

1896.
—
WESTERN AUSTRALIA.

R E P O R T

OF THE

DEPARTMENT OF MINES

FOR THE YEAR

1895,

WITH SUPPLEMENTARY NOTES ON PART OF 1896.

Presented to both Houses of Parliament by His Excellency's Command.

PERTH:

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I N D E X .

	Page
General Report	3
Irwin Coalfield, by H. P. Woodward, Government Geologist...	19
Yalgoo Goldfield, by H. P. Woodward, Government Geologist	21
Ore Deposits of Coolgardie and Kalgoorlie, by S. Göczel, Field Geologist	23
Cement Deposits at 25-Mile near Coolgardie, by S. Göczel, Field Geologist	26
Diamondiferous Country, Nullagine, by F. F. Groome	27
Pilbarra Goldfield, by S. J. Becher, Acting Inspector of Mines	28
Tin Deposits near Blackwood River, by R. Wachsmuth	32
Bromo-Cyanide Process for Tailings, by H. L. Sulman	33
Central Goldfields, by F. Reed, Inspector of Mines ...	37
Development and Geological Features, Yalgoo Goldfield, by F. Reed, Inspector of Mines	41
Development and Geological Features, Nannine District, by F. Reed, Inspector of Mines	42
Workings of Mines on Dundas Goldfield, by W. H. Angove, Temporary Inspector of Mines	47-48
Auriferous Deposits, Dandalup, by T. Fowler, Inspector of Mines, Eastern Goldfields ...	59
Kimberley Goldfield, by Warden	62
Bonus for Deep Sinking, Kimberley	64
East Murchison Goldfield, by Warden	64
Yalgoo Goldfield, by Warden	66
Yilgarn Goldfield, by Warden	69
Coolgardie Goldfield, by Warden	70
North Coolgardie Goldfield, by Warden	71
Townships, North-East Coolgardie Goldfield, by Warden	74
Greenbushes Tinfields, by Mining Registrar	75
Operations of Government Prospecting Party, Blackwood	76
Surveys on Eastern Goldfields, by Inspecting Surveyor	76
Government Assayer's Report	77

TABLES.

	Page
General Return	16
Deaths	17
Mining Companies	17
Areas of Goldfields	17
Mining Revenue	17
Lithograph Plans	18
Leases on Goldfields	18
Returns Murchison and Yalgoo Goldfields ...	39
Machinery on Murchison and Yalgoo Goldfields	39
Particulars of Principal Mines on Murchison and Yalgoo Goldfields ...	40

PLANS.

Areas under Operations of Mines Regulation Act.
Collie River Coal Mining District.
Sections of Bores 4, 6, 7, Collie River.
Diagram—Annual Export of Gold.
Auriferous Discoveries outside Goldfields.
Distribution of Minerals, Gascoyne and Lyons Rivers.
Carboniferous Area, Irwin River.
Geological Sketch, Yalgoo and Murchison Goldfields.
Geological Sketch, Pilbarra Goldfield (Coloured).
Auriferous Reefs, Dandalup.
North Coolgardie Goldfield, Auriferous Belt (Coloured).
Göczel's Plan Interior Auriferous Region (Coloured).
Sample Plan, Section of Mine Workings (Coloured).

*Report of the Department of Mines, Western Australia,
for the year 1895.*

(With Supplementary Notes on part of 1896.)

To the Honourable E. H. Wittenoom, M.L.C., Minister of Mines.

SIR,

Department of Mines, 1st June, 1896.

I have the honour to submit my Annual Report for the year 1895, together with a Supplementary Report for the first portion of 1896, of the Mining operations carried on in the Colony, together with the administration of the Goldfields Acts and Regulations; also certain Reports from Wardens, and other papers of geological and scientific matters, one of which has been specially prepared for the information of mining companies and presented to the Department by Mr. H. L. Sulman, the discoverer of the Bromo-cyanide process, which promises to be of great importance to the future economy of our goldfields production.

Owing to the great increase in the area covered by prospectors, who, during the year, arrived in large numbers, chiefly from the Eastern Colonies of Australia, the number of mining holdings applied for, and correspondence connected therewith, compelled a large increase in the numbers of officers of the Department and in the expenditure connected therewith. Although with every hope of such an increase, from past experience and rumours, it was impossible to foresee the tremendous increase of business that fell upon this and other Departments, and the result was that, in spite of the continual additions being made to the staff, the discoveries were always ahead of the powers of the administering offices. The public, however, was fully aware of these extraordinary circumstances, and very little friction arose owing to their tolerance. The Department has done its utmost in these latter months to catch up the work as much as possible, and, as far as mining matters are concerned, to meet the growing demands upon it. It will be found, however, on reference to the tables given, that although the expenditure may have far exceeded the estimates, the revenue rose in such a manner as to justify it, even without taking into consideration that which accrued under the heads of "Customs" and "Lands" from increased activity in mining.

Not only has public attention been devoted on the Goldfields to the precious metal; but on some of them other discoveries have been made of minerals which will be conducive to the comfort and prosperity of the inhabitants; and the great question of water supply, which, during 1894, was of vital importance, and seemed to be that which would sway the balance either in favour of or against the future prosperity, and even life, of some of our Goldfields, has, I am happy to say, by the enterprise and acumen of some of the leading scientists on the fields, and by the efforts of the Public Works Department, in a great measure been answered in our favour so far as domestic supply is concerned. No doubt, the reports on this subject from that Department will be found highly satisfactory.

Although the year 1895 cannot boast of so many sensational discoveries as previous years, it still has to show a large number of really good ones, and a marvellous development of some old ones. In the Kimberley district, there are signs of a revival of interest and energy, and the outlook is far more encouraging, and miners who found it difficult to embark in ventures on some of the Southern Fields, owing to the plethora of newcomers, are turning their attention to this good but neglected district; and although the land communication is very little improved, there is a regularity of access to the ports which makes things more convenient. The other Northern Goldfields,

always acknowledged to be rich, are steadily progressing, and it is only a matter of time to allow the formation of easy means of transit ere they may be expected to be as busy and as prosperous as the rest of our great auriferous belt. The recent discoveries of auriferous deposits in the immediate neighbourhood of Esperance Bay verify the predictions which have been made as to the one great auriferous belt of country completely across the continent. It is a cause of congratulation to find that the reports of many gentlemen of the highest reputation in mining matters have testified to the great wealth of our mineral land, and that now the Colony is recognised throughout the world as one of the most important fields of investment, by capitalists, not only in the mother country, but of almost every civilised nation.

LEGISLATION.

The working of the Goldfields Act and Regulations existing at the end of 1894 had been the cause of much criticism, and it was generally acknowledged that some radical changes would have to be made. This was not to be wondered at, as they were principally based upon the conditions of another Colony, where the climate and general features were of a totally different character. The Amending Act, which was passed by the Legislature, and assented to on the 27th November, 1894, touched upon very few of the points under discussion, and was devoted to certain alterations in leasing, and the confirmation of previous transactions of doubtful validity. The services of Mr. Warden Gill (who, from his long experience in the administration of other goldfields and mining laws, was eminently qualified to advise) were obtained, and he recast the whole of the previous Goldfields Acts and Regulations. He was assisted in his work by Mr. DeCourcy Browne, a gentleman of considerable experience, from New South Wales, and was supplied with a mass of suggestions which, at my solicitation, had been received from the leading people on the various Goldfields. After many weeks of assiduous labour, the draft of a new Bill was laid on the table of the House of Parliament, and after undergoing several amendments therein, was assented to in the latter part of the year, and took effect on the 1st of January, 1896. It is impossible within the scope of this report to touch upon the many alterations made by this new Act; but the main points were the cancellation of all previous Acts; the reduction in price of miners' rights from £1. to 10s.; the altered procedure in regard to transfers; the establishment of a Court of Mining Appeal; mining under reserved lands and townsites; the amalgamation of leases; notifications in *Gazette*; lodging of *caveats*, &c. The progressive development of established mines also made it necessary to prepare a draft of a Bill dealing with this subject, and the Mines Regulation Act of 1895 was passed by the Legislature and assented to on the 12th October, 1895. By this Act the Governor was empowered to place the whole or any portions of Goldfields under its operations, over which portions the officers called Inspectors of Mines were enabled to take such action as to secure safety of life and property, and to procure detailed information for the use of the Department. The draft of this Bill was based upon the corresponding law of Queensland, which is considered to work most satisfactorily. An Act regulating the importation, carriage, storage, manufacture, and sale of explosives was also passed during the year, which will be of paramount influence on the Goldfields. The question of escort has cropped up on several occasions, and some attempts have been made to place it upon a proper footing. Apart from the safety of transit, there is little question that the other benefits which arise from a proper system of escort are still wanting to give the accuracy of returns of gold from the respective districts, and the declaration whether it is alluvial or otherwise, and the opinion is still rife that a considerable quantity of gold is leaving the country without being declared, in violation of Section 101 of the existing Act. No doubt, in the near future, when the industry has settled down around the numerous established centres, it will be more easy than heretofore to establish an escort system far more satisfactory.

I regret to say that 1895 was the last year during which the services of Mr. H. P. Woodward were available by the Department as Government Geologist. This gentleman underwent the toils and difficulties incurred in the most marked degree by a newly discovered and unexplored region; and his reports, which were readily and frequently given, threw as much light as was possible upon the vast and novel circumstances of our interior; and as his investigations had to be pursued in the face of great difficulties, every credit must be given to him for the amount of information he obtained, and also for the subsequent verification of his theories. It was with much regret that I handed to you his resignation of office at the close of the year.

Mr. Göczel was employed during the year as Assistant Field Geologist, and sent in some detailed reports of his tours, giving general ideas of the Geological formation of the unexplored lands through which he travelled during the first half of the year. During the latter part of the year, he was employed as Field Geologist to report more in detail around the principal centres, especially Coolgardie; and although, from various reasons, I am not able to publish his plans, I have attached his general report; and a report on the auriferous cement deposits found at the "25-mile" workings in the Coolgardie Goldfield will be found in Appendix 3.

The celebrated German Scientist, Bergrath Schmeisser, accompanied by Dr. Vogelsang, during the year made a tour of the Eastern and Central Goldfields. With his previous reputation as a high officer in the Mining Department of the German Empire, and from his celebrated publications on the Goldfields of South Africa, his opinions were eagerly looked forward to. But as his visits were prompted chiefly by a private engagement, it is not until quite recently that they have been made known to the world.

There seems to have been very little change in the rapidity with which West Australian mining ventures have been floated in the London market, and though, from time to time, there are fluctuations, the general amount of business is not retrogressive. The subscribed capital at the end of the year has approached to the large amount of £50,000,000, although the sum actually set aside for the development of the mines is so far nothing like this amount, which is to be regretted, but not wondered at, in our present embryo state; and also when one remembers that many mining speculators depend more upon the rise and fall of shares than the actual output of the mines. Statistics are given in Table 3.

A review of the state of our Goldfields will be of interest.

KIMBERLEY GOLDFIELD.

The transactions in this field were small throughout the year, only three mines being in actual operation; the "Mount Bradley," "Ruby Queen," and the "St. Lawrence."

The mining population, scattered over a considerable area, numbers less than 300. There was a fresh find on the Panton River in the early part of the year of alluvial gold, but the whole number of alluvial diggers does not seem to have exceeded 50 men. The distance from the coast, and absence of means of communication, militated against any increase of population; but a certain number of diggers are reported to filter into the district from the Northern settlements of South Australia, but they do not stay. To give some encouragement to those companies that have bravely continued work, the Government offered a bonus for the sinking of shafts below a certain depth, and the "Ruby Queen" and "Mt. Bradley" Companies availed themselves of this, the former having sunk 234 feet to date. The health of the district has been very good, and the small establishment at Hall's Creek is carried on in a satisfactory manner. The prosperity of this district is still much affected by the Southern Goldfields, which at present are more fashionable. Warden's Report is attached (Appendix 13).

PILBARRA GOLDFIELD.

This field can boast of being the producer of several of the largest nuggets found in Western Australia; and the reefs, not only in one series, but in several, have proved of great richness on the outcrop. The population, which so far is about 1,000 people, is divided among several settlements, the principal of which are Marble Bar, Bamboo Creek, Nullagine, Talga, Western Shaw, Croydon, Mallina, Tamboura, and Egina; the Warden's offices being at Marble Bar, and Branch Registries established at Bamboo Creek, Nullagine, and Mallina. Several of the mines on this Goldfield have been floated as English and Colonial Companies, and are developed and vigorously worked, the returns from the crushings proving eminently satisfactory; but on Nullagine and Croydon the work is still almost entirely alluvial, although at the former place a few promising reefs have been lately discovered. There is a good supply of water over the whole field, though during the dry season some of the pools or natural reservoirs run dry. So far there has never been any outcry on account of the want of water, and such a thing as the sale of water is unknown on the field. The principal mines are at Marble Bar and Bamboo Creek, where batteries and other mills are regularly worked. The whole country is of a volcanic nature, and, in addition to the gold deposits, gems will probably be found. Already the existence of diamonds has been proved; but as yet only small ones have been secured, although it is believed that larger ones may have been broken up by the stampers in the extraction of the gold, the matrix being very hard. (*See Report by Mr. Groome, Appendix 4.*) There are many rivers flowing through the District, all trending to the North; and as the sea coast is not more than 100 miles from Marble Bar, much of the road being over level country, there is every prospect that the facilities of transit, in a short time, will be much improved. An interesting report has been furnished by Mr. Becher, Mining Engineer, which will be found in Appendix 5.

Towards the latter part of the year, owing to the discoveries of gold within a few miles of Roebourne, it was decided to proclaim a new Goldfield, and the Western portion of the Pilbarra Goldfield was included therein; the field being called

WEST PILBARRA GOLDFIELD.

This field is administered by an Acting Warden at Roebourne, assisted by a Mining Registrar; and in addition to the mining centre at the Nickol River, now comprises those of Egina, Old Pilbarra, Mallina, Croydon, and Towranna. Like the Pilbarra field, there has never been any difficulty as to water in this Goldfield; and having been an old pastoral settlement, the cost of provisions is not high, and communication is easy; but owing to its distance from the more fashionable fields, its best time has not yet arrived.

ASHBURTON GOLDFIELD.

This field, for some time almost deserted, has shown signs of resuscitation. The alluvial returns were at one time very heavy, and it is even now considered that, when diggers can get alluvial nowhere else, they are sure of a living on this Goldfield; but it is not very accessible, and the office of administration is necessarily far from their operations, being at the Port of Onslow, at the mouth of the Ashburton River. Rumours of some rich reefs have lately come to hand, and a few leases have been applied for. The immediate future of this field is, in my opinion, dependent on the overflow of miners from the Murchison Goldfields by way of Peak Hill and Horse Shoe Bend, which lie on the Upper Gascoyne.

MURCHISON GOLDFIELD.

The business on this Goldfield was so active at so many different centres that, early in the year, the Southern portion was separated from it and formed into the

Yalgoo Goldfield. The number of mines around Cue, the Warden's head-quarters, and at Day Dawn, a few miles to the South-West, is considerable; there being no less than 17 batteries erected in the immediate vicinity of Cue. Around Nannine, which is the Northernmost district of the field, there are five batteries, and in the Mount Magnet District there are two. The Warden of this Goldfield also visits the outlying centre of Peak Hill, on the Upper Gascoyne, where about 150 men are making considerable profits from small but rich leaders. The Murchison Goldfield does not suffer from want of water. The country, although dry looking on the surface, is permeated with fresh water at tolerably shallow depths, salt water being only found in the immediate vicinity of the large salt lakes—in fact, in every mine, the presence of water from 50 to about 100 feet is the difficulty, and pumping machinery is always necessary. In allusion to my previous remarks, one of the mines on this field has yielded a splendid average during the year, although the original discovery was not sensational. There was a larger amount of machinery in operation on this field than on any other, and the mines generally were more fully developed. The Government railway in course of construction between Geraldton and Cue, *via* Yalgoo and Mount Magnet, was completed as far as Mullewa, and tended to reduce expenditure, and no doubt on its completion, at a short date, the activity of this field will receive great impetus. Timber, which is not plentiful either for construction or fuel, is a difficulty which this will tend to reduce. I attach a very full report on this group of goldfields by the Inspector of Mines (Appendix 8).

EAST MURCHISON GOLDFIELD.

Owing to the discoveries made by prospectors from Cue and from the South, in the country lying Eastward of the head of the Murchison and Gascoyne Rivers, at Lake Darlôt, Mount Sir Samuel, and certain places on the road from Cue to Lake Carey, it was decided early in the year to proclaim a new goldfield, and station a Warden at Lawler's mine, which appeared to be the most central situation. Owing to the great distance from the seaboard, nothing much in the way of development of leases was made during the year except by the "Great Eastern Company," at Lawler's, whose machinery was deposited on the ground; but a great deal of alluvial was found in the neighbourhood of Lake Darlôt. The reefs at Mount Sir Samuel were reported to be exceedingly rich, and many leases were taken up at this spot, which is about 40 miles North of Lawler's. Nearly the whole of the carriage of material is obliged to be performed by camels. The Warden's general Report is attached (Appendix 15).

YALGOO GOLDFIELD.

This comprises the centres of Yalgoo, Melville, Carlaminda, Gullewa, Bilberatha, Wadgingarra, and Pinyalling. The development of the mines in this Goldfield are not in a forward state, there being no pumping machinery on the field. Prospecting is chiefly the order of the day, the completion of the Railway to Yalgoo being looked forward to before any attempt is made to lodge the machinery. The miners on this field seem very hopeful of the future however, and are carrying on their operations in a very energetic manner. *

Geological reports on this Goldfield are attached, written by the Government Geologist (Appendix 2), and by the Inspector of Mines (Appendix 9).

YILGARN GOLDFIELD.

This is now the remains of the great Yilgarn Goldfield after the districts at Coolgardie and to the Eastward were cut off. The principal work on this field was in the immediate vicinity of the townsite of Southern Cross, where three or four mines kept their batteries steadily going on comparatively poor stone, but so economically worked

* While this is in the press news has been received that trains now run to Yalgoo.

that it paid to continue. The reefs at Parker's Range to the South Eastward, formerly so highly thought of, were for a time almost deserted; but there seems now a revival, and one battery exists. Some fresh finds, however, a little to the North-West of Southern Cross, were made during the year, and Companies successfully floated and operations carried on actively. A new centre about 80 miles North from Southern Cross, at Mount Jackson, was opened up and some good reefs pegged out, and there is now a population of about 60 at this spot but increasing. A battery was in course of erection, and the Warden is of opinion that this will become a prosperous district. The old mines, I am glad to say, have shown a considerable improvement in their outputs, and also in the prospects of their stone and depth. This being one of those fields which is in the saline belt of country, I regret to say is still in difficulties with regard to the supply of fresh water, all of which is obtained by condensation or pumping, which adds considerably to the expense of ventures on this field. Warden's Report is attached (Appendix 18).

COOLGARDIE GOLDFIELD.

One of the principal, if not the principal mining field of the Colony. The Warden's head quarters are in Coolgardie township, which is our principal mining township. The country round for many miles is being taken up under Mining Lease. The fame of Bayley's mine, the "Londonderry," and the "Wealth of Nations," did much for Coolgardie during the year. It was the chief centre of attraction for all newcomers, as well as for mining agents and tradesmen, conveniently situated as it is for an *entrepôt* for trade. Coolgardie, during 1895, increased enormously in its population, and business was very brisk; the enterprise of our nation was noticeable in the way in which the difficulties of transit were overcome. A road 120 miles long, between a railway terminus at Southern Cross and Coolgardie, and of an execrable character in most parts, forming a great obstacle, was successfully traversed by hundreds of teams, and the sacrifice of an immense amount of horse power. The price of all sorts of horse-feed at times was almost incredible, and the great price of water, and the difficulty of even getting it at any price, was so deterrent to the determination of the thousands who made Coolgardie their goal; the consequence was that buildings rose in all directions, and the town extended over several miles; timber mills and a brewery were started, brickfields were worked, ice was manufactured, and numbers of small industries successfully carried on. The growth of Coolgardie during 1895 compares very favourably with that of Broken Hill in its best days. This field comprises, besides those centres already mentioned, Siberia, the 45-Mile, Mt. Burges, Lake Lefroy, and Bullabulling, which now shows great promise. Large areas of purchased land belonging to the "Hampton Lands Company"—a strong English corporation—approach within a mile and a half of Coolgardie town on the East, and much money is being expended by this company in boring for water and other experiments. On this field there are 11 batteries, a cyanide plant, and 12 other mills, and a great deal of work is being done; a railway during the year, from Southern Cross, was being pushed forward with speed, and was opened as far as Woolgangie, about two-thirds of the distance. Within the town of Coolgardie, in an area known as the Water-belt, many wells for fresh water have been successfully sunk, though the supply is rather feeble. The field itself is principally supplied by condensers and a few dams, the roads being kept open by the energy of the Works Department. The country is well covered with hard gum timber, suitable for mining purposes and firewood; and there will be no difficulty on this score for many years to come. A large project for the supply of electricity from Northam is on foot, but as yet no permanent work has been done.

The duties of the Inspector of Mines of this group of goldfields have been so arduous that it has been impossible for him to prepare, so far, any report thereon.

EAST COOLGARDIE GOLDFIELD.

This was an offshoot from the Coolgardie Goldfield, and promises to become, perhaps, the most important district in the future. Towards the latter end of the year, so great was the run upon the land that nearly 700 leases were applied for in one month within a few miles of Kalgoorlie. The Warden's head quarters, formerly known as Hannan's, and the well defined lodes running for miles in a South-Easterly direction justify this action. Some of the principal mines, such as the "Hannan's Reward," the "Great Boulder," and the "Brown Hill" proved phenomenally rich, and improved as they went down, and still keep up their reputation. The White Feather district, 16 miles to the North of Kalgoorlie, also proved rich, and was notable for a rich patch of cement. The other centres on this field are the I.O.U. (or Bulong), Kurnalpi, Broad Arrow (or Kurawa), and Bardoc, which have all kept up their reputation during the year, although Kurnalpi, which is distant and principally famous for the rich alluvial deposits found there, is not in such favour as formerly. The water question is just as troublesome here as at Coolgardie and Southern Cross; but, owing to the presence of a large lake a few miles South of Kalgoorlie, a strong company has obtained a lease, and it is hoped that by the expenditure of a large capital, the mines around Kalgoorlie will soon be much benefited. There is no difficulty, so far, in regard to timber. This field is also found to possess good building stone. Owing to changes in the official administration, and the area of this field, I am unable to furnish a Warden's Report, but refer you to Table 1 for certain statistics.

NORTH COOLGARDIE GOLDFIELD,

the principal centre of which is at Menzies, was cut off from the Coolgardie Goldfield dearily in the year owing to the run upon the country, principally around Menzies. The other districts opened up were Niagara and Edjudina. The latter lies North from Kurnalpi, and on it, so far, not much has been done, though many leases have been applied for; the Niagara district, however, promises well. This is situated 30 miles North-East of Menzies, and a large scheme of water conservation has been assented to, and a lease given to a private firm. There are other districts, such as Ularring and Mulline, to the North-West of Menzies opening up, but still in their infancy. The Mount Margaret, or Lake Carey country, is another prosperous and rising district in this Goldfield, where many good reefs have been hit upon, and much alluvial found, but being at the great distance of more than 100 miles North-East of Menzies, all provisions, &c., had to be carried on camels, and were almost at famine prices. The natives at this latter place were a source of considerable trouble. (*See Report, Appendix 20.*)

DUNDAS GOLDFIELD.

This goldfield commenced with a few promising little reefs in the vicinity of Dundas Range; but early in the year some new reefs of a rich character were discovered about 18 miles to the North, and now the principal settlement is at this spot called "Norseman," where a town has been laid out and nearly all the business done. The Warden's quarters, however, having been built at Dundas, he resides there, but visits the Norseman about once a week. There was difficulty with regard to water on this field, and also on the road leading to it from Esperance Bay; and though a few small lagoons of fresh water are found here and there in the wet season, they are not reliable, and condensers have to be resorted to. Most of the material required is carted up from the port of Esperance Bay, 130 miles to the South; but there is also frequent communication both by teams and camels from Coolgardie, and by cycle post. A find of opals was reported, but so far it appears to be only opaline quartz, and nothing is being done now. There is a small mining settlement at the Peninsula and Lake Cowan, about 38 miles from Dundas. Timber is fairly plentiful, and copper ore is known to exist in the vicinity of Lake Cowan. An exhaustive report on the mines of this field will be found in Appendix 11, and some statistics in Table 1.

GREENBUSHES TINFIELD.

Operations on the Greenbushes Tinfield have been comparatively quiet, being in the hands of working miners; but to give some encouragement to the better development of this well-known patch of stanniferous ore the Government have offered a bonus for the erection of smelting works on certain conditions, and notice has been received that certain parties have commenced their erection. A grant was made of £400 for the purpose of prospecting for fresh lodes, but so far the party sent out have been unsuccessful in their efforts. The Mining Registrar's Report is attached (Appendix 22).

Coal.

The development of coal seams on the Upper Collic River undertaken by the Government, by the driving from the outcrop of an incline plane for a distance of 1,000 feet at an inclination of 1 in $5\frac{1}{2}$ to a depth of 175 feet vertical, has established the fact that the coal seam is workable, and it was contemplated at the end of the year to declare and throw open a Coal Mining District in this locality.

An interesting report from the Government Geologist with regard to the coal measures on the Upper Irwin River, will also be found in Appendix 1. Applications have been made for licenses to prospect for coal at the Deep River inlet, and also in the vicinity of Flinders Bay, but very little has been heard as to the quality of coal, &c.

Copper.

The only spot in which copper is being attended to is at the Whim Creek Copper Mine, Eastwards from Roebourne, but little activity is displayed owing to the low price of the metal. The land comprised in the lease formerly held by Messrs. Bateman & Company has now been sold to them in fee simple, under the conditions of the Land Regulations ruling at the time it was taken up.

Lead.

I regret to say that no reports have come in of the workings of this, and apparently nothing is being done.

General.

Here and there isolated parties have hit upon mica deposits, but none of these were very promising, except one on the Upper Gascoyne near Pyramid Hill, good reports of which have recently been received. Much activity was displayed on the Darling Range, near the Serpentine River, and about half-a-dozen parties were engaged sinking on some large reefs which have been known for years in that locality. Small test assays showed a few dwts. to the ton, but no gold was visible. The stone was highly mineralised, and no doubt the pyrites contained what gold there was; but the public expectations were still great as to the ultimate payable nature of these reefs. Asbestos also has been discovered near Kalgoorlie.

A considerable amount of quarrying has been done under licenses issued under the Mineral Lands Act, chiefly in the neighbourhood of the metropolis.

DEPARTMENTAL.

For your information I now add a few particulars regarding the official administration of the Mining Laws, and the working of the Department.

The mining revenue during the year 1895 was £77,885 from all sources. The Departmental expenditure was £20,880. Tables are added showing in detail how these were made up.

The number of officers was, perforce, largely added to both on the fields and at head quarters; and I am happy to report that in most cases those selected have conducted themselves with zeal and accuracy. Owing to the splitting up of the fields into districts, several additional Mining Registrars, subordinate to their Wardens, were established, and some new fields being declared, both from parts of old fields as well as in new country, some new Wardens had to be appointed. At the end of the year there were 12 Goldfields and one separate mining district.

A number of new plans have been lithographed of new centres, list of which will be found in Table 6.

With regard to the administration of the Department at the end of 1894, nine Goldfields were in existence, viz.:—"Kimberley," "Pilbarra," "Ashburton," "Murchison," "Yalgoo," "Yilgarn," "Coolgardie," "East Coolgardie," and "Dundas." During the year the number was increased by the formation of the following:—"Yalgoo," "North Coolgardie," and "East Murchison."

"Yalgoo" being the Southern portion of the Murchison Goldfield cut off therefrom.

"North Coolgardie" being the Northern portions of Yilgarn, Coolgardie, and East Coolgardie Goldfields cut off therefrom.

"East Murchison" being entirely new country to the East of the Murchison Goldfield.

The Murchison Goldfield was also divided into Districts by defined boundaries, and the necessary Wardens were appointed for the new Goldfields. It was also found necessary to appoint an Inspecting Surveyor to be stationed at Coolgardie. The services of a Field Geologist were obtained for a considerable portion of the year, the Government Geologist's duties being generally confined to parts of the Colony outside the Goldfields. The number of miners increased rapidly, especially on the Eastern Fields; and the number of leases applied for during the year will be found in Table No. 7.

The number of leases surveyed during the year, was 2,750.

A number of surveyors having been appointed to perform mining surveys in accordance with the Regulations, information was collected from which a considerable number of plans of Mining centres was added to those previously in existence; and with those added during the early part of this year—the lithographic plans now published amount to 36—will be found in Table No. 6.

With regard to correspondence, there was naturally a great increase as follows:—

Papers registered—9,006.

Letters written—4,288.

Table No. 1 shows the totals of the gold yield, number of leases working, quartz and alluvial miners, number and description of machines, and of Miners' Rights issued during 1895.

The Mining Revenue for 1895 amounted to £77,885, the details of which are shown in Table No. 5.

The total number of mining companies registered during the year was 233, which, added to those previously registered, amounts to 303.

Accidents on the Goldfields were not numerous. The details of those which were fatal will be found in Table No. 2.

GEOLOGICAL.

The Government Geologist (Mr. H. P. Woodward) was employed during the early part of the year investigating the carboniferous areas in the Upper Irwin River basin and to the Northward thereof, and also in a general inspection of the Yalgoo Goldfield, reports of which are attached (Appendices 1 and 2). He then superintended the operations of the contractor for bores in the coal basin of the Upper Collie River, and in the preparation of plans, &c.

Mr. S. Göczel, who prepared in the early part of the year a report of his journey from Coolgardie to Cue, which was published in my report for last year, spent the latter part of the year in the neighbourhood of Coolgardie, where he was sent to obtain detailed information of the country round that centre, from which a plan might be made. He was also employed in one or two short expeditions, among others to the cement deposits in the neighbourhood of the "25-Mile," known as Coonalion. His report of his labours will be found in Appendix 3; but the plan handed in therewith, I regret to say, was in an unfinished state, and I am unable to reproduce it. It will, however, form the basis on which future work can be shown, and I trust to lay it before you in the future. I also append a coloured plan of the area reported on by him, given in my Annual Report of 1894, but then only in black and white. This has been reproduced at our own lithographic establishment.

ASSAYS.

The number of assays made at the laboratory amounted to 802.

The Government Assayer's report is attached. (*See Appendix 23.*)

GOLD YIELD.

A diagram, showing the proportionate amount of gold yielded by the several Goldfields in 1894, is attached. By this it will be seen that the increase per quarter does not compare favourably with that of the previous year in its rate of progress. The probable explanation of this principally lies in the fact that so many leases were applied for, on which the labour conditions had to be complied with, that the greater number of men previously employed in alluvial digging accepted wages on the leases, and also that the patches of alluvial were more nearly worked out, and new ones were not discovered. In fact, the nature of the gold deposits is apparently such that there are fewer alluvial tracts in proportion to the reefing tracts compared with the other colonies. Many of the so-called alluvial tracts also being not properly such, but merely ground full of the sheddings from disintegrated reefs, which in many cases have now been found in their original state underneath the few feet of surface operated on by the alluvial diggers.

MUSEUM.

The management of the Museum was, by direction, handed over to a committee appointed by His Excellency; and the Department has now nothing to do with this branch.

SUPPLEMENTARY (1896).

In order to give an idea of the strides which are still being made in the gold mining and general mining industry, I may add a few words with reference to the early part of the present year. In the first place, the increase is shown by the necessity which has arisen of adding to the number of Wardens, new fields being proclaimed over portions of country taken from other fields, as well as new lands. In the North, more rich finds have been made in the vicinity of Roebourne, and the country between the Fortescue River and the coast, together with that portion of the Pilbarra Goldfield lying West of the Yule River, was proclaimed as the "West Pilbarra Goldfield." Fifty leases now stand in this goldfield and comprise 702 acres.

The Ashburton Goldfield has also shown, recently, considerable signs of revival, and some discoveries of rich stone made to the Westward of it, on the Upper Lyons River, point to the fact that some steps towards the administration of this, as a separate Goldfield, will soon have to be taken. The number of leases taken up in the East Murchison Goldfield, is also on the increase, as well as those in the neighbourhood of Mount Margaret in the North Coolgardie Goldfield. At East Coolgardie, such a large patch of country is now completely covered with leases, and the business has become so great, that it has been found necessary to curtail the boundaries of this Goldfield to a few hundred square miles; and the remainder of the original Goldfield now called the "North-East Coolgardie Goldfield," has been placed under a Warden stationed at Kanowna (White Feather), under whose jurisdiction branch courts are established at Broad Arrow and Kurnalpi, which were previously under the Warden at Kalgoorlie.

In the North Coolgardie Goldfield, branch courts have been established at Yerilla and Murrin Murrin, which latter is in the centre of a large group of valuable properties, including, among others, the "Princess Alix" and "The Lady Juliet" mines. The establishment of these branch courts arises from the great increase of business on this Goldfield—the Warden reporting to me that his revenue on mining account alone is at present pouring in at the rate of £50,000 per annum from his whole field, and appears to be on the increase.

There is also a great increase in the number of leases on the Dundas Goldfield, especially in the neighbourhood of the Norseman, 18 miles North from Dundas township; and the Warden's head quarters will be, in future, at the latter place.

In the Yilgarn Field, the new centre at Mount Jackson, previously mentioned, is opening up rapidly, and a battery is at work. (*See* Supplement to Appendix 18.)

To show the general increase in the selection of leases throughout the Colony, it is only necessary to say that the amount of rental accruing from that source for the year ending 30th June, 1896, was £102,074 against £33,700 for the previous twelve months. Much attention was directed to the large reefs known to exist for many years in the Darling Ranges, a little to the South of Perth. Protection areas were being applied for, and reports circulated as to the payable nature of these reefs, early in the year, to such an extent that I decided to visit them; and shortly afterwards, with the consent of the original discoverers, one of the Inspectors of Mines (Mr. T. Fowler, from Coolgardie) was sent to extract a fairly large parcel of stone, and, after having it treated at Coolgardie, to report thereon. His report was a pleasant surprise to most people, and will be found in Appendix 12, and in order to prevent the country being covered with protection areas, which at best are an unsatisfactory sort of tenure to the holders as well as to the Department, a small goldfield was proclaimed and an Acting Warden appointed. A parcel of 10 tons of stone from the original find has quite recently been sent to Adelaide and Ballarat for testing, the result being at rate of 1oz. 4dwt. per ton.

GOLD FROM PRIVATE LANDS.

From the commencement of 1895 to the end of June 1896, the operations of the various companies, which are prospecting on the large blocks of land belonging to the Hampton Lands Company to the East of Coolgardie, have been, so far, restricted almost entirely to prospecting. Their reports do not show that much gold has yet been extracted. The amount on which royalty has been paid was 31oz. 16dwt. 5gr.—value declared at pit's mouth £113 18s. 10d.; but report of the value of a further lot of 226 tons of ore raised during this period has not yet reached me, and, consequently, the royalty cannot yet be estimated. No gold has been reported to have been found on any other portion of the alienated lands of the Colony.

The information has been received that about 1,000 tons of tailings have been treated at Day Dawn by Sulman's bromo-cyanide process, the average extraction being $3\frac{1}{2}$ dwts. out of an original assay value of 4dwts. The consumption of cyanide is from 3 to 4oz. per ton, whilst that of bromide of cyanogen is 2 to $2\frac{1}{4}$ oz.

