Talc schist* is showing in the face of the crosscut from the east side of the pit, and the west boundary has been pegged at the surface. The extent and usefulness of the talc schist, however, has yet to be investigated.

SOUTH PIT.

No explanation of the pegging is necessary but a few other things must be mentioned.

Judging from surface evidence the width of the kaolinised schistose greenstone in the end of the crosscut off the west side of the pit is much greater than that already exposed in the crosscut.

The kaolinised dolerite (No. 3 Clay), owing to its mode of origin, may cut across the strike of the country or may not persist along the strike.

Sillimanite schist, which is thought to be the northerly continuation of the sillimanite schist in the south pit, was found outcropping in the creek near the north pit, and the probable position of the bed between these two places is shown on the map.

The green clays disclosed in the south pit are decomposition products of schistose greenstone and may be stained with nontronite. These clays are of little use commercially as they cause excessive shrinkage.

There is obviously some discrepancy in the mapping of the geology in the workings off the north end of the south pit, but only further development work will clear up this point. Since garnet is a metamorphic mineral, the garnet schist will occur sporadically, so that the absence of garnet schist in the north drive at the boundary of the sillimanite schist does not refute the presence of faulting as shown.

* This is now believed to be only a decomposition product of the mica schist.

LANCEFIELD GOLD MINE.

MT. MARGARET GOLDFIELD.

(By R. S. Matheson, B.Sc.)

CONTENTS.

GENERAL REMARKS.

The Lancefield Gold Mine is situated at Beria, approximately 5 miles north-north-west of Laverton, in the Mt. Margaret Goldfield.

The area is featureless, except for a gentle rise in the country to the south-east, towards the Mt. Crawford line of hills.

The Lancefield G.M. Co. holds twenty leases embracing an area of approximately 371 acres, and these are shown on the accompanying geological plan (Plate II.). Mining operations in the past have been carried out on G.M.L's. 715T, 806T, 2221T and 2225T, but at present (November, 1937), work is confined to the latter three leases. Preparations are being made to retreat accumulated tailings.

The mine has been one of the largest producers in the State, and from 1899 to 1937 1,221,166.98 tons of ore were treated for an average value of 7.34 dwts. of gold per ton. The production table appears as Appendix A. at the end of this report.

Wells are the source of an adequate supply of water for domestic and mining purposes, ground water level being generally from 50 to 70 feet below the surface. Timber for fuel and underground use is unobtainable in the vicinity of Beria, and supplies are at present being carted a distance of about 30 miles.

GENERAL GEOLOGY.

The country rocks in the vicinity of the mine consist of metamorphosed basic lavas and tuffs, which have an average strike N. 30° E. and an average dip 40° south-eastward, and these are referred to throughout the report under the general term "Greenstone." Interbedded with the greenstones are several bands of ferruginous quartzite or jaspilite of sedimentary origin. It has been impossible to determine whether these bands of jaspilite are separate horizons, or whether they represent one bed which has been repeated by folding. The rocks are highly folded, and have been intruded by granite and quartz porphyry. Mapped with the granite, and undifferentiated from it on Plate II., are large areas of gneiss, granitised greenstone, and hybrid rocks, which are considered to owe their origin to the replacement or assimilation of large portions of the greenstones by the invading granite. All the rocks are presumed to be of Pre-Cambrian age.

Exposures in the vicinity of the Lancefield Gold Mine are very poor owing to deep weathering, and large areas are entirely masked by alluvium. The true nature of the greenstones was only determined after examining the exposures in the mine workings and bore cores.

Areal mapping, now in progress, suggests that the Lancefield ore body is situated on the eastern limb of a south-easterly pitching anticline. The main structure is complicated by minor folds, one of which has an important influence on the Lancefield ore body, and is referred to further in the section of this report dealing with recommendations and conclusions. This fold is indicated at the surface by a marked change in strike, near the south-west corner of the Lancefield group of leases, from N. 30° E. to N. 35° W.

