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THE GEOLOGY
OF
THE COOLGARDIE GOLDFIELD,

BY

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*Issued under the authority of the Hon. H. B. Lefroy, M.L.A.,
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PREFATORY NOTE.

IN an extensive Colony such as this there are two totally distinct classes of geological survey work necessary to meet the public requirements.

The *first* is the detailed examination of the important mining centres, and comprises the accurate mapping of the geological formations, the accumulation of information relating to the occurrence of the various ore deposits, and their mode of formation. In the search for new deposits, and in defining limits of those already known, the geologist has to be guided to a large extent by a knowledge of the methods by which particular ore bodies have been formed; for it is only in this way that the peculiarities of their distribution can be anticipated and their continuity forecasted. The accurate location of the geological formations, more especially in mining districts, being a practical necessity for their interpretation, the construction of topographical maps is a first essential, and consumes an ever-increasing share of the Geological Surveyor's time, which could well be more profitably employed.

The *second* class of work is the preliminary examination of comparatively unknown tracts of country with the view of ascertaining how far its geological characteristics are likely to affect its possibilities as mineral bearing country. Theoretically this latter work should, as far as possible, be carried out in advance of the occupation of the country for mining or other purposes; the exigencies of the public service, however, do not always admit of this being done, although a great deal can be accomplished in this direction.

Of the former class of work the Geological Survey Department has carried out a detailed examination of the more immediate vicinity of Coolgardie. The mapping of the formations of this goldfield was entrusted to Mr. Torrington Blatchford and Mr. E. L. Allhusen, while to the former member of the staff was allotted the preparation of the descriptive report on the district. The present report embraces not only the original work of the Departmental officers, but includes a brief *aperçu* of the labours of other observers.

A geological map, on the scale of 40 chains per inch, accompanies this report. It is designed more as an index to the four-sheet map, on a scale of 10 chains per inch, which contains many more details than would be possible to show on the smaller map.

In addition to mapping the geological boundaries (a matter of some difficulty in places, owing to the thick cover of recent superficial accumulations), the geologists ran contour lines at intervals of 20 feet over the area embraced by their work. Their labours in this direction were much facilitated owing to the courtesy of F. W. T. Saunders, Esq., the District Engineer of the Goldfields Water Supply Department, who was good enough to place at our disposal the contour survey of the portion of the district lying more immediately in the vicinity of Coolgardie.

The geological character of Coolgardie consists of a mass of intrusive granite on the West, succeeded by a belt of hornblende and talcose schists, the whole being intersected by dykes of diorite (?) and acidic rocks. The dykes follow the strike of the schists, but there are local exceptions to the rule. The acid eruptive rocks in all probability emanate from the main granite mass, as cases occur in which a gradual passage from the latter can be identified. The recent superficial deposits cover a very large portion of the field, and vary in thickness from a few inches up to several hundreds of feet, as in Rollo's bore. In some portions of Coolgardie there occurs, resting on the denuded granite surface, a thin bed of cement of the type occurring at Kanowna and the 25-Mile.

What now remains of this cement occurs in every case at levels between 1,380 and 1,460 feet above sea level, showing that the deposit has a somewhat uniform level. The average thickness of this deposit does not exceed three feet, and although auriferous, it has not, up to the present, proved to be payably so.

The gold obtained from Coolgardie has been derived from three principal sources, viz., alluvial deposits, lode formations, and quartz reefs.

The gold from the recent superficial deposits presents all the usual characters. Unfortunately there are no data available by which the amount of alluvial gold obtained from the Coolgardie Goldfield can be deduced. The "lode formations," as a rule, consist of schistose rocks traversed by a network of quartz leaders; the formations appear to possess no sharply defined boundaries, unless in exceptional cases, the limits of the deposit being defined by purely technical considerations. A great deal of gold seems to

have been derived from these formations, but, owing to the way in which the returns are kept, it has not been possible to separate the yield of formations from that of the quartz reefs proper. The quartz reefs would seem to be practically confined to the schists. The reefs trend generally North and South, and have a dip of from 60 degrees to 80 degrees to the East. The gold occurs in shoots in the reefs, but so far no observations have been recorded as to either direction or the strike of the shoots.

Up to the end of 1898 there have been crushed from the Coolgardie Goldfield 206,211 tons of ore, yielding 242,235ozs. of gold, or at the rate of 1oz. 3dwt. per ton.

The Customs authorities, however, give 521,104ozs. of gold, as being that entered for export from the Coolgardie Goldfield, being 278,869ozs. in excess of the figures furnished to the Mines Department.

The discrepancy may be partly accounted for by the difficulty experienced in obtaining any record of the output of alluvial gold, and also that a good deal of the gold won in the early days of the goldfield was never officially reported to the Department of Mines, and until quite recently deemed worthy of no better record than the ephemeral currency of the newspaper.

A. GIBB MAITLAND,
Government Geologist.

Geological Survey Office,
Perth, 20th March, 1899.

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THE GEOLOGY OF THE COOLGARDIE GOLDFIELD.

Introduction.

The object of this report is to place before the public such general geological information of the Coolgardie Goldfield as can be gathered from previous writings on the subject, and any (official) data collected by officers of this and the other Government Departments of this Colony. In addition to such general description, an accurate geological survey has been made of that particular portion of the Goldfield in the immediate vicinity of the Coolgardie Townsite, and notes made on the 25-Mile (Kunanalling) Cement Deposits. Considering the area of the Coolgardie Goldfield, it would be impossible, with the present staff, to carry on a detailed survey for the whole area. It has therefore been necessary to choose the most important mining portions as a basis, to which any future detail work can be subsequently added. Situated in the centre of an auriferous belt of country striking North and South, this area was chosen first for obvious reasons, and though due reference will be made to other parts of the field, a detailed description of this particular portion will occupy most of this report.

The Coolgardie Goldfield.

“The Coolgardie Goldfield at present is bounded by lines
“starting from the North-East corner of the Yilgarn Goldfield
“(which is a point about 50 miles West from a cairn marked
“NB 1, near the Wangine Soak) and extending South about
“118 miles through a cairn, H 26, on Koorarawalyee Granite
“Rock; thence East about 113 miles through the summit of a
“granite rock near the 50-Mile Soak, on the Dundas and Lake
“Lefroy Road; thence North about 48 miles to a point 35 miles
“East of the South-East corner of the above-mentioned location;
“thence along the boundaries (surveyed) of Location 48, Westerly
“443 chains 91 links, Northerly 564 chains 87 links to the South-
“East corner of Location 51; thence along the boundaries (sur-
“veyed) of that location Westerly 160 chains, Southerly 60 chains,

“Westerly 119 chains 87 links to South-West corner of Location 51; thence Northerly 400 chains along the Western boundary of Location 51 and Eastern boundary of Location 53 to the North-East corner of Location 53; thence 36 miles 1,481 links along a surveyed line $324^{\circ} 46'$; thence North 30 miles 47 chains 36 links along a surveyed line to a tree, R 3, near the Cane Grass Swamp, on the 90-Mile Road; thence Westerly to a cairn marked “NB 1, near Wangine Soak; thence Westerly about 50 miles “to the starting point, excluding all townsites and fee simple lands “within the said boundaries.”

The area included within these boundaries is computed by the authorities to be 11,974 square miles.

Previous to March 20th, 1896, the Coolgardie Goldfield embraced the present Coolgardie, East Coolgardie, North-East Coolgardie and Broad Arrow Goldfields, all of which, together with the present Yilgarn Goldfield, were originally known as the Yilgarn Goldfield.

The Geological Map of part of the Coolgardie Goldfield.

The accompanying map embraces a tract of country extending four miles North and South, and two miles East and West of the Coolgardie Townsite. On it are indicated all shafts and works on the leases, the position, strike, and dip of lines of reefs, and all geological boundaries and topographical features.

Contours at 10ft. intervals have been run out over the whole area, so that the approximate form of the surface of the field is represented. This work was much facilitated through the courtesy of F. W. T. Saunders, District Engineer of the Goldfields Water Supply Department, who was good enough to place at our disposal tracings of the contour surveys made in connection with the water reservoirs to the South of the Townsite.

In mapping out these various boundaries, etc., a Plane Table and Tacheometer were used. The scale of the original plane table sheets was 10 chains to one inch. In addition to purely geological work, its economic aspects, including statistics of gold outputs, water supplies, working plans, etc., are also dealt with in the following report.

It is much to be regretted that the circumstances under which this work has been carried out to effect this object have been some-

what unfavourable, inasmuch as the prospecting has been, as a rule, of a very meagre character, consisting in most cases of sinking shafts, at most, to the water level, or till hard country is reached.

In addition to this, except in isolated cases, reliable working plans have either not been kept or are otherwise unprocurable.

In consequence, much of the field remains unprospected, and covered as it is by thick accumulations of detritus, the boundaries of the various formations, and sometimes the lines of reefs, have of necessity been often only approximately delineated upon the plan.

History of the (Coolgardie) Goldfield.*

Although H. M. Lefroy, in 1863, C. C. Hunt, in 1864, J. Forrest, in 1871, E. Giles, in 1875, and D. Lindsay, in 1891, passed over various portions of what now forms the Coolgardie Goldfield, it was not till late in 1892 that gold was discovered within that area.

The real history of the Goldfield commences on the 18th of September, 1892, when Arthur Bayley first reported, at Southern Cross, the discovery of gold by John Ford and himself near the Coolgardie Water Hole. In 1891-2 several prospecting parties went East from Southern Cross to examine the quartz outcrops near the Hampton Plains, discovered by C. C. Hunt in 1864.

About the months of May or June, 1892, Arthur Bayley and John Ford, after fitting themselves out with two horses and provisions for a lengthy prospecting tour, left Southern Cross and travelled Eastward towards the Hampton Plains. They followed C. C. Hunt's old track, and, after crossing much monotonous sandy country, at length arrived at the Gnarlbine Rock, where they found fresh water and food for their horses. Here the party camped for two days to enable their horses to recruit. Setting out in a North-Easterly direction, they came to a native well, known to the aborigines as Coolgardie. Grass was abundant, and allowing their horses to feed, they prospected in the vicinity of the well. This well, at which they camped, has since been replaced by a tank sunk by the Goldfields Water Supply Department, on the Government Reserve, to the South-East of the Coolgardie Railway Station.

* The following account of the History of the Coolgardie Goldfield is taken from the History of Western Australia by W. B. Kimberly.

Starting from this camp Ford was the first to discover gold, and picked up a piece weighing half an ounce which was lying on the surface. In a few weeks 200 ounces more were picked up or "speeked" in this locality, which was afterwards to be known as "Fly Flat." Returning to Southern Cross for rations, they kept their secret and hastened back as soon as possible to the scene of their original discovery.

One Sunday afternoon, towards the end of August, 1892, Bayley broke the cap of one of the many quartz outcrops occurring in the vicinity of the camp, and thus proved the auriferous character of the afterwards celebrated Bayley's Reward Reef. The same day they had dollied out 500 ounces of gold by means of a tomahawk, the reef being phenomenally rich. Shortly afterwards Bayley returned to Southern Cross and reported his discovery, on the 18th of September, 1892, to the Warden and Registrar, Messrs. Finnerty and Compton. He applied for, and obtained the Reward Claim, known as Bayley's Reward G.M.L. 133.

Mr. Finnerty then returned with Bayley to obtain an idea as to the importance of the discovery, and with them went nearly the whole male population of Southern Cross. By the 8th of the following month, October, there were 150 men on the field, and before the 25th of the same month 3,000 ounces had been collected from the alluvial workings, which proved to be very rich. At the end of October, 1892, there were 400 men assembled on the field, and about this time the great scarcity of water began to be felt. Food, too, rose to a fabulous price, and the cost of water was several shillings per gallon. In consequence, towards the end of 1892, Coolgardie was nearly deserted.

About March of 1893, however, rain fell, and fairly good supplies of water were to be obtained, in consequence of which a greater influx of prospectors took place, so that by June, 1893, 1,492 persons were present on the field. From June, 1893, continual "rushes" to various scenes of discovery took place. The first of these was caused by a prospector, named Frost, finding gold at the "90-Mile," to the North of the present Coolgardie Townsite. On Saturday, 17th June, 1893, "Pat" Hannan and "Tom" Flannagan found rich alluvial ground at a distance of 24 miles to the East. This discovery was accidentally made by these prospectors while travelling to the Mount Youle rush. The following Sunday morning Coolgardie was all astir, and in the evening the place was almost abandoned, the men flocking to the rush on camels, bicycles, horses, and many on foot. For a short time the returns from "Hannan's Patch," as it is locally named, were re-

markable, but the richer reefs and ore deposits, which are now so successfully worked, were not discovered till some considerable time afterwards. The next "rush" was to the 45-Mile, where Messrs. Cashman and Lee reported gold. Of all the "rushes" from Coolgardie the most disastrous was the one to Siberia. Messrs. Frost and Bonner brought in news of their having discovered rich specimens 75 miles North-North-West from Coolgardie. The alluvial at "Hannan's" and "Fly Flat" had by this time been mostly worked out, and a great crowd started, with the true gold fever, on one of the worst watered tracks on the field, leaving Coolgardie and Hannan's almost deserted.

In a few days the want of water began to be very seriously felt. Mr. Renou started out on their tracks with two teams loaded with water, and leaving one tank at the 25-Mile, the other was taken on to the scene of the rush, while men on camels, provided with water, scoured the country in search of those who had separated from the main body. In spite of all these efforts, however, several deaths occurred, and had it not been for the prompt action on the part of Mr. Renou, in praise of which too much cannot be said, death must have overtaken a much greater number. Up to 1st July, 1894, the Eastern Railway extended only as far as Northam, but after that date railway communication was opened up as far as Southern Cross. In March, 1894, the Kurnalpi rush took place, and in May, 1894, that to the I.O.U. (Bulong). Both of these places lay to the East of Hannan's, and for a short time yielded a very large amount of precious metal. Shortly after this a series of rushes took place to White Feather (Kanowna), Broad Arrow (Kurawa), and Black Flag to the North-East, Wealth of Nations to the North-West, and Londonderry to the South of Coolgardie.

The Londonderry "find," which was discovered by a party of prospectors, Messrs. Carter, Dawson, Mills, Gardner, Elliot, and Huxley, proved to be enormously rich, 4,000 to 5,000 ounces of gold being dollied out of the quartz in a few days. Big Ben, a piece of quartz and gold broken from the outcrop, weighed 240lbs. (a.d.p.) and was valued at £3,500. Four thousand two hundred and eighty ounces were taken from this mine to Coolgardie on June 23rd, 1894. The property was shortly afterwards sold for £180,000 to Lord Fingall, who floated it into a company of 700,000 £1 shares. With such a handicap this mine soon fell into disfavour, especially when the "Golden Hole" was found to be of comparatively small extent. About July, 1894, Mr. J. G. Dunn discovered a very rich reef 28 miles West of North from Coolgardie.

This was afterwards known as the "Wealth of Nations," and proved to be almost as rich as the Londonderry find. In a short time Dunn dollied out £22,000 worth of gold, and afterwards sold the mine for £147,000.

In September, 1894, Messrs. R. Menzie and J. E. McDonald discovered gold to the North of Coolgardie, at a place now known as Menzies, and pegged out the Lady Shenton and Florence leases. No general "rush," however, set in to this place.

The Coolgardie Goldfield, as at present constituted, was officially declared on April 5th, 1894, and Mr. J. M. Finnerty was appointed as Warden, a Local Court being established on the 13th of the same month. Towards the middle of the year 1894, the population had increased to 3,000 or 4,000, so that if only for sanitary reasons it became necessary to proclaim Coolgardie as a municipality. This took place on the 4th July, 1894. The history of Coolgardie for the year 1895 is marked principally by the numerous flotations of properties and influx of English and Colonial capital. During this year no less than 39 local companies were registered, and power of attorney granted to 194. Prospectors received from £50 to £15,000 for their claims, which were then floated into companies with capitals ranging from £25,000 upwards, the most of which was in many cases swallowed up in expenditure, which left little for the development of the property. The total amount of capital invested is estimated to have reached the enormous sum of £50,000,000.

Towards the end of December, 1895, there were 6,000 people in Coolgardie, and 3,000 at Kalgoorlie, as Hannan's had come to be called. This increase in population in so short a time is probably partly accounted for by the increase in fresh water production by means of condensers. An abundance of salt water was always procurable on the field on sinking to a depth of usually about 100 to 200 feet, and this was then condensed by various methods hereafter described.

The year 1896 witnessed the rise of a land boom and the partial collapse of the mining boom. A fair idea of the prices paid for land can be formed when it is remembered that the Government realised £41,235 from sale of land in Kalgoorlie for the month of November alone. The influx of population from the Eastern Colonies was enormous during this year, the total reaching to 55,215, while the departures numbered only 19,266. It will not be an exaggeration to say that most of these new comers turned their footsteps Eastward.

On the 23rd of March, 1896, the railway from Southern Cross to Coolgardie was opened, and offered fresh facilities to intending prospectors, as it reduced both travelling expenses and the prices of food.

Since 1896 all the Eastern Goldfields, as well as Coolgardie, have suffered considerably from the reaction which set in after the great mining boom in 1895-6. This reaction is being less keenly felt now, and its ultimate result will be to promote more legitimate mining than was the case in the early history of the field. That the Coolgardie Goldfield is increasing its output of gold can be seen by the returns accompanying this report, and though the boom days are over there should still continue to be a steady increase in this output in the near future. Similar rich patches to those discovered at Londonderry, Bayley's, and Wealth of Nations may possibly be found from time to time, but on this point there can be no certainty, and it is on the development of the large low grade ore deposits that the future prosperity of the field must depend. Up to the present the working expenses have necessarily been too heavy for many of these ore deposits to be treated profitably. Strenuous efforts are however now being made by the Government to supply the field with fresh water from the Darling Ranges. This scheme, if successfully carried out, will reduce the expenses of ore treatment considerably, as it is estimated that it will be possible to supply fresh water to the mines at 3s. 6d. per 1,000 gallons, while the cost of salt water at the present ranges from 5s. to 10s. per thousand, and this supply is not regular. A copious supply of fresh water will also make living much less expensive, and so induce workmen to settle on the fields, instead of leading a nomadic life as at present. Taking into consideration the statistics of gold production, the development of mines, etc., there seems every probability of there being a lasting and prosperous future for the Coolgardie Goldfield.

Previous Observations on the Geology of Coolgardie.

In his Mining Handbook, Mr. H. P. Woodward, late Government Geologist, refers the rocks forming the greater portion of Western Australia to the Archæan age. According to his account, these Archæan rocks are usually crystalline, and are found outcropping throughout the Colony, and overlain only in isolated places by more modern formations; these latter are rarely of any great thickness. The Archæan rocks he divides into "three

“sections, the granites, the gneisses, and the schists, which, as a rule, run in parallel belts North and South, with a slight trend to the North-West. These belts are six in number. The first extends from the Murchison River to the South Coast, and is only exposed at Northampton, the Irwin River, and between Capes Naturaliste and Leeuwin. The rocks in this belt consist of clay slates, quartzites, and schists, and are characterised by the plentiful occurrence of copper, lead, zinc, iron pyrites, and ferruginous graphite. Parallel to this the second belt extends North and South from the South Coast to the Murchison River, and forms the bold escarpment known as the Darling Range. After passing the Murchison River this belt turns to the North-East for about 200 miles, and finally disappears beneath the magnesian limestone to the Northward.”

“In this belt the rocks are mostly hard and crystalline, consisting principally of gneiss and schist, with dykes of diorite, granite, and felstone, and veins of quartz. The minerals of commercial value occurring in this belt are tin (at Greenbushes), iron, and manganese, mica, and asbestos. Near Bridgetown a large deposit of graphite has lately (1896) been opened up.”

“The third, or great granite belt, lies 100 miles East from the West Coast. It extends from the South Coast to the Murchison River.”

“The fourth, or first auriferous belt, is situated immediately to the Eastward of the granite belt, and is some 20 miles in width.”

“Starting from the South coast, at the Phillips River, it extends Northwards in a narrow belt by the Ravensthorpe River, Parker’s Range, Southern Cross, Golden Valley, Mount Jackson, Mount Kenneth, Mount Magnet, Austin’s Lake, to Cue, and then turns to the North-East to Nannine, after which it skirts more to the North, round the bends of the Murchison and Ashburton Rivers, and finally disappears beneath Paleozoic rocks, after passing down the Ashburton Valley to its junction with the Henry. The rocks of this belt consist of hornblende, mica, and talc schists.”

“The fifth, or second granite belt, is about the same width and similar in every way to the first-mentioned. It extends from the South coast, following the first auriferous belt North, and, like it, dips under the Paleozoic tableland of the Fortescue. A small portion of it appears on the Northern side of the Yule River, near Pilbarra.”

"The sixth, or second auriferous belt, lies next, and at present its width is unknown. It extends from Dundas Hills through Widgemoultha, Coolgardie, Three Pinnacles, Ullaring, and Lake Carey, following about the same lines as the other belts, and turning with them to the North-West through Nullagine, Marble Bar, Pillbarra, Egina, and Mallina, upon the North-West coast. The rocks of this belt are, generally speaking, very similar to the first auriferous belt—*i.e.*, they consist of hornblende, mica, and talc schists.*"

"The ages of the other rocks, which are chiefly sedimentary, range from Cambrian to Recent.†"

Baron Sloet Van Oldruitenborgh, in dealing with the geological history of the Western portion of Australia, considers that "it has been dry land ever since the end of the Pre-Cambrian era, and constitutes a vast tableland, which has formerly been continuous with the old Austral-Indo-African continent (the Lemuria of zoologists). The metamorphic schists composes this plateau, and more particularly their upper layers, are interbedded with numerous and frequently powerful overflows of diorite, diabase, etc., which are probably of submarine origin, which overflows, and seem to have been the precursors of the tectonical uplift, whence arose the Austral Continent of primitive ages. Very likely, near the end of the Permo-Carboniferous era, the partial sinking of this Austral Continent, the successive depressions of which have generated the (actual) Indian Ocean, must have provoked in an Eastward direction a most intense compression of all the strata that then remained of the West Australian portion of the same continent."

"This East-North-East thrust has generated along the Western shore, for a length of about 800 miles, the upheaval of a doubly folded chain North-North-West perpendicular to the direction of orogenical pressure."

"The roots of this Lemurian chain, traceable by outcrops of granite and gneiss for some 800 miles, alone remain, and run North-North-West in two parallel streaks, each from 60 to 100 miles wide."‡

Mr. S. Göczel, late Field Geologist, in writing on "The Interior Gold Region of Western Australia" refers to its

* Mining Handbook to the Colony of Western Australia, by Harry P. Woodward, F.G.S., F.R.G.S., etc., Government Geologist. Perth: By Authority, 1895, pp. 37 and 38.

† For a complete list of these rocks *vide* Handbook to the Colony, page 29.

‡ Technical observations upon the Coolgardie Goldfield by Baron Van Oldruitenborgh. Translated from the French for *Mining Journal*, London.

geological history in the following terms:—"The geological monuments in the gold regions are bare of paleontological remains, but none the less, taken in conjunction with features of adjoining areas, they open a retrospective view into the early geological history of that portion of the Colony."