In other minerals, I am also happy to report that business is on the increase; the results obtained from the shaft sunk on the Collie Coalfields being satisfactory, a coal mining district was thrown open on the 23rd March, and a considerable area has been applied for, namely, 44 leases, comprising 13,770 acres. Some strong syndicates are in possession of this ground, and machinery is being sent for to properly open up the coal seams, exemption from the labour conditions having been allowed until this is *in situ*. A Plan is attached.

On the South Coast, to the Westward of Flinders Bay, at the mouth of the Blackwood River (namely, in the basin of the Scott River) a great number of areas for prospecting for coal have been taken up; and from the vigour which the holders are exhibiting, there seems reason to believe that they must have very good prospects.

The Greenbushes Tinfields, although in a languishing state from want of water and capital, have attracted the attention of some capitalists who have carefully prospected the country and apparently discovered what is known as the "break of the granite," in which heavy deposits of tin ore are likely to be found. It is said that the tin country extends for many miles Westward from the present district—probably as far as St. John's Brook, but, as the results of the prospecting have not been reported to me, I am unable to say more. I would call your attention to a Paper on this subject which has been kindly supplied to me by Mr. Rudolph Wachsmuth. (*See Appendix 6.*)

Although, as before stated, mica has been found in many places, and areas have frequently been taken up from which to extract it, these have not been held long except in one instance, namely, Chawner's Find, near Pyramid Hill, on the Upper Lyons River. Specimens from this recently shown to me, are the largest I have seen, and of clear quality, and the prospectors are in very good spirits with regard to their success. I trust to be able, in my next report, to have full and encouraging information to lay before you on the last mentioned subject.

Auriferous areas have recently been opened up also at Boojidup Brook near Hamelin, at the 80-Mile post on the Perth-Albany Road, and at spots on the Darling Range, both North and South of the Dandalup Goldfield. (*See Plan attached.*)

The Inspectors of Mines, appointed under the Mines Regulation Act, have had their time fully occupied, and the duties of Mr. Fowler, on the Eastern Goldfield, have been so onerous that it has been impossible for him to supply any report as he has been kept constantly on the move, not only inspecting mines, of which considerably over 2,000 lie within those portions of his district which have been placed under the Mines Regulation Act, but also in viewing and investigating a large number of accidents which have unfortunately occurred. He has also attended, as an *ex officio* member, at the examination of applicants for certificates as engine drivers. Mr. Reed, on the Eastern Goldfields, was, for a few weeks, incapacitated from duty by an attack of typhoid fever, which was very prevalent at Cue for a time, but, nevertheless, he has made good use of the rest of his time, as may be seen from the three reports which he has furnished. He also has had to attend at similar examinations held at the principal centres of his district. On the Northern Goldfields the services of Mr. S. J. Becher have been secured to act as inspector, more for the sake of reporting to the head office and advising miners than for actual action under the Act, no part of his district having as yet been placed thereunder. The same may be said of Mr. Angove, on the Dundas Field. The work of these gentlemen will be useful as a preliminary step towards appointing proper inspectors, and placing portions of their districts under the Act, which will

probably have to be done at an early date, as great numbers of the mines under their view are now being developed at depth. Reports from Mr. Reed will be found in Appendices 8, 9, and 10; from Mr. Becher in Appendix No. 4; and from Mr. Angove in No. 11.

The examinations for certificates as engine drivers have resulted as follows:—

Eastern Goldfields—No. of applicants, 202.

No. of certificates granted, 179.

Central Goldfields—No. of applicants, 92.

No. of certificates granted, 72.

And here I trust I may be allowed to pay a tribute to the untiring zeal shown by a majority of my fellow officers in the Perth Office, as well as on the Fields, who have generally devoted their entire time to their official duties, being at their desks till daylight falls, and again attacking their work till a late hour of the night, thus showing their desire that the public shall be properly served. As, however, we are beset daily with inquiries from all quarters, arising as much from the difficulties and disputes attendant on a great change in the Mining Laws, as from the strong advancing tide of ordinary work, we are naturally subject to those criticisms which generally fall upon new organisations. It may be said that an increased staff would overcome this; but though the Government have been most liberal in answering our large demands for officers, the number of which is now greatly in excess of that for the previous year, yet we often find ourselves in the position of the miner who knows that water must be found early, yet cannot with advantage employ more than three men in his shaft. To give some idea of the views of the outside world as to the immense progress and possibilities before us, I may be pardoned for quoting a few words from the last of four articles written for the *Illustrated London News*, by Mr. J. M. Price, appearing on the 14th March:—

“A comprehensive work is a hopeless task at present, not from the point of view of its magnitude so much as from the fact that the entire country is just now in a state of transition, and therefore not in a position for being ‘written up’ with any degree of accuracy. It is highly interesting to note the vast strides made during the past few months solely as a result of the unprecedented success of the Goldfields; for it would be idle to deny that this remarkable era of prosperity is due to any other cause. New towns, and even districts have sprung up as if by magic where, so recently as three months ago, there was but unopened bush; and by the time this goes to press, famous and flourishing camps will fill up blank spaces on the map Under such conditions, it will be understood, that in any attempt to do anything but make sketchy notes I should have been undertaking an impossibility. In fact, most of those made are as it were, already obsolete, so rapidly have events shaped themselves.”

The above extract will explain to the thinking man the difficulties and hard questions with which the Department has daily to cope.

I have, etc.,

HENRY C. PRINSEP,

Under Secretary for Mines.

TABLE No. 1.

General Return showing the Gold Yield, Quantity of Quartz Crushed, also the Number of Leases, Miners, Batteries, and other Data on the Western Australian Goldfields, for the Year 1895.

	CENTRAL GOLDFIELDS.			EASTERN GOLDFIELDS.					PILBARRA GOLDFIELDS.	KIMBERLEY GOLDFIELD.	ASHBURTON GOLDFIELD.	TOTAL.	
	Murchison Goldfield.	East Murchison Goldfield.	Yalgoo Goldfield.	Yilgarn Goldfield.	Coolgardie Goldfield.	East Coolgardie Goldfield.	North Coolgardie Goldfield.	Dundas Goldfield.	Pilbarra Goldfield.	West Pilbarra Goldfield.	Kimberley Goldfield.	Ashburton Goldfield.	Total.
Total Gold Yield in ounces for the year ...	65475	Included in M'rch's'n	Included in M'rch's'n	19747	125106	Included in C'lg'rdie	Included in C'lg'rdie	242	19522	Included in Pilbarra	877	541	231512
Total Yield of Alluvial and Dollied Gold in ounces ...	15434	Do.	Do.	2637	Included above.	Do.	Do.	§	§	Do.	§	§	
Total Yield of Auriferous Quartz in ounces ...	47813	Do.	2230	17110	Do.	Do.	Do.	§	9483	Do.	§	§	
Total Quantity of Quartz crushed in tons ...	40607	Do.	2400	§	§	§	§	§	§	§	§	§	
Average Yield of Gold per ton of Quartz crushed ...	1oz. 3½ dwt.	§	18½ dwt.	§	§	§	§	§	§	§	§	§	
Number of Leases Working ...	419	94	142	100	1924	2268	888	324	99	42	3	8	6311
Area do. do. in acres ...	3924	900*	1524	1373	23650	38400	14000*	4393	1011	554	33	99	89861
Number of Quartz Miners ...	2260*	100*	750*	500*	5500*	6500*	1350*	1200*	560*	350*	200*	40*	19310
Do. Alluvial do. ...	300*	200*	50*	50*	100*	1000*	50*	None.	140*	100	40*	120*	2150
Number of Batteries ...	24	None.	4	7	11	10	6	1	6	2	4	None.	75
Do. Stamps ...	280	Do.	23	167	124	67	75	10	55	15	25	Do.	831
Do. Other Crushing Mills ...	4	Do.	None.	None.	12	None.	None.	None.	3	None.	None.	Do.	19
Do. Cyanide Plants ...	2	Do.	Do.	Do.	1	Do.	Do.	1	None.	Do.	Do.	Do.	4
Number of Miners' Rights ...	2074	110	356	433	5632	2641	...	774	421	183	62	39	
Total Gold Yield previous to 1895 in ounces	100578	Nil.	Nil.	145421	105330	Included in C'lg'rdie	Included in C'lg'rdie	376	79946	Included in Pilbarra	21605	1592	454848

* Approximate. § Not reported.

Table 2.

Number of Deaths reported on Goldfields for the Year 1895.

Goldfields.	Disease.	Drought or starvation.	Suicide.	Mining accidents.	Drowning.	Homicide.	Total.
Kimberley	3	...	...	...	1	...	4
Pilbarra	11	...	...	...	...	...	11
Ashburton ... ..	...	...	...	...	...	...	...
Murchison	91	...	2	3	...	1	97
Yalgoo ... ..		...	...	...	...	...
Yilgarn ... ..		...	...	...	...	...
Coolgardie ... ..		...	...	...	...	...
Do. East	29	1	4	6	1	...	306
Do. North ... ..		...	...	...	...	...
Do. North-East ... ..		...	...	...	...	...
Dundas ... ..	...	...	...	...	...	...	...
	399	1	6	9	2	1	418

Table 3.

Showing Mining Companies Registered in 1895 and first six months of 1896.

1895.—Powers of Attorney (relating to Mining) registered	...	194
„ Local Companies	...	39
1896.—Powers of Companies, &c., registered to 15th instant	...	299

Table 4.

Showing Areas of Goldfields, 15th June, 1896.

Coolgardie	12,300 square miles.
East Coolgardie	740 „ „
North-East Coolgardie	23,800 „ „
North Coolgardie	45,000 „ „
Dundas... ..	19,000 „ „
Kimberley	47,000 „ „
Ashburton	8,200 „ „
Yilgarn	15,000 „ „
Murchison	20,600 „ „
East Murchison	62,700 „ „
Yalgoo	18,820 „ „
Pilbarra	35,100 „ „
West Pilbarra... ..	10,500 „ „

Table 5.

Gross Receipts as Mining Revenue, 1895.

	£	s.	d.
January	3,655	4	0
February	2,310	5	9
March	4,986	7	6
April	8,662	4	0
May	6,727	2	11
June	9,016	17	0
July	5,823	0	0
August	4,688	4	0
September	9,004	15	6
October	6,196	5	6
November	9,929	0	9
December	7,044	0	3
	£78,043	7	2
By Refunds	158	1	0
Net Receipts	£77,885	6	2

Table 6.

Lithographs of Lease Maps and Route Maps on Sale.

At the end of 1894.	Editions.	At the end of 1895.	Editions.
Coolgardie	5	Coolgardie	7
Kalgoorlie	2	Kalgoorlie	4
Murchison Route Map	1	Murchison Route Map	3
Coolgardie Route Map	1	Coolgardie Route Map	3
Mt. Burges	2	Mt. Burges	3
25-Mile... ..	2	25-Mile	5
90-Mile... ..	1	90-Mile	4
Kanowna	1	Kanowna	2
Nannine	1	Nannine	1
Cue and Day Dawn	1	Cue and Day Dawn	3
Pilbarra Route Map	1	Pilbarra Route Map	1
Mt. Magnet	1	Mt. Magnet	2
Cuddingwarra	1	Cuddingwarra	2
		Londonderry... ..	1
		Broad Arrow... ..	1
		Niagara	1
		Bardoc	1
		Yerilla and Mt. Catherine... ..	1
		Mt. Jackson	1
		Southern Cross	1
		Edjudina	1
		Marble Bar	1
		Black Flag	2
		Dunnsville	1
		Kurnalpi	1
		I.O.U... ..	1
		Island and Mainland	1
		Lake Lefroy	1
		Norseman	2
		Menzies	1

Lithographs of Lease Maps and Route Maps on Sale at the end of June, 1896.

	No. of Leases shown.	Edition.		No. of Leases shown.	Edition.
Coolgardie	364	8	Southern Cross	39	2
Kalgoorlie	748	6	Ejjudina	38	1
Murchison Route Map ... ..	...	4	Marble Bar	18	1
Coolgardie Route Map ... ..	...	4	Black Flag	188	3
Mt. Burges... ..	57	4	Dunnsville	62	2
25-Mile	66	6	Kurnalpi	134	4
90-Mile	38	5	I.O.U.	123	2
Kanowna	190	4	Island and Mainland	57	1
Nannine	8	2	Lake Lefroy	20	1
Cue and Day Dawn	243	4	Norseman	241	3
Pilbarra Route Map ... ..	...	2	Menzies	174	3
Mt. Magnet	128	6	Lake Darlot	32	1
Cuddingwarra	46	3	Lawler's	34	1
Londonderry	172	2	Parker's Range	17	1
Broad Arrow	165	2	Collie Coalfield ... ..	...	1
Niagara	115	2	Yalgoo	135	1
Bardoc	135	2	Corsair Group	138	1
Yerilla and Mt. Catherine	38	1			
Mt. Jackson	28	1		3991	36

Table 7.

Returns showing the Number of Leases applied for and granted in the Year 1895 in the undermentioned Goldfields.

Goldfield.	No. of Applications.	No. of Applications Approved.
Murchison	355	284
Dundas	316	308
West Pilbarra	41	36
Yalgoo	162	155
Yilgarn	124	105
Ashburton	8	8
Pilbarra	208	206
East Coolgardie	2200	2117
North Coolgardie	870	848
Coolgardie	968	871
East Murchison	106	106
Kimberley	1	1

Appendix 1.

*Report on the Carboniferous Areas in the Irwin River basin by H. P. Woodward,
Government Geologist.*

From the Government Geologist to the Hon. the Minister for Mines.

SIR,

I have the honour to hand you herewith my Report and Map of the Irwin Coalfield.

I have etc.,

HARRY P. WOODWARD,

Government Geologist.

14-1-96.

THE IRWIN COALFIELD.

The Irwin Coalfield is situated upon what is generally known as the Upper Irwin, or, in other words, the area drained by the various Eastern branches of the Irwin River.

This tract of country lies between 30 and 40 miles from the coast, and is extremely fertile. The soil for the most part consists of rich red loam or clay, which yields, year after year, fine crops, even when cultivated in the most primitive manner. The great drawback in this district is the scarcity of fresh water, and to this fact may be attributed the small amount of settlement that has taken place, for had fresh water been easily procurable there is not the least doubt but that it would have been long ago a large wheat producing district, since the land can be cheaply prepared for the plough, and as there are no rock outcrops anyone taking up land can cultivate the whole of it.

The soil of this area is of great depth, resulting as it does from the decomposition of the carboniferous shale beds; it more nearly resembles that of the agricultural districts of England than that generally met with in this Colony, which is, as a rule, of no great depth except in the gullies, and even there outcrops of rock are often met with.

The carboniferous basin spreads out to the Eastward, covering a fan-shaped area, which is surrounded on most sides by cliffs of horizontally bedded sandstone, about 200ft. in height, which form the edge of the sandy tableland, and it is at the base of these beds, where they rest directly, but generally unconformably upon the shales, that springs break out at several places, which form the principal water supply of the district, since in most of the wells sunk brackish water has been met with, but where fresh water has been struck the supply proved generally to be too small to be of any great value.

Indications of coal were first reported to exist upon the Irwin River, by Gregory, in the year 1846, which report was a little later confirmed by the Geologist (Dr. Von Sommer), who stated that there were two seams 6ft. and 8ft. in thickness respectively, and it was upon this report that the Government declared a reserve of 10,000 acres. For over 30 years this important discovery was not investigated further; but, in the year 1879, the Legislative Council voted the sum of £100 in order to test the quality of the coal, with which object a shaft was sunk to a depth of 50ft., in which, although no coal was struck, the indications were considered promising. A little later the Government sent the Rev. Mr. C. G. Nicolay, M.A., who reported that, on account of the great quantity of water met with in sinking and the poor quality of the coal, the discovery was of no value.

The field was therefore abandoned until the year 1888, when Messrs. Bell and Eliot found some fragments of coal in the bed of the North branch, which proved to be of a very fair quality. These they traced up to their source, which they found to be a seam of about 4ft. in thickness, into which they put a drive 150ft. down the dip, but although it improved both in size and quality it did not prove at the time to be of sufficient value to induce them to expend any more money upon its development.

Another lower seam of smutty coal, about 2ft. in thickness, was also opened up, and about 10 tons raised, which proved to be of a rather better quality, but work was then discontinued owing to the breaking up of the company.

Some more seams were also opened up upon another branch, but they did not prove, at the time, of any value, on account of there being no local demand for coal, and also because the quality was not good enough for export.

The carboniferous area spreads out from Mingenew in an Easterly direction, covering an area of about 200 square miles, its greatest length from North to South, from Badgeree Pool upon the North branch to Mt. Scratch, being about 30 miles, whilst its greatest width from Mingenew to Narandagry, upon the Lockier River, is about 17 miles.

To the North-West this area is bounded by the high sandy tableland which extends away to the Northward as far as the Greenough River. The South is bounded for the most part by the low outcrops of metamorphic rock, which contains many copper lodes; to the Eastward by the bold escarpment of crystalline rocks, flanked by horizontally bedded tertiary sandstones, which often present towards the plains vertical cliff faces of as much as 200ft., particularly where streams have cut deep channels through them; whilst to the Westward it is bounded by more high sandy plains which extend as far as the coast.

Of these boundaries, that to the South and East may be taken as the definite edges of the carboniferous formation, but that to the North and West only as provisional, since the sandstones which form the high sand plain in these directions are of a much more recent date, and may overlie extensions of the carboniferous formation, and since we know that carboniferous rocks outcrop in the river valleys further to the Northward, it is highly probable that they are part of the same formation; and if this should prove to be the case, valuable coal deposits may be found beneath the high sand plains which lie between the Irwin, Greenough, and Murchison Rivers.

The carboniferous formation consists of a series of beds of shale, sandstone, and limestone, the latter being rich in lower carboniferous marine fossils, but since these beds dip under the coal bearing series, it is probable that the latter may belong to the upper carboniferous period, but this has not yet been determined.

The thickness of these formations exposed in cliff sections is about 300ft., but from trial bores, wells, &c., sunk on the plains further to the Westward, we know that shale beds of great thickness underlie the fossiliferous limestones.

The coal measure seen in section consists of:—						feet.
Yellow sandy shale, about	...	...	...	...	...	10
Coal	...	...	...	...	...	3 to 5
Sandy shale	...	...	...	...	...	10
Blue shale	...	...	...	...	...	10
Brown shale	...	...	...	...	...	20
Coaly shale	...	...	...	...	...	4
Yellow shale	...	...	...	...	...	15
Grit	...	...	...	...	...	6
Blue shale	...	...	...	...	...	4
Coal	...	...	...	...	...	2
Dark shale	...	...	...	...	...	20
Upper or coal bearing series						105

Here a break occurs, but as the recent ferruginous sandstone formation, which caps all the cliff, descends and covers the passage beds, it is impossible to say what relationship the upper series bear to the lower, which latter consist of:—

Mottled sandstone	...	...	...	...	...	20ft.
Calcareous sandy shales	...	...	...	...	...	40ft.
False-bedded sandstone	...	...	...	...	...	5ft.
Shaly sandstone	...	...	...	...	...	5ft.
Calcareous sandstones, often shaly (fossils)	...	...	...	...	...	30ft.
Blue gypsum shales (fossils)	...	...	...	...	...	20ft.
Blue shale	...	...	...	...	...	unknown.
Thickness exposed						120ft.

Mr. R. Ethridge, F.R.S., reports on a sample submitted to him:—"It is a dull, soft, impure, sooty coal, ignites quickly, and burns to a fine ash, giving out great heat. This sample, although impure, is not a lignite. It resembles 'Mother coal,' bands of which often occur in the coal measure seams, interbedded between thick coals of the best quality. It appears to me to have been taken from near the outcrop, or at a little depth from the air. No woody, earthy, or sedimentary matter occurs in this sample, and although far less valuable than Nos. 1 and 2, yet it is quite equal to much of the coal used on the North German railways, and is (although inferior) a true coal measure coal and not a lignite. No evidence of a ligneous structure could be observed under the microscope."

The fossils are all of characteristic carboniferous age, and although there are no coal measure plants, there is no reason to doubt that the coal seams and associated limestone belong to one and the same age, *i.e.*, carboniferous.

The coal itself occurs in thin seams mixed with coaly shale; it is dirty to the touch, and contains so much water that it falls to pieces on exposure to the atmosphere.

Two assays made in London gave the following results (No. 1 was by Mr. Harland, and No. 2 by Mr. Wingham), whilst No. 3 was made in Perth by the Government Assayer:—

Water	...	...	17·04	...	12·4	...	15·63
Volatile matter	...	...	28·61	...	32·2	...	23·06
Fixed carbon	...	...	41·29	...	43·5	...	39·32
Ash	...	...	13·06	...	11·9	...	21·99
			100·00	...	100·0	...	100·00
Sulphur	..	...	...	...	0·83	...	Trace.

The large amount of ash may, in part, be due to extraneous earthy matter. The coal cannot be utilised for gas making, as it does not cake, and the coke formed, being in powder, is valueless; but the coal can be used for steam boilers and household purposes, and for those metallurgical operations in which a particularly high temperature is not required.

All these samples, it must be remembered, are of highly weathered coal, and were taken from or near the cliff face. If any samples were assayed from the end of the drive they were done privately for the company, and the results are not obtainable, whilst at present the drive is full of water. When it is remembered, therefore, that it is only outcrop coal, we have every reason to predict that it will improve greatly when opened up further, and should prove to be a very similar coal to that being worked at the Collie.

The Midland Railway Company, upon whose concession the Coalfield is, have put down several bore holes to test it, but most of this work has been done without system, whilst in the deepest bore, which is something like 500ft., they abandoned work just as they struck black shale. The known outcrops are almost upon the line of the proposed railway between Mingenew and Mullewa, and therefore will be of great value to the Murchison Goldfield, where the great scarcity of fuel is already being greatly felt. Therefore, although it is not a first-class coal, it should be able to hold its own against imported coal, when we consider the extra handling, shippage, carriage, duty, &c. We may therefore hope before long to see this long neglected field the centre of a thriving industry.

A belt of carboniferous country, about 20 miles in width, extends from the Irwin River to the Northward, crossing the Greenough, the Murchison, the Wooramel, the Gascoyne, the Lyons, and Minilya Rivers, then spreading out over the Henry, Ashburton, and Fortescue Rivers, and forming the great tableland at the head of the DeGrey. It is true that up to the present only carbonaceous shales have been found, and the fossils all belong to the lower carboniferous or even to the Devonian series, but when the enormous area over which these rocks extend is taken into consideration, and that they dip under the Mesozoic formation to the Westward, it is highly probable that true coal measures do exist further North than the Irwin; but this point can only be proved by boring, and this work should be started at once along the Cue-Geraldton railway where it crosses the sand plain to the Westward of Mullewa.

HARRY P. WOODWARD,

Government Geologist.

14-1-96.

Appendix 2.

Report on the Yalgoo Goldfield, by H. P. Woodward, Government Geologist.

From the Government Geologist to the Hon. the Minister for Mines.

SIR,

I have the honour to hand you Map and Report of the Yalgoo Goldfield. I am sorry that I was unable to carry out my original intention of making detailed maps of the chief centres; but, since no map of the leases had been published at the time of my visit, this was impossible.

I have, etc.,

HARRY P. WOODWARD,

Government Geologist.

11-2-96.

This Goldfield, although only declared in 1895, had been worked for some years previously as part of the Murchison Goldfield, but since the principal workings were so far from the official centre of that field, it was decided to divide the field into two. Gold was first discovered upon this field at the Nancarrong Hills in 1890, but as this discovery did not prove to be of any great value it was abandoned, and nothing more done upon the field until 1894, when the rich discovery at Yalgoo, later on known as the Emerald Mine, was made. Since, the gold has been found at several places along a belt of country which runs in a North-Westerly direction from the Lakes Monger and Moore to the main Cue road near Chain Pump.

The main mining centres of this goldfield are nearer the coast than any other in the Colony, Yalgoo itself being about 150 miles from the coast. This field embraces what was the Western portion of the Murchison Goldfield, and is situated upon the high ground immediately behind the range which rises at the head of the Irwin River. It is drained by the Murchison and Greenough Rivers, whilst to the Southward all the streams discharge themselves into Lake Monger; of these the Greenough River drains much the largest area; in fact this goldfield may be said to be situated upon the upper courses of that river. The surface is broken and hilly, small stony sides or granite hills rising abruptly from alluvial flats. As a rule it may be called well watered country, and the water is generally fresh, but it is rather doubtful whether any large supplies will be obtained in depth. Both timber and firewood will be serious items in the near future, but since the railway will cross this field shortly this difficulty may be overcome.

The principal centres of the field are Yalgoo, Carlaminda, Melville, Gullewah, Pinyalling, Woodley's, Damperwah, and Nancarrong.

Yalgoo, which is the official centre, is situated upon the Cue Railway. The reefs occur in a broken belt of schistose country, the strike of which is East and West, whilst the diorite dykes and lodes mostly follow the same lines. Many of these veins were extremely rich, particularly one called the Emerald, where a very showy deposit was discovered, but which, when the company that had purchased it started to work, proved to be, instead of the cap of a lode, a small almost flat reef, with no defined formation, and of no extent. Several of the other lodes here are nothing more or less than lenticular bunches of quartz, and although often pretty rich they will not pay since there is no great quantity of stone. There are a series of small reefs with a more North and South strike, which are more likely true lodes, but they are so small that they will scarcely pay deep work. A few miles North of Yalgoo a cap of a large reef carrying gold has been discovered, but it is not probable that it will increase its size along its strike. The stone has a promising appearance and is highly mineralised, but will be found to contain sulphides in depth.

The "Joker" line is also a few miles South of Yalgoo, where a series of rich veins strike off from a large dyke.

At Carlaminda a reef about 2ft. 6in. has been taken up and tested for about a mile along its outcrop. It has a good formation and will, probably, continue in depth. It is rather small, but should the stone prove to be rich it may pay very well.

Melville is situated a little further North on the same belt of country, but at the point where it is suddenly cut off by the granite, the country is much broken, the reefs strike in many different directions, and are mostly of the same lenticular form as at Yalgoo. They are not true fissures lodes, and will not probably be of any extent, although the large rich masses of stone may pay very well to crush.

At Gullewah are a series of small reefs, some of which are pretty rich, but they are rather small to work.

At Pinyalling, which is situated on a ridge at the East end of Lake Monger, are a series of very promising reefs; they are not particularly rich, but carry fine gold all through the stone. They have a very good formation to a depth of 100ft. (as far as tested), but the great feature is the abundance of stone, for the reefs are of considerable size, and there are so many of them.

Woodley's and Damperwah are situated further to the Westward, at the Southern end of ridges of schistose country, which are cut off by granite outcrops. The exact positions of these finds are uncertain, but it is generally believed that they are outside the boundary of the Yalgoo field. Several other small finds have been made about Mt. Singleton, near Lake Moore.

At the Nancarrong Hills, a few miles East of Yeuwin sheep station, a few reefs have been worked off and on during the last five years, but never with any success.

Upon this field it will be found, as a general rule, that the more or less North and South lodes are true veins, and may be expected to continue in depth, whilst many of the others which have a more or less East and West course will be found to be only purely local bunches, and will cut out. This is a great pity, because some of these contain really good stone, and are of a considerable size, whilst many of the true veins are either too poor or too small to work.

The great point this field has in its favour is its proximity to the settled districts, which so greatly reduces the price of cartage.

The belt of country which should be thoroughly prospected extends South from Yalgoo to Lake Monger, and it is highly probable that some very good discoveries will be made.

There are three large crushing plants upon the field, one being at Yalgoo and two at Melville, whilst a third small plant is at Nancarrong. These batteries crush for the public, so that there should be no difficulty in working the reefs in these districts, as no outlay is required, therefore it is not necessary to put them into companies, and if a man has anything really good he is certain not to want to do so.

Appendix 3.

ORE DEPOSITS OF COOLGARDIE AND KALGOORLIE.

Report by the Government Field Geologist.

Mr. S. Göczel, late Government Field Geologist, forwarded the following report to the Minister of Mines, prior to his resignation.

GENERAL REMARKS.

Practical utility has necessarily been the leading motive during all my investigations, and as these have had to be extended over a stretch of country exceeding the area of the United Kingdom of Great Britain, it appears evident that I could not devote much time to special geological details.

The geological and physiographical similarity prevailing, more or less, throughout the whole of the interior gold region, has enabled me to generalise my observations in my earlier reports.

In explaining the various features, I have made use of universally recognised natural laws and geological principles which are based on, and can be proved by, exact science.

The interior gold region from a geological point of view presents, like its flora, fauna, and aboriginal inhabitants, Nature's progressive work during a relatively early phase.

However embarrassing to us the unprepared encounter with forms and features of such early phases may appear, we must remember that they are results of the identical forces of nature, the actions and reactions of which we may perceive every day. If those results differ from objects of our habitual observations, properly directed investigation will generally prove that the differences are due to simplified conditions under which the genetic and transforming actions of the natural forces took place.

Keeping the above in view, the investigation and explanation of the various geological features within the interior gold region are facilitated. During the present rapid progress which gold mining in this Colony, and chiefly in the interior gold region, is making, more and more insight is daily offered into the nature of the auriferous deposits, and also into the conditions under which they occur.

The financing of mining enterprises now chiefly occupies the attention of the mining community, and generally during such a period, the practical operations at the mines are made more or less subordinate to the above purpose. Under those circumstances, for obvious reasons, it becomes advisable to defer detailed description of particular mines, and my written instructions tend also that way. In most cases the development of good gold deposits into good and payable gold mines will depend on the *modus operandi* which the owners adopt.

Mining, within the interior gold region, has not yet advanced sufficiently to admit the forming of opinions as to the latter point. The practical geologist and mining engineer is, therefore, enabled only to form a justified opinion as to the quality and condition of an ore deposit, but his judgment as to the payability of mining enterprises he will have to reserve till the time when it becomes possible for him to judge the direction and management of such mining enterprises, not only by the social standing and wealth of directors, but from the course pursued in the financial as well as in the technical steering of those enterprises.

The future interests of the gold mining industry recommend systematic geological work, such as geological surveys with special regard to the water supply problem, a general and detailed description of the various gold mining centres, and, in conjunction with the latter, also descriptions of developments in prominent mines, which can be periodically supplemented.

The geological survey of the various gold mining centres, as pointed out in my instructions, requires a topographical basis upon which to work. Such a basis is in no instance as yet available. The execution and completion of such a work wholly requires, on account of the extent of the various gold mining centres, exertions of a numerous staff for a number of years to come.

The economical and satisfactory solution of the water supply problem, upon which solution the degree of development of the gold resources within the interior region is dependent, requires a special preliminary investigation. Practical geology on a scientific basis offers here valuable help to the prospector during his search, to the miner during the development of gold deposits, and the water supply engineer, if his intention is to draw effectively potable water from subterranean stores, will have to base his operations on the data supplied by geological investigation.

The publication of reliable geological knowledge, relating to the nature and extent of useful mineral deposits, supplemented by geological plans and maps, besides the above referred to advantages accruing directly to those already engaged in the production of mineral wealth, offers also one of the most important means for the maintenance of the financial support and confidence of the outside world. The importance and influence of this financial confidence in the development of the gold mining industry within this Colony, and therefore also in the destiny of the latter, makes itself felt at every step, and needs, therefore, no further comment.

By reading my previous reports it can be seen that I have taken the preliminary steps in the above indicated direction. The present report is a supplement to the knowledge of the ore deposits of Coolgardie and Kalgoorlie in particular. On account of the prevailing similarity of the geological features within the interior gold region, the matter treated in this report will, in many respects, apply also to other gold mining centres. The reason why my exertions during my last sojourn on the fields are less fertile than they have previously been is known to the Department, and need not be further spoken of here.

COOLGARDIE.

In the vicinity of Coolgardie a contact zone between gneissic granite (which is partially overlaid by contact conglomerates) from the West, and diorite and dioritic schists from the East, 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 eruptive magma rose through the widest portions of the fissures until it became solidified within by successive cooling. Intermediate open spaces in the main fissures, to which spaces volcanic magma had found no access, and countless branch and lateral fissures became, later on, filled by secretion or by the deposition of mineral matter derived from deep-seated solfatara solutions. For these solutions the open spaces and fissures have served as vents and channels.

The country formation in which those lodes occur is chiefly diorite and dioritic schist, and the eruptive rock material forming the principal lode contents of the main fissures is usually closely related to the country rock. Describing those occurrences in terms which are well understood in Australia, we may say we have here dioritic dykes running in diorite country formation. Those dykes consist usually of diorites, diorite porphyries, and porphyrites. The rocks of the dyke outcrops and those of the country formation, on account of their relationship and also on account of the general surface alteration or decomposition, offer usually only slight contrasts. In some instances country rock as well as dyke present schistose texture received conjointly through dynamic pressure.

The general alteration of the paleozoic greenstones has chiefly produced chloritic features, and to this general alteration is also due the predominant chloritic character of the dyke-forming rocks in their upper portions. In some instances we meet kaolinous features of altered or decomposed greenstones. Such kaolinous decomposition has sometimes affected the country formation as well as dykes; but almost in every instance we find such features confined to true fissures or to the vicinity of such. There can be no doubt that an exceptional decomposition of similar and identical rocks must have an exceptional cause. A most natural and, in some instances, traceable cause for the kaolinous decomposition of the paleozoic greenstones appears, "solfatara action," which generally is a sequence of volcanic activity. In the greenstones affected by such action, the feldspars became altered into amorphous silicate of alumina, the amphybole and pyroxene minerals and biotite into a talcose mineral substance, whereas oxides of iron, under the reaction of solfatara waters and exhalations, have formed pyrites. The latter, in consequence of the gold yield of the solfatara solutions, are auriferous. The oxides of iron concurring in that process were in part originally contained in the eruptive rock, in part derived from the decomposed ferruginous amphybole and pyroxene minerals.

The auriferous pyrites, when not affected by a succeeding decomposition progressing under the influence of surface waters and air, impregnate the altered rock in form of countless small hexahedrons. The solfatara solutions have risen from their deep-seated place of generation under gas pressure, and have most probably received their gold yield from a leaching process acting on the archæan substratum. If solfatara action occurred alongside, or in broken portions of dykes, not only the breaks and contraction-fissures which were accessible for rising mineral solutions became filled with auriferous quartz, but often also to portions of the dyke, and adjoining country-rock, an auriferous character became imparted.

The compound lodes, as described in my first official report on the Central Goldfields of Western Australia (p. 29), are of such origin, and the workings in Tyndal's Mine near Coolgardie show a typical representation of this class of gold-ore deposits. The dyke-fissures near Coolgardie were accompanied by a great number of branch and lateral fissures, which gave occasion for the formation of single lodes and quartz reefs. The shallow gold-deposits in the so-called flats near Coolgardie are of lacustral alluvial origin, and their gold is derived chiefly from destroyed portions of primary deposits. It appears most likely that, as well as portions of auriferous lodes and reefs, a number of primary surface gold deposits have also succumbed to lacustral erosion, and that such surface-deposits have supplied the larger portion of the alluvial gold found in that locality.

Most of the dykes in the vicinity of Coolgardie have a general Northerly course, and converge more or less Southwards. The lodes and reefs accompanying those dykes, on account of their auriferous character, are objects of a great number of mining enterprises. Occasionally some portions of the main dyke fissures which chiefly contain eruptive rock material, appear as quartz reefs of comparatively short extent, and with bulky outcrops (quartz blows). Those features are in some instances also more or less auriferous.

