

1907.  
—  
WESTERN AUSTRALIA.

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ANNUAL  
  
PROGRESS REPORT  
  
OF THE  
  
GEOLOGICAL SURVEY  
  
FOR THE YEAR  
  
1906.

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PERTH:  
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1907.



TABLE OF CONTENTS.

Title.	Page
Table of Contents ... ..	3
Administrative Report ... ..	5
The Staff ... ..	5
Fieldwork ... ..	5
Laboratory Work ... ..	6
Geological Collection ... ..	7
Publications ... ..	7
Palæontological Work ... ..	7
Principal Results of the Year's Field Operations ... ..	7
Mineral Resources ... ..	7
State Aid towards the Development of the North End of the Kalgoorlie Goldfield ... ..	7
Mineral Discoveries at Narlarla, in the West Kimberley District ... ..	11
Cue, Day Dawn, and Cuddingwarra ... ..	13
Barrambie and Errol's ... ..	15
Lawlers, Mount Sir Samuel, Mount Ida, Darlôt, and Wilson's Patch ... ..	17
The Saxon Lead Mine, Northampton ... ..	20
Wagin ... ..	21
Arrino and Yandanooka ... ..	23
Clay Deposits of the Clackline District ... ..	24
Beverley District ... ..	25
Miscellaneous Mineral Notes ... ..	28
Index to Names of Places, Mines, Reefs, etc. ... ..	31



• **Prevalence** = the proportion of a population that has a disease at a particular point in time



## *Annual Progress Report of the Geological Survey for the Year 1906.*

### *The Under Secretary for Mines.*

Geological Survey Office,  
Perth, 13th February, 1907.

SIR,

In conformity with the usual practice, I have the honour to submit for the information of the Hon. the Minister for Mines a succinct account of the operations of the Geological Survey for the calendar year 1906.

This account, which contains a statement of the work carried out by the various members of the staff both in the office, the museum, the laboratory, and the field, has been arranged on approximately the same lines and sequence as that hitherto adopted.

In addition to what may be called the ordinary work of the staff, 127 special reports bearing on the alienation of mineral lands, and 21 in connection with the granting of State aid under the provisions of the Mining Development Act were made, as well as six special reports relating to Mining on Private Property, under the provisions of "The Mining Act of 1904."

#### THE STAFF.

The operations of the Department have been carried out during the year under review by 14 officers.

Recent experience having demonstrated that the strength of the staff is hardly capable of efficiently meeting the requirements of the day, it is to be hoped that adequate provision will ultimately be made to overcome this, and that, in the event of the exigencies of the Treasury admitting of any additional appointments being made, such salaries will be offered as will enable the Government to secure and retain the services of highly qualified officers.

The only change in the *personnel* of the staff during the year was the resignation of Mr. C. C. Williams, Laboratory Assistant, which took effect from the 30th of April, but his position having been temporarily regraded, he rejoined the Department on the 26th of September.

It was found necessary to temporarily enlist the services of Dr. F. S. Earp from the 1st of March to the 31st of August, and Mr. A. Farrant from the 1st to the 30th of September, in order to assist in some special investigations carried out in the Laboratory. The salary of Dr. Earp, however, was paid by the Department in whose interest the special work was carried out.

#### FIELD WORK.

The field work of 1906 has been distributed over various portions of the State as exigencies of the public requirements demanded.

A GIBB MAITLAND. The Administrative duties of my office prevented me devoting very much time during the year in the field. A short visit was paid to Kalgoorlie between the 22nd of June and the 11th of July, in connection with proposals to grant State Aid under the terms of the Mining Development Act, and another to Albany, between the 3rd and the 15th of October, in connection with the reputed occurrence of oil in the harbour. Altogether 34 days were spent by myself in field work.

H. P. WOODWARD.—In the early part of the year this officer's time was occupied upon the compilation of his report and plan of the Menzies District, which also included two special reports for subsidies, one for the Queensland Menzies and one for the Menzies Crusoe Gold Mines. He also visited the Wagin District between March 24th and 28th, with the object of reporting upon recent gold discoveries. The month of April was occupied with various office matters and minor reports and upon the preparation of plans, etc., for the proposed Murchison field work. From 3rd May until 19th June he was engaged upon mapping and examining the Cue District. This work included a special report for subsidy upon the Cue No. 1 mine. Mr. Woodward was then recalled to Perth in order that he might proceed to Kimberley to make a report upon the Narlarla Hills, for which place he left Perth on 26th June, returning upon 23rd August. A few days were then spent upon the preparation of a report, when he again returned to the Murchison Goldfield on 7th September. Whilst there he completed his examination of the Day Dawn and Cuddingwarra districts and also made a flying trip out to Barrambie and Errols; he also made a special report for subsidy upon the Caledonia Hill mine at Cue. On his return journey to Perth he examined the Saxon Lead mine in the Northampton district to report upon the application to have this brought under the Mining on Private Property Act. He arrived in Perth on 8th November, when he prepared a short report upon his field work and made arrangements for starting for Onslow, for which port he left upon 22nd November for the purpose of defining the artesian area between that place and Carnarvon, and was engaged thereon at the close of 1906. During the year, this officer has been 210 days in the field.

W. D. CAMPBELL. This officer made in all nine trips in the field during 1906. These included visits to Beverley, the Dale River and Wagin regarding the occurrence of auriferous deposits; to the Greenough River in connection with the question of the



occurrence of coal in the vicinity; to Dandarraga examining phosphate deposits. Visits of more or less short duration were paid to Clackline, and the neighbourhood of Perth. The remainder of the year was devoted to those multifarious office duties which the various matters dealt with by the Geological Staff entail. This officer spent 92 days in the field.

CHAS. G. GIBSON. This officer spent the greater portion of his season's field work in the East Murchison and Mt. Margaret Goldfields. Between 1st February and 3rd March Mr. Gibson was engaged reporting upon the Whim Creek Copper Mine in the West Pilbara Goldfield. From the 1st of June until the 31st of October was devoted to a more or less detailed examination of the East Murchison and Mount Margaret Goldfields. The balance of the year, except that from the 22nd of November until the 31st of December, when Mr. Gibson was absent on leave, was spent in the preparation of reports and maps bearing upon the field work on which he had been engaged. This officer spent 183 days in the field.

H. W. B. TALBOT. Between the 23rd of April and the 17th of September this officer was engaged

at Cue, Day Dawn, and Cuddingwarra on field work in connection with the detailed Geological Survey of those centres, then in progress. Between the 1st of October and the 2nd of November found him on the Coolgardie Goldfield engaged upon the prosecution of certain preliminary field work in connection with a proposed geological examination of Bonnievale, Kintore, Carbine, Carnage, and Cashman's. The remaining portion of the year was devoted to writing reports, the compilation of mining statistics, the preparation of plans, and assisting in the arrangement of the Government Mineral Exhibit at the Exhibition held under the auspices of the Western Australian Chamber of Manufactures. During the year Mr. Talbot was engaged in the field for 183 days.

#### LABORATORY WORK.

As usual, the work in the Survey Laboratory has been under the control of Mr. E. S. Simpson.

The following table shows a detailed statement of the work carried out during the period covered by this report:—

*Table showing details of Assays, etc., made in the Geological Survey Laboratory during 1906.*

Classification.	Public.		Official.		Total.
	Pay.	Free.	Geological Survey.	Other Departments.	
Total Samples dealt with.	184.	570.	154.	210.	1,118.
Assays for Platinum ... ..	...	1	...	...	1
"  Gold ... ..	135	311	62	78	586
"  Silver ... ..	7	112	3	13	140
"  Mercury ... ..	...	3	...	...	3
"  Copper ... ..	21	68	10	14	113
"  Tin ... ..	5	55	4	1	65
"  Lead ... ..	3	29	6	...	38
"  Zinc ... ..	...	3	6	...	9
"  Nickel ... ..	...	1	1	...	2
"  Cobalt ... ..	...	...	1	...	1
"  Iron ... ..	1	4	...	1	6
"  Manganese ... ..	...	1	...	...	1
"  Chromium ... ..	...	2	...	...	2
"  Tungsten ... ..	...	3	...	...	3
"  Tantalum ... ..	8	12	...	...	20
"  Niobium ... ..	8	12	...	...	20
"  Molybdenum ... ..	...	1	...	...	1
"  Tellurium ... ..	...	1	...	...	1
"  Arsenic ... ..	...	1	...	...	1
"  Phosphorus ... ..	...	11	11	2	24
"  Radium ... ..	...	1	...	...	1
Analyses Complete ... ..	2	4	14	76	96
"  Proximate ... ..	1	9	7	2	19
"  Partial ... ..	...	7	2	23	32
Determination of Rocks and Minerals ... ..	10	180	49	56	295
Miscellaneous ... ..	4	10	8	8	30
Totals ... ..	205	842	189	274	1,510

In reporting upon the work done in this branch of the Survey's operations, Mr. Simpson informs me:—

"On comparing these figures with those for previous years it will be seen that a record has been established, the total number of samples and estimations exceeding those for 1905 by about 25 per cent. and equalling the combined totals for the two years 1903 and 1904. This is due in a large measure to a revival in prospecting brought about by the phenomenal rise in the price of almost all metals

during the past eighteen months. This rise is shown by the following figures:—

	Price 30-6-05.	Price 21-12-06.
Copper, standard, ton ...	£65 16 9	£106 15 0
Tin ...	142 0 0	197 10 0
Lead, soft ...	13 6 0	19 18 3
Zinc ...	24 5 0	28 10 0
Antimony ...	52 10 0	107 10 0
Nickel (98-99%), ...	165 0 0	185 0 0
Aluminium (98-99%), lb.	0 1 4	0 2 1
Silver, standard, oz.	0 2 2½	0 2 8½

"It was found impossible to deal with this volume of work with the ordinary staff of the laboratory,



and temporary additions were made to the staff from time to time.

"The assay fees received during the year amounted to £149 14s. 6d.

"A collection of minerals, illustrative of the mineral resources of the State, was prepared and exhibited at the Exhibition of the Perth Chamber of Manufactures which opened on 5th December. In view of the frequent necessity for advertising the mineral wealth of the State in this way, it is highly desirable that efforts should be made to get together a floating collection of minerals which would be available for exhibition in any part of the world as required."

It will thus be seen that a very large portion of the time of the Laboratory staff has been taken up with what may be called work of a purely routine nature, and that very little opportunity has been left for devoting any time to those important mineralogical, petrographical, and other questions which have arisen in the course of the field work.

The time has now arrived when either some additions to, or rearrangements in, the Staff of the Department must be made to enable these very necessary duties to be carried out, if the work of the Survey is to maintain its efficiency.

#### GEOLOGICAL COLLECTION.

In consequence of the large amount of routine work in the laboratory, it has been found impossible for much attention to be devoted to the arrangement of the Museum during the year.

There have been added 524 new specimens to the Survey Collection during 1906, thus bringing the total number up to 7,096; of microscopic slides there have been made 99, making a total of 719 entered in the register. The various members of the staff have taken 37 negatives of different subjects in connection with their work, and many of them have been used in illustration of the official reports, or enlarged for use in the Museum. The total registered number of negatives of geological and cognate subjects now amounts to 290.

#### PUBLICATIONS.

The following is a list of the different publications prepared by the Geological Survey during the past year:—

Annual Progress Report for the year 1905.

The Geology and Mineral Resources of the Norseman District, Dundas Goldfield: by W. D. Campbell.

The Auriferous Deposits and Mines of Menzies, North Coolgardie Goldfield: by H. P. Woodward.

Third Report on the Geological Features and Mineral Resources of the Pilbara Goldfield: by A. Gibb Maitland.

The Laverton, Burtville, and Erlistoun Auriferous Belt: by Chas. G. Gibson.

The Prospects of obtaining Artesian Water in the Kimberley District: by R. Logan Jack, L.L.D., F.G.S., F.R.G.S.

The Library of the Department contains 2,596 volumes devoted to works on Geology, Mineralogy, and cognate subjects; of these 2,259 were received as donations from the various Geological

Surveys, and Mining Departments, throughout the World, and 337 have been acquired by purchase. There have been received in addition 1,294 maps presented by the Geological Surveys of Great Britain and Ireland, Canada, Cape of Good Hope, Transvaal, British Guiana, Russia, Sweden, Austria, Java, Philippine Islands, and Japan. Many of these publications, some of which cannot be replaced, are unbound, and it is hoped that an early opportunity will be taken of having this done for the double purpose of facilitating their preservation and ready reference. The Library continues to be, as it has always been, available for consultation by those desiring any information having a geological bearing.

#### PALAEONTOLOGICAL WORK.

Mr. R. Etheridge, of the Australian Museum, Sydney, continues to act in an honorary capacity as Palaeontologist to the Department, and during the year several consignments of fossils have been despatched to him for determination and description.

Mr. F. Chapman, the Palaeontologist to the National Museum, Melbourne, has submitted "Some Notes on Fossils from the Collie Coalfield" in the collection of the National Museum, Melbourne, which are about to be printed, with other matter from Messrs. Etheridge and Howchin, in bulletin form.

The fossils to which Mr. Chapman's report refers were forwarded to Melbourne by the then Premier of Western Australia in the year 1898; they were however not collected by, nor were they ever seen by any member of the Western Australian Geological Staff. Mr. Chapman recognised the plants:—*Glossopteris browniana*; *G. browniana*, var. *indica*; *G. browniana*, var. *communis*; *G. browniana*, var. *angustifolia*, and *G. gangamopteroides* in the associated sandstones, the following Foraminifera:—*Endothyra* sp., *Valvulina plicata*, *Bulimina* sp., *Truncatulina haidingeri*, and *Pulvinulina exigua*.

Mr. Chapman's observations, in conjunction with those of Mr. R. Etheridge, jun., referred to on page 6 of the Annual Progress Report for 1903, corroborates the view of the late Mr. R. Etheridge that the Collie River Beds are of Permo-Carboniferous Age. In view of all the evidence at present to be deduced from the plant remains and the marine organisms in the beds associated with the Collie Coal Seams—despite the nature of the coal and the physical characteristics of the basin, it seems that a Permo-Carboniferous Age for the series presents very strong claims to acceptance.

#### PRINCIPAL RESULTS OF THE YEAR'S FIELD OPERATIONS.

##### MINERAL RESOURCES.

*State Aid towards the Development of the North End of the Kalgoorlie Goldfield.*—In the month of August, I submitted the following report upon the question of the development of the North End of the Kalgoorlie Goldfield by State Aid. The various properties to which allusion is made may be found by reference to the 10-chain Geological Map of Kalgoorlie issued in 1902.

In March the following notice was inserted in the *Kalgoorlie Miner*, by Authority:—

"It is hereby notified, for general information, that applications will be received at the Department of Mines, Perth, until 14th of April, from any persons



or companies holding G.M. Leases at the Northern end of the 'Boulder Belt,' who desire to obtain assistance under 'The Mining Development Act, 1902,' for prospecting and developing their holdings. The particulars required by Section 6 of the Mining Development Act must accompany each application.

"H. S. KING,  
"Secretary for Mines.

"Perth, 9th March, 1906."

In response to this, nine applications were received, viz.:—

- (a) Hannan's Hope, 4046E and 4157E.
- (b) Hird's Lease, 3991E.
- (c) Sarnian, 4115E.
- (d) Treasurer, 4147E.
- (e) Lucknow, 4103E.
- (f) Hannans Reward North, 1228E and 796E.
- (g) Devon Consols South Extended, 4037E.
- (h) Ivy Gold Mine, 3965E.
- (i) Criterion, 4057E.

The application from the Hannans Reward North has been withdrawn.

With one exception (The Criterion) none of the applications are accompanied by the statutory declaration which the Mines Development Act requires; this omission being probably due to the applicants not being quite familiar with the requirements of the Act.

An inspection of the Geological Map of Kalgoorlie shows (and the work done since it was prepared bears this out) that lodes lines traverse the whole of the North end of the field, though the results have indicated that they are not of that size or value which characterises the lodes of the Southern end of the belt.