Mr. Göczel then traces the history of the Colony, through the Paleozoic age, when "the Colony was represented by a volcanic archipelago round which the Western part of Australia was gradually built, and the gold region joined by secular upheaval."

"To the beginning of the Mesozoic age, when a more general upheaval was completed, and volcanism in this portion of the globe apparently lost its intensity and manifested itself chiefly in seismic and hydrothermal activity."

"It was during later Paleozoic time that the writer considers the bulk of the primary gold deposits were formed, and were due to a hydrothermal gold emanation."

"In conclusion he inclines to the belief that the elevation of the country above the sea and the later cessation of volcanism and volcanic after action have inaugurated a new era, during which great depressions occupied by inland lakes and estuaries were successively filled in with rock material derived from the adjacent high country." *

In a subsequent description of the Coolgardie field, Mr. Göczel states that it is situated at "the contact zone between gneissic granite (which is partly overlaid by contact conglomerates) from the West and diorite and diorite schists from the East, and encloses a number of fissure lodes, most of which have a Northerly course. The main fissures extend for miles, and contain predominantly eruptive rock material; whereas ferruginous quartz with a higher or lower gold yield is only of secondary occurrence within them."

The dykes he considers to consist "usually of diorites, diorite porphyries, and porphyrites." †

Dr. Charles Chewings states in his pamphlet on the Coolgardie Goldfields that "the prevailing metamorphic rocks of the goldfield are schists and slates." ‡

* *Ad Interim Report on the Department of Mines for half-year ending 30th June, 1894, Appendix 4.* Perth: By Authority, p. 19.

† *Report of the Department of Mines for the year 1895.* Perth: By Authority, p. 24.

‡ *Geological Notes on the Coolgardie Goldfields by Dr. Charles Chewings, Ph.D., F.G.S.* A paper read before the Royal Colonial Institute, March 17th, 1896.

"Chemically these range from the most acid to the most basic, "petrologically from amphibole to quartz schist. The geological age "is probably not younger than Cambrian. Interbedded in these "schists are limestones. Vast beds of conglomerates are also found "interbedded with the schists and slates. One of these beds is to be "seen some eight miles West of Hannan's, and another at the White "Feather (Kanowna)." *

In reference to the eruptive rocks, Dr. Chewings maintains "that the Coolgardie Goldfield is the remnant of a large mountain "chain which has been planed down to its roots by denuding "agencies. This chain marks a line of weakness in the earth's "crust, through which poured the materials which formed the "chain, while vast quantities remained beneath, and have been "exposed to the present surface through the wearing away of the "upper portions."

In dealing with the portion of the Coolgardie field in the immediate vicinity of the Coolgardie Townsite, the author considers that this portion lies along "the contact zone between granite on "the West and amphibole schists and diorite on the East. Along "this contact line remarkable rich discoveries were made such as at "Bayley's and the Londonderry. Pegmatite dykes are commonly "found in the neighbourhood of such, notably at Londonderry." † As the gold in these two celebrated mines occurred in patches, the author considers that "the recurrence of similar patches is "likely." Dr. Chewings then refers to the occurrence of the auriferous granite porphyry dykes worked in the vicinity of and at Tindall's gold mine, and concludes by stating that though "the ore "in these dykes is not of high grade, there is any quantity of it."

With reference to the question of the geological age of Western Australia, the foregoing extracts have been taken from the writings of the geologists who have dealt with this subject, and have been placed before the public in this pamphlet in order that they may be known and compared. It might be added, however, that—

1. Accurate geological information about many—in fact, most—parts of the Colony, is at present unprocurable.
2. A great majority of the rocks are destitute of fossils.
3. The surface in many places is completely hidden from view by superficial deposits of a very recent age.

* Report on so called deep leads at Kanowna by T. Blatchford; Annual Progress Report of the Geological Survey for the year 1897. Perth: By Authority, 1898.

† Geological Notes on the Coolgardie Goldfields by Dr. Charles Chewings, Ph.D., F.G.S. Read before the Royal Colonial Institute, March 17th, 1896.

4. Much of the Colony remains still unexplored.
5. The series to which a correct geological age can be attributed are usually disconnected.

Taking a general view of these obstacles, it will be seen at once that an accurate determination of the geological age of much of the Colony is an impossibility in the present condition of our knowledge.

The Geology of the Field.

The following is a concise description, based on personal observations, of the geological features, etc., of that part of the Coolgardie Goldfield embraced within the boundaries of the accompanying map:—

Topography.

Taking the Townsite of Coolgardie as a starting point, the country has a gradual and even slope for a considerable distance towards the West, the watershed running nearly due North and South.

The Eastern slope has a greater incline than the Western, and is broken by ridges of diorite which attain a height of from 100 to 300 feet above the level of the surrounding country. The direction of these ridges is irregular, though in the South the inclination is to a North and South course, while in the North the direction is more or less East and West. The country between these ridges consists of extensive flats covered with recent superficial deposits of a red colour, resulting from the decomposition of the ironstone gravels and the diorites and associated hornblende rocks.

General Geological Features.

The general geological features of the field are as follows:— Underlying the red alluvium on the Western slope lies a belt of intrusive granite running North 20° West throughout the length of the field, the Eastern boundary coinciding very closely with the watershed above described. Lying to the East of this belt, and dipping at angles varying from 30° to 60° to the East, and having an average strike corresponding to that of the granite, lies a belt of much altered and probably very ancient hornblende and talcose schists, through which have intruded diorites and acid eruptive rocks.

These, as a rule, follow the strike of the schists, though cases occur in which they cross the strata at all angles.

Closely associated with, and often inseparable from these diorite dykes, are amphibole rocks, which at the surface weather into the form of schists, and are often mistaken for such. As far as can be seen, however, these amphibolites pass into diorites at a depth, and, as at present it is not possible to follow this gradual alteration through all its stages, it will be interesting to trace the change when the mines are further developed. There is sufficient evidence, however, to show that the diorites are entirely distinct from those lying adjacent to the granite, as they vary greatly both in texture and chemical composition.

The acid eruptive rocks which occur in many places on the field as narrow dykes usually trend towards the granite, and in some cases the gradual change, from coarse granite to what appears to be a quartzite, can be traced through every stage. Associated with these dykes are belts of dark compact rock, closely resembling slate, both in texture and cleavage, and often containing abundance of iron and arsenical pyrites. On analysis this has been proved to carry as much as 8dwts. of gold per ton, the gold not being in a free state, but contained in the pyrites. Since these belts of slate-rock are usually found associated with the felsite dykes, and often lie on each side of the latter with a similar strike and dip, it seems more than probable that they are simply much-altered schists or hornblende rocks.

Overlying the granite are the remains of what was once an extensive ironstone gravel deposit. This deposit, which apparently extends over a considerable area of Western Australia, has been so subjected to denuding agencies in this district that, except where it has attained considerable thickness by filling in the eroded surface of the granite, it has been entirely removed.

Between the granite and these above-mentioned ironstone gravel beds can be seen in places a thin stratum of so-called "cement;" but, unlike similar deposits at the 25-Mile and Kanowna, this bed seems of limited extent, and, unfortunately, has so far been proved to be unpayable to treat for gold.

Alluvial Deposits.

The alluvium, which forms the flats and Western slopes of the field, varies in thickness from a few inches to some 400 feet. The following are the details of a section as seen in Rollo's Shaft

(Government Reserve No. 23), the position of which is shown on the map attached to this report:—

Description of Strata, etc.	Thickness of Strata.	Depth of Strata in feet and inches.
	ft. in.	ft. in.
Red alluvium	6 0	6 0
Blue clay	50 0	56 0
Yellow clay	30 0	86 0
Moist sand	1 0	87 0
Schist floaters, etc.	2 0	89 0
Blue clay	30 0	119 0
Blue clay, containing bands of lignite and shoots of pyrites	81 0	200 0
Yellow clay	55 0	255 0
Coarse diorite boulders	15 0	270 0
Mixed schist and diorite boulders	40 0	310 0
Dark wash	48 0	358 0
Blue clay and diorite boulders	22 0	380 0
Carbonaceous shale	8 0	388 0
Diorite and quartz wash	10 0	398 0
Black sand	1 6	399 6
Bed rock, probably diorite ... ..	...	400 0

Section of Coolgardie Deep Alluvial Prospecting Company's Bore in the vicinity of Colreavy's Dam, Government Reserve No. 23.

No. 1.

Nature of Strata.	Thickness of Strata.	Depth from Surface.
	ft. in.	ft. in.
Alluvium	10 0	...
Greenish clay	87 0	10 0
Jet black clay	7 0	97 0
Green and blue clays (with ironstone pebbles, etc.)	85 0	104 0
Hard country rock (schist, etc.)	4 0	189 0
TOTAL	193 0	

No. 2.

Nature of Strata.	Thickness of Strata.	Depth from Surface.
	ft. in.	ft. in.
Red Alluvium	11 0	...
Ironstone boulders	3 0	11 0
Blue clay	29 0	14 0
Hard blue clay... ..	3 0	43 0
Soft blue clay	0 6	46 0
Hard blue clay... ..	...	46 6
TOTAL	46 6	

On the surface it consists of loose sand or quartz fragments, and ferruginous matter, the former being the result of decomposition of the granites, cements, and quartz reefs, the latter that of the ironstone gravels and hornblende rocks. The quartz particles, which vary considerably in size, are usually of a fine texture, and more or less rounded, probably by the action of the wind; and it is somewhat remarkable to notice how great an amount of friction is caused by the constant movement of the sand from this agency alone, by observing the results on glassware lying exposed to the open, the surfaces of such being invariably scratched to such an extent as to have a frosted appearance.

Lower down in the deposit, however, larger pieces of quartz are met with, and these are usually sub-angular and have probably been exposed to the action of water as they are met with on the eroded surface of the granite in what appear to have been ancient water-courses. In no case have I detected free gold in these blocks, and on inquiring from the miners working in such deposits the verdict has always been that they are barren. The ferruginous material which tends so largely to the composition of the alluvium, consists of impure oxide of iron, and is of a fine texture on the surface, with large loose-rounded pebbles of ironstone occurring in patches.

In many instances free gold is showing, both on the exterior and on freshly broken surfaces. After passing through the loose upper portions of the deposit, the amount varying with the locality, and immediately overlying the granite, the deposit becomes more compact, and often necessitates the use of explosives before the ground can be worked. This greater hardness is due to the solution and subsequent deposition of the iron, which then acts as a powerful cementing agent.

Examined under a lens or microscope, the finer samples show the presence of minute quantities of garnets and zircons occurring in broken and partly worn fragments together with magnetic iron, commonly known as "black sand." This latter was found in some quantity at the bottom of Rollo's Shaft, at a vertical depth of 394 feet, but, a pumping plant being necessary to cope with the influx of water, prospecting of any definite nature at this level was unfortunately prevented.

On consideration of the source from which these alluvial deposits were derived, and from the evidence of a heavier rainfall than that of the present day, it seems probable that gold may be found in payable quantities at the base of this deposit. On the other hand,

several of the small flats have already been tested without success; so it still remains doubtful whether the gold has been sufficiently concentrated to render it payable for working by present methods, assuming the old water-courses are eventually discovered. As showing that such ancient water-courses exist in other portions of the Coolgardie Goldfield, reference may be made to the report of the Government Geologist, in which a description is given of a deposit filling in an old valley.*

This deposit has been utilised as the source of the water supplied to Coolgardie by the Hampton Plains Company, and has been pierced by a bore to a depth of 162 feet.

The following is a section of the beds pierced:—

Nature of Strata.				Thickness of Strata.	Depth from Surface.
				ft. in.	ft. in.
Clay (with ironstone gravel)	...	...	...	27 0	...
Fine sand	...	...	...	30 0	27 0
Coarse yellow (water-bearing sand)	...	...	...	43 0	57 0
Clay	...	...	...	4 0	110 0
Sand wash	...	...	...	11 0	104 0
Kaolin (?)	...	...	...	8 0	115 0
Bed rock (nature undetermined)	...	...	...	39 0	123 0
Total	...	...	...	162 0	

A large quantity of gold, however, has been won from purely surface workings by a method commonly known as “dry-blowing.” This process of recovering gold from loose dry auriferous wash is somewhat unique, and gives very fair results when used by experts. Though simple in principle, great care is required when the gold is at all fine, and beyond a certain stage the process is absolutely useless. Hence the “dry blown” heaps still retain a considerable amount of gold, assays averaging in many places at least 10dwts. per ton.

There are several ways in which dry-blowing is carried on, the most primitive being to drop the wash from one dish to another, allowing the wind to blow away the light and finer particles during their passage, while the gold and coarser refuse falls into the lower dish. The large pebbles are then removed by “picking” with the hands, and the process repeated till the wash is sufficiently concentrated either to “spec” or wash with water in the ordinary way. As this is a very slow and laborious process, it was soon replaced by a simple form of machine, locally called a “shaker.” Of these

* Report of the Government Geologist in connection with the Water Supply of the Gold-fields: page 4. Perth: By Authority, 1897.

there are many varieties, though in all the principle is very similar, and may be briefly described as follows:—

Slanting wooden frames covered on the bottom with gratings of different meshes and partitioned by wooden ripples are fixed on stands in such a way as to allow the worker to either “shake” or “oscillate” the wash when placed on the sieves. The finest particles are thus passed through the sieves, while the coarser grains, owing to the incline, gradually pass over the ripples and discharge at the lowest edge; the gold, for the most part, settles down behind the ripples. The concentrates are then taken out of the boxes and carefully treated by the first process.

As an improvement on this, a pair of wind bellows are sometimes added to blow away the finer particles, and thus help the sieves. In such machines the bellows and sieves are worked in conjunction by being coupled by belting to a fly-wheel turned by manual labour. The principle of this machine is identical with the latter, but, being more cumbersome and expensive, though more efficient, it has not replaced the simpler and home-made varieties.

A more detailed account of this mode of gold recovery is to be found in an article by Mr. T. A. Rickard.*

The geological age of these alluvial flats is somewhat a matter of conjecture, as they have, with two exceptions, proved to be unfossiliferous, and it is doubtful if one of these two exceptions can be accepted as a genuine discovery.

The one undoubted discovery of plant remains was made in Rollo's shaft, at a depth of 380 feet, in a bed of carbonaceous shale eight feet in thickness. These remains have, on examination, proved to belong to the Eucalypti, and the age of the deposit is placed as probably late Tertiary.

Besides the plant remains and impressions, fossil bones were also said to have been discovered; but, judging from the pieces shown as such, there seems to be considerable doubt whether these fragments were ever pieces of bones, and whether they are not some secondary mineral.

Attached to this report, on a previous page, is a section of the shaft, which both illustrates the depth at which the plant impressions were found and the difference between this and the other alluvial deposits in the vicinity.

*“The Alluvial Deposits of Western Australia,” by T. A. Rickard, State Geologist, Denver, Colorado. Transactions of the American Institute of Mining Engineers, October, 1898.

The second report of a discovery of fossils originated in the supposed unearthing of a large fossil tooth on Fly Flat. Unfortunately the evidence in favour of this discovery being genuine is somewhat faulty, while that against such is very strong. Most probably in some unaccountable way the specimen had been carried and deposited there by man. Mr. R. Etheridge (Government Paleontologist of New South Wales), to whom a photograph of the specimen above-mentioned had been sent, states that it "is a molar of the Indian elephant (*Elephas Indicus*), and could only have reached its resting place by accident."

Cement Deposits.

Underlying the conglomerate, and resting on the denuded surface of the granite, lies a thin bed of "cement" similar both in character and appearance to that found in the "25-Mile deposits," and which most likely is a portion of those beds, or, if separate, was at least contemporaneous in its formation with them. Similar deposits are also found at Kanowna. As these deposits at the 25-Mile and Kanowna were the source from which a considerable amount of gold was won, I purpose to insert here some notes made from the descriptions given by Mr. S. Göczel and Mr. H. Y. L. Brown, Government Geologist of South Australia, also a brief account I am able to give from personal observations.

Cement Deposits at the "25-Mile."

Location of the Deposit.

The 25-Mile Cement Leases lie at a distance of some six miles North-North-West of the 25-Mile, the latter place being situated at a distance of 20 miles North of Coolgardie, on the Coolgardie-Menzies route.

The exact position of the deposit may be ascertained from studying the position of the following leases, on which the greater part of the cement was found. *

Name of Lease.	No. of Lease.	Acreage.
Hilton	100s.	19
Ophelia	105s.	13
Patena	356s.	3
Himalaya	357s.	3
Windsor	358s.	3
Hilton North	361s.	3
Coogee	362s.	3
Rock of Ages	363s.	3
Battler	364s.	3
Ruby	365s.	3

* The situation of these leases can be ascertained by a reference to the latest issue of the 20 chain lithograph of Mining Leases of Kintore Group, Coolgardie Goldfield, Kurnalung District, issued by the Department of Mines, Perth.

General Description of the Deposits.

Writing on the Cement Deposits at the 25-Mile (Kunanalling) Mr. T. A. Rickard gives us the following description:—"Under a thin covering of sand and dust there occurs a bed of kaolin ranging from a couple of inches to a foot in thickness, and this overlies from 15 inches to two feet of 'sand-rock,' which in turn gives place to the gold-bearing cement, which has an average thickness of $2\frac{1}{2}$ feet. The last lies directly upon an irregular surface of decomposed granite. The several layers composing the deposit are separated by seams of pipeclay, which, like the kaolin, are simply the product of decomposition of the constituents of the granite, particularly the felspar. The sand-rock may be described as a coarse incompletely consolidated sandstone or grit, consisting mainly of iron-stained particles of quartz loosely cemented. The cement has a bluish grey tinge, owing to the play of light on the quartz fragments. This too is not quite compacted, since fractures through the material do not break across the pebbles, which are harder than the clay binding them together. In this respect the cement differs, for example, from the South African 'Banket' to which it has been compared."

"The binding material, the overlying layer of kaolin, and the sand-rock capping the gold bearing stratum of cement all exhibit very clearly their derivation from a decomposed granite similar to that which encloses the reefs and forms the bed rock of the alluvium itself." *

Mr. Göczel refers to this deposit in the following terms:—"Lithologically considered the rock of which these deposits consist is sandstone with more or less frequent transits into conglomerates. The auriferous sandstone banks overlay immediately the country formation. The latter is gneissic granite rotted or decomposed to a considerable depth." †

"The component elements in the auriferous deposits are:—

"1. Sharp-edged quartz grains derived from the decomposed country formation."

"2. Quartz breccia, derived probably from secretion veins, which are contained in the decomposed country formation."

* "The Alluvial Deposits of Western Australia" by Mr. T. A. Rickard, State Geologist Denver, Colorado. Transactions of the American Institute of Mining Engineers. Buffalo, October, 1898, page 35.

† On the Deposits of Auriferous Cements at the 25-Mile Workings. Report of the Department of Mines for the year 1895. Perth: By Authority, p. 26.

"3. And occasionally small, rounded, and smoothened
"quartz pebbles."

"The matrix cementing these rock elements consists chiefly of
"crypto-crystalline silica, which frequently becomes more or less
"ferruginous, imparting to the rock variegated colouring."

"The gold occurs embedded in the matrix, and the gold
"particles are frequently visible to the eye. . . . In some
"of the more ferruginous portions, pseudomorphs of brown hæma-
"tite after pyrites can be observed. In such portions some of
"the gold was associated originally with pyrites and became
"liberated during the decomposition of the latter. Considering the
"above observations, it follows that the cementing matrix and the
"gold contained in the same are a contemporaneous precipitate
"from one and the same thermal solution."

The cement consists of sub-angular and rounded fragments of quartz varying in size from grains smaller than a pin's head to pieces over an inch in diameter. These grains are usually bound together by kaolin in varying proportions, the hardness of the rock varying with the amount of kaolin present.

Where the cementing material is more or less absent the grains are usually of a finer or more even texture, giving the rock the appearance of sandstone, whilst it becomes so soft as to crumble easily under the pressure of the fingers. As a general rule ironstone gravel overlies the cement and fills in the potholes and gutters cut in the latter. In places, however, it is found intermixed, showing that though the cement is of greater age, its deposition, at least in some places, was not complete when the ironstone was in process of formation, and thereby demonstrating the similarity of age of these deposits. The maximum thickness of the cement is about 15ft., with a maximum width of 90 to 100ft. The cement follows a serpentinous course along the much eroded surface of the granite for a distance of some $1\frac{1}{2}$ miles, though there are frequent breaks undoubtedly due to subsequent erosion.

In section, the deposit shows distinct horizontal stratification, with dark bands occurring at intervals; evidence which, when coupled with the subangular nature of the quartz grains and pebbles, leaves no doubt as to the sedimentary origin of the deposit. Between the cement and ironstone gravel is sometimes seen a thin layer, having a maximum thickness of six inches, of nearly pure white kaolin, which points strongly to the origin of the deposit being of a lacustrine nature. The floor on which these

beds rest is decomposed biotite-granite, the results of erosion being strongly marked by an abundance of "pot holes" and deep gutters.

Age of the Deposit.

Judging from the lithological character of the deposit, and the recent plant impressions found in what may be considered almost contemporaneous deposits in the Coolgardie district, the age of these beds may be put down as late Tertiary or Pleistocene.

Mr. H. Y. L. Brown, Government Geologist of South Australia, considers these beds to be of a similar age to the Cretaceous or Tertiary Cements found in other parts of Australia.

Yield of Gold.

The quantity of gold derived from the 25-Mile Cement Deposit, so far as official returns show, is, up to the end of 1897, as follows:—

Date.	No. of Lease.	Name of Lease.	Ore Treated.	Yield of Gold therefrom.	Rate per ton.
			tons.	ozs.	ozs. dwt. grs.
1897	100s (1931)	Hilton	4,397	6,836	1 11 2
1897	105s (1945)	Ophelia	1,000	527	0 10 12
		Total	5,397	7,363	1 7 6

Occurrence of the Gold.

Though the ironstone gravels and kaolin do contain small quantities of gold, they have not been treated.

The payable gold is, without exception, found in the cementing material of the quartz particles, the quartz pebbles themselves being barren, which is a considerable detriment, as this barren matrix has, as in the "Banket" in South Africa, to be treated with the cementing material before the gold can be recovered from the latter. In rare cases, however, gold has been found in the pebbles themselves, which though not important commercially, afford evidence as to the probable origin. The richest portions of the deposit have been found where the coarser material was lying on the bottom, and especially where it had gathered on the lower side of some of the larger "pot holes" in the granite.

Probable Source of Gold.

As the deposit was worked from the centre towards the edges, it was found to become much poorer in gold, till at the extreme

edges it was almost barren, not assaying more than 2dwts. to the ton. This absence of gold was often indicated by the colouring material in the kaolin; the barren parts being recognisable by the presence of a dull grey colour.