KALGOORLIE.

The auriferous deposits in the surroundings of Kalgoorlie, considered systematically and also practically, may be classed as two distinct types, although they are of a similar and probably contemporaneous origin. The representatives of these types are respectively the Hannan's Hill-Maritana series and the Great Boulder-Brown Hill series. Both series of ore deposits appear in conjunction with eruptive lodes or dykes. The contents of the branch and lateral fissures, as well as those portions of the lodes which became fractured, and have served in conjunction with those branch and lateral fissures as solfatara and thermal vents, are highly auriferous. The difference in both series of gold deposits lies in, and is chiefly caused by, the different country formation in which they occur.

The auriferous lode material in the Great Boulder-Brown Hill series of lodes consists, besides chloritic talcose and serpentinous gangue of a loose and porous gossan, quartz, and silicious sinter. Portions of those lodes contain sometimes massive eruptive rock, which, in form of magna, has centered the fissure from below, and became solidified within. The Brown Hill lode offers such an example. Mineral solutions have entered the diabase schist country formation, where least resistance was offered, that is along fissures. Those solutions, along their channels, have highly altered the country rock, and caused its ore impregnation. The country alteration and ore impregnation retains a true lode appearance. The course of most of those lodes follows more or less the predominant North of Westerly strike of the schistose country formation, and they have generally a steep but varying underlay.

The gold in those lodes which are locally called "formations," as far as they are opened up, occurs almost entirely as free gold, but in two allotropic modifications, namely, as the usual yellow gold with metallic lustre, and also as amorphous gold of brown, red, and purple colour. Samples of the latter assume, by heating, and also by rubbing in the agate mortar, the usual gold colour. This modification is more resistive against amalgamation, but dissolves easily in chlorine, or cyanide of potassium—facts which recommend themselves to consideration where gold-extraction from such ores is concerned.

The free gold found in the upper levels of those lodes was originally only partly deposited as such. A large percentage of this only became liberated after the decomposition of sulphites, with which the metal was previously associated, and in conjunction with which sulphites it will be found to occur at lower levels. In order to comprehend this better, it will be advisable to follow the chemical reactions which, in these lodes, most likely have occurred. An abundance of pseudomorphs of brown hematite after pyrites proves their original presence. The auriferous pyrites, by gradual access of air and surface water, became chemically affected. During the succeeding process, ferro-sulphates (FeSO_4) and free sulphuric acid were formed, and sulphuretted hydrogen evolved in the meantime. Ferro-sulphate, under presence of air, oxidizes into ferri-sulphate, $\text{Fe}_2(\text{SO}_4)_3$. This chemical compound, according to Le Conte and others, is capable of dissolving small quantities of gold, whereas ferro-sulphate precipitates this metal. Those reactions, in all probability, have played a most important rôle in the decomposition of the upper portions of those auriferous lodes, and in the simultaneous gold concentration. In pursuing this process further, we find that the ferri-sulphate transmits oxygen to the sulphites, transforming them into sulphates, and becoming in the meantime reduced to ferro-sulphate again. The regenerated ferro-sulphate oxidizes again into ferri-sulphate; and if the latter meets no sulphites upon which to act, it forms partly insoluble basic sulphates, and partly alters into hydrated oxide of iron, which latter is not likely to become subject to further alteration.

The surface waters entering and percolating through the rocks soon absorb lime, and contain more or less of this substance in form of carbonate in solution. On this account they act upon the basic sulphites, and the results of this reaction are hydrated oxide of iron, carbonic acid, and gypsum. The latter being soluble in water, only hydrated oxide of iron remains as final residue from this portion of the process. Besides the above-mentioned process of natural gold concentration, during the general decomposition of the upper portions of those lodes, several others may have also concurred. Sulphuric acid resulting from the decomposition of pyrites, with oxide of manganese and chloride of sodium or common salt, which in this instance is almost omnipresent, are capable of forming chlorine. The latter coming in contact with gold, forms soluble chloride of that metal.

Alkaline super-sulphides, the presence of which, in this instance, can be accounted for, are also capable of dissolving gold. Such gold solutions, forming gold precipitates by coming into contact with sulphuric acid, may have also taken part in the natural gold concentration within the upper levels of the lodes.

The solubility of gold in sodium-carbonate or sodium-silicate solutions, as Dölter has proved, supplies one more possibility for natural gold concentration.

From the above it can be seen that careful observation of the decomposed portions of such and similar gold ore deposits in conjunction with detailed chemical analyses, permits reliable approximate estimates as to the nature and richness of those gold deposits in their lower undecomposed portions.

The Great Boulder Proprietary, the Associated Gold Mines of Western Australia, the Ivanhoe, the Hannan's, the Brown Hill, and several other Gold Mining Companies are occupied in the exploitation and development of gold ore deposits of the above description.

S. GÖCZEL,
Government Field Geologist.

Report on the Deposits of Auriferous Cement at the "25-Mile" workings, Coolgardie Goldfield, by S. Göczel, Field Geologist.

To the Secretary for Mines.

SIR,

Coolgardie, August 5th, 1895.

In addition to my telegraphic report on the so-called cement deposits, I beg to state as follows:—

The auriferous deposits in question are situated about seven miles in a Northerly direction from the "25-Mile" (Coonahion). They appear as banks and cappings, and, although partly covered by more recent surface formations, they must be regarded as surface deposits.

Lithologically considered, the rock of which those 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 principal component elements in the auriferous deposits are:—

1. Sharp-edged quartz grains derived from the decomposed country formation;
2. Quartz-brecciac, derived probably from secretion veins which were contained in the decomposed country formation; and occasionally
3. Small, rounded, and smoothened quartz pebbles.

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

In some portions the auriferous rock presents porphyritic habitus, and in such places the cementing matrix assumes felsitic character.

The transit from the silicious into the felsitic matrix is in some instances abrupt, in others gradual.

The gold occurs embedded in the matrix, and the gold particles are frequently visible to the naked eye.

Partial crystalline development on some of the observed gold particles, and the absolute absence of a waterworn character, admit only primary deposition from a solution.

In some of the ferruginous portions pseudomorphs of brown hematite, 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.

Genetically identical auriferous surface deposits occur in many places within the interior auriferous region. Lithological differences find full explanation in the difference of the country formation in which the thermal vents were situated, and also in local conditions.

Such gold deposits within the interior auriferous region, wherever they have proved to be payable, have been worked by the digger.

The surface gold deposits within the interior auriferous region are sometimes of primary, sometimes of secondary origin; but it would be a difficult matter to draw a practical line of distinction between the two.

Joint occurrences and gradual transits produce that difficulty. An attempt to draw such a line of distinction between surface gold deposits would only widen the field for litigation and paralyse part of an energy which has proved of great value to the advancement of our gold-mining industry.

I have, &c.,

S. GÖCZEL,
Government Field Geologist.

Appendix 4.

*Report of a Visit to Nullagine, Pilbarra District, to examine the country reported to be
Diamond yielding.*

To the Hon. Sir J. Forrest, K.C.M.G., Premier.

SIR,

In accordance with the arrangement made with you in October last, I proceeded to Roebourne per s.s. "New Guinea," sailing on 5th November, and having obtained a suitable vehicle and horses, together with the necessary stores, tools, &c., made a start on the 18th of the same month for the Nullagine, in which I had ascertained the supposed diamond field existed.

While staying at Roebourne, a digger from Nullagine showed me five small diamonds, which he stated he had taken from the gravel remaining in the stamper boxes after the crushing was over; they were undoubtedly diamonds of good quality, but very small and of little market value.

On arriving at Nullagine I was taken by Mr. Muldoony, the constable in charge of the district and the Mining Registrar, to a small valley about $1\frac{1}{2}$ miles distant and shown two places where diamonds had been found, in fact all the diamonds with the exception of two. These places were on the tops of little hills, one in the centre, and the other at the side of the small valley; the hill in the middle, known as Brooks' Hill, was composed of decayed slate covered by a thin layer of decomposed conglomerate. Here nearly all, or at any rate the greater number of most valuable diamonds were washed out by Mr. Brooks while working the ground for gold. On the other hill the diamonds found were taken out of the stamper boxes after crushing a few tons of conglomerate, of which this hill is wholly composed.

There is no doubt, in my opinion, that the diamonds are enclosed in the conglomerate, a sample of which accompanies this report, and such as have been found by the diggers in washing for gold have been released by the gradual decay of the rock.

This bed of conglomerate rock I believe to be of considerable extent, probably about 20 square miles, and is composed of conglomerate boulders of a much older date and finer texture mixed with quartz, granite, basalt, slate, and oxidized clay. These have been cemented together with iron in some form (many of the hills on one side of the conglomerate are capped with iron ore) and then heated, setting into a compact mass that requires crushing power of considerable force to reduce it; the force is so great that the diamonds, at least those of any size, would be broken by the stampers.

On the last day of my stay in Nullagine, I was present at the cleaning up of the battery after crushing about two tons of stone taken from the hill situated at the side of the valley previously mentioned, and from which hill the digger I met in Roebourne had obtained the five diamonds. On carefully panning off the gravel left in the stamper boxes, nine small stones were found, varying from the size of a pin's head to a pepper corn, or from $\frac{1}{16}$ to $\frac{1}{2}$ carat in weight. I put the lot into the scales; they weighed $1\frac{1}{2}$ carats, and it took the four largest to weigh one carat.

I was informed that Mr. Brooks found one diamond, for which he obtained £76; another he sold for £28. These, with one other, valued by the finder at £12, were all the diamonds I could hear of as having been found of any value; the last mentioned stone was described as being bright yellow. As the Nullagine has been worked for gold for seven years, and the three above mentioned were the only marketable diamonds I could hear of, it is not at all probable that large diamonds will be found in the neighbourhood; and there will never, in my opinion, be a diamond field found in the Nullagine district. The conglomerate rock is not sufficiently weathered or decayed, consequently very few diamonds have been released. There may be places where the older conglomerate beds exist, or where the detritus from the rocks composed in the older beds may be found that have not been cemented together, and where the diamonds may be found that would prove payable; but these places would require to be searched for, and a considerable sum of money would be required for that purpose. In either of the last mentioned places it is probable that the diamonds, if they exist, could be obtained by the simple process of washing the soil and passing the remaining gravel through suitable sieves.

The tracing of the conglomerate to the place where the rocks were first formed would prove a very interesting study to a geologist, and might prove payable not only to work for diamonds but for gold as well, as these extensive beds of conglomerate at Nullagine are gold yielding, and at the time of my visit were marked off as claims; some of which claims are now being worked, I understand, with profit to their owners.

I have, etc.,

FRED. F. GROOM.

Perth, 27th January, 1896.

Appendix 5.

*Report on the Pilbarra Goldfield, 1894-5, with references as to its Geological character
By S. J. Becher, Acting Inspector of Mines, Northern Goldfield.*

At the present time the chief mining centres of the Pilbarra Goldfield are Marble Bar, Nullagine, Bamboo Creek, Talga Talga, Northern Shaw, Western Shaw, Tambourah Creek, Pilbarra, Egina, Mallina, Croydon, Nickoll, and Whim Creek. There are also several outlying camps around the above-mentioned centres, which will, in course of time, become distinctively known.

Marble Bar being the main centre, and being also the headquarters of the Warden, claims first consideration. Spacious Government buildings, costing something like £10,000, and comprising Court House, Warden's and Registrar's Offices, Police quarters, Post and Telegraph Office and quarters, all built of handsome local stone, rise from an eminence and overlook the growing township. An additional air of importance will be added to the place upon the erection of the Hospital and the Warden's and Doctor's houses. Two stores and two hotels do a brisk business, which, with a few mining and commission agency offices, &c., are an index of the present and future prosperity of the field.

There is a weekly mail service, and the telegraph line connects with the main line at Condon.

Though it is only a matter of years since the Marble Bar Field was first worked for reefs, wonderful progress has been made considering the adverse circumstances. Several groups of properties in the neighbourhood are owned by English companies, and systematic development is being carried on. There are also mines held by Victorian and Queensland companies, besides those held locally.

At the Ironclad Mine a boldly outcropping reef of great width is being systematically worked. The owners have erected a fine crushing plant of 15 stampers with copper plate and blanket tables, also two Cornish boilers, engine, and pump.

A Queensland company are sinking a deep shaft on a "block" lease to cut the reef in depth.

At the Stray Shot mine much work has been done on good stone, and the crushings for the past two years have been, and still continue to be consistently good. Here there is a five-head battery, copper plates, and blanket tables, boiler, engine, and pump. Additional machinery will shortly be erected. The water supply both on this mine and the Ironclad is derived from wells, the water being returned thereto after passing through settling pits.

At the "Coongan Mine," better known as the "Augusta," also a great deal of work has been done underground, and a considerable quantity of stone awaits the completion of the milling plant. Huntingdon mills, tables, stonebreaker, engine, and pumping plant are in course of erection.

Amongst other prominent local mines are the Coongan Star group, True Blue, Rejected, and White Angel.

The whole appearance of the country proclaims it a reefing field. Quartz reefs, quartz blows, and quartz sheddings are to be seen on all sides. The reefs vary in size and in character, some of the richest being highly, though not deleteriously, mineralised. The general character of the country is hilly, and broken with surrounding flats and plains. The main ranges strike about North-North-East, with broken and some times rounded hills intervening. Most of the auriferous reefs occur either in magnesian limestone, locally termed "opaline," or have this and diorite for their walls. A vast boulder-strewn granite plain lies to the East, and reefs intersect the granite, but are not sought after. To the West, flowing Northwards, is the Coongan River.

A considerable amount of gold has been obtained from alluvial in past years, but is now mainly derived from the mines.

Bamboo Creek.—Although of more recent development than Marble Bar, can boast of a large extent of workings, and a very considerable amount of systematic mining development and progress.

Several individual properties have been proved to be very valuable, and there is not a doubt that many more will yet rise above the average and come to the front.

There are two batteries at work, and a third is being erected.

English capitalists have, during the past year, secured several groups of first-class properties, and Queensland capital has also played a part in the progress of the field. There is a healthy tone of solid work and progress about the place which shows that its resources are good. Two hotels and several boarding-houses have crowded tables. The mail service is once a fortnight, and there is a Post and Telegraph Office.

Crushings from the various mines are consistently good, and the output of gold is large considering the infancy of the field. Among the best mines may be mentioned the "Bulletin," Bamboo Queen, No. 1, and Mount Prophecy. The water supply is obtained from wells, and seems to be abundant. Timber is very expensive owing to the distance from which it has to be carted. The character of the country is very rugged, and the township is situated in a deep valley through which the Bamboo Creek runs. The main range of granite and granitic rocks striking North-East lies a little to the East of the field. The mines and workings for the most part being on two lines or belts of "opaline" and diorite ranges, running parallel to the main range. The backbone of one of these lesser ranges is an immense quartzite, or quartz and jasper dyke. Traces of gold have been found in this dyke, and prospecting work is being carried out thereon. The present field is about three miles long by three quarters of a mile wide, but there

is little doubt that it will extend greatly as time goes on, especially South-Eastwards towards the Little DeGrey River. The auriferous quartz of the district is characteristic, and is highly mineralised with iron, copper, lead, and manganese. Calcite and carbonate of iron veins are locally considered favourable indications of gold. The reefs taken as a whole are small on the surface, but widen out well in depth. This is particularly well shown in the celebrated "Bulletin" mine, where the lode in places widens out to 10 or 12 feet in thickness at about 60 feet in depth. The gold occurs both in rich coarse chutes, and also well disseminated through the stone. Like most of the other fields, Bamboo Creek owes its origin to alluvial gold finds. Much alluvial gold has been won from the gullies in the form of slugs and nuggets as well as fine gold.

Talga Talga.—Fifteen miles Northwards from Marble Bar is another field which is fast making a name for itself. Attention was first paid to it by dryblowers, and in times past a considerable amount of gold has been won from the gullies. During the past year a very rich creek bed has been worked adjoining the celebrated "McPhee's Reward," and some £2,000 worth of gold has been found in the wash, occurring in the form of slugs, weighing from an ounce up to 10 or 12lbs., the larger ones carrying, in some cases, over 100oz. of gold; these slugs being the debris, in all probability, of past ages from the main "Reward" line of reef, in which rich shoots are being worked in the mines. English capital has during the past year become well represented, and, in fact, now owns nearly the whole of the mines in this locality. This will undoubtedly give an impetus to mining, and, in a few years, Talga should be a thriving township. Here, as at Bamboo Creek, the reefs are found in "opaline" or diorite country. An immense dyke of quartzite, quartz, and jasper intermingled, rises some 200 feet high along the crest of the main range, forming a backbone to it. This bears slightly East of North and underlies Westwards, having been, together with other strata with a coincident general strike, much upheaved.

The general character of the reefs is of a large and well-defined order, the quartz being white or coloured, with ores of iron, copper, and manganese. Pseudomorphs of iron pyrites and cubical pyrites occur in great profusion in almost every formation; these are by some considered good indications of gold.

There is at present only one battery on the field, that on "McPhee's Reward," where 10-head of stamps, copper-plate and blanket tables and Berdan pan, with two portable engines and steam pump, have been erected. Another 10-head battery, belonging to the North-West Goldfields Co., is *en route*.

The Talga River is within three miles of the township, from which a good supply of timber and firewood is obtainable. Supplies will also soon be obtainable from the Coongan River-bed, four miles to the West, when a projected road is formed.

There is a direct mail service once a fortnight, and a telegraph office.

Nullagine, one of the oldest and best districts of the whole field, lies about 80 miles South-East of Marble Bar. Geologically it is perhaps unique. The general character of the country is that of table-topped hills about 200ft. high, intersected by deep ravines, gullies, and valleys, widening out into flats and plains in all directions. In the immediate neighbourhood of the township the main characteristic features are:—First and centrally, flat-topped hills having ironstone formations as "crust" overlying decomposed conglomerate matter; secondly, hills more rounded on top consisting of red and white cement and conglomerate deposits of varying thickness, some of the water-worn quartz being quite boulders in size. The conglomerate contains a great quantity of ferruginous matter, and this apparently carries most of the gold, which occurs in a fine state.

The central hills seem to have been the result of denudation and decomposition of the material of the surrounding conglomerate and other formations. For the past six or seven years there has been a steady output of alluvial gold from this field. Every gully has been systematically worked, the wash being screened and then carted down to the pool in the river for puddling and washing. The screenings, &c., have even been re-worked at a profit by dry blowers. It was noticed that the "runs" of gold extended up the hill sides from out of the creeks and gullies. These runs were followed up the surface rubble for a few inches in depth, being all put through the dry blowing machines, until the run ceased, when it was found that the original source of the gold was a seam or perhaps a big lode of conglomerate, whose outcrop was on the contour line where the run of gold ceased extending up the hillside. Though alluvial work is still carried on, more attention is now paid to the conglomerate lodes, which are being extensively worked and put through the battery with payable results. Of late, too, some very rich reefs have been found a few miles out, in what is locally known as the "claypan" country.

Crushings from the outcrops and superficial works on these reefs are returning from 2 to 4oz. per ton, and their prospects of permanency in depth are, it is said, good. The conglomerate lodes have attracted the attention of English capitalists, and there will soon be extensive works thereon in operation. At present there is a crushing plant of 10 head of stamps and machinery erected near the township, a good water supply being derived from a well having a crosscut driven into the subterranean wash of the river bed.

A question of great interest, and about which there has been much discussion, bearing on the future of the Nullagine is the finding there of diamonds. That diamonds have been found seems to be an established fact, though they have only been very small ones. It was lately reported that 30 small diamonds were found when cleaning up the battery boxes after crushing some conglomerate. This points to the conglomerate as the matrix, hitherto a moot question. There may have been larger crystals in the matrix which would have been certainly shattered by the falling stamps. It has been an unfortunate popular belief locally that diamonds are unbreakable, and larger crystals than those at present shown have been subjected to "test" with a sledge hammer. It is said to be the intention of an English Company that has lately acquired considerable property on the field to thoroughly test the possibilities of working profitably for diamonds. Teams cart machinery and goods from Roebourne or Condon. There is a fortnightly mail service, and a telegraph line is about to be constructed.

There are several outlying districts, notably the "Forty-mile," where good alluvial gold is obtained, and which will, when wells have been sunk, become reefing fields.

Between Marble Bar and Nullagine are two belts of most promising reefing country, as yet very little prospected, though good alluvial has been found thereat, namely, the "Salgash" belt, on the main road about 16 miles from Marble Bar, and the "Spring Gully" belt, which lies on the West side of the Coongan River and runs on down towards the celebrated "Sharks" and "Pantomime" country, where the "Little Hero" nugget of 333oz. was found. In both these localities there are splendidly defined reefs, and the geological formations are similar to those of Marble Bar, Talga, and Bamboo Creek. Until wells are sunk, however, these and other inviting localities cannot be properly prospected during the greater part of the year.

Westward and South-Westward from Marble Bar, on the course of the Shaw River, lie the North Shaw and Western Shaw fields, also the now deserted Shaw tinfields.

At *North Shaw* some of the reefs and ironstone formations are very promising, and some stone taken from present workings is very rich. Local conditions, geologically and otherwise, favour the probability of a brilliant future for this new field.

The Shaw Tinfields, once the scene of considerable activity, lie in the granite country to the East of the "Black Range," on the coach road from Marble Bar to Roebourne.

Cassiterite (tin oxide) of excellent quality is obtainable in the gullies and watercourses, but since the drop came in the price of tin, those who were at one time working at a profit found it would not pay any longer on account of the cost of transport.

The Western Shaw, although a field which has been well known for many years for its alluvial gold, is one of the new reefing fields coming quickly to the fore. The general character of the country, lying on the outskirts of the granite, is most attractive in its rugged nature and geological conditions. Immense quartzite or quartz-jasper dykes form the crests of ranges of diorites, "opaline," slates, and schists, all having a generally uniform bearing or strike slightly West of North. The strata are much upheaved and underlie Westwards.

Many large well-defined and continuous reefs are to be seen, and a considerable amount of work is being done on good stone. During the year several rich finds have been made.

A 10-head battery is about to be erected by an English company upon their property. There is apparently a good supply of timber, and water is obtainable at no great depth. The township is situated on the main Roebourne Road, and there is a fortnightly mail service.

Six miles Northward, also on the main road, is situated the recently opened reefing field of

Tambourah Creek.—Lying also on the outskirts of another vast granite area which stretches away North-Westwards. The character of the country differs from that of the Western Shaw somewhat; the hills being low and more rounded. The formations, too, consist mainly of hornblende schists, diorite, and opaline. The outcrops of the reefs are small, but they mostly widen out in depth. Very rich stone has been obtained from some of the workings, and the general character of the quartz is very "kindly." Some is highly mineralised with ores of iron, copper, and manganese.

From Tambourah Creek North-Westwards for some 80 miles along the Eastern side of the Yule River there extends a vast area of granite country, apparently reaching back Eastwards to the Upper Shaw country.

Pilbarra is situated on the West side of the Yule River, and on the Western skirt of the above-mentioned granite area. This is one of the oldest mining camps on the field, and gave its name to the field. A great deal of alluvial gold has been obtained here, but though there are still some dryblowers at work, more attention is now paid to the reefs, very rich stone being worked in some of them, notably on Mr. Laffer's leases.

The geological features closely resemble those of Marble Bar and adjacent fields. Large reefs outcrop along the ranges, and small rich leaders intersect the slates and "opaline," these probably being the source of much of the alluvial gold worked out in the gullies and coombes. The township is situated on the coach road and has a fortnightly mail service. A Roebourne gold mining company own a 5-head battery and plant, which is kept busy. Timber is easily obtainable, and water is got at no great depth.

Some rich reefing finds have lately been made about six miles North-West, at a place (also on the main road) now known as "Hong Kong," the original find having been made by a Chinaman. Several leases are in work, with excellent prospects on the line of reef, and trial crushings of small lots have given good results.

At *Egina* a wholly different type of country is met with. At present it is an alluvial field pure and simple, situated in an immense area of slate country. The dryblowers obtain the gold in almost every gully, watercourse, and depression where the ground is not too deep for them. In some instances phenomenally rich patches have been found. The district should be well worth prospecting for reefs.

At *Mallina* and *Peewah* the mines are mostly worked by British Companies, and a considerable amount of work has been done. One company has erected an extensive crushing plant, &c.

Within the past year a new reefing field known as *Towranna* has been opened about 15 miles South of Mallina. This camp is situated on low undulating ground at the foot of a spur of hilly country, the ranges radiating East to Egina, and South of West to Croydon. All the country around these ranges, and to a great extent all through them probably, is a vast area of slates, with intersecting belts of diorite and "opaline." This should, in favourable seasons, afford a wide and promising field to prospectors.

The reefs at Towranna occur in schists, slates, and porphyry. Much of the quartz is of a characteristically blue nature; the richer portions of the reefs and lodes, however, are mineralised with iron and lead ores. The gold occurs both in a coarse and fine state. Energetic developments are being made by an English company owning several leases, and good stone is being raised, notably on the Yellow Aster mine.

Croydon is a well-known alluvial field of long standing. Nearer Roeburne are the *Nickoll Mines*, where a considerable amount of work has been done with English capital.

At *Whim Creek* rich copper ores are found and worked. If the rumoured revival in the copper market takes place, more attention will probably be attracted to this district.

SUMMARY.

The most noticeable geological features of the Pilbarra Goldfield are the immense areas of granite country, consisting of vast boulder strewn plains and rugged ranges. Our granite range, called the "Black Range," runs in a dead line for 50 miles, only broken where the Shaw River flows through. These areas are separated by almost parallel belts of mineral country, striking slightly East or West of North, and bearing a great geological similarity to one another. The "opaline" or magnesian limestone seems to be the rock in which the auriferous reefs most frequently occur.

Were the conditions of price and local circumstances more favourable, there is no doubt tin would be again worked on the Shaw field, and further discoveries ensue. A railway from the coast to Marble Bar would reduce the distance of carting the ore from 250, as it now is, to about 40 miles.

Asbestos of a crude quality has been found in several localities on the field, and a superior article may be obtainable with further search.

Iodargyrite and other ores of silver are found, notably at Northern Shaw, sometimes in intimate association with free gold.

Auriferous antimonial ores occur at Mallina and Peewah.

The accompanying sketch geological map shows approximately the general geological features of the field; the exact location of Bamboo Creek, Nullagine, Tambourah Creek, Towranna, and Croydon being uncertain.

SEPTIMUS J. BECHER,
Acting Inspector of Mines,
Pilbarra Goldfield, W.A.

*Supplementary Report by Temporary Inspector of Mines, Northern Goldfields,
up to 30th June, 1896.*

To the Under Secretary for Mines, Mines Department, Perth.

Marble Bar, Western Australia,
June 26th, 1896.

SIR,—

I beg to report that, since my arrival here on the 9th inst., I have made an inspection of the majority of the mines in the immediate vicinity of Marble Bar, and that I intend, upon completion, to proceed to the Talga Talga District.

I am pleased to be able to report that mining around Marble Bar is at present active, and the prospects have never before been more encouraging. Very few leases are now in the hands of original private parties, consequently the work being done is of a more systematic nature than heretofore upon properties lately taken over.

I am, etc.,

S. J. BECHER,
Temporary Inspector of Mines, Northern Goldfields.

Appendix 6.

Report on condition of Mining Operations and Future Prospects of the Tin Deposits near the Blackwood River; furnished by R. Wachsmuth.

The Greenbushes Tinfields are situate in the South-Western portion of the Australian continent, and occupy a portion of the country between Bridgetown and Donnybrook. The highest point of the tinfield is over 900ft. above sea-level, being partly a densely timbered plateau. The field, as far as developed, is an alluvial field, but, as more prospecting is done, the lodes that exist there will no doubt be profitably worked. The mountain system in and about this district has a Northerly and Southerly direction, and is virtually a granite range, with basaltic outcrops near the margin of the Blackwood River. The granite here is slightly off the general direction that the granite ranges in Australia take. This is demonstrated by the fissures that occur in the locality. There is a true fissure lode at Greenbushes, on which a shaft has been sunk to a depth of 96ft.; it penetrates a crust of partly decomposed masses of granite to a depth of 60ft., and the tin stone that was discovered on the surface, and followed down through these broken masses, entered the solid granite at this point, and continued its perpendicular downward course between two solid granite walls to the 96ft. level. This fissure is filled with calc spar, in conjunction with various carbonates, broken mica flakes, and tin, the latter of which may be estimated at from 5 to 10 per cent., the tin being evenly disseminated through the material. The fissure runs 8° West by South and 8° East by North, and is therefore over 35° off the course of the natural granite break of Australia, but, as it runs at right angles to the leading range, this can be accounted for by the great volcanic upheavals that took place when the crust of this continent assumed a definite form. This fissure, in conjunction with other parallel fissures, may extend many miles on this course through the country, and they may contain good tin stone to a great depth. There are other fissures at right angles to the above described true fissures, which run parallel to the mountain range, but they are only shallow ones, and they take the direction in which the mountain system has been lifted in their immediate vicinity. Some of these fissures are filled with kaolin and tin crystals, and they have been profitably worked by alluvial miners to a depth of 15 to 20ft. The general break of the granite in the locality, though off the general course as stated, is still in the line of the great break that took place at the cooling of this earth's crust, defining the Southern coast of Australia. Its continuation is looked for at the foot of the Rocky Mountains in North America, in the direction of the Gulf of Mexico, where tin is profitably worked. The tin found at the Southern portion of the Australian Alps indicates another point in this great break, but, as the fractures there are very contorted and ill-defined, the tin industry there is likely to prove unprofitable. The great break to the South of Asia, where good tin occurs in the Straits Settlements, does not belong to the group of breaks referred to above, and is here cited only because the conditions of the tin stone and rocks are similar to those found in Australia, and more particularly to those of the Greenbushes Tinfield. Returning to the subject of the local tinfield, where tin lodes have so far been hardly touched, the stream tin there commands some attention. The stanniferous alluvial deposits that are formed from the detritus of tin-bearing lodes are here, as elsewhere, the first source of the tin-winning industry. The stream tin here occurs in almost all known varieties, principally the tetragonal prisms of diamond-pointed black tin and sparrable tin. This sparrable tin shows examples of the most imperfectly fractured tin stone in existence, no prismatic forms being visible in any particle of the ore. This is accounted for by the great antiquity of its formation. The tetragonal prisms here, are often striated vertically, and contain in some samples fully 76 per cent. of stannic dioxide, and the alluvial beds, where this tin occurs often in great abundance, follow the Easterly and Westerly course of the fissure lode above described. The style of mining the alluvial tin ground at Greenbushes is rather primitive, and is what is known in some parts as the "circumlocution" method, which is as follows:—A miner sinks a hole, and when he strikes washdirt containing half a pound of tin or upwards to the dish, he gauges the stuff out, and throws it on the surface, either directly or by benching; a pile is thus raised, and added to so long as the hole is practicable. When the hole collapses, the pile of dirt is barrowed to a convenient cart track, where, in course of time, a horse and cart is used to expedite it another stage, where it is tipped, ready to be barrowed to a good site adjacent to a puddle machine. Here it lies until barrowed into the puddle machine, and puddled by means of a horse pulling a beam round and round to which rakes are attached; the miner meanwhile pumps water into the puddler. When the tin stuff has been sufficiently puddled, it is once more barrowed to a sluice box, where it is got ready for being streamed. After the streaming operation the binoxide of tin is ready, when dried and bagged, to await the carter who will take it to the nearest railway station, to be handled and re-handled, shipped, transhipped, and re-shipped, smelted, and re-shipped for the English market. This "circumlocution" method, though a great success in providing healthful recreation to the miners, is, commercially, a great failure. The cause of this is, in reality, the total absence of water for nine months of the year, and until a method is improvised by which the stanniferous dirt can be dealt with in a more summary manner, the field will remain unprofitable to the few venturesome spirits still remaining in the locality. On the whole, however, the Greenbushes is a rich tinfield, capable of supporting a number of miners, but science and vigorous measures will have to be brought to bear upon it to make it remunerative.

Yours, etc.,

RUDOLPH WACHSMUTH,

Late Engineer of 10th Army Corps, Germany;

B.A. University of Göttingen.

Perth, 4th June, 1896.

Appendix 7.

*Submitting an important Paper on the Bromo-Cyanide Process by H. L. Sulman, Esq.
F.I.C., M.I.M. & M., for Departmental Annual Report.*

From Inspector of Mines, Central Goldfields, to Under Secretary for Mines.

Perth, 20th May, 1896.

I have great pleasure in submitting a most important and valuable paper on the above subject by Mr. Sulman, the discoverer of the process, one of the leading chemists of the day.

The process is in use at the Randt Mines, in Arizona, Hungary, Canada, and elsewhere, and is doing excellent and rapid work upon ores which the older cyanide process has signally failed to extract, and it is being brought into use at Day Dawn Mine, W.A., and Coolgardie. It is one of the latest and most discussed subjects in connection with mining.

I beg to recommend that this paper be inserted in the Departmental Annual Report.

FRANK REED,
Inspector of Mines.

THE BROMO-CYANIDE PROCESS FOR TAILINGS EXTRACTION.

By H. Livingstone Sulman, F.I.C., M.I.M. & M., etc.

The erection of the large "bromo-cyanide" extraction plant for the treatment of the tailings produced by the battery of the Day Dawn Mine, at Day Dawn, Murchison, having created considerable interest in the mining circles of this field, a short description of the process and its relation to somewhat similar processes may prove worthy of the attention of mine managers who intend to supplement their amalgamation returns by a subsequent treatment of their mill tailings.

The above process (patented by Sulman & Teed in Western Australia, No. 601, 1894) may be briefly defined as a development of the older cyanide process upon an entirely new basis. Amongst the chief advantages claimed for it are simplicity, shortness of the extraction period (economy in time permitting reduction of plant capacity), and reduced cost of treatment.

To these may be further added the greater ease in the recovery of bullion from the leaching solutions used, and the application of the process as a whole to many refractory ores, concentrates, and tailings, which have hitherto proved intractable to plain cyanide.

A glance at the chemistry of the two methods, which may be referred to for convenience as the "cyanide" and "bromo-cyanide" processes, may shortly show the fundamental differences existing between them, although potassium cyanide is used in both cases.

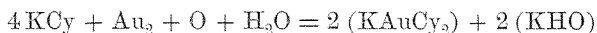
In each the gold is extracted as a soluble salt of the nature known to chemists as a "double cyanide."

Cyanide of gold (AuCy) is itself insoluble in water, and dissolves only in an excess of potassium cyanide solution. In other words, it can only be dissolved as a "double salt" called cyanide of gold and potassium, or "potassium auro-cyanide" (KCyAuCy or KAuCy₂).

In order to produce cyanide of gold initially, it is evident we must split up the molecule of potassic cyanide, and in some way liberate the potassium, in order to permit the cyanogen (Cy) to combine with the precious metal. Mere contact of gold with a solution of cyanide of potassium ("cyanide" for short) will not *per se* accomplish this, for potassium has a greater chemical affinity for cyanogen than has gold.

In fact a solution of pure cyanide of potassium in distilled water, and protected from the action of the air, is absolutely incapable of dissolving any gold whatever. We have, therefore, to seek the intervention of some aid or chemical agent which shall reinforce the power of the gold and enable it to decompose the cyanide. Such an agent the cyanide process finds in atmospheric oxygen.