The position of the properties held by the various applicants for State aid have been indicated by a red colour on the excerpt from the Geological map attached.

I am of opinion that the guiding principle in the granting of State aid towards the development of such a field as Kalgoorlie should be in the direction of the acquisition of information which would be of general benefit to the community at large, rather than indiscriminate assistance to struggling prospectors, no matter how deserving of encouragement, for claims of this latter nature bulk very largely amongst those soliciting aid from the public purse.

The proving of the existence of lodes at much greater depths than has hitherto been done at the Northern extremity of Kalgoorlie, if successful, would in my opinion tend to encourage deeper sinking elsewhere in this portion of the district, and may be held to warrant the expenditure necessary to subsidise the applicant whose property seems to present reasonable prospects of success.

Having this in view, the applications may be narrowed down to the following:—

- (a) Devon Consols South Extended, 4037E.  
(North End Gold Mine).
- (b) Hird's Lease, 3991E.
- (c) Criterion, 4057E.

The North End Gold Mining Company owning the Devon Consols South Extended G.M.Ls. have opened up one of the easternmost lodes on the field,

and a rich shoot has been opened out at a vertical depth of about 230 feet below the surface.

The Hird's Lease property has had a good deal of work done upon it, but despite this not much gold has been won. The owner proposes to crosscut westwards from the bottom of the main shaft at a depth of 370 feet. To do so would, as may be seen by the geological map, test the country lying between the Hidden Secret Lode and the Isabel-Etraweenie Lode.

The Criterion Company's ground is somewhat favourably situated for intersecting the north-west extension of the Hidden Secret Lode if not interrupted by faults. The deepest shaft however has only been carried down to a vertical depth of 160 feet.

Assistance being granted, it should in my opinion be given to owners of mines to enable them to go deeper and should be exclusively devoted to sinking, driving, crosscutting, or boring, *at greater depths than have hitherto been attained*; for every shaft sunk, level driven, etc., may be held to be, in a sense, a national asset, which the purchase of machinery for development purposes is not.

Whilst there are undoubtedly strong points in favour of the claims of the owners of the Criterion Lease, and Hird's Lease, I am of opinion that, that of the North End Gold Mining Company presents, *ceteris paribus*, the greatest possibilities of success.

*I therefore recommend that State aid be granted to the North End Gold Mining Company for the purpose of carrying the main shaft down to a vertical depth of 400 feet and crosscutting or boring west to pick up the main lode, and if necessary driving thereon at that depth, provided the statements in their application are supported by the statutory declaration as required by the Act, and that the mine has been worked to the satisfaction of the local inspector.*

The following is a description of the workings, etc., in the different properties:—

- (a) HANNAN'S HOPE G.M.L.'s 4046E AND 4157E.

Mr. Thomas Thompson applied for assistance to further develop his mine. On visiting the property (after communicating with the applicant) I learned that he had abandoned the property and had left the district.

None of the workings were accessible.

- (b) HIRD'S LEASE, G.M.L. 3991E.

There has been a good deal of work done upon this property since it was first taken up. There are five shafts, which have been sunk to varying depths, varying from 70 to 374 feet.

The main shaft which is near the centre of the lease, sunk by former owners of the lease, has levels driven at 100, 160, 220, 300, and 360 feet; there are however no mining plans, hence an intelligible description of the workings cannot be given.

It is proposed crosscutting in a westerly direction from the bottom of the main shaft.

This property is reported to have yielded 391.16 ozs. of gold, obtained by milling 253.50 tons of ore, or at the rate of about 1.5 ozs. per ton.

- (c) SARNIAN, G.M.L. 4115E.

This property is traversed by a well-defined quartz reef, trending generally north and south and underlying at a high angle to the east, which has been



exploited by means of a vertical shaft 100 feet deep, sunk on the west side of the outcrop.

Work however has been concentrated upon a deep shaft situated near the eastern portion of the lease, about 30 feet west from the boundary between it and 4043E.

This shaft, which was inaccessible to me, had been carried down to a depth of 164 feet, and it is proposed to continue it a further distance of 100 feet, with the object of intersecting the lode worked in the adjoining lease 4043E, a sketch of which is shown on page 10, Mines file 3075/04.

From the data at my command, it does not however appear likely that this lode can possibly be the same as that in the Hidden Secret, which lies further to the east.

This application has been fully reported upon by Mr. Inspector Lightly, and the applicant informed accordingly.

(d) TREASURER, G.M.L. 417E.

Mr. Inspector Hudson reports (30-7-06) that "the main shaft is 12ft. by 4ft., and is 150 feet in depth; at 100 feet a drive south-east for a distance of 100 feet, 64 feet of the drive is in lode formation carrying values of 2 to 3 dwts. per ton.

"One hundred and fifty foot level, crosscut north-east distance 165 feet, the present holders have driven 145 feet of the crosscut. The lode at the 100 feet level was driven through but the values were nil. This crosscut is now being extended, and the last 40 feet has been in hard mineralised greenstone of no value. It is the intention of the holders to extend the crosscut with a view of cutting a supposed lode to the east, they estimate that it will be necessary to drive 40 feet to cut it, which would cost about £5 per foot. This lease is north of the Great Northern which has just completed a subsidy of £200 without anything payable being located. There is no machinery on the lease. The work for which the subsidy is required can only be classed as a prospecting venture."

(e) LUCKNOW, G.M.L. 4103E.

The Secretary, Mr. W. H. Fisher, applies for assistance in developing the lease. It is proposed, in the event of assistance being granted, to open out and drive on the lode at the 160 feet level in No. 3 shaft, and also to pump the water in a winze in No. 1 shaft and exploit a large sulphide lode said to exist there.

A well-defined belt of graphitic schist traverses the western portion of the lease in a general north-west and south-east direction and forms an important structural feature.

There are three shafts upon the lease.

The main shaft, No. 1 (or the black dump shaft) sunk to a depth of about 214 feet, vertically below the surface.

At 100 feet in this shaft, a crosscut has been carried north-eastwards and intersects No. 2 shaft.

In the main shaft and about 20 feet therefrom is a short drive put in on a lode trending north-west and south-east.

The "lode" which has only been followed for a short distance is of the banded ferruginous type, and at the face of the south-east end of the drive is about 3ft. 6in. thick. The long crosscut which

connects the two shafts has been continued for a distance of about 300 feet in a north-east direction from the No. 2 shaft. The rock exposed is of the usual decomposed (Kaolinic?) type with here and there a few insignificant quartz leaders. At one spot in the crosscut, a small ironstone vein has been opened up and is said to have assayed on careful sampling about 11 dwts. per ton.

At the 200 foot level and at the foot of the main shaft is a black graphitic schist, with small irregular veins and pellets of pyrites; the footwall of this vein is a thin hard hematitic band. The graphitic schist is at the foot of the shaft 12 feet in thickness, and dips east at a high angle.

In the eastern crosscut from the shaft and about 50 feet from it is a winze now full of water, and said to be 112 feet in depth, it is inaccessible in consequence.

This crosscut has been continued eastward from the winze, through country rock for a considerable distance and ends in a band of quartzite (?) of as yet unknown thickness.

The owners of the property propose to use any subsidy to pump the water from the winze and exploit the large sulphide lode (?) said to occur therein. Obviously to work the lode (?) it will be necessary to deepen the main shaft.

No. 3 Shaft which lies some distance north of No. 1 has been carried down to a vertical depth of 160 feet. At a depth of 50 feet, a crosscut has been put in for a distance of 18 feet to the south-east, through a band of ironstone of the type prevailing on the field, and 20 feet to the north-west.

From this point a drive has been put in for a considerable distance along a band of sheared or cleaved country rock, and thence a short crosscut in the direction of the shaft, with the object of exploring the country but without any success.

At a depth of 100 feet, a crosscut has been driven 45 feet to the east and drives north and south, of about 65 feet respectively. The crosscut has been carried through bands of ferruginous quartz (?) which are asserted to be appreciably auriferous.

At a vertical depth of 150 feet, the lode is to the east of the shaft, and is about 7 feet thick; this has been followed for about 20 or 30 feet northwards.

It is proposed to exploit this lode with the aid of any subsidy which may be granted.

A good deal of dry-blowing has been carried out over the surface of the lease with apparently good results.

Up to the end of 1905, this lease has yielded 88.40 ozs. of gold from the milling of 341.50 tons of quartz, or at the rate of .259 ozs. per ton.

(f) HANNANS REWARD NORTH, G.M.L's 1228E. 796E.

This application has been dealt with in its proper file.

(g) DEVON CONSOLS SOUTH EXTENDED, G.M.L. 4037E (The North End Gold Mines, Ltd.).

This is one of the easternmost leases, upon which any active work is going on, at the North end of Kalgoorlie.



Mining operations have been carried out upon a well-defined lode which has a trend approximately parallel to that of the main lode system of Kalgoorlie.

The lode has been worked from the surface to a vertical depth of about 230 feet, and one of the levels, No. 2, has been driven for about 500 feet.

At No. 1 level, the lode lies about 30 feet east of the main shaft; at No. 2 about 12 feet and at the bottom of the shaft (V.D. 234 feet), it is 18 feet to the west.

A well-defined and apparently rich lode, about 6 or 7 feet in thickness, has been met with in No. 1 winze below the floor of No. 2 level. This lens of good ore had been opened up to a depth of about 45 feet and about 40 feet in length.

A level was being driven from the crosscut at the bottom of the shaft to intersect the shoot at a greater depth and so far as operations had been carried, the assays as shown by the Assay Register at the mine showed that the ore was of good value.

From information which was supplied to me at my request, it appears that about 690 tons of ore have been taken from this lens of an average assay value of 1 oz. 12 dwts. per ton.

Owing to the ore from this lens having been milled along with that from No. 1 level, which is considerably lower value, it is not possible to arrive at the actual quantity of gold won.

So far as can be ascertained from the official figures, it appears that this lode yielded:—

Year.	Tons.	Ozs.	Rate per ton.
1904 ... ..	970	688.19	ozs. .71
1905 ... ..	1,281	712.57	.55
1906 ... ..	4,651	1,847.04	.38
Total ... ..	6,902	3,247.80	.47

(h) IVY, G.M.L. 3965E.

Messrs. Frank Smith, Robert Bradshaw and party, the owners of Prospecting Area 111E (18 acres), included within the boundaries of G.M.L.'s 3965E and 3966E, are applicants for a subsidy.

At the date of the application (March) the shaft, which is situated on the west side of the Railway Line, and not far from it, had been carried down to a depth of 190 feet, and it is contemplated continuing it down to 200 feet. A little gold was discovered on the surface by the present applicants, which resulted in their sinking the shaft on the present site.

An inspection of the Geological map of the north end of the Kalgoorlie field, which is attached, indicates that the site of the shaft put down by the applicants lies along, or in close proximity to, what may be called the Main Devon Consols and Kapai Lode.

At 50 feet from the surface, a crosscut 34 feet in length has been put in in a direction of north 30 degrees east, through decomposed country rock; at the face is a thin ferruginous band, striking at right angles to the general trend of the crosscut, and underlying to the north-east. The country

rock in the crosscut is traversed by a few quartz leaders, which are said to be auriferous, though by no means payable. Another crosscut bearing south 30 degrees west, and distant about 30 feet, has been put in through similar country, but was inaccessible to me. At 100 feet, a drive had been put in for a distance of about 50 feet in a southerly direction. A well-defined slickensided face marks the lode and can be followed to the face, where however the lode lens appears to have almost disappeared; the average width of the lode at this level is about 5 feet. From this level fair prospects are said to have been obtained from the lode and a trial crushing at the Devon Consols Battery of 14 tons yielded 5.12 ozs. while later on 31 tons yielded 7.87 ozs.

At a depth of 190 feet, the lode was met with at a point 18 feet west from the shaft. So far as could be ascertained, the general trend of the lode is north 20 degrees west, with a very high underlay to the east. At the face of the north drive on the lode free gold was visible in the rubbly quartz which forms the lode, which at this point proved to be about 2 feet in thickness. The vein carrying the free gold occurred about the centre of the lode, and was intersected by an almost horizontal vein of quartz 2 to 3 inches in thickness, which was abruptly truncated at both walls of the lode, from which it appears that the latter is along a fault line. The lode has been followed about 18 feet south at this level, where at the face of the drive a well-defined quartz vein occurs on the footwall.

Adjoining the shaft sunk by Messrs. Smith, Bradshaw and party, a good deal of work had been done, in the way of shaft sinking, driving, crosscutting, and diamond drilling, but as these workings are inaccessible no description thereof can be obtained. It does not appear however that the results have been very satisfactory.

(j) CRITERION, G.M.L. 4052E.

The Criterion Lease lies some distance to the north of the Hidden Secret Lease and there seems good reason for the belief that what may be called the shatter zone of the Hidden Secret traverses the property.

There are two shafts upon the property but only upon one of them was any work being done. This shaft, No. 1, upon which operations are being concentrated is situated on the eastern portion of the ground.

The shaft attained a vertical depth of 160 feet; from the bottom of the shaft a crosscut has been put in for a distance of about 80 feet north-east. At a point in the crosscut, 30 feet distant from the shaft, is a fault (? lode) underlying to the west, and said to have assayed about 2½ dwts. per ton; and 9 ozs. 16 dwts. of silver. A commencement has been made with sinking a winze upon it.

From the winze, the crosscut has been carried through a belt of very much contorted and banded ironstone. At the surface is a band of 3 or 4 inches of a black pyritous quartz inclined at a high angle to the east; abutting against this is a band of graphitic schist of the usual type, the thickness of which however has not been ascertained.

It is proposed to deepen the shaft 50 feet and crosscut for the lode intersected in the crosscut.



# MINERAL DISCOVERIES AT NARLARLA, IN THE WEST KIMBERLEY DISTRICT.

In the month of August Mr. H. P. Woodward, the Assistant Government Geologist, submitted the following report:—

"In the early part of June this year considerable excitement was caused by the publication of a report by Mr. J. H. Grant, who was engaged by the Narlarla Hills Silver Lead Co. This company's shares had for some time previous been quoted on the market but until this report appeared in the Press it was not generally known that the properties were situated in this State.

"These properties consisted of the Narlarla Hills silver-lead leases, which are situated in the Napier Range, West Kimberley district (142 deg. 43 min. E. long., 17 deg. 16 min. S. lat.) 75 miles due east of Derby upon the south side of the Barker River Gorge at a point a little above that river's junction with the Leonard River, at Narlarla, or Marlarla by the native name; and Mondooma Copper leases situated about 30 miles north-west of the Narlarla blocks close to Trig. Station L 2 (124 deg. 28 min. E. long., 16 deg. 56 min. S. lat.) at the north end of the Napier Range and about 10 miles south-east of Old Mondooma Station upon the Robinson River.

"These leases had in the early part of the year been applied for by Mr. Poulton, the company's representative, who was one of the early settlers of this district and at one time owner of the Mondooma Station.

"These discoveries were by no means new since leases at both localities had been taken up by Mr. Pettigrew as far back as 1900 and 1901, but as developments did not turn out to his satisfaction they were abandoned.

"A good deal of confusion has been caused by the use of the name Narlarla Hills because this name does not appear upon the maps, neither is it known by the settlers whilst the name of Napier Range has been known and used upon all the State maps, for the last 25 years.

"The Napier Range, the rocks of which are crystalline limestone, was described in 1884 by the late Mr. E. T. Hardman, who was at that time Government Geologist, and are classed by him in conjunction with the overlying sandstones and shales as Lower Carboniferous. The rocks strike in a north-west and south-east direction whilst the individual beds dip at an angle of from 12 to 23 degrees to the south-west, the lower or basal beds consisting of limestone conglomerates containing fragments and boulders of the schistose and granitic rocks which underlies them unconformably.

"The range rises abruptly from the flat which lies to the westward to an altitude of from 200 to 400 feet, whilst both the Barker and Leonard Rivers have cut gorges through it, the latter known as the Wingrah Pass, being historic as the stronghold of the outlaw Pigeon.