There can be little doubt that the gold found throughout this deposit has been laid down by the mechanical action of water, and, judging from the nature of the associated material, this deposition took place in a small shallow lake, the gold and quartz being carried down mechanically by inflowing waters from leaders and quartz reefs, of which there are examples existing at the present day. Mr. H. Y. L. Brown considers these deposits to have been formed along the shore of a lake or inland sea by aqueous action, the gold being derived from the veins and reefs in the bedrock beneath, and that only in the vicinity of auriferous veins can such a formation be expected to prove gold bearing.

He also thinks "that a thicker deposit (in other words deeper "ground) may exist in the vicinity of the cement cappings, and "that probably heavier gold would be found in such, and that the "gold now scattered through the whole thickness of the deposit "would be concentrated in the lower portion, lying above the bed-rock in more defined runs or 'leads.' " *

Method of Treatment and Mining.

Being a shallow deposit, and on the surface, mining is carried on without impediment on the "open cut" system, the ore being carried to the batteries in small iron trucks, run on a light horse tram line.

On the Hilton Gold Mining Lease, No. 100s, the battery used is of Thompson's patent, and is worthy of description. This battery differs from the ordinary stamp mill in the following way :— Instead of having four stamps on one shaft, the stamps are run in pairs on parallel shafts connected by spur gearing, and so forms a nest of four. The feed is central, so all the material fed into the battery must pass under the stamps before reaching the screens. The discharge is an "all round" one, and consequently more or less radial. There are two amalgamating tables, instead of the usual single table in such mills as Messrs. Fraser and Chalmers.

* "Auriferous Deposits of Western Australia," H. Y. L. Brown, Government Geologist, Adelaide: By Authority, 1896.

So-called Deep Lead at Kanowna.

Locality of the Deposit.

The position of the "lead" is about half a-mile North-West of the Kanowna Post Office, extending from M.L. 637 Westward past the Cemetery.

The topography of the field is of a simple character. A low chain of hills curving from the Golden Crown G.M.L. (No. 3188E) to the North, East, and West, with minor heights in the Warden's and Hospital Reserves, form the higher grounds from which the surface gradually slopes and spreads out into extensive flats several miles in length.

Since the Kanowna field was originally discovered, dry-blowers have, in places, profitably treated the surface of many of these flats. Work was carried to no greater depth than from two to three feet, and discontinued when what was considered to be "true bottom" had been reached. Recent operations have proved this "bottom" to be merely a thin bed of coarse detritus cemented together and forming a somewhat compact layer of only a few inches in thickness.

It was not till the commencement of the year 1897 that this was proved to be of sedimentary origin by Messrs. Sim and Greson, who, sinking on their property (G.M.L. 637x*) struck a true "gutter" containing rich prospects of gold at a depth of about four feet from the original surface.

Though of similar occurrence, these "leads" are distinct from the old "cement" workings on this field, the latter being situated some $1\frac{1}{2}$ miles to the East of the present workings on the Eastern slope.

In dealing with the "cement" at Kanowna, Mr. T. A. Rickards considers that the origin of these deposits is clearly shown by studying the accompanying rocks. The greenish clay underlying the deposit he considers to arise from the decomposition of the epidote in the diorite as the kaolin arose from the decomposed felspar of the granites at the "25-Mile" deposits. The ironstone overlying parts of the deposit he likewise considers to have originated from the decomposition of the diorite. "The cement lies in a shallow depression, at the upper rim of which the quartz reefs cross the country. Furthermore, these reefs traverse

* Vide Lithograph, Kanowna District, North-East Coolgardie Goldfield. Perth: By Authority, 1896.

"a low divide, which, in a rough way, separates the deposit from another (the Fitzroy cement), which slopes in the opposite direction."

In conclusion, he considers these cement deposits to be "the placers of a country destitute of running water," and in support of this statement shows that the component parts (1.) have suffered little from attrition, and so have not likely been transported by water. (2.) They are the decomposed products of the surrounding rocks. (3.) They are comparatively unclassified, which is in keeping with the evidence afforded by the material of which they are composed. (4.) "The gold particles, which have rendered the cement worth mining, are found to be identical in fineness and physical appearance with the gold of the neighbouring veins, and their scarcely rounded edges invite the conclusion that the gold also has not been borne far from the place of its origin."* (5.) Transportation of the material has been carried on by the united action of wind and flood waters.

Mr. H. Y. L. Brown, Government Geologist of South Australia, examined somewhat similar deposits at the 25-Mile (Coolgardie Goldfield) and the cement deposits at Kanowna, and refers to them in the following terms:—"A limestone and ironstone cement is found to contain gold at Kalgoorlie and elsewhere. The auriferous cement deposit at White Feather (Kanowna), and at the Kintore and Ormuz mines (25-Mile) is essentially an alluvial deposit, i.e., it is the result of denudation and the re-deposition of gold from auriferous veins. The bedrock is coated in most places with travertine limestone, and magnesium limestone, arising from the decomposition of the rocks. Considering the wide area covered over by the plains it seems probable that deep leads may in the course of time be discovered beneath them, the alluvial gold-bearing cement mentioned above representing the shallow ground of such leads."†

Description of the "Lead."

For a distance of some 50 yards the prospectors followed up their discovery in an "open cut," but the "over burden" becoming thicker and thicker at length necessitated sinking and driving, which is now the practice in all the workings. The deposit here, and for some distance to the West, consists almost entirely of iron-

* "The Alluvial Deposits of Western Australia," by T. W. Rickard, State Geologist, Denver, Colorado. Transactions of the American Institute of Mining Engineers, Buffalo, October, 1898.

† "Auriferous Deposits of Western Australia," by H. Y. L. Brown, Government Geologist, Adelaide: By Authority, 1896.

stone pebbles cemented together with oxide of iron or kaolin, the former closely resembling ironstone lode stuff. The dimensions of the "gutter" vary considerably, ranging from two feet in the "prospectors'," to about eight feet in width in Messrs. Graham and party's claim, and from two to four feet in thickness. Proceeding to the Westward the deposit changes both in character and dimensions. Instead of the ironstone predominating as at the head of the "lead," kaolin and rounded grains of quartz commence to replace it (the ironstone only occurring in patches), till at length a width of 30 feet is attained. The thickness of the deposit is five feet; the lower two feet is that from which payable gold is obtained.

The gold, instead of being free, is more or less associated with quartz, and more frequently found in the form of small slugs than at the head of the "lead," though throughout the whole deposit it bears strong evidence of being mechanically rounded during transportation to its present position. Shortly after this change occurs, the "lead" apparently divides into two branches; the one trending North-West, and commonly called the North Lead, has been followed for a considerable distance, probably a mile; the other trends South-West, and passes through the cemetery and to a considerable distance beyond; this is known as the Cemetery or South Lead.

Output of Gold.

The following are the gold statistics of Kanowna as received from the Statist of the Mines Department :—

Date.	Class of Ore Treated.	Yield of Gold.		
		Ore Treated.	Total Yield.	Rate per ton.
		tons cwt. qrs.	oz. dwt. gr.	oz. dwt. gr.
Previous to 1898	Quartz ...	27365 11 0	28243 15 11	1 0 15
1898	Quartz ...	24858 2 0	20892 0 0	0 16 19
Previous to 1898	Alluvial ...	...	10611 18 10	
1898	Alluvial ...	...	63548 0 10	
1898	Cement ...	45983 4 2	68183 10 22	1 9 16
Total output ...	Reefs & Alluvial	...	191478 15 8	
Total output ...	Alluvial only...	...	142343 9 18	

Geological Structure.

The geological structure of the field, studied with special reference to the auriferous alluvial deposits, is, in general terms, as follows :—

Large dykes, grading from a true granite to a felsite, have intruded, broken, and contorted the schists, and, resisting denudation more effectually than the latter, now form the higher ground of the field.

The breccia, visible in many parts of the field, is evidence of the violence of these intrusions, and on examination will be found to consist of schist and rounded or subangular masses of porphyry. As the junction lines of these porphyry dykes and schists run North 20 degrees West and South 20 degrees East across the lead, much confusion has arisen regarding when to cease sinking, and for this reason I make special reference to the fact that either decomposed porphyry or schist will be the true bottom, varying in accordance to the position on the field; and I would strongly advise prospectors who have not struck wash to try similar localities in the neighbourhood, and not waste valuable time and labour sinking where there is little or no hope of success.

Prospects of the Field.

Judging from the character and structure of the surrounding country, the probable source of the alluvial gold on the Fitzroy Lead may be taken to be quartz reefs and leaders which traverse the main ridges above described, and if such be the case, there seems to be every probability that other channels radiating from this watershed may have been enriched in a similar manner. In support of this theory it is noticeable that the workings known as the "cement workings" lie on the South-Eastern face of the same watershed, and exhibit evidence of being the result of decomposition of the same rocks as those whose detritus is found in parts of the workings forming the subject of this report.

If this be the case, it necessarily follows that boring is a comparatively useless task, as the deepest deposit of alluvium is not more than sixty feet, and the leads are so scattered and difficult of location that sinking and driving would be the safer, and probably the cheaper mode of prospecting. In conclusion, I might add that in the technical acceptance of the term I do not consider this or any other of the alluvial deposits on this field to be deep leads, but merely auriferous alluvial deposits of comparatively recent age—probably late Tertiary—above which later deposits of alluvium and coarse detritus have formed an "over burden" of considerable thickness.

Only one outcrop of cement is to be seen in the vicinity of Coolgardie, and this extends from the Bluff, past the Recreation

Ground to the Coolgardie Brewery. The maximum thickness of this deposit is 8 feet, but this is exceptional, the average not exceeding 3 feet. Unfortunately this bed has so far proved to be of limited extent and of low grade as a gold producer, the prospects being so poor as not to warrant further investigations.

Ironstone Gravel Beds.

Scattered over a belt of the field, running North and South through the centre, are patches of ironstone gravel, usually semi-detached and surrounded by the alluvial deposits, to which they have supplied most of the fine red coating above described.

The thickness of these deposits varies from a few inches to some 15 feet. This must have been very much greater, however, when the deposit was first laid down, for at the present day there is a difference of at least 80 feet between the lower and higher levels. In addition, the immense amount of detritus found in the alluvial points to the more extensive nature of these beds, which were undoubtedly the source from which this was taken.

The composition, too, has changed, the old ferruginous clays having been altered *in situ* by concretionary action into ironstone nodules, which at the surface finally changes into the hard ironstone pebbles so frequently met with in this and other fields in Western Australia. In places these hard ironstone pebbles have been cemented together, forming compact impure ironstone, which is usually found on the caps of the high grounds, and never of any great extent.

On analysis a sample of this ironstone from near the Retribution Gold Mining Lease 2483, yielded, at the hands of the Mineralogist to the Survey, the following composition:—

Fe_2O_3 ...	...	...	...	...	...	...	35.25 per cent.
FeO} ...	...	...	...	...	...	...	00.51 per cent.

being an equivalent to 25.07 per cent. of metallic iron.

Assays made of the ironstone gravels gave results varying from 3 to 5 dwts. up to 8 dwts. of gold per ton, but it is doubtful, whether when treated in large quantities, such results would be obtained.

Over that area embraced within the accompanying map the remains of this deposit are seen to lie within the contours 1380 and 1460, showing that the deposit has a somewhat uniform level. Whether such uniformity exists in other parts of the Colony is at present unknown, but there is little reason to doubt that such is the case on the tableland portion of the Colony. On the other

hand, minor deposits are found at lower levels, such as at Coates' Siding,* in the South Western portion of the Colony and elsewhere. The origin of these latter can often be accounted for by examining the accompanying rocks, for in many instances undoubted evidence exists to prove that they originate from the detritus of the latter. No such evidence is to be found however to explain the origin of the more extensive class of deposit. Covering as it does such an extensive area, and taking into account deposits, such as the desert sandstones,† which have a similar habit, there seems to be much likelihood of its being a marine deposit. The total absence of fossils however renders an absolute decision almost impossible.

An examination of some parts of the beds in question shows that the nodular appearance is due only to surface weathering, the rock being at a few inches from the surface, merely a ferruginous claystone. This gradual change is traceable in most instances. It is therefore probable that the composing materials are either volcanic dust or the denuded products of some more or less basic rock, which have been in either case deposited in water. The only known evidence of extensive volcanic action on the central tableland is the occurrence of so-called "obsidian bombs."‡ Mr. R. H. Walcott, F.G.S., has dealt with the probability of the bombs being of volcanic origin, and has shown that various authors on the subject cast considerable doubt as to their being such. There is, therefore, practically no direct evidence as to the origin of these beds at present. A certain limit, however, can be made to their geological age.

At Rollo's bore certain plant remains were found in alluvial beds partly composed of the detritus of the ironstone beds. These plant remains, as already stated in this report, were thought to be of late Tertiary age. The ironstone gravel beds are therefore of an earlier age than late Tertiary. Overlying the Collie Coal Measures, which are thought to be of Mesozoic age, the ironstone gravels are again found occurring to a considerable extent. From this evidence an age, therefore, of between Jurassic and Miocene or Pliocene can be attributed to these beds in question, of which the later age is more probable, judging from their lithological character.

* Annual Progress of the Geological Survey for the year 1897. Perth: By Authority, 1898. Page 4.

† Report on the Murchison Goldfields, by H. P. Woodward, F.G.S., F.R.G.S. Perth: By Authority, 1893.

‡ "The Occurrence of so-called Obsidian Bombs in Australia," by R. H. Walcott, F.G.S. Proceedings of the Royal Society of Victoria. Vol. XI., Part I., Art. III. Melbourne, 1898.

Granite.

Beneath the alluvium of the Western slope, and sending out offshoots in the form of narrow dykes which break through the diorites and schists of the Eastern side, lies an extensive and intrusive granite mass, approximately extending from the Coolgardie-Menzies and Coolgardie-Norseman telegraph lines to some three or four miles to the Westward. This mass has evidently broken in along the line of strike of the older schists and slates, as these are found on either side dipping away from the granite. They are also much contorted, twisted, sometimes broken, and in all cases much altered in their general characteristics. This alteration has probably been due either wholly or at least in part to the action of the intrusive granite. To the West of the slates, some three miles west of the Londonderry, occurs another granite mass, which differs considerably from the former, and whether the two are connected or not needs further investigation, great differences existing between the two, both in composition and general appearance.

Taking the Western examples first, they are found to consist entirely of large patches of quartz, mica, and felspar, sometimes with a weight of several tons, and quite separate from each other, or in the form of ordinary coarse granite in which the minerals have more or less blended together.

For some time the mica in this locality has been mined, a ready market being open for all the best quality that can be obtained. The greatest size in which it is found is 15 inches by 12 inches, but this is exceptional, the average not exceeding five inches to six inches. The mineral, when not less than about $\frac{1}{32}$ of an inch in thickness, gives a distinct sherry red colour when examined by transmitted light, but in sheets split finer than this it is difficult to detect colouration. Besides these large sheets the mica also occurs in long crystals which, when grouped together as they frequently are with the longer axes parallel, present a peculiar scale-like impression. The colour of such specimens varies from a pale pink to a pale green, or is quite colourless. The cleavage of all the varieties is very perfect. The felspar, which occurs like the mica in large bunches, is a potash one, and has good cleavages often developed so that it can be readily split into oblong blocks. The felspar is either colourless or possesses a pale sea-green hue. The quartz is almost colourless and glassy, and, as far as the workings show, occurs in less quantity than either of the other two associating minerals.

On the Gnarlbine Road, about two miles South-West of Coolgardie, on Reserve No. 3647, a bore was sunk 3,000 feet

in the hope of obtaining artesian water. Microscopic sections were cut from some of the core taken out at the 2,370 feet level, and on examination proved to be as follows:—The rock is a holocrystalline hornblende granite, somewhat clouded by the slight decomposition of the feldspars, which with hornblende and quartz are well developed and fairly evenly distributed throughout the section. On close examination the feldspars, with one exception, proved to belong to the monoclinic variety, distinctly showing single twinning in several crystals. The hornblende, which is of a dark green colour, occurs in lath-shaped crystals which are evenly distributed throughout the slide. It exhibits strong pleochroism, and in several instances shows cleavage planes crossing at an angle of 120 degrees. Occurring between the hornblende and feldspar are patches of quartz, more or less granular, and usually showing stress figures. The freedom from inclusions is very marked. As accessory minerals muscovite-mica forms the most important, but is in small proportion compared with the hornblende. Small needles of apatite are found in places in the feldspar crystals. Magnetic oxide of iron occurs in small grains throughout the whole rock.

A section cut from a piece of granite (2)* taken from the 496ft. level differs from the above in the following details:—The feldspar and quartz in this section both show irregular forms, the former being considerably kaolinised, and in places showing a fair rectangular cleavage. Hornblende is scattered throughout the rock in irregular masses. Both the brown and green varieties are present. In one case only is a crystal of hornblende found showing idiomorphic contours. In this sample perfect cleavage is also present.

Iron is found in very small quantities in minute grains.

Apatite and muscovite are entirely absent.

Connected with the main mass of granite, and traceable from a true granite through every gradation to what appears to be a massive quartzite, occur acid eruptive dykes. These dykes, which are seldom more than 10 feet to 12 feet wide, cross the country in all directions, though they are often found following the strike of the schists. They are easily traced, both by their outcrop and their close association with thin bands; not more than nine feet wide, of a dark-coloured rock resembling true clay slate. These altered rocks invariably have the same strike and dip as the dyke with

* The figures in brackets refer to the Geological Collection number.

which they are connected, and seem to be, without any doubt, the product of contact metamorphism produced in the schist or diorite by the intrusion of the acid dykes.

On a microscopic examination the bands show an almost perfect slaty cleavage, texture, etc., with, in many specimens, a banded structure, in all probability due to infiltration of solutions and deposition of secondary minerals, especially magnesite and iron pyrites. In many specimens, too, are seen elaborate contortions of the bands and beautiful miniature examples of saddle reefs, in which the deposits are almost invariably magnesite. Examined under the microscope, the rock is found to exhibit a distinct banded or schistose appearance; the minerals, principally feldspars, with occasional crystals of quartz, hornblende, augite, and numerous grains of magnesite and crystals of pyrites, having arranged themselves in wavy bands, which are almost opaque owing to the oxidation of the iron either in the pyrites or more probably some ferro-magnesian constituent of the rock mass. Intermixed between these bands are abundant magnesite and probably calcite crystals, undoubtedly of secondary origin. These rocks having frequently been described as clay slates, thereby inferring a sedimentary origin, it might be useful to state the existing evidence to the contrary, and such is briefly as follows:—

1. They occur often in diorite, and intersect the dykes at all angles.
2. They are usually associated with acid eruptive dykes, having the same strike, dip, etc., and occurring in several cases on both sides of the latter.

In addition to these dark banded rocks, quartz reefs are often found in close association with the felsite dykes, in some cases apparently forming portions of the latter, and often following the same strike, etc. In such cases they are almost invariably barren, though branch reefs or cross leaders to these often yield good prospects of gold.

Microscopic sections of the dykes themselves show, in all its stages, the gradual change of granite from a holocrystalline rock to a pure quartz reef. A section of the granite has already been described, and except the diminution in size of the crystals, the character of the rock remains unchanged till a felsitic ground mass, with a few larger crystals of orthoclase scattered throughout makes an appearance, this ground mass becoming more and more acid till at length it becomes one of pure quartz.

Schists and Amphibole Rocks.

To the East of the granites, belts occur of what at the surface appear to be hornblende schists, having corresponding strikes to the intrusive diorites and granite.

On investigation of the nature of these rocks, it seems highly improbable that any are of sedimentary origin, as the successive changes from a schistose rock to either massive, hornblende, or diorite can be traced in several of the mines which have opened out below the 200ft. level.

For convenience of description they will be divided into two, and treated separately. The first and more extensive of these two divisions is found lying adjacent to the granite; this belt consists entirely of hornblendic and talcose rocks. In most instances where decomposition has not been extensive, they both possess a more or less perfect cleavage, but when much altered the cleavage vanishes, and the rock then becomes massive and more homogeneous.

Of the two varieties, the hornblende is the more important, as the talcose is very likely derived from the former, all the hornblende having a tendency to decompose into either serpentine or talc. Typical specimens of this rock, on examination, show the hornblende forming a kind of net work of long crystals in a ferro-magnesian ground mass. The crystals are usually partially decomposed, and sometimes only skeletons remain, the whole rock invariably having a greasy feeling when rubbed with the finger. The general strike varies from North 20° West, and South 20° East to North, 20° East and South 20° West, the angle of dip changing from 30° to 60° to the East, though in places the strata may be seen dipping to the West at similar angles, the change being due to subsequent intrusions of diorite dykes.

In several places these schists have been mined for building stone, blocks having been easily hewn either with saws or hatchets; but only in places where the schistose structure has been destroyed either by metamorphism induced by dykes, or where leaching has taken place to a greater extent. In such places the rock has a predominance of silicates of alumina, the magnesian minerals being present, but in a minority. Of the talcose variety little need be said, as they resemble the hornblende rocks in general features, differing only in composition, etc. They are usually of a greyish to yellow colour, very soft and greasy, and in many cases show distinct skeleton needles which have undoubtedly been hornblende

crystals similar to those in the hornblende variety. The cleavage is somewhat more perfect than the latter.

As before noticed, the next class, though resembling schists on the surface, change so quickly to massive hornblende that the almost inevitable conclusion is that the apparent schistose structure is simply due to surface weathering. Studied in sections the rock has no appearance whatever of a schistose habit, and the hornblende either arranges itself in a radiating form, or else becomes an irregular mass, with acicular crystals crossing each other at all angles. The foreign material found in this rock is, as a rule, in small quantities and consists of triclinic felspar, oxide of iron, magnesite, and in some cases calcite. The hornblende is of a dark green variety, and is usually in lath-shaped pieces, with a more or less radial structure. The felspar, though often much decomposed and cloudy, is seen to be of the oligoclase variety, and occurs in irregular patches throughout the rock, and mixed with the magnesite and calcite. In one instance free gold was found in a specimen taken from Mining Lease 113. Sections from a depth resemble diorite more closely still, as the hornblende occurs in more regularly shaped crystals, and does not have a radial structure. Taking all these points into consideration, it has been deemed advisable to map these rocks and diorites together, and distinguish them on the map by a single colour, as there seems to be little doubt that the amphibole rock is a diorite in which there is a preponderance of hornblende. There seems to be a great probability of the schists on the Western side of the field being the weathered remains of some ancient hornblende rock, but further investigation will be necessary to conclusively decide whether they are the same as those found in the deeper workings.

As regards the amphibolites, there is little doubt in my opinion that they are so closely associated with the diorites as to be inseparable from them.

Diorites and Andesites.

These occur in bosses and dykes, the latter originating from the main masses and found breaking through the schists, and in some cases are found in the granite. They are evidently not all of the same geological age, as instances occur in which they are found crossing one another, the andesites being undoubtedly the newer. On microscopic examination they are found to consist of hornblende and plagioclase felspar, varying in size from coarse grained varieties to a texture so fine that the individual minerals are not distin-

gnishable even with a powerful lens. The coarser varieties are generally found as the centres of the main masses, the edges and dykes on the other hand consisting of the finer grained portions.