More than 50 years ago Elsner discovered this fact, and represented it in the chemical equation which still bears his name:—



(or, potassic cyanide + gold + oxygen + water yield auro-potassic cyanide + caustic potash).

This "reaction" is the fundamental principle of the modern cyanide process. It is at once seen that by this method the solution of gold from ores or tailings is dependent upon such supplies of oxygen as may be derived from—(1) air previously dissolved in the liquors; (2) that entangled between the grains of ore or tailings; (3) or dissolved by the surface layers of liquid and slowly diffused throughout the mass during leaching.

In most cases these supplies are sufficient to effect the fairly rapid dissolution of the finer particles of the gold; but the varied applications of strong and weak solutions, the necessity in many cases of alternate drainings of the partially extracted ores, and, in general, the effecting of as much aeration as possible, all point to the comparatively rapid exhaustion of the oxygen supply, and, consequently, to the intermittent nature of the solvent action occurring in simple cyanide liquors. The coarser the particles of gold, and the richer the ore, the more striking does the increased necessity for oxygenation become.*

* Frequently even to the extent of draining and turning over the partially leached ore mass when pyritic concentrates are under "cyanide" treatment.

Beyond this a far more serious limitation to the cyanide method lies in the disturbing influence of copper, arsenical, antimonial, manganiferous, and other ore compounds. The alleged "selective" action of very dilute solutions of cyanide for gold, in preference to copper-containing minerals, has, in some cases, been found to render the cyanide method available, but when these substances occur in moderate quantities they are usually fatal to that process.

It is upon the last classes of ore that by means of the bromo-cyanide process a series of quick and successful extractions have been made, whilst upon other less refractory ores considerably increased rapidity in extraction has been attained—in general, also, at a less cost in solvent materials.

The reason of the, at any rate, *partial* failure of cyanide to deal with such classes of ore is to be ascribed to the other product of the "cyanide-plus-oxygen" reaction, viz., to the caustic potash formed. This substance attacks iron, copper, and arsenical pyrites—antimonial and other sulphurets generally (many of which compounds, it is anticipated, will presently be met with in the lower levels of Westralian mines) yielding soluble compounds, which, in their turn, react upon and destroy considerable portions of the unused cyanide of the extracting solutions in use. These compounds are termed "cyanicides," and the useless compounds produced from the cyanide are various sulpho-cyanides, ferro-cyanides, sulpharseniates, &c.

The actual amount of caustic potash produced is of course small compared with the bulk of the leaching solution and the mass of ore or tailings under treatment; but this fact has little or no importance in view of the circumstance that the caustic alkali is continuously formed in exact proportion to the gold dissolved *precisely at the actual point* at which such solution action is proceeding—precisely, therefore, in the actual position in which it can produce the most harmful results.

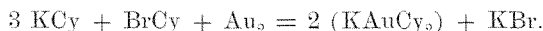
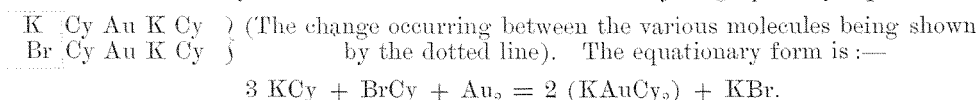
The greatest loss of cyanide takes place whilst its solutions are in contact with ores containing pyrites and other refractory sulphurets. The solvent action of the cyanide on the gold here frequently takes place in what may be described as the ultimate cell of the ore, where a small bay or cavity is formed containing the gold particle and where alone the cyanide can do useful work. In many cases only a portion of the gold is exposed between layers of pyrites, and as solution of the former proceeds edgewise, a minute chamber is formed containing the solvent solution. It is here, in this almost closed circuit, that the production of caustic potash in quantities chemically equivalent to the cyanide used for gold dissolving takes place. In such small reservoirs (where the walls consist of refractory sulphurets) the cyanide rapidly becomes non-existent, very largely owing to the reactions of the caustic potash upon the base minerals. Moreover, from the capillary nature of many of these cavities the caustic potash and deteriorated cyanide do not readily diffuse out and give place to fresh leaching liquid, thus the solvent action upon the gold may almost entirely cease whilst the cyanide is gradually, even completely, destroyed.

Having shown the basis and limitations of the cyanide process, let consideration be directed to the bromo-cyanide method.

In this case the solvent employed consists in the addition to the potassium cyanide solution of certain small proportions of another chemical, another cyanogen compound, whose *rôle* it is to render the intervention of oxygen unnecessary to the solution of gold in cyanide. This compound is the bromide of cyanogen or "bromo-cyanogen:" BrCy.

We have already seen that, in the older process, *air* plays the part of a cyanogen liberator, freeing it (in presence of gold) from the potassium, and allowing it to combine with the precious metal.

In bromo-cyanogen we have not only a cyanogen liberator, but a cyanogen carrier as well; the chemical contains this substance in a condition much more ready to unite with gold in presence of cyanide than in the former system. The reaction which occurs may be graphically represented thus:—



It will at once be seen that the necessity for oxygenation is here entirely avoided, and with it its train of attendant disadvantages; *no* caustic potash being produced.

Besides, therefore, being rendered independent of the comparatively slow air action of cyanide upon gold, the other reaction product (bromide of potassium) is a neutral salt, absolutely without action upon the refractory ores before specified. Thus a great point in the conservation of the solvent solution is gained, and considerable economy effected.

Furthermore, the supply of bromo-cyanogen, instead of air, to cyanide renders the latter a vastly more rapid gold solvent. It is no exaggeration to state that with particles of the metal of equal fineness the bromo-cyanogen solvent is more than 600 times as rapid as plain cyanide and air—a fact which may readily be demonstrated by comparative experiments upon gold leaf. This enables a great shortening of treatment time to be made, this in turn permitting of decreased capacity of the plant initially required to perform the same amount of work.

As an example of what may be done by the bromo-cyanide process, it has been demonstrated that in from 8 to 12 hours, the whole of the "accessible" gold* may be extracted from the Day Dawn battery tailings, at a consumption of under $\frac{1}{4}$ lb. of cyanide and $\frac{1}{8}$ lb. of bromo-cyanogen per ton of material treated.

In proof of the completeness of the treatment during this time, samples of the leached residue were digested for some hours in strong "aqua regia." This failed to extract even a trace more gold, which had thus been perfectly removed by bromo-cyanide.

The above tailings have an initial average assay value of only 5 dwts., whilst the cost of materials consumed in extraction is under 1s. per ton of sands treated.

The "strong" solution used contains only 0.1 per cent. of cyanide, to which additions of bromo-cyanogen are made equal to about 0.025 per cent. A weak solution of about 0.04 to 0.05 per cent.

* (i.e., exclusive only of that which remains imprisoned in the solid quartz of the larger sand particles, which is of course inaccessible to an aqueous solvent of any nature.)

is afterwards rapidly run through the charge in small quantity, in order merely to displace the residual amount of stronger liquor still adhering to the sands, and this in turn is displaced and re-collected by a wash of ordinary water.

In this Colony where labour is such an expensive item, the discharge of tailing pits and the refilling of the tanks by hand and trucking is out of the question. Beyond a doubt, the pernicious Westralian system of collecting, simultaneously, slimes and tailings indiscriminately in the various tailings pits must be abandoned; separation of slimes from tailings, cheaply and thoroughly, being of the first importance.

By the adoption of the simple spitzlutte apparatus and a belt elevator, all these conditions are easily fulfilled. Slimes are at once and completely separated from tailings, the former being passed into the slime pits and dams, for settlement and future treatment (which will be referred to anon), whilst the clean sharp sands are automatically filled into the tanks by means of the elevator and distributing launder (at the mere cost of running this piece of machinery) without any further handling. Moreover, by the use of the spitzlutte, the sands are so well cleaned as to render unnecessary the usual preliminary water-washing of the tank contents, whereas hand filled charges invariably demand this.

In addition to the economy of the solvent portion of the bromo-cyanide process, a further novelty and improvement is made in the precipitation plant and process for the recovery of the gold from the leaching solutions.

Instead of the cumbrous zinc shavings method, necessitating the constant operation of a lathe in their preparation, an entirely different form of this metal is used, one which is produced in zinc smelting works in large quantities as a bye product. It is a metallic zinc dust of almost impalpable fineness, and is known technically as "zinc fume." Not only is it obtainable at cheaper rates than the cost of zinc shavings, but is far more rapid and complete in its action, mainly on account of its extreme subdivision, and, therefore, its infinitely increased surface for action. Its consumption is considerably smaller than that of shavings, and it permits of greater concentration of gold in the resulting precipitate; finally, a purer bullion can be obtained from it, with a considerable saving in time and materials, whilst it will precipitate perfectly the most dilute liquors.

The gold bearing solutions from the now exhausted tailings are run through a simple apparatus in which the precipitation of the gold is continuously effected by means of zinc fume. After passing through this they are quite depleted of gold, and are returned into the ordinary storage vats. Here they are strengthened by the amount of cyanide which they have lost in the last leaching, an amount before instanced, ready for the next charge of sands.

Returning for a moment to the leaching operations, it must be noted that the bromo-cyanogen and cyanide solutions are kept separate, the former being added, in the requisite small quantity found necessary by a preliminary trial, to the latter, only during the addition of the joint solvent to the mass of tailings in the vat. The proportion necessary, fixed as above, is that required to enable the cyanide to extract the tailings in the shortest practicable time without leaving any surplusage of the assistant chemical in the final liquors drawn off. A recent example of the application of the bromo-cyanide method to a *refractory* ore may be here instanced. The substance in question was a comparatively poor arsenical pyrites concentrate (United States), which had been *cyanided* with a maximum extraction of *30 per cent.* of the gold. The same ore treated with bromo-cyanide solvent yielded a 72 per cent. extraction in considerably less time, whilst the consumption of cyanide, which had before been high, was lowered to 1½ lbs. per ton, and 0.4 lb. of bromo-cyanogen. These leachings were on a scale of 50 tons.

In every leaching process it must be borne in mind that the gold particles present in the ore product must be of a fineness capable of permitting ready solution by a chemical solvent; *coarse* gold, or such as would be retained by a battery plate, is unsuited for recovery by *any* leaching process, whether bromo-cyanide, cyanide, or chlorination. Except in special cases, such processes are to be looked upon as commencing their legitimate sphere of operations *after* amalgamation has completed its own work.

Amalgamation may, however, be frequently adopted simultaneously with bromo-cyaniding; for example, in cases where both coarse and fine gold are present in a mass of mullocky ore material to which battery amalgamation is inapplicable. Here the employment of some form of barrel amalgamation and the application of bromo-cyanide contemporaneously is obviously demanded.

The tailings gold must be of course "accessible" to a solvent, or at least the bulk of it, *i.e.*, it must not be "locked up" in solid quartz particles impervious to liquids. The preliminary treatment of a sample of tailings with aqua regia for some hours, followed by a complete water washing and the assay of the exhausted residue, will readily show the amount of gold which cannot be extracted by any chemical means, and this will necessarily define the ultimate limit of a leaching extraction of any description.

Recrushing of the residues to a finer mesh will enable a considerable percentage of the gold to be rendered "accessible" to a solvent once more, but, except in rare instances of rich and very coarse sands,* recrushing is generally outside the range of "practical politics."

Slimes, after separation from the tailings by "spitzkasten" or "spitzluten," may be treated with marked success by the bromo-cyanide method; and it is worthy of remark that in several cases Westralian battery slimes have very considerably exceeded the tailings in richness. The precious metal contents in these highly divided products are of a very great degree of fineness, and being practically entirely accessible, call for an extremely short extraction period, and also permit of the employment of highly dilute solutions of the bromo-cyanide solvent. Leaching and percolation being out of the question, resort is made to "subsidence" methods, and the method adopted is the following:—

The slimes are mixed with a large volume of very dilute bromo-cyanide solution in a capacious tank to a moderately thin "emulsion" or "mud," and a period of 15 minutes allowed for perfect extraction. An addition of a little milk of lime is now made, just sufficient to produce a coagulation or slight clotting of the slimes, and the whole mass is then allowed to stand to allow of the deposition or subsidence of the

* A "grading-out" separation of these may easily be effected by a series of three or more spitzluten. The bulk of the fine sands being passed on to direct leaching treatment, this considerably simplifies the problem of recrushing.

exhausted material. The clear liquor above is now run off continuously from the surface (by means of a floating delivery pipe) down to the level of the ultimate slime layer, and passed through the precipitation plant. An experimental treatment has shown that 86 per cent. of the gold in the slimes may thus be recovered.

Water.—The action of Westralian water supplies, both on cyanide and bromo-cyanide, has yet to be fully investigated. Doubtless the very highly mineralised waters often met with will, in many cases, bar a leaching process, but with mine waters, of *fairly* good quality, no difficulty up to the present has been encountered. In fact the results are distinctly reassuring in face of the assertion that even small amounts of magnesia are detrimental to the cyanide process, owing to the instability of the magnesium cyanide produced in solution.

In the Day Dawn and Cue districts the slightly brackish supplies average about 0.75 per cent. of mineral matter (525 grains or $1\frac{1}{4}$ ozs. per gallon) of which a considerable proportion consist of soluble magnesian salts. So far these contents seem to have no deleterious or “cyanicidic” effect either upon cyanide or upon bromo-cyanide liquors.

11,000 gallons 0.13 per cent. potassium-cyanide made in such a water showed absolutely no deterioration at the end of 7 days, and a bulk of 4.825 per cent. bromo-cyanide remained similarly unaffected during the same period.

These facts are of considerable interest to the cyanide industry and justify confidence in the future of leaching processes on Westralian Goldfields.

It may be taken for granted that at least 1 per cent. of saline impurities in water (provided no soluble iron or metallic salts be present) will leave leaching solutions of the nature described practically unaffected.

The plant now being completed at the Day Dawn mine has a capacity of 2,000 tons per month, and was supplied to the order of the Gold Ore Treatment Company of Western Australia by Messrs. Fraser & Chalmers. The general form of plant closely resembles the ordinary cyanide apparatus, except in the details before specified.

Full details of the bromo-cyanide process and plant required for same can be obtained on application to the Manager of the above-named Company, Mr. Edward Hooper, Esq., St. George's Terrace, Perth. The royalty charged for the use of the process is 5 per cent. upon the value of the bullion recovered by it.

Report by Inspector of Mines (Mr. F. Reed) on Professor Sulman's Bromo-Cyanide Process.

FIRST TRIAL AT “DAY DAWN” MINE, WESTERN AUSTRALIA.

The first working installation of this process in Australia on a large scale has taken place at “Day Dawn” Mine, on the Murchison Goldfield, during the present month, and the results are so excellent that this system of gold extraction may mark an epoch in the gold mining industry of this Colony.

Three hundred tons of tailings were treated in one week. From these tailings 10 to 15 dwts. of gold had previously been extracted by battery amalgamation.

These tailings contained about 8 per cent. of slimes, and had, before treatment by the Sulman process, an assay value of 4 dwts. 7 grs. per ton. After treatment the assay residue did not in any instance exceed 12 grs. of gold per ton, which was afterwards found unextractable by *agua regia*, showing that the precipitation was complete. The gold residue consisted of fine particles, covered by a film of quartz through which the solution did not penetrate.

The actual time of extraction was 15 hours, and the working cost, including depreciation and interest on plant, was only 3s. 10d. per ton of tailings treated, which is a quite unprecedented cost, considering the high rate of wages and material on the Murchison Goldfield.

For comparison it may be stated that at the Rand mines in South Africa the average cost by the McArthur process is 5s. to 5s. 6d. per ton treated. By the latter process the speed of extraction is about twice as long as by the Sulman process.

The essential points of the Sulman process are the leaching of the tailings or ore by a solution averaging (on “Day Dawn” ore) 0.1 per cent. potassium cyanide, 0.03 per cent. or less of bromide cyanogen, and precipitation of liquors by zinc fume powder.

Having, by the courtesy of Mr. Knutsen, the manager of the “Day Dawn” Mine, been enabled to thoroughly inspect and inquire into the practical and working details of the above test, I am of opinion that the results obtainable will revolutionise the systems at present adopted for gold extraction in Australia, and the question of the fullest gold recovery at a minimum cost will be answered. The process is simplicity itself.

FRANK REED,

Inspector of Mines,

Member North of England Institute M. and M.E.'s.

Cue, 23rd July, 1896.

Appendix 8.

General Report for 1895, from the Inspector of Mines, Central Goldfields.

From the Inspector of Mines for Central Goldfields to the Under Secretary, Mines Department.

Cue, 15th April, 1896.

I have the honour to submit my Report, also certain Returns and Tables, together with other data, for insertion in the Departmental Annual Report for 1895, if desired by you.

The data contained in these Reports, &c., is accurate, and has been obtained from the Mines and the Registrar's Offices by myself.

I have modelled my Report and Returns on those published by the Mines Department of Queensland, Reports which I consider, after careful comparison, the most complete in the British Colonies.

The following is a list of the data I have supplied:—

1. Report of the Inspector of Mines for the Central Goldfield.
2. Return of the Mining Machinery on the Central Goldfield.
3. Return of Auriferous Quartz Yield, Number of Leases, Area of Leases, Number of Miners, Batteries, Engines, and Boilers, Value of Machinery, Number of Mining Accidents, &c., &c., on the Central Goldfield for 1895.
4. "Specimen Mine Plan," for a guide to Mine Managers in preparing their plans (much required). I recommended it being lithographed and inserted in the Annual Report (previously forwarded under separate cover).*
5. Return of Geological Features, Number of Miners Employed and Condition of the Principal Mines on the Central Goldfields (showing their gold and quartz yield in detail for each mine).
6. Revised edition of my paper on "Accidents in Mines." This has been carefully revised by me, and brought up to date. It is customary in the other colonies to insert scientific papers such as this one in their Annual Reports.

I hope that this data will be acceptable to you.

FRANK REED,
Inspector of Mines.

REPORT.

I have the honour to report on my preliminary visit of inspection to those mines on the Central Goldfields which come under the operation of "The Mines Regulation Act of 1895," which Act became law at the beginning of the present year.

The first goldfield which I visited was Yalgoo, where I found that mining operations generally had only reached their initial or prospecting and opening up stage, and the amount of underground work performed had not exceeded in most instances the sinking of an underlay or vertical shaft to the water level, a depth rarely exceeding 90 feet, and the driving of short levels along the line of reef; and pending the arrival of pumping machinery, of which at present there is none on this field, further developments below ground are unlikely to be undertaken at many of the mines, the owners of which are waiting to make use of the railway (which will shortly be completed) for the purpose of bringing their pumping and other machinery on to the field.

My duties, therefore, at Yalgoo consisted chiefly in explaining the requirements of the Act to the mine managers, and, when occasion required, drawing attention to any defects which I observed in the manner in which the existing works were being conducted.

It will be found advantageous to the future administration of the Act on the Yalgoo Goldfields that the system of regulation and inspection has been inaugurated at the mines during the initial stage of operations, as this should insure the works being commenced properly in the first instance, and reduce the chances of any wholesale condemning of works by the Inspector of Mines, which is always a disagreeable duty, and which occasionally cannot be avoided in instances where mines, when fully developed, are brought under the operations of a Mines Regulation Act.

Fortunately, during the past year (1895), there have been no accidents upon that goldfield, although 750 men were employed there; the greater proportion of which, however, were not engaged on actual mining operations below ground.

On completion of my inspection of the mines on the Yalgoo Goldfield I proceeded to the Murchison Goldfields, where I found that, owing probably to the fact of that field being discovered a considerable

* This excellent plan was drawn by Mr. W. R. Thomas, Surveyor, while resident at Mt. Magnet, and was furnished by him to Mr. Piper, by whom it was supplied for reproduction.

time previous to Yalgoo, mining operations were in a considerably more advanced and further developed state, although even on this field the mining companies have generally refrained from bringing more plant and equipment on to their mines than was absolutely necessary, until the completion of the railway now in course of construction; nevertheless, many mines on this field, taking everything into consideration, are very well equipped, and my duties on the Murchison embraced a considerably greater scope than at Yalgoo.

Speaking generally, I found that, although nearly all the mine managers I met were acquainted with and had experience of the Mines Regulation Acts of the other Colonies and elsewhere, yet, beyond a few of the most absolutely necessary and self-evident precautions against accidents being taken, many other important precautions had been neglected; for instance, I did not find upon the whole field one safety hook or safety cage, the use of which is necessary and compulsory as a protection against overwinding. I did not find one instance of a properly constructed magazine, as required by "The Explosives Act of 1895"; I found that few, if any, of the 70 steam boilers on this field had ever been subjected to a proper hydraulic test since their arrival, and I did not find one instance in which the ladders used in vertical shafts were properly inclined and supplied with platforms in compliance with "The Mines Regulation Act of 1895." It is only fair to state, however, in justice to the mine managers, that at the time of my preliminary visit of inspection the Act had barely been in force sufficient time to enable the necessary precautions being taken as required by the Act, and in nearly every instance the mine managers consented willingly to remedy the defects which I pointed out to them.

The greatest source of danger upon this field is from falls of earth and stone, and owing to the extreme scarcity, and consequently great cost of mining timber, the use of it is very stinted, and I found in many instances that the underground workings were unsafe on this account. In extreme instances I had this remedied at once, but as to bring the timbering of the mines to that degree of safety reached on most other mining fields would entail an absolutely prohibitive expenditure, I have therefore refrained from exacting too much from the mining companies in connection with their timbering, pending the arrival of the railway, when it is to be hoped, in the interest of human life and limb, that mining timber will be carried at a sufficiently low rate to enable its free and unstinted use, for it is found on all mining fields that the most prolific cause of mining accidents is from falls of rock, and the only way this may be guarded against is by a plentiful use of mining timber.

During the year 1895, I find that there have been 15 serious mining accidents on the Murchison Goldfield, three of which proved fatal. The number of persons engaged at mining on this field at the end of the year was 2,200, so that the proportion of accidents is by no means high, but it must be taken into consideration that fully one half of those persons were occupied in prospecting, dryblowing, and other surface work, and did not ordinarily work below ground. The following table shows the number and cause of accidents during the past year on the Murchison Goldfield:—

Causes of Accident.	Result.	
	Fatal.	Non-fatal.
Falls of earth or rock	1	3
Accidental explosion of blasting compounds ... ..	...	2
Shaft and winze accidents	2	4
Machinery accidents ... ..	...	2
Blow from windlass handle ... ..	...	1
Total	3	12

It must be noted that these accidents occurred previous to the introduction of the Mines Regulation Act, and at a time when there was no Government inspection provided for.

Before concluding this report I must express my thanks to the mine managers whose mines I have visited, and who have, in almost every instance, extended to me the greatest courtesy.

FRANK REED,

Inspector of Mines.

Cue, 15th April, 1896.

NOTE.—To accompany this Report are Tables 1, 2, 3, and 4 of Statistics *re* the Central and other Goldfields, also a paper on "Accidents in Metalliferous Mines" (revised), and a Specimen Mine Plan for the information and guidance of Mine Managers and others in preparing their plans.

Table No. 1.

MURCHISON AND YALGOO GOLDFIELDS.

Return showing Gold and Quartz Yield, the Number of Mining Leases and Miners, also Mining Machinery and Accidents for 1895.

	CENTRAL GOLDFIELDS (Sub-divisions).			Total.
	Murchison Goldfield.	Yalgoo Goldfield.	E. Murchison Goldfield.	
Total Gold Yield for 1895 ...	...	...	...	65477 oz.
Gold Yield from Alluvial or Doolyng ...	...	...	...	15434 oz.
Gold Yield from Auriferous Quartz ...	47813 oz.	2230 oz.	...	50043 oz.
Number of Tons of Quartz crushed ...	40607 tons	2400 tons	...	43007 tons
Average Yield per Ton ...	1 oz. 3½ dwts.	0 oz. 18½ dwts.	...	...
Number of Leases working on December 1st ...	498	115	108	721
Area of Leases working on December 1st ...	4715 acres	1167 acres	1000 acres	6882 acres
Number of Quartz Miners ...	2064	390	100 (approx.)	2554
" Alluvial Miners and Prospectors (approx.) ...	300	360	200	860 (approx.)
Number of Batteries ...	24	3	...	27
" Stampers ...	280	20	...	300
" other Mills for Reduction ...	4	...	...	4
Number of Steam Engines ...	72	4	...	76
" Boilers ...	67	3	...	70
" Cyanide Plants ...	2	...	...	2
Estimated Value of Mining Machinery (<i>in situ</i>) ...	£123411	£4700	...	£128111
Number of Mining Accidents {	{ 3 fatal } { 12 non-fatal }	...	1 non-fatal	{ 3 fatal } { 13 non-fatal }

FRANK REED,

Inspector of Mines for Central Goldfields.

Table No. 2.

MINING MACHINERY ON THE MURCHISON AND YALGOO GOLDFIELDS.

Return showing the number, description, and value of Machinery on each Goldfield during the year 1895:—

	CENTRAL GOLDFIELDS.		Total.
	Murchison Goldfield.	Yalgoo Goldfield.	
Steam Engines employed in Mining ...	44	...	44
" " Quartz Reduction ...	28	4	32
Pumping Plants ...	20	...	20
Steam Boilers ...	67	3	70
Stone Breakers ...	4	1	5
Automatic Feeders ...	5	1	6
Batteries ...	24	3	27
Stampers ...	280	20	300
Huntington Mills ...	2	...	2
Otis Mills ...	1	...	1
Arrastras ...	1	...	1
Berdan Pans ...	8	2	10
Dry-crushing Rollers... ..	2	...	2
Frue Vanners ...	3	...	3
Amalgamators and Barrels ...	3	...	3
Concentrators ...	3	...	3
Cyanide Plants ...	2	...	2
Estimated value erected ...	£123411	£4700	£128111

NOTE.—At the present time there is no Machinery on the East Murchison Goldfield, although a considerable quantity will be required there shortly.

FRANK REED,

Inspector of Mines.

Table No. 3.

MURCHISON AND YALGOO GOLDFIELDS.

Return showing the Geological Features, Gold and Quartz Yield, Number of Miners employed, and other data in connection with a few of the Principal Mines on these Goldfields for 1895.

Name of Mine.	Locality.	Name of Mine Manager.	Numbers of Leases.	Area of Leases.	PREVIOUS TO 1895.*		DURING 1895.*		Number of Miners employed.	Number of Stampers.	Estimated Value of Machinery (<i>in situ</i>).	Course of Lode.	Average width of Reef or Lode.	Inclination of Lode.	Description of Country Rock.		
					Tons of Quartz Crushed.	Ounces of Gold Yielded.	Tons of Quartz Crushed.	Ounces of Gold Yielded.									
<i>Yalgoo Goldfield—</i>																	
Emerald Reward	Yalgoo... ..	J. Penberthy ...	66	24	411	4485	1016	1045	5	10	£ 1800	...	...	...	Amphibolites or Dioritic Schist
Yalgoo Joker	Bilberatha ...	W. J. Ward ...	518, 76, 75, & 146	42	100lbs.	104	...	...	22	None	Nil	N.N.E. & S.S.W.	Above 30'	45°	do.
Dollar	Carlaminda ...	T. H. Harris ...	408, 450, 26, & 27	32	...	...	...	...	12	do.	do.	N.N.E. & S.S.W.	1' to 3'	65°	do.
<i>Murchison Goldfield—</i>																	
New Chum	Mt. Magnet ...	T. Williams ...	92 & 171	36	752	3400	2922	11128	85	10	4330	N. & S.	2' to 5'	72° W.	Talcose Schist		
Morning Star and Easter	do. ...	J. Bryant ...	155 & 568	18	Mostly specimens	744	5785	5785	57	10	3425	E. & W., N. & S.	3' to 6'	75° S., 75° W.	do.		
Mt. Magnet	do. ...	R. Piper ...	563 & 64	24	41	65	86	122	15	None	Nil	...	3' to 5'	...	do.		
Golconda	Lake Austin ...	A. Benson ...	805, 806, 807, & 569	63	270	2076	1230	2091	43	10	7000	N. & S.	4'	45° W.	Dioritic Schist		
Mainland Consolidated...	do. ...	G. M. Roberts ...	113, 130, 132, 133, 742, & 570	49	Specimens	8200	Specimens	500	50	10	3740	N.E. to N.W.	2' 6"	45° N.E.	do.		
Victory United	Cuddingwarra	J. A. McLeod ...	595	21	2867	731	640	1374	20	10	4860	N.N.E.	3'	80° E.	do.		
Fortune of War	do. ...	H. R. Shubert ...	95	12	769	568	657	788	15	10	2000	N.E.	3'	Vertical	do.		
Kinsella	Day Dawn ...	T. Hewitson ...	360, 673a, 675	53	?	103	545	407	56	10	8460	N.N.E.	6'	do.	do.		
Trenton	do. ...	R. Arkley ...	326	24	1397	2054	4370	2749	48	10	3850	20° W. of N.	3'	50° W.	Diorite		
Day Dawn West	do. ...	H. Knutson ...	156	20	310	259	2061	1490	15	} 20	16500 {	...	...	...	Diorite Schist
Day Dawn North	do. ...	do. ...	70	12	Nil	Nil	230	60	4			do.
Day Dawn	do. ...	do. ...	69	12	6957	5050	7412	4608	55			25° W. of N.	15'	50° W.	do.
Light of Asia	Cue ...	G. B. Lidell ...	253	21	52	74	20	40	...	Being erected	...	N.E.	11'	50° N.E.	Gneissic Granite		
Lady Mary Amalgamated	do. ...	L. Bloxome ...	674, 1002	28	?	292	70	51	44	10	4830	N. & S.	10'	36° to 45° W.	do.		
Cue One	do. ...	J. W. Rayfield ...	203	12	585	1163	830	1019	11	10	3130	N.N.E.	4'	40° W.	do.		
Red, White, and Blue ...	do. ...	A. B. P. Bayne ...	745 & 746	45	None	None	100	97	20	Nil	Nil	N.N.E.	2' to 6'	45° to 75°	Gneiss & Diorite		
Nannine	Nannine ...	J. McCord ...	1	12	1358	2991	687	914	22	10	3000	N. & S.	3'	Slightly W.	Diorite Schist		
Queen of the Lake	do. ...	J. Dunsrao ...	20	8	4675	4560	777	357	4	10	3000	do.	3'	do.	do.		
Star of the East	do. ...	A. Dick ...	344	25	4850	8641	5020	2929	24	20	8811	do.	3'	do.	do.		
Royalist Consolidated ...	do. ...	J. G. Robinson ...	25	9	123	719	62	222	4	Nil	1500	do.	3'	do.	do.		

* NOTE.—The Gold and Quartz Returns here quoted are obtained from the Quarterly Returns supplied by the Mine Managers, and their accuracy is not guaranteed.

FRANK REED,
Inspector of Mines.

Appendix 9.

Report on the Geological Features and state of Development of the Principal Mines on the Yalgoo Goldfield, for Departmental Annual Report.

From the Inspector of Mines for Central Goldfields to the Under Secretary for Mines.

Yalgoo, 6th June, 1896.

I beg to submit a Report on the above subject for the above purpose, which I have prepared from information gathered at the principal mines on this Goldfield during the past few days—the data is accurate and up to date, and may be of interest, no Geological Report of this Goldfield having been previously issued.

FRANK REED,
Inspector of Mines.

YALGOO GOLDFIELD.

A Report on the Geological Features and State of Development of the Principal Mines by Frank Reed, Inspector of Mines and Member North of England Institute of M. and M.E.'s.

As this Goldfield is at present attracting a considerable amount of notice, and mining operations are being conducted in a very energetic manner, a few notes about the geological features and state of development at a few of the principal mines may be of interest.

This field, which was originally part of the Murchison Goldfield, was declared a separate field in the latter part of 1894.

The principal mining centres on this Goldfield are Yalgoo, the official centre, where the Warden's Court is situated; Melville (a small postal townsite), Bilberatha, Carlaminda, and Wadgingarra, all within a radius of 14 miles from Yalgoo township; also Gullewa (40 miles away) and Pinyelling (a distance of 80 miles by road from Yalgoo), and Rothesay (late Woodley's), 40 miles further.

I have visited the first four named places, and have taken a few notes in connection with some of the mines.

The Emerald Reward Mine (Lease No. 66, Area 24).—This mine, which is situated in the township of Yalgoo, was the first on the Goldfield in which any sensational discoveries were made, above 4,000ozs. of gold being obtained from a surface deposit of quartz of boat-like shape, about 100 feet in length by about 10 feet in width and depth. Since this body of stone has been exhausted a considerable amount of prospecting work has been done in the shape of trenching, shaft-sinking, and driving levels and crosscuts to ascertain if a lode of equal richness exists upon this lease, but up to the present time these efforts have not been successful. Although a few rich quartz leaders have been discovered and worked profitably, the rich deposit before referred to occurred in a dioritic schist country, but had no defined walls, and was not enclosed in any description of fissure or lode, and it is a difficult problem to determine how this phenomenally rich body of quartz was formed, and how it got there. If this company's plucky endeavours to find a lode from which it was an offshoot, either as an overflow or detached body, are rewarded with that success which they so richly deserve, the district will receive a considerable impetus. This mine has a five-head stamper battery.

Mr. James Penberthy is mine manager for the Emerald Reward Company. At present there are 13 men engaged upon this mine, which is the property of an English Company.

The Gullewa Queen, or Mindulgarra Mine.—This mine is also situated at Yalgoo township, on the hill at the back of the Warden's quarters.

The work done on this property, which consists of a prospecting character, shows that considerable volcanic disturbances have shattered the diorite country rock in every direction, and the fissures thus caused have been filled with quartz, consequently their course and inclination varies very much, and a network of these veins, some of considerable thickness and showing gold freely in places, occurs on this property.

Several shafts have been sunk to water level, a depth of about forty feet, and from thence levels and crosscuts are being driven to ascertain which of these lode formations will be the best to begin operations upon.

There are sixteen men working at this mine under Mr. W. J. Clark, an experienced mine manager from Broken Hill.

The Joker Mine.—This mine, which is the property of the W.A. Venture Syndicate, is situated at Bilberatha Hill, a distance of about eight miles South-East of Yalgoo.

There are four leases, having an area of 42 acres, belonging to this company.

Considerable interest has been taken in this property, owing to its reputed richness and its remarkable and unique geological formation.

Bilberatha Hill, like all the rest of the Yalgoo district, is of diorite and dioritic schist formation; this hill has every appearance of having been subjected to severe volcanic disturbance at no very distant date.

A huge lode or dyke formation crosses this hill in a North-North-Westerly direction, and it is upon the contents of this lode or dyke that mining operations are being conducted.

A visit to this remarkable formation will well repay a student of geology.

The contents of this lode are most unique, and consist partly of a red calcined dioritic schist, and partly a breccia of angular quartz in a matrix of volcanic iron and slag, the whole being traversed in various directions by small quartz veins, very rich in gold, in fact in some places phenomenally so; subsequent small fissures (caused by the volcanic matter cooling) have been filled by quartz, talcous schist, and kaolin.

Fine gold can be obtained by dollying and washing the contents of this lode, taken from almost any part.

The workings at this mine consist of an underlay shaft in the lode, sunk at an inclination of about 48° for a distance of 105 feet, and a vertical shaft is now being sunk to strike the lode at a greater depth. These shafts have been connected by a cross-cut, which shows the lode to be of great width; but there are no defined walls, and the lode matter blends with the country rock to such a degree that it is a difficult matter to ascertain the exact width of the lode, but in the present workings it exceeds 30 feet.