"This range like most limestone hills is riddled by numerous caverns, some of which are of very considerable dimensions and have in the past been used by the natives as places of interment, but strange to say they are almost destitute of stalactites, and when these do occur they are of a dull grey colour.

"There are a number of fine springs along the base upon the western side of the range, some of which flow from caverns whilst others are met with at some little distance from the hills.

"The Narlarla blocks are situated on the top of the range upon the south side of the Barker gorge, the leases being pegged in a more or less north and south direction under the supposition that the lode followed that course.

"The ore deposits consist of two small parallel iron-stained blows of carbonate of lead about 20 chains apart whilst the limestone country between is found upon close examination to contain small stains of carbonate of copper here and there which apparently gave rise to the belief that the lode ran in a north and south direction.

"These blows upon development proved to be small veins of lead ore following the bedding of the rocks, the caps of which had fallen over, thus making a considerable surface show whilst the supposed width, viz. 40 or 50 feet is in reality the length of the vein beyond which no sign of a fissure can be traced.

"The south blow from which some high-grade ore was obtained at the surface is found upon sinking to pass into iron pyrites with little or no lead at a depth of 8 or 9 feet.

"The north blow is better defined, the vein apparently following the bedding of the limestone in a north-west and south-east direction with a dip of 23 degrees to the south-west. The ore in the lode cap is iron and copper stained carbonate of lead but this passes rapidly into the sulphides near the water level which is here strange to state only 19 feet below the surface although the river gorge which is close by is some 200 feet below. The lode at the water level is much more settled, there being one well-defined vein of galena about 2 feet in thickness, whilst the other portions carry a considerable quantity of zinc and iron pyrites.

"The lode contains a considerable quantity of calspar in places, some of which is of a brown colour, this is what was supposed to be scheelite.

"A number of other leases have been applied for but little or no work has been done upon them, some have been taken up on account of copper stains, some upon small lead outcrops, but mostly as position blocks.

"Although there are a good number of tons of very fair ore upon the surface of these leases, even with its silver contents it is not of sufficient value to pay the cost of mining, transport, and treatment, whilst the lodes themselves give no indication of continuity either horizontally or vertically, being in all probability nothing more or less than segregations deposited in fissures in the limestones which themselves apparently carry small quantities of metallic ores.

"The Napier Range terminates to the northward a little south of Trig. Station L 2, the limestone being replaced by mica schist and diorite dykes, which here strike nearly east and west, and it is at the contact of these latter rocks that a copper stained ferruginous reef can be traced for a distance at the surface of about 300 yards.

"The cap of this reef has been crosscut at three points in each trench, however the lode proves to be very small and to carry very little copper ore.



"Although a few tons of fair ore might be raised which would possibly pay expenses, the negative character of the developments are such as to prove beyond a doubt that the lode is of no value.

"As the outcome of the reported discoveries before referred to, further prospecting companies were formed, the most noticeable amongst these being Grant's North West Prospecting, the local representative of which, Mr. J. H. Grant, in July last reported certain fresh copper discoveries in the vicinity of Mt. Nellie. These he applied for as a reward claim and a number of leases on behalf of his company. He also applied for certain leases called the Mt. Nellie blocks, on behalf of the Narlarla Hills Silver Lead Company.

"Mt. Nellie is situated (124 deg. 3 min. E. long., 16 deg. 33 min. S. lat.) about 60 miles north-east of Derby and about 15 miles south-west of Collin Bay. It has been used as a locality name although the discoveries are situated at some distance from it owing to the fact that this tract of country is unsurveyed and therefore this is the nearest named hill. The Mineral discoveries are in reality situated some few miles east of Mt. Nellie upon the Little Taragee River, which is not shown upon the map, although it is of considerable size.

"The mineral belt which is schist and slate intersected by quartz reefs and diorite dykes extends in a north-westerly direction from Mondooma upon the Robinson River to Mt. Nellie, where it is overlaid by a flat-topped quartzite range from beneath which it again appears to the northward and apparently extends in the same direction towards Yampi Sound.

"In this schist belt to the northward of the Taragee River and extending up to the base of the quartz range, there are a series of dyke-like mineralised quartzose ridges, containing quartz veins usually much copper stained. These ridges which are generally of considerable length have the appearance of being fissure lines which have allowed the flow of the mineral solutions that have altered and silicified the adjoining schistose rocks.

"These dyke-like lines are intersected by numerous quartz veins or lodes some of which are of considerable size and length being usually copper stained whilst they sometimes contain copper ore either in veins, bunches, or disseminated through the quartz itself.

"Numerous leases have been pegged out of which Grant's Reward is one of the most promising, this is situated at the extreme north end of the mineral belt close to the quartzite range. The lode mass rises in the form of a razor-back up to a height of 100 feet above the adjoining flat, its base being about 50 feet in width whilst it can be traced for a distance of over  $1\frac{1}{4}$  miles in length. In this there are three distinct quartz veins or shoots, the central one which is the largest being seven chains in length and varies from 2 up to 17 feet in width at the surface.

"The ore, which is mostly green carbonate with a little red oxide, is met with at one or two points in the form of small veins or bunches of high-grade ore, but it generally occurs intimately intermixed with quartz, when it varies from a low-grade siliceous ore to stained quartz.

"Since the outcrop must have been subjected to considerable leaching action, in its present unde-

veloped state it is absolutely impossible to form anything like an estimate of the value of the lode but this, owing to its character, can be quickly and cheaply proved by crosscutting by means of drives from the adjoining flat which will not only demonstrate its character in the solid ground but will prove its richness at points varying from 50 to 80 feet below the outcrop and so near the water level that it is quite possible that sulphides will be met with.

"There are a number of similar lode masses in this locality but so far these possess no further indications than copper stains, they therefore are apparently of no value and are not worth expending money upon unless Grant's Reward proves when developed that this class of lode improves with depth.

"Upon the north side of the Taragee River and about six miles south of Grant's Reward and the same distance north of Boulder Hill, Mr. R. Wilson has pegged out some leases upon a series of broken ridges which are very similar in character to those previously mentioned, the copper ore however is generally of a higher grade and is in more concentrated condition but the individual portions of the lode which carry the ore are not so extensive either in length or breadth.

"Upon the northern block, a series of small but rich veins of ore occur, which apparently cross the quartz lode at an angle, whilst upon the southern blocks the veins run parallel with the quartz. These ore bodies cannot be so cheaply tested as Grant's since the portions of greatest enrichment are not met with at points where the lode attains any considerable elevation, and therefore sinking will be necessary.

"The examination of this district has demonstrated that a highly promising mineral belt extends for a distance of 40 miles in a north-westerly direction from Mondooma upon the Robinson River to Mt. Nellie on the quartzite range, and since the schists outcrop again to the northward of that range it will probably be found to continue further.

"At the south end of this belt to the westward of Mondooma, the slatey country is intersected by numerous parallel quartz reefs of considerable length and of a very promising appearance. This tract of country should be well worthy of the attention of prospectors.

"Mt. Broome diggings situated at the foot of the Leopold Range at the head of the Richenda River was also visited, but although this area has been worked off and on for a number of years, only comparatively small quantities of gold have been obtained, whilst owing to the fact that there are no quartz reefs, dykes, or lodes it is not probable that any great discovery will be made in this locality.

"In conclusion it may be stated that although a very promising belt of mineral country exists it would not be advisable for prospectors to undertake its examination unless a strong party with ample funds, for not only may trouble be experienced with the natives but owing to the fact that large tracts of country are flooded in the wet season it will be necessary to have sufficient supplies to last over this uncertain period.

"It has been stated that a good road without engineering difficulties can be obtained to Secure



Bay, this there is good authority for stating is not a fact. Whilst owing to the bad nature of the surface even carting to the Robinson landing will be always expensive and quite impossible in the wet season, whilst the river below the landing is so full

of banks that a 4-ton boat can only attempt the passage twice a month on the spring tides."

The following are the results of assays of six samples from this district made in the Departmental Laboratory:—

Locality.			Class of Ore.			Copper.	Lead.	Zinc.	Silver per ton.			Gold per ton.
						per cent.	per cent.	per cent.	ozs.	dwt.	grs.	grs.
Narlarla North Shaft	...	...	Oxide	...	...	4.43	42.39	4.47	4	8	14	3
Do. do.	...	...	Sulphide	...	...	42	13.94	40.83	3	7	0	Nil
Do. South Shaft	...	...	Transition	...	...	52	39.66	1.34	5	1	6	Trace
Grant's Reward	...	...	Oxide	...	...	34.63	.72	?	0	4	22	20
Do.	...	...	do.	...	...	23.22	Nil	?	0	1	15	20
Wilson's Reward	...	...	do.	...	...	37.58	Nil	?	0	11	10	20

CUE, DAY DAWN, AND CUDDINGWARRA.

A more or less detailed Geological Survey of Cue, Day Dawn, and Cuddingwarra was carried out by Mr. H. P. Woodward, with the co-operation of the Field Assistant, Mr. Talbot. The following synopsis of the results of Mr. Woodward's observations was prepared on his return to Perth on the conclusion of the field work; a detailed report accompanied by explanatory mining plans and geological maps and sections is in course of preparation. In consequence of the exigencies of the service necessitating Mr. Woodward's presence in the Minilya River district, in connection with an important geological question affecting the water supply of the district, it has not been possible for him to proceed immediately with the preparation of his report on the Cue Survey; this delay, however, has not been without its uses, in that it has enabled good progress to be made with the drafting of several of the more important of the maps.

"Cue, which is the official centre of the Murchison Goldfield, is one of the oldest gold-mining centres in the southern portion of this State, and from it a very large quantity of both alluvial and reef gold has been obtained.

"In the early portion of 1890, it attracted considerable attention and a large number of properties were floated upon the London market, but owing largely to the heavy expenses that were necessarily incurred upon transport, etc., and to the fact that milling appliances were erected previous to development the expected returns were not forthcoming and as a consequence the greater part of the capital was withdrawn to be placed in the then booming Kalgoorlie district.

"The greater number of the mines are in practically the same condition as when abandoned some 10 years ago, but they are inaccessible owing to the fact that the workings are flooded and in most cases the shaft collars and logging have been removed. Masonry foundations indicate the positions of batteries and engines, etc., but sands resulting from the crushings have for the most part been removed to cyanide works or have been subsequently treated on the spot when the quantity warranted it. The mines being worked and those worked during the last ten years are for the most part privately owned, the stone being crushed at one of the Public Batteries. The only Company working at the present time is the Salisbury where an up-to-date mill has been erected which is employed solely upon the treatment of ore from that mine.

"The Cue area of reproductiveness is situated at the junction of the Grano-diorites (called granite) and the greenstones, the greater number of the mines being in the granite area.

"The reefs generally may be classed under two heads: first, those which radiate from the contact zone in a northerly direction into the granite, and secondly, those which follow the contact zone, having a more or less easterly and westerly course; these latter are met with on both sides of the junction and may be called parallel contact veins. The universal dip of the radiating series is to the westward, whilst the parallel contact series with one exception dip to the northward.

"The radiating series as a rule present well-defined outcrops which can be traced in some cases for a distance of a mile, whilst half a mile is quite common, but the parallel contacts are not individually of great extent although a series of lenticular veins may be so grouped as to present the appearance of one continuous fissure.

"Under the head of radiating reefs may be classed the Victoria, the Deceiver (Brilliant and Lily), the Belgravia, the Campania (Real MacKay), the Bonnie Dundee, the Welcome (New England and Maori), the Young Colonial (Maude), the Lady Mary (Lady Florence), the Cue No. 1 (Rising Sun), the Arcadia, the Salisbury, the Light of Asia, the Perseverance (Star of Asia and Three Crows), the Sarepta (New Bismark), the Duke of York (Great White Eye).\*

"Of these only three are being worked at the present time, viz.:—Cue No. 1, which is situated upon the northern boundary of the town, which mine is practically idle at present but a Government Subsidy has been granted the owners for driving southward at the 500 feet level in order to prove whether the reef, which produced a considerable quantity of gold, carries its values at depth.

"In this mine the zone of enrichment (? shoot) in the upper levels appeared to dip to the southward, which is quite exceptional in this district. The question therefore to be tested is whether or not a shoot does dip in this direction; if this should prove to be the case it will possibly throw a considerable light upon a class of ore deposits upon the field which have been looked upon as bunches without continuity in depth, therefore this work will be watched with very considerable interest.

"Upon the Salisbury, development work is being energetically carried on, the main shaft was now

\*Names in parentheses refer either to other leases upon the same or to names by which the individual mine has been called.



been connected with the lode at the 250 feet level and the reef driven on to the northward with the object of cutting a well-defined shoot of stone which has been worked from the surface to the 200 feet level. The reef is contained in a large formation between good walls, the whole of which carries gold but the reef is the only portion which so far has proved to be payable.

"The Light of Asia is a large quartz reef in which two shoots of gold have been discovered, the southern of which was worked down to the water level some years ago by a company, whilst the northern one which is being worked by the present owner is rapidly approaching that depth. The quartz body is of considerable size but is not very rich; however it pays well to raise and cart to the Gem of Cue Extended Battery.

"Of the parallel contact lodes, only a few are being worked at the present time; the Princess Royal, which is situated at the back of the Hospital, is being tributed in the upper levels.

"The Catalpa, which lies to the eastward of it, is being unwatered with the object of further trial.

"The Caledonia Hill upon the Northern boundary of the town is being worked at the 100ft. level where occasional rich patches are met with.

"Upon the Princess, a small cross reef is being worked, whilst the Cue Victory and Golden Stream Extended are being worked in the upper levels only.

"The Agamemnon, which is a large quartz blow, was originally worked by an English Company to the water level, but the present owners have discovered another shoot farther to the eastward, which being of considerable size pays well to cart and crush.

"Other parallel contact veins such as the Lady Forrest, Polar Star, and the Homeward Bound, upon which considerable work has been done, are at present idle.

"Beneath the rich dryblowing patch, which is situated upon the northern side of the town, a series of flat reefs have been discovered and worked, being generally known as the Volunteer Group; they include the various Volunteer leases, the Starlight, the Twilight, and the Countess Extended.

"Upon the surface of this area not only was free gold discovered but also a large number of specimens (quartz embedded with gold) which would generally be considered as indications of the proximity of an auriferous reef, so far however all the outcrops have proved to be practically of low value, therefore the only solution which can be suggested is that the gold and specimens were derived from the disintegration of a horizontal vein overlaying those recently worked.

"Although the flat reefs overlying this area are not of phenomenal richness they have yielded, for a considerable period, a very material proportion of the gold production of the district, therefore assuming that the surface gold was derived from a similar deposit, it would be reasonable to expect that other veins of the same class might exist at a greater depth. This question could be readily tested by boring at points above where the greatest enrichment has been proved to exist in the flat reefs already worked.

"Besides the reefs before mentioned there is a group situated about  $2\frac{1}{2}$  miles to the north-westward of Cue which strike in a north-easterly direction dipping to the north-west, but although several of these present bold outcrops for a considerable distance, little work has been done upon them since the Companies abandoned them in the early days.

"When everything is considered, it must be allowed that the Cue district has never had a really fair trial since capital was withdrawn at a critical stage, therefore what work has been done since has not been carried out in the best interests of the mining, because only the richest portions of the lode would pay, the balance of lower grade ore, which would have paid well if treated with the richer ore on the spot, has been left *in situ* and is therefore by itself of no value.

"*Day Dawn.*—Upon the north side of the Trenton Hill at a point about four miles to the southward of Cue is the township of Day Dawn. The country rock consists entirely of greenstones, which are sometimes schistose but often massive, the foliation rarely extending much below the water level except along the main lode fissures. The main fissures of this district may be said to run in a northerly direction, but apparently owing to a line of disturbance which crosses the foliation of the rocks in a south-westerly direction certain of the reefs have changed their course for a short distance.

"At the present time and for some time past, very little productive mining has been done in this district, with the exception of the Great Fingall, where work of such magnitude has been carried on as to dwarf all others.