A large dyke having a distinctly porphyritic structure can be traced from Mineral Lease 1111 Southward through Gold Mining Leases 2051, 2937, 2576, and on past the Burbanks Birthday Gift to the West of the Londonderry. In this rock the feldspars, which are both of the orthoclase and oligoclase varieties, have been so developed in the fine ground mass that they give the rock quite a mottled appearance, the crystals often attaining a size of at least a quarter of an inch in diameter.

This is probably the latest of the intermediate rock intrusions, as it is found breaking through both the diorites and schists. On microscopic examination these rocks exhibit the following characteristics:—

A section (43) taken from Gold Mining Lease 1699, Coolgardie. The section consists of crystals of dark green fibrous hornblende, showing marked pleochorism, quartz occurring in irregular granules, the base being a clear glassy feldspar, probably orthoclase, showing few cleavages and little or no twinning. Small irregular patches of iron are scattered throughout the mass, and the whole rock, owing to a very regular arrangement of the hornblende crystals, has a distinctly schistose structure.

Another section (41) taken from Gold Mining Lease 651, Coolgardie. This section shows large irregular and a few idiomorphic dark-green crystals of hornblende. All show strong characteristic pleochorism, and in many instances perfect cleavages. Quartz is absent. The feldspar shows neither cleavage nor twinning, and occurs in small irregular patches throughout the whole network of hornblende crystals; as in the previous specimens, grains of magnesite are abundant.

Water Supply.

In connection with the water supply of the Coolgardie Goldfield, the Government Geologist made a report* as to the possibilities of artesian water being found by diamond drill bores. He

* Reports by the Government Geologist in connection with the Water Supply of the Goldfields. Perth: By Authority, 1897.

also discussed the probable extent of the supplies gained from sinking in the decomposed granite and schist areas, and the accumulations arising from percolation into basins covered over by recent alluvial deposits, so no further reference need be made to the subject in this place.

The following are some statistics in connection with this subject, which have been collected since his visit to the fields, and which will doubtless act as confirmatory evidence to what he has already reported :—

*Supply of Water from Wells sunk in decomposed Granite in
Coolgardie Townsite.*

No. of Well.				Depth in feet.				Supply per diem in gallons.	
1	...	...	...	194	...	...	...	1,500	
2	...	...	...	200	...	...	...	1,500	
3	...	...	...	180	...	...	...	2,000	
4	...	...	...	180	...	...	...	2,000	
5	...	...	...	186	...	...	...	2,000	
6	...	...	...	200	...	...	...	2,000	
7	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...
10	...	...	...	180	...	...	...	1,000	
11	...	...	...	...	...	...	...	...
12	...	...	...	190	...	...	...	1,000	
13	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...
19	...	...	...	230	...	...	...	1,500	
20	...	...	...	212	...	...	...	500	
22	...	...	...	220	...	...	...	2,000	
23	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...
27	...	...	...	230	...	...	...	200	
28	...	...	...	191	...	...	...	500	
29	...	...	...	184	...	...	...	800	
30	...	...	...	190	...	...	...	1,200	
31	...	...	...	190	...	...	...	1,000	
32	...	...	...	190	...	...	...	2,200	
33	...	...	...	178	...	...	...	1,700	
34	...	...	...	220	...	...	...	2,000	
35	...	...	...	200	...	...	...	4,000	
36	...	...	...	210	...	...	...	1,000	
37	...	...	...	210	...	...	...	1,000	
39	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...

N.B.—The numbers refer to numbers on the accompanying map. Blanks are due to the abandoning of several of the wells, the supply being in excess of the demand.

Supply of Salt Water from Mines in Coolgardie Goldfield.

No. of Lease.	Name of Lease.	Output in Gallons per diem.
133	Bayley's Reward	10,000
400	... ..	Amount unknown, but in considerable quantity.
1966	... ..	50
1787, 1798	Derby Leases	2,000
2071	Queensland Coolgardie	1,000
232	... ..	2,000
188A	Golden Bar	23,000
3319	Great Hanover	150,000
2725	Steadman's Choice	1,000
122	Cosgrove Bayley's Reward	10,000
1599	Rose Hill	15 to 20,000

It has been conclusively proved, especially in the wells, that the continual use of the water diminishes the output to the extent of at least one-half in a very short period. The annual rainfall of Coolgardie, as supplied from the records of the Observatory, Perth, is as follows:—

Year.	Points of Rainfall 100=1 inch.
1895	6·79
1896	8·51
1897	5·55

the average rainfall for the past three years being 6·95 inches. For the year 1893, April to December, the points registered were 9·41, and from May to December, 1894, the number of points were 4·79. As these two would include most of the rainfall for 1893 and 1894 they can be added to the others, and will then bring the total average for five years to 7·01 inches.

Comparing this average rainfall to the demand on the supply of water originating and depending on this source, the natural conclusion is that the demand would soon exceed the supply; on the other hand the demand for water for domestic purposes is constantly decreasing, owing to the extensive storage of rain water in galvanised iron tanks attached to the roof catchments. The supply for mining purposes is a somewhat more serious problem, for though, in some cases, there is sufficient, in the majority of cases, water will have to be, and is, brought from a distance, either from other mines or the Hampton Plains supply, the cost per 1,000 gallons ranging from 10s. downwards, according to the amount required. These supplies, too, are dependent on the rainfall, but what quantity is stored up in the deep alluvial basins from whence it is drawn can only be calculated by careful mapping out of the areas in which it is held. The probabilities of artesian water

supplies have been fully dealt with in the Government Geologist's report previously referred to, and, so far, the bores which have already been sunk have proved that artesian water does not exist.

The following are the details in connection with these diamond drill bores:—

Coolgardie Diamond Drill Bores. — Government Reserve No. 3448. Details supplied by Western Australian Government Water Supply Department.

Nature of strata.	Thickness of strata.	Depth from surface.
	ft. in.	ft. in.
Alluvial	3 10	
Limestone conglomerate	12 0	3 10
Kaolinised granite	55 0	15 10
Soft white kaolin	32 6	70 10
Decomposed granite	36 8	103 4
Granite	2,383 10	140 0
Diorite	441 11	2,523 10
Granite	36 9	2,965 9
Total	3,002 6	

118ft. level salt water struck.

Coolgardie Diamond Drill Bores. — Government Reserve No. 3096. Details supplied by Western Australian Government Water Supply Department.

Nature of strata.	Thickness of strata.	Depth from surface.
	ft. in.	ft. in.
Sand	7 0	
Cement	47 0	7 0
Kaolinised granite	9 0	54 0
Decomposed granite	102 0	63 0
Total	165 0	

Water level, 156 feet.

As can be expected, the water drawn from these underground sources is invariably more or less salt. The percentage of salts present varies from a slight brackishness, as in the case of some of the well water which is fit for stock, to an intense saltiness, the amount of soluble saline matter sometimes being as high as 25oz. to the gallon. The greater part of the water being unfit for domestic use necessitates extensive condensing plants.

These condensers consist of two parts—the one in which the water is heated, the other in which the steam is converted through pipes, the exteriors of which are in direct contact with the air. These pipes are usually made of galvanised iron, though in two cases where the steam is under pressure strong iron pipes are in use. By these methods fairly pure water is obtained. The price per hundred gallons of condensed water ranges from 8s. to 10s. according to the amount consumed.

The following are some analyses supplied from official records to this office:—

Sample taken from Bore Shaft, Coolgardie, on 20th August, 1894.

Specific gravity (pure water, 1000)	1010
Solid matter (per gallon, 70,000 grs.)	861 grains
Solid matter containing chlorides of Sodium, Potassium and Magnesium	807 „
Sulphate of Sodium, Magnesium, and Calcium—Carbonate of Sodium	Trace
Iron	„
(The liquid is colourless and odourless.)	
Taste	Salt *

*Sample of water taken from the Coolgardie Town Well
(in granite rock).*

Water free from animal and vegetable contamination. Contains a small quantity of mineral salts, chiefly chloride and sulphate of lime, with traces of iron and magnesium. Water potable. †

As an example of the lake water, an analysis from a sample taken from Hannan's Lake yielded the following:—Soluble matter, consisting of chloride of calcium, silicates, and chlorides of magnesium and sodium, and a considerable amount of alum, 22 ounces per gallon. *

Great inconvenience is experienced in conducting this latter, and similar water, through metallic pipes. The cause of this may arise from the erosion due to soluble salts, and probably from the presence of free acid. That free acid does occur in some of the water is proved by the condenser at Rollo's Bore, one mile from Coolgardie Townsite. ‡ Here the water was condensed from steam under a pressure of from 60 to 70lbs. per square inch. The arrangement of the condenser was such as to avoid any possibility of solid matter being carried over in the condensers. When using the condensed water for domestic purposes the following was

* Analysis by B. H. Woodward, late Government Analyst.

† Signed by E. A. Mann, Government Analyst.

‡ The water condensed was from The Great Hanover Gold Mine, Limited, 3319.

noticed (1) that the water readily attacked metallic vessels, (2) that the water was "hard," (3) that it gave a strong reaction for sulphuric acid.

Water condensed under the pressure of the atmosphere only did not give these results, so that the natural conclusion was that acid requiring a higher temperature for evaporation is present in the water. The temperature at which sulphuric acid in water evaporates is 290° F., while the pressure of steam at 60 to 70 lb. pressure requires a temperature of 293° to 303° F. Hydrochloric or nitric acid, if present, would evaporate at the lower temperature, and would not give a reaction similar to sulphuric acid.

Description of Reefs.

The Occurrence of Gold.

The gold won on this field has been derived from three sources, viz.:—Alluvial workings, lodes or formations, and quartz reefs. From the date of its discovery to the present day the Coolgardie Goldfield has been noted for its rich "alluvial finds," the first and richest of these being in the vicinity of Bayley's Reward Claim, and locally known as "Spud" and "Fly Flats." Besides the above named localities the dry-blower has prospected, often with success, most of the other flats on the eastern slopes, though only to a few feet from the surface, as in few cases do the alluvial deposits exceed a greater depth than ten feet. The form in which the gold has been thus found is variable, changing from coarse nuggets and slugs to so fine a quality that up to the present all efforts of the dry-blowers to recover it have been useless.

The methods used in the winning of this alluvial gold have been described on a previous page. Unfortunately, accurate information as to the size of the nuggets which were first found on the surface, is not procurable, because in most instances the discoverers of nuggets preferred secrecy, and when such information was printed in the local papers, this source was lost when the first news offices were destroyed by fire. From hearsay, it seems that a great number of pieces averaged from 10 oz. to 60 oz., some reaching a gross weight of at least 100 oz.; but as there was a considerable amount of quartz in many of these the information is vague and unsatisfactory. In September, 1897, however, a nugget, weighing some 64 oz., was found on Goldmining Lease 118, and was almost pure gold. Its depth from the surface was not more than six inches,

and it was found lying on the top of large angular diorite boulders covered up with fine red alluvium. The origin of this alluvial gold has undoubtedly been from several sources, inasmuch as the surrounding country is all more or less auriferous, and has suffered extensive denudation. But as the richest patches were found in the vicinity of lodes and quartz reefs containing gold, it is probable that the majority of at least the coarser gold was derived from the sheddings of these last-mentioned, while much of the finer must have undoubtedly come from the refuse of the old cement and iron-stone gravel deposits.

Lodes or Formations.

These can be described as lenticular patches of ferruginous material, often only much altered schist, through which run numerous small quartz leaders forming "stockworks." As far as can be seen at present, such patches invariably pinch out when hard country is met with, though the quartz leaders sometimes unite into a quartz reef and continue, but become of low grade and charged with pyrites below water level. On the origin of these deposits Mr. S. Göczel has written in his report on the ore deposits of Coolgardie and Kalgoorlie*, and refers them to the "filling by secretion derived from deep-seated solfatara solutions of the fissures along the contact zone of gneissic granite and diorite and dioritic schists."

The last dykes to force their way through the schists, diorites, etc., were those belonging to the acid eruptive series, and, in following the course of such one notices that the majority of these smaller "stockworks" are in close association with the acid dykes. Through their agency lines of weakness were formed, into which permeated solutions carrying gold, alkaline carbonates, etc., either from the surrounding rocks or in some cases partly from subterranean sources.

The boundaries of these lodes are very often absent, the only difference between the lode and country rock being that the former is auriferous, and sometimes, not always, crossed and recrossed by small quartz leaders.

When these quartz leaders are dark coloured, due to the presence of oxide of iron, they are usually more or less auriferous. Though much gold has been won from this source, these lodes

* Report of the Department of Mines for the year 1895, with Supplementary Notes on part of 1896. Perth: By Authority, 1896. Appendix 3. Ore Deposits of Coolgardie and Kalgoorlie.

when rich in gold are so small and irregular in habit that much of the profit is of necessity often wasted in prospecting and expensive treatment, and when they are of any extent are invariably found to be of low grade.

Quartz Reefs.

The quartz reefs occur principally in the schists, running in a general North and South direction, and usually with a dip of 60° to 80° to the East. There are two distinct varieties, one closely resembling the lode formations and occurring in large lenticular patches, often exposed at the surface as "quartz blows"; the other class belongs to the true fissure type. Of the first variety the reefs on Bayley's Reward Claim and the Big Blow Mining Lease, No. 35, are the best examples, while Sherlaw's Perseverance and Burbank's Birthday Gift Mining Lease, No. 3252, are typical examples of the second class. Whether those possessing a lenticular shape will be found occurring again at greater depths remains as yet unproven. There is one notable instance of this "remaking" both in a horizontal and vertical direction in Bayley's United Mine. Here the reefs are found to taper out horizontally, and eventually are lost, but on cross-cutting are found remaking, and sometimes overlapping, the new reef coming in as gradually as the old one disappeared.

There is also proof of the reefs in this locality behaving in a similar way vertically. At the deeper levels the quartz reefs usually carry arsenical and iron pyrites, and no doubt the oxidation of these minerals has been the chief source from which the free gold in the top levels has been derived. The mode of occurrence of the gold in the quartz is what is generally termed "patchy," and is found in shoots sometimes of great value, for example, that in Bayley's, where several thousand ounces of gold were found in a very small area.

Much speculation as to the origin of these patches has been brought forward, the usual theory being that of a secondary deposition from solfatara sources, but this seems improbable, as the gold is found surrounded by solid quartz.*

Minerals found associated with the Ore Bodies.

Several metallic minerals are found in the auriferous ore bodies above described, and are usually seen in close association with the gold therein. Of these minerals the most important are the

* Technical Observations upon the Coolgardie Goldfields by Baron Sloet Van Oldruitenborgh.

sulphides and arsenides of iron, and sulphides and carbonates of copper. As a source of gold, arsenical pyrites has, so far, proved to be the most productive, especially in Bayley's United Gold Mines (Gold Mining Leases 133, 139), where the pyrites carries large quantities of gold, both in the free and combined state.

In other mines such as the Flagstaff (Gold Mining Leases 1604, 1605), and Jubilee (Gold Mining Lease 3511), the arsenical pyrites is more or less mixed with sulphides of iron, and is of lower grade. Occurring in most of the lodes opened out below water level are large quantities of iron sulphides; these assume two forms—ordinary iron pyrites and pyrrhotine * (magnetic pyrites). Both forms are of frequent occurrence throughout the field, but only in one instance have they been profitably treated, viz., at Sherlaw's Perseverance (Gold Mining Lease 3415).

In the mines in which the copper ores occur, little, if any, work has been done below the oxidised zone, in consequence of which the prevailing copper ores are the blue and green carbonates. These are found mixed up with the quartz, and are not rich enough to work as copper ore. Good samples of the mines in which such ore is found are the Black Prince (Gold Mining Lease 2208), the Lombard (Gold Mining Lease 1721), and the Sydenham (Gold Mining Lease 1711). At the surface, in these mines, small quantities of red oxide of copper (cuprite) are also found, but to an inappreciable extent. Native copper also exists in some of the reefs in the form of small grains of the unaltered metal, and, as such, seriously hampers amalgamation of gold. Such inconvenience is experienced in the Golden Bar (Gold Mining Lease 20) where native copper is found in considerable quantities.

Of the more rarely occurring metallic minerals, the most important are galena and molybdenite. This latter is sometimes mistaken for galena. The galena is found in the quartz in the form of small irregular cubes, and is a sure indicator of higher grade ore. Free gold is sometimes visible in the galena crystals, showing the intimate connection between the two. The most noteworthy example of galena in quartz is to be found in the Union Jack (Gold Mining Lease 1385). In one instance molybdenite was found occurring in amphibole rock in the Ensign (Gold Mining Lease 1953). The relation, if any, between this mineral and the ore bodies was not apparent.

* Dana gives the composition of pyrrhotine as $\text{FeNS} (\text{N} + 1)$, but usually as Fe_7S_8 . Vide Dana's "System of Mineralogy."

Of the non-metallic minerals the most important are the carbonates of magnesium and calcium, and sulphates of calcium. As most of the rock-forming minerals near the surface have undergone extensive denudation and alteration, the products have been rendered more liable to the solvent powers of percolating waters. In consequence, secondary minerals such as calcite, dolomite, etc., are of very common occurrence. Of these the most important is the dolomite, which ranges from almost pure magnesite on the one hand, to calcite on the other. Filling in the crevices and cavities left by the removal of former minerals, these dolomites are found either in the crystalline or amorphous form; as the former they are often mistaken for felspars, as the latter for carbonate of lime only.

The white nodules which are so often seen on the surface are another form of magnesium mineral, and consist largely of hydrous silica and magnesium carbonate. In consequence, all attempts to burn such in hopes of obtaining a product for building purposes have proved futile.

Both magnesium and calcium carbonates are frequently found in the amphibole rocks, and take the place of the felspars. This replacement is sometimes due to decomposition of the felspars only, while in others the supply of mineral is drawn from aqueous solutions permeating the crevices of the rock.

Occurring in association with these carbonates, sulphate of lime is the most important mineral. In Sherlaw's Gold Mine (Gold Mining Lease 3415) an admixture of crystalline gypsum and calcite is seen filling what was once a cross fissure. The gypsum is found here in flat plates, while the calcite assumes a scalenohedral form, this shape arising from the peculiar arrangement of the small rhombohedrons.

The Mines.

During my work on the field I made notes, when possible, on the workings and underground features of the mines from a geological point of view only, and not with any intention of disseminating information as to the intrinsic value of the properties. The object of such observations is to give to the public a reliable statement as to the trend of the lodes, their dip, size, and other structural features, as well as the amount of development, and, when possible, the probable behaviour of the ore bodies.

Such public information cannot interfere with legitimate mining or the interests of individuals, and may prove of considerable utility to the investor and prospector. It will be seen, no doubt, that the names of many of the mines are omitted in the following descriptions, and such omissions will be found to be due to my inability to descend the mine, either on account of its being abandoned or under exemption during the time of my visit. As a whole, I received in the course of my work the most cordial assistance from numerous mine owners and others, and take this opportunity of expressing my gratitude therefor.

Balmoral Castle Gold Mining Lease 2754.

The reef on this property is a continuation of the Hurtle Grove reef. On this lease one shaft has been sunk to a vertical depth of 50 feet. Driving was then carried on to the East from the bottom level for 100 feet in order to try and intersect the Hurtle Grove reef, but without success. The country intersected in this drive consisted of highly kaolinised rock (decomposed schist) with narrow bands of probably altered dioritic rock. The strike of the country is North 20° East and dips to the East at an angle of 70°.

No crushings have been made of the reef opened out on this property.

Bayley's Consols Gold Mining Lease 22 (No. 2 South).

This lease is situated to the South-East of Bayley's United, and is on a branch of the same series of reefs as Cosgrove, Bayley's Reward, Golden Bar, etc. In occurrence, however, the quartz bodies differ from those found in the mines to the South, and closely resemble those opened out in Bayley's United. The workings are all connected to one main shaft, which has been sunk to a vertical depth of 220 feet. Prospecting was at first started in a whip shaft to the West of the main shaft, and in some unaccountable way the main shaft was sunk on the wrong side of the reef, which has a slightly Westerly, not an Easterly, underlie. Under the present management, however, the quartz bodies have been well opened up in three levels, which are connected to the main shaft by crosscuts about 92 to 97 feet in length.

In the 120 feet level the reef has been opened out to a distance of 110 feet South and 35 feet North of the crosscut, and is seen to have a thickness of four feet in the South face, while it tapers out in the Northern end. The strike of the reef is North 45° East, with a slight underlie to the West.

Two hundred feet level.—The drives at this level follow the reef 148 feet to the South and 39 feet to the North of the crosscut. It is doubtful, however, whether this is the same quartz body as in the top level, as the reef, though fully four feet in thickness on the floor, has almost pinched out in the roof of the drive. The character of the quartz is the same, however, being of the milky-white vitreous variety. This reef, however, extends to the bottom level, and strikes North 42° East, with an underlie of 75° to the West. Stopping is now being carried on to some extent between these two levels, the quartz body attaining a maximum size of some eight feet.

Though not conclusively proved, there seems to be little doubt, however, that these quartz bodies will prove of a similar character to those in Bayley's United (Gold Mining Lease 133). At a distance of 77 feet from the main shaft, in the crosscut at the 120 feet level, a branch, probably of the felsite dyke which has been described as occurring along this line, is seen in section, and has a thickness of some seven feet. This is probably a branch of the dyke met with in Bayley's United mine, and no doubt accounts for the faulting of one of the reefs in the latter.

The country rock is a coarse-grained hornblende rock, merging into more or less typical diorite at the greater depths.

At the 200 feet level the black bands charged with pyrites, which are so often found in association with the felsite dykes, are seen on the foot wall. The quality of the quartz is white and vitreous, and shows in the lower levels variable quantities of pyrites.

The total output of this mine, as taken from official records, is 3,977 tons crushed, with a yield of 2,387ozs. 18dwts. of gold, giving a rate of 12dwts. per ton. The value of the gold is £3 17s. 10½d. per ounce, giving a total value of £9,297 10s. 11d. to the gold won.

Bayley's United Gold Mining Leases 133, 139, 142, 547.

Three distinct parallel lines of reef occur on this property, and have been opened out from three main shafts known as the "Sylvester," "Price" and "No. 1 South"; of the three reefs the outcrop of one only is now visible at the surface, and stands out as the highest part of a small ridge to the North-West of the Price Shaft. The reef at the Sylvester Shaft also outcropped, but has since been stoped out to the surface from the 100 feet level.

The Sylvester Shaft.—The vertical depth of this shaft is 523 feet; levels at the 100 feet, 170 feet, 200 feet, 280 feet, 380 feet, and 480 feet have been opened out along the reefs and connected to the main shaft. The shaft is well equipped with hauling gear. Compressed air rock drills are used in place of ordinary hand drill labour.

One hundred feet level.—From this level to the 170 feet level the reef is practically vertical. From the main shaft it has been followed as far South as the Green Shaft, where it is faulted and thrown to the West a distance of nine feet, and then recontinues for a distance of 10 feet to the South, after which it tapers out. The average thickness of this reef is three feet, and it has been stoped out to the surface.