A considerable amount of work is being done upon this property, and 63 men are employed under Mr. James Ward, a mine manager of considerable experience.

The working expenses of this mine should be low on account of the size of the lode and the plentiful supply of fresh water which is obtained on the leases from shafts, etc.

The owners are obtaining crushing and other machinery to commence actual mining operations without delay.

May Queen Mine.—This mine is situated at Melville, about 14 miles from Yalgoo.

Two shafts have been sunk on this property, one an underlay to a depth of 80 feet, and the other vertical to a depth of 65 feet, from the bottom of which a cross-cut is being driven to cut the reef which exists in the underlay shaft.

The quartz showing here varies in thickness up to 4 feet. A trial crushing has been made, but the results have not been published.

The walls of this reef are not very well defined.

The country rock is dioritic schist, which in places bears every appearance of having been subject to intense heat.

The vertical shaft here is being well timbered and divided into compartments for winding, pumping, and an inclined ladder-way.

This mine has a ten head battery.

The Mystery Mine.—This mine is also situated at Melville, and consists of one lease (No. 41, of 9 acres).

Two shafts have been sunk here also in a country rock of dioritic schist, where a lode having a North and South course underlaying to the West at an average inclination of about 50° exists.

There are at present 14 men employed on this mine under Mr. J. Joyce, mine manager, and the work is being done in a systematic manner.

The Dollar Mine.—Situated at Carlaminda, about 8 miles from Yalgoo, on the Melville road.

This company have four leases, of a total area of 32 acres.

A well defined reef runs through these leases in a North-North-East and South-South-West course, underlaying to the West at an average inclination varying between 65° and 84° ; the thickness of this reef varies between one and three feet, and fine gold appears to be disseminated throughout the greater part of it.

The country rock consists of dioritic schist and diorite, the hanging wall of the lode being exceptionally well defined, and having that striated appearance which is evidence of it being a true fissure.

A considerable amount of work has been done here by Mr. Harris, the manager for this company. Several shafts have been sunk, proving the reef for a considerable distance, and a vertical shaft, having separate compartments for winding, pumping, and an inclined ladder way, is being sunk to cut the lode at a depth of 300 feet; fresh water in considerable quantities was tapped in this shaft at a depth of 96 feet.

This property is being developed in a systematic manner, and it is evident that thoroughly legitimate mining is intended here, and the company deserve the greatest encouragement for the class of work they are doing, and the manner in which they are performing it.

Mr. Harris, the manager, has had great experience both in this and other colonies, and the company are fortunate in possessing his services.

The Sovereign Prospecting Claim Mine.—This mine is also situated at Carlaminda, where a line of reef parallel to the "Dollar" line is being worked by the Sovereign Company.

Several shafts have been sunk upon this reef, proving it to a considerable length of uniform North and South course; this lode underlays to the West at an inclination of 60° to 70° ; the width of this lode varies considerably, and in places is of large size.

The quartz carries fine gold, and is highly mineralised, containing a large quantity of iron pyrites, and in places, copper pyrites and native copper in small quantities; the quartz in one shaft is incrustated with malachite and azurite, which gives it a remarkably pretty appearance.

The work being done on this property is of a prospecting nature, and it would be premature at present to pronounce on the prospects of the mine, but if the lode is found to enter solid country with well defined walls, there should be an abundance of quartz for the company to operate upon.

There has been no trial crushing yet made of the quartz from this mine, so I am unable to state what yield may be expected, but the fineness of the gold, and the highly mineralised and somewhat refractory nature of the quartz, will necessitate special consideration when the operations of the Company are in a more advanced state.

Mr. W. T. C. Forbes is manager for this company.

Carlisle Mine.—This mine, which has only been recently discovered, is situated at Wadgingarra, distant about 9 miles North-East from Yalgoo.

There are two leases of 12 acres each, and upon one of these, No. 199, a shaft has been put down to a depth of 25 feet, and is still being sunk.

This shaft exposes from surface to bottom a splendid reef of dark coloured quartz of most promising appearance, the whole of which carries fine gold plentifully disseminated from wall to wall. The thickness of this reef varies between 2 feet 9 inches and 5 feet, and it has every appearance of being a permanent body of stone; the course of the reef is North and South, with an almost imperceptible underlay to the West; about 3 chains to the North of the shaft the reef outcrops very strongly; at this outcrop the quartz is of a jaspery character.

In respect to this property I have no hesitation in stating that the quartz being mined is the very best I have yet seen on the Central Goldfields; every piece of stone in the heap at the shaft carries gold freely visible to the naked eye—in fact the quartz is quite of an ideal character—and the working of this mine, provided that the reef is permanent, will be a success in my opinion. The country rock is dioritic schist, but the walls of the reef are not yet sufficiently defined to enable me to pronounce as to whether the lode is a genuine fissure or otherwise, but from the massive appearance of the quartz I can hardly imagine it will not live to a considerable depth.

I estimate that the quartz at grass will yield throughout an average of more than 3 ounces per ton. It is free from pyrites or other refractory constituents.

The Cumberland Mine.—Also at Wadgingarra, and distant about half a mile North of the “Carlisle,” consists of 4 leases and a reward claim, having an area of 31 acres.

A fine reef, varying in thickness between 7 feet and 15 feet, runs through these leases, having a North and South course, with almost imperceptible underlay to the West.

The character of the quartz is similar to that at the Carlisle Mine, but I did not observe the gold to show so freely to the naked eye as at that mine, although there is a larger reef and more work done at the “Cumberland.”

At this mine two shafts have been put down a distance of about 50 feet apart: one of these, to a depth of 61 feet, shows the reef to be about 7 feet thick at the bottom; the other, to a depth of 45 feet, exposes the reef, having a thickness of 15 feet at the bottom.

This reef, both in size and general appearance of stone, is very similar to that at the “Day Dawn” mine, the premier mine of the Murchison Goldfield.

The quartz at one point on the “Cumberland” has, like that outcropping to the North of the “Carlisle” shaft, a jaspery appearance.

The jaspery quartz carries gold freely visible to the naked eye at both places.

The Renmark Mine.—I visited this mine, the property of a South Australian company I believe.

The operations here have been concentrated on developing a surface gash vein, which pinched out at a comparatively shallow depth.

The formation here worked is off the main line of the auriferous belt, and successful results could not have been expected.

The class of work done here is also of a most primitive nature, and dangerous to the lives of the miners employed.

I found dynamite caps and fuse scattered about the face of temporarily abandoned workings, and a lively disregard of the Mines Regulation Act to exist at this mine.

GENERAL.

It will be seen from the above notes that the country rock of the whole district in the immediate vicinity of Yalgoo is diorite, and dioritic schist (called by Mr. Göczel *amphibolites*). The general course of the lodes is North and South, and their inclination between 50° and 70°, generally to the West. The walls, except in one instance, are not very well defined, and do not appear to be true fissures. The gold appears generally to be disseminated through the quartz, which is of various kinds, that of dark colour and that of sugary appearance usually being the richest in gold.

Fresh water is obtained in abundance at comparatively shallow depths, and firewood is not scarce although timber for mining purposes is considerably so.

Yalgoo is now connected by railway with the capital.

Mining operations upon this field are being conducted in a legitimate manner, and booming and false reports are not encouraged by those at the head of affairs, which is a matter which will redound to the credit of the field when other places which have been boomed and exploited, without let or hindrance, have collapsed.

Yalgoo, 6th June, 1896.

Appendix 10.

Report on the Geological Features and State of Development of some Mines in the Nannine District, Murchison Goldfield, by Frank Reed, Inspector of Mines, Member of N. of England Inst., M. & M.E.'s.

I have the honour to report that I have visited the Nannine District, and beg herewith to submit my report on the geological features and state of development at some of the principal mines at Nannine, Star of the East, Gabinitha, Mt. Yagahong, and the recently discovered Meekathara.

GEOLOGICAL.

The geological features at Nannine, the oldest mining centre on the Central Goldfields, are very similar to those which exist at many other places on these goldfields.

The country rock consists of dioritic schist, which occupies a break in the archæan gneissic granite which occurs in this locality.

These dioritic schists (named amphibolites by Mr. Göczel in his valuable reports to your Department) are undoubtedly of volcanic origin; but whether occurring as a sedimentary rock re-deposited in beds, or in its primary state, it is difficult to determine, as it is quite possible that the schistose form may be the result of tangential pressure on the diorite rocks during an age of extreme volcanic activity and disturbance.

In the upper strata the felspar in these schists is frequently altered to chloritic or talcose schist, thereby becoming a metamorphic rock by kaolinisation of the felspar.

These dioritic schists are traversed by quartz reefs, having generally a North and South course, underlying to the West at various inclinations.

These reefs are of considerable thickness, and maintain their course and width for great distances; for instance, the line of reef upon which the Nannine, Royalist, and Home Rule group of mines are situated, is being worked upon in an almost straight line for two miles, and at the greatest depth yet proved, viz. 217ft., shows no indication of pinching, or any lenticular form at any place.

It is difficult to determine to what class of lode these main reefs belong, owing to the massive and generally unstriated appearance of the walls, but it is quite certain that they are not "gash veins," or "segregated veins," or "stockworks," neither are the main reefs "compound lodes"; the much hackneyed term "fissure lode" may be applied to them, but they do not quite answer to the popular description of that class, and I have no doubt that geologists will eventually decide upon a special name for the large master reefs occurring as single lodes in the dioritic schists, and gneissic granites, of the West Australian Goldfields.

It is my opinion, however, that those reefs, which maintain their course and thickness for considerable distances, will go down, and in this I am but endorsing the views held by Bergrath, Schmeisser, and other eminent geologists who have reported on these goldfields. It would be difficult to imagine that such massive ore deposits, which undoubtedly are of hydrothermal origin, are of anything else but permanent nature, and that they will not be found to live to great depths.

Lodes of another character with little prospects of permanency do occur on the Murchison Goldfields; these appear generally as "compound" lodes. The opinions previously expressed, however, refer generally to the master reefs in the Nannine District, although many reefs of similar character exist at other places on these goldfields. They may be easily determined, however, by their more uniform thickness and maintenance of course.

The country rock is also traversed by diorite dykes of more recent origin than the main reefs, also by bars of ferruginous jasper or silicious ironstone and other quartz reefs, which cross the main reefs at various angles. At the points of intersection of these cross-courses with the main reefs, gold shoots, often phenomenally rich, are frequently found.

These shoots of gold or ore columns also occur along the line of fracture caused by faults which have fractured the lode quartz, the line of fracture being frequently cemented by gold and brown hematite containing solutions which existed at considerable pressure, and found, at these fissures, the line of least resistance to their ascent, by hydrothermal action, to the surface. A shoot thus formed has been worked at the Royalist Mine for a continuous length of 180ft., having a uniform inclination of 30 degrees. This shoot yielded several thousand ounces of gold.

Occasionally these shoots cross each other diagonally in this locality, thus indicating the angles of dislocation of the strata by faults; at Nannine these angles appear to be generally either about 30 degrees or vertical.

The class of ore contained in these reefs is, excluding that contained in shoots, low grade, but the great quantity available for treatment and the general absence of refractory matter in the ore render the future prospects of the locality very encouraging.

To work this field to the greatest advantage, large crushing capacity will be necessary, also modern labour-saving appliances such as automatic feeders, elevators, rock drills, and concentrators. The works will require to be supervised by managers trained to economy, and working costs will require to be carefully watched.

The cost of mining timber and pumping will always be a considerable item, but fresh water will be comparatively plentiful, and the ore will be easily won.

STATE OF DEVELOPMENT.

NANNINE MINE.

Leases No. 1 and 16N. Total area 24 acres.

This is the pioneer mine of the Central Goldfields, and has been working for several years.

Four vertical shafts have been sunk on the lode to depths varying between 95 and 217 feet, and levels connecting them have been driven, the lowest, being at a depth of 200 feet, is driven 50 feet in a Southerly direction on the line of reef.

The course of the reef is about North and South underlaying slightly to the West, the country rock is dioritic schist, and the reef is intersected at points by silicious ironstone bars and diorite dykes; at the points of intersection rich shoots of gold occur.

The line of reef on this property has been proved by workings for about 800 feet in length, this is the main master reef referred to in my geological notes; between this property and its neighbour, the Royalist Mine, a diorite dyke crosses the quartz reef at an acute angle.

Water level was reached in this mine at 75 feet, and at present the active operations below ground are suspended to allow of pumping and winding appliances being erected to enable work being resumed on a larger scale; these improvements were almost completed at the time of my visit of inspection on July 8th.

A new vertical shaft, excellently timbered, and divided into four compartments, has been sunk to a depth of 150 feet. This shaft will cut the lode at an approximate depth of 500 feet.

I did not inspect the reef at the lowest level, owing to the fact that it was under water, but the manager informed me its thickness was 3 feet 6 inches; at the 50 feet level I estimated it to be of greater thickness.

This property is under the able management of Mr. J. McCord, J.P., the pioneer mine manager of these goldfields. The work is being conducted in a substantial and systematic manner. The necessary precautions required by the law in the interest of the safety of the workmen are observed, and the undertaking thoroughly deserves success.

During 1895 the quantity of auriferous quartz crushed at this mine was 687½ tons, which yielded 914½ ounces of gold.

The mine is supplied with a 10-head battery and powerful winding and pumping plant, and a high and substantial poppet head which would not be out of place in the most extensive gold mine existing.

ROYALIST CONSOLIDATED.

This mine is situated at Nannine and joins, at the South, the Nannine Mine previously described.

The reef here worked is that which passes through the Nannine property, and the same geological conditions prevail, although the thickness of the reef is here greater, the average width being fully six feet.

On this property very rich shoots of gold occur, which I have previously referred to in my geological notes.

A considerable amount of work has been done here, six underlay shafts have been sunk to water level, which occurs at a depth of 40 to 60 feet, and one main vertical pumping and winding shaft has been sunk to a depth of 120 feet, which, it is estimated, will cut the lode at a depth of about 700 feet.

From this shaft a cross cut has been driven at a depth of 110 feet to strike the reef, and the levels driven therefrom expose a large lode, about 6 or 7 feet in width, of a blueish-grey quartz, through which the rich shoots of gold occur.

The gold yield from this mine during 1895 was 222 ounces from 62½ tons, and the total yield to date has been 1,134 ounces from less than 300 tons of quartz; but, including specimens and alluvial, over 5,000 ounces of gold have been taken from this property.

The various shafts on this property prove the reef for about 1,100 feet, and in some of these very rich quartz may be seen.

The only machinery on this mine is a winding engine and boiler, which is also used for baling water.

This mine is the property of Mr. John G. Robinson, who manages the works himself; and, if operations were conducted on a scale of greater magnitude, with modern appliances, the results would be very satisfactory.

HOME RULE SOUTH MINE.

Leases Nos. 54N and 55N, of total area of 50 acres.

This property is a continuation of the Nannine and Royalist line of reef to the South, the latter of which it adjoins.

The same geological conditions prevail here; but, owing to the lowness of the ground, but little work has been done pending the arrival of powerful pumping machinery, as this property is on the shore of Lake Annean, and salt water, at a depth of 18 feet from the surface of the ground, has prevented prospecting at any greater depth being undertaken.

The surface outcrops, exposed by longitudinal trenches, show a strong reef of white quartz, apparently of low grade.

This mine also is one of those that will require a large output and low working cost to prove successful.

The lake previously referred to is very salt, but, fortunately for the proprietors of this mine, seldom contains any water.

QUEEN OF THE LAKE MINE.

Lease No. 20, of 8 acres.

This mine is situated about one and a quarter miles due North of the "Nannine" Mine, but not apparently on the same line of reef.

The lode here worked belongs to that class known as "compound" lodes, and does not maintain a uniform thickness or course for any distance.

A considerable amount of work has been done here. Underlay shafts have been sunk on the reef, and levels driven, and, in some places, stoping has been done. A main winding shaft has been sunk to a depth of 104ft.; at a depth of 70ft. water level was reached.

The reef has been much faulted by volcanic action, and the close proximity of a diorite dyke has thrown the lode out of its original course.

The quartz is much mixed with brown hematite, and, in places, was very rich in gold.

There is a 10-head battery and winding plant at this mine; at the time of my visit, viz., on July 9th, the battery was at work.

During 1895, from 777 tons of quartz crushed 357oz. of gold were obtained.

CHAMPION MINE.

Leases Nos. 10N, 11N, 13N, 17N, 37N, and 43N, of 39 acres total area.

This property also is situated at Nannine, and distant about half-a-mile West from the "Nannine" Mine.

The reef here worked runs parallel to the line worked at "Nannine" and "Royalist" Mines, and has a somewhat similar general course.

The same geological conditions apply here also, but there are not so many cross-courses or faults here exposed, and the reef is, if anything, larger, and perhaps contains more gold disseminated through the quartz; but of course the battery will prove that fact better than mere inspection of ore at grass or in the working places.

There are a number of shafts sunk here to water level, a depth of 62ft., and about 340ft. of levels have been driven at that depth; the average thickness of the reef appears to be about 8ft.

The quartz is of a pinkish white colour, highly mineralised in places, and carries gold in the pyrites and in a free state very plentifully in places; at certain points where these pyrites have become oxidised the gold remains in the vughs of the honeycombed quartz, showing that the pyrites may be considered the matrix of the greater quantity of the gold in this mine.

A very extensive plant is being erected here, but 20-head of stampers is not, in my opinion, nearly sufficient; a large output and low cost should be the object aimed at by this company.

STAR OF THE EAST.

Lease No. 344, of 25 acres.

This property is located about 18 miles East of Nannine.

Similar geological features here generally prevail, but owing to the fact that the lower levels of the mine were flooded, pending the resumption of work with enlarged plant in a few weeks' time, I was unable to inspect the underground workings on my visit of inspection on July 10th.

The lode here, which has an East and West course, has been stoped out from water level, a depth of about 75 feet, to the surface for an approximate length of 200 feet.

This lode is almost vertical at the surface, but gets more inclined to the South at a depth of about 50 feet.

Very rich ore has been obtained at this mine, but during 1895 the yield was only 2,929 ounces from 5,020 tons of quartz.

A very extensive and powerful plant has been erected here recently, and when operations are resumed under the able management of Mr. James McGhie, the well-known Queensland mine manager, this mine will be heard of again.

There is a 20-head battery, powerful winding and pumping plants, and the highest poppet heads on the Murchison Goldfields exist at this mine.

GABINITHA LINE.

This line of reefs is situated about 2 miles North-East of "Star of the East."

The reefs, which have a general North and South course, are being prospected successfully, and are found to be of considerable thickness and carry gold freely visible; the quartz is also much impregnated with copper pyrites, and is coated with malachite.

The presence of this copper may be found troublesome to gold extraction.

MT. YAGAHONG MINE.

Leases Nos. 1N and 22N, and 451, of 24 acres total area.

The lode here is a "compound lode," occurring in a country rock of talcose schist apparently derived from rotted felspathic rocks; the lode matter is talcose, kaolin and schist carried into the fissures in mechanical suspension by percolating water. The seams of quartz therein are chemically deposited.

This lode, although rich in gold in places, does not maintain any uniform course or thickness, and I do not consider it will prove a profitable undertaking.

A considerable amount of prospecting work has been done here.

Two lodes occur on this property.

The auriferous lode matter is similar to that which is being successfully worked at the "Morning Star" and "Easter Mine," at Mt. Magnet.

MEEKATHARRA MINE.

Leases Nos. 90, 91, and 93 of 12 acres.

This property, which is situated about 21 miles due North of Nannine, was only discovered in May of this year, consequently little work has been done to develop it.

The country rock here is dioritic schist traversed by quartz reefs, silicious ironstone, and diorite dykes.

There are two reefs upon this property running parallel to each other and about 40 feet apart, their course is North and South and underlaying to the East; the thickness of these reefs at the point exposed is 7 feet and 4 feet respectively; at the former, the quartz is of a blue-grey colour and carries no gold visible to the naked eye; at the latter the quartz is of a whitish colour and is very friable at the outcrop. This quartz is remarkably rich in gold; but it is impossible to gauge the value of this property until further work is done. If such a reef as I saw there on July 12th is found to carry its gold for any distance or depth, the property is a phenomenally rich one.

From present appearance, I believe the lodes will unite at a comparatively shallow depth and form one permanent master lode.

Appendix II.

Reports on the workings of Mines on Dundas Goldfield by the Temporary Inspector of Mines.

The Under Secretary for Mines, Perth.

Norseman,

30th May, 1896.

SIR,

I have the honour to forward, herewith, report of work done on a number of other leases in this district.

I have not been able to visit Dundas yet, mostly in consequence of my assistant being taken ill with typhoid fever, and also because for the last three days I have been very unwell myself, and unable to do anything.

From my knowledge of the mines at Dundas, I am able to say that a great deal of work has been and is being done.

On the *Scotia Mine*, situated 6 miles South of Dundas, several shafts have been sunk and drives put in. This mine is being developed systematically and satisfactorily. Between 20 and 30 men have been employed for some time.

Several other mines are at work in that district, and about 50 men altogether are employed in that neighbourhood.

At *Dundas* work is being carried on at "Mawson's Reward" on a new make of stone, which looks very well. A great deal of work has been done on this mine, but for some time back only enough men have been employed to keep the labour conditions alive.

The Great Dundas Mine is at a standstill, a dispute having arisen through wages. A lot of work has been done on this mine also, several shafts being sunk to water level.

Several leases have been taken up North of the "Great Dundas Mine," on which work has been done, but mostly of a prospecting nature.

On the *Adelaide Mine* a lot of good work has been done, and the reef opened up in each shaft.

At *Mt. Kirk*, situated 5 miles South-West of Norseman, work is being carried on over 10 leases, but I have not been able to visit them yet.

Around the *Edwards Mines*, situated about 12 miles South-South-East of Norseman, several other leases other than those I have reported on are at work. I hope to be able to visit them shortly.

I have, &c.,

W. H. ANGOVE.

Temporary Inspector of Mines' Report on Leases in the Dundas Goldfields.

Norseman,

22nd May, 1896.

The Norseman Gold Mines Co. comprises Leases Nos. 19, 20, 21, 25, 18, 26, 47, 48, 94, 101, 115, 116, and 138, having an aggregate area of about 148 acres, through which the Norseman reef runs for fifty chains. The property was purchased by Dr. Simon, and floated in the London market under the above name. It is under the management of Mr. John Morgan, and all work is being carried out in a systematic manner. On the block claims very little is being done, the labour at present being concentrated on the Norseman line of reef, on which there are 60 men employed by this company.

On Lease No. 20 the Sydney Norseman Shaft is down 93 feet on the underlay. Average width of the lode is 8 feet. An adit has been driven from the Southern end of this lease Northward to the Sydney shaft.

On Lease No. 19 the Cachuca shaft has been sunk 90 feet on the underlay, and drives 80 feet North and 80 feet South have been put in from the 60 feet level along the reef, whose average width is 7 feet. A main tunnel is being driven 100 feet on this lease, and the lode is expected to be cut in another 20 feet. This will give 100 feet of backs to stope out going North.

On Lease No. 21 the Hardy Norseman shaft is sunk on the underlay 120 feet, the reef in the bottom being 8 feet wide. A vertical shaft has been sunk to a depth of 25 feet.

On Lease No. 25 the Hardy Norseman No. 1 shaft has been sunk on the underlay 76 feet, the reef being 3 feet 6 inches wide.

On Lease No. 18 the Mildura North shaft is down on the underlay 105 feet, and at this depth 120 feet of drives have been put in North and South on a lode averaging 5 feet in width. A main shaft, now 70 feet down on the underlay, is being sunk.

On Lease No. 48 a vertical shaft is being sunk and is down 70 feet.

On Lease No. 47 also a vertical shaft is being sunk and has reached a depth of 167 feet.

On Lease No. 26 the Viking shaft has been put down on the underlay 130 feet, and a drive at the 100 feet level Northward for 90 feet on a reef 2 feet wide. Two other shafts, 90 and 40 feet respectively, have been sunk, as well as trenching to find the reef.

On Lease No. 101 the Donotti shaft has been sunk 90 feet on the underlay.

Everything in the above property is in good working order, and stone to the amount of 60,000 tons is practically in sight, all of which, at the lowest, will yield an ounce of gold per ton. A 40-head battery has been ordered and is expected to be on the mine by August next. Three winding engines are also expected to arrive at any time. A scheme for a permanent water supply has been adopted, 44 acres having been secured on Lake Cowan, from whence the water will be pumped to the mine, a distance of about two miles.

The Royal Dane Gold Mining Co. embraces Leases Nos. 17 and 57, containing an area of 18 acres. All the work is being done on Lease No. 17. A main shaft is sunk on the Northern portion of the lease to a depth of 191ft. on the underlay, the average width of the lode being 4ft. 6in. At the 100ft. level drives have been started both North and South to open up the mine. At 40ft. a drive has also been put in 50ft. South. Water was struck at 170ft. in this shaft.

No. 2 shaft was sunk and connected with the 40ft. level in main shaft. At the bottom (50ft.) there is a drive 15ft. South. In the centre of the property an engine shaft, 8ft. by 5ft. in the clear, is being sunk; it is now down 100ft., timbered all the way, and is being continued. The reef, 8ft. wide at the surface, but varying as it is followed, underlies at an angle of about 45°, and is well defined.

No. 3 shaft, on the South end of the property, is down 70ft. on the underlay. Ten men are employed, and they have about 500 tons of stone at grass.

The Norseman Reward Co. own two blocks, the Reward Claim No. 3, and Lease No. 15, containing in all 25a. 2r. 18p. Allsopp's shaft, on Lease No. 15, has been sunk to a depth of 165ft. on the underlay, but, through the inflow of water and hardness of ground, not much is being done pending the receipt of winding gear. The reef in the shaft, from the surface to 50ft., was about 5ft. wide. At 50ft. it pinched out, and became extinct to 60ft. From there it commenced to make again, and is now a compact, well-defined lode, 5ft. wide. At the 50 feet level a drive has been put in North 60ft., which communicates with another shaft, now being sunk on the lode. The drive is 15ft. past this second shaft. It is also driven South from Allsopp's shaft.

Allsopp's Shaft South is down 70ft., and is being continued to 100ft. At the 50ft. level in this a drive was put in 116ft. along the lode. The first 70ft. of this is very large, the latter portion smaller, but still very compact and well defined. It looks exceedingly well, and is considered to be worth 3oz. of gold per ton. Allsopp's Shaft and Allsopp's Shaft South have been connected in the 50ft. level.

On the Reward Claim a vertical shaft has been sunk East of the lode, and connected with it by a drive 50ft. long. The size of the shaft is 8ft. by 5ft. in the clear. No work is being done in it at present, but another shaft is being sunk on the line of reef to communicate with a tunnel to be put in from the surface further North. The tunnel, when completed, will connect all the shafts South of this, and will give many thousand tons of stone, easily and cheaply stoped. On the Northern part of Lease No. 15 another main shaft is being sunk on the underlay, and is down 40ft., with the reef getting flatter. The size of the reef at surface is 2ft., and at bottom 1ft. 6in.

A battery site has been reserved, and when the battery is erected there will be no trouble to find plenty of stone that will average an ounce of gold per ton. 100 tons of stone are now at grass. The manager's office and dwelling, together with smithy and a store-room, have been erected on the property. Fourteen men are employed.

The No. 1 North Norseman Co. hold 12 acres of ground in Lease No. 16. Their No. 1 shaft is down on the reef, which underlies about 32° to the East, 185ft. The lode averages 2ft. in width. No. 2 shaft is 87ft. deep, on a lode 2ft. in width, carrying good gold. In this shaft they are preparing to open out at 30ft. The reef in No. 1 shaft for 93ft. from the surface is carrying gold which, from appearances, should give 2oz. per ton.

No. 3 shaft is sunk 60ft. vertically.

An open cut to expose the reef has been made for 150ft. in length, 100ft. of which shows good gold. A battery is being arranged for with the Mount Barker Reward claim, to be erected on that property. A winding engine has also been ordered. About 500 tons of stone are at grass, and the mine is fully manned.

No. 2 North Norseman Co.—This lease was originally taken up as No. 27, and then abandoned.

It has since been taken up as No. 111, and consists of 13 acres. Three shafts have been sunk on it to find the Norseman lode, but so far the owners have met with no success. The first shaft was sunk near the Western boundary to a depth of 95ft. No. 2 shaft, further East, is 110ft. deep, and has a drive of 10ft. to the West. On the North end of the lease a shaft was put down 20ft. and then abandoned. Two men are engaged in sinking another shaft still further East from No. 2 shaft, being now 10ft. down.

No. 3 North Norseman, Lease No. 324, containing 12 acres. Nothing is being done on this property.

The United Scotchman comprises Leases Nos. 22, 24, and 239, containing 16 acres.

No. 1 shaft North, 70ft. deep, 50ft. of which is on the underlay; No. 2 shaft is 88ft. deep on the underlay; No. 3 is 90ft., and No. 4 is 20ft. deep, also on the underlay. There is a drive on the lode for 60ft. from the No. 1 to No. 2 shafts at the 50ft. level. At 88ft., in No. 2 shaft, a drive has been put in North 55ft. and South 40ft.; it is being continued at both ends. In the No. 3 shaft, at 70ft. level, stoping is being carried on in the drives North and South of the shaft.

The main shaft is started in about the centre of the lease. Manager's office and dwelling, also smithy erected. 15 men at work. 1,000 tons of stone have been crushed for 1,000 ozs. of gold.

Sussex (Norseman).—Lease No. 30 contains $6\frac{3}{4}$ acres. No. 1 shaft has been sunk 40ft. vertically and 90ft. on the underlay. The reef averages one foot in width. No. 2 shaft is 40ft. deep with a drive in 24ft. Two other shafts are down 25ft. and 35ft. respectively.

Palparara (Norseman).—Lease No. 110, containing 11 acres. Shaft sunk on a cross reef 40ft. underlying South. Several small shafts and costeens have been put down in prospecting for the reef.

St. Agnes Gold Mining Co. comprises Leases Nos. 29, 35 and 189, containing 21 acres. Most of the work done has been on Lease No. 29.

No. 1 shaft on underlay to East is sunk 100ft. No. 2 shaft on underlay to East is sunk 68ft. No. 3 shaft on underlay to East is sunk 75ft.

In the No. 1 shaft at 68ft. level a drive starts, going South 55ft., North 145ft., then on to No. 3 shaft 83ft.; then North from No. 3 shaft 68ft. On Lease No. 35 there is a vertical shaft 25ft. deep, and 30ft. of costeeing.

On the machine area a water shaft is being sunk and is down 54ft.

The width of the lode is from 1ft. to 4ft., the battery return from which should be, to all appearances, equal to 2ozs. of gold per ton. 400 tons of stone are at grass, and plenty of it ready for stoping. A battery of 10 heads is now at Esperance, and a winding plant is daily expected. 18 men are employed on the mine.

Bonanza.—Lease No. 36 contains $5\frac{1}{2}$ acres.

No. 1 shaft is sunk 65ft. on the underlay, on what is supposed to be the St. Agnes reef. Another vertical shaft has been sunk 16ft. Two men employed.

Bonanza Extended Co.'s Lease, No. 200, contains 6 acres. A small East and West reef has just been cut. Two men employed.

St. Agnes Extended No. 1, Lease No. 113, contains five acres. One shaft has been sunk near the East boundary 50ft., and another 60ft. Two men employed.

St. Agnes North, Lease No. 37, contains 6 acres. Two shafts have been sunk near the Eastern boundary, one on the underlay for 50ft., and the other vertical 30ft. Several pits and costeens have been cut for prospecting purposes.

St. Agnes No. 2, Lease No. 46, contains 6 acres.

St. Agnes No. 2 Extended, Lease No. 142, contains 9 acres. These two properties belong to the same parties, and are being worked together. No. 1 shaft is 54ft. deep, No. 2 shaft 70ft. At 40ft. level a crosscut of 4ft. was put into the reef. Drive on the course of the reef 20ft. Reef 2ft. 6in. wide. The crosscut was continued through the reef to 28ft.; also drove crosscut West from the shaft 19ft. to reef 2ft. wide. At 70ft. a drive has been put in on course of the lode South 35ft.

No. 3 shaft sunk to a depth of 50ft. Crosscut put in East 25ft. to Western reef, which is 4ft. through. No. 4 shaft on East reef 31ft. deep. Drive in on course of lode 12ft. No. 5 down 11ft. on Eastern reef. The average size of the Eastern reef is 20in. The work on these two leases has been done totally at the prospectors' expense.

On the Kingswood Lease, No. 123, containing 15 acres, and situated East of the St. Agnes Gold Mining Co., two shafts have been sunk. No. 1 is 195ft. on Westerly underlay; No. 2 is 150ft. vertical, and 60ft. on underlay. A crosscut connects the two shafts.

The Ophir, Lease No. 98, contains 12 acres. This mine is working on a very well defined East and West reef. No. 1 main shaft is sunk on Southerly underlay 78ft.; driven East 34ft., and West 46ft.

Lode varies from 18in. to 20in. wide in East level, and in the end of the West level it is from 2ft. to 3ft. wide, carrying gold. No. 2 shaft West is 70ft. deep on underlay. No. 3 shaft East is 30ft. deep on underlay, the reef in the bottom being 2ft. 6in. wide. On Eastern boundary a pit has been sunk 12ft. on a reef 18in. wide, carrying gold. On the North boundary a shaft is down 20ft. on another reef. Forty tons of stone have been crushed for a yield of 125 ounces of smelted gold. There are 50 tons of stone at grass, and four men are employed.

Ophir Extended, Lease No. 258, containing 18 acres. Shaft sunk 30ft. on supposed line of the Ophir lode, as well as several pits and costeens put down for prospecting purposes.

The Royal Standard, Lease No. 100, contains 12 acres. A shaft was sunk 40ft. and then the property was abandoned. It has been taken up again and the parties are at present costeening for reefs.

The Mararoua, Lease No. 60, contains 24 acres. No. 1 shaft is 110ft. deep on Easterly underlay. At 90ft. a drive was put in North 60ft. from the shaft and South 50ft.; both drives are on the course of a lode which averages 6ft. in width. No. 2 shaft, situated 300ft. South from No. 1, is down 80ft. on underlay, the reef being 2ft. 6in. wide, showing fair gold. Nine men are employed on this mine.

Mararoua South, Lease No. 126, contains 12 acres. The main shaft is sunk 110ft. on underlay. From the 70ft. level a drive has been put in South 70ft. and North 30ft.; also a crosscut from same depth West 35ft. and East 35ft. Another shaft, 15ft. deep, has been sunk; also various pits and costeens for prospecting.

The Mararoua Junction, Lease No. 283, contains about 10 acres. The shaft has been sunk 50ft. from the surface.

The Mararoua Extended North, Leases Nos. 68 and 298, contain 12 acres. A prospecting shaft has been sunk 47ft. vertically and 50ft. on the underlay, the reef being 4ft. wide, showing gold. Various other shafts have been sunk from 10ft. to 15ft., together with costeens. Two men are employed.

The Bethnal Green, Lease No. 67, contains 12 acres. The main shaft is 65ft. deep, 30ft. vertical, and 35ft. on underlay. Three other shafts have been sunk 25ft. each, and two others 30ft. each. This claim is working on the "All Nations" line of reef.

The Mararoua North has a vertical shaft on it 30ft. deep.