"The large rich shoot in this mine has produced about three-quarters of a million tons of stone, which has yielded upon the average about one ounce of fine gold per ton. It occurs in the reef at a point where the buckling of the rock has turned the fissure from its normal northerly course to the north-west, in which direction the shoot dips. This shoot has now been followed down to a vertical depth of about 1,300 feet where although the stone is not of great value it is payable and the reef well formed and of great size.

"The zone of greatest enrichment in this shoot appears to have been mainly influenced by the junction of a comparatively flat reef upon the footwall side at the No. 5 level; should another of these unite with the main body it is quite possible that the values may again be considerably raised.

"The Trenton mine is situated upon the eastern side of the hill of that name and it is now after many years of idleness being reopened by an underlay shaft which it is proposed to continue down to a depth of 500 feet. The old workings in the early days of the field were carried down to a depth of 250 feet upon a well-defined ore shoot which increased in size from the surface downwards dipping to the north, but although there was a battery upon the mine and some 8,000 tons of stone crushed, which yielded 14 dwts. to the ton over the tables, it was not in those days considered to be worth working.

"The Kinsella mine is situated upon the eastern side of the railway line; the reef is of great size in places and upon it a considerable quantity of work has been done, but owing to the fact that the payable stone appears to occur in patches without



definition and of rather low grade, the mine is at present idle and full of water.

"The Creme d'Or, adjoining the railway yard upon the east, upon which a long and rich shoot was worked some years ago, is now being opened by a vertical shaft sunk to a depth of 200 feet, from which a crosscut is being driven to the reef. In a winze sunk below the old workings in the direction of this crosscut the reef was found to go down strongly and to carry gold at the rate of  $1\frac{1}{2}$  ozs. per ton.

"To the northward of the last is the East Fingall, where a vertical shaft has been sunk to a depth of 500 feet with the object of cutting the dip of the Eureka No. 5, which belongs to the same company. Two quartz reefs have been cut at the bottom level, one of which carries gold in payable quantities, but without some very great dislocation has taken place it cannot be the Eureka reef.

"A fissure, very heavily charged with water, was cut in the 250ft. crosscut, therefore this has now been dammed up; however had it been possible to continue that another 40 feet the Eureka reef must have been cut.

"The Rubicon has practically ceased to be a productive mine since the lode in the lower levels, although of considerable size and well defined, carries no values. Prospecting has been carried on upon a most extensive and systematic style to a depth of 800 feet, but unfortunately so far without results.

"Adjoining the Rubicon upon the east are some old mineral leases which have recently been retaken up. Upon these there are some small copper lodes of very fair ore, but sufficient work has not yet been done to form any opinion as to their permanency.

"There are a large number of these gold-bearing reefs in the district some of which are being worked upon a small scale, but owing to the large volume of water met with at a comparatively shallow depth and the expense of getting the stone crushed and carted when raised, proprietary mining is on the whole extremely quiet.

"Cuddingwarra is situated about seven miles to the westward of Cue, in the greenstone area upon the western side of the grano-diorite belt.

"At the present time there is only one mine working, viz., the Victory United, and upon this property only development work is going on.

"In this mine, a short but rich shoot has been traced down from the surface to the 600ft. level and the lode, apparently rich, followed down for another 100 feet by a winze.

"There are a number of apparently promising reefs in this district, but owing to the heavy water struck at a shallow depth and other great expenses such as cartage and treatment it would be quite impossible to work there without capital."

#### BARRAMBIE AND ERROL'S.

Mr. H. P. Woodward visited Barrambie and Errol's and in November submitted the following report on the result of his inspection:—

"Barrambie is situated at the 284 mile post upon the Rabbit-proof Fence and about 72 miles due east of Cue; by road however the distance is about 90 miles owing to the fact that the old Lake Way road

is followed (which runs in a north-easterly direction) until it intersects the new cut track from Nannine to Barrambie at a point near Barangi Rock. Several attempts have been made to obtain a direct track from Cue but owing to the rough and broken nature of the country between the two points this has so far proved to be impossible.

"The nearest railway station is Nannine, which is 60 miles distant, and from it a direct road *via* Quinns has been cleared, but since there is at present no State Battery at this centre a good deal of the traffic has been diverted to Tuckanarra, 70 miles distant, where there is one, on account of the chance of return loading.

"The Barrambie Ranges present a bold appearance when approached from the westward, but since they are backed up by an elevated tableland upon the east, from that side they appear only like a series of low rocky peaks.

"The rocks composing this range are schistose greenstones the foliation of which runs in a nearly north and south direction with a dip to the eastward. The surface is extremely rough, the rocks being little weathered except immediately along the ore channels along which they have been considerably altered to a depth of 100 feet.

"Upon the eastern side of the range the rocks are much more highly altered where, in some canyon-like ravines, sections of 30 to 40 feet of weathered rock with cappings of detrital laterite are exposed.

"Little quartz is exposed along the main belt but in the direction of the General Kuropatkin, which is about  $1\frac{1}{2}$  miles in a south-easterly direction, large reefs are in abundance.

"The main lode can be traced at the surface along the range for a distance of 34 chains without a break, but about 3 chains south of the main shaft in a small cross gully it apparently ends. This is possibly a fault line which has thrown the reef to the westward since south of this point a well-defined lode can be traced for 15 chains in that direction.

"The Barrambie Ranges G.M. Co. own the principal group of leases but it is only upon one of these that any development work can be said to have been done, this is called the Golden Treasure, G.M.L. 1458, and upon it three shafts have been sunk to a depth of about 100 feet and one to 45 feet and the whole connected by a level. There has also been sunk a shaft to the same level upon the boundary of this lease with the Golden Hill, G.M.L. 1459, which together prove the existence of the lode at the 100ft. level for a length of 500 feet.

"The main shaft, which is upon the underlay, has been sunk to a depth of 105 feet, the grade being about 70 degrees from the horizontal. This shaft is now equipped with a head gear and winding engine, the latter being located in the engine room which also contains the engine intended to drive the 10-head stamper mill, which latter is already erected and housed. It is proposed to add rock breakers and automatic feeders to the plant, also concentrating tables, in order to eliminate the sulphides before the sands are passed in to the cyanide vats.

"From the bottom of the main shaft, the lode has been driven on in a northerly direction for a distance of about 400 feet and this level will be carried on (so soon as the winding engine is working) to the shaft that has been sunk just within the Golden



Hill lease, which is about 100 feet distant from the present face.

"The lode has also been driven on for a length of about 200 feet at the 45-foot level, whilst the other two underlay shafts exclusive of the Golden Hill shaft have been sunk to the 100 feet level.

"The lode is well defined showing a particularly well-formed hanging wall at one or two points where it is exposed but the footwall is not so marked. The entire lode between the walls where crosscut is from 5 to 6 feet but since only from 20 inches to 2 feet upon the footwall side is rich the portion upon the hanging wall side has not been removed although to judge from its character and the richness of the footwall portion it is probable that it will be found more profitable to work the whole body as a lower grade rather than only a portion as a higher.

"So far the value of the lode has been estimated only by the dolly pot, therefore the values of the sulphides have not been taken into consideration and as a consequence the formation without quartz upon the hanging wall side, which carries pyrites, is looked upon as barren.

"Quartz only occurs in small veins and strings in the rich footwall portion of the lode, this at the 100-foot level is heavily mineralised but still carries free gold in considerable quantities, whilst in the oxidised zone the cavities from which the sulphides have been removed are often filled with spidery forms of gold.

"Large quantities of very rich specimens were obtained from this mine, so rich in fact that it was found necessary to bag many tons, but still upon examination the dumps which contain close upon 1,000 tons are seen to be covered thickly with specimens, whilst all the stone yields good prospects.

"It is proposed to carry down the main shaft still upon the underlay to the 200-foot level as soon as the winding gear is in working order, this should go far to demonstrate the permanency and value of the lode and may possibly also prove the existence of a water supply upon the mine.

"So far as can be judged at present this lode, owing to its well-defined hanging wall, angle of its dip, and length of the outcrop, appears to be of the class generally called true fissure veins whilst the length over which the rich stone extends in the sulphide zone promises well for its continuation to lower levels.

"It appears that the shoot or shoots are dipping to the northward but no decided opinion can be expressed upon this point until the 200-foot level has been driven, and until this question is determined it would be wise to postpone the question of sinking a main vertical shaft.

"At present the water supply is being obtained from a water shaft upon the flat about three quarters of a mile to the south-west, the water level being 130 feet, but it is probable that a supply will be cut in the mine in the course of sinking to the 200-foot level.

"The water is of fair potable quality but hard.

"Timber for mining purposes is not plentiful but there is a considerable quantity of firewood in the neighbourhood which should last for some time.

"Upon the other properties not held by the Company very little work has been done owing to the fact that the nearest State Battery is at Tuckanarra, therefore the owners who are mostly working miners find it difficult to devote much time to them, but are holding with the object of a sale; however properties like the Magnum Bonum, Dawn of Hope, Barrambie South, Queen, and General Kuropatkin appear to be worthy of development.

"*Errol's* is situated upon the flats about 10 miles to the north-west of Barrambie. There are no rock outcrops, the whole surface being covered by a cement capping much quartz strewn, with here and there reef outcrops having very variable courses.

"The main line, which is called the Legacy, can be traced at the surface by a series of blows for a distance of 30 chains, striking in a north-westerly direction with a westerly dip.

"This reef was tested by a series of trenches cut across it at distances of 10 feet apart, the results being apparently satisfactory to the purchasing company.

"The stone is for the most part massive, fine grained, and ironstained in places having an alabaster-like fracture with lines of cubical-shaped cavities often very rich in gold; they are apparently the moulds from which the pyrites has been leached.

"The solid stone carries very fine gold in places, but the only visible gold met with is in these cavities or along thin mineral lines, but upon the whole the stone prospects well.

"The reef has been opened upon by shafts at four points, Nos. 1 and 2 shafts being at the south end upon G.M.L. 1465, No. 3 or water shaft upon G.M.L. 1466, and No. 4 close to the boundaries of G.M.L.'s Nos. 1466 and 1474.

"In No. 1 shaft, which is 50 feet in vertical depth, from 6 to 7 feet of stone was cut at 20 feet from the surface.

"No. 2 shaft is 10 feet vertical where it cuts the reef, which is here 8 feet in width; from this point it was followed on the underlay for a distance of 25 feet, the dip being about 35 degrees west. At this point it was cut off by what appears to be a decomposed diorite dyke, which dyke was driven on a short distance to the northward, but in it no stone is visible; it was then crosscut when about 3 or 4 feet of quartz was passed through, dipping steeply towards what is apparently a decomposed granite dyke.

"At the cap of the reef at this point it appears to turn over in an anticlinal fold, dipping both east and west; it may therefore possibly be a saddle reef as the management hope, or this may only represent a spur or leader running off from it to the eastward; and this question it is proposed to set at rest by boring. The stone in this shaft is estimated at worth 15 dwts. No. 3 or water shaft so called from the fact that it was sunk to a vertical depth of 60 feet in order to obtain a supply of water for the battery. Just above the water level, a small quartz vein was cut which varied from 6 inches to 1 foot, but this opened out to 4 feet just beneath the water.

"No. 4 shaft has been sunk vertically to the water level upon the western side of the reef, and a crosscut is now being driven towards it.



"There is unquestionably a large quantity of payable stone in sight along the outcrop, but so far the limited explorations in depth have been of rather a negative character, this however is very possibly due to the fact that a reef of such variable size at the surface will maintain this character at a depth, therefore until it has been driven upon at the water level it is quite impossible to express an opinion as to its character with any degree of confidence.

"A 10-head mill is in the course of erection, whilst a good water supply has been struck in the mine itself at a depth of 60 feet.

"Good timber for mining purposes, like the Bar-rambie district, is not over-plentiful in the immediate vicinity, but the firewood supply should last for some time.

"There are several other properties which are at the present time attracting considerable attention, the principal of these is the Three Star, G.M.L. 1490, which is situated at the north end of the belt. This is an east and west reef which dips southerly at an angle of about 45 degrees. Only a small outcrop was visible at the surface, but it has now been traced for a length of 3 chains, the cap being covered by from 4 to 8 feet of cement.

"The west shaft was sunk to a depth of 12 feet, from which a crosscut was driven 10 feet south to the footwall of the reef, from which 4 to 5 feet of stone was taken out which prospected well, the remainder of the reef upon the hanging wall side as far as tested by drill holes was of little value, but its size is unknown.

"About three chains south in the main shaft, which has been sunk to a vertical depth of 20 feet with a winze 25 feet, a reef was cut so identical in character to that in the west shaft that it is apparently the same.

"The stone from the footwall portion of this reef has been stoped from the 20ft. level to the surface for a distance of 30 feet east of the shaft, but at this end the ore body is small, being only a few inches in the face.

"Two crushings have been taken from this reef, the first reported in the March statistics is 10 tons, yielding 55.66 ozs. of fine gold, or 5.66 ozs. per ton; the tailings from this parcel are said to assay 23 dwts per ton. The second parcel is not yet officially reported, but the 41 tons crushed yielded gold at the rate of 2½ ozs. per ton, but the sands have not yet been assayed.

"To judge from the nature of the decomposed rock passed through in these workings the country is apparently a porphyritic rock, most probably a dyke.

"The Inheritance, G.M.L. 1528, is situated immediately to the eastward of the last mentioned, but the reef here, which may possibly be the northern extension of the Legacy, strikes north and south, dipping west. An underlay shaft has been sunk to a depth of 59 feet with a drive north for a distance of 30 feet, the stone in these workings averaging about 2 feet, but is only about 10 inches at the south end.

"The stone differs from the other in this locality, being schistose, gossany, and much ironstained, whilst the country is weathered greenstone.

"A parcel of 11 tons was crushed from this lease which yielded 19.25 ozs. of fine gold, or at the rate of 1.75 ozs. per ton, whilst the sands are reported to assay 1 oz. 22 dwts. per ton.

"About 2 chains to the northward, a shaft has been sunk to a vertical depth of 30 feet, where a decomposed granite bar was met with and some broken reef, but northward of this although several shafts have been sunk no stone has been cut.

"At the south end of the line is the Legacy South, G.M.L. 1470, upon which there is an outcrop which prospected well, being apparently the extension of the Legacy line. A shaft had been sunk upon this, but collapsed after the rain.

"Some two miles south a lease called the Bar-rambie Perseverance has been pegged upon a large quartz blow which strikes east and west and dips north. From a crosscut at the west end of the blow some good prospects were obtained, and a vertical shaft is now being sunk with the object of cutting the reef at the water level, the country passed through so far being apparently a decomposed porphyritic dyke.

"The outcrop can be traced for a distance of 5 chains to the westward of the blow, where it is considerably broken, one branch apparently turning away upon a southerly course.

"There are several other leases upon which gold has been discovered, but so little work has been done upon them that they are not worth mentioning.

"As a whole the district is a promising one on account of the size, number, and value of the auriferous outcrops, large quantities of stone from which should pay the owners well to crush, but no opinion can at the present stage of the developments be expressed upon the permanency of the ore bodies in depth."

#### LAWLERS, MOUNT SIR SAMUEL, MOUNT IDA, DARLOT, AND WILSON'S PATCH.

In connection with the field work on the East Murchison and Mount Margaret Goldfields, the following mining centres were examined and reported upon by Mr. Gibson, who furnished the following interim report:—

"Lawlers, Mount Ida, Mount Sir Samuel, Darlot, and Wilson's Patch; in addition to which a brief examination was made of the country between these places and also between Wilson's Patch and Laverton.

"*Lawlers.*—This place is the administrative centre of the East Murchison Goldfield, and is situated about 80 miles north-west from Leonora, which is the nearest railway station.

"The rocks comprising the auriferous series are the usual type of greenstones, intersected by bosses and dykes of granite, the intrusive nature of which is beyond dispute; this main body of quartz is, in turn, intersected by numerous felsitic dykes, these occurring chiefly along, or close to, the junction of the two classes of rocks.

