform in the slate. They have been opened in four shafts and many shallow pits and in trenches. None of them proved of any importance.

(7)—Myrtlebank Area.

A.—VEINS.

Falkiner Prospect.

In Myrtlebank area on property owned by Claude Falkiner an irregular body of bluish quartz is exposed in slates, sandstone, and quartzite. This body is from 6 inches to 18 inches wide, and is contained between ill-defined walls. Samples of the stone from two shallow holes yielded gold in the proportion of 2 dwt. per ton, the average content.

B.—IMPREGNATIONS.

(a) Just-in-Time Prospect.

On land at Myrtlebank, owned by G. E. Tole, are beds of gold-bearing sandstone intercalated with slates similar to those at Cradle Creek. In the joint planes of the sandstone are veinlets of amber-coloured quartz and brown clay containing a little fine gold. Here the sandstone rock is almost barren, but is heavily impregnated with iron oxide. The body has been exposed in a long trench and in a shaft (25 feet deep) where the quartz contains a little arsenopyrite. It is there a seam of sandstone 10 feet wide coursing 302°. Although the gold content appears to be increasing at depth the average value is very low, and does not lend encouragement to further effort.

On the same property a shaft has been sunk 25 feet on veins of quartz in felspathic sandstone. Traces only of gold have been found. From the Lisle fall of the hill an adit crosscut 75 feet long has been cut towards the shaft. In the end of the adit much pyrite shows in the rock. At surface black tourmaline and gilbertite are common secondary minerals, especially in the sandstone. Manganese oxide stains are particularly noticeable. Two dykes, apparently of the porphyroid series of rocks, have been opened in shallow trenches at the summit of the ridge near these workings.

The prospect of finding gold in this stone in profitable proportion appears to be very remote.

(8)—Mt. Arthur Area.

On the Lilydale-Patersonia road a cutting exposes a bed of Permo-Carboniferous mudstone conglomerate, which has been regarded in local circles as stream gravel of recent origin. The greater number of the pebbles shed from the waste of this rock are of water-worn quartz which probably was derived from a far-distant source. Very little gold is associated with this member of the formation, and the quartz component is barren. Whereas the Lisle gold-bearing deposits are of Recent to Quaternary age, this is of very great age, and is not connected in any way with those deposits.

(9)—St. Patrick's River Area.

Whiting Prospect.

This prospect is outside Golconda district, but in the St. Patrick's River valley section of the same gold belt. Here a 15-foot dyke of white porphyry, partly decomposed, intrudes slates and sandstones of Cambro-Ordovician age. The porphyry appears to belong to the porphyroid group of intrusives, so well developed in the Western Division and is, therefore, unrelated to the granites and granitites of Devonian age in the adjacent area. The strike of the dyke is 345°, and the direction of dip is north of east. With this dyke are associated irregular bodies of quartz containing much pyrite and a little arsenopyrite. These bodies have been opened at a number of points in trenches, open cuts, and adits.

In the upper open cut a 4-foot body of quartz in sandstone is exposed. The quartz is white opaque and pellucid, and is studded with pyrite. Its content of gold is low.

Another body of similar quartz is exposed in a trench cut into the bank of a small creek nearby. A little arsenopyrite is present in this stone. The direction of this body is 315°, and the dip is nearly vertical towards the east.

In the lower open cut, whence rich ruby silver ore samples were taken, a brecciated quartz body containing muscovite cuts the porphyry dyke at right angles to its strike, which here is 307 degrees. The quartz contains also pyrite, arsenopyrite, and chalcopyrite.

From the adit crosscut a drive follows the course of the dyke north and south exposing a quartz-limonite body of little value. Not one of the large number of samples of the gold-bearing rock taken from the several workings during the recent visit yielded gold or silver in profitable proportion. Samples taken of the ore from time to time yielded both gold and silver in considerable amount. One sample contained silver at upwards of 300 ounces per ton. The general bulk sampling, however, shows that the ore body as a whole is poor and irregular. It may be stated definitely that the prospects do not appear to justify further expenditure in exploration.

GEOLOGICAL SKETCH MAP

OF

THE LISLE DISTRICT

CHARACTERISTICS

- Roads
- Railways
- Stations
- Contours
- Geological Boundaries
- Strike & Dip of Strata
- Shafts
- Veins

5 cm

Alex. Intosh Reid,
Government Geologist

10 5 0 20 40 60 80 CHAINS

LEGEND

SEDIMENTARY

QUATERNARY & RECENT	Sands and Gravels
PERMO-CARBONIFEROUS	Conglomerates, Mudstones, Shales, & Sandstones,
ORDIVICIAN	Slates, Sandstones & Tuffs,

IGNEOUS

TERTIARY	Basalt
UPPER MESOZOIC	Diabase
DEVONIAN	Biotite Granite, Porphyries & Syenite Granite
ORDIVICIAN	Dykes of porphyroid rocks

Photo Algraphied by John Vail Government Printer Hobart. Tasmania.