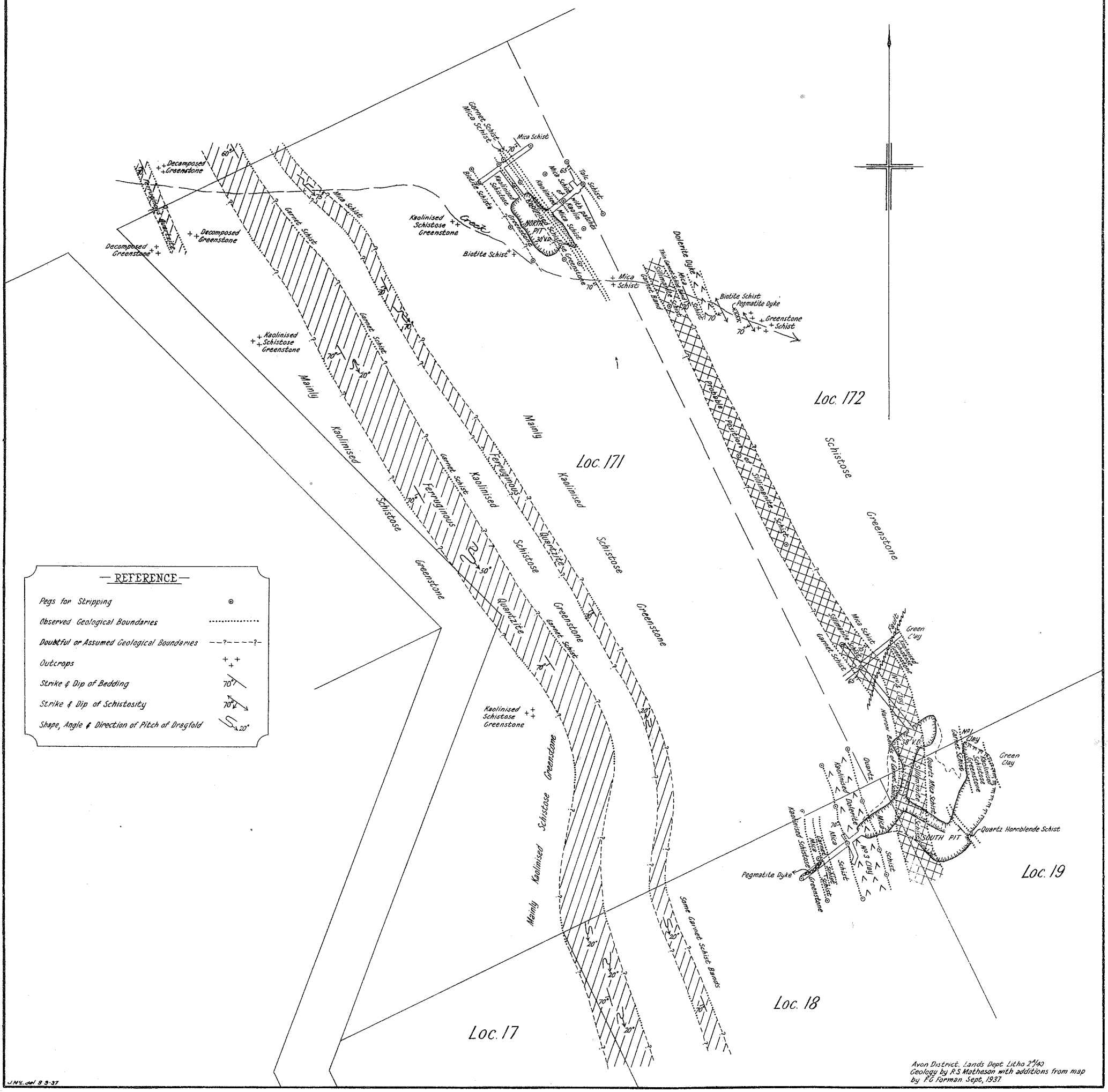
GEOLOGICAL MAP

IN

THE VICINITY OF

CLACKLINE FIREBRICK CLAYPITS

Scale 2 chains to an inch



REFERENCE

Pegs for Stripping	⊙
Observed Geological Boundaries	.....
Doubtful or Assumed Geological Boundaries	--?----?-
Outcrops	+ +
Strike & Dip of Bedding	70°
Strike & Dip of Schistosity	70°
Shape, Angle & Direction of Pitch of Dragfold	20°

Avon District. Lands Dept. Litho 2/40
Geology by R.S. Matheson with additions from map by F.G. Forman. Sept, 1937

J.N.L. del 8.9.37

The easterly pitches of dragfolds observed in the underground workings of the Lancefield G.M. would not normally be expected in the south-easterly pitching structure described above, and are thought to be due to local crossfolding.

THE COUNTRY ROCKS.

Information concerning the country rocks is meagre, owing to the small amount of crosscutting in the mine, and the almost complete absence of petrological descriptions of the bore cores, which themselves are not now available for examination.

Footwall Country.—Massive, greyish, coarse-grained greenstone, grading through greenstone schist to talc schist, constitutes the major portion of the footwall country. The footwall country is thought to have originally consisted entirely of the massive type of greenstone, the schists having been produced from it by shearing. The degree of dynamic metamorphism determines the nature of the country rocks, and the presence of talc schist indicates areas which have undergone the greatest changes. This fact has been useful in interpreting some of the geological structures in the underground workings. The footwall rocks are believed to be mainly of tuffaceous origin, and they are very susceptible to mineralisation.

Hanging Wall Country.—Exploratory work in the hanging wall country has disclosed metamorphosed basic lava. In contrast to the greyish colour and sheared nature of the footwall country, the hanging wall country has a dark greenish colour and generally a blocky jointing. The hanging wall rocks are also remarkably free from mineralisation.

The hanging wall country has been penetrated in very few places in the underground workings, and is best exposed in a short south-east crosscut off the north drive, No. 5 level.

The core of bore No. 5 (new) was megascopically examined by Mr. K. R. Miles, and the hanging wall section of it was found to consist entirely of metamorphosed basic lava. The log of the bore is included in this report in the section on diamond drilling. The lava is bleached and schistose in places, and variations in grain size occur, indicating that there may be more than one flow.

Intrusives.—The greenstones have been intruded by quartz porphyry, and this rock is encountered in several places in the workings.

A quartz porphyry sill, showing assimilation and chilling at its contact, is intersected in the Nos. 9, 10 and 11 level crosscuts off the main shaft.