"The auriferous belt has a width of from 12 to 16 miles, and is known to be continuous between Lawlers and Mount Sir Samuel, cutting out northerly a little to the north of Abbots, its southern limit being some ten miles or so to the south of



Lawlers, thus having a total length of from 50 to 60 miles.

"The ore deposits fall into three classes:—

- (a) contact reefs,
- (b) normal quartz reefs (fissure reefs), and
- (c) lodes.

"The first class occurs along the junction between the greenstones and the granite, and are usually somewhat irregular. Reefs of this description have been worked at the Eastern and Caroline mines.

"The second class is found both in the granite and the greenstones, but as a general rule it is only those in the greenstones that are auriferous; they are often of large size, and run for considerable distances. The reef worked at the Vivien may be taken as a typical example of this class.

"The only lode formation being worked is at the Waroonga, and this is of large size and very persistent.

"Generally speaking, all the deposits of the Lawlers district are low grade; they are however mostly of large size and shew every sign of permanency.

"There is a good supply of fresh water throughout the district, but timber is scarce and is rapidly becoming a serious item with the larger mines.

"The Leviathan District, Lawlers.—The Leviathan—or as it is better known locally, the Fairyland—district is situated some ten miles slightly south of east of Lawlers and within the same auriferous belt, close to its eastern junction with the main body of granite.

"At the time of my visit (Aug. 30th) the only lease being worked was the Leviathan, G.M.L. 846; other leases in the district on which work has been done in the past are the Excelsior, G.M.L. 762; Excelsior North, G.M.L. 786; Kinglike, G.M.L. 774, and Fairyland, G.M.L. 761.

"The country generally speaking is flat and mostly covered with a varying thickness of recent detrital deposits, so that very few reefs are found outcropping on the surface.

"There is a Government well close to the Fairyland lease from which a good supply of fresh water is obtainable.

"Leviathan G.M.L. 846.—This is a twenty-four acre block situated about two miles east-south-east from the Government well and about twelve miles from Lawlers. At the time of my visit, it was the only lease being worked, and only two men were employed on it.

"A quartz reef runs through the block on a bearing ranging between north and north-north-east; it is of fair size, and outcrops almost continuously for a length of about 20 chains, though towards the north end it is apparently a good deal broken and very irregular, and is also much smaller than at the south end.

"Close to the present workings, which are situated on a slight rise, and on the main line of reef, there is a very large outcrop, or 'blow,' of quartz some 6 or 8 feet in width but very irregular, as these large 'blows' almost invariably are. Just here there are three parallel lines of reef about 20 feet apart, the western one being the main line and the other two only extending on the surface for

a short distance. All these reefs dip at a fairly flat angle to the east.

"A little to the east of the main 'blow' two vertical shafts have been put down: No. 1 to a depth of 100 feet and No. 2 75 feet. No. 1, which is the most easterly, has not been sunk deep enough to cut any of the reefs, but should cut the east one in another 20 or 30 feet. No. 2 shaft has been put down on the middle reef, the first part underlay and the remainder vertical, and at the 75ft. level a cross-cut has been put in about 30 feet to cut the reef, and about 40 feet of driving has been done on it; the west (main) reef comes into the shaft near the bottom and cuts out altogether in the shaft, but makes again in the bottom of the crosscut where it is some 18 inches in thickness. The reef on which work is being done at present is irregular and bumpy, being about 12 inches in thickness at the crosscut, 5 feet a little farther north, 4½ feet in the north face of the drive, and 3 feet in the south face. The quartz is for the most part white and glassy and often laminated, with thin seams of chlorite along the cleavages; it carries a little pyrites at depth and is a good deal ironstained near the surface; a little metallic bismuth and oxide of bismuth is also present in places, and when this occurs the gold contents are said to be usually higher; this bismuth will prove troublesome when the stone comes to be cyanided, and will considerably detract from the value of the tailings.

"As a whole the gold contents of the stone are said to vary a good deal, some patches being very good whilst others again are just the reverse; the stone at present opened up is expected to average about 10 dwts. per ton. A parcel of about 30 tons obtained in sinking the first part of the shaft is said to have been crushed for an average yield of about 5 dwts.

"The country is a foliated greenstone, the foliation running about north and south, and is very soft and rotten and will require heavy timbering below water. Insufficient work has been done on the property to thoroughly prove the value of the main line of reef, which although of considerable length is very irregular both in size and gold contents; the lenticular character which is noticeable in the workings is also present at the surface, and it is difficult to form even an approximate estimate of its average size; generally speaking it is decidedly low grade and not likely to prove of much value to its owners as long as it is worked under existing conditions.

"The official returns from this lease to date are 31 tons for 7.95 ozs.

"Excelsior, G.M.L. 762.—On this property three lines of reef about a chain apart have been worked, but not much has been done on any of them. These reefs strike about east and west and dip at a fairly flat angle to the south; owing to the covering of recent deposits it is impossible to follow them on the surface, and the workings have not proved them for more than three or four chains. Most of the work has been done on the middle reef, which has been opened up to a depth of about 100 feet; the shaft however at the time of my visit had been filled in, and the workings were inaccessible; there appeared to be from 100 to 150 tons of stone at grass at this shaft; this reef at the surface was about 2 feet in thickness, and the quartz was very glassy and a good



deal ironstained. The south reef has also apparently been worked to a depth of about 100 feet, but the main underlay shaft on this has been filled in; the reef where visible near the surface is about 2 feet in thickness. The north reef appears to have been the smallest, and not much work has been done on it. Altogether on this lease there are probably a couple of hundred tons of stone at grass evidently too low grade to be of any value.

"From information received subsequent to my visit, it appears that the stone crushed was obtained from a small rubbly quartz leader along the footwall of the main reef and that this (the leader) cut out at a depth of about 90 feet. The stone in the main reef is said to be of no value.

"The total returns up to the end of August, 1906, are 30 tons for a yield of 53.85 ozs.

"Excelsior North, G.M.L. 786.—On this lease an underlay shaft has been put down to a depth of 50 or 60 feet on a small east and west quartz reef dipping pretty flat to the south. Apparently very little work has been done from the shaft, and only a couple of tons of stone are at grass. The property was undoubtedly abandoned owing to the poor quality of the stone. No stone has been crushed from this lease.

"Kinglike, G.M.L. 774.—No work worth speaking of has been done on this lease, and no stone has been crushed.

"Fairyland, G.M.L. 761.—The only work done on this block consists of a shaft down some 50 feet from which about twelve tons of low-grade stone has been raised. The workings were inaccessible but the reef, which runs east and west and dips south, appears to have been not more than 12 inches or so in thickness. There has been no stone crushed from the lease.

"In conclusion, I am of opinion that this district is a poor one and not likely to prove of any great importance. Prospecting will always be rendered difficult owing to the recent deposits which cover the greater part of the district and beneath which the reefs are hidden. The reefs, judging from those prospected, are irregular and very low grade, and the east and west reefs, of the class opened up on the Excelsior leases, are apparently of no value at all.

"The nearest public crushing plant at the present time is Smith's battery, near Lawlers and about 15 miles from the Leviathan.

"*Mount Sir Samuel.*—The town of Mount Sir Samuel is situated about 32 miles north from Lawlers on the north side of Lake Miranda and at the southern extremity of the Violet Range. This range is from one to two miles in width and extends northerly in an irregular line as far as Abbots; east and west of it flats covered with a considerable thickness of recent deposits extend indefinitely. The rocks forming the range are, for the most part, massive and foliated greenstones of the usual type, and generally speaking are pretty hard and unweathered; they are intersected by numerous granitic dykes, especially towards the northern end, these often being of considerable size and running in all directions, being evidently offshoots from the main body of granite which is said to make its appearance again a few miles to the east.

"Mining matters at the present time are very quiet at Mount Sir Samuel, there being only two mines working in the district, and on only one of these, the Bellevue, is any considerable amount of work being done. All the reefs that have been opened up are normal fissure reefs, and one or two of them are of fair size. Most of them are low grade, and this is a serious drawback in a district so far removed from the railway line.

"Timber is getting very scarce, and has to be brought in considerable distances, principally on camel teams. Salt water for battery purposes is of course plentiful enough near the lake, but the want of an adequate supply of fresh water for boiler use was proving a serious drawback to the big mine until a few months ago, when a good supply was met with on the flat a mile or so to the east.

"*Mt. Ida.*—This centre is situated in the North Coolgardie Goldfield some 65 to 70 miles north-west from Menzies, this being the nearest point on the railway. Travelling from Lawlers, the road passes over granite country the entire way until about three miles from Mt. Ida, where the greenstones again make their appearance. This greenstone belt is here said to have a width of some 12 miles or so, and runs in a somewhat north-westerly direction; it is apparently a continuation of that belt in which the auriferous deposits of Menzies are situated. At Mt. Ida a boss of granite some two miles in width and probably 12 miles or so in length has been rendered schistose for some distance on each side of it, and it is within these two belts of schists that the majority of the auriferous reefs are found. The schists run on a bearing generally slightly west of north and dip away from the granite on either side, and the reefs run and dip with the schists.

"The reefs, taking them as a whole, are of considerable length, but are generally small and irregular; those at present being worked are mostly, to a very marked degree, lenticular—being locally known as 'kidney' reefs—and consist often of merely a series of varying sized lenses of quartz connected by a thread of quartz and often only by the line of the walls. These lenses are sometimes almost contiguous, and sometimes are 50 or 100 feet apart, and as they vary greatly in length and depth, and there is nothing to show when they are going to cut out or come in, the reefs are naturally unsatisfactory for a prospector to work on; they have however the compensating feature that they are usually pretty high grade. There are a few well-defined and continuous lines of reef in the district which have been worked with success, and a good example of one of these is the Copperfield line, which has been opened up for a continuous length of over 1,000 feet. A typical example of the lenticular form of reef is being worked on the Unexpected lease.

"The district has been considerably handicapped owing to insufficient development having been done on many of the properties in past years, and I am of opinion that if one or two of the properties which are now abandoned were properly opened up and exploited they would turn out to be payable propositions.

"There is at present a fairly plentiful supply of timber in the district for mining and other purposes; there is also a good supply of water, fresh water being obtained in the granite country, while



the majority of that so far met with in the schists is salt.

"*Darlot*.—This centre is situated about 50 miles slightly north of east of Lawlers. The country between the two places consists of a granite tableland for the most part covered with extensive deposits of loose sand, this being the result of the gradual weathering and decomposition *in situ* of the granite.

"The workings at Darlot are situated within an area of greenstones of the usual type, the belt extending in width for three to four miles both east and west of Darlot townsite; its northern limit is not known, but it runs southerly for about 8 or 10 miles; east from Darlot, granite tableland country apparently extends uninterruptedly to the Erlistoun district.

"The country at Darlot is mostly flat and covered with a considerable thickness of recent deposits so that very few rock outcrops are visible. About three miles north of the townsite is a low ridge of 'break-away' hills trending in a general north-westerly direction and apparently marking a big fault or shearing line; it is along this line that most of the principal reefs have been worked and that all the alluvial which made Darlot famous some years ago was obtained.

"At the time of my visit mining at Darlot was fairly quiet; all the alluvial appears to have been worked out, and not much was being done in the reefing line.

"Several pretty good lines of reef have been worked in the past, and one of these (the Zanglar line) is now being opened up with apparently every chance of success. Taking the district as a whole, reefs are fairly numerous but vary greatly in size and values; they can for general purposes be divided into two classes:—

- "(a) reefs in which the gold occurs in irregular bunches or pockets, and
- "(b) reefs in which the gold is uniformly distributed throughout the stone.

"The first class is formed principally at the north end of the field along, or close to, the line of break-aways, and the pockets are usually found at the point where a second reef or leader comes into the main line. These pockets vary greatly in size, but when they are met with the stone is invariably dollying stone, the rest of the reef being practically barren. It is from the breaking down of the reefs of this class that the majority of the alluvial gold has been derived.

"The second class of reefs is by far the most important, as it is on these that the district has to depend for its future; they are usually of fair size, and can often be followed for considerable distances; they are well defined, and show all signs of permanency; whether the gold will live down with them is a matter that can only be proved by trial. So far the majority of these reefs have proved of pretty low grade. The Zangbar-Monte Christo reef is a good example of this type.

"Water is plentiful throughout the district, being salt on the west side towards the southerly continuation of Lake Darlot, but fresh at the townsite and to the north and east. Timber is not too plentiful, and will shortly have to be brought in from considerable distances.

"*Wilson's Patch*.—Mining operations at this centre are very quiet at the present time, there being only one mine working. The country is essentially granite, the area being part of the main belt which extends practically unbroken between Lawlers and Erlistoun. A few small isolated patches of greenstone occur scattered throughout this area, and it is usually along the junction of these with the granite that the principal gold-bearing reefs are found. There are however a good number of well-defined and fair-sized quartz reefs in the granite; these usually have an east and west trend, and so far have proved unpayable.

"The Great Western, which is the only mine working in the district, is working a quartz reef of an average width of about two feet which runs in an east and west direction alongside a lenticular mass of greenstone which has been caught up in the granite. The reef is pretty irregular, and taking it right through decidedly low grade.

"A good deal of alluvial gold has been got in this district in past years, mostly resulting from the breaking down of small quartz leaders in the granite; these patches however have been abandoned for some time, and nothing is being done in this line now, though I see no reason why this should be so.

"Water and timber are both fairly abundant in the district.

"From Wilson's Patch to Laverton, the road passes over granite country all the way until within a few miles of Mt. Morgans. This granite belt extends northerly indefinitely, but its southern limit is practically marked by the road as a mile or two south of this, and practically following it all the way, is that extensive area of greenstones in which the centres of Leonora, Mertondale, Malcolm, and Morgans are situated.

"About 25 miles from Wilson's Patch along this road are situated what are known as the Linger and Die workings. Here a small alluvial patch was worked about 10 years ago and a fair amount of gold won from it. At the present time a couple of small parties are working some small leaders in granite country. These leaders are only an inch or two in width but are sometimes exceptionally rich; no work however of any importance has been done.

"A full description, with geological map, of these centres and the mines working will be given in a bulletin now in course of preparation."

#### THE SAXON LEAD MINE, NORTHAMPTON.

Mr. Woodward reported, in November, on the Saxon Lead Mine, as follows:—

"This old mine is situated upon Location 470 in the Northampton district, being about 30 chains east of the railway line from a point about one mile north of the White Peak Railway Station, which is nine miles from Geraldton. The country rock is gneissic granite, the foliation of which runs in a northerly direction with an underlay to the westward. Following this is a well-defined quartzose lode of considerable size, upon which at a point a little north of the surveyed road near the centre of the block, a rich shoot of lead ore appears to have been worked. The workings consist of a winze (mostly collapsed) down to the water level (40 or 50 feet), from which the ore won from the stopes



was raised, but of what extent the latter are it is impossible to state, since without means of descent no inspection can be made, besides which the old workings are at present quite unsafe. It is evident that a considerable quantity of ore must have been removed from this mine, since the road from the workings, which has not been used for the last 30 years, shows signs of heavy traffic, whilst further, the ore must have been of high grade because little refuse is met with in the spoil heaps. The galena appears to have been practically all removed, but the carbonates were discarded, since a considerable quantity of the latter still remains at the surface. There is an abundant supply of water for dressing purposes, whilst timber for mining purposes and fuel is abundant. The position of the property reduces cartage to the lowest limits, whilst the 9-mile railage to a port is greatly in its favour. It is quite impossible, under the circumstances, to make any definite statement with regard to this property, but to judge from surface indications there is a reasonable probability of it containing minerals in payable quantities at the present market value of lead."

#### WAGIN.

"In consequence of the discoveries in the vicinity of Wagin, Mr. Woodward was deputed to visit and report thereon. In the month of April, this officer submitted the following report:—

"The discovery is upon Mr. H. W. Spragge's property 1010/56, which is situated about two miles south of Badgarning Hill and four miles west of Wagin (*see* Crown Lands litho. 409/80).