The All Nations Gold Mining Co. comprises Leases Nos. 39 and 97, both containing 12 acres each. Three shafts have been sunk on this property. No. 1 sunk 90ft. on Easterly underlay; size 8ft. by 6ft., and timbered all the way. No. 2 is 46ft. deep, sunk on the underlay. A drive has been put in at 46ft. level connecting these two shafts. No. 3 shaft is down 154ft. with drive of 12ft. A battery and tailings area have been taken up, and a winding engine and ten-head battery ordered.

The McCarthy, Lease No. 175, contains 12 acres, and is situated East of the "All Nations" Lease No. 39. A shaft has been sunk 30ft. on the underlay, on an East and West reef. At present there are no men employed.

The Homeward Bound, Lease No. 286, North of the last-named lease, contains 12 acres. A shaft has been sunk for 12ft., and some few feet of costeens put down. At present there are no men employed.

The Southern Cross, Lease No. 162, is West of the "No. 1 North Norseman," and contains 12 acres. A few pits and costeens only have been sunk on this lease.

The Melbourne Norseman, Lease No. 167, contains 12 acres. Four shafts have been sunk. No. 1 35ft.; No. 2 40ft., with a crosscut in the latter at the bottom of 35ft. West and 5ft. East; No. 3 is 40ft., and No. 4 is 18ft. deep. A few costeens have been cut on the lease. Two men are employed.

The Cosmopolitan, Lease No. 321, containing 18 acres, is situated North of the "All Nations Extended." No. 1 shaft is sunk 25ft. vertical, and then on an Easterly underlay 35ft. Another shaft has been put down 13ft., with a drive at the bottom of 10ft. East. Three chains of costeening have been done, and two men are employed.

The Morning Star, Lease No. 54, contains 12 acres. No. 1 shaft is sunk 100ft. on Easterly underlay, and a drive put in South 30ft. and North 5ft. The lode here is from 3ft. 6in. to 6ft. wide. No. 2 shaft is 115ft. deep on the underlay, with reef averaging 3ft. 9in. wide. A new shaft has been started between No. 1 and No. 2. 500 tons of stone are at grass on this mine, and four men are employed.

The Morning Star Block Claim, No. 150, contains 12 acres. A vertical shaft is being sunk, and is now down 50ft.

The Sudden Norseman, Leases Nos. 44 and 139, are 18 acres in extent. A good deal of work has been done on this property. Two vertical and two underlay shafts have been sunk, the former measuring 308ft. in all, and the latter 233ft. 104 feet of driving has been done, principally from the underlay shafts.

The Scandinavian, Lease No. 151, contains 12 acres, and adjoins "The Morning Star" lease on the South. No. 1 shaft was sunk 85ft. vertically, and 40ft. on Easterly underlay, the reef in bottom being about 2ft. 6in. wide. No. 2 shaft is sunk 80ft. on the underlay. Two men are employed.

The Bohemian, Lease No. 124, is North of the "Sudden Norseman," and contains 12 acres. A shaft has been sunk on the underlay, the reef being 3ft. wide. A vertical shaft is 70ft. deep, and several pits and costeens have been cut. Fifty tons of stone are at grass, and two men are employed.

The Jessie Margaret, Lease No. 177, contains 18 acres, and is North of the "Gipsy Girl." Two shafts have been sunk on this property to a depth of 40ft. each. No one is at present employed.

The Last Chance, Lease No. 344, containing 6 acres, joins the "Jessie Margaret" on the North. One shaft has been sunk to a depth of 40ft. No one at present working.

The Maloney, Lease No. 56, contains 12 acres. No. 1 shaft is sunk 60ft. on an Easterly underlay, the reef being well defined and about 4ft. wide. No. 2 shaft is down 35ft. on underlay, with a drive going South, at bottom, for 30ft. No. 3 shaft is sunk 135ft. vertically, and 15ft. on the underlay of a parallel reef averaging 3ft. in width. Several pits and costeens have been made, disclosing three other reefs averaging from 5ft. to 6ft. wide. From No. 1 and No. 2 shafts 50 tons of stone have been crushed, the yield being one ounce of gold per ton.

The Lady Ellen, Lease No. 63, South of the "Maloney," contains 12 acres. No. 1 shaft is sunk on an Easterly underlay 50ft., and then vertically 20ft. No. 2 shaft is 60ft. deep (vertically), and at 40ft. a drive has been put in—South 30ft., East 10ft., West 65ft., and North 12ft.

The Lucky Hit, Lease No. 108, North of the "Maloney," contains 12 acres. Four shafts have been sunk on the property. No. 1 shaft has been put down 120ft. on a reef 3ft. wide. No. 2 shaft is 50ft., No. 3 is 50ft., and No. 4 is 50ft. deep.

The Gladstone, Lease No. 256, containing 12 acres, is East of the "Maloney." No. 1 shaft has been sunk vertically 80ft., and timbered for 15ft. down. No. 2 shaft is sunk 40ft. vertically. 80ft. of costeens from 5ft. to 6ft. deep have been cut. Four men are employed.

The British Norseman, Lease No. 442, contains 18 acres West of the "Cosmopolitan." A vertical shaft has been sunk 15ft., and then on the underlay (Southerly) for 40ft. No one is at present working on this lease.

The Lady Clara, Lease No. 144, contains 12 acres, and is situated West of the "All Nations" property. A vertical shaft has been sunk 30ft., and two other shafts of 10ft. each, on a strong ironstone lode. No one working on the property.

The Rising Sun, Lease No. 304, contains 6 acres, and is situated South of the "Lady Clara." A good deal of costeening has been done on this lease, but the property seems to be abandoned.

The Thames, Leases Nos. 411, 429, and 430, contain 36 acres, and are situated West of the "Lady Clara," and about half-a-mile North of the North-East corner of Norseman townsite. The main shaft has been sunk vertically 52ft., the reef on the surface being 16ft. wide. They are now crosscutting West from the bottom of the shaft; are in 8ft., but are not yet through the lode. No. 2 shaft is sunk on another lode on a Westerly underlay 85ft., the reef being 2ft. wide. Several prospecting holes and costeens have been sunk, exposing the reefs in various places. On Lease No. 429 a shaft has been put down 65ft. on a Westerly underlay, another one 10ft., and several costeens put down. Six men are employed.

The Mount Barker Reward Co. comprises "Reward Claim No. 2," of 5 acres, and Lease No. 14, of 14 acres. The No. 1 shaft on the North end of the property is sunk 40ft. on an Easterly underlay. No. 2 shaft, which is about 5 chains South of No. 1 shaft, is down 119ft. The reef at 74ft. is 11ft. wide, between well-defined walls. No. 3 shaft, sunk 8 chains South of No. 2, is 70ft. on an Easterly underlay on a parallel reef 20in. wide, with good payable stone. Another shaft has been sunk 2 chains South of No. 3 to 20ft. No. 5 is a vertical shaft put down on the "Reward Claim" to 122ft., with a considerable amount of water making in the bottom. The country, when sinking was stopped, consisted of soft schists, easy to work. In No. 3 shaft, at 68ft., a drive has been put in 68ft. North on a reef 2ft. 6in. wide. In the same shaft, at 34ft., a drive has been started to go North. They have 500 tons of stone at grass, and eight men employed. The "Mount Barker Welcome," Lease No. 28, consists of 13½ acres, North of the "Mount Barker," Lease. No. 1 shaft is sunk on the main lode 80ft. No. 2, on the same lode, is 82ft., from where a crosscut has been driven 80ft. West.

Mount Barker Extended No. 2, Lease No. 40, contains 12 acres, and adjoins the "Mount Barker Welcome" on the North. The main shaft is sunk 90ft. vertically. At 40ft. level a crosscut has been put in East and West 55ft. to main lode, thence along the lode 25ft. No. 2 shaft is sunk 80ft. on an Easterly underlay on the main lode. No. 3 shaft is down 50ft. on Easterly underlay on a parallel lode. They have 200 tons of stone at grass, and four men employed.

Mount Barker No. 3 North, Lease No. 102, contains 12 acres. No. 1 shaft is sunk 120ft. on Easterly underlay. No. 2 is sunk 100ft. From the bottom of this shaft they have driven West to No. 1, a distance of 82ft., and from the bottom of No. 2 shaft they are driving on the lode, which is now 12ft. wide. Another shaft has been put down near the North boundary 30ft. vertically. 200 tons of stone are at grass, and the company has four men employed.

The Mount Barker No. 4 North, Lease No. 107, contains 12 acres. No. 1 shaft is sunk 110ft. At 50ft. a drive has been put in 12ft. North on a lode 12ft. wide. No. 2 shaft, on North part of the lease, is sunk 60ft. on a reef about 2ft. wide. No. 3 shaft is sunk 60ft. vertically. All the work is now being carried on in No. 3 shaft only. Two men are employed.

Mount Barker No. 5 North, Lease No. 109, contains 12 acres. No. 1 shaft is sunk 175ft. on Easterly underlay. The lode is 4ft. wide in the bottom. No. 2 is down 70ft., and No. 3 30ft. on underlay. The reef in the latter is 3ft. wide at the top and 7ft. in the bottom. Two men are employed.

The Highfield Lease, No. 121, contains 12 acres. A shaft is sunk on the South end of the property 96ft., and one near the West boundary is on the Easterly underlay 25ft. No person is at present working the property.

St. Alban's line of Reef.—This line is situated about one mile East of the "Norseman" reef, and consists of large ironstone and dyke formations, extending Northwards to the "Eden Park" and "Mary Cater" leases, for a distance of over two miles, and Southwards through the "Oriental" leases, continuing down to Dundas, and further South, beyond the "Scotia" mine for a considerable distance. A great deal of work has been done on this formation, necessitating a large expenditure of money because of its hardness, requiring either in sinking or driving the almost exclusive use of hammer and drill, and free use of blasting material. Many parts of this country show a great width of gold bearing strata, gold being plainly visible in ironstone and other dyke formations. The first lease taken up on this line of

country was the "St. Alban's," No. 55, containing 12 acres. On the property five shafts have been sunk to various depths. No. 1 is down 45ft. vertically, with a drive North-Easterly at bottom 35ft. long. No. 2 is sunk 30ft. on Westerly underlay of reef 15in. wide. No. 3 is 60ft. on Westerly underlay of a reef 2ft. wide. No. 4 is 60ft. on Westerly underlay of a reef 2ft. wide, and No. 5 is 10ft. vertical. A tunnel also has been driven on the Western side of the Range into the formation 30ft. All gold bearing stone.

The St. Alban's South, Lease No. 61, contains 12 acres. A tunnel has been driven 200ft. into the large ironstone and dyke formation, and very good prospects have been obtained from various parts whilst driving. Two shafts have been sunk, No. 1 being 30ft., and No. 2 31ft. About 450ft. of costeening has been done, averaging 5ft. deep.

The St. Alban's South No. 2, Lease No. 387, contains 12 acres. No. 1 shaft sunk 35ft. vertical driven West 40ft. and East 10ft., on main "St. Alban's" lode. No. 2 shaft 12ft. deep. Several costeens about 6ft. deep have also been sunk.

St. Alban's West, Lease No. 443, containing 18 acres. Two shafts, 24ft. and 18ft. respectively, have been sunk on Westerly underlay.

Albert Edward, Lease No. 331, contains 12 acres. No. 1 shaft is 30ft. deep on a nice reef 12in. wide. No. 2 shaft is 35ft. deep on a reef 4ft. wide.

The Gambier, Lease No. 384, contains 12 acres. One shaft, 40ft., is sunk in broken country.

Blue Ensign, Lease No. 372, 12 acres, has two shafts sunk 50ft. and 10ft. respectively, the reef in the former shaft being 4ft. wide. Six men working.

The Erl King, Lease No. 127, contains 24 acres. A tunnel is driven East across the dyke formation for 196ft. No. 1 shaft has been sunk 85ft. on Easterly underlay, with a drive along the reef 6ft. long. No. 2 shaft is sunk 93ft. on Easterly underlay, with drive 50ft. North and South. No. 3 shaft is down 15ft., and 10 men are employed.

The Gwendoline and Erl King Extended, Leases No. 81 of 12 acres, and No. 272 of 6 acres.—Four shafts have been sunk on this property. No. 1 is 103ft. vertical, the last 30ft. in a lode formation carrying fair gold. In this shaft 83ft. of drives have been put in. No. 2 is sunk 54ft.; No. 3 is 25ft., and No. 4 is 18ft. deep. These latter have been put down on different reefs. About three chains of costeening, averaging 5ft. deep, have been cut.

The Narracoorte Leases, Nos. 161 and 250, contain 24 acres. No. 1 shaft is sunk on Easterly underlay, and driven 9ft. South. No. 2 is down 25ft., carrying rich specimen gold. No. 3 is 16ft., and No. 4 15ft. deep.

The Tarpeena Co. comprises Leases Nos. 192 and 249, and contain 24 acres. No. 1 shaft is sunk 70ft., and a crosscut driven 40ft., and drives along the reef for 30ft. No. 2 shaft is 20ft., and No. 3 is 24ft. deep, with several pits and costeens.

The Duke, Lease No. 431, contains 12 acres. Several pits and costeens have been dug for prospecting purposes.

The Norwood, Lease No. 305, contains 12 acres; pits and costeening only for prospecting purposes.

The Leviathan Extended, Lease No. 87, containing about 6 acres.—A shaft was sunk on the Western side of the lease 60ft., and abandoned. The lease has since been re-applied for.

The Christmas Gift, Lease No. 64, contains 24 acres. A tunnel has been driven East into the ironstone and dyke formation 30ft. One shaft sunk 90ft. on reef 18in. wide, carries very good gold. Another shaft has been sunk on the Western side of lease 60ft. deep.

The Mignon, No. 78, contains $6\frac{3}{4}$ acres. Shaft sunk on cross reef underlying South for 50ft., and a vertical shaft sunk near the South-West corner of lease for 70ft.

The Red, White, and Blue, Lease No. 59, contains 12 acres. Vertical shaft sunk 70ft. and crosscut driven 25ft. to lode. Three other shafts sunk on same line of reef for prospecting purposes. On the East boundary a shaft has been sunk 20ft. on a cross reef, underlying South. Another underlay shaft sunk on another cross reef to 40ft.

The Red, White, and Blue Extended, Lease No. 218, contains 6 acres. Two shafts are put down on this lease to a depth of 20ft. and 25ft. respectively, on a cross reef having a Southerly underlay. Reef 18in. wide.

Lone Star, Lease No. 80.—A little prospecting work was done on this, then it was abandoned. It has since been taken up as the "Caledonian," Lease No. 313, and contains 12 acres. Vertical shaft sunk on ironstone formation 60ft. deep, and a drive put in 15ft. on a reef 5ft. wide.

The Moonlight, Lease No. 280, 12 acres. A little prospecting only has been done on this lease.

The New Chum, Lease No. 73, contains 6 acres. Two shafts sunk, one 40ft. vertical, another 15ft. on Westerly underlay.

The New Chum North, Lease No. 223, and *New Chum Extended*, No. 361. No work done on these leases.

The Florence, Lease No. 122, containing 12 acres. A shaft has been sunk on Westerly underlay 80ft.; Reef 8ft. wide. Vertical shaft sunk 34ft.

The Lydia, Lease No. 310, contains 9 acres. A shaft has been sunk 8ft. on a quartz outcrop 10ft. wide.

Lady Millie, Lease No. 254, contains 12 acres. A vertical shaft being sunk now down 35ft.

Welcome, Lease No. 403, containing 12 acres, and No. 419 contains 12 acres. No. 1 shaft sunk 24ft.; No. 2, 12ft.; No. 3, 8ft.; besides several pits. Reef in all shafts about 20in. wide.

The Albany, Lease No. 105, contains 12 acres. Tunnel driven West into ironstone and dyke formation 95ft. Shaft sunk on underlay East 30ft. Reef 3ft. wide.

On Leases Nos. 349, 350, and 351, surrounding No. 105, no work has been done.

The Bon Accord, Lease No. 49, contains 12 acres. Two shafts sunk on cross reef, one on the underlay, 55ft., and one vertical, 50ft.; the reef averaging 5ft. wide. In the underlay shaft at 30ft. a drive has been put in 10ft. In the vertical shaft drives are put in East 25ft. and West 30ft. On the big ironstone and dyke formation, running through the lease, a shaft has been sunk 35ft. West, and a cross-cut driven 10ft. West.

Grand Junction, Lease No. 145, contains 12 acres. Shaft sunk 90ft. on Westerly underlay.

The Bon Accord South, Lease No. 125, contains 12 acres. A good deal of work has been done on this lease. Several shafts have been sunk, and many yards of deep costeening done in prospecting for lodes.

The Broken Hill, Dundas, Lease No. 240. Two shafts have been sunk on this lease to a depth of 30ft. each.

Golden Gully, Lease No. 328. A shaft has been sunk in the South-West corner for 20ft.

The Salisbury Rose, No. 327.—A shaft is being sunk near the South-East corner of the lease and is down 30ft.

Star of the West, No. 439.—A few pits and costeens sunk for prospecting.

Great Boulder, Lease No. 104, contains 24 acres. Shaft sunk on the Eastern side of lease on a cross reef 60ft. Vertical shaft on Southern end of lease sunk 50ft. At the South-West corner are two shafts sunk on the Boulder lode, both about 50ft. The reef is 3ft. to 4ft. wide, and from it some rich stone has been got. A main vertical shaft is being sunk to cut the Boulder lode, and is down 70ft., and timbered; size of shaft, 8ft. by 6ft. in the clear. About 200 tons of stone are at grass, and 13 men are employed.

The Pekin, Lease No. 118, contains 6 acres. Vertical shaft sunk 55ft.

The Canton, Lease No. 244, is also 6 acres. Two shafts have been sunk on Easterly underlay 52ft. and 60ft. respectively. Reef from 9in. to 12in. wide.

Middleton, Lease No. 91, contains 12 acres. The North shaft is sunk vertical 30ft., and the central shaft 115ft., on Easterly underlay. Two other shafts on different reefs, besides costeens, have been dug. The company have 100 tons of stone at grass.

The Blue Flag, Lease No. 179, contains 12 acres. A good deal of work has been done on this lease. Six shafts have been sunk to a depth of 62ft., 30ft., 42ft., 54ft., 44ft., 26ft., and 46ft., on three different reefs, with 46ft. of drives. Several chains of costeens have also been sunk in prospecting for reefs.

The Fair Saxon, Lease No. 311, contains about 18 acres. Shaft sunk near the South boundary, 30ft. vertical. Several costeens and pits sunk opening up reef.

The Era, Lease No. 241, contains 12 acres. North shaft on underlay sunk 30ft. Vertical shaft 30ft. Near South boundary, shaft 30ft. vertical.

St. Agnes Consols, Lease No. 353, 24 acres. A vertical shaft down on East and West lode 70ft., underlying South, with a drive East 35ft.

Norseman Junction, Lease No. 268, 12 acres. Excepting some costeens no other work has been done on this lease, and at present no one is working.

Norseman Queen, Lease No. 352, 12 acres. No work seems to have been done on this lease.

Great Norseman Junction, Lease No. 242, 24 acres. A vertical shaft sunk near North-West corner of the lease 50ft., and seems now to be abandoned.

Right Bower, Lease No. 154, 12 acres. Adjoins the South boundary of the Norseman townsite. Shaft sunk 40ft., but apparently abandoned.

Lone Hand, Lease No. 141, 24 acres. Five shafts sunk on this lease, besides several pits to expose the different reefs running through this property. No. 1 shaft, 90ft. on Westerly underlay. At 70ft. level there is a drive South 40ft. on a reef 5ft. wide. No. 2 shaft, 90ft. on Westerly underlay, on parallel lode to the last mentioned, 4ft. 6in. wide, driven on South 30ft. No. 3, a vertical shaft sunk 40ft. No. 4 shaft, 40ft. on a reef 2ft. wide. No. 5 shaft, 40ft.

The True Blue, Lease No. 233, contains 12 acres. A vertical shaft sunk near the South boundary 40ft., and crosscut driven East. A good deal of costeening has also been done.

The Canny Scotchman, Lease No. 198, contains 18 acres. No. 1 shaft, near the West boundary, sunk 60ft. Crosscut driven West 55ft., and a drive North along the lode 10ft. No. 2 sunk 10ft., and No. 3 down 14ft. on a cross lode.

The Cornstalk Lease, No. 119, contains 12 acres. Two shafts have been sunk. The North shaft is 40ft., and the South shaft is 90ft. deep.

The Cornstalk East, Lease No. 374, 6 acres. One shaft down 60ft.

The No. 1 North Norseman Block Claim, Leases Nos. 169 and 170, contain 12 acres each. Several hundred feet of costeening done to find the reef. Shaft sunk on a cross reef underlying South for 43ft. A main vertical shaft has been started and is down 32 feet, part timbered. Underlay shaft on a North-East and South-West reef down 20 feet.

Broome Hill, Lease No. 394, 12 acres. On this lease there is a shaft sunk 10ft. vertical and 20ft. on the underlay West. Another shaft 15ft., and several pits and costeens.

Blue Flag Extended, Lease No. 285, contains 24 acres. On the North end of the lease a vertical shaft is sunk 15ft.; a pit on cross reef 12ft. deep. On the western boundary is a shaft sunk 20ft. vertical. On the South boundary, shaft sunk 20ft. vertical. A new vertical is started a few feet to the South of last shaft.

The Joker, Lease No. 148, 12 acres. Three shafts sunk on this lease, but nobody at present working.

Chris, Lease No. 309, 9 acres. Shaft sunk 30ft., but now abandoned.

Spirit of the West, Lease No. 264, 18 acres. Two shafts have been sunk on a cross reef to a depth of 50ft. and 60ft. respectively. Lease abandoned.

Leap Year, Lease No. 400, 12 acres. One shaft sunk and lease abandoned.

Midas, Leases situated about 2 miles South-East of Norseman.

The Midas, Lease No. 135, 12 acres. Brown's shaft sunk 65ft. on the "Midas" reef running East and West with Southerly underlay. No. 2 shaft sunk 70ft., and drive in East 20ft. On a North and South lode are shafts down 25ft. and 15ft. Several pits and costeens also cut.

Midas South, Lease No. 206, 12 acres. Vertical shaft sunk 110ft., all timbered. Reef cut in the shaft at 53ft., 3ft. wide.

Midas Junction, Lease No. 205, 12 acres. Shaft 60ft. deep on Westerly underlay, the reef being about 3ft. wide.

Midas Consols, Lease No. 207, 12 acres. Shaft sunk 70ft. on underlay. Several pits and trenches.

Northumberland, Lease No. 156, 12 acres. A vertical shaft sunk 42ft. A drive in South 33ft. Lode cut at 29ft. about 6ft. wide.

Midas East, No. 215, 12 acres. Several prospecting shafts have been sunk on this lease in depths of 14, 12, 9, and 34 feet, with about 50ft. of drives. A new shaft has been started to cut the reef found in prospecting shafts. Width of reef 2 ft.

Madam Midas, No. 199, 12 acres. No work at all done on this.

The Three Colonies line of reefs are situated about six miles North of the Norseman Townsite, and on the Eastern edge of Lake Cowan. The amount of work done on the group of leases immediately on and adjoining the main reef is as follows:—

THE DESIRABLE MINES.

On Lease Block No. 85, there are four shafts, three vertical, and one on the underlay. No. 1 shaft is 70ft. deep, and has a cross cut at the bottom in 10ft. A condenser is now built over it. No. 2 is 25ft., and No. 3 is 90ft. deep, the latter being timbered all the way. A cross cut 50ft. in length has been put in. The underlay shaft is 65ft. deep, timbered to the bottom, the size of the shaft being 8ft. by 4ft. 6 in. In this shaft is a drive 40ft. North and 8ft. South on the course of the lode.

Machinery to the value of £6,000 has been erected, the work being just completed. It consists of one Cornish boiler, 25 h.p., a battery engine, 20 h.p., 1 ten head stamper battery complete, 1 Worthington pump, 1 Blake pump, with tanks, condensers, and settling pits. At present there are 16 men working.

On Lease Block 84, there are seven shafts, five vertical and two on the underlay. The depths of the vertical ones are—No. 1, 13ft.; No. 2, 25ft.; No. 3, 48ft.; No. 4, 30ft.; No. 5, 85ft. The size of the last one is 7ft. by 3ft. 6in. It is timbered all the way down, and at the bottom a crosscut has been put in 20ft. The two underlay shafts are 35ft. and 10ft. respectively. 21 men are employed.

On Lease Block 168, there is one shaft 60ft. deep; 50ft. of driving has been done at the bottom. Several costeens have been cut, averaging 4ft. in depth, for prospecting purposes, and a dam has been made capable of holding 100,000 gallons of water. Four men are employed on this lease.

On Lease Block 152 there are some open cuts and costeens.

On Lease Block 196 there are also open cuts and costeens.

On Lease No. 228 there is a dam made capable of holding 30,000 gallons of water, together with some open cuts and costeens.

On Lease No. 229 open cuts and costeens have been put down. The men for the last named four leases have been put on in Lease No. 84.

THREE COLONIES GOLD MINES (Nos. 88, 117, 251, 147, 197, &c.)

Plant and Buildings.—Four roomed corrugated iron house erected, 40ft. by 30ft. Timber and brush house, 50ft. by 50ft. for stores. Large (600 gallon) condenser and 400ft. of 5in. atmospheric cooling pipes. Site cleaned and levelled, and foundations for machinery begun. Timber horses and frames erected for winding and pumping engine and gear.

Mining.—1. Open quarry on outcrop of reef 60ft. by 30ft., all in good gold bearing quartz, average samples assaying $3\frac{1}{2}$ ounces per ton. Available to be worked as an open quarry when the machinery is erected.

2. Open cutting or quarry across reef 30ft. long, 12ft. wide, and 16ft. deep, all in rich quartz, kaolin, and ironstone, assaying from 12ozs. 18dwts. to 3ozs. 5dwts. per ton. Faces on all sides. This material is also available for working when the machinery is erected.

3. Vertical shaft, 10ft. by 5ft., and 30ft. deep, originally intended for the main shaft, but now abandoned.

4. Vertical shaft, 5ft. by 2ft. 6in., and 42ft. deep, all through hard diorite. Intended for a water shaft, but no water obtained. Abandoned.

5. Vertical shaft 5ft. by 2ft. 6in., 33ft. deep, all in hard diorite. Abandoned.
6. Vertical shaft 25ft. deep in reef. Abandoned except for airway.
7. Vertical shaft 5ft. by 2ft. 6in., and 46ft. deep. Bottom of shaft in reef, the full width of which between the walls is very rich. The influx of water is too great to compete with, so operations have been suspended pending the arrival of machinery.
8. Main hauling and pumping shaft in two compartments, 5ft. by 4ft. 6in., for ladderway and pumps, the other compartment, 8ft. by 4ft. 6in., for winding stone. This shaft is down 35ft. on the underlay, the whole distance in reef carrying good gold. The influx of water is too great to be dealt with by manual labour. Operations suspended till the arrival of steam pumps.
9. A tunnel or level driven on course of reef from quarry 100ft. North and 170ft. South. Good quartz and ironstone reef all the way. Still being driven Southwards.

THREE COLONIES EXTENDED GOLD MINING COMPANY.

Lease Block 147.—One shaft 5ft. by 4ft. 6in., 63ft. deep. Quartz reef 2ft. wide passed through at 23ft., and another reef 2ft. wide cut at 52ft. Great influx of water at 60ft. Operations suspended.

1. *Lease Block 89.*—Shaft 5ft. by 3ft., 55ft. deep. Good quartz reef cut at 25ft. level, 4ft. wide, and a good quartz and ironstone reef 3ft. wide at bottom of shaft.

2. *Lease Block 89.*—Shaft 56ft. deep, 5ft. by 3ft., good reefs 4ft. and 3ft. in width respectively, cut at 25ft. and 52ft. levels. Drive 80ft. in reef at 25ft. level.

3. Shaft 56ft., 6ft. by 3ft. No reef struck.

4. Main hauling shaft 12ft. by 4ft., 38ft. deep. This shaft has gone down on underlay of reef from the surface, the reef varying from the full width of shaft to 18in. This shaft is being pushed forward with three shifts of men. The two companies, "Three Colonies" and "Three Colonies Extended," join in all expenses of management, buildings and machinery. The total number of men employed is 31.

The following is the Machinery to be erected on these properties:—Winding engine, compound double expansion pair of engines, 3 boilers, condenser for boilers, Langley mill with elevator and separator, stone breaker, saw bench, Huntingdon mill, and two pumps. The estimated cost of this plant, including transit and erection ready for work, is £11,565. It is also intended, later on, to add either the Cyanide or Haycraft process for treatment of tailings.

The Golden Bottle, Lease No. 112, containing 12 acres. On it are sunk seven vertical shafts. No. 1, 34ft. No. 2 is 22ft., with a drive South-East of 60ft. No. 3 is 41ft., and struck heavy water, No. 4 is 22ft., with a drive 24ft. East in heavy water. No. 5 38ft., with 40ft. drive East. No. 6 24ft., with drive 6ft. West, water in bottom. Three chains of costeening, averaging 4ft. deep, has been cut. Four men are employed.

Three Colonies West, Lease No. 260, contains 12 acres. No. 1 shaft is vertical and 30ft. deep, with drives in at the bottom North 15ft., South 12ft. No. 2 is vertical, 25ft. deep. Struck heavy water. No. 3 is 12ft. One chain of costeening to 12ft. deep has been done. Two men are employed.

The Four Jolly Smiths' and St. Elmo Leases are situated about $4\frac{1}{2}$ miles North of the "Three Colonies" group, and on the edge of Lake Cowan. On the "Four Jolly Smiths'" lease two shafts have been sunk, one vertical and one on the underlay. The vertical shaft is down 50ft., the reef in bottom being 16in. wide, carrying good gold. The underlay shaft is 35ft. deep, with drive 25ft. on the course of a lode 16in. wide. Five men are employed.

On the *St. Elmo* Lease there are two vertical shafts. No. 1 is 32ft. deep, with a crosscut 35ft. East into the reef, and a drive of 5ft. along the reef, which is 7ft. wide. No. 2 is 30ft. deep, with drive at bottom of 27ft. A little costeening has been done on the surface. Three men are employed.

Mt. Benson line of Reefs.—These are situated about 3 miles South-East of the Townsite of Norseman.

In the Cumberland, Lease No. 45, five shafts have been sunk. No. 1 is vertical, 36ft., with a crosscut in at bottom to cut the "Kirkpatrick Mt. Benson" lode. The size of the shaft is 6ft. by 4ft. No. 2 shaft is on the underlay to a depth of 62ft. The lode, 15in. wide, carries good gold. At 40ft. a drive East 9ft. has been put in, also one West for the same distance on the reef. No. 3 is 15ft. deep on the underlay, the reef being 18in. wide. No. 4 is sunk on a lode 18in. wide, underlying East, and carrying fair gold. A prospecting shaft has also been put down 90ft. on a lode averaging one foot in width. Eleven men are employed.

The Mount Benson Consolidated Co. consists of 9 leases (Nos. 58, 325, 252, 357, 289, 355, 356, 350, and 239) having a total area of 108 acres. On Lease No. 58, "The New Zealand," there are 4 shafts. No. 1 is on the underlay to 34ft., on a reef 2ft. wide. No. 2 is on the underlay to 45ft. The reef in this shaft averages 3ft. in width, and carries good coarse gold. A crosscut has been put in at the bottom for 12ft. No. 3 is 41ft. deep on the underlay, the reef being 18in. wide, and of good quality. No. 4 is sunk on the underlay 45ft. Five chains of costeening has also been done, averaging 4ft. in depth.

The Athelstone, Lease No. 325.—Two shafts have been sunk, No. 1 being 57ft. deep on the underlay, with a crosscut at the bottom 55ft. long, and a drive North along the reef. No. 2 is on the underlay to the East 30ft. on a reef 1ft. wide at the surface, but cut out at bottom. One and a half chains of costeening, averaging 3ft. deep, has been done.

The Hope, Lease No. 252, contains four vertical shafts. No. 1 is 39ft. on small leaders, No. 2 is 40ft. on reef 20in. wide, and No. 3 is 15ft. deep, all being vertical. No. 4 is on an Easterly underlay, sunk 30ft., with a drive at bottom 20ft. on the reef, which averages 1ft. wide. Two chains of costeening, 4ft. deep, has been cut.

On the *Auraria*, Lease No. 357, two shafts are sunk on the underlay, No. 1 being 41ft. on a reef 18in. wide of poor quality. No. 2 is 40ft. on Easterly underlay of reef, averaging 2ft. 6in. wide. There is a drive along the reef at bottom of 10ft. Two chains of costeening 5ft. deep has been cut.

The Twilight, No. 289.—No. 1 shaft down 57ft. on Westerly underlay, the reef averaging 20in. No. 2 is vertical, 30ft. deep, with crosscut at bottom 33ft. East, cutting leaders underlying West carrying gold. No defined reef met with. No. 3 is a vertical shaft 40ft. deep. Eight chains of costeening to 5ft. deep has been cut.

Globe, No. 355.—No. 1 shaft 45ft. on underlay East. Reef cut out in the bottom. No. 2 is 30ft. vertical. A crosscut has been driven West at bottom 40ft., passing through leaders carrying gold. Four chains of costeening, averaging 6ft. in depth.

Waterloo, No. 356.—No. 1 is 25ft. on Easterly underlay. Reef 1ft. wide at surface; cut out in bottom. No. 2 is a vertical shaft 36ft. deep. Drive put in North-East on small leader 5in. wide. No. 3 is a vertical shaft 55ft. deep. Crosscut put in at 40ft. 10ft. West.

Mount Benson Junction.—No. 1 shaft is 45ft. on Easterly underlay, with a crosscut East 30ft. at bottom, and drives, North 18ft., and South 25ft., on course of lode 18in. wide, carrying fair gold. No. 2 is 25ft. vertical; still sinking. No. 3 is 20ft. deep on a vertical reef; formation cut out at bottom. Six chains of costeens, averaging 5ft. deep, cut.

Alice, No. 350.—No. 1 shaft 30ft. vertical. A crosscut has been put in West 40ft., but no reef found. Eight chains of costeening cut. Twenty-six men are employed by the company.

The Esperance, No. 436.—No. 1 shaft, vertical, 15ft. deep. Struck reef in bottom carrying fair gold. No. 2 18ft., vertical, on a jumbled reef. Three men are employed.

On the *Hackney* and *Sir William Wallace* leases nothing has been done with the exception of a little costeening.

Mount Benson Reward, No. 43.—No. 1 shaft is 48ft. deep, part vertical and part on underlay. The lode is 18in. wide, and carries payable gold. No. 2 is 60ft. on the underlay of an 18in. reef, carrying payable gold. No. 3 is 100ft. East of No. 2 shaft, and is 85ft. deep on underlay. Reef 2ft. wide, carrying good gold from the surface. This shaft is connected with No. 2 at 50ft. Lode, an East and West one, averages 4ft. in width. The drive is in 40ft. East at 50ft. No. 4 is 53ft. on underlay reef, averaging 2ft. 6in. wide, carrying payable gold. Engine shaft 80ft. vertical, 8ft. by 4ft. in the clear, and close timbered to the bottom. On Lease No. 42 No. 1 shaft is 62ft. on the underlay South. This shaft is connected at 62ft. with No. 2 shaft; lode averaging 1ft. 3in. No. 2 is 65ft. deep on the underlay, carrying good gold. No. 3 is 20ft. on underlay; lode averaging 3ft. wide and carrying good gold.