An underground diamond drill hole, bored south-eastward from the bottom of the inclined tunnel, intersected quartz porphyry in the footwall country below the No. 13 level, which is probably an offshoot from the sill encountered in the upper levels.

THE ORE BODY.

The Lancefield ore body occurs in the most conspicuous of the western jaspilite beds shown on Plate II., and has been formed by the mineralisation of the jaspilite and the injection of auriferous quartz veins presumably by solutions emanating from the granitic magma. These quartz veins have penetrated the jaspilite, where it was fractured, sheared, and contorted, during folding.

The pay shoot occupies the full width of the jaspilite band, and has an average length of 560 feet and an average width of 20 feet. The general strike is N. 30° E., the dip 30 degrees in a direction S. 60° E., and the shoot pitches about 30 degrees in an easterly direction. The values are said to have been better on the hanging wall side of the ore body than on the footwall side, and the best values are generally in the vicinity of the quartz veins and stringers.

The main shoot has been stoped out from the surface to the No. 11 level (787 feet V.D.), and stoping is at present in progress between the No. 11 and No. 12 levels (860 feet V.D.).

The jaspilite has been mined in the past to a vertical depth of about 60 feet (reported* to have been the original ground water level) for some distance beyond the northern end of the main shoot. Abandonment of this section of the lode suggests that values became unpayable at depth, and that the stoped portion of this northern extension consisted of secondary enriched lode material overlying primary lode material with unpayable values. Owing to the inaccessibility of the upper levels, the oxidised zone could not be examined, but C. G. Gibson† states that—

> "The zone of oxidation stops a little above the 200ft. level, there being a small percentage of sulphide in the stone from this level; below the sulphides come in heavily . . ."

At the No. 13 level (968½ feet V.D.) which is at present being developed, the ore shoot has a length of 110 feet, and an average width of 5 feet. These dimensions are considerably less than those at higher levels, and the reasons for this marked decrease in size of the ore body, and the possibility of its return to more normal dimensions at a greater depth, are discussed later in this report.** The lode material is, however, reported to show an improvement in values at the No. 13 level, which is an indication that the values will persist with depth.

Mineral Associations.—The principal gangue mineral in the ore is quartz, with minor amounts of calcite which occurs as veinlets, and graphite which, besides being disseminated through the lode, is occasionally found on the hanging wall of the ore body.

The sulphide minerals are pyrite, arsenopyrite, pyrrhotite, chalcopyrite and sphalerite. The two reports appearing as Appendices B and C to this report, and dealing with the mineragraphy of the Lancefield ore, were kindly made available by the manager of the Lancefield Gold Mine, Mr. Fox. They serve to show the close association of the gold with the sulphides, and to explain the difficulties of cyanide extraction.

STRUCTURAL CONTROL.

The Lancefield ore body is best described by reference to a plane parallel to the average strike and dip of the lode. The determined strikes and dips vary greatly throughout the mine workings, and referred to the reference plane the lode shows numerous

* Gibson, C. G., G.S.W.A. Bull. No. 24, p. 19.
† G.S.W.A. Bull. No. 24, p. 19.
** See page 71.

domes, basins and saddles, which have been formed by the intersection of two systems of folding, one set with an axis parallel to the pitch of the ore body, and the other practically horizontal.

If each system of folding is considered separately it is found that the ore body has been thrown by it into alternate anticlines and synclines, which have affected the width of the lode. The width of the lode is generally less at the crests of anticlines than in the troughs of the adjacent synclines. A study of conditions in the underground workings, under the influence of the two systems of folding combined, shows that the lode is thinner on the domes than in the adjacent basins. Owing to the lack of uniformity in the magnitude of the folding, the relation between lode widths and geological structure can only be recognised by comparing adjacent folds of similar magnitude. If the two systems of folding, and also the folds within each system, were of the same order of magnitude, the ideal case would be presented and the maximum lode widths would invariably occur in the basins, and the minimum lode widths on the domes.

A lack of assay plans for the greater part of the workings makes it impossible to correlate values and geological structure, but there is some suggestion that the basins, besides locally containing the greatest widths of ore, may contain the best values. The section of the lode embraced by co-ordinates 100′ N. and 250′ N., and between the No. 8 and No. 9 levels, is reported to have contained the greatest widths and the best values, and this is the largest basin in the mine.

The decrease in the dimensions of the ore body at the No. 13 level is thought to be due to its proximity to the crest of an anticline with a horizontal axis (see Plate V.). It might be argued that this decrease in length and width of the lode could possibly be due to a lensing out of the jaspilite lode formation. It seems much more probable as a result of actual inspection of the ore body, and the known wide distribution of the jaspilite, that the decrease in width and length of the ore shoot is due to the influence of a fairly strong anticlinal fold with a horizontal axis. No such exceptionally marked changes in the width and length of the lode have been produced by the anticlines belonging to this system, which were encountered in the higher levels, but the writer is of the opinion that the fold now being approached is of a greater order of magnitude than the preceding ones. It is not intended to imply that the No. 13 level is at the crest of this fold, but the crest is somewhere between this level and the point of intersection of the lode by the No. 5 bore (new).