To the North of the Gordon Shaft, a lens-shaped reef was opened out to the 100 feet level by an underlay shaft. The reef was then found to discontinue, but has been all stoped out from the 100 feet level to the surface. It was at the cap of this reef that the celebrated "Bayley's Find" took place.

Number 2 (170 feet level).—The crosscut to the drives, from the main shaft, at this level, is 50 feet to the West. Where the crosscut joins the drive, the reef is eight feet in thickness. From here the reef extends for a distance of from 45 to 50 feet to the South, and then tapers out. Some 18 feet further South, however, the reef remakes and continues to the end of the Southern drive. A winze was put down on the reef to follow it to the No. 3 level, but at a short distance below the No. 2 level, it was found to taper out. In consequence it seems probable that this is a distinctly separate body of quartz from that opened out in the lower levels. The average thickness of the reef along this level is about four feet. The quartz is of a white vitreous nature.

Number 3 (220 feet level).—Here the reef is followed to the North for some 30 feet, and South for 100 feet, at which distances respectively it is seen to taper out.

The maximum thickness of the quartz in this level is about six feet, and occurs near the centre, gradually diminishing to the North and South.

Number 4 (280 feet level).—In the Southern drive the reef continues from the shaft for 40 feet, when it is suddenly cut off, and a hard fine-grained diorite forms a solid face. This is evidently a fault, though, as the workings have not been continued, further particulars are not obtainable at present. The reef is some six feet in thickness at the shaft, and four feet at the face.

In the Northern drive the reef tapers out at a distance of some 20 feet from the main shaft. The underlie of the reef at this level is 70° East for some 30 feet and then 45° to the East till it reaches the 380 feet level, when it assumes a fairly constant underlie of 70° East. Such is seen to be the case in a winze passing from No. 4 to No. 5. levels.

Number 5 (380 feet level).—A crosscut, 50 feet in length to the East, connects this level to the main shaft. Following along the drive to the North the reef is seen to continue for about 20 feet, when it tapers out and has not re-occurred in the drive, which has been continued for a distance of 180 feet. At the end of this drive a crosscut has been put in 60 feet to the East, following a band of softer country resembling a line of fault, but no reef was discovered. In the Southern drive the reef pinches out at 60 feet from the crosscut to the main shaft. This drive has also been continued for a distance of some 250 feet in hopes of the reef re-occurring, but without success. The strike of the reef in these drives is North 35° West, with an underlie to the East.

The "country rock" as seen throughout this mine is dioritic, varying from an amphibole to a very hard and close-grained diorite. Occurring along the walls, which are usually more or less serpentineous, due to the alteration of the magnesian salts in the hornblende, one sometimes finds rock more or less graphitic, the origin of which has not yet been accounted for.

Passing through the coarse hornblende rocks the mode of occurrence of the finer grained ones resembles that of intrusive dykes, except that there is no evidence of contact metamorphism visible. However there is no doubt as to there having been extensive faulting, and such I think will be found to have occurred before the formation of the reef, otherwise there would have been evidence of such in the reefs themselves. That the quartz has penetrated several distinctly different fissures in the country rock there is no doubt, neither is there any reason to suggest the possibility of the three series being at one time one continuous line. From the lowest level to the surface little or no water is met with in these workings.

Price Shaft.—This shaft is the most Northern of the three main shafts, and has been sunk to prospect the line of reef running parallel to but to the North of the reef prospected from the Sylvester shaft. At the date of my visit the vertical depth of the Price shaft was 270 feet. Levels had been opened out at the 40,

100, 170, and 250 feet. Of these the 40 feet level is not directly connected with the main shaft, but was connected to and worked from an old prospecting shaft situated to the North of the main shaft.

Number 1 (100 feet level).—On this level the reef is followed from some 60 feet South of the main shaft to the Cockshot shaft, when the reef ends. The thickness of the reef throughout this level is from nine to fourteen feet. Two winzes are being sunk on the reef to connect with the No. 2 level, and thus open out a large body of stone. A drive from No. 1 winze turns to the North-West, and then North to connect with the Everard shaft. In this drive a new reef comes in just North of the air shaft, and continues North to McCulloch's shaft; the reef is six feet in thickness in the centre, but tapers out at both ends. In the 40 feet level the same reef as is in the North of the 100 feet level is followed from the air shaft to the North past McCulloch's shaft. This reef outcrops at the surface. A winze put down at the 100 feet level proved that the reef tapers out vertically at the 120 feet level, and thus proved it to be distinct from the Southern quartz body, though in appearance there is great similarity, both reefs being of a white and vitreous nature.

No. 2 (170 feet level).—In the South drive the reef is found at a distance of 35 feet from the main shaft, and continues South to the Cockshot shaft, where it tapers and eventually discontinues. For the first 45 feet of the Northern end, the reef varies from four to 12 feet in thickness, but the Southern portion does not exceed five feet. Prospecting has not been carried on to the South of the Cockshot Shaft.

No. 3 (250 feet level).—At this level the reef, which strikes North 30° West and South 30° East, has been opened out some short distance to the South of the main shaft. Here the maximum thickness is 12 feet, but the reef pinches out in the North end, though it seems likely to continue some considerable distance to the South. The quartz is heavily charged with arsenical pyrites, which is considered a good indicator of gold. A very small quantity of the stone in these reefs has been treated, though the mine is well opened out, and large quantities of ore, when required, can be easily obtained. The quartz, as in the Sylvester Shaft, is vitreous and white, showing small quantities of arsenical and iron pyrites.

No. 1 South Shaft.—This shaft is situated near the battery, and has been sunk to prospect a third series of reef which runs

parallel and to the South-West of the other two reefs on this property.

The shaft is opened out at the 230, 170, 120, and 90 feet levels. Owing to the large influx of water (about 10,000 gallons per 24 hours) two of the levels were full of water. At the lowest, or 230 feet level, a considerable amount of driving had been carried on to the North and South of the main shaft. The reef at the shaft has a thickness of nine feet, and is four feet six inches across the Southern face of the drive, which is 50 feet from the main shaft. The strike of the reef is North 50° West. Following along to the North, the reef tapers out at a distance of from 60 to 70 feet North of the shaft. Here there is a discontinuation of the reef but for a short distance only, another reef coming in at a distance of nine feet to the West of the first one. This second reef continues for some 50 feet, and then discontinues, though the drive was carried on many feet to the North.

A crosscut to the East, however, of 20 feet revealed another reef, which in its turn pinched out after attaining a length of some 20 to 80 feet. The average thickness of this reef is five feet. All three have approximately the same strike, and are vertical.

The upper workings have opened out these reefs so that the whole are ready for stopping. These are the most perfect examples of the lenticular nature of the reefs to be found on the field, and as there is no clue to their relative positions, prospecting is rendered extremely difficult and expensive.

With the exception of a narrow felsite dyke found in the 90 feet level at a distance of 240 feet South of the main shaft, the country rock is similar to that in the other two workings, and consists of hornblende or amphibole rock and diorite. The excess of water in these workings is probably accountable for from their proximity to the felsitic dyke, which in all probability has disturbed the country, and opened out lines of passage for the water. The theory has been put forward that the reefs in this, and similar mines have been faulted and so are discontinuous. If such were the case it is highly improbable that the ends would taper so persistently; and though the termination of the reefs in two cases is abrupt, this will not account for the repeated occurrence of the other form. The occurrence of gold in this mine (Bayley's United) has been phenomenal for its richness, both in native gold and rich arsenical pyrites, containing at times free gold. Such has usually been found in patches or "chutes," the origin for which, in the "Interior Gold Region," has been accounted

for by Mr. S. Göczel in the following terms:—"During subsequent movements in the earth's crust, already complete quartz lodes were broken through, and sometimes dislocated by newly formed fissures, and in some instances the original lode fissure was partly reopened. Fractured portions of such broken reefs gave easy access to circulating mineral solutions, and if those solutions were derived from subterranean solfatara action, and were auriferous, these conditions favoured the formation of rich gold shoots and auriferous ore columns in otherwise poor or barren quartz reefs."*

In the quartz reefs on the Coolgardie Goldfield there was one example only, to my knowledge, in which subsequent infiltration and deposition of mineral has taken place in a fault in the reef, viz., Sherlaw's Perseverance (Goldmining Leases 3415, 3416), and here the faulting was most marked. The great indicator of rich patches in the Bayley's United reefs is not the presence of faults but of arsenical pyrites, and, as is the general rule, this mineral is not uniformly distributed through the reef, and being of a highly auriferous nature, in this mine its presence in the lower levels would naturally point to the occurrence of free gold in the oxidised zone. Taking one other example of a phenomenally rich gold reef, I would quote the famous Londonderry mine. For a considerable time after the "Golden Hole" proved to be a failure as a gold producer, the mine was considered to be of low grade and unpayable, except where rich patches occurred. This was proved otherwise when systematic prospecting opened out the reef and revealed the true value of the mine.

At the 250 feet level the reef was proved in places to be some six to eight feet in thickness, but only the last few inches, on the hanging wall of the lode contained much gold, the remainder of the reef not averaging more than from two to five dwts. Such can scarcely be known as a "chute," as the richer portion is more or less continuous in habit.

In dealing with the amount of gold obtained from these three reefs, no record has been kept from which the individual outputs can be taken. Taken collectively, 18,670 tons of ore have been milled, and have yielded a return of 53,249ozs. of gold, or at the rate of 2ozs. 17dwts. per ton. The estimated value of the gold won is £207,327 7s. 2d., giving the gold an average value of £3 17s. 10d. per ounce.

* Report on the Department of Mines for the year 1894. Perth: By Authority, 1895, page 18.

Big Blow Gold Mining Lease 3,590.

The Big Blow Gold Mine, as its name would imply, is conspicuous on account of the outcrops of quartz, which rise to a considerable height above the surface of the ground.

Shafts have been sunk in four places to test the nature of these reefs, but to date the owners have been unfortunate in that the reefs have proved to be lenticular masses of quartz rather than continuous fissure veins.

No. 1 shaft, from which most of the stone has been taken for treatment, is situated between the two quartz outcrops, and has been carried down to a vertical depth of 150 feet, and levels opened out at the 35 feet, 85 feet, and 150 feet. In these workings, the larger quartz reef has proved to have a North and South strike, with an underlie to the East, while the smaller lode strikes to the East of North and underlies to the West. Taking the levels in order from the first, downwards, the following description will give an idea of the amount of underground work completed.

No. 1 (35 feet level).—The crosscut to this level from the shaft is eight feet in length. Drives have then been opened out along the reef to the North for 75 feet, and to the South for a distance of 75 feet. Along these drives the reef averages about seven feet in thickness. The quartz is white and glassy in appearance, and almost destitute of foreign minerals. Perhaps the most profitable part of the mine in this level is the stockwork through which the drives pass. The dimensions of this ore body exceed 20 feet in thickness in places; and it extends the whole length of the drives. It consists of kaolinised material intersected by numerous small quartz veins and leaders, in which occur visible gold.

No. 2 (85 feet level).—The crosscut from the shaft to this level is six feet to the West. From the crosscut a drive extends 98 feet to the South along the footwall of the reef, which is about from five to six feet in thickness. The 85 feet and 150 feet levels are connected by means of a winze situated at a distance of 50 feet to the South of the main crosscut. From this level a crosscut was put in to the East to cut the Eastern load and connect to the Eastern shaft. No defined quartz body was cut, though a distinct outcrop can be seen on the surface.

No. 3 (150 feet level).—At this level the crosscut to the shaft is only four feet in length to the West, showing that the incline to the East is four feet in 115 feet. Driving has been carried on to the South for a distance of 58 feet along the footwall of the reef,

the driving being exclusively in the stockwork, which was mined at this level for battery purposes.

Though the exact dimensions of this stockwork have not as yet been proved, sufficient development has taken place to show that to the 100 feet level it attains a considerable thickness, not less than 20 feet.

At the 100 feet level in the Southern shaft a crosscut was put in to test the Western outcrop. This crosscut extended for a distance of 132 feet, but did not pass through any body of quartz. A similar result was gained in making a crosscut 145 feet to the West from the 270 feet level of No. 4 shaft.

All these workings have been in compact hornblende rock, changing in places to hard, close-grained diorite, and have proved conclusively that the nature of the reefs on this property are of a decidedly lenticular nature. The output for the mine to date, as taken from official returns, is as follows:—Ore treated, 2,829 tons, giving a return of 858 ounces of gold, at the rate of 6dwts. 1gr. per ton. The average value of the gold is £2 13s. per ounce, giving a total value of £2,268 14s. 2d. to the amount of gold won.

Black Prince Gold Mining Lease 2208.

This property is situated in the North-East corner of the field, and has been prospected to some extent by three vertical shafts. There are two reefs running diagonally through the property past the South-West corner peg of Gold Mining Lease 2215. One of these reefs strikes East and West through No. 1 shaft, the other North-East and South-West through No. 2 shaft. Number 1 shaft has been carried to a vertical depth of 112 feet, and a parcel of 70 tons of ore stoped out between this and the 50 feet level. The reef is four feet in thickness, and for the 70 tons which were treated at the Northam Public Battery, yielded a return of 11dwts. per ton. This reef does not outcrop at the surface. The second reef runs through No. 2 shaft into the Black Prince No. 1 Gold Mining Lease 2215, where it has been opened out by three shafts; the vertical depths of which vary from 33 to 55 feet. Considerable quantities of copper carbonates impregnate the quartz here, and in some patches the copper ore predominates. The quartz does not outcrop in any continuous line at the surface, though floaters of quartz can be seen. The vertical depth of No. 2 shaft is 120 feet, at which level driving has been carried on to the East and West for a distance of 100 feet, and to the North and South 70 feet in

amphibolite rock. There has not been any stone treated by a battery from this second reef.

A statement as to the gold returns from these reefs has not been forwarded to the Department of Mines.

Cosgrove Bayley's Reward Gold Mining Lease 122.

Prospecting was formerly pursued on the Golden Bar and Great Hanover series of reefs, but on account of the great influx of water and the low grade of the ore these workings were abandoned. The present workings are on a reef running parallel to the main one, but lie some three chains to the East of the latter.

The strike of this second line of reef is North and South, with an underlie of 45° to the East. This reef has been opened in a very unsystematic style to the 116 feet level. Two drives on the bottom level, one 100 feet to the North and one 130 feet to the South, are still open, but the workings in the top levels have been filled in. The country rock throughout the mine is amphibolite, with the exception of the Northern face, which is hard compact diorite and apparently of a subsequent age. In this face the reef vanishes, it being faulted and thrown probably to the East. On the footwall of the reef the hornblende rock contains coarse gold in sufficient quantities to warrant its being mined and treated in the battery in preference to the quartz, which is of low grade. So far this auriferous hornblende rock has been proved to extend for a distance of from two to three feet on the footwall of the reef.

A main shaft is now being sunk on the underlay of the reef, *i.e.*, to the East, and eventually will be connected to the 116 feet level, from which the old workings will be systematically re-opened. The nature of the quartz in the reef is similar to many of the outcrops in the vicinity, and is white and opaque. In thickness the quartz body does not exceed two feet on an average. Between the 50 feet and 80 feet levels 340 tons have been stoped out and crushed, but the more profitable ore on the walls has not been touched.

From the first workings a plentiful supply of salt water may be obtained, and is calculated to be in excess of what would be required to supply a ten-head stamp battery.

From official records the output of the mine to date is 1,206 tons of ore treated for 912ozs. 4dwts. of gold, giving a rate of 15dwts.

3grs. per ton. The average value of the gold is £3 18s. 2½d., giving a total value to the gold won of £3,565 11s. 0d.

Derby Mine Gold Mining Leases 1797 and 1798.

On Gold Mining Lease 1797 a shaft has been sunk to a vertical depth of 130 feet. Crosscutting was then proceeded with to the West for 135 feet, and to the East for 164 feet, at the 125 feet level.

At the end of the 164 feet crosscut, drives have been put in to the North and South for about 25 feet each way. From the end of the Southern one, a rise was then put up for 20 feet, and the drive continued to the South for 80 feet to connect with the shaft on Gold Mining Lease 1798. No defined reef or lode stuff was found in these workings, so that the leases were eventually abandoned. Potable water was struck in abundance at the 130 feet level.

Empress of Coolgardie Gold Mining Lease 1865.

The main shaft, which has a vertical depth of 212 feet, has now been abandoned, as the quartz reef, which was opened out extensively on the 120 feet level, proved to be almost barren. This reef runs parallel to the felsite dyke now worked by a party of miners who have taken the lease up "on tribute."

These workings are carried on in the open cut system, and so far have given satisfactory results. The strike of the dyke is North and South, with an underlie almost vertical. The width of the lode averages 20 feet. A five-head stamp battery is on the property, and affords means to crush the stone which is being mined.

The yield to date is 517ozs. 18dwts. 7grs. of gold from 1,383 tons of ore treated, giving an average of 7dwts. 11½grs. of gold per ton. The gross value of this gold is £1,931 10s. 4½d., the average value per ounce being £3 14s. 6¾d.

Flagstaff Gold Mining Leases 1604 and 1605.

At the time when I visited this mine exemption had been granted for several months and the mine shut down. The following information was given to me by the Manager in charge.

The outcrop of a well-defined reef is visible, extending through Gold Mining Leases 1604, 1605, and 3415 running parallel to the North and South boundaries of the leases. After entering Gold Mining Lease 3415, however, the reef bends round to the South-West, and from the strike of what outcrop is visible, will most

likely be found to pass through the Perseverance Extended (Gold Mining Lease 3252).

This lode has been opened out by three shafts which are connected with drives. Starting from the East the first shaft—Star shaft—has been sunk to a vertical depth of 116 feet. At this level a drive has been put in 33 feet to the East on the lode.

The central, or Ethel shaft, has a vertical depth of 160 feet. At the 60 feet level a drive has been made 160 feet West, and 100 feet East along the lode, which lies 11 feet to the South of the shaft, and is connected to the shaft by a crosscut.

The Annie shaft has a vertical depth of 112 feet. It is connected to the Ethel shaft at the 60 feet level by a drive 198 feet in length, and at the 100 feet level to both the Ethel and Star shafts by drives which follow along the lode.

Several short cuts are put in to the North and South from these shafts, but are of little importance, except to prove that the country rock is diorite.

The strike of the lode is North-East and South-West, with a slight underlie to the South-East. In thickness the lode is said to vary from four to 10 feet. The lode consists of clear glassy quartz, heavily charged with oxides and sulphides of iron. There are no crushing returns available to denote its quality as a gold producer.

The total output of this mine to date, as taken from official records, is 1,572ozs. won from 1,155 tons, or at the rate of 14dwts. 14grs. per ton. The average value of the gold per ounce is £3 12s. 6d., giving a gross value of £5,698 to the total output.

Forrest King Gold Mining Lease 234.

Two underlay shafts follow the reefs which underlie at a high angle to the East. The Southern one of these has a vertical depth of 115 feet. At the 50 feet level two drives have been put in to the North and South, the former extending for a distance of 28 feet to the North, with the latter 20 feet to the South.

In the Northern end of the drive the reef vanishes, but attains a thickness of from one to five feet in the shaft, and underlies at an angle of 60° to the East. The Northern underlay shaft is opened out at the 50 feet level with a drive extending 141 feet along the reef. At the end of this drive the reef ends. An old prospector's shaft is seen in this drive at a distance of 120 feet from

the underlay shaft. Descending to the 130 feet level, a winze follows the reef from the 50 feet level. The reef in this winze attains a thickness of six feet. Driving to the extent of 90 feet has shown the reef to have a thickness of from three feet six inches to four feet at the 130 feet level.

At the 170 feet level the reef has been opened out by drives extending to the South for 313 feet, and to the North for a distance of 256 feet from the main shaft. In the South drive the reef vanished at a distance of 150 feet from the main shaft. A crosscut was then put in to the East, and another reef was struck, striking at an angle of North 20° East and South 20° West. This reef is now being opened out to the South with rock drills, and shows a thickness of some five feet in the face. The country rock is diorite. At a distance of 134 feet from the main shaft, in the North drive, the reef also pinches out, but a quartz leader is seen bearing away to the North-East. This leader has been followed for some distance, as the walls were well defined, and there seemed great probability of finding another body of quartz to the East of the present main lode.

The vertical depth of the main shaft is 235 feet. A winze 134 feet to the North of the main shaft, on the 170 feet level, connects the 150 feet level to the 225 feet or bottom level, which latter is opened out to a distance of 134 feet to the North by a drive following the reef. The reef in this bottom drive has an average thickness of some four feet. The total yield, as gained from official returns, is 938ozs. 1dwt. 9grs. won from 1,362 tons 10cwt. of ore, or at the rate of 13dwts. 18grs. of gold per ton.

Golden Bar Gold Mining Lease 188H.

The Southern end of the Great Hanover line of reef passes through the centre of this property. No distinct outcrop of quartz is visible at the surface. The reef has been opened out from a main shaft. This shaft has been sunk for a vertical distance of 215 feet. In addition to sinking the shaft, the reef, which dips slightly to the West, has been opened out to some considerable extent at the 62 feet and 129 feet levels.

On the 62 feet level stoping has been carried to the surface from 80 feet along the drive to within some 30 feet of the main shaft. The reef along this drive is about 10 feet wide.

On the 129 feet level overhead stoping has been carried on from 114 feet along the drive to within some 20 feet of the main shaft, the quartz maintaining a thickness of about 4 feet.

The average strike of the reef is North 13° West, with an underlie of 1 in 8 to the West. Considerable difficulty in amalgamation is experienced, due to the presence of native copper in some considerable quantity.

A ten-head Fraser & Chalmers Mill has been erected, the Krupp Mill proving a failure for the class of stone treated.

A salt water supply is estimated at 23,000 gallons for every 24 hours.

Up to date official records show that 5,408 tons of ore have been treated, and have yielded 2,966ozs. 5dwts. 8grs. of gold, or at the rate of 10dwts. 23grs. per ton. The average value of the gold is £3 10s. $1\frac{1}{2}$ d., giving a total value of £10,396 10s. $0\frac{1}{2}$ d. to the gold won.

Great Hanover Gold Mining Lease 3319.

This mine, on the day of my visit, was undergoing extensive alterations in the way of machinery erection. Owing to the influx of some 150,000 gallons of salt water per diem into the lower levels, it was found necessary to erect a large Cornish lift-pump. In consequence of the delay the mine was flooded, and it was impossible for me to descend. The following information was given to me by the manager (Mr. Thomas), and such, I have every reason to believe, is correct:—

The main shaft has been put down to prospect the most Eastern of the three reefs (the outcrops of which run North and South through the lease) and has been carried to a vertical depth of 250 feet.

The strike of the reef is North 10° West, with a slight underlie to the West. In thickness the quartz varies from six inches at the surface to three feet at the 250 feet level. The water level is at a vertical depth of 140 feet from the surface.

Eighty tons of quartz taken from the upper levels have averaged, on battery treatment, 15dwts. per ton.