"From Badgarning Hill, which is a bold granite outcrop, the country falls rapidly in a southerly direction, the surface being covered by a feldspathic and micaceous grit indicative of its derivation from the disintegration of granitic rocks.

"In the vicinity of the find no rocks outcrop, but the surface is strewn along a well-defined line which runs in a north-east and south-west direction with fragments of a granular ironstained quartz from which the first prospects are said to have been obtained.

"Upon the eastern side of this blow a shaft has been sunk to a depth of 20 feet (water level) in white quartz and kaolin. From the bottom of this shaft a crosscut has been driven 35 feet north-west through a kaolinized rock with bands of quartz, many of which are ferruginous. At this point what is apparently the main formation was cut and driven upon 30 feet south-west and 15 feet north-east, whilst the crosscut was continued in quartz and formation for a further distance of 12 feet, thus, including the level which is 7 feet wide at this point, 19 feet of quartz veins and formation have been proved to exist.

"Some of the quartz veins are large, barren, and white, yielding no prospect of gold, but associated with them are ferruginous veins which yield prospects of fine gold.

"At the point where this formation was first cut in the crosscut there appear to be indications of a footwall dipping to the north-west, but so far no hanging wall has been met with.

"A short distance south of the shaft the formation has been crosscut by a trench, samples from which yielded prospects of fine gold.

"So far as can be judged from the character of the stone in the oxidised zone, the gold will most probably be carried in veins of pyritic quartz below the water level.

"The ferruginous quartz and formation yields fine colours of gold with a dish, as do also the sands of the creek to the southward.

"The following is the result of the sampling:—

"No. 1, from the north side of the trench, 6 feet in width, gold: 4 dwts. 2 grs. per ton.

"No. 2, from the south side of the trench, 6 feet wide, gold: 4 dwts. 22 grs. per ton.

"No. 3, from the north drive, 3 feet wide, 10 grs. per ton.

"No. 4, from the south drive, gold: *nil*.

"No. 5, from the face of south drive, 4 feet wide, gold: minute trace.

"No. 6, from dump, gold: minute trace.

"From the above it will be seen that the results of the sampling of the shaft workings is not at all encouraging, but that from the trench is much more so; since however it proves conclusively that a formation of six feet in width carries between 4 and 5 dwts. of gold to the ton, it is decidedly worth further prospecting.

"With this object in view, and in order to avoid expending labour upon barren ground, it would be advisable to prospect the cap of the lode at distances of 50 feet by shallow trenches, average samples from which should be tested; after which a shaft should be sunk at the point where the lode proved to be of the highest value; this shaft should be at least 50 feet deep, from which the lode should be crosscut and driven upon.

"At the present time an examination can only be made with the object of ascertaining whether gold really does exist, and this end has been attained, the results not only proving that gold does exist, but in sufficient quantity to encourage further prospecting. When this work has been carried out, another inspection could be made, since it then might be possible to express a much more definite opinion than it is at present."

The following are the results of the Mineralogist and Assayer's assays of the samples from Wagin:—

L 1899, W. 1.—Gold, 4 dwts. 2 grs. per ton.

L 1900, W. 2.—Gold, 4 dwts. 22 grs. per ton.

L 1901, W. 3.—Gold, 10 grs. per ton.

L 1902, W. 4.—Gold, *nil*.

L 1903, W. 5.—Gold, minute trace.

L 1904, W. 6.—Gold, minute trace.

Acting under my instructions, the Assistant Geologist, Mr. W. D. Campbell, visited Wagin, and in August submitted the following report upon the recent mining developments at that centre:—

"I visited Messrs. Spragge and Murray's reward lease on the 2nd inst. Since Mr. Woodward's report of the 9th April a second vertical shaft has been sunk to a depth of 55 feet at a distance of 77 feet south-west from the first shaft, at the place in the



costeen where some gold was found to occur. Water had been allowed to accumulate in both shafts, and stood at normal height, about 20 feet below the surface. At the time of my visit I was therefore unable to examine the workings. The owners informed me that practically no work had been done at the first shaft since Mr. Woodward's report. In regard to the second shaft, they state that the first 40 feet was wholly in quartz which included seven ferruginous bands, about two feet apart each, then the footwall was met with underlaying north-westerly; below this there were 15 feet of stiff kaolin and then a parallel rubbly quartz vein, 18 inches wide, which showed gold. This vein was not driven on, however, on account of water. At 50 feet depth a crosscut was made northerly for 15 feet; here a drop of 7 feet was made (I presume to the footwall again), and the crosscut was continued again for 15 feet without meeting the hanging wall. Ten tons of ore obtained from this development work were treated at the Coolgardie State Battery and yielded 5 ozs. 14 dwts., which is at the rate of .57 oz. per ton (11 dwts.). Mineral specimen No. 1 in the accompanying list was obtained from the north side of the shaft at 2 feet depth; it is an opaque whitish quartz of the usual type in the district, and is very similar to those near Beverley. Mr. Murray informed me that I was taking this sample from the poorest part of the reef, it however assays minute traces of gold. A new shaft has been begun 59 feet north-westerly from the second shaft. From what I could see of the reef, it appears to be underlaying 50 degrees in that direction, with a strike of 223 degrees, but the latter is somewhat uncertain. About 2 chains north-easterly from the No. 1 shaft a costeen has been made across the line of reef and shows quartz similar to the bulk of the quartz in the two shafts.

"I may remark here that the workings appear to be in a very insecure state, through the absence of timbering.

"Sinclair's prospecting area, No. 3, adjoins the north-east end of Messrs. Spragge and Murray's ground; here some trenching is being carried out. In one trench there is a layer of well worn quartz pebbles at 2ft. 6in. depth; the trenches are down to a depth of four feet in the slightly ferruginous kaolin, but the cap of the reef has not yet been found. About 7 or 8 chains north from here there is an outcrop of a glassy quartz, which probably belongs to different line of reef (*see* Collection Nos. 14 and 16).

"Another prospecting area, No. 7, has been taken up about half a mile farther north-easterly on what may be a reappearance of Spragge's reef.

"About half a mile northward of this are Prospecting Areas 8 and 9, where there is an outcrop of whitish quartz; a small pothole only has been made here as yet. Sample No. 3 in list is from here; the strike of the reef is 25 degrees. This reef outcrops again in Loc. 3996, south of Mr. C. A. Piesse's house, and one mile due north of this again there is an outcrop of a white quartz; this is probably another parallel reef, strike 33 degrees, with cross-jointing 70 degrees; this has been taken up by Messrs. Conder and Gill, but no work has yet been done on it. Two miles farther north-easterly, on the west side of the Railway, is Messrs. Bailey

and party's ground in Loc. 4245, which I did not visit, as only a little trenching had been done there.

"Three miles south-west of Wagin in Loc. 3632 is Messrs. Doig and Hanke's ground, in which there is a well-defined outcrop of quartz forming a slight ridge, striking about 35 degrees. The reef is about 24 feet wide and has cross-jointing 95 degrees. A costeen was being made across the reef, with a depth of 4ft. 6in. The quartz has ferruginous portions, and somewhat resembles Spragge's reef. Collection No. 2 is from the bottom of the middle of the trench, but does not assay any gold.

"Prospecting Areas Nos. 5, 10, and 11 are on the west side of the main line of railway about 2½ miles south of Wagin in Loc. 1804, where a low ridge indicates the line of reef for over half a mile striking 29 degrees, but towards the south end the reef deviates to 57 degrees. Messrs. Mann and Hawkins have made two costeens across the reef about 135 feet apart. The northernmost of these is about 4 feet deep, and shows the quartz mixed with partings of a dark coloured gossan. The walls of the reef are not clearly shown in the costeen, but the width of the reef is evidently over 30 feet. Some good prospects are stated to have been obtained from the drillings here. Samples Nos. 8 and 9 were obtained from about mid length in the costeen at 4ft. depth, and were selected as fairly representative samples of the quartz and gossan respectively; both have yielded minute traces of gold on assay.

"In the southern costeen, the quartz reef is solid and whiter, but the average depth would be little more than 18 inches. At the west end a shaft has been begun in the decomposed granite on the side of the reef, and was about 5 feet deep. This shaft will follow the reef underlay to the east. The reef is at least 37 feet wide here, and as the eastern end of the costeen shows rubbly quartz, the width may be more than this. There are three slightly ferruginous bands at 10, 26, and 32 feet from the west side. Sample No. 7 is from the centre at 10 feet, Nos. 5 and 6 are from the north and south sides at 26 feet, and No. 4 from the centre at 32 feet, and all except the last assay minute traces of gold. The ferruginous bands are usually the most favourable portions of the reef. About 7 chains north of these two there is another smaller costeen showing similar quartz.

"Three miles northwards from here on the east boundary of Wagin Townsite, and in Mr. Just's Loc. 518, is an outcrop of quartz, which may be a continuation of Mann's reef. It strikes 27 degrees, and a costeen about 20 feet long and 4 feet deep has been made by Mr. Simms across it at the top of the rise. Prospects of gold are stated to have been obtained from the surface stone here. My samples also from the surface, as the trench was full of water, have not yielded any gold (*see* Nos. 12 and 13).

"There are other outcrops of reefs in or parallel to the line of Spragge's reef for some miles south-westerly; one or more occur in Gleeson's holding (Loc. 953?) four miles from the reward lease (*see* sample No. 10), which shows minute traces of gold. Two miles farther, quartz rubble occurs on the east side of Loc. 2109; some of this is very ferruginous (*see* sample 11), which however does not assay any gold.



"The only diorite dykes that I saw were some ranging from 3in. to 12in. thick, trending 122 degrees, which is nearly at right angles to the prevailing course of the reefs (*see* Collection No. 15).

"I took the opportunity to visit Lime Lake, and obtained two samples of the lime, and some of the small shells enclosed in the deposit, and took the three attached photographs showing the kilns owned by Mr. W. E. Clark.\* Operations are suspended here during the winter months owing to the boggy nature of the ground around the lake. There are now ten special leases of about 25 acres each; these and the various prospecting areas and leases are shown on the attached litho plan 409/80 and 409/40 B. and C.\*

"It is not possible in the present early stage of development to express any very definite opinion regarding the further occurrence of gold in the district. The results from Mr. Spragge's mine are certainly very encouraging, and justify careful prospecting elsewhere around Wagin. Messrs. Spragge and Murray show their confidence by working their mine without outside aid, but better results would probably be obtained by opening up the mine on a larger and more systematic scale."

*List of Mineral Specimens and results of Analyses,  
by Mr. E. S. Simpson.*

G.S.L. No.	Coll. No.		Gold.
2266	1	Spragge & Murray's shaft, Loc. 1504	Minute trace
2267	2	Doig's costeen, Loc. 3632 ...	Nil
2268	3	Sinclair's P.A. 9, Loc. 617 ...	"
2269	4	Mann's costeen, Loc. 1804 ...	"
2270	5	" " " " ...	Minute trace
2271	6	" " " " ...	"
2272	7	" " " " ...	"
2273	8	Mann's costeen, 2½ ch. north of Nos. 4 to 7	"
2274	9	Mann's costeen, 2½ ch. north of Nos. 4 to 7	"
2275	10	Gleeson's reef, Loc. 953 ...	"
2276	11	Ferruginous reef, Loc. 2109 ...	Nil
2277	12	Just's Loc. 518, at costeen ...	"
2278	13	Just's Loc. 518, near town- site boundary	"
	14	Quartz outcrop, Loc. 1645	
	15	Diorite, Loc. 1566	
	16	Waterworn quartz pebbles, Sinclair's P.A. 3	
	17	Lime from small pit, Lease No. 4, shown in photo.	
	18	Limestone ridge, 3 chs. north of kiln, Lease 4, shown in photo.	
	19	Shells from limestone in lake bed, west of kilns	

"On the 22nd of August, an auriferous specimen, received through the West Australian Bank, was handed to me by you for inspection and report. After careful examination I submitted the following memorandum thereon:—

"In reply to your memorandum of the 22nd inst., which did not reach me until 4.30 yesterday, the specimen is not of the same type as that which characterises the quartz of any of the Wagin reefs known to me, neither does it in any way resemble the ore obtained by Mr. Campbell on the occasion of his recent visit to the locality, and referred to

in his report. Owing to the condition in which the stone recently submitted by you for assay was received it is hardly possible to state whether it bears any resemblance to the sample accompanying your memorandum, and which is returned herewith. I may add, however, for your information, that I have very good grounds for suspecting that some of the rich ore purporting to have been obtained from certain of the Wagin reefs has come from a much more distant source."

ARRINO AND YANDANOOKA.

Mr. Campbell submitted the following memorandum on some observations made by him in the vicinity of Arrino and Yandanooka during the year:—

"The Eastern boundary of the granite in the Arrino and Yandanooka districts is shown in two plates in the Departmental Report for the year 1903, reproduced from the map accompanying my report of September 30th in that year, on the Arrino Copper deposits; this embraced about six miles; since then the boundary has been traced as opportunity offered for a further distance of nine miles northwards to near the Yandanooka Railway Station. The illustrative rock specimens have also been extended, and they now number 52, nearly all collected by the Department. Their localities are shown on the map, and they are enumerated in the accompanying list.

"The sedimentary beds adjacent easterly to this granite are a series of sandstones and conglomerates, which are occasionally altered into quartzites; they have a general underlie of about 60 degrees to the east; with them are associated beds of fine-grained chocolate-coloured tuff or tufaceous sandstone; these occur mostly along the immediate contact with the crystalline rocks, and are plainly seen near Mt. Muggawa and northwards, blocks of travertine up to 12 inches thick occur frequently along its outcrop, and are burnt when required for lime: the calcareous nature of this tuff produces a fertile soil which has caused this ground to be sought for occupation. Both the sandstone and conglomerates are largely ferruginous and often capped by laterite, or occur as quartz conglomerates as at the hill misnamed Granite Hill at Yandanooka. The age of these beds have not yet been ascertained, but they may be Permo-Carboniferous.

"At Mt. Muggawa the lodes occur in the granite gneiss and mica schist, but at Arrino they penetrate the sedimentary beds in which they are dispersed into small veins of ore rarely more than half an inch wide. When I was at Arrino in January last ore was still being raised near Baxter's shaft on Block 342 by means of open cut, worked on tribute.

"The western margin of the granite area has not yet been mapped; it is much obscured by the sand forming the adjacent sandplains, which have apparently resulted from the decomposition of the more recent horizontal sandstones that have been deposited along the old coast line of granite and older sedimentary beds; with these sandstones occur argillaceous beds as at the Yandanooka home-  
stead of Forrest, Emanuel & Co. and the valley of the Arrowsmith River (*see* 3 mineral specimens from there in the attached list). These clay beds cause springs to occur. The age of these beds may be Jurassic or Cretaceous.

\* Not reproduced.



“Samples of water were taken from two springs at Yandanooka; an analysis of one of these has been made in the Survey Laboratory and is attached, the other sample will have to await the exigencies of the Departmental work.”

*Analysis of Water, by E. S. Simpson.*

Locality—Yandanooka North Spring.  
Geological Survey Laboratory No.—1839B.

—	%	grs. per gall.
Sodium Chloride ... Na Cl	.1293	90.51
Potassium Chloride ... K Cl	.0015	1.05
Magnesium Chloride ... Mg Cl <sub>2</sub>	.0078	5.46
„ Sulphate ... Mg S O <sub>4</sub>	.0086	6.02
„ Carbonate Mg C O <sub>3</sub>	.0013	.91
Calcium Carbonate ... Ca C O <sub>3</sub>	.0011	.77
Sodium Nitrate ... Na N O <sub>3</sub>	.0011	.77
Silicate ... Si O <sub>2</sub>	.0097	6.79
Alumina... Al <sub>2</sub> O <sub>3</sub>	.0001	.07
Iron Peroxide ... Fe <sub>2</sub> O <sub>3</sub>	.0001	.07
Organic matter ...	strong trace	strong trace
Hardness ...	.1606	112.42
	...	11.7

CLAY DEPOSITS OF THE CLACKLINE DISTRICT.