The above interpretation of the structure is based on the following evidence:—

1. Dragfolds—

   Small dragfolds belonging to both systems of folding are present in the workings, and the effect of geological structure on the width of the lode can be seen on a small scale in a few places.

2. Flattening in dip—

   Between the No. 11 and No. 12 levels there is a noticeable steepening in the dip of the ore body, but the dip flattens considerably as the No. 13 level is approached.

   Further evidence for this flattening in dip in the vicinity of the No. 13 level was obtained from an underground diamond drill hole off the bottom of the inclined tunnel, which at the time of inspection (November, 1937), had passed through 102 feet of footwall country without encountering the lode. The general dip must be flatter here than it is at the No. 13 level (see Plate IV.).

3. Intense dynamic metamorphism—

   In the winzes from the No. 11 and No. 12 levels more frequent changes in dip, associated with a thickening or thinning of the lode, are met with than in the upper levels.

   The predominant type of footwall country between the No. 11 and No. 13 levels is talc schist, indicating more intense dynamic metamorphism than previously encountered.

4. Decrease in stope length.

   The two systems of folding could easily cause the decrease in stope length at the No. 13 level. If an anticline with a horizontal axis crossed the pitching set of folds, there would be a tendency for the pitching synclines to close at the crest of the anticline and bring about a decrease in stope length.

5. Decrease in width of lode.

   If the structure is anticlinal, the decrease in width of the lode at the No. 13 level conforms with the behaviour of the ore body observed in the higher levels.

6. Lode at depth.

   The lode has been encountered on the pitch at a greater depth than the No. 13 level in bores Nos. 5, 6 and 7 (new), and a greater stope length than that at the No. 13 level is indicated. The shoot would be expected to regain gradually its original dimensions as the syncline succeeding the anticline inferred above is approached. (See Plate V.)

Faulting.—A vertical fault, which strikes north-westward and has slightly displaced the lode, is encountered in the long north drives throughout the workings, but it causes no serious obstacle to mining.

DIAMOND DRILLING.

The lode formation has been prospected at various depths by diamond drilling through the hanging wall country. In all, seventeen diamond drill holes have been put down, eight of which were drilled fairly recently. The presence of two sets of bores on the mine plans is rather confusing, particularly as the numbers overlap, and an attempt to clarify this has been made in the following table. The bores were all started vertically, but they have deflected up the dip, and the deeper the bore the greater is the deflection.

Unfortunately there are no petrological descriptions of the country encountered in these diamond drill holes, and in most cases the core has not been retained.

TABLE.

Old or New Bores.	Bore No.	Bore Depth.	Co-ordinates of Site.	Inclination.	Remarks.
		ft.			
Old	1	363	252′ S. 497′ E.	Vertical ...	Lode first encountered at 318ft. Value 42s. 26ft. wide.
Old	2	335	92′ S. 474′ E.	Vertical ...	Lode at 288ft. Value 34s. 25ft. wide.
Old	3	360	387′ S. 520′ E.	Vertical ...	Lode at 307ft. Value 22s. 8ft. wide.
Old	4	380	531′ S. 533′ E.	Vertical ...	No lode.
Old	5	356	35′ N. 591′ E.	Vertical ...	Lode at 326ft. Value 20s. 14ft. wide.
Old	6	389	105′ N. 449′ E.	Vertical ...	Lode at 200ft. Value 3s. 2ft. wide.
Old	7	535	291′ S. 641′ E.	Vertical ...	Lode at 357ft. Value 38s. 12ft. 3in. wide.
Old	8	370	233′ N. 569′ E.	Vertical ...	Lode at 316ft. Value 32s. 12ft. wide.
Old	9	418	526′ N. 641′ E.	Vertical ...	Lode at 388ft. Value 28s. 18ft. wide.
New	1	996	229′ N. 1,664′ E.	Vertical ...	No lode.
New	2	967	498′ N 1,608′ E.	Vertical ...	18ft. 6in. lode (from 924ft. to 942ft. 6in.).
New	3	1,236	734′ N. 1,964′ E.	Vertical ...	No lode.
New	4	335	766′ N. 414′ E.	Vertical ...	8ft. 1in. lode (from 294ft. 5in. to 302ft. 6in.).
New	5	1,299	1,028′ N. 1,899′ E.	Vertical ...	11ft. 2in. lode (from 1,247ft. 5in. to 1,258ft. 7in.).
New	6	1,300	1,159′ N. 1,830′ E.	Vertical ...	10ft. 2in. lode (from 1,250ft. 10in. to 1,261ft.).
New	7	1,248	882′ N. 1,934′ E.	Vertical ...	10ft. 9in. lode (from 1,201ft. to 1,211ft. 9in.).
New	8	1,315	1,290′ N. 1,758′ E.	Vertical ...	10ft. lode channel (from 1,259ft. to 1,269ft.).

The values stated above are based on the old price of gold (£4 per ounce). The widths are not the true widths of the lode as all the bores cut through the lode obliquely.

The core of bore No. 5 (new) was megascopically examined by Mr. K. R. Miles, and as it is one of the deepest bores it should give a representative section of the country.

Log of Diamond Drill Bore No. 5 (new).