The reef is in amphibole rock, and is in close connection with a felsite dyke—the same which passes through the Cosgrove Bayley's Reward and Bailey's United on the North, and the Golden Bar on the South. Unfortunately it is not possible to gain information as to the exact relation between these two, owing to the mine being filled with water. In consequence of the excessive quantity of water, the Big Blow (Gold Mining Lease 3590) and the

Herbert Consols (Gold Mining Lease 2885) have been able to draw a constant supply for battery purposes. Though too salt to be potable, this water is fresher than ordinary sea water, and contains about 2.5 per cent. of soluble salts only. The total output of gold to date, as taken from official records, is 185 tons of ore treated for 1100zs. 1dwt. of gold, or at an average of 11dwts. 21grs. of gold per ton of ore treated.

Hurtle Grove Gold Mining Lease 2755.

The only shaft on this property has a vertical depth of 100 feet with one level opened out at the 75 feet to the North and South for a distance each way of 35 feet.

The reef as seen here has a thickness of 3 feet, and runs North 20° East with an underlie of 70° to the East. An irregular outcrop of the reef is traceable at the surface. No crushings have been taken from this property.

The country rock is decomposed schist, which shows numerous slickensides. The lease has since been abandoned.

Lady Charlotte Gold Mining Lease 1384.

The reef which is being prospected on this lease does not outcrop very distinctly, though the underground workings prove its existence both in the Lady Charlotte and Duke of Wellington leases. All the underground workings are connected to one main shaft, which has a vertical depth of 300 feet. Levels are opened out at depths of 50, 75, 105, 198, and 300 feet.

Seventy-five feet level.—Starting from No. 2 shaft to the Southward, a reef continues for about 60 feet. At this point the drive discontinues, and a rise is put up to the 50 feet level. From No. 2 shaft a crosscut has been put in to the East for a distance of 20 feet, when the drive is continued to the North along the line of the main reef, which commences again 20 feet North of the crosscut, and continues for a distance of about 150 feet to the North, averaging eight inches in thickness. The stone in this drive shows coarse gold in places. The country rock is kaolinised material, the product of decomposed diorite. From the rise in the South end of the 75 feet level driving has been continued to the South, past the Duke of Wellington shaft*, on a 50 feet level.

Starting from this shaft a reef may be followed in the drive to the South for a distance of 55 feet, when it pinches out, nor is it again met with in any further workings to the South. At a

* For location of Duke of Wellington shaft, *vide* accompanying map.

distance of some 30 feet to the North of the shaft, however, a reef gradually widens out from a small quartz leader to a body at least two feet in thickness, and continues to some 220 feet to the North. Taking these reefs as they are seen in this mine, there can be little doubt of their lenticular nature, and whether they will re-make in harder country rock in the lower levels is a subject of much doubt, as there is no direct evidence on which to base an opinion either in this or the other mines of the field.

In the 84 feet crosscut on the 300 feet level the black bands are evidence, I take it, of the presence of a felsitic dyke, probably an extension of the one passing through the St. Simon (Gold Mining Lease 2419) to the North. If such be the case the Mount Charlotte reefs might be of a similar character to those in Bayley's United, which are also in close proximity to the seat of felsitic intrusions.

One hundred and five feet level.—The crosscut at this level from the main shaft to the lode is 15 feet in length.

In the south drive the cross reef found in the 198 feet level is met with at a distance of 60 feet from the main crosscut. Here, at the junction, as in the lower level, the main lode widens out considerably, but only continues a distance of 90 feet South, when, as below, it finally tapers out.

This South drive is continued for a total length of 212 feet, when a crosscut is put in a distance of 30 feet to the West, and the drive recontinued to the South for 50 feet, but no defined reef is cut. The 30 feet crosscut is continued for 30 feet more to the West, and a reef six inches is cut, but this reef so far has proved to be barren. The reef strikes North and South and underlies to the East.

One hundred and ninety-eight feet level.—The crosscut to the lode at the 198 feet level is 24 feet in length, and connects to a drive which extends 400 feet to the North. For 200 feet of this drive the reef averages about 15 to 18 inches in thickness, but afterwards tapers considerably. Its underlie is to the East at an angle varying from 45° to 70°. Going South from the crosscut a drive extends for 200 feet, after which the reef pinched so much that work in that direction was suspended. At a distance of 110 feet from the crosscut in this drive a cross reef striking North 40° East makes its appearance, but has not been followed to any distance. The underlie of the cross reef is 59° to the South-East.

The thickness of the reef in the South drive at the 198 feet level, varies from a few inches to six feet, the maximum thickness being near the intersection of the cross reef.

Three hundred feet level.—The working on this lowest level had not been carried on to any great extent, as the shaft had only recently been sunk. Crosscutting to the East for the reef, however, had been extended for a distance of 84 feet in hard, compact, diorite country, but no regular reef has been cut, though patches of quartz were met with, and bands of the dark rock resembling slate, which is so often found associated with the felsitic dykes.

Up to the present crushings have not been made of the ore in this mine, though the reef is so opened out that large quantities of quartz can easily be supplied when required.

Lady Loch Gold Mining Lease 336. •

The main reef on this property strikes East and West, and is almost vertical, but has a slight dip at times to the South. A whip-shaft, due North of the main shaft, has a vertical depth of 100 feet. At this level a drive has been opened out to a distance of 480 feet to the East.

Following along this drive, the Lady Loch reef is seen to have a thickness varying from six inches to four feet, but pinches out at a distance of 180 feet East of the whip-shaft. At a distance of 270 feet East from the whip-shaft a larger reef makes its appearance, and follows along the same strike as the first, but underlies to the North. The average thickness of this reef is two feet. To the West of the whip-shaft the main reef is seen to continue for a distance only of 120 feet. Stopping from this level to the surface has been completed for distances of 110 feet West and 180 feet East of the whip-shaft. The appearance of this stone is white and vitreous, while that of the Eastern reef is very white and semi-granular.

The vertical depth of the main shaft is 150 feet, and is connected by a crosscut to the 150 feet level by a crosscut 65 feet in length to the North.

Driving along the reef at the 150 feet level has been carried on 105 feet West and 175 feet East of the crosscut. A winze has been sunk to a depth of 100 feet at a position 100 feet to the East of the crosscut, but is now filled with water, so that I could not gain information as to the occurrence of the reef at a lower level than 150 feet. The reef at the 150 feet level is inclined to dip to the North, like the Eastern reef.

Work was suspended on this mine at the time of my visit. A small cross reef, which has been slightly exposed at the surface, strikes across from the Lady Loch to the Forrest King reefs, but, up to the present, has not been opened out underground.

The country rock in this mine is diorite, of a similar nature to the prevailing diorite found elsewhere on the field. The total amount of gold won from this reef is 5,260 ounces, obtained from 1,697 tons of ore. The average rate of gold per ton is 3ozs. 1dwt. 23grs.

Macpherson's Reward Gold Mining Leases 664 and 1739.

The line of reef worked on this property strikes North-North-West and South-South-East, and underlies at an angle of 45° to the East. No distinct outcrop is visible at the surface. Two underlay shafts (Nos. 2 and 3) to the 60 feet level, and a vertical shaft with a depth of 185 feet, have been sunk, and levels opened out principally at the 60 feet and 177 feet levels. Taking the 60 feet level first, this is found to follow the reef for a distance of 240 feet to the North-West, when the reef tapered to a mere leader. At a distance of 80 feet from main shaft, a winze has followed the reef to a distance of 30 feet from the 60 feet level. Also at a distance of 30 feet a winze follows the reef to the 80 feet level, which is opened out to the North-West by a drive of a few feet in length. A crosscut to the North-East has passed through diorite for a distance of 108 feet.

Except several minor drives and crosscuts at the 50ft., 90ft., and 110ft. levels the workings on the 60ft. level comprise all that has been done to open out the reef as yet. Stopping between the two underlay shafts has been carried on from the 60ft. level to the surface, and it is in this spot that the richest part of the lode was found. For this short distance the reef averaged 20 inches in thickness, but afterwards tapered very much when followed to the North. The quartz is of a white vitreous nature. Development has so far proved the country rock to be diorite or amphibole rock.

The returns from 1,623 tons 15cwt. of ore crushed from this mine, were 1,359oz. 6dwts. 4grs., giving an average of 16dwts. 10grs. of gold per ton of ore treated. The average value of the gold is £3 16s. 2d., giving a gross value of £5,177 0s. 7 $\frac{3}{4}$ d. for the gold won.

Mount Rowe Gold Mining Leases 1004, 754, 988, and 621.

The reef which runs through this lease is probably a continuation of the line of reef extending Northward through the "No Gammon" (Gold Mining Lease 1019), to which an indistinct outcrop can be partially traced.

Two levels have been opened out at the 150 and 207 feet levels from a shaft with a vertical depth of 223 feet 8 inches. These workings are carried on to prospect a felsitic lode and a quartz reef which cut through the shaft at the 150 feet level. Starting with this level, which has been opened out to the South of the shaft, a mixed lode of felsite and quartz and a quartz reef have been followed for a distance of 250 feet. The reef for this distance varies in thickness from four to seven feet; the lode from 10 to 15 feet. The strike of the lode is South 25° East. Some 28 feet to the South of the main shaft a branch reef joins the main lode, the trend of this latter being at first North-East, but afterwards it turns to the North and assumes a North 25° East strike for a distance of some 100 feet, when it gradually tapers out. This branch reef averages about two feet in thickness, and dips to the East. At a distance of 80 feet from the junction with the main reef, the branch reef itself branches off to the North-West, having a strike of North 30° West, but does not continue for more than some 30 feet in this direction.

From the shaft a crosscut to the East has been made for a distance of 140 feet. This crosscut cuts the branch reef at a distance of 20 feet from the shaft. The felsitic lode and associated quartz reef have not been opened out to the North on this level.

At a distance of 100 feet North from the main shaft, *i.e.*, at the end of the North drive, a small cross reef is followed along an apparent line of fault striking East 50° North. This fault will be found, I think, to connect the felsite lode to the felsitic dyke seen outcropping to the East, higher up on the side of Mount Rowe. In appearance the quartz reefs are white and glassy.

Two hundred feet level.—At this level a crosscut has been made in massive hornblende rock of a very fine grained and extremely hard nature, but no reefs have been cut in the 170 feet opened out.

In a crosscut to the East the felsite lode is met with at a distance of 10 feet from the main shaft, and has been followed at this point for a distance of 75 feet in a winze which underlies to the

East at an angle of about 1 in 5. The formation has also been followed in a drive for a distance of 60 feet to the South.

In the crosscut, and at a distance of 37 feet East from the main shaft, a reef averaging about one foot in thickness was cut. This is probably the branch reef of the upper level, but has not been followed any distance to the North and South. Its dip and strike correspond to that of the branch reef of the 150 feet level.

No crushings have been made of the ore in this mine.

New Australasian Gold Mining Lease 1093.

This mine forms perhaps the most noted example of the lenticular nature of some of the quartz bodies in the Coolgardie Goldfield, inasmuch as the whole of the quartz has been removed, and no direct indications of a continuation of the deposit can be discovered. The trend of the drives shows that the strike of the lode was practically North and South, while the direction of the winzes points to an Easterly dip. The lowest level is 249 feet below the surface, but Diamond Drill bores have increased this to a depth of about 500 feet. So far the cores from these bores show that the country rock below the 249 feet level is hornblende rock, with occasional patches of carbonate of lime, and in one or two instances narrow quartz leaders.

Crystals of pyrites were common in parts of some of the cores. To the 200 feet level the country rock is decomposed diorite, but between the 200 feet and 250 feet levels extremely hard compact hornblende rock made its appearance. The following are the complete returns to the end of the year 1897, as furnished by the Company's office. Two thousand eight hundred and eleven tons of ore treated for a return of 7,239 ounces of gold, giving a gross value of £26,093 15s.

In addition to these the official returns for the year 1898 give an output of 1,427ozs. 6dwts. 12grs. from 195 tons, making a gross return of 8,666ozs. 6dwts. 12grs., won from 3,006 tons, or at the rate of 2ozs. 17dwts. 15grs. per ton.

Perseverance Extended Gold Mining Lease 3252.

Probably the same reef which passes through the Bird in the Hand (Gold Mining Lease 2080) to the Flagstaff (Gold Mining Lease, 2753) has been worked in the main shaft of this lease.

The main shaft is down to a depth 150 feet, and the reef has been opened out at the 60, 100, and 150 feet levels by drives

extending North and South each way for a distance of 50 feet on the three levels. The strike of the reef is North 20° East, with an underlie of 1 in 15 to the East. The quartz is of a milky white appearance, and of low grade.

A second shaft to the East of the main shaft is down 75 feet on a felsite dyke, which contains small quartz leaders carrying gold. The felsite rock has decomposed into a soft kaolin, and is easily mined. It is undoubtedly a continuation of the felsite dyke running North from the Golden Dyke (Gold Mining Lease 2080).

The yield of gold from this mine to date is 6ozs. from 55 tons of ore treated, yielding an average of 2dwts 4grs. per ton.

Queensland-Coolgardie Gold Mining Lease 3573.

A reef runs through the centre of this lease in an almost North and South direction. Though the outcrop can be followed on the surface, the reef is not well defined till the lower levels are reached.

The main shaft has a vertical depth of 133 feet. At the bottom level a crosscut 24 feet in length to the East connects the shaft to the main drive at the 133 feet level. This drive follows a reef which strikes North 10° West, and underlies to the East at an angle of 65° . Following along this drive to the North a winze is first passed which has been sunk on the reef to a depth of 40 feet. The drive is then continued for 120 feet further, when a crosscut to the West connects the present workings to the old prospecting shaft which is 27 feet along the crosscut. The crosscut has been continued 60 feet further to the West of the prospecting shaft.

The reef along the main drive is very variable in thickness, ranging from a width of a few inches to several feet, and averaging about one foot six inches to two inches for the whole distance. The quartz is white and of a more or less granular appearance. It carries coarse gold in many places, and gives every promise of being payable. The country rock is amphibolite, and is unoxidised even at the surface.

On the Eastern side of the lease is another line of reef which follows parallel to a felsitic dyke, but so far prospecting has not been carried on to any extent on this lode, which, at the surface, does not give encouraging prospects. The strike of both reefs is slightly to the West of North, with a dip of 65° to the East.

The total yield of gold as taken from official records for this mine is 270ozs. 3dwts. 8grs., won from 218 tons 10cwts. 1qr., or at the rate of 1oz. 4dwts. 17grs. per ton.

Rose Hill Gold Mining Lease 1599.

The workings on this lease are in a decomposed kaolinised rock, probably altered felsite, intersected by numerous quartz leaders containing gold. The strike of the lode is North 60° West, and underlies to the North-East at an angle of 71°. In character the walls vary from amphibole rock to a coarse-grained diorite. The lode has been followed in a vertical shaft to 183 feet beneath the surface, at which level its character is entirely different, the quartz veins having apparently collected into more or less irregular quartz masses in which both free gold and pyrites are visible.

The encasing rock, too, is auriferous, and is treated with the quartz for a variable distance on either side of the quartz. Both the quartz and the walls are impregnated with pyrites.

Noting the gradual change from the surface, there seems every probability of the quartz eventually turning into a true quartz reef. Crosscuts to the West for 57 feet and to the North-East for 45 feet have been put in at the 183 feet level. In the latter the lode was struck, and proved to be from eight feet to ten feet in thickness.

As the end of the 45 feet drive was on the boundary of the Killarney (Gold Mining Lease 3070), further development was suspended. At the 80 feet level considerable development has taken place, the lode opening out to a width of 60 feet.

The supply of water (which is salt) averages from 15,000 gallons to 20,000 gallons per diem.

A great change in the country rock takes place after sinking below the water level, fine-grained diorite taking the place of the amphibole rocks and coarser-grained diorites. The lode consists of a kaolinised rock through which run small quartz leaders. Such evidence as there is tends to the probability of this lode being part of a felsite dyke similar to those already described in other mines on this field.

The total output to date is 364 tons crushed for a return of 185ozs. 1dwt. 20grs., or at the rate of 10dwts. 4grs. per ton. The

value of the gold is £3 15s. per ounce, giving a total value of £694 1s. 10½d. to the gold won.

St. Simon Gold Mining Lease 2419.

The principal workings on this lease consist of two vertical shafts which have been sunk to prospect a felsite dyke through which run small veins of quartz carrying gold. No outcrop of the lode is visible at the surface.

In the South shaft, which has a vertical depth of 150 feet, two crosscuts have been put in to the East and West simply to prospect the surrounding country. Of these the Eastern one extends for a distance of 200 feet from the shaft, while the other follows parallel to the Southern boundary of the lease for a distance of about 300 feet. At a distance of 180 feet in the East crosscut a felsite dyke has been cut, otherwise the country consists of diorite. In the Western crosscut occasional quartz leaders striking North and South and underlying at variable angles to the East were passed through.

A main drive partly following the felsite lode extends to No. 3 shaft. The strike of this lode is North and South for about 80 feet, but after this it turns away to the West. The average thickness of the lode is about 10 feet.

Number 3 shaft is also connected to the No. 1 shaft at the 85 feet level, but reveals no change of importance. The felsite lode will be found to continue far away to the North, passing through the Oriental (Gold Mining Lease 618) and Orient (Gold Mining Lease 3338). To the West of this lode is a large quartz reef passing through Gold Mining Leases 618 and 3338. In Gold Mining Lease 3338 this reef is found in closer proximity to the felsite lode, and will eventually be found occurring in association with the latter, like similar lodes and felsite dykes in other parts of the field. Prospecting had been suspended in these particular workings of the St. Simon (Gold Mining Lease 2419) at the time of my visit, as the prospecting had been concentrated on the Lady Charlotte (Gold Mining Lease 1384). No crushing of any of the ore has been made up to the present.

Sherlaw's Perseverance (Gold Mining Lease 3415).

No distinct outcrop of the main reef of this lease is visible, though the workings have proved the continuity of the quartz vein

for a considerable distance underground, in a line running parallel to the Western boundary.

Two other reefs, which are still unprospected, run parallel to this main line, but are near the Eastern boundary.

The main shaft has been sunk to a vertical depth of 414 feet on the Western lode, and is one of the deepest workings on the field. Levels have been opened out at vertical depths of 100, 200, 300, and 414 feet.

One hundred feet level.—Two drives have been opened out at this level to the North for 264 feet, and to the South for 150 feet following along the reef. In the Southern face the reef tapers out, and is of very small dimensions throughout the whole length of this and the Northern drive at this level. In consequence, work has been suspended in this portion of the mine, and development carried on more extensively at the lower levels. The 100 feet level is perfectly dry, and in the oxidised zone. The strike of the reef is North 30° East, with a very slight underlay to the West.

Two hundred feet level.—Drives extending 154 feet to the North and 143 feet to the South open up the reef at this level. The drives lie six feet to the East of the main shaft, and are connected with the latter by means of a small crosscut. This level is the lowest one in the oxidised zone, sulphides occurring at no great depth beneath. The quartz vein, though continuous, is narrow and of low grade, so that work in this level too has been suspended.

Three hundred feet level.—At this level the reef cuts through the shaft, and attains a thickness there of some 12 feet. From here the reef has been followed for a distance of 70 feet by means of a drive, in the face of which the reef has a thickness of two feet. At a distance of 47 feet South from the main shaft, a calcite band is seen to cross the reef striking North-West and South-East, and dipping at a high angle to the South-West. In the vicinity of this band, which is also met with in the next level, richer stone usually occurs. Iron pyrites and pyrrhotine are of common occurrence in the ore at this level. Free gold is also sometimes visible. The country rock throughout the mine is diorite.

Four hundred and fourteen feet level.—In this level the reef strikes North 30° East, and underlies at an angle of 85° to the West. Drives have been extended 110 feet South and 40 feet to the North along the reef. These drives are connected to the main shaft by

means of a crosscut extending 12 feet to the West from the shaft. In the Southern drive on this level, at a distance of 86 feet from the shaft, the reef has been broken, and a subsequent deposition of calcite and gypsum taken place. The trend of this latter deposit is North-West and South-East, and has a thickness of some six feet. The faulted or Southern portion of the reef has been thrown several feet to the East. Throughout this lower level the reef maintains an average thickness of eight feet, and shows no signs of tapering out in either face. Considerable change in the quality of the reef has taken place at a depth, the returns obtained from crushing and concentrating being much greater than those from the 100 feet and 200 feet levels. Great difficulty has been experienced from lack of water on this property, and the irregularity of supply from other sources. So far the ore has been treated on the ground by means of a ten-head stamp battery. In appearance the ore is white and vitreous, and heavily charged with pyrites below the 200 feet level. The following are the official returns of the output of gold to date:—Crushed 4,752 tons, for a yield of 3,015ozs. 19dwts. 12grs., at the rate of 12dwts. 16grs. per ton. The average value of the gold is £3 8s. 2d. per ounce, giving a gross value of £10,281 0s. 10½d. to the gold won.

Steadman's Choice Gold Mining Lease 2725.

There are apparently two lines of reef on this property running almost parallel in a North and South line, but having variable underlies. Prospecting had not been extended far enough for the junction of the two reefs to be determined. The old workings, which are on the Western outcrop, have been carried on to a small extent by means of two prospecting shafts, which were not accessible to me. On the Eastern line a main shaft has been put down in diorite country to a depth of 150 feet, which depth is slightly below the water level. The influx of salt water is about 1,000 gallons per 24 hours. In passing down the shaft the reef is seen at the 100 feet level, and is of some considerable thickness with a slight dip to the West.

The quartz in this reef is highly charged with pyrites, but is said to yield satisfactory assays. Further development is to be carried on at the lowest level of the main shaft. The long line of reef extending in an East and West direction through the Southern portion of Gold Mining Lease 2725 has been prospected to a very small extent and then abandoned. The outcrop of this reef is

sometimes at least 16 feet in thickness, but has a barren, white, semi-opaque appearance.

Nineteen tons 19cwt. of ore from this mine were crushed at the Golden Bar Battery, and yielded 9ozs. 10dwts. 7grs., or 9dwts. 13grs. of gold per ton of ore treated. The value of the gold is £3 17s. 6d. per ounce.

Tartar Gold Mining Lease 2769.

This property is on the same line as the Hurtle Grove and Balmoral Castle Leases, and has, since my visit, been abandoned. The old workings consist of two shafts, the most Northern of which is 100 feet in depth, with a drive to the East for 30 feet. The reef in the end of this drive is some 20 inches in thickness, and runs North and South with an underlie of 70° to the East. The second shaft was sunk on the underlie of the reef for a depth of 50 feet, and then a crosscut was put in 30 feet to the West. The country rock is decomposed schist. Up to the date of my visit to this mine no crushings of the reef had taken place.

Tindal's Gold Mining Lease 33.

At the date of my visit the old workings, which had opened up a large quartz reef, had been abandoned, and a fresh start made by a party of miners "on tribute," who recommenced work in an "open cut" on the auriferous felsite dyke running parallel to the reef. This dyke, which attains a thickness of some two chains, runs North and South, and dips to the West at an angle of 35°. It is evidently a small branch of a larger dyke which strikes North and South throughout the property. Along the South-East boundary of the lease a fault occurs in the latter, the Southern portion, which passes through the Golden Dyke Gold Mining Lease 2080, being thrown slightly to the South-West. So far the returns from ore taken from the open cut have averaged 8dwts. per ton. The water used for the five-head stamp battery is taken from the shaft on the Eastern side of the lease.