In July the following report was submitted by Mr. Campbell:—

“The country around Clackline examined for the purpose of this report is included in a radius of about 1½ miles around the townsite. The country is hilly and is traversed in a general east and west direction by the Clackline Gully, which junctions with the north and south valley of the Nanamullen Brook a little to the east of the townsite.

“Granite and gneiss are the prevailing types of rock in this district, and these are traversed in various directions by dykes of diorite, which mostly outcrop along the tops of the ridges and spurs, having resisted the surface decomposition in a greater degree than the surrounding rock. There are also various outcrops of quartz of a ‘glassy’ character which appear to have been subjected to the same foliating action as the gneiss, for they have sometimes a fluted jointing and a straight cleavage and almost fibrous in texture, quite unlike the normal condition of quartz reefs.

“Some prospecting for gold was carried out some years ago by a miner named Ford near where are now the fire-brick works, a small specimen of gold having been said to have been found by George Bardon, a settler, and some pits were put down from 10 to 50 feet deep; a sample of stone from one of these is stated to have yielded on assay about 2 dwts. of gold per ton. Two of these shafts however proved the existence of fireclay to, it is said, 50 feet, this led eventually to the starting of fire-brick works there. These are situated in Loc. 19 about one mile west of the townsite. There is here a broad band of mica schist, crossing the valley of the Clackline Brook in a direction of about 155 de-

grees. On the north slope of this valley the schist has a width of about eight chains with ferruginous walls composed of laminated ironstone; between these walls the schist has been kaolinized into a grey and white clay, varying from pipeclay to hard kaolin, from which the fire-bricks are being made. The clay pit is 30 feet deep, but there is no sign of the clay being limited to that depth, nor is there any deterioration with depth. The kaolinization of the schist can be seen to extend for ¼ mile at least to the northward. In a southerly direction, the ironstone walls do not cross the brook, and the schist appears to widen out to about one-third of a mile, but as far as can be seen in three small wells there, it is not so completely kaolinized. Attached to this report is the result of an analysis by Mr. E. S. Simpson of a sample from a hard seam of clay in the pit, and also a test of the fire-brick produced at these works.

“Most of the dykes are formed of coarsely crystalline quartzose hornblende with occasional finely crystalline portions, as may be seen in the main dyke to the south-east of the town boundary, and in the bed of the Clackline Brook, within the school-ground. In the latter instance the dyke has evidently been intruded while the adjacent gneiss was in a semi-plastic state, for spurs and seraps of diorite occur in the gneiss and small streaks of gneiss occur within the diorite, as shown in the attached sketch.

“The gneiss in the district is almost uniformly very white and quartzose, but adjacent to this dyke it has dark hornblende bands as if produced by an admixture of the same magma that produced the dyke. It is probable that the course of the brook is along a line of fracture in the rocks, with also probably a throw of the southern portion to the eastward. Mineral specimen (6709) is from a bulge-like protrusion from the east side of the dyke on the ridge about seven (7) chains south of the south end of Dwyer Street; here there are several feet thickness of hornblende-mica schist. Several instances of a partial alteration of the diorite towards an epidote rock are to be seen in the neighbourhood.

“The Clackline Brook water has not been found to be suitable for boiler purposes. A small well near the brook was first used for the engine at the fire-brick works, but that source was abandoned in favour of the Coolgardie Water Supply, the pipes of which pass close to the railway there, as the former was found to contain a large proportion of salts of lime and magnesia, as shown by the following analysis made in January last by Mr. S. S. Dougall, F.I.C.:—

	Grains No. 1.	per gallon. No. 2.
Salt ...	199.0	249.4
Magnesium chloride ...	46.1	77.2
Calcium sulphate ...	11.2	16.6
Do. carbonate ...	23.7	2.0
Phosphoric acid ...	2.5	4.4
Soluble silica ...	1.0	3.0
Organic matter and water or hydration	103.8	94.0
	387.3	446.6

“The dam in the brook opposite the railway station, made for the use of the locomotive engines,



has also been abandoned in favour of the Coolgardie Water Supply."

*Analysis of and report upon a hard seam of Clackline fireclay, by E. S. Simpson, Mineralogist and Assayer.*

Geological Museum, No. 6256  
Do. Laboratory, No. 1896

Silica $\text{SiO}_2$ ... ..	51.55
Titanic Oxide $\text{TiO}_2$ ... ..	2.19
Combined Water $\text{H}_2\text{O}$ ... ..	10.41
Soda $\text{Na}_2\text{O}$ ... ..	.31
Potash $\text{K}_2\text{O}$ ... ..	.11
Magnesia $\text{MgO}$ ... ..	.40
Lime $\text{CaO}$ ... ..	.09
Iron peroxide $\text{Fe}_2\text{O}_3$ ... ..	.43
Alumina $\text{Al}_2\text{O}_3$ ... ..	33.25
Hygroscopic Water $\text{H}_2\text{O}$ ... ..	.90
	<hr/> 99.64

From the analysis it would appear to be of excellent quality.

"I have examined the samples of Clackline firebricks submitted (by the State Mining Engineer), testing them against the well-known Garteraig bricks from Scotland, which so far as I know are the best obtainable in the local market. The following are the outlines of the test, which is as severe as it can be. The bricks as received were examined for cracks, for fused spots, and for grain. A test was made of their toughness and porosity, and the percentage of silica present was determined. They were then put cold into a red-hot fire packed round with coarse coke and brought to a white heat; after being in the fire for an hour, they were taken out, and whilst still bright red, tested for toughness and plunged into cold water, where they were left till cold. They were then again examined for cracks and signs of fusion, and tested for toughness. The results obtained were as follows:—

	Garteraig.	Clackline.
<i>As received—</i>		
Silica percentage ... ..	60.1	65.6
Large cracks ... ..	none	none
Small surface cracks ... ..	very few	numerous
Fused iron spots ... ..	few	medium
Toughness ... ..	very high	high
Grain, coarsest fragments	$\frac{1}{4}$ inch	$\frac{1}{2}$ inch
Density, weight of 1 cub. in.	.068	.063
Water absorbed ... ..	12.9 per cent.	20.4 per cent.
<i>When red hot—</i>		
Toughness ... ..	very high	high
<i>After quenching—</i>		
Signs of fusion ... ..	none	none
Cracks ... ..	very few	few
Toughness ... ..	moderate	moderate."

#### BEVERLEY DISTRICT.

In March, Mr. Campbell submitted the following report on the results of a geological examination of the Beverley District:—

"In accordance with your instructions of the 7th December last, I made a visit to the Beverley district from 24th January to 19th February, taking first the easterly portion on the Mount Caroling Road and the neighbourhood of County Peak, 12 miles south from that road, and returned to Beverley via Bally Bally and Mount Kokeby on the 1st February.

"On the 5th February I left Beverley for Dale River westerly and examined the neighbourhood of Bechtel's station, and crossed the head of the Dale Valley westward to the Canning watershed, and thence in a south-west direction to the 47 mile post on the Albany Road on 13th February, returning to Perth on the 19th February.

"At Ford's location 3886, about two miles north of the Caroling Road and 14 from Beverley, there is a large ferruginously laminated quartz reef, strike about north and south, underlaying easterly about 63 degrees; it is apparently about 30 feet wide (6609.) At a large outcrop of this reef about 10 chains south of Ford's north boundary several potholes were made many years ago, and some fair prospects are said to have been obtained. The samples collected by myself from both here and from the same reef about four chains north of the north boundary of Loc. 3886 have been tested in the laboratory, but have yielded only minute traces of gold. The reef is flanked on its western side by ferruginous schist (6610). The reef is considerably brecciated, showing that movement of the rocks has taken place. About ten chains north of the same boundary there is an east and west reef, much faulted, and both it and the adjacent gneiss rock are greatly contorted (6608); about a mile north from here there is a porphyry dyke (6607). There are numerous flat-topped hills about here with a capping of laterite, or ironstone conglomerate.

"The next locality visited was the small watercourse on the south boundary of Loc. 6043 about 21 miles from Beverley, where a small nugget of gold was found lately by Mr. C. Hine, Government Land Guide.

"Three samples of the wash in this watercourse were obtained from 6 to 15 inches depth, and also some samples of a rose-coloured quartz that lay scattered about on the north-east bank, and from some small quartz veins in the south-west bank; these samples and also some collected by Mr. Hine have been tested in the laboratory, minute traces of gold being found in the quartz samples only. The country rock is hornblende gneiss. There is a large white quartz reef about  $\frac{1}{4}$  of a mile west of the watercourse having a north and south direction, and which has an unpromising appearance. The watercourse extends only about 12 chains from the road northwards, there being no outcrop of the quartz at this spot. I was not able to form any opinion in regard to it.

"I then proceeded to County Peak and inspected the large quartz reef on which a shaft has been sunk at the north corner of Loc. 2587; this shaft was made by one Jenkins, and is said to be 40 feet deep with a crosscut to the east and a winze. It is said that some prospects of 13 dwts value were obtained here. This reef is over 30 feet wide, and it outcrops very conspicuously for half a mile to the north and south; beyond this distance northward it seems to disappear, but it can be traced at intervals for 3 miles to the south, outcropping very distinctly on the north boundary of Loc. 3705. The quartz throughout is mostly very white with rose-coloured patches, more particularly where cross-jointing occurs.



"On the north boundary of Loc. 3863 about  $\frac{3}{4}$  mile east of County Peak, or Quajabin, two fencers, Dan Turnbull and John Ryan, found a 1dwt. slug of gold about November last, while sinking holes for posts. The gravelly soil is here about 18 inches thick, resting on the granite; a small patch has been stripped and shows veins of an amber coloured quartz. There are two diorite dykes adjacent (6614, 6615). The best method of testing both this gravel and the wash in the watercourse at Loc. 6043 would be by means of dryblowing. About  $\frac{3}{4}$  mile from here, near the east boundary of Loc. 3190, there is another outcrop of a rosy quartz reef, and another very ferruginous one in Loc. 4945 (6620). None of my samples of quartz and soil from this neighbourhood however have been found according to the Laboratory analyses to contain any gold.

"An east and west dyke of a very coarse-grained diorite, resembling a green syenite, occurs in Loc. 2614, half a mile south of County Peak; it outcrops in large boulder-like blocks (6612). The adjacent rock is a coarsely laminated gneiss (6611). Another very similar outcrop occurs farther south on the north margin of the salt lake.

"Quajabin Peak and the line of laterite topped hills north-westerly from there comprise a belt of hornblende gneiss and granite (6613, 6617). The decomposition of this rock forms most of the rich chocolate coloured soil in this neighbourhood.

"My return journey was made through Bally Bally, where there is a very large white quartz reef about 45 feet wide, forming the top of 'Quartz Hill' in Loc. 3735; it is very similar in character to the large reef near County Peak; its strike is 35 degrees. There is a parallel diorite dyke a few chains to the eastward of this reef and another  $\frac{3}{4}$  mile to the east which passes through Kilpatrick's homestead ground.

"My visit to the Dale River was made by the road through Annandale to Bechtel's station, where at Loc. 6447 and Loc. 6448 there is a large reef having an approximate east and west course. At an outcrop in a gully a little north of the north-west corner of Loc. 6445, some surface work has been done by Mr. Bechtel; the reef is here about 22 feet; it underlays south. A diorite dyke about 100 feet wide crosses the reef about 100 feet west of the place; both the quartz and the diorite are slightly pyritic. There is another large outcrop of quartz in the centre of Loc. 6444 having a slightly more north-easterly course, which may be the same reef. Samples from both these localities have yielded minute traces of gold according to the Laboratory report.

"Outcrops of a continuation westerly from these localities were inspected at the division line between Loc. 6447 and 6448 where there is a ferruginous schist on the north side of the reef and at the west boundary of 6448 and along a ridge for 15 chains westerly; at the crossing of the watercourse at the latter place a pothole was made by Jones and party, but no gold occurs in my samples from these two places according to the Laboratory tests. The reef reappears  $\frac{1}{4}$  mile westerly and continues for about half a mile farther.

"I was informed by old residents that about the year 1887 a hawker named Carl Heider lost his way in this neighbourhood and found his way out to the Perth-Albany road somewhat south of the 47 mile post, where there was then the Coach and Horses Inn. When there he showed some quartz with gold in it, which he said he had found in a gully within 24 hours before reaching the road. He afterwards spent a month in company with Mr. T. Willey searching for it, but without success. I saw Mr. Willey, and he showed me a piece of this stone, and I thought that it would be worth while to travel through this tract of country, and on 12th February I left the boundary of Bechtel's Loc. 6448 and journeyed 7 miles west with a pack-horse to the surveyed watershed boundary of the Canning. At about  $73\frac{3}{4}$  miles according to the plan numbering, if my identification of the spot is correct. It is most unfortunate that neither the Canning nor the Helena river's watershed survey posts are numbered so that identification of the posts is rendered difficult even to a surveyor: this is, I submit, an omission that ought to be rectified before the cut lines are too much overgrown or obliterated. On my way I found all the watercourses' pools dry, so that when on the ridge I decided to take a south-west direction so as to cut the Albany road in the shortest possible direction, 11 miles. It was across the trend of all the valleys and ridges of the head of the Canning watershed, and I passed over some very rough country and bare granite tracts before I struck the road at the 47 mile post. The Dale side is largely undulating country, but the western side is very rough. I saw a few quartz reefs, and also some diorite resembling the coarse kind near County Peak. I did not see any gold. I then proceeded to the Bannister River, reaching Pollard's on the evening of the 13th. At the Bannister River I noticed some quartz reefs and diorite dykes and was told of some other reefs in the neighbourhood; a little alluvial gold was found eight years ago in Loc. 341.

"Mr. Schorer, the postmaster of Wandering and now of York, I was told, found a small piece of gold-bearing quartz at Wandering, and Mr. Geo. Watts I understand has a slug of gold found by Mr. R. Pollard on the Hotham river, eight miles south of Bannister. I however did not spend any time in this locality, and made as speedy a return as possible by conveyance *via* the Wandering settlement to the Dale river, and returned to Perth on the 19th February.

"My journey showed that there are numerous quartz reefs in the Beverley district, some very promising looking, but only the samples from Ford's and Bechtel's selections yielded any traces of gold on assay in the Laboratory; but the finding of occasional nuggets of alluvial gold and pieces of auriferous quartz show that there may yet be some gold patches in the district. I regretted having to make such a hurried journey across the Canning area. The month of September would probably be the best time to go there.

"Attached is a list of mineral specimens obtained from these districts, and also three lithos 343A/40, 342/80, and 379/80 showing the route and localities visited."