0′	to	188′	No record.
188′	,,	230′	Weathered fine-grained greenstone schist.
230′	,,	266′	Slightly weathered greenstone schist.
266′	,,	318′	Fine-grained greenstone schist with patches of more massive greenstone (probably sheared lava).
318′	,,	413′	Dense greenstone with patches of schistose greenstone (lava).
413′	,,	416′	Fine grained greenstone schist (probably sheared lava).
416′	,,	462′	Dense greenstone (lava ?).
462′	,,	475′	Fine grained greenstone schist.
475′	,,	508′	Dense greenstone.
508′	,,	518′	Massive fine grained greenstone, varying to medium grained greenstone.
518′	,,	600′	Fine grained greenstone schist.
600′	,,	666′	Massive dense greenstone (lava).
666′	,,	674′	Massive dense greenstone (lava) (specimen at 671′), grades off to schistose greenstone.
674′	,,	693′	Fine grained greenstone schist.
693′	,,	703′	Dense greenstone with schistose bands.
703′	,,	704′	Very dense dark greenstone band—edge of lava flow (?)
704′	,,	716′	Dense greenstone with schistose bands.
716′	,,	721′	Dense greenstone.
721′	,,	750′	Medium grained greenstone partially schistose—varies to medium grained schistose greenstone.
750′	,,	754′	Medium grained greenstone varying to amphibolite (?) (specimen at 754′).
754′	,,	763′	Massive medium grained greenstone with bands of schist.
763′	,,	768′	Fine grained greenstone schist with more massive bands.
768′	,,	777′	Fine grained greenstone schist.
777′	,,	784′	Grades to medium grained partially sheared amphibolite.
784′	,,	787′	Rather massive medium grained greenstone.
787′	,,	825′	Fine grained greenstone schist.
825′	,,	859′	Massive dense greenstone (lava) (specimen at 853′)—with schistose bands and irregular quartz veinlets.
859′	,,	915′	Fine grained schistose greenstone with more massive bands.
915′	,,	922′	Massive fine grained greenstone (lava).
922′	,,	930′	Fine grained greenstone schist, containing patches of actinolite schist.
930′	,,	960′	Fine grained greenstone schist with irregular quartz veinlets generally mineralised.
960′	,,	971′	Fine grained greenstone (lava) with local changes to schist.
971′	,,	976′	Massive fine grained greenstone (lava).
976′	,,	983′	Schistose fine grained greenstone (lava).
983′	,,	989′	Massive fine grained greenstone (lava).
989′	,,	1,082′	Fine grained greenstone schist (probably sheared lava).
1,082′	,,	1,085′	Massive greenstone with muscovite pegmatite veinlet.
1,085′	,,	1,245′ 2″	Fine grained greenstone schist (sheared lava ?)—probably contains serpentine.
1,245′ 2″	,,	1,247′ 5″	Mineralised fine grained greenstone schist (sheared lava ?)—probably contains serpentine (no values).
1,247′ 5″	,,	1,258′ 7″	Lode material.
1,258′ 7″	,,	1,278′	Medium grained greenstone schist with patches of massive medium grained greenstone.
1,278′	,,	1,279′	Quartz vein.
1,279′	,,	1,335′	Medium grained greenstone schist with quartz stringers and local gradations into massive greenstone—in places strongly mineralised.
		1,335′	End of bore.

Description by K. R. Miles, 8/11/37.

Summary.—The hanging-wall country appears to consist entirely of metamorphosed basic lava. The rock is generally massive and dark greenish in colour, but schistosity and bleaching are frequently developed. Variations in grain size also occur, indicating that there may be more than one flow.

Numerous irregular veinlets of quartz and calcite were intersected by the bore, but they were not recorded.

RECOMMENDATIONS AND CONCLUSIONS.

1. The lode is expected to be very lenticular, and in places perhaps entirely absent, between the No. 13 level and its intersection by bores Nos. 5, 6 and 7 (new). Nevertheless the prospects of the ore body regaining its original dimensions deeper down are promising, and the diagrammatic longitudinal section (Plate V.) shows its probable behaviour with depth.

Diamond drilling is strongly recommended on the pitch of the shoot to intersect it 300 feet below the present limit of prospecting, and an increase in length and width is expected, provided that the granite on the east (see Plate II.) has not replaced the lode channel. This is a possibility, and the dip of the granite contact is the deciding factor. The granite is, however, not true granite, but a granitised zone, and it is to be hoped that the action has been confined to the horizons which show granitisation at the surface.

2. There is good evidence for the existence of parallel jaspilite beds in the footwall country, and these should be prospected, particularly opposite the main shoot.

A parallel jaspilite band, 3 feet wide and showing mineralisation, was intersected in the crosscut from the main shaft at the No. 8 level. Ore shoots may exist in this bed along the strike or down the dip. Underground diamond drilling would probably be the best method of prospecting, and initial drilling should be carried out westward from the large basin, in the main lode, between the No. 8 and No. 9 levels.

Mineralised outcrops of another jaspilite bed are exposed to the north-east of M.A. 15T, and samples from it are reported to have assayed from 1 to 2 dwts. gold per ton. Alluvium and tailings obscure any other outcrops of this bed, but it probably persists southwards through the leases. The prospecting of this jaspilite should not be neglected.