Mount Benson, West.—Lease No. 259. No. 1 shaft is 45ft. on underlay, with drive South 8ft. No. 2 is vertical, 40ft. deep, on few small leaders. No. 3 is 35ft., still sinking. 92ft. of costeens, averaging 6ft. 6in., have been dug. 12 men are employed.

Onkaparinga, No. 227.—No. 1 shaft is down 30ft. on underlay, lode being 4ft. wide, carrying payable gold from the surface. No. 2 is 50ft. deep, 30ft. on the underlay, and 20ft. vertical. No. 3 is 40ft. deep on the underlay of a lode 18in. wide.

Excelsior, No. 275.—No. 1 shaft is 40ft. deep on underlay, the reef here being 4ft. wide, and carrying gold from the surface. No. 3 is 25ft. on underlay. Reef, 18in. wide, showing a little gold.

Try Again, No. 159.—No. 1 shaft is 60ft. deep on the underlay. Reef 15in. wide. No. 2 is 40ft. deep on the underlay, the reef averaging 15in.; connected with No. 1 shaft at 30ft. No. 3 is 25ft. deep on underlay. Reef, 2ft. wide, showing little gold.

Union, No. 114.—No. 1 shaft is 45ft. vertical. Reef, 2ft. 6in. wide, carrying gold. No. 2 reef—shaft, 129ft. down on vertical reef, averaging 2ft. in width, and carrying payable gold. A crosscut has been put in at 75ft. North-East for 125ft. No. 3 reef—39ft. on underlay of reef 4ft. wide, carrying gold.

Kadina, No. 202.—Three shafts sunk 40ft. each; two shafts sunk 15ft. each, with 27 pits cut from 3ft. to 8ft. deep.

The Princess Royal and *Princess Royal South* leases, are situated East about $1\frac{1}{4}$ miles from the "Three Colonies" group of leases, and South-East from the "Four Jolly Smiths" and "St. Elmo" leases. On both the properties a good deal of work has been done.

The Princess Royal has within its boundaries six shafts. No. 1 is vertical 95ft., and is sunk 5ft. below water level, timbered to the bottom for engine shaft. No. 2 is on the underlay to water level, 90ft. At 70ft. a drive has been put in along the reef, which is 2ft. wide, 14ft. North and 14ft. South. No. 3 is on the underlay 70ft. At the bottom a crosscut was put in 34ft. East, and a reef 2ft. wide was struck. They are at present driving along it. No. 4 is on the underlay to 80ft. No. 5 is down 35ft., and still sinking. No. 6 is 20ft. down on underlay for the purpose of prospecting a reef West of the main lode. 200 yards of costeening have been done, the average depth being 3ft. 12 men are employed.

On the *Princess Royal South* there are two shafts, one vertical, and one on the underlay. The former is 20ft. deep, and the latter 70ft. At the 30ft. level, in the underlay shaft, there is a crosscut 25ft. East. At the 70ft. level a crosscut was put in 40ft. East to the reef, and a drive 12ft. North and 14ft. South along it, the average width of the lode being 1ft. wide. Seven chains of costeening, averaging 4ft. deep, has been done. Five men are employed.

The Little Rachel, Lease No. 136, 12 acres in extent, is situated a quarter of a mile East of the "Mount Barker Reward" claim. The main shaft is sunk 56ft. on Westerly underlay. No. 2 is on a parallel lode sunk 35ft. No. 3 is on reef running North-West and South-East, sunk 20ft.

The Surprise, No. 248, 12 acres, North of the "Little Rachel." One shaft sunk 25ft., and another started. Lease then abandoned. It is since applied for by other parties.

The Union Jack, No. 166, 12 acres, South of the "Little Rachel." One shaft sunk 90ft., the reef cut at 80ft. Another shaft sunk 30ft. on a cross reef. New shaft started.

Lady Argyle, No. 367, 12 acres, situated North-West of the "Little Rachel." Two shafts sunk, one 60ft., with drive West 30ft. and North 20ft. No. 2 shaft sunk on Easterly underlay, reef 6ft. wide. About 30ft. of costeening 5ft. deep done.

Lady Alice, No. 238, 12 acres. No. 1 shaft, near East boundary, sunk 30ft. on underlay, and drive in 12ft. West. No. 2 is near the South-East corner of lease, sunk 35ft. on reef 1ft. wide. About 100ft. of costeens 6ft. deep.

Josephine, No. 418, 12 acres. The shaft near the North-East corner sunk 40ft. vertical, with drive North 17ft. Shaft near Western boundary 25ft. deep on a cross reef. Drive going South-East. Shaft near the South-West corner sunk 30ft. on Southerly underlay.

Lady Katherina, No. 409.—Several pits and costeens sunk for prospecting purposes.

The Pot Luck, No. 230, of 12 acres, is about half a mile North-East of No. 5 "Mount Barker" Lease. Shaft sunk on big reef with Westerly underlay 90ft. Lease apparently abandoned.

Little Beatrice, No. 274, 9 acres, South of the "Pot Luck."—Shaft sunk 60ft. vertical. Lease apparently abandoned. To the North of the "Pot Luck" Lease a shaft has been sunk 30ft. and abandoned. At present there is no work being done on this line of reef.

La Mascotte, No. 441, of 12 acres, North of the "Norseman Star."—Vertical shaft sunk 45ft. Crosscut driven 34ft. East. A little costeening done in prospecting.

Great Mildura, No. 391, 12 acres.—Shaft sunk on Westerly underlay 35ft., reef 4ft. wide.

Mildura North, No. 392, 12 acres.—Main Shaft sunk 75ft. vertical. Several pits of 10ft., and about 100ft. of costeens 4ft. deep.

Queen of the West, No. 390, 12 acres.—Main shaft sunk 70ft. vertical. A few pits and about 100ft. of costeens about 4ft. deep have been cut.

The Mary Cater, No. 402, is situated about a quarter of a mile East of the "Eden Park." No. 1 shaft sunk 30ft. vertical, then drove West 25ft. to hanging wall, then 8ft. on underlay of a big ironstone and quartz lode. It was from this shaft that some very rich stone was obtained. No. 2 shaft at North end of the lease sunk 22ft. vertical. This is also on a big ironstone and dyke formation, carrying gold for 25ft. wide, and is in the same line of reef as the "St. Alban's." About 40ft. of trenching, 5ft. deep, has been dug.

Mary Cater North, No. 459.—Several feet of costeening done for prospecting.

Eden Park, No. 133, situated about 4 miles North-East of Norseman.—No. 1 shaft sunk 100ft. on a North and South lode, Easterly underlay. Drive put in South 30ft. and North 50ft. Reef 2ft. 6in. to 3ft. wide, carrying fair gold. No. 2 shaft, near the South boundary, down 40ft. on Easterly underlay. Driven North 23ft.; reef 2ft. 6in. wide. Several trenches and pits along the line of reef.

Eden Park South, No. 134, 12 acres.—Main shaft down 100ft. on a North and South lode. Drive put in 10ft. along lode 3ft. 6in. wide. No. 2 shaft is sunk 80ft. on Easterly underlay on reef; all the way 4ft. wide, and parallel to reef in the main shaft. No. 3 shaft sunk 20ft. on underlay.

Eden Park Extended, No. 176.—Shaft sunk 50ft. on underlay on Western lode. Reef 2½ft. wide.

Homestake, No. 334, 12 acres.—Shaft sunk 40ft. on Western lode. These four leases are adjoining, and are worked by the same company. Ten men employed.

No. 1 North Eden Park, No. 287.—Main shaft sunk on "Eden Park" lode 15ft. Several pits and trenches for prospecting and opening up the reef.

The Golden Bar, Lease 380, 12 acres, situated West of the "Morning Star," Lease No. 54.—Vertical shaft sunk 60ft. Several pits and costeens.

Miss Harriet, No. 332, 12 acres, West of Lease No. 44.

Sudden Norseman, No. 44.—Underlay shaft sunk 80ft. on East and West reef 4ft. wide. Vertical shaft down 50ft., about 55ft. from the underlay shaft. Several pits and 70ft. of costeening.

Lucindale, No. 376, 12 acres, North of the "Miss Harriet" Lease. Underlay shaft sunk 35ft. on a lode 15in. wide. Vertical shaft down 20ft.

Golden Dyke, No. 377, 12 acres, West of the "Miss Harriet" Lease. Shaft sunk 12ft. vertical, then 48ft. on Easterly underlay on North and South lode 3ft. wide. Another shaft sunk 10 chains North and down 70ft. on underlay. Two other shafts sunk 10ft. and 20ft. on another East and West reef.

Zimmerman, No. 412, 12 acres, West of "Lucindale." Shaft sunk on North and South lode on Westerly underlay 45ft. Lode about 6ft. wide. Vertical shaft sunk 15ft. Several pits and costeens on different parts of the lease.

The Golden Thorne, No. 432, 12 acres, situated about 8 miles North-East of Norseman. Shaft sunk 40ft. on Westerly underlay with drive 30ft.

The Golden Crest, No. 426, near "Golden Thorne." Shaft sunk 45ft. on underlay. Reef 4ft. wide. Three other reefs opened up by costeens.

The Lady Mary Gold Mining Company, comprising Leases Nos. 49, 99, and 77, containing 42 acres, is situated about six miles South-East of Norseman. There are seven shafts sunk on this property on a Westerly underlay, all about 100 feet deep. At the 50ft. level, there are from the various shafts 270ft. of levels driven, and at the 100ft. level 400ft. of drives have been put in. The reef averages nearly 3ft. wide, and by the appearance of the stone should be worth 2ozs. of gold per ton. In No. 6 shaft the reef is 5ft. wide at the 100ft. level, and showing good gold.

Lady Mary South.—One shaft sunk 18ft., and another 12ft., the “Lady Mary” reef being cut in both.

Lady Mary South Extended.—Two shafts sunk 35ft. and 28ft. respectively on reef, showing fair gold.

Lady Mary North Extended.—One shaft sunk 50ft. on large ironstone and quartz formation. Another shaft sunk 35ft.

Anchor, No. 74, 12 acres, about one mile North of the “Lady Mary” Lease. Two shafts sunk 40ft. and 18ft. deep, respectively.

Lady Ettie.—Adjoining the “Anchor” Lease. Reef exposed by costeens and pits.

Clarence, No. 75, 12 acres, North of the “Anchor” Lease. Tunnel driven 90ft. in ironstone and dyke formation, showing a little gold all the way. One shaft sunk 40ft. on same formation.

The Oriental Mines, comprising Leases Nos. 69, 70, 370 and 371. North of the Clarence; containing about 50 acres. On Lease No. 69 a tunnel has been driven 420ft. through a big ironstone and dyke formation. Shaft sunk 10ft. On Lease No. 70 a tunnel has been driven 70ft. and shaft sunk 40ft. Costeens and several pits sunk on Leases 370 and 371.

The Blucher, No. 83, 12 acres, one mile North of the “Oriental.” No work done on this lease, and apparently abandoned.

The Iron Duke, No. 82, 12 acres, North of the “Blucher.” A tunnel has been driven 60ft. Lease apparently abandoned.

The Edwards Mines, Lease No. 128, contains 12 acres, and is situated about six miles North-North-East of Dundas, and about 12 South-South-East from Norseman. This property was discovered in July of last year, some very rich stone being got on the surface. Some few tons of it were sent to Adelaide for treatment, and returned 15ozs. to the ton. One hundred and fifty tons have just been put through the public battery at Norseman but the result has not yet been made known. It is confidently expected to go 3ozs. per ton at least. The work done on the mine consists of large open trench 100ft. long, 6ft. deep, and 8ft. wide. This exposes a reef underlying East at an angle of 45°; width of reef 2ft. A vertical shaft sunk 40ft. on a North-West and South-East reef 18in. wide. Another shaft is down 15ft. on a reef 5ft. wide, underlying West.

Waratah, No. 137, 18 acres, North of the “Edwards.” No. 1 shaft sunk 55ft. on underlay Easterly reef 18in. wide. No. 2 shaft is sunk 20ft. Several pits and costeens.

Woonaminta, comprising Leases Nos. 414, 415, 416, containing 36 acres. Three-quarters of a mile West of the “Edwards.” Shaft sunk 40ft. on a large ironstone and dyke formation carrying fair gold.

Pactolus, No. 342, 24 acres, about a mile North of the “Edwards.” Shaft sunk 25ft.

Hercules, No. 341, 24 acres, North of the “Pactolus.” Shaft sunk 30ft. Several pits and costeens.

Enterprise, No. 181, 12 acres, North of the “Waratah.” No. 1 shaft sunk 60ft. vertical. Several pits and costeens.

Albermarle, No. 183, 24 acres, situated about two miles North of the “Edwards.” Shaft sunk 55ft. vertical. Underlay shaft sunk 25ft. on reef 3ft. wide. No. 3 shaft sunk 20ft., and a pit sunk 10ft. on a reef 4ft. wide.

Emu, No. 271, 24 acres, about a quarter of a mile South of the “Albermarle.” Four parallel reefs and two cross reefs have been opened up. Various shafts, pits, and costeens sunk from 10ft. to 15ft. One shaft down 45ft.

Little Wonder, No. 270, 12 acres, East of the “Albermarle.” Shaft sunk 50ft. on a reef 15in. wide. A crushing was treated at the local battery, yielding 2½ozs. per ton.

Kangaroo, No. 326, 18 acres, South of “Little Wonder.” Shaft sunk 25ft., and several pits and costeens.

W. H. ANGOVE,
Temporary Inspector of Mines.

Appendix 12.

*Report by the Senior Inspector of Mines, Eastern Goldfields, on the Auriferous Deposits,
Dandalup River, Darling Range.*

The Hon. the Minister of Mines, Mines Department, Perth.

SIR,

Coolgardie, 6th May, 1896.

In accordance with your instructions, I inspected G. H. Lovett's Reward Claim, Block 11, North Dandalup, Darling Ranges, area about 33 acres, and herewith submit my report thereon:—

The property is situated about four miles from the North Dandalup Railway Siding, and about 43 miles from Perth in a Southerly direction.

Prior to giving a *résumé* of my inspection, I must state that the manager, Mr. Moore, left the mine entirely under my direction; no interference whatever was advanced, but assistance tendered, which was only accepted to define the East and West wall. This, I think, may be set down as established in proving the huge formation at considerably more than two chains in width.

Adjacent to the Northern boundary a cutting is excavated 27ft. into the hill South, starting at North at *nil* until, at the distance named, it is 11ft. high, exposing the formation of more than ordinary features of promise, that should prove of value if not of auriferous wealth. The small amount of work done will not allow anyone to form a decided opinion, every district having its own peculiarities and requiring invariably a separate study in each case, yet it may yield abundantly at a depth.

Associated with the geological features of this particular mine, and no doubt the vicinity as a whole, there are many accessory minerals other than gold; therefore it may be expected many of the following minerals may be met with, *i.e.*, tin, copper, antimony, iron, lead, or silver, so we may therefore infer a wide range is open and justifies the expenditure of capital in a course of well devised and properly conducted mining operations.

Below the level of the cutting, near the extreme end, the formation has been sunk upon to a depth of 7ft., and mined East 5ft.; this exposes a face of 9ft. South of the formation.

The whole opened up disclosed matrix of close grained quartz carrying arsenical pyrites stained with magnesia and oxide of iron, besides apparently minute stains of copper.

The 9ft. face referred to being the most suitable place to gain a correct result, I set on the two miners engaged and brought out by myself, to break down a foot or more from the face as it stood. After clearing away the whole of the quartz carefully, I then ordered them to shoot down the virgin country inside, which gave me three bags, marked A., B., and C., which were treated by the Cyanide process as one sample, the result being herewith appended.

Another shot was put in West of the face where a laminated band of stone is on view from the outcrop to a depth of 18 feet, when, after clearing away the *débris*, I bagged a sample, marked "D."

By adopting this precaution there cannot be a scintilla of doubt as to the genuineness of the trial, as each bag was sealed by me and handed to a trustworthy man, who took charge of each until after the inspection, and the samples were all obtained, when they were removed by buggy to Perth, safely deposited there, and to make assurance doubly sure I had two boxes made in order that the lot might be conveyed to Coolgardie, and thence to the "Golden Bar Cyanide Works," where I left them with the manager, Mr. Uriah Dudley, who is an expert in the business, in full confidence that he would give the stone every care and arrive at a correct result.

At the boundary of Blocks 11 and 10 (*see plan*) a shaft 11 feet deep has been sunk, the formation being struck at 7 feet, showing the same compact and solid appearance; from this I bagged a sample, marked "No. 4."

Prior to leaving this block I took the altitude of the hill from base to cone, and found by aneroid barometer a registration of 170 feet in the distance of seven chains going South on the line of strike, 28° East of South, the underlay of the lode being 74° from the horizon.

The outcrop showed the whole distance, and as far as the eye could reach in the direction named, of a compact massive appearance, proving very conclusively, so far as my limited time would allow me to arrive at a conclusion, that this was the main lode of the district.

The men kindly allowed me by Mr. Moore I had defining the East and West wall, both of which are granite. This allowed me to base my geological features as stated. These features having presented themselves, I should have liked to inspect some five miles North and South on the line of strike, had time allowed. North, as I am given to understand, serpentine country intervenes, and South, for the simple reason that the Eastern slopes, in my experience, have usually been more prolific in auriferous wealth; besides which, 2½ miles South strong ironstone outcrops may be seen, and about five miles in this direction, I am informed, the true gold-bearing zone (slate and sandstone) is to view; but much as I desired to see these important features, shortness of time deprived me of inspecting this and the surrounding district.

After inspecting Block 11 I visited Block 10 to inspect the reputed rich find, every facility in the way of inspection being given me as on Block 11.

I was shown some stone from the find, which was covered up carefully with bags and *débris* from an adjacent costeen. This I ordered to be placed on one side, and mined to a depth of about 2ft. immediately below the place where the stone was found. I had samples taken therefrom, which are similar in every respect to that in Block 11, except that I did not see a stain of copper. This I had bagged and sealed, and marked "E."

Some few feet South from this, on the Western wall of the formation, there is an East and West costeen, from which I obtained a bag, marked "F."

Concluding my inspection, I took the bearings of this Western wall, and found that the place where the wall was cut in Block 10 tallied exactly with the place where I had the men defining the Western wall in Block II, thus proving to my mind the magnitude of a huge formation.

I have, &c.,

THOMAS FOWLER.

THE GOLDEN BAR GOLD MINING COMPANY (NO-LIABILITY), COOLGARDIE.

Cyanide Works,
May 6th, 1896.

Report of Stone left for Treatment by Thomas Fowler, Coolgardie.

	Bags.	Marks.	Weights.	ozs.	dwts.	grs.
April 28	3	A,B,C.	135 lbs.	...	...	45
	1	D.	44½ "	...	...	361
	1	E.	41½ "	...	...	485
	1	F.	46½ "	...	...	458
	1	4	20 "	...	...	784

The above samples were most carefully crushed and cyanided. Gold was not visible in any of the above samples, and it is most likely the small amount of pyrites in the stone carries all the gold.

Small samples of each of the above parcels, all sealed, have been handed you.

URIAH DUDLEY,
Manager.

To Thos. Fowler, Esq.,
Senior Inspector of Mines,
Coolgardie, W.A.

The Hon. the Minister of Mines, Mines Department, Perth.

SIR,—

Coolgardie, 6th May, 1896.

Referring to Mr. Uriah Dudley's letter and analysis of the 6th inst, I requested Mr. Dudley to give analysis of tailings in each case, and also have samples from each bag, which I have submitted to a competent assayer to make a check fire assay. When completed will forward you result.

I am, &c.,

THOMAS FOWLER.

H. Prinsep, Esq., Under Secretary for Mines, Perth.

DEAR SIR,

Coolgardie, 8th May, 1896.

After the enclosed analysis came to hand, yesterday, from G. Graves, Gifford, & Co., I wired to await return of cyanide check assay before publishing returns.

Gifford & Co.'s fire assay somewhat astonished me; consequently hurried Mr. Dudley's assay of tailings forward (herewith enclosed) with explanation and results from that gentleman.

Am fully impressed the Manager of the "Golden Bar Cyanide Works" gave every attention to arrive at a correct estimate of the ore value in bulk, which, to my mind, should be more reliable than an 800-grain test by fire assay, yet must say Gifford & Co. exercised the greatest care in sampling and manipulation of parcels submitted, besides which (usual in such cases) they put through another check assay of 800 grains each, then taking the mean of the two.

Have kept balance of samples, which are now under seal, and will likewise sample, bag, and seal tailings.

I am, &c.,

THOMAS FOWLER.

ASSAY NOTE.

No.	Description of Sample.	Mark.	Lbs.	Assay on Dried Material.		
				Gold ...	oz.	dwts.	grs.
E 478	Crushed Sample	A, B, C	1½	...	8	16
E 479	" "	D	¾	" ...	6	20
E 480	" "	E	1½	" ...	5	12
E 481	" "	F	½	" ...	4	21
E 482	" "	4	¼	" ...	5	5

Per ton of 2240 lbs.

G. GRAVES GIFFORD AND CO.

THE GOLDEN BAR GOLD MINING COMPANY (NO-LIABILITY), COOLGARDIE.

Cyanide Works, May 8th, 1896.

Report of Stone left for Treatment by Thomas Fowler, Coolgardie.

1896. April.	Bags.	Marks.	Weight.	Treated by cyanide direct.			Assay of the tailings after cyaniding.		
				Yielded: Gold per ton.			Gold per ton.		
				ozs.	dwts.	grs.	ozs.	dwts.	grs.
28	3	A, B, C.	135lbs.	0	0	4·5	0	13	1·6
"	1	D.	44½lbs.	0	0	3·61	0	9	3·5
"	1	E.	41½lbs.	0	0	4·85	1	0	23·7
"	1	F.	46½lbs.	0	0	4·58	0	9	3·5
"	1	No. 4	20lbs.	0	0	7·84	0	7	4·4

No visible gold could be detected in any of the parcels. All have been carefully crushed to 2,500 holes per square inch, and then cyanided with an 0·4% solution, with the result showing that the extraction of the gold is an extremely low one and not suited to that treatment. The tailings of all the parcels are kept, and can be obtained at any time.

URIAH DUDLEY,
Manager.

To Thos. Fowler, Esq.,
Senior Inspector of Mines,
Coolgardie, W.A.

Coolgardie, 9th May, 1896.

The Under Secretary for Mines, Perth.

SIR,—

Relative to the returns from the Dandalup quartz, I must say I met with three surprises, each of greater extent than the other.

Whilst the ore was in solution Mr. Dudley went frequently over the different vats with a zinc pencil, trying each in rotation, but not a scintilla of gold presented itself; yet the return of a small fraction of grains per ton of ore created surprise (No. 1), leading me to ruminate, *i.e.*, if gold were contained in minute quantities, then it is necessary to have an analysis of the residue tailings from cyanide, together with a fire assay, taken and sampled from each bag prior to cyaniding being commenced.

The return from Gifford & Co. (No. 2 surprise) created a sense of uneasiness to know if a mistake had occurred with the firm stated or Mr. Dudley's treatment, resulting, when it came to hand, in the last but not least degree of astonishment.

As I explained previously, cyaniding was the result of bulk tests, whereas that of fire assay from the mean of two 800 grain charges in each case. Therefore, I naturally consider the former more reliable than the latter.

I may here state the cyanide solution was fresh, and every part or portion in which the stone was crushed, and after manipulation cleansed with more than ordinary care; consequently no doubt should exist as to the result.

That being so, and from the fact that this particular ore will not cyanide, unfortunately, under present conditions of cyaniding, destroys the intrinsic value of the huge masses of ore as a whole, for there is no doubt, and it cannot be controverted, in an all-round battery process from 14 to 20 per cent. is lost from that held in suspension and solution, then what must it be in this case when the gold must be of such exceptional fineness?

Of course we are in a progressive age, and the refractory agents may be overcome; if so, then the value of these properties cannot be estimated—nothing so stupendous having come under my observation—always providing the quality is of equal value to that mined, brought to Coolgardie, and operated upon here.

I have, &c.,

THOMAS FOWLER.

Appendix 13.

Reports on the Kimberley Goldfield, by the Warden.

From the Warden, Kimberley Goldfield, to the Under Secretary of Mines.

I have the honour to forward, for the information of the Hon. the Minister, the following Report on the Kimberley Goldfield for the month ending October 25, 1895 :—

GOLD EXPORT.

347ozs. 4dwts. and 15grs. have been sent or taken away during the month. This amount is only the amount declared and weighed in my office, and does not represent in any way the total output.

TRIPS.

During the month I have visited the "Ruby" and "Mary" workings; also Long and Hall's Gullies, and McPhee's. I have also continued my weekly visits to the "Brockman."

BONUS.

I have inspected and passed 34ft. below the 100ft. level in the main shaft of the "Ruby Queen," and have paid the owners from my advance account £136, being the stipulated reward at £4 per foot. The owners of the "Mount Bradley" and the "Saint Lawrence" have given me notice of their intention to sink at once.

LEASES.

During the month three new leases have been applied for—two at White's Gully, to be called "The Lone Hand" and "The Brilliant" respectively, and one at Mt. Dockrell, to be called "The Lone Star." The specimens from the two former are splendid. About 13 tons from the "Lone Hand" are to be crushed to-morrow, and the result I will telegraph to you at once.

MACHINE AREAS.

Machine Area No. 7, Mt. Dockrell, was declared forfeited for non-payment of rent. Mr. Stanley applied for this area, and it was registered in his name. I gave the late owner three months to remove his machinery. He has no agent on the field, so I requested you by wire to notify him, which you informed me also by wire had been done. Mt. Dockrell lease and area have been almost constantly under exemption, and the company's promises to the Government and previous wardens as to providing capital to work the claim have never been fulfilled.

ABORIGINALS.

In another communication I have dealt with the subject of your letter of August 28, 1895. In addition to what I have said there, I would beg to draw the Hon. the Minister's attention to the subject of half-caste children.

To allow these to grow up in a nondescript sort of way—neither as full blacks nor as full whites—means danger in the near future. The police and settlers here constantly approach me on this subject, and I recommend that the Wardens be authorised to send them to orphanages whenever they may deem it necessary. During the present month a digger named Meyerhoff was speared at Mt. Dockrell. He is recovering, although severely wounded. I am afraid the diggers encourage natives into their camps, and I have warned them that it is a dangerous and unwise practice.

The police immediately started for the scene of the attempted murder, and will, no doubt, teach the aboriginals of that district, already noted for two murders and this attempt, a good and wholesome lesson.

HOSPITAL.

A tender for the erection of this most needful addition to Hall's Creek has been accepted, and the contractor has commenced work.

MINERS' INSTITUTE.

An institute and reading room is well supported here, and much valued by the miners. At present it is located in a part of the Warden's Court, a most inconvenient arrangement, only meant to be temporary. I have asked the Treasury for a small grant to erect a building, which will be appreciated by all on the field.

ADMINISTRATION.

As I informed you by wire, the Mining Registrar, Mr. Mansbridge, has been transferred in his own department to Jarrahdale as postmaster.

I have previously testified as to the capabilities and qualities of this officer, and therefore need only say that I am very sorry the necessity arose for his transfer.

OVERLANDERS.

The influx is very small just now, owing to it being almost impossible to travel for want of water. Some eight declared their horses here during the month, and I hear on very good authority that the wet season will see a great many more.

Order is well kept, and, on the whole, the feeling generally on the field is good.

W. D. CUMMINS,
Warden.

Warden's Office, Kimberley,
October 26, 1895.

From the Warden, Kimberley Goldfield, to the Under Secretary of Mines, Perth.

I have the honour to forward, for the information of the Hon. the Minister, the following report on the Kimberley Goldfields for the month of May, 1896.

As you are aware, I was absent from the field in Perth, and going and coming during the months of January, February, March, and part of April. Since my return, I regret to say, as I have also informed you by telegram, I have suffered from a severe attack of malarial fever caught in the swamps on the Derby Road. I have thus been unable to visit any part of the field, and am afraid work in my office has been obliged to fall slightly behindhand. This state of affairs will be very soon remedied now.

DEEP SINKING.

The "Mount Bradley" and the "Ruby Queen" are still at work under the bonus, and the "St. Lawrence" Mine has notified me of the shareholders also wishing to take advantage of the bonus offered by the Government. Very good reports are made to me by the Manager of the "Ruby" Mine, and a crushing is about to be put through which I hope will be very satisfactory to the owners.

POPULATION.

I am sorry to have to report that the population, owing to temporary causes, has dwindled away considerably. In the first place, the rush on the Fergusson (which I hear has turned out very unsatisfactorily) has prevented the usual number of overlanders crossing the border. A great many men have left temporarily for the shearing on the stations on the Derby Road. Of course, after the shearing season is over these will return, but the principal causes of our decided loss in numbers can be traced to the terrible floods which Kimberley experienced this year, almost unknown to white or black before. The roads from Wyndham were rendered utterly impassable by bog and flood, and the men could not get even the bare necessaries of life. Even now it is a hard matter to buy provisions on the field, and only for the arrival of Mr. Landrigan's wagons last week there would have been a famine again on Kimberley. This state of affairs continuing, as it did, nearly four months, naturally disheartened a great many of the miners, who made their way down to more Southerly fields. I might also report that I am informed that the heat on Kimberley during the past summer was at times almost unbearable. This, together with bog, flood, and fearful rains, must have made the stoutest heart wish for pastures new, but brighter times are now, I trust, in store for us. I hear of overlanders on their way, and if the "Ruby" crushing is anything like what the trustworthy manager hopes it will be, a large amount of our population will return. So I look upon the present rather slack time only as a natural result of the exceedingly arduous summer heat, flood, and rain, to which this unfortunate field has been treated.

MEDICAL.

I am very glad to inform you that the Government has seen fit to comfortably furnish the hospital recently built here, to send us a Hospital Orderly, who has just arrived, and last, but certainly not least, a Medical Officer, who has started from Fremantle by boat; all this is most satisfactory, and I must say that it is with gratitude that I can see in these benefits the hand of the Hon. the Minister of Mines' administration. Mr. H. V. Falkiner, the Mining Registrar, has picked up his work very readily, and though, through illness, I have not been able to assist him in the office work, he has been of the greatest use during the time when help and assistance was of absolute necessity to me. The Orderly, unfortunately, has been practically useless, through illness, since his arrival on the Creek, having caught the fever, I suppose, at the same time as I did; but I sincerely hope and trust that he will soon be able to take up his work. At present he is confined to his bed in the Residency.

EQUIPMENT.

It is with great pleasure that I inform you that the buggy furnished by the Mines Department has turned out a really good and serviceable article. Messrs. White and Son deserve a great deal of credit for having furnished a buggy so eminently suited to the roads, or rather the non roads of a district like this. I have to inform you my horses gave out half-way from Derby, and in order to proceed I was obliged to purchase two new animals, a grey gelding, under five years, already trained to the buggy, and a roan gelding, about seven years, also a particularly good buggy horse. I was compelled to make these purchases, as otherwise I would have to have camped on the road. It was impossible for me to properly spell my horses, as I had also to mount Mr. Falkiner and the Orderly, so that no horse could get a day's rest. Had this not been necessary I should not have presumed to make a purchase, knowing that your approval ought to have been gained in the first instance, but as that was clearly impossible, and the purchase was an absolute necessity, I sincerely hope you will see your way clear to recommend to the Hon. the Minister the approval of the amount expended. These two animals will take the place of Tuart and Otway, who are both utterly worn out in the service.

GENERAL.

I might add that a Mr. Napier, evidently an expert from some company, is very carefully inspecting the different mines, and has already informed me that he has great hopes for the improvement of mining in Kimberley.

I am sorry there is a doleful note ringing throughout this report, but I hope you will put it down to the fact that I am still a victim to that abominable fever, and therefore, perhaps, see everything through very sad coloured spectacles.

I have, &c.,

W. D. CUMMINS,
Warden.

Appendix 14.

*Reports on the Results of the Offer of a Bonus for Deep Sinking, Kimberley Goldfield,
by the Warden.*

SIR,—

Perth, March 4th, 1896.

I have the honour to make the following report on the deep sinking in Kimberley during the year 1895, for the information of the Hon. the Minister.

Only two claims availed themselves of the Government offer, viz., "Ruby Queen" and "Mt. Bradley" Tunnelling Claim. The manager of the first of these reports, under date February 29th, that they have now reached 192ft. from the surface. No water has yet been struck, the sinking is improving—black slate and quartz, carrying gold. The formation looks as if the main reef will come back to shaft when the sinking is down another 50ft. He is at present raising good stone from the 90ft. level.

The "Mt. Bradley" Tunnelling Claim was down 45ft. in January last, and is now, I suppose, at a much greater depth. The owners of this mine also report being on payable gold. The success that has met the deep sinking in these two claims, to a certain extent, proves that the reefs do go down and are not mere surface shows.

In an interview with the Hon. the Premier he gave me to understand that this bonus would be offered for another year at least, and I think I may safely predict that it will be more taken advantage of, and probably at the end of the present year we shall have better results to show.

I have, &c.,

W. D. CUMMINS,

Warden, Kimberley.

The Under Secretary of Mines, Perth.

Appendix 15.

Warden's Report on the East Murchison Goldfield for the Year ending 30th June, 1896.

Lawler's, East Murchison Goldfield, 1st July, 1896.

I am pleased to be able to report, for the information of the Honourable the Minister, that for the twelve months ending 30th June, 1896, the East Murchison Goldfield has made steady progress, especially when considering the difficulties that had to be contended against: stores, machinery, etc., being carted a distance of 450 miles from Mullewa—the terminus of the railway—or 500 miles from Geraldton, our nearest seaport; until recently the extreme difficulties of transport, owing to long stages on the road without water. It is now twelve months since this field was proclaimed. I received instructions to proceed here from Perth, and select the most suitable place for a township and official centre, arriving here after a severe journey by camel train (bringing with me all tents, books, etc., necessary for the opening of a Warden's Court). The weather being dry, and water long distances apart, the camels were three days without water.

On my arrival at Lawler's on the 14th August, 1895, I issued the first miner's right for the field, and the first goldmining lease was applied for. At the present time, there are 200 leases taken up, and the mining revenue for the ten and a half months amounted to £3,700, exclusive of survey fees.

There were no signs of permanent settlements on any part of the field at that time, there being only a few men left from the large alluvial rush which took place some time before to Lake Darlôt, and practically no reefs had been taken up. I almost felt inclined to report to Head Quarters for my recall, there being apparently nothing to warrant a Warden on my visit here.

Within a few weeks, after visiting the different centres, my opinion was quite changed, when I saw the reefs that were being tried by the first prospectors. I then felt satisfied this was destined to become one of the most important reefing fields in the Colony.

Lawler's Patch, being the most general centre, I selected it as the official centre for the field. To-day there is a busy and thriving town, buildings in all stages of erection, composed of brick, stone, iron, and hessian.

The greatest alluvial workings were at Lake Darlôt, which is situated about 50 miles East from here.

There were also other small patches of alluvial at "Wilson's," "McAffery's," "Ogilvie's," "Lawler's," the present town being named after the prospector of the latter alluvial patch.

All these patches are now practically worked out, and the prospectors are turning their attention to the reefs, with the most favourable results.

The reefing centres are "Lawler's," "Lake Darlôt," 60 miles East; "Wilson's," 40 miles South; "Black Range," 100 miles West; "McAffery's," 4 miles North-East; "Ogilvie's," 6 miles; "Anderson's," 15 miles; "Mt. Sir Samuel" and "Pascoe," 40 miles; and "Lake Way," 120 miles North of Lawler's.