The following is the total gold output to the end of the year 1898:—Crushed 4,594 tons of ore, which yielded 1,311oz. 19dwts. 14grs. of gold, giving an average of 5dwts. 17grs. of gold per ton of ore treated.

Union Jack Gold Mining Lease 1385.

The shafts on this property are four in number. Of these the main shaft has a vertical depth of 172 feet, and has been sunk on

the Eastern branch of a line of reef running North 20° West through the centre of the Union Jack and Ensign (Gold Mining Leases 1385 and 1953). The strike of the Eastern branch is North and South, with an underlie of 80° to the West. Both reefs outcrop at the surface, the main line in particular being traceable by a large body of quartz appearing several feet above the surface. The continuation of this outcrop is of short duration. At the 100 feet level in the main shaft a 30 feet crosscut to the reef has been made in hornblende rock. The reef here attains a thickness of 10 feet. A similar crosscut at the 160 feet level is 53 feet in length, and passes through hornblende rock. The reef is five feet six inches in thickness at the end of this crosscut. Driving to the extent of 100 feet North on the 100 feet level, and 35 feet North on the 160 feet level along the reef, comprise the underground workings. Work was suspended at the date of my visit. The country rock is diorite, changing in places to an amphibole rock. Galena is visible in the quartz (which is of a glassy white nature) and is considered a good indicator of the richer portions of the reef. In some stone from the workings of the Ensign (Gold Mining Lease 1953) which had been shut down, some small pieces of molybdenite were found, but the relation of this mineral to the lode was not ascertainable.

The total yield to date of stone treated from the Union Jack (Gold Mining Lease 1385), according to official returns, is as follows:—477 tons 10cwt. yielded 522ozs. 9dwts. 18grs. of gold, the rate per ton being 1oz. 1dwt. 21grs. In value the gold averages about £3 13s. 4d. per ounce.

Gold Production.

It will probably be noticed that there is a discrepancy of 278,869 ozs. between these Returns and the amount of Exported Gold as furnished from the Customs House.

This difference in amount may be accounted for partly by its not being compulsory to furnish returns of the alluvial gold won, and from the difficulty of obtaining statements of the output of quartz claims. As, however, the greatest difference arises in the Returns previous to the year 1897, it will probably be found to be due to mistakes arising confusing the different Goldfields, as it was about this time that the Coolgardie Goldfield was sub-divided into the East and North-East Coolgardie Goldfields. The difference between the two sets of Returns may also be due to the fact that a good deal of gold won in the early days of the field was not reported

to the Mines Department. The following is a comparative table, and will show the variation in the discrepancy :—

Amount of Gold entered for Export.		Amount of Gold as supplied to the Department of Mines in Quarterly Statements.	
Date.	Ozs.	Date.	Ozs.
Previous to 1897 ...	299,571	Previous to 1897 ...	66,691
1897	104,306	1897	64,555
1898	127,227	1898	110,989
Total	521,104	Total	242,235

Difference 278,869 ounces.

Return showing the Yield of the Leases on the Coolgardie Goldfield.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
464s 3676	Admiral Dewey Admiral Sampson	1898 1898	tons cwt. qrs. 26 0 0 44 0 0	ozs. dwts. grs. 36 9 0 18 0 15	ozs. dwts. grs. 1 8 0 0 8 5	£ s. d. 142 3 1 70 15 5½	£ s. d. 3 18 0 3 18 6
319s	A Golden Do.	Previous to 1897 1897	0 2 0 14 0 0	50 0 0 127 0 0	500 0 0 9 1 10		
		Total	14 2 0	177 0 0	12 11 1		
2613 3608 3668 538 463s	Auckland Aurum Australasian Junction Australasian United Bantam	Previous to 1897 1898 1898 1898 1898	50 0 0 61 0 0 15 0 0 43 5 0 40 10 0	24 13 0 46 19 0 7 3 0 21 17 0 33 8 6	0 9 20 0 9 19 0 9 12 6 9 1½ 0 16 7	172 16 10 27 3 4½ 81 18 9	3 10 0 3 16 0 3 15 0
1988, 1989	Bass and Flinders	Previous to 1897	10 0 0	5 10 0	0 11 0		
22	Bayley's Consols (No. 2 South) Do.	1897 1898	852 0 0 3125 0 0	455 18 0 1932 0 0	0 10 16 0 12 8	1774 16 5 7522 14 6	3 17 10½ 3 17 10½
		Total	3977 0 0	2387 18 0	0 12 0	9297 10 11	3 17 10½
133, 139 142, 157	Bayley's Reward Bayley's United G.M. Co. Do.	Previous to 1897 1897 1898	13312 0 0 1397 0 0 3961 3 1	35287 0 0 3533 0 0 14429 0 0	2 13 3 2 10 13 3 10 8	137325 4 10 13749 5 2 56252 17 2	3 17 10 3 17 10 3 17 10
		Total	18670 3 1	53249 0 0	2 17 0	207327 7 2	3 17 10

471	Bayley's South Extended	1897	47 0 0	8 11 0	0 3 15		
207, 423	Bayley's South, Number 2 Do.	Previous to 1897 1897	100 0 0 514 0 0	29 0 0 312 16 0	0 5 11 0 12 4	90 0 5 970 19 7	3 2 1 3 2 1
		Total	614 0 0	341 16 0	0 11 3	1061 0 0	3 2 1
351, 724	Bendigo and Coolgardie Proprietary G.M. Co. Do.	1897 1898	263 0 0 730 0 0	296 7 0 921 15 9	1 2 12 1 5 1	1148 7 1½	3 17 6
		Total	993 0 0	1218 2 9	1 4 13		
295s	Belavon	1897	48 0 0	51 4 0	1 1 8		
35	Big Blow (Coolgardie) Do. Do.	Previous to 1897 1897 1898	154 0 0 265 0 0 2410 0 0	71 0 0 124 0 0 663 0 0	0 9 4 0 9 8 0 5 12	188 3 2 328 12 0 1751 19 0	2 13 0 2 13 0 2 13 0
		Total	2829 0 0	858 0 0	0 6 1	2268 14 2	
439s	Big Blow (Kunanalling)	1898	85 15 0	72 9 4	0 16 19	282 11 8½	3 18 0
162s 71s	Blackett's Gold Mines Do.	1897 1898	394 12 0 478 13 0	318 5 13 255 19 0	0 19 0 0 10 15	1113 19 4½ 991 16 1½	3 10 0 3 17 6
		Total	813 5 0	574 4 13	0 14 2	2105 15 6½	3 13 3½
3631 3542 2146 3066 35s 11s 3618 444s 193, 1624	Blue Peter Bobbie Dazzler Bonnie Vale Breakespeare Brevier Brevier No. 2 Brilliant British Lion Briton's United	1898 1897 1898 1897 1897 1898 1898 1898 Previous to 1897	118 0 0 Specimens 363 12 0 16 0 0 70 0 0 34 10 0 102 0 0 34 0 0 36 0 0	77 10 0 54 6 12 186 16 0 34 8 0 83 0 0 17 5 22 101 0 0 57 18 0 27 0 0	0 13 3 0 10 5½ 2 3 0 0 9 10 0 9 20 0 19 19 0 15 0	301 15 3½ 671 3 0½ 132 0 0 67 5 3½ 379 9 1 ...	3 17 10½ 3 11 10 4 0 0 3 17 10½ 3 15 1½ 3 15 4½

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
			tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
458s	Broncho	1898	40 0 0	17 13 4	0 8 19		
119s, 181s	Bunyip	Previous to 1897	100 0 0	213 5 0	2 2 5		
2210	Burbank's Consols	1898	18 0 0	14 19 0	0 16 14		
1799	Burbank's Grand Junction	Previous to 1897	362 0 0	1385 0 0	3 15 18	5286 1 8	3 16 4
	Do.	1897	100 0 0	258 0 0	2 11 14	978 5 0	3 15 10
	Do.	1898	415 0 0	567 5 0	1 7 7	2239 5 6	3 18 0
	Total		877 0 0	2210 5 0	2 10 10		
3632	Burbank's Horseshoe	1898	11 0 0	67 14 22	6 3 4	195 11 10	3 15 1
3627	Burbank's Ivanhoe	1898	88 0 0	52 2 0	0 12 6		
3444	Burbank's Main Lode	1898	90 0 0	88 1 0	0 19 13½	330 3 9	3 15 0
3200	Burbank's Star	1897	87 0 0	85 12 0	0 19 16		
134, 135	Burbank's Birthday Gift	Previous to 1897	1822 0 0	7136 10 0	3 18 8	26761 17 6	3 15 0
	Do.	1897	6190 0 0	13453 8 18	2 3 10	50450 7 9½	3 15 0
	Do.	1898	11414 0 0	16970 3 5	1 9 18	63698 2 0½	3 15 0
	Total		19426 0 0	37560 1 23	1 18 17		
152s	Camperdown	Previous to 1897	0 1 0	100 0 0			
1950, 1630	Cardiff Castle	Previous to 1897	1350 0 0	254 12 22	0 3 18		
86s	Caroline	1897	6 0 0	39 16 0	6 12 16	161 3 9	4 1 0
123s	Castle Hill	1898	101 0 0	143 12 0	1 8 11	572 17 0	3 19 8
404s	Castle View East	1898	152 10 0	73 16 6	0 10 6	278 12 10½	3 15 6
161s	Catherine	1898	4 0 0	8 11 4	2 2 19	33 9 8	3 18 3
113s	Central Wealth Consolidated	1898	229 0 0	313 15 8	1 7 9		
1852, 2168	Charing Cross	Previous to 1897	10 0 0	15 10 0	1 11 0		

3460	Cheapside	1897 1898	59 10 0 264 0 0	69 10 4 240 19 0	1 3 4 0 18 6		
		Total	323 10 0	310 9 4	0 19 5		
64s	City of London	1897 1898	406 0 0 313 0 0	486 17 0 186 0 11	1 3 23 0 11 20	1451 8 5	2 19 7½
		Total	719 0 0	672 17 11	0 18 17		
84	Clyde	Previous to 1897 1898	102 0 0 740 0 0	91 0 0 231 3 0	0 17 20 0 6 5½	901 4 1	3 17 11½
		Total	842 0 0	322 3 0	0 7 15		
3602	Condenser King	1898	209 10 0	184 11 21	0 17 13	718 15 2½	3 17 10½
3524	Coonong	1898	39 0 0	10 14 0	0 5 11½	40 2 6	3 15 0
432s	Corneuba	1898	12 0 0	6 0 0	0 10 0	25 5 0	3 17 6
122	Cosgrove Bayley's Reward	Previous to 1897 1897 1898	150 0 0 112 0 0 944 0 0	37 0 0 142 5 0 732 19 0	0 4 22 1 5 9 0 15 12	144 1 4½ 553 17 8½ 2867 11 11	3 17 10½ 3 17 10½ 3 18 3
		Total	1206 0 0	912 4 0	0 15 3	3565 11 0	3 18 2¼
445s.	Daisy Bell	1898	20 10 0	28 14 0	1 7 9	111 4 3	3 17 6
115s.	Dark Horse	1898	4 4 0	277 1 19	65 19 1		
428s.	Daybreak	1897 1898	28 0 0 25 9 0	42 10 0 50 7 0	1 10 8 1 19 13		
		Total	53 9 0	92 17 0	1 14 10		
1854	De Beers	1897	3 0 0	4 10 0	1 3 8		
3621	De Beer's West	1898	10 0 0	3 1 0	0 6 2	12 4 0	4 0 4

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
225s., 241s.	Denver City Do.	1897	tons cwt. qrs. 32 0 0	ozs. dwts. grs. 121 7 0	ozs. dwts. grs. 3 15 15	£ s. d.	£ s. d.
		1898	74 3 0	279 2 12	3 15 10		
		Total ...	106 3 0	400 9 12	3 15 13		
1555	Dunallan No. 1... ..	1897	17 15 0	5 8 0	0 6 2		
15s.	Eclipse	1898	50 0 0	34 12 13	0 13 20	134 16 6½	3 17 10½
3251	Eldorado	Previous to 1897	76 0 0	18 9 3	0 4 20		
2926	Elvira	1898	74 0 0	15 0 0	0 4 1	45 0 0	3 0 0
1982s.	Emu	1898	102 0 0	146 16 9	1 8 19	587 5 6	4 0 0
1596	Emperor	1898	5 0 0	1 3 0	0 4 14½	4 12 0	4 0 0
1865	Empress of Coolgardie Do.	1897	472 0 0	101 19 0	0 4 7	382 6 3	3 15 0
		1898	911 0 0	415 19 7	0 9 3	1549 4 1½	3 14 5½
		Total ...	1383 0 0	517 18 7	0 7 11½	1931 10 4½	3 14 6½
3453	Enterprise Do.	1897	1120 6 0	691 1 18	0 12 8	2637 13 0	3 16 4
		1898	306 0 0	153 6 12	0 10 0½	598 6 4½	3 18 0½
		Total ...	1426 6 0	844 8 6	0 11 20	3235 19 4½	3 16 7
1604, 1605	Ethel Flagstaff Gold Mining Company ... Do.	Previous to 1897	90 0 0	46 0 0	0 10 5	166 15 0	3 12 6
		1897	2065 0 0	1526 0 0	1 8 15	5531 5 0	3 12 6
		Total ...	2155 0 0	1572 0 0	0 14 14	5698 0 0	3 12 6

34s	Fair Adelaide Do.	Previous to 1897 1897	10 0 0 8 0 0	16 0 0 7 9 0	1 12 0 0 18 15		
		Total	18 0 0	23 9 0	1 6 1		
260s	Fitzroy	1896	58 0 0	17 11 21	0 6 1	30 13 1½	3 15 0
284	Forrest King Do. Do.	Previous to 1897 1897 1896	697 0 0 665 10 0	472 0 0 466 1 9	0 13 13 0 13 23	1807 3 4½	3 17 7
		Total	1362 10 0	938 1 9	0 13 18		
53s	Fremantle Consols Do.	1897 1896	40 0 0 94 1 0	243 10 0 144 0 0	6 1 18 1 10 15	576 13 10½	4 0 0½
		Total	134 1 0	387 10 0	2 7 20		
3617	Garfield	1896	40 0 0	65 6 0	1 12 15½	253 2 6	3 17 5¾
595	Gem Do.	1897 1896	360 10 0 3179 0 0	336 10 0 1765 12 8	0 18 15 0 11 2	1278 14 0 6400 10 9¾	3 16 0 3 12 6
		Total	3539 10 0	2102 2 8	0 11 21	7679 4 9¾	3 13 0¾
3630 261s 12s	Gem of the Vale General Lee Gladstone Extended	1896 1897 1897	24 2 0 20 0 0 90 0 0	9 7 9 11 7 0 23 0 0	0 7 18 0 11 8 0 5 18	320 0 0	4 0 0
717, 1149	Gleeson's Success Do.	1897 1896	143 0 0 295 0 0	177 3 0 374 11 0	1 4 18 1 5 9	1433 7 0	3 16 6
		Total	438 0 0	551 14 0	1 5 4½		

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
1918	Glenloth South Do.	1897 1898	tons cwt. qrs. 329 0 0	ozs. dwts. grs. 468 4 0	ozs. dwts. grs. 1 8 11	£ s. d. 182 2 6	£ s. d. 3 17 6
			43 0 0	47 0 0	1 1 20½		
		Total ...	372 0 0	515 4 0	1 7 16		
424s	Glenmore	1898	98 10 0	169 17 0	1 14 7	655 11 8½	3 17 1½
20	Golden Bar Do. Do.	Previous to 1897 1897 1898	110 0 0	79 12 0	0 11 12	278 12 0	3 10 0
			1945 0 0	1132 5 0	0 11 15	3962 17 6	3 10 0
			3453 0 0	1754 8 8	0 10 20	6155 1 6½	3 10 2
	Total ...	Total ...	5408 0 0	2966 5 8	0 10 23	10396 11 0	3 10 1½
49s	Golden Crest Do.	Previous to 1897 1898	10 0 0	5 0 0	0 10 0		
			405 0 0	89 3 18	0 4 9		
		Total ...	415 0 0	94 3 18	0 4 2		
1405	Golden Drop Do.	1897 1898	283 10 0	269 4 0	0 18 22	1022 19 2½	3 16 0
			899 0 0	540 16 5	0 12 0	1960 8 8½	3 12 6
		Total ...	1182 10 0	810 0 5	0 13 16	2983 7 11	3 13 8
1777	Golden Gate	Previous to 1897	50 0 0	130 0 0	2 12 0		
3509	Golden Jubilee	1898	40 0 0				
98s	Golden Plum	Previous to 1897	85 0 0	2 0 0	0 0 11		

1559, 3541	Golden Queen Do.	1897 1898	5 5 0	16 10 0	3 2 20	66 0 0	4 0 0
			288 0 0	146 19 21	0 9 20	561 14 2½	3 16 5
		Total ...	293 5 0	163 9 21	0 11 2	627 14 2½	3 16 8
1641, 1835 256s 400	Golden Dyke (Tindal's Extended) Goulburn (Extended) Great Coolgardie	1897 1898 Previous to 1897	18 0 0	2 5 0	0 2 12		
			47 6 0	27 11 5	0 11 10		
			10 0 0	12 0 0	1 4 0		
93s	Great Dyke and Orizaba Cement Claims Do.	1897 1898	3532 0 0	1110 6 0	0 6 6	4302 8 3	3 17 6
			5 0 0	15 0 0	3 0 0	60 0 0	4 0 0
		Total ...	3537 0 0	1125 6 0	0 6 8		
3319	Great Hanover Do.	1897 1898	75 0 0	66 0 0	0 17 14		
			110 0 0	44 1 0	0 8 0	170 13 10½	3 17 6
		Total ...	185 0 0	110 1 0	0 11 21		
442s	Great Junction	1898	114 0 0	134 19 0	1 3 16	519 10 9¼	3 16 11
132s	Great Scott Do.	1897 1898	67 0 0	314 14 9	4 13 22	1231 6 8½	3 18 4
			44 0 0	103 18 8	2 7 5	408 0 1	3 18 6
		Total ...	111 0 0	418 12 17	3 15 10	1609 6 9¾	3 18 4½
3647 3473 89s	Great Western Gympie Jim Hands Across the Sea United	1898 1897 1897	24 0 0	16 19 0	0 14 3	66 10 6¼	3 18 6
			87 12 0	99 15 22	0 19 8	361 15 2¼	3 12 6
			30 0 0	33 0 0	1 2 0		
61s, 62s	Hands Across the Sea G.M. Co. Do. Do.	Previous to 1897 1897 1898	45 0 0	34 0 0	0 15 2		
			290 0 0	203 0 0	0 14 0		
			990 0 0	765 1 3			
		Total ...	1315 0 0	1002 1 3	0 15 5		

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
			tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
4835	Harp of Erin	1898	16 0 0	7 8 10	0 9 6		
1204	Herbert	1897	399 0 0	390 7 0	0 19 13	892 10 10½	3 10 0
	Do.	1898	245 0 0	255 0 6	1 0 19		
	Total		644 0 0	645 7 6	1 0 1		
3346	Herbert North	1897	9 0 0	16 1 12	1 15 17	312 11 8½	3 15 0
	Do.	1898	79 0 0	83 7 3	1 1 2		
	Total		88 0 0	99 8 15	1 2 14		
3629	Herbert South	1898	31 0 0	23 5 11	0 15 0	81 9 1¼	3 10 0
100s	Hilton	1897	2362 0 0	6836 0 0	2 17 21		
	Do.	1898	360 11 1	68 15 9	0 3 19		
	Total		2722 11 1	6904 15 9	2 10 16		
3607	Home Rule	1898	69 0 0	69 11 10	1 0 4	73 11 0 774 16 4½ 526 3 11½	3 17 10½ 3 16 0 3 16 11
3586	Hotspur South	1898	9 0 0	16 0 0	1 15 13½		
3456	Ida May	1898	10 0 0	18 18 0	1 17 19		
62s	Isa Muriel	1898	287 0 0	203 18 0	0 14 5		
447s	John Bull	1898	10 0 0	136 16 18	13 13 16		
462s	John Bull East	1898	45 0 0	95 14 0	2 2 12		

1401	Just in Time Do.	1897 1898 Total ...	53 0 0 182 0 0 235 0 0	37 5 0 64 10 0 101 15 0	0 14 1 0 7 2 0 8 15	241 8 9½	3 14 8
3280	Keep it Dark	1897	18 0 0	65 0 6	3 12 5		
405s	Kieora Do.	1897 1898 Total ...	20 0 0 8 10 0 28 10 0	134 7 0 31 8 0 165 15 0	6 14 8 3 13 0 5 15 0	507 3 5 122 5 3½ 629 8 8½	3 15 6 3 17 10½ 3 16 1
3530	King's Cross Do.	1897 1898 Total ...	52 0 0 33 0 0 85 0 0	50 16 0 39 16 4 90 12 4	0 19 13 1 4 4 1 1 8		
3536	King's Lynn Do.	1897 1898 Total ...	10 0 0 35 0 0 45 0 0	14 17 0 32 19 0 47 16 0	1 9 16 0 18 9 1 1 5	119 8 10½	3 12 6
376, 18, 82, 8A, 3598	King Solomon Do.	1897 1898 Total ...	593 0 0 407 0 0 1000 0 0	1130 0 4 454 4 6 1584 4 10	1 18 2 1 3 3½ 1 11 16	4181 0 7½ 1739 15 6½ 5920 16 1½	3 14 0 3 16 6 3 14 8
269s.	Kinross	1898	24 0 0	24 9 0	1 0 9	85 11 6	3 10 0
359s.	Kintore North Do.	1897 1898 Total ...	67 10 0 18 0 0 85 10 0	367 19 13 48 4 12 416 4 1	5 9 0 2 13 14 4 17 7	1439 14 2½ 189 1 6½ 1628 15 8½	3 18 4 3 18 8 3 18 4½

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
			tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
1010, 1528, } 2321	Ladas and Poston	Previous to 1897	6 0 0	2 8 0	0 8 0		
420s	Lady Alice	1897	28 0 0	23 10 0	0 16 18		
3552	Lady Bell	1898	50 17 0	21 12 0	0 8 6	81 0 0	3 15 0
532	Lady Emily	Previous to 1897	20 0 0	15 0 0	0 15 0		
414s.	Lady Elizabeth	1898	9 15 0	9 5 0	0 18 23	35 19 11½	3 17 10
3s.	Lady Evelyn	Previous to 1897	10 0 0	50 0 0	5 5 0		
	Do.	1898	618 18 0	693 4 20	1 2 9		
	Total		628 18 0	743 4 20	1 3 15		
2499	Lady Forrest Extended	1897	3 0 0	3 0 0	1 0 0		
1646	Lady Jeannie	1898	130 0 0	64 5 0	0 9 20½	248 19 4½	3 17 6
2010	Lady Forrest South	1897	195 0 0	585 0 0	3 0 0		
336, 284, } 1583, 745, } 2094, 2105, } 2073	Lady Loch	Previous to 1897	1697 0 0	5260 0 0	3 1 23		
1768	Lady Mary	1897	50 0 0	15 6 0	0 6 2		
	Do.	1898	30 14 0	19 7 0	0 12 21	74 9 11½	3 17 0
	Total		80 14 0	34 13 0	0 8 10		
2281	Lady Maud	Previous to 1897	14 0 0	11 15 0	0 16 18		