3. The area marked "A" on Plate II. embraces a sharp fold in the country which warrants prospecting. The area is devoid of outcrops, and whether or not the jaspilite exists in this place is problematical, but even if it is absent, auriferous quartz reefs may be present.

Auriferous quartz stringers and lode material, in talc schist are being mined at the "Beria Main Lode," G.M.L. 2216T, in this vicinity, but the workings are not in the most favourable position with regard to structure. The ore shoots occur in the noses of small folds. The presence of talc schist proves conclusively that the workings are in the Lancefield footwall country.

4. Small isolated, lenticular shoots of ore may exist in favourable structures along the strike of the main lode formation. Bore No. 9 (old) shows values below the No. 5 level, which were not encountered on that level, and this is probably an ore body of the type previously mentioned.

5. A jaspilite bed outcrops discontinuously, close to the granite contact, on the eastern side of Plate II., and it warrants prospecting due east of the main ore body. The jaspilite is dipping flatly towards the granite which is not a promising feature for its persistence with depth. It is characteristic of the jaspilites, however, that when intruded by granite they suffer bleaching over some distance, and as this bed appears to be the normal type the granite contact is probably dipping more or less parallel to it.

6. Prospecting should be done on the Mt. Crawford line of jaspilite, over the section extending from south-east to east of the Lancefield G.M. The intervening greenstone country is not without possibilities.

APPENDIX A.

Name of Lease or Company.	Mining Centre.	Lease No.	Period.	Alluvial.	Dollied and Specimens.	Ore Treated.	Gold Therefrom.	Total Gold.	Silver.
				fine ozs.	fine ozs	long tons.	fine ozs.	fine ozs.	fine ozs.
Lancefield G.M. Co., Ltd.	Beria	715T, 806T, 1206T, 1207T, 1483T, 1523T, 1524T, 1525T, 1542T, 1544T, 1548T	1899	....	....	5,768·00	1,923·61	1,923·61	....
Do. do.	do.	do. do.	1900	....	....	11,701·00	5,639·75	5,639·75	....
Do. do.	do.	do. do.	1901	....	....	16,847·00	6,256·55	6,256·55	....
Do. do.	do.	do. do.	1902	....	....	20,781·00	7,780·60	7,780·60	....
Do. do.	do.	do. do.	1903	....	....	21,928·00	7,068·29	7,068·29	....
Do. do.	do.	do. do.	1904	....	....	25,154·78	10,734·01	10,734·01	....
Do. do.	do.	do. do.	1905	....	....	47,693·00	15,383·22	15,383·22	430·81
Do. do.	do.	do. do.	1906	....	....	5,946·00	3,005·82	3,005·82	219·12
Do. do.	do.	do. do.	1907	....	....	61,906·00	25,993·20	25,993·20	3,420·32
Do. do.	do.	do. do.	1908	....	....	38,284·00	14,460·23	14,460·23	1,754·14
Do. do.	do.	do. do.	1909	....	....	46,961·00	19,458·08	19,458·08	3,258·87
Do. do.	do.	do. do.	1910	....	....	90,789·00	35,299·63	35,299·63	7,747·58
Do. do.	do.	do. do.	1911	....	....	95,305·00	37,505·50	37,505·50	8,189·85
Do. do.	do.	do. do.	1912	....	....	27,694·00	11,272·33	11,272·33	2,415·99
Kalgoorlie and Boulder Firewood Co., Ltd.	do.	do. do.	1914	....	....	10,977·00	2,954·97	2,954·97	417·18
Do do.	do.	do. do.	1915	....	....	39,746·00	14,062·33	14,062·33	2,083·77
Do. do.	do.	do. do.	1916	....	....	21,079·00	7,985·81	7,985·81	863·06
Lancefield Gold Mines, Ltd.	do.	715T, 806T, 1206T, 1523T, 1524T, 1525T, 1542T, 2050T, 2051T	1916	....	....	47,062·00	16,744·38	16,744·38	3,057·41
Do. do.	do.	do. do.	1917	....	....	76,453·00	26,929·64	26,929·64	4,609·99
Do. do.	do.	do. do.	1918	....	....	71,157·00	26,281·30	26,281·30	3,909·27
Do. do.	do.	do. do.	1919	....	....	78,068·00	28,649·74	28,649·74	5,124·80
Do. do.	do.	do. do.	1920	....	....	78,235·00	25,565·79	25,565·79	3,345·36
Do. do.	do.	do. do.	1921	....	....	1,679·57	2,981·77	2,981·77	966·05
Do. do.	do.	do. do.	1922	....	....	22·44	23·01	23·01	....
Do. do.	do.	do. do.	1923	....	....	49·51	346·09	346·09	....
Do. do.	do.	do. do.	1924	....	....	3·26	1,610·64	1,610·64	0·70
Do. do.	do.	do. do.	1925	....	....	....	999·30	999·30	68·00
Do. do.	do.	do. do.	1926	....	....	0·27	1,000·57	1,000·57	....
Do. do.	do.	do. do.	1927	....	....	....	1,015·15	1,015·15	....
Do. do.	do.	do. do.	1928	....	....	....	598·01	598·01	....
Lancefield Leases	do.	715T, 806T	1928	....	....	....	191·30	191·30	....
Do. do.	do.	do.	1929	....	....	....	401·82	401·82	....
Do. do.	do.	do.	1931	....	....	135·00	14·50	14·50	....
Do. do.	do.	do.	1932	....	....	0·15	2·28	2·28	....
Lancefield (W.A.) Gold Mine, N.L.	do.	715T, 806T, 2221T, 2225T, 2232T, 2233T, 2234T, 2235T, 2236T, 2245T	1935	....	....	62,045·00	19,054·30	19,054·30	....
Do. do.	do.	do. do.	1936	....	....	104,355·00	34,747·19	34,747·19	....
Do. do.	do.	do. do.	1937	....	....	113,342·00	34,477·12	34,477·12	....
		Total Production, 1899–1937		....	....	1,221,166·98	448,417·83	448,417·83	51,881·27