## Mineral Specimens from Beverley District.

Regd. No.	Lab. No.	Coll. No.	Specimen.	Gold Assay.	No. of Specimens.
6607	...	1	Porphyry dyke, 3 miles N. of Mt. Coroling Road and N. of Loc. 3886	...	3
6608	...	2	Contorted gneiss and quartz veins, 10 chs. N. of Loc. 3886	...	1
...	1700	3	Quartz, 10 chs. N.E. of spec. No. 4, E. and W. reef	Minute trace	...
6609	1701	4	Ferruginous quartz reef, 3 chs. N. of Loc. 3886	do.	...
...	1702	5	Ferruginous quartz reef, E. side of high outcrop of Loc. 3886	do.	...
...	...	6	Ferruginous gossan of reef	...	...
...	1703	7	Earth at 2 chs. S. of No. 5	do.	...
6610	...	8	Ferruginous schist, W. side of reef, Loc. 3866	...	3
...	1704	9	Quartz floaters, adjacent to Coll. No. 11	Minute trace	...
...	1705	9a	Do. do. do.	do.	...
...	1706	10	Earth at Coll. No. 9	Nil	...
...	1707	11	Earth at Watercourse, 15 chs. from road, Loc. 6043	Nil	...
...	1708	12	Earth opposite (20ft. N.) of 10 ch. peg N. side of road crossing, Loc. 6043	Nil	...
...	...	13	Hornblende gneiss, head of the above small gully	...	...
6611	...	14	Coarsely laminated gneiss, Loc. 2614, half mile S.W. of Quajabin or County Peak, S. boundary	...	2
6612	...	15	Coarse-grained diorite, Loc. 2614, S. boundary	...	3
6613	...	16	Hornblende gneiss, near top of County Peak	...	3
...	...	17	Granite, N.E. side of County Peak, Loc. 3191; a similar rock occurs in Loc. 2620	...	...
...	...	18	Quartz, Loc. 3190, $\frac{1}{4}$ mile N.W. of County Peak	Nil	2
6614	1709	19	Diorite, Loc. 3863, 5 chs. S. of N. boundary E. and W. dyke	...	1
6615	...	20	Diorite, Loc. 3863, N. boundary, N.W. and S.E. dyke near where 1dwt. nugget of gold was found	...	3
6616	...	21	Epidote, Loc. 2587, about one mile N.W. from Quajabin Peak, N. side of diorite	...	2
6617	...	22	Hornblende gneiss, Loc. 5040, 2 miles N.W. of Peak	...	3
...	...	23	Coarse diorite, S. of Loc. 6854, at edge of Lake, similar to 6612, Coll. No. 15	...	...
6618	...	24	Granite, Loc. 808, well dump	...	1
6619	1710	25	Quartz, Loc. 5040, 34 chs. N.E. of shaft	Nil	3
...	1711	26	Wash from where 1dwt. nugget was found on Loc. 3863	Nil	...
6620	1712	27	Quartz, outcrop in Loc. 4945	Nil	...
6621	1776	28	Quartz, near N.W. corner of 6445, Bechtel's	Minute trace	2
6622	...	29	Diorite, crossing reef, spec. 6621	...	2
...	1777	30	Quartz outcrop centre of 6444 strike 267ft.	Minute trace	...
...	1778	31	Ferruginous casing of reef, crossing middle boundary, 6647-6648	Nil	...
...	1779	32	Pothole in reef, crossing W. boundary 6448	Nil	...
6623	...	33	Pyritous diorite, W.R. 9336, Dale River	...	3
...	...	34	Ferruginous gneiss, in W.R.	Gold, Nil Silver, Nil Copper, Nil	...
6624	1780	35	Quartz, 7 chs. E. of W. boundary, Loc. 6448	Nil	...
...	1781	36	Quartz, Loc. 6257 (Noonan's)	Nil	...
...	1782	37	Quartz, Loc. 341, Bannister River	Nil	...
6625	...	38	Diorite, central portion of dyke, Loc. 341	...	1
6626	...	39	Diorite, shows central change of texture	...	2
6627	...	40	Diorite, outer portion of dyke	...	2
6628	...	41	Granite, N.E. side of County Peak, Loc. 3191	...	2
6629	...	42	Felsite, S. boundary Loc. 6446, Bechtel's, Dale River	...	1
6630	...	43	Diorite, S. boundary Loc. 6446, Bare Hill	...	1
6631	...	44	Granite, Booraginning Rocks	...	2
6632	...	45	Granite, Conoring Rocks	...	1
6633	...	46	Granite, Loc. 2911, near Yenadine Pool, cave in granite, flake from interior of cave	...	1



## MISCELLANEOUS MINERAL NOTES.

Mr. Simpson, the Mineralogist and Assayer, has furnished the following information regarding some of the more interesting material which has passed through the Laboratory during the year under review:—

L1692B. *Coal, Fly Brook*. A hard, bright brown coal from the lower seam at Fly Brook had the following composition:—

Moisture ...	...	...	13.31
Volatile hydrocarbons ...	...	...	37.42
Fixed carbon ...	...	...	46.45
Ash ...	...	...	2.82
<hr/>			
			100.00

Calorific value per lb. ... 10,167 B.T.U.

L1911B. *Diatomite, Cape Arid* (Eucla Division). A second grade diatomite or kieselguhr of great purity but low absorptive capacity. It is of very little value as an absorbent base for dynamite, etc., but might well be employed for heat insulation, soluble-glass manufacture, etc.:—

## Mechanical Analysis—

Diatoms and sponge spicules ...	...	...	97.88
Roots and other coarse organic matter ...	...	...	.41
Sand grit passing 60 sieve, refusing 90 ...	82	...	...
"    30    "    "    60 ...	65	...	...
"    10    "    "    30 ...	24	...	1.71
<hr/>			
			100.00

Percentage absorptive capacity 90

Chemical Analysis—		Crude.	Calcd.
Moisture ...	...	2.39	...
Organic and combined water ...	...	10.94	...
Silica ...	...	83.84	96.74
Lime ...	...	.31	.36
Magnesia ...	...	.32	.37
Manganese oxide ...	...	Trace	Trace
Iron peroxide ...	...	.54	.62
Alumina ...	...	.98	1.13
Alkalis, etc. ...	...	.68	.78
		<hr/>	<hr/>
		100.00	100.00

L1978B. *Bitumen, Albany Harbour*. A high-grade asphalt of the following composition:—

Moisture ...	...	...	73
Petrolene ...	...	...	56.48
Asphaltene ...	...	...	42.22
Non-bituminous Organic ...	...	...	Trace
Ash ...	...	...	.57
<hr/>			
			100.00

This is closely related to the other asphalts found on the south coast, and with them may not be of local origin, but drifted in by the sea, or dropped by whalers, etc. It is of excellent quality, well suited for paving or any other purpose to which asphalt is put.

L2075/8. *Ochres, Cossack*. These four samples were examined for their suitability for making paint. They were found to be readily ground, and with one exception (L2078B) very free from grit. In both the raw and burnt states they formed excellent pigments with plenty of body, and yielded smooth paints of good colour, high covering capacity, non-poisonous, and very permanent.

## COLOURS.

Raw.	Burnt.
2075.—Olive brown ...	Dark purple brown
2076.—Purple brown ...	Dark purple brown
2077.—Burnt sienna ...	Burnt sienna
2078.—Bright ochre yellow ...	Yellow brown

A bright red ochre of excellent quality (L2627B) was received from near Coondip in the Phillips River G.F.

L2111B. *Asbestos (Chrysotile), Tambourah*. The high-grade asbestos from some distance north of Tambourah has yielded the following results on analysis:—

Silica ...	...	...	42.98
Magnesia ...	...	...	39.92
Manganese protoxide ...	...	...	Trace
Iron protoxide ...	...	...	.24
Iron peroxide ...	...	...	1.68
Alumina ...	...	...	.44
Water above 100° ...	...	...	12.88
Water below 100° ...	...	...	1.94
<hr/>			
			100.08
<hr/>			
Specific gravity ...	...	...	2.37

L2414B. *Gold-coated sheeps' jaws, Peak Hill*. The teeth in these jaws were coated with a metallic-looking deposit suspected to consist largely of gold. No gold or other metallic mineral however was present, the deposit consisting of small scales of bronze-coloured mica cemented together with the organic matter usually occurring on teeth.

L2445/8B. *Argentiferous copper ores, Uaroo*. These ores from Weston's Find, 12 miles south-west of Uaroo homestead, assayed:—

2445.—Copper, 54.69 per cent.; silver, 21ozs. 1dwt. per ton; gold, *nil*.

2446.—Copper, 62.35 per cent.; silver, 39ozs. 15dwts. per ton; gold, *nil*.

2447.—Copper, 54.11 per cent.; silver, 34ozs. 16dwts. per ton; gold, *nil*.

2448.—Copper, 4.22 per cent.; silver, 6ozs. 9dwts. per ton; gold, *nil*.

L1244B. *Meteorite, Nuleri District*. A small meteoric iron (Octahedrite) found by a prospector about 200 miles east of Sir Samuel. Composition:—

Iron ...	...	...	93.57
Nickel ...	...	...	5.79
Cobalt ...	...	...	.41
Magnesium ...	...	...	.09
Copper ...	...	...	Trace
Carbon ...	...	...	.01
Phosphorus ...	...	...	.13
Sulphur ...	...	...	Trace
Silicon ...	...	...	<i>Nil</i>
Chlorine ...	...	...	Trace
<hr/>			
			100.00
<hr/>			
Specific gravity ...	...	...	7.79

A complete report on this will appear in Bulletin No. 26.

L2264/5B. *Clays, Newlands*. Two clays from Newlands were examined with a view to determining their value for making stoneware pipes, etc., for which they appear to be well suited. They were



well vitrified on burning at 1,400 deg. In the raw state, after being air-dried, their composition was:—

G.S.L.	...	...	2264	...	2265
Colour	...	...	White	...	Red
Silica	...	...	65.45	...	61.39
Soda	...	...	.31	...	.40
Potash	...	...	1.09	...	1.98
Magnesia	...	...	.71	...	1.00
Lime	...	...	Nil	...	Trace
Manganese protoxide	...	...	.09	...	.11
Iron protoxide	...	...	.12	...	.12
Iron peroxide	...	...	.94	...	8.74
Alumina	...	...	21.53	...	18.12
Water above 100deg.	...	...	7.34	...	6.38
Water below 100deg.	...	...	1.96	...	2.16
			100.14	...	100.40

L2413B. *Briquettes of Collie Coal.* Briquettes made of a mixture of dried Collieburn slack coal and the resinous husk of the grass tree (*Macrozamia preissii*). Analyses:—

Coal,	{ Carbonaceous matter	...	77.1
77.7%	{ Pyrites	...	.6
Grasstree,	{ Resin	...	17.1
22.3%	{ Wood fibre...	...	5.2
			100.0
Moisture	...	...	9.78
Volatile hydrocarbons	...	...	40.08
Fixed carbon	...	...	41.63
Ash	...	...	8.51
			100.00

Calorific value, 5,683 calories.  
10,230 B.T.U.

L2600/4, 2610, 2613/7B. *Phosphatic rocks, Dandarraga.* A full report on these interesting rocks will appear in Bulletin No. 26. The rocks are sandstones and ironstones with variable amounts of fossil bone, lime-phosphate concretions (coprolites), dufrenite and other iron phosphates, and occasionally a little wavellite.

L2262B. *Microlite, Wodgina.* Several water-worn fragments of this rare tantalate of lime have been detected in two tantalum ores from Wodgina. A rough analysis of the mineral gave the following results:—

Tantalum and niobium pentoxides	...	77.16
Tin dioxide	...	Present
Lime	...	13.46
Magnesia	...	.42
Iron protoxide	...	3.64
Manganese protoxide	...	.60
Potash	...	.20
Soda	...	1.66
Water, etc., on ignition	...	1.06
Water below 100°	...	.22
		98.42
Specific gravity	...	5.422

I have, etc.,

A. GIBB MAITLAND,  
Government Geologist.



THE UNIVERSITY OF CHICAGO  
DIVISION OF THE PHYSICAL SCIENCES  
DEPARTMENT OF CHEMISTRY

REPORT OF THE  
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# INDEX TO NAMES OF PLACES, MINES, REEFS, ETC.

	Page
Agamemnon Lease ... ..	14
Albany ... ..	5
Albany Harbour ... ..	28
Alienation of Mineral Lands ... ..	5
Aluminium ... ..	6
Analyses ... ..	6, 23, 24, 25, 28, 29
Annual Progress Report, 1905 ... ..	7
Antimony ... ..	6
Arcadia Reef ... ..	13
Argentiferous Copper Ores ... ..	28
Arrino... ..	23
Artesian Water ... ..	5, 7
Asbestos ... ..	28
Assay Fees ... ..	7
Assays ... ..	6, 21, 28
Australian Museum, Sydney ... ..	7
Austria, Geological Survey of ... ..	7

Badgarning Hill ... ..	21
Bailey and party ... ..	22
Bally Bally ... ..	26
Barrambie ... ..	5, 15
Barrambie Perseverance Lease ... ..	17
Barrambie Ranges ... ..	15
Barrambie South Lease ... ..	16
Belgravia Reef ... ..	13
Bellevue Lease ... ..	19
Beverley ... ..	5, 25
Bitumen ... ..	28
Bonnie Dundee Reef ... ..	13
Bonnievale ... ..	6
Brilliant Lease ... ..	13
Briquettes ... ..	29
British Guiana, Geological Survey of ... ..	7
Burtville ... ..	7

Caledonia Hill Mine ... ..	5, 14
Campania Reef ... ..	13
Campbell, W. D. ... ..	5, 7, 21, 23, 24, 25
Canada, Geological Survey of ... ..	7
Cape Arid ... ..	28
Cape of Good Hope, Geological Survey of ... ..	7
Carbine ... ..	6
Carnage... ..	6
Carnarvon ... ..	5
Caroline Lease ... ..	18
Cashmans ... ..	6
Catalpa Lease ... ..	14
Chapman, F. ... ..	7
Chrysotile ... ..	28
Clackline ... ..	6, 24
Clay Deposits ... ..	24, 28
Coal ... ..	6, 28
Collection, Geological ... ..	7
Collie Coalfield ... ..	7
Collie River Beds ... ..	7
Conder & Gill ... ..	22
Coolgardie Goldfield ... ..	6
Coolgardie, North, Goldfield ... ..	7
Coondip ... ..	28
Copper ... ..	6
Copperfield Reef ... ..	19
Copper Ores, Argentiferous ... ..	28
Cossack ... ..	28
Countess Extended Lease ... ..	14
County Peak ... ..	25, 26
Crème d'Or Lease ... ..	15
Criterion Lease ... ..	8, 10
Cue District ... ..	5, 6, 13
Cue No. 1 Mine ... ..	5, 13

	Page
Cue Victory Lease ... ..	14
Caddingwarra District ... ..	5, 6, 13, 15
Dale River ... ..	5, 25, 26
Dandarraga ... ..	6, 29
Darlôt ... ..	17, 20
Dawn of Hope Lease ... ..	16
Day Dawn District ... ..	5, 6, 13, 14
Deceiver Reef ... ..	13
Determinations ... ..	6
Devon Consols South Extended Lease ... ..	8, 9
Diatomite ... ..	28
Doig & Hanke ... ..	22
Duke of York Reef ... ..	13
Dundas Goldfield ... ..	7

Earp, Dr. F. S. ... ..	5
Eastern Lease ... ..	18
East Fingall Lease ... ..	15
East Murchison Goldfield ... ..	6, 17
Erlistoun ... ..	7
Errol's ... ..	5, 15, 16
Etheridge, R. ... ..	7
Eucla Division ... ..	28
Eureka No. 5 Lease ... ..	15
Excelsior Lease ... ..	18
Excelsior North Lease ... ..	18, 19
Exhibition, W.A. Chamber of Manufactures' ... ..	6, 7

Fairyland Lease ... ..	18, 19
Farrant, A. ... ..	5
Field Work ... ..	5
Fireclay ... ..	24, 25
Fly Brook ... ..	28
Fossils ... ..	7

General Kuropatkine Lease... ..	15, 16
Geological Collection ... ..	7
Gibson, C. G. ... ..	6, 7, 17
Gill, Conder & ... ..	22
Golden Hill Lease ... ..	15
Golden Stream Extended Lease ... ..	14
Golden Treasure Lease ... ..	15
Grant's North-West Prospecting Co. ... ..	12
Grant's Reward Lease ... ..	12, 13
Great Britain, Geological Survey of ... ..	7
Great Fingall Mine ... ..	14
Great Western Lease... ..	20
Great White Eye Lease ... ..	13
Greenough River ... ..	5

Hanke, Doig & ... ..	22
Hannan's Hope ... ..	8
Hannan's Reward North Leases ... ..	8, 9
Hardman, E. T. ... ..	11
Hawkins, Mann & ... ..	22
Hird's Lease ... ..	8
Homeward Bound Lease ... ..	14
Howchin, W. ... ..	7

Inheritance Lease ... ..	17
Ireland, Geological Survey of ... ..	7
Ivy Gold Mine ... ..	8, 10



INDEX TO NAMES OF PLACES, MINES, REEFS, ETC.—*continued.*

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