2160	Lady Robinson... ..	1897	94 0 0	55 3 0	0 11 17	206 16 3	3 15 0
	Do.	1898	86 8 0	49 14 4	0 11 8	193 11 0 $\frac{1}{2}$	3 17 10 $\frac{1}{2}$
		Total	180 8 0	104 17 4	0 11 12	400 7 3 $\frac{1}{2}$	3 16 4
756	La Mascotte	1897	50 0 0	21 11 0	0 8 14		
1840	Lefroy Gold Mines	Previous to 1897	100 0 0	10 0 0	0 2 0		
577	Lefroy Imperial	Previous to 1897	13 0 0	29 17 0	2 5 22		
478	Lily	1898	259 15 0	197 3 12	0 14 17	764 0 2 $\frac{1}{2}$	3 17 6
3556	Limerick	Previous to 1897	100 0 0	28 0 0	0 5 14		
4468	Life Boat	1898	33 0 0	13 2 0	0 7 22		
808, 2232	Lindsay's Gold Mines	1897	2842 0 0	1668 6 17	0 11 17	6674 6 10	4 0 0
	Do.	1898	1328 0 0	930 16 7	0 14 0	3721 1 4 $\frac{1}{2}$	3 19 10 $\frac{1}{2}$
		Total	4170 0 0	2599 3 0	0 12 11	10395 8 2 $\frac{1}{2}$	3 19 11 $\frac{1}{2}$
3297	Lindsay Gordon	1897	61 0 0	58 18 3	0 19 7		
	Do.	1898	63 0 0	26 18 0	0 8 12		
		Total	124 0 0	85 16 3	0 13 20		
2596, 2392	Little Blow and Golden Ridge Extended	1897	9 0 0	9 0 0	1 0 0		
1721	Lombard	Previous to 1897	25 0 0	28 17 0	1 3 1		
575	Londonderry	Previous to 1897	712 0 0	2379 0 0	3 6 10	8326 10 0	3 10 0
	Do.	1897	782 0 0	1204 13 0	1 11 14	42140 0 0	3 10 0
	Do.	1898	3563 0 0	4094 13 0	1 2 23	14962 1 4	3 12 11
		Total	5057 0 0	7678 6 0	1 10 8	65428 11 4	3 10 8 $\frac{1}{2}$
1076	Londonderry South Block	Previous to 1897	20 0 0	40 0 0	2 0 0		

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
3531	Mammoth	1898	tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
471s	Matrix	1898	20 0 0	13 8 0	0 13 9½	46 18 0	3 10 0
22	McCulloch's	Previous to 1897	62 0 0	112 2 20	1 16 4		
1918	McKenzie's	Previous to 1897	70 0 0	10 0 0	0 2 10		
			329 0 0	468 4 0	1 8 10		
664, 1739	McPherson's Reward Do.	1897	696 16 0	864 18 4	1 4 19	3304 12 7½	3 16 5
		1898	926 19 0	494 8 0	0 10 8	1872 8 0½	3 15 11
		Total	1623 15 0	1359 6 4	0 16 10	5177 0 7½	3 16 2
106s	Mexico Do.	1897	731 0 0	1542 0 0	2 2 4	4626 0 0	3 0 0
		1898	729 10 0	1753 0 0	2 8 2		
		Total	1460 10 0	3295 0 0	2 5 3		
151s	Mexico Extended	1898	66 0 0	37 18 0	0 11 12	128 17 2½	3 8 0
188a	Moon's Coolgardie	1898	92 0 0	32 13 3	0 7 2		
1902	Morning Star	1897	327 0 0	575 12 0	1 15 4	94 19 4½	3 15 0
2597	Mountain (Annatta)	1898	141 0 0	25 6 12	0 3 14		
2413	Mount Burgess Do. Do.	Previous to 1897	5293 0 0	5143 11 13	0 19 10½	20574 6 2	4 0 0
		1897	638 0 0	640 12 0	1 0 1½	2562 8 0	4 0 0
		1898	560 0 0	371 18 18	0 13 4	1473 14 3½	3 19 3
		Total	6491 0 0	6156 2 7	0 18 23	24610 8 5½	3 19 11½
1019	Mount Rowe Consolidated	Previous to 1897	16 0 0	13 0 0	0 16 6		
248s	Multum in Parvo	1897	55 0 0	68 16 0	1 5 0		

459s 1383	Mystery Nepean	...	...	...	...	...	...	...	1898 1898	33 0 0 26 0 0	38 10 23 10 0 0	1 3 8 0 7 8	149 17 2½ 40 0 0	3 17 10½ 4 0 0
1098, 2292	New Australasian Do. Do.	...	...	...	...	...	...	...	Previous to 1897 1897 1898 Total ...	20 0 0 2791 0 0 195 0 0 3006 0 0	82 0 0 7157 0 0 1427 6 12 8666 6 12	4 2 0 2 11 6 7 6 9 2 17 15	317 15 0 25776 0 0	3 17 6 3 10 0½
1405, 595	New Victoria Consols	...	...	...	...	...	...	...	Previous to 1897	105 0 0	59 0 0	0 11 6		
2638	New Victoria South Do. Do.	...	...	...	...	...	...	...	Previous to 1897 1897 1898 Total ...	90 0 0 1222 0 0 987 0 0 2299 0 0	150 4 0 1118 6 18 788 11 14 2057 2 8	1 13 9 1 13 9 0 18 7 0 16 8	574 10 3¼ 4277 12 9½	3 16 6 3 16 6
3484 1741, 1867	New Zealander No. 1 Worth Three Jolly Britons	...	...	...	...	...	...	...	1897 1897	10 0 0 20 0 0	2 13 0 9 7 0	0 5 7 0 9 8		
448s (2870)	Nil Desperandum	...	...	...	...	...	...	...	1898	10 0 0	5 0 0	0 10 0		
73s	Nordenfeldt Do.	...	...	...	...	...	...	...	1897 1898 Total ...	231 10 0 408 0 0 639 10 0	374 15 0 411 18 15 786 13 15	1 12 7 1 0 4 1 4 15		
1610 2413	North Burgess Gold Mine Do. Do.	...	...	...	...	...	...	...	Previous to 1897 1897 1898 Total ...	101 0 0 102 0 0 783 0 0 986 0 0	75 0 0 703 12 0 1984 13 0 2763 5 0	0 14 2 6 7 23 2 10 6 2 16 1		

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
3252 105s	Old Chum Extended	Previous to 1897	tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
	Ophelia	1897	6 0 0	8 0 0	1 6 16	3207 12 0	4 0 0
	Do.	1898	1740 0 0	801 18 0	0 9 5		
			334 3 3	246 2 11	0 14 17		
	Total		2074 3 3	1048 0 11	0 10 2		
317s	Ora Bunda	1897	120 0 0	165 15 19	1 7 15		
	Do.	1898	81 10 0	69 0 0	0 17 0		
	Total		201 10 0	234 15 19	1 3 8		
3481	Orchin	1898	478 0 0	129 0 0	0 5 9	503 2 0	3 18 0
77s	Ormuz	Previous to 1897	35 10 0	8 10 0	0 4 18		
	Do.	1898	2682 5 0	2353 12 0	0 17 13		
	Total		2717 15 0	2362 2 0	0 17 10		
99s	Orizaba	1898	Specimens	31 3 15		258 18 7½	3 17 6
337s	Pagoda	1897	25 0 0	5 0 0	0 4 0		
189s	Pantomime	1898	121 0 0	128 17 0	1 1 7		
427s	Palmer	1898	93 10 0	66 13 0	0 14 3		
243s	Pearce's Find	Previous to 1898	10 0 0	60 0 0	6 0 0		
2s	Berry's Gold Reef	1897	120 10 0	223 10 0	1 18 2	39 3 9	3 15 0
2434	Perseverance Extended	1897	55 0 0	6 0 0	0 2 4		
1903	Phoenix	1897	53 0 0	26 10 0	0 10 0		
3613	Pilgrim	1898	10 0 0	10 9 0	1 0 22		
113s	Platypus	1898	201 0 0	240 6 4	1 3 21	903 1 6	3 15 1

79s	Premier	Previous to 1897	3141 0 0	6906 15 12	2 0 19	24131 1 3 $\frac{1}{2}$	3 16 6
	Do.	1897	4358 0 0	4901 3 6	1 2 11	18746 8 10 $\frac{1}{2}$	3 16 6
	Do.	1898	9085 0 0	5863 7 19	0 12 21	22405 17 4 $\frac{1}{2}$	3 16 11
	Total		16584 0 0	17073 6 13	1 0 14	65283 7 6 $\frac{1}{2}$	8 16 7 $\frac{1}{2}$
74s	Premier South	1897	69 0 0	126 2 0	1 16 13		
	Do.	1898	813 0 0	268 19 6	0 6 14		
	Total		882 0 0	395 1 6	0 8 23		
369s	Pride of the Jaurdies	1897	44 0 0	100 0 0	2 5 10	387 10 0	3 17 6
3417	Princess Midas	1898	19 0 0	14 19 0	0 15 17		
3573	Queenslander	1898	141 6 3	696 14 5	4 18 0		
3809	Queensland Coolgardie (Richmond)	1898	218 10 1	270 3 8	1 4 17		
1019							
3623		1898	25 0 0	5 4 20	0 4 4	19 0 0	3 12 6
1728		1898	2 0 0	0 17 0	0 8 12		
	Queen of Sheba	1898	12 0 0	38 4 0	3 3 16	144 10 5 $\frac{1}{2}$	3 15 8
	Quartz Claim	1897	4 12 0	6 9 0	1 8 1		
2077	Ramage Syndicate	Previous to 1897	2 0 0	3 0 0	1 10 0		
1728	Red Jacket	1898	0 4 0	15 0 0	75 0 0	54 7 6	3 12 6
3648	Rising Sun (Coolgardie)	1898	13 0 0	13 0 8	1 0 0 $\frac{1}{2}$	47 3 8 $\frac{1}{2}$	3 12 6
441s	Rising Sun (Kunanalling)						
45s	Royal Sovereign	Previous to 1897	2 0 0	30 0 0	15 0 0		
	Do.	1897	90 0 0	196 7 12	2 3 15	787 18 6 $\frac{1}{2}$	4 0 1
	Do.	1898					
	Total		92 0 0	226 7 12	2 9 5		
226	Rose Hill United	1898	364 0 0	185 1 20	0 10 4	694 1 10 $\frac{1}{2}$	3 15 0
1839	Royal Tar	1897	50 0 0	2 11 15	0 1 0	9 7 1 $\frac{1}{2}$	3 12 6
	Do.	1898	72 5 0	36 13 3	0 9 10 $\frac{1}{2}$	132 17 6 $\frac{1}{2}$	3 12 6
	Total		122 5 0	39 4 18	0 6 9	142 4 8 $\frac{1}{2}$	3 12 6

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

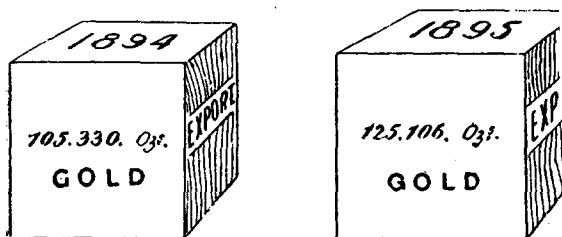
Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
			tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
1383	Sam's Wealth of Nations	1897	47 0 0	10 0 0	0 4 16	182 2 6	3 17 6
	Do.	1898	26 0 0	10 0 0	0 7 16		
	Total		73 0 0	20 0 0	0 5 11		
3426	St. Mildred	1898	386 0 3	1201 14 8	3 2 6	4263 8 0½	3 10 10
3578	Saint George	1898	61 0 0	89 10 0	1 9 8		
3416, 3415, 3510	Sherlaw's Perseverance	Previous to 1897	216 0 0	444 0 0	2 1 2	1515 3 0	3 8 3
		1897	1895 0 0	718 10 12	0 7 13	2451 4 3½	3 8 3
		1898	2641 0 0	1853 9 0	0 14 0	6314 13 6½	3 8 1
		Total	4752 0 0	3015 19 12	0 12 16	10281 0 10½	3 8 2
3562	Smith's Find	1898	21 0 0	80 8 0	3 16 3½	301 4 3½	3 17 1½
376a	Stanley	1897	23 0 0	11 0 0	0 9 13		
73	Star of the South	1897	150 0 0	270 0 0	1 1 14	36 17 4½	3 17 6
2725	Steadman's Choice	1898	19 19 0	9 10 7	0 9 13		
409s	Sugar Loaf	1897	146 0 0	746 12 0	5 10 22		
	Do.	1898	107 10 0	286 15 0	2 13 5		
	Total		253 10 0	1033 7 0	4 1 12		
3520	Telluride King	1898	25 0 0	30 17 20	1 4 17		
1835	Tindal's Central	1898	156 0 0	65 13 10	0 8 10		

33	Tindal's Coolgardie Do.	1897 1898	550 0 0 4044 0 0	246 19 0 1065 0 14	0 8 23 0 5 64	3940 0 84	3 10 11
		Total	4594 0 0	1311 19 14	0 5 17		
3561	Tindal's Consols Do.	1897 1898	19 16 0 172 0 0	11 8 0 42 17 10	0 11 12 0 4 23	42 9 34 156 1 24	3 14 6 3 12 6
		Total	191 16 0	54 5 10	0 5 15	198 10 54	3 12 114
94s.	Trident	Previous to 1897	100 0 0	32 0 0	0 6 9		
1385	Union Jack Do.	1897 1898	300 0 0 177 10 0	340 15 0 181 14 18	1 2 17 1 0 9	1235 4 44 681 3 104	3 12 6 3 14 11
		Total	477 10 0	522 9 18	1 1 21	1916 8 24	3 13 4
130, 215, 436, 1145	United Gold Beefs Do.	Previous to 1897 1897	29 0 0 4 0 0	10 0 0 7 0 0	0 6 21 1 15 0		
		Total	33 0 0	17 0 0	0 10 7		
3587	United Brothers	1898	56 0 0	32 1 0	0 11 10		
1552	Vale of Coolgardie Do. Do.	Previous to 1897 1897 1898	166 0 0 2476 0 0 2165 0 0	127 0 0 3379 3 22 1527 14 6	0 15 7 1 7 7 0 14 2	492 2 6 13094 7 74 5919 17 24	3 17 6 3 17 6 3 17 6
		Total	4807 0 0	5033 18 2	1 0 22	19506 7 44	3 17 6
3616	Valentine	1898	17 10 0	18 10 0	1 0 15		
225s	Victor Do.	1897 1898	24 0 0 74 3 0	9 7 0 279 2 12	0 7 19 3 15 6	36 4 74 1122 10 74	3 17 6 4 0 4
		Total	98 3 0	288 9 12	2 18 20	1158 15 24	4 0 3

Return showing the Yield of the Leases on the Coolgardie Goldfield—continued.

Number of Lease.	Name of Lease.	Date.	Quantity of Stone Crushed.	Yield of Gold.		Value of Gold.	
				Total Yield.	Rate per ton.	Total Value.	Rate per oz.
			tons cwt. qrs.	ozs. dwts. grs.	ozs. dwts. grs.	£ s. d.	£ s. d.
3663	Victoria Cross	1898	11 1 0	2 6 0	0 4 4½	8 6 9	3 12 6
16s	Vincent	1897	74 10 0	44 15 0	0 12 0		
124s	Waverley	1897	20 0 0	30 7 0	1 10 8		
	Do.	1898	195 16 0	375 19 12	1 18 7	1499 5 1½	3 19 8½
	Total		215 16 0	406 6 12	1 17 7		
1151	Westralia Extended	1898	10405 9 0	4312 8 19	0 8 6	15840 10 11½	3 13 5
144	Westralia	1898	6013 14 0	2937 17 2	0 9 18	10771 5 10	3 13 3½
1639	Westralia East Extension	Previous to 1897	232 0 0	106 0 0	0 8 3	393 1 8	3 14 2
144, 1151	Do.	1897	7555 2 0	8183 15 6	1 0 5	30348 2 4½	3 14 2
2146	Do.	1898	16697 11 0	16317 1 21	0 12 8	38302 4 2½	3 14 2
	Total		24484 13 0	18606 17 3	0 15 4	69043 8 2½	3 14 2
308s	Westralia Premier	1897	Specimens	17 6 12			
17s	Wealth of Nations	1898	7715 0 0	4545 18 6	0 11 15	17194 6 8½	3 15 7
378s	Zealandia	1897	25 0 0	5 0 0	0 4 0		
368s	Zulieka	1898	318 0 0	408 5 0	1 5 16		
362s	Zulieka North	1897	26 0 0	38 14 0	1 9 18		
	GRAND TOTAL		206211 13 1	242235 14 16	1 3 11		

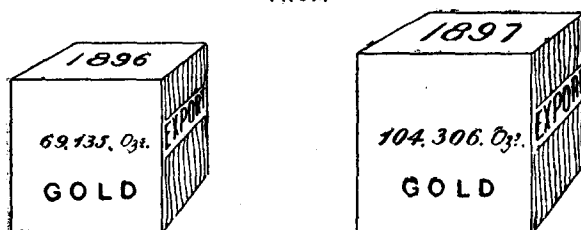
TORRINGTON BLATCHFORD,
Assistant Geologist.



DIAGRAM

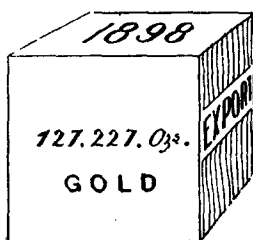
SHewing YEARLY EXPORT OF GOLD

FROM



THE COOLGARDIE GOLD FIELD

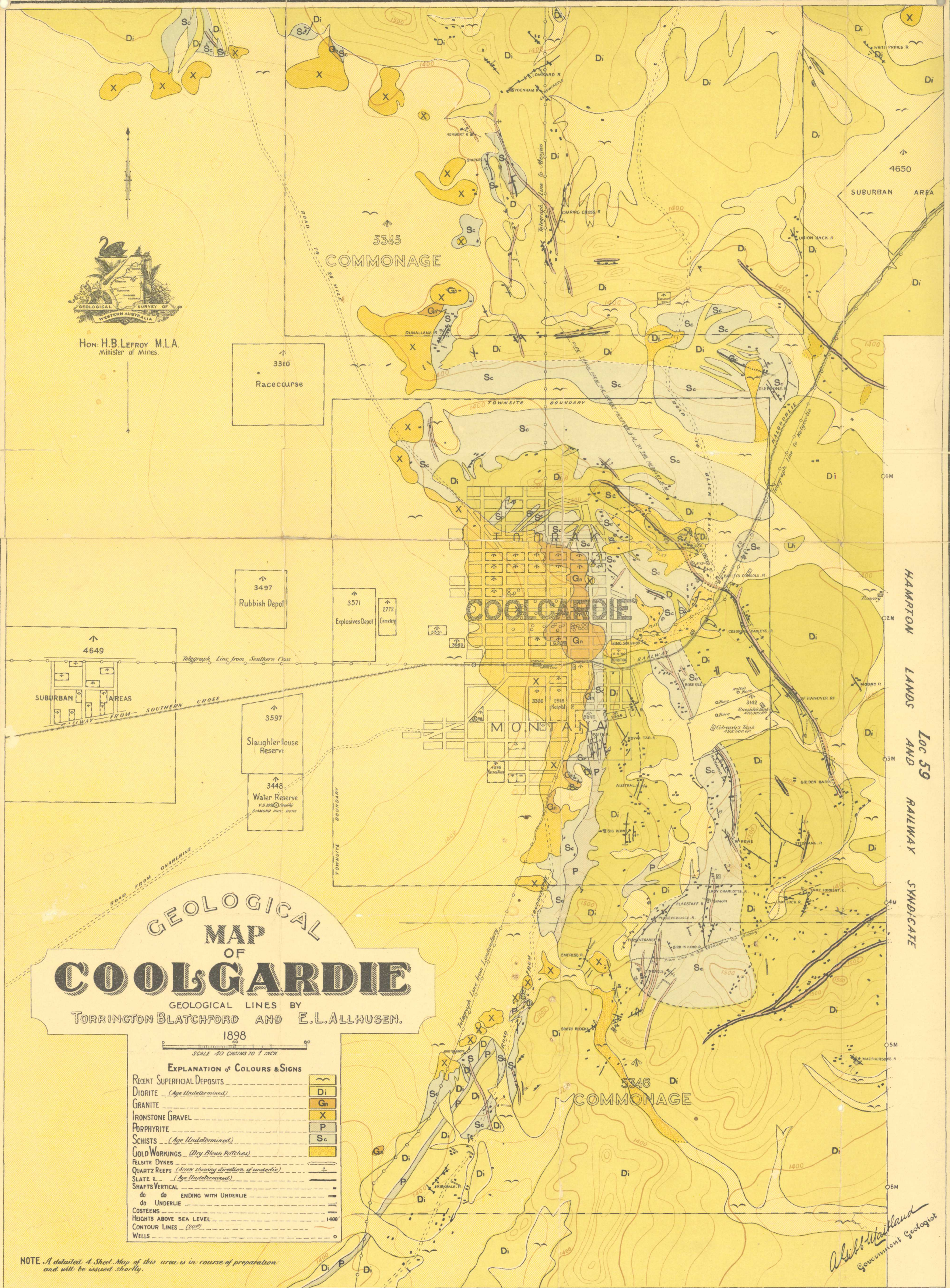
SINCE 1894.



200 tons net
1898.



HON. H.B. LEFROY M.L.A.
Minister of Mines.



GEOLOGICAL MAP OF **COOLGARDIE**

GEOLOGICAL LINES BY
TORRINGTON BLATCHFORD AND E.L. ALLHUSEN.

1898

SCALE 40 CHAINS TO 1 INCH.

EXPLANATION OF COLOURS & SIGNS

RECENT SUPERFICIAL DEPOSITS	
DIORITE (Age Undetermined)	Di
GRANITE	Gn
IRONSTONE GRAVEL	X
PORPHYRITE	P
SCHISTS (Age Undetermined)	Sc
GOLD WORKINGS (Dry Blown Patches)	
FELSITE DYKES	
QUARTZ REEFS (Arrow showing direction of underlie)	
SLATE (Age Undetermined)	
SHAFTS VERTICAL	
do do ENDING WITH UNDERLIE	
do do UNDERLIE	
COSTEENS	
HEIGHTS ABOVE SEA LEVEL	1400
CONTOUR LINES (200)	
WELLS	

NOTE A detailed A Sheet Map of this area is in course of preparation and will be issued shortly.

Alfred H. Wallland
Government Geologist