Grade of Ore = 0·367 fine ozs. gold per ton.
= 7·34 dwts. gold per ton.

APPENDIX B.

MINERAGRAPHIC INVESTIGATIONS OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

University of Melbourne,
September 16th, 1936.

Report No. 80.

ORE AND MILL PRODUCTS FROM LANCEFIELD G.M., W.A.

Five samples of ore and mill products from the Lancefield Mine, at Beria, W.A., have been submitted for examination by the Lancefield Company.

1. *Ore.*—The sample of ore is a highly siliceous specimen with disseminated sulphides. Pyrite is the most abundant sulphide, and, in addition, arsenopyrite, pyrrhotite, chalcopyrite, and sphalerite are present. In places, arsenopyrite is intimately intergrown with pyrite, while pyrrhotite, sphalerite, and chalcopyrite may occur as inclusions in pyrite and arsenopyrite, as well as forming isolated particles in the gangue.

Gold particles, .010 x .006mm. and .019 x .006mm., have been observed as isolated particles in the gangue. A gold particle, .004 x .005mm., has been observed at the junction of a particle of pyrrhotite with the gangue, similar to that illustrated in fig. 1* (.011 x .009mm.). A large gold particle, .032 x .015mm., has been observed on the margin of pyrite embedded in gangue, while a small gold particle, .004 x .005mm., has been observed attached to a minute crystal of arsenopyrite in the quartz.

2. *Drill Core.*—The sample of drill core is highly siliceous, with disseminated sulphides. Pyrrhotite is the abundant sulphide, while sphalerite and chalcopyrite are also more abundant than in the specimen of ore. Pyrite and arsenopyrite are also present. Gold particles, .002 x .022mm. and .004 x .004mm., have been observed isolated in quartz. A gold particle (fig. 1)* has been observed at the margin of pyrrhotite and quartz. Gold particles, .005 x .007mm. and .002 x .004mm., have been observed in narrow veins of sphalerite and chalcopyrite cutting pyrite.

3. *Flotation Tails.*—The sample of flotation tailings is found to contain a small amount of sulphides. The predominant sulphide is pyrrhotite. Such particles of pyrite and arsenopyrite, as observed in the material, are attached to, or embedded in, particles of gangue. No gold has been revealed in the prepared sections. Occasional grains of hematite and magnetite are present.

4. *Flotation Concentrate.*—Pyrite is the predominant sulphide in the flotation concentrate, as well as in the specimen of ore. Arsenopyrite, pyrrhotite, chalcopyrite, and sphalerite are also present. A considerable number of gold particles have been observed in this concentrate. There are comparatively large flakes, .086 x .020mm., which are apparently free, as well as smaller particles, .010 x .008mm. An irregular shaped particle, apparently free, with a crumpled appearance, is illustrated in fig. 2,* where it appears on the surface of the section as two isolated areas. There are also a number of particles with attached fragments of sulphides. One of these is illustrated in fig. 3,* where pyrrhotite is attached to one side of the gold particle. A large particle of gold, .039 x .037mm., has a thin film of arsenopyrite on one edge, while another particle of gold, .014 x .023mm., has an attached particle of pyrite.

A number of particles of gold have not been exposed during crushing, and occur in the flotation concentrate

* Figures not available. (R.S.M.)

* Figures not available. (R.S.M.)

as inclusions in pyrite or arsenopyrite and, in one case (fig. 6*) in pyrrhotite. Fig. 4* illustrates an extremely minute inclusion of gold in pyrite, while fig. 5* illustrates gold at the margin of a composite grain of pyrite and quartz. A gold particle, .003 x .003mm., has been observed at the margin of an inclusion of pyrrhotite in pyrite, while fig. 6* illustrates a minute inclusion of gold, .003 x .002mm., in an inclusion of pyrrhotite in arsenopyrite.

5. *Calcine Residues.*—Very little sulphide persists in the calcined product, and such particles as can be found occur as inclusions in particles of gangue. No gold has been observed in the prepared section. There occur, however, numerous particles of iron oxide, which are more or less pseudomorphous after the particles of sulphide.

If a particle of pyrite, such as illustrated in fig. 4,* is converted by roasting into a solid particle of iron oxide, it is obvious that the included particle of gold will not be exposed. Unless such particles are disintegrated by the oxidation, the included gold will not be recoverable by cyanidation.

The silver-bearing mineral in the ore has not been recognised.

Fig. 1.*—Drill Core. Gold particles situated on the margin of a particle of pyrrhotite embedded in quartz. Mag. 450. The white squares illustrate the relative size of a 200-mesh I.M.M. Screen.

Fig. 2.*—Gold particle in flotation concentrate, isolated from sulphides. It appears on the surface of the section as two areas isolated in the mounting medium. Other grains in the field are pyrite. Mag. 370.

Fig. 3.*—Gold particles in flotation concentrate. A particle of pyrrhotite is attached to the left side of the gold. Mag. 700.

Fig. 4.*—Particle of pyrite in flotation concentrate containing a minute inclusion of gold. Mag. 500.

Fig. 5.*—Composite grain with dotted outline of quartz and pyrite in the flotation concentrate. Gold is included in the marginal part of pyrite. Mag. 370.

Fig. 6.*—Minute particle of gold in an inclusion of pyrrhotite in arsenopyrite. Flotation concentrates. Mag. 700.

(Signed) FRANK L. STILLWELL.

APPENDIX C.

DESCRIPTION OF SAMPLE.

Approximately 50 lbs. of roasted concentrates were received and analysis of a typical sample of the material gave the following results:—

Analysis.†

		%
Silica	(SiO_2)	30·60
Alumina	(Al_2O_3)	2·50
Titania	(TiO_2)	0·11
Manganous oxide	(MnO)	0·10
Lime	(CaO)	4·26
Magnesia	(MgO)	2·24
Soda	(Na_2O)	0·08
Potash	(K_2O)	0·14
Water < 105° C.	(H_2O)	0·61
Water > 105° C.	(H_2O)	0·59
Carbon dioxide	(CO_2)	1·10
Total sulphur	(S)	2·03
Sulphur trioxide	(SO_3)	4·35
Sulphide sulphur	(S)	0·29
Total iron	(Fe)	36·00
Ferrous oxide	(FeO)	0·71
Total copper	(Cu)	0·37
Ammonia-soluble copper	(Cu)	0·09
Total arsenic	(As)	0·50
Total oxidised arsenic	(As as As_2O_3, As_2O_5)	0·22
Arsenious oxide	(As_2O_3)	0·17
Cobalt	(Co)	0·022
Zinc	(Zn)	0·45
Carbon	(C)	0·70

Assays.

The average head values of the small samples used in tests were as follows:—

Gold (Au)—91.50 dwts. per short ton of ore.
Silver (Ag)—37.96 dwts. per short ton of ore.

* Figures not available. (R.S.M.)

† Analysis carried out by the Imperial Chemical Industries.

MINERALS PRESENT.

Sulphide.—The material received contains a small amount of sulphides and examination of a flotation concentrate indicated that the principal sulphide was arsenopyrite; pyrite was also identified.

Carbon.—Carbonaceous material is present in the sample.

Gold.—Some free gold is present, mostly as fine grains and flakes. On examination, some of the particles were noted to be partly coated with iron oxides, but in no case was the coating such that difficulty might be expected in extracting this gold.

Silver.—A small amount of silver appears to be associated with gold as bullion, but from the results of tests it is considered that the majority of the silver content bears little or no relation to the gold content.

LANCEFIELD GROUP.

REPORT ON "BERIA MAIN LODE," G.M.L. 2216T, MT. MARGARET GOLDFIELD.

(K. R. Miles, B.Sc. (Hons.).)

This G.M.L. is situated just south of the Lancefield leases (see plan accompanying Lancefield report). The ore-bodies here consist of three approximately parallel lodes in an area of finely schistose greenstone and talc schist, with lenses of a dense greenstone which weathers to fine clay. This country appears to be in all respects similar to the footwall country of the main Lancefield lode. In marked contrast to the Lancefield lode, however, the lodes and country here strike approximately N. 30°—40° W. and dip 50°—60° N.E. with local variations due to minor folding.

The lode material consists of mineralised schist, which may or may not contain stringers of ferruginous quartz. The distribution of values in the lode appears to be somewhat sporadic, but for the most part the lodes are confined to definite bands in the schist. Here and there the lodes pinch and make, reaching a maximum width of about 14 feet, under the control of a number of minor dragfolds which have a fairly steep northerly pitch.

At the time of inspection (November, 1937), the East Lode was the only one being worked, there being two accessible shafts (shafts A and B). The Middle Lode is no longer accessible, while no work has been done on the West Lode for the last five or six years.

The East Lode has been opened up to 110 feet, V.D., with levels at 70 feet and 102 feet. The tortuous nature of these drives clearly shows the change in strike of the lode due to the dragfolding. Towards the centre of the lode stoping has been carried on from both the 70ft. and 102ft. levels, and here the lode has an average width of about nine feet. In the upper level the stope rises for 18 feet over a length of 45 feet. The faces at the north-western ends of the 102ft. level and of a small drive at 90 feet, have passed through the nose of a small dragfold which is pitching in the direction N. 50° E. at an angle of 40 degrees. Values are reported to occur in a narrow band about one foot wide on the western side of the drives but not in the faces. To follow the lode the drive should be continued at about 45° west of its present direction.

The water level in the East Lode varies from 102 feet at the south-eastern end (shaft B), to 110 feet at the north-western extremity.