The township has been surveyed, but has not yet been proclaimed, and no land sales have yet taken place; there are three wayside hotels and six small stores. Twelve auriferous leases are being worked in the locality. One 5-head stamp battery is being worked on the Emerald Reward claim. A good deal of alluvial gold has been found about this locality. No sensational finds have been made since the discovery of the Emerald Reward mine, but a number of the reefs are looking well and show gold freely. Good water is obtainable at any depth over 20 feet. Timber suitable for mining purposes is scarce. The deepest mining shafts here are about 70 feet.

The climate is a very healthy one, and although the summer heat is at times excessive during the day, the nights are cool and breezy. During the six months of winter, viz., April to September, I do not think it is possible to find a more genial climate.

The rates of cartage from Mullewa to Yalgoo, and from Mingenew to Yalgoo, are £12 per ton.

A Government school will be opened shortly.

CARLAMINDA,

Seven miles North of Yalgoo, has a population of about 50 miners. There is a bi-weekly mail service from Yalgoo. One wayside hotel and a small store do business here, and 14 auriferous leases are being worked in the neighbourhood.

The main line of reef can be traced for considerably over a mile in length. All of the mines appear to have strong well defined reefs, the quartz carrying fine gold.

I believe that good payable returns can be obtained from any portion of the reefs by dollying. Good work has been done in developing these mines, some of the shafts being sunk to a depth of over 100 feet, the reefs appearing to improve in richness as they go down. The miners have been handicapped to a certain extent through having no crushing appliances in the locality. Good water can be obtained at a depth of about 70 feet. A Government well is now being sunk here.

Mining timber is scarce.

I believe that a number of the leases here have been successfully floated on the London market lately.

MELVILLE,

Fourteen miles North of Yalgoo, has a population of about 200. Melville is connected with Yalgoo by telegraph, and has a bi-weekly mail service. There are three Wayside hotels and two small stores. Two public crushing plants, 15-head stamps, have lately been erected by Messrs. Reynolds and Finlayson and Nottle. Thirty-seven auriferous leases are being worked here.

The majority of the mines are held by working miners, and the manner in which they have held on to them, often under great difficulties, prove that they, at all events, have every faith in these mines turning out valuable properties. The deepest shafts are about 80 feet, and the majority of the reefs show every indication of going down well, and carry good payable gold, in some instances being very rich. A good deal of alluvial gold has been found in this locality.

I think there is every probability of Melville turning out a fair share of the precious metal within the next twelve months.

Good water is obtainable at a depth of about 60ft.

Mining timber is scarce.

WADINGARRA,

Situate about eight miles North-East of Yalgoo. A good deal of prospecting is now being carried on in this locality; several protection areas and seven auriferous leases have been taken up, the reefs being large and carrying fine gold well through the quartz. The work was carried on, until lately, under great difficulties, owing to the absence of water, but a Government well has now been put down which will enable the various claims to be worked and will greatly assist in opening up and developing the surrounding country; this well has been sunk on a flat a short distance from the mines, and good water was struck at a depth of 90ft.

A number of the mines here known as the "Renmark" group of leases and "Fisher's" protection area, held by South Australian gentlemen, are, I believe, about to be taken over by an English company.

Mining timber is scarce.

BILBERATHA,

About 10 miles East-South-East of Yalgoo. A large number of auriferous leases have been taken up near Bilberatha Peak; the well known "Yalgoo Joker" group of leases is here; recent developments on the "Joker" show that a large and rich lode of quartz and hematite conglomerate exists there, so that this locality is likely to become a very important centre in the near future.

The deepest mining shaft is about 40ft.

A public well has lately been sunk on a flat near the mines and good water was struck at a depth of between 30 and 40ft.

EDARGO,

Twenty-five miles South-West of Yalgoo. A number of miners are now prospecting in this locality. Several auriferous leases and protection areas have been taken up. Good reefs appear to exist here, but so far very little work has been done on the various claims.

GULLEWA,

Forty miles South-West of Yalgoo. A little more than twelve months ago the prospectors reported finding payable gold, and since then a number of auriferous leases have been taken up. Good work has been done by the miners in developing their various properties; some of the richest mines on the Yalgoo Goldfield are here, and the reefs are of fair size and appear to be going well.

A number of the mines have recently been purchased by London capitalists.

Good water has been obtained at a depth of from 50 to 70ft.

A limited supply of mining timber can be obtained a few miles from the mines.

The total population is about 70; one wayside hotel and one store do business here.

About three miles West of Byrnes "Gullewa Reward Claim," and near to Mugga Mugga Hill, a recent discovery was made by Messrs. Webb and party; a number of auriferous leases have been taken up, and they look well and promising.

PINYALLING,

About 80 miles South-South-East of Yalgoo. A large area of good looking auriferous country exists here, especially along the shores of Lake Monger. The lake was dry when I visited the locality at the latter end of November, and its bed was, in places, covered with salt.

LAKE MONGER

Covers a large area extending away to the South-West of Pinyalling.

Twenty-six auriferous leases have already been taken up among the Pinyalling Ranges, and the locality is now attracting the attention of numbers of prospectors; some good reefs are being opened up, and I have every reason to believe that before very long Pinyalling will become a rich and thriving mining district. An occasional nugget is picked up in the locality.

The great drawback up to the present time has been the scarcity of fresh water, but wells are now about to be put down, and I feel sure that no difficulty will be experienced in obtaining good water at a reasonable depth.

The deepest shaft is over 100ft. Fair mining timber can be obtained from a belt of gum trees about 10 or 12 miles away.

Approximate population about 75.

The road from Yalgoo is a good one, and is fairly well watered.

WOODLEYS,

About 100 miles South of Yalgoo, and about 40 miles West of Pinyalling. The Reward Claim and the principal leases here are held by Mr. Hugh Walker on behalf of Glasgow capitalists.

A large amount of work has been done here; the main reef is a very strong one, going down well, and carrying fine gold. I believe that the "Glasgow" properties have been successfully floated in London, and that a large cyanide plant (rollers), equalling 60 head of stamps, will very shortly be placed upon the property.

All the reefs in this locality appear to be large and well defined, though no sensational finds have been made.

The mines are situated right in the centre of a splendid forest of straight gimlet and salmon gum, so that first-class timber for mining and building purposes may be obtained on the spot.

Good water has been struck on one of the mines at a depth of 155ft. The deepest mining shaft is 160ft. deep.

I believe the main line of reef has been proved to contain payable gold for a distance of 3,000ft. along the line.

Population about 60.

GENERAL REMARKS.

I am pleased to be able to report that no fatal accidents have occurred in the mines during the year, and that the general health of the field has been excellent.

I have not been able to obtain a correct estimate of the rainfall, but it has been unusually small for the year.

Up to the present this field has had very little attention from the mining public, but I hope to see greater developments take place during the coming year, as a large number of rich and well-defined reefs have been proved to exist on the various mining centres, and as there is a large extent of auriferous country which has not yet been prospected there should be good openings both for capitalists and prospecting parties.

The small output of gold from the reefs is to be accounted for by the absence of public crushing appliances. Two batteries have recently started at Melville, and I have no doubt that others will shortly be erected at other centres, when I hope that the output will compare favourably with the older fields of the Colony.

P. L. GIBBONS,
Warden.

Warden's Office, Yalgoo.

Appendix 17.

Warden's Report on Yilgarn Goldfield for Half-Year of 1896.

I have the honour to report a considerable amount of progress in the Yilgarn Goldfield of late. The developments at Southern Cross have been considerable, and at Mount Jackson have been remarkable. Toomey's Hills also have the most promising reports, and this part of the field has been attracting much attention.

Mount Jackson, 84 miles from Southern Cross, by the new road, is becoming one of the important centres of the Eastern Goldfields, and the "Nil Desperandum" mine has made great development, and has a fine plant for crushing ore. There is more machinery also coming for other mines. The blocks in the township are being eagerly sought for, and there is every indication of prosperity in this centre. Other finds in the vicinity are also certain to occur. In Southern Cross, gold mining has never been so active as during this year and the latter half of last year. The town and district are more settled than has ever been the case, and miners with their wives and families have made their homes here, where before they were mostly single men, expecting at any moment to move Eastward. In the town, schools, hospitals, and other public buildings show the signs of permanent and comfortable settlement, with more advancement than has ever hitherto been the case, and the proximity of Southern Cross to Perth, and the railway passing through, enable the field to be worked satisfactorily on low grade ore. There are still many reefs which are not worked, and some not even prospected on this field, and not less at Southern Cross than elsewhere, which would turn out quite payable, in fact more than payable, and more especially if fresh water can be supplied. The railway has passed through to Coolgardie, and has thus removed a large number of teamsters and boarding-house keepers and others from the town, but the increase in the mines has made up for this, and has brought to the field the more desirable miner, and those who are at best merely migratory have been replaced by miners and their families. Fraser's mine, at Southern Cross, has been for a long time yielding large returns, and I think that those who consider that this mine has crushed stone continuously for over six years, and has for some time past yielded considerably over 1,000 ozs. of gold per month, will see that the Yilgarn Goldfield includes mines of great value and stability. Machinery is still arriving for various parts of the field, and applications for leases, &c., continue to come in. At Golden Valley also a great amount of activity has been recently shown, and much attention is being directed to that quarter. I may say that Golden Valley is a pleasant spot in these fields, and the soil is excellent, and, in a good season, well suited for agriculture. At Hope's Hill, and at Blackbourne's, a great deal is being done, and the developments in both are most promising. I may add that, with such a plentiful supply of fresh water as the Government propose to give the fields, and @ 3s. 6d. per thousand gallons, Southern Cross should enter upon even a more promising future than it has already.

To the Under Secretary for Mines, Perth.

VICTOR BLACK,
Warden.

Supplementary Report on Mt. Jackson District.

From the Warden, Yilgarn Goldfield, to the Under Secretary for Mines, Perth.

I beg to report that I have just returned from a visit to Mount Jackson, and travelled by the new road recently made by the Government. At present there is no water till the condenser (half-way) is reached, except at the Government bore, 26 miles out, and that is not yet for the use of the public, as the supply is not sufficient. Beyond the condenser, and between that and Mount Jackson, there is sufficient water at Glasse's Well and the Native Soak. The distance by the new road is 84 miles.

The mines at Mount Jackson are looking well, and all have the greatest hopes of the place. There are about 120 people, and the population is increasing steadily.

The survey of the residence areas is being proceeded with as authorised by the Minister, and there will be a good many blocks applied for in the township.

While on the field I was approached by a number of people as to the requirements of the place. First and most important is the weekly mail, which everyone is very anxious about, and which has now become a necessity, and I trust that a weekly service will be granted. The residents were also very anxious to have the soak cleaned out and improved, which is about twelve miles from the town on the new road, and I hope this will be done, as it will be of great use to the town and the road. At present it is of no use at all.

A number of Miners' Rights were applied for, and there is a good deal of prospecting going on North of Jackson, and if a new find should be made there, as is probable, Jackson will advance with rapid strides. I may mention that the manager of the "Nil Desperandum" is building a house of white stone, of which there is abundance, and will no doubt, if the field goes on as it is doing, be used greatly for building purposes.

Southern Cross, 25th April, 1896.

VICTOR BLACK,
Warden.

Appendix 18.

Warden's Report on Coolgardie Goldfield for 1895, and half of 1896.

Warden's Office, Coolgardie,
June 20th, 1896.

SIR,

I have the honour to forward, for the information of the Hon. the Minister for Mines, the following report on this Goldfield (1) for the year ending December 31st, 1895, and (2) report from January to end of May, 1896.

During 1895, 1,006 Mining Leases were applied for; 3,183 Miners' Rights, and 93 Business Licenses were issued; four Machine and one Tailings area were granted.

The total revenue collected at Coolgardie was:—

	£	s.	d.
<i>Land Revenue</i> (exclusive of amounts received by Lands Office, Perth, for purchase of Town Lots at Coolgardie, and which amount to a large sum)	27,551	19	10
<i>Mining Revenue</i>	24,758	2	11
<i>Internal Revenue:</i>			
Water Receipts	12,902	16	4
Licenses, Judicial Fines, Warden's and Local Court Fees, &c.	2,768	12	10
<i>Revenue Stamps:</i>			
Exclusive of stamps sold by Revenue Stamp vendors in Coolgardie, and which must amount to many times the amount sold from this Office	2,921	2	2
<i>Survey Fees:</i>			
These fees are only received and paid out again to the Mining Surveyors	7,855	11	0
Total approximate receipts therefore amount to ...	£78,758	4	3

Output:

96,040 (Ninety-six thousand and forty ounces) were sent from the Banks at Coolgardie during 1895. This included amounts from what are now separate goldfields.

Business done:

In addition to applications for leases, exemptions, &c., 829 (eight hundred and twenty-nine) plaintiffs were heard in the Warden's Court. In the Local Debts Court 318 plaintiffs were heard, and in the Police Court there were 729 cases.

1896.

From January 1st to end of May, 262 Leases were applied for.

4,520 Miners' Rights were issued.

The revenue received was, not including amounts paid at the Perth offices for lands, etc., sold at Coolgardie:—

	£	s.	d.
Land Revenue	3,290	9	8
Mining Revenue	16,749	3	6
<i>Internal Revenue—</i>			
Water receipts	£14,398	1	11
Licenses, Judicial Fines and Fees, Warden's and Local Courts	1,680	4	5
Revenue Stamps, not including those sold by licensed vendors in Coolgardie	483	6	4
Survey Fees	1,711	6	0
Total approximate receipts	£38,312	11	10

Output.—During this period 23,579 ounces of gold have been sent from Coolgardie. This appears small when contrasted with the amount for 1895. It must be remembered that last year the gold from country now formed into other goldfields all went through Coolgardie.

Business done.—From January 1st to 31st May, 416 complaints, in addition to lease applications, exemptions, &c., were heard in the Warden's Court; 267 complaints in the Local Debts Court, and 544 Police Court cases have been heard.

The increase in the size and population of the town of Coolgardie has been very great, especially since the opening of the railway. Substantial buildings of brick or stone are fast taking the place of the galvanised iron shanties first erected. The streets of the town are now at night illuminated by electric light; in fact Coolgardie is fast becoming a city.

The population of the town and suburbs I calculate at about 6,000; the population of the whole goldfield being about 13,000.

A considerable amount of machinery has been landed on the field. I regret that having already sent the return of machinery to you, and not having retained a copy, I am unable to repeat the details. Unfortunately, much of this machinery is idle from want of sufficient water supply. Up to the present time the total number of leases applied for on this goldfield is 2,932. Of these 897 (eight hundred and ninety-seven) have been abandoned, withdrawn, surrendered, refused, or forfeited; of those remaining on the books I consider that one-half at least are unworked.

I have, &c.,

JOHN M. FINNERTY,
Warden.

Appendix 19.

Warden's Report on the North Coolgardie Goldfield.

From the Warden, North Coolgardie Goldfield, to the Under Secretary for Mines, Perth.

North Coolgardie, formerly portion of the Coolgardie Goldfield, was proclaimed a separate goldfield in the month of June, 1895, with an area of about 45,000 square miles, and may be said to have commenced its distinctive official existence when I took charge as Warden, on the 17th July following.

The Warden's Court was then established at Menzies, and the Registrar's district office at Goolgarrrie transferred thereto, Menzies being the more central and important township.

The whole of the 45,000 square miles, or indeed any considerable portion of the goldfield, cannot be said to have been prospected, and it is impossible to estimate how much of it has, but in consequence of the very dry seasons of the past year, and scarcity of water, prospecting operations have been carried on under great hardships and difficulties, but, taking into consideration the success so far achieved under adverse circumstances, it is not difficult to foresee the immense advancement this field is destined to make under more favourable circumstances, such as Water Supply and Railway communication.

The width of the auriferous belt running through this field up to the present time proved is about 140 miles, stretching from Edjudina, Mount Margaret, &c., on the East to Mulline, Mount Ida, &c., on the West, and running Northward from the Southern boundary of the field, apparently the whole distance to Lawler's on the East Murchison goldfield.

The main centres of this field are :

MENZIES.

This is the most important mining centre, and the developments have been very rapid, and of a permanent nature. Very rich stone is being obtained on all the mines which have been opened up near the town. Prominent among these are the Lady Shenton, Lady Florence, the Crusoe Group (Gold Estates Company), the Friday group (Menzies Gold Reef Proprietary Company), The Maori, The Wedderburn (Queensland Menzies Company), the Royal group, and St. Alban's group. Work on all these mines is being vigorously pushed with such satisfactory results that the proprietors have already landed crushing machinery on the field, and, in the following cases, the erection thereof is being rapidly proceeded with.

Crusoe and Friday Groups of Leases	...	20-head of stampers now nearly completed
The Lady Shenton	... ..	10 " " " "
The Maori	... ..	5 " " " "

As soon as the Menzies Water Supply Company's pipes are laid, these batteries will be in full work operating upon payable stone, of which there is sufficient at grass and in sight in the mines to keep the batteries going for a long time to come.

In addition to the batteries mentioned, there is another complete plant of ten stampers on the property of the Menzie's Exploration Company, but it is not yet decided upon which of their mines it is to be erected.

A 20-head battery has been ordered for, and is to be erected on, the Royal group of leases, and a separate 10-head battery for the Friday group; also a 10-head battery for the Queensland Menzies Company; in all 85 head of stampers, representing a very heavy outlay of capital, and it is very satisfactory to be able to report that this outlay has been the outcome of satisfactory developments in the mines warranting it, and not, as is too often the case, the landing of machinery before any mining has been done.

WATER SUPPLY.

Several schemes have been mooted for supplying Menzies with water, but the only one that has assumed practical shape is that of the Menzies Water Supply Company, which has for its object the conveying of salt water from a lake situate about $5\frac{1}{2}$ miles North-North-West from Menzies, by means of a pipe line to the various batteries at Menzies. These works are now being rapidly pushed on, and they are expected to be completed by the end of February, or early in March, when the Crusoe, Lady Shenton, and Maori batteries should be ready for work.

Water suitable for stock purposes has been obtained in two wells at the Southern end of the town at a depth of about 160ft., and a very fair supply of water is being obtained therefrom; but I am without details as to the exact quantity, as the owners, Messrs. O'Driscoll & Co. and Mr. R. H. Wilson, are at present opening out drives at the bottom of their shafts (about 160ft. deep) in order to increase the flow.

At the "Federal Lease," $5\frac{1}{2}$ miles East from Menzies, fresh water has been struck in small quantities, but it is daily increasing.

I estimate the population of Menzies and the surrounding district, within a radius of eight miles, to be—

Men	850
Women	50
Children	20
Total	920

Number of leases applied for, eight-mile radius, 256.

Average acreage per lease, $15\frac{1}{2}$ acres.

Men required to work leases applied for full handed, 1,319.

NIAGARA.

Niagara is situated about 30 miles in a direct line North-North-East from Menzies, and, including North Niagara and Dingo Creek (five to seven miles distant), has a total population of about 300.

In any portion of this district a good supply of fresh water, equal to the requirements of stock and domestic purposes, is obtainable by sinking to a depth of 40ft. and downwards.

Population, about	300
Number of leases applied for	226
Average acreage of lease	$15\frac{1}{2}$ acres
Number of men required to man these leases full handed ...	1,170

There is no crushing machinery in this district yet, but I have reason to believe machinery will be erected during the next year on the "Challenge" group of leases, the property of Messrs. Northmore and Doolette.

Considering the very large number of leases taken up in this district the amount of development work carried out is small in proportion thereto. The telegraph line, now being extended to Niagara from Menzies, will materially assist in the development of the place.

GOONGARRIE.

Goongarrie is situated, by the telegraph line, 26 miles South from Menzies, and was the first district opened in this goldfield. Its present population is about 150. 157 leases have been taken up, averaging 7 acres each, or a total of 1,030 acres.

There are several well developed lines of reef in this district; but owing to various reasons, mainly the want of capital and the funds of original owners being exhausted, several of the main lines of leases have recently been taken over by companies, notably "The Boddington," "Caledonian," and "Ikey Mo" lines, and I anticipate a reaction to take place in this somewhat neglected district during the coming year.

There is a good crushing mill of 20-head of stamps at the "Caledonian" lease, recently erected, and another of 10-head in course of erection at "The Boddington" lease.

Salt water is plentiful, and condensed water sells at from 6d. to 8d. per gallon.

MOUNT MALCOLM, MURRIN MURRIN, PRINCESS ALEX, AND SURROUNDING CAMPS TO BIRKS.

This district, situated about 50 miles North from Niagara, is developing well and is becoming a scene of activity and importance, and its centre, about Murrin Murrin, is situate about 85 to 90 miles North-North-East from Menzies.

The number of leases applied for is 65, with an average acreage each of 16 acres. Total acreage under lease 1,068.

The present population is about 400, rapidly increasing.

MOUNT IDA.

Situated about 60 miles North-West from Menzies.

Population, about	50
Leases applied for	17
Total acreage	202 acres
Average acreage per lease	17 acres

The only water leaseholders depend on at present is at Granite Creek, 25 miles East, but they are sinking for water in the neighbourhood of the mines.

MULLINE AND ULARRING.

This district is situated about 40 miles West from Menzies.

Population (a moving one), about	...	...	...	...	100
Leases applied for	...	...	...	...	94
Total acreage	...	...	...	...	1,495 acres
Average acreage per lease	...	...	...	...	15 acres

Some very rich outcrops have been discovered in this district, but owing to scarcity of water no considerable amount of development has yet taken place, the nearest water supply being Siberia Soak, 20 miles distant.

YERILLA, MOUNT CATHERINE, PENDENNIE, AND EUCALYPTUS.

Present population, about	...	...	...	...	150 (daily increasing)
Leases applied for	...	...	...	...	105
Total acreage	...	...	...	...	1,885 acres
Average per lease	...	...	...	...	18 acres

There is a permanent soak of water at Yerilla, but the supply is lower this season than ever before known.

REDCASTLE.

Distant about 100 miles North-East from Menzies. 64 Leases. Acreage, 1,150 acres. Average, 18 acres. Population 80 men. Good water at about 12 miles, recently struck. Previously miners have been carting it 25 miles.

EDJUDINA.

160 miles South-East from Menzies. 1,199 acres. 57 Leases. Average 21 acres. Present population about 100 men. Water procurable within a short distance.

MOUNT MARGARET.

About 130 miles North-East from Menzies. 74 Leases. Acreage, 1,064 acres. Average, 14 acres. Present population 200 men. Good water at a depth of 108 feet in good quantities. There are two crushing machines at Mount Margaret, both of 10-head of stampers each—one being erected on the Mount Margaret Reward Claim, the other on a group of leases owned by a company represented by Mr. Fitzgerald Moore.

I estimate the total population of the field settled on the various centres at 2,530, and in addition thereto a number of about 400 moving from place to place; perhaps 3,000 in all.

The very dry seasons have militated against the steady development of the mines in some places.

The public health of the field generally has been good, taking into consideration the disadvantages of a dry season and a not too generous diet.

I have great confidence in the future of the field and do not think the so-called water difficulty will be of long duration as, if properly handled, it will be soon overcome as in other places where the output of gold warrants the necessary expenditure.

I attach hereto a statement of Revenue receipts for the period from 1st July to 31st December, 1895.

I also attach a plan showing all latest settled camps and places referred to in this report.

FRANCIS GILL,
Warden.

Statement of Revenue collected on the North Coolgardie Goldfield from 1st July to 31st December, 1895.

	£	s.	d.
Mining Revenue	7,299	17	6
Land Revenue...	28,303	0	0
Survey Fees	4,543	0	0
License Fees	250	0	0
Stamp Duty	2,806	2	6
	<u>£43,202</u>	<u>0</u>	<u>0</u>

R. E. WRIGHT,
Mining Registrar.

Appendix 20.

Report on the Townships of the North-East Coolgardie Goldfields, by Warden Fielding.

KANOWNA (White Feather).

The township of Kanowna is situate 12 miles North-East of Kalgoorlie, and is the head-quarters of the Warden of the North-East Coolgardie Goldfield (Percy Fielding, J.P., Warden and Resident Magistrate; John Cockburn Campbell, Mining Registrar). Here there is a Post and Telegraph Office, Money Order Office and Savings Bank (E. T. Hackett, Postmaster). There is a Government Hospital capable of accommodating 25 patients (Medical Officer, H. G. Browne, M.D.). Mr. H. N. Harper is an honorary J.P. There is also a Wesleyan Church and a Roman Catholic Church building. There is a Police Station (P.C. John Smith, in charge, and two troopers). Medical practitioners, Drs. Browne and Swanson. There are four hotels and two wine and beer saloons. Kanowna has been proclaimed a municipality, but the mayor and councillors have not yet been elected. Population, about 700 males and 80 females, while within a radius of four miles, the population is about 3,000. Water supply is derived from condensers on salt lakes four miles away, and fresh water clay pans seven miles away. The principal mines in the neighbourhood are the "White Feather Reward" ("McAuliffe's") on which is a 10-head battery; "Robinson's" (formerly "Cocktail and Buster") "Bissenberg," "Golden Crown," "Duke of Westminster," "Nemesis," on which a 3-head battery is erected, and the famous cement leases.

The "Hayes' Find" is situate 20 miles North of Kanowna. There are two hotels, the population being about 700, about 300 men being employed on the "Hit or Miss." Lindsay's new find is four miles East of Hayes', the population being about 55.

Hayes' new find is 20 miles East-North-East, the population being about 50.

BULONG (I.O.U.).

This is the principal township of the I.O.U. division of the North-East Coolgardie Goldfield and is situate 15 miles South-South-East of Kanowna. Here there is a Post and Telegraph Office (— Tucker, Postmaster), a police station is in course of erection. The Government Hospital here has accommodation for 10 patients. Dr. Swanson, of Kanowna, is the visiting medical officer.

There are three hotels, and one wine and beer saloon. The population of the town is about 150 males and 10 females, and there are about 600 men within a radius of four miles. The water supply is drawn from condensers on Lake Yindalgooda, six miles away. The principal mines in the neighbourhood are the "Bulong," "Melbourne United," "Queen Margaret," "White Horse," and "Slug Hill."

The I.O.U. division includes Ballagundi, six miles West of Bulong, the population of which is about 200, and there is one public-house and several good mines.

KURNALPI.

This is the chief township of the Kurnalpi Division of the North-East Coolgardie Goldfield, and is situate about 45 miles East of Kanowna. Mining Registrar, H. W. McKinnery; Warden from Kanowna visits once a month. There is a post and telegraph office, a police station in course of erection, one hotel open and two building. The population is about 20, while there are about 500 men working within a radius of four miles. The water supply is drawn from condensers on Lake LaPage. The principal mines are the "Success" (5-head battery), "Comstock" (Adelaide Syndicate property), and "Glen Ewen."

BLACK FLAG.

This township is situate within the Bardoc Division of the North-East Coolgardie Goldfield, and is 25 miles West from Kanowna. There is a post office and two hotels. The population is about 60, and within a radius of four miles about 1,000. The water supply is drawn from condensers on wells round the township. The principal mines are the "Black Flag Proprietary," "Four in Hand" (battery in course of erection), "Talisman," "Lady Bountiful," "Crown," and "King Solomon."

KURAWA (Broad Arrow).

This township is situate about 25 miles North-West of Kanowna, and there is situate the office of the Mining Registrar of the Bardoc division of the North-East Coolgardie Goldfield (T. H. Hannah). The Warden from Kanowna visits once a week. There is also a post office, police station, and three hotels. The population is about 150, or within a radius of four miles, about 800. The water supply is derived from condensers at the "Paddington" mine, and from rock holes eight miles away, while salt water has been struck in the Government bore, two miles from town, and a tank is about to be excavated. The principal mines are the "Hill End" (5-head battery), "Golden Arrow," "Pride of the Arrow," "Railway Venture," "Paddington," and "Arrow Proprietary."

BARDOC.

This township is 9 miles North of Kurawa, and is also in the Bardoc division. There is a post office and one hotel. The population is about 150 males and seven females, while there are about 700 men within four miles.

The water supply is derived from rock holes 20 miles away, while a Government well is being put down $1\frac{1}{2}$ mile East of the town. Principal mines are the "Excelsior" (5-head battery), "Nerrin Nerrin," "Bank of England," "Arthur," "Queenslander," and "Zoroastrian."

The Bardoc division also includes Smithfield, where about 200 men are working. The principal mines being the "Pakeha" (3-head battery), and "Kingsley Hall."

It also includes the "Six-Mile," where about 100 men are working, the principal mines being the "Scottish Chief" and "Bulletin."

PERCY FIELDING,
Warden, North-East Coolgardie.

Appendix 21.

*Report on Greenbushes Tinfield for Year ending June 30th, 1896,
by the Mining Registrar, Greenbushes.*

In reporting on this field for the year ending June 30th, 1896, I much regret that I am unable to report any improvement or fresh development during the greater part of that time. The continued low price of tin ore has, as I have before pointed out, had a depressing effect, not only by preventing prospecting, but by rendering unpayable several spots where tin is known to exist; unpayable, that is, under present conditions of working.

There are at present just under 50 men on the field.

The number of mining licenses issued during the year was 61.

Claims registered, 9 only, and of these 3 were "extended" claims for working abandoned ground.

Application has also been made for 5 leases, of which I shall speak later.

The amount of tin ore shipped during the year was 277 tons 13cwt. This may not be the exact amount obtained on the field for the same period, as there is usually some tin held over in Bunbury or elsewhere, either waiting for a rise in price or for various other reasons. As, however, the price of tin ore, *i.e.* 10s. 6d. a unit, is not materially different to what it was last year, the figures above represent the amount very nearly.

The highest price realised for tin shipped by the Union Bank (from whom alone I have been able to obtain the information) is £40 11s. 1d., and the average of the whole £37.

The total value of the year's export, therefore, is about £10,250.

I regret that owing to an absence of information concerning the earlier years of the field, I cannot give the total yield from the field since its commencement, but I regard the figures quoted above as fairly satisfactory in view of the depressed state of the market and the small number of men left at work.

The old alluvial leases issued under the Land Regulations are very nearly a thing of the past. Only one of them now remains, and that is liable to forfeiture.

There is also, I am sorry to say, a block of virtually deserted ground of 60 acres in extent, which is freehold; an awful warning against the alienation of mineral land.

During the last portion of the year five applications have been made for leases, for the purpose of working lode tin. On only one of these has any work been done as yet; on this an old shaft has been cleared out and deepened, and a quantity of stuff taken out and crushed, with, I believe, good results.

There is also a proposal now before the Hon. the Minister for a concession of 1,000 acres on this field, the concessionaires proposing to construct an aerial tramway to the Blackwood River, and there to treat the alluvial on a large scale. A concession of this sort will, in my opinion, be good for the field, if properly safeguarded by working conditions. The four chain claim system does not seem to be likely to develop the field in the present state of the tin market. Small holders can only afford to work the richer pockets, and cannot at present do any prospecting at all. But I repeat that any concession should be made conditional on its being worked, and on any failure in the conditions should be immediately cancelled.

The bonus of £1,000 for smelting works attracted a syndicate, who very promptly registered a "Furnace Area," and had the timber on it grubbed. This was several months back, and the timber has not yet been removed. I anticipate that that £1,000 will not be expended this year.

I have already reported on the operations of the party who were equipped and subsidised by the Department at the beginning of 1896; nothing payable was found, but colours of tin which may be useful hereafter.

With the construction of the Bridgetown railway, which will pass through the field, and the surveys for which are now complete, I anticipate a revival of the tin mining industry, especially if capital can be attracted to the field. One thing, however, I must mention in this connection, the construction of the railway will certainly bring about the establishment of timber mills in this neighbourhood, as there is abundance of good jarrah along the line; and I venture to hope that care will be taken that the interests of the miners, under Section 5 of the Mineral Lands Act, will be carefully guarded.

W. A. G. WALTER,
Registrar.

17-7-96.

Population	...	...	...	...	150
Claims	...	...	...	...	9 (3 extended)
Lease Applications	...	...	...	...	5 lode tin
Mining Licenses	...	...	...	...	61
Water Rights	...	...	...	...	6
Powers of Attorney	...	...	...	...	2
Transfers	...	...	...	...	2
Lien	...	...	...	...	1
Exemptions	...	...	...	...	15
Tin yield for year 1895, 178 tons 9 cwt. 2 qrs. 9 lbs.					

*Supplementary Report on the operations of the Government Prospecting Party.**To the Under Secretary for Mines, Perth.*

Bridgetown,

May 11th, 1896.

Herewith I enclose accounts for prospecting party's wages up to the 4th inst., when they ceased work. King reports that they have prospected a large part of the Upper Blackwood and the country between that and the Donnelly, and have found nothing beyond colours of gold and tin, which I have mentioned in a previous report. I have paid them off, and as only £149 4s. 3d. (which includes equipment) has been spent out of the vote of £400 for this purpose, I have communicated with the Greenbushes Miner's Progress Association with a view to the formation of a fresh party. The equipment, for the present, I have put in Moulton's charge, who resides in Bridgetown. It is in good condition, except for ordinary wear and tear.

W. A. G. WALTER,

Registrar,

Greenbushes.

Appendix 22.*Report on Surveys performed on Eastern Goldfields.**From Inspecting Surveyor, Eastern Goldfields, to the Under Secretary for Mines.*

Coolgardie, 3rd August, 1896.

As requested in your wire of the 1st inst., I forward herewith a brief report as to the branch under my care, and the surveys carried out during the year ending June 30th, 1896.

As you are aware, this branch was established in August, 1894, and at that time there were only two mining surveyors working on these fields, and my staff consisted of myself and one assistant. Now there are 20 surveyors at work, and my usual staff consists of an assistant inspecting surveyor and about seven computers and draftsmen.

In March, 1895, a branch of this office was established at Kalgoorlie, in charge of a draftsman, and since then draftsmen have been appointed at Menzies, Norseman, Kanowna, and Broad Arrow. The appointment of these draftsmen in connection with the Registrar's offices has, I think, been fully justified, and I would urge that, in future, draftsmen be appointed wherever a Registrar is stationed.

In the Coolgardie office the work chiefly consists—

- (1.) In checking lease plans before sending them to the head office;
- (2.) In compiling standard plans of the goldfields;
- (3.) In making tracings of these for the head office to enable lithographs to be prepared.

The survey work has largely increased during the past year, during which time 23 surveyors have been employed. There are at present 20 surveyors working on the Eastern fields.

The surveys, generally, are up to date, with the exception of those in the Mt. Margaret and Ularring districts. In these two districts the leases are scattered, and, until February and March last, when good rains fell, it was almost impossible for a surveyor to get over the country. Now that these districts are becoming more opened up, and more water is obtainable, I trust that in a month or two the surveys will be up to date.

Owing to the recent sub-division of the fields, and the short time at my disposal, I cannot give separately the numbers of surveys done on each field; but I give below the total number of leases surveyed during the year ending June 30th; the plans and accounts for which come, in their usual course, to this office.

	£	s.	d.
Leases surveyed on Eastern Goldfields (including Yilgarn and Dundas), 4,196, at a cost of	28,313	6	0
Traverses and connections, 356 miles, at a cost of	1,296	10	0
Boundary lines marked, 97 $\frac{3}{4}$ miles, at a cost of	390	15	0

H. S. KING,

Inspecting Surveyor, Coolgardie.

Appendix 23.

Report by the Government Assayer for 1895.

From the Government Assayer to the Under Secretary for Mines.

I have the honour to report, for the information of the Honourable the Minister for Mines, that during the year ending the 31st December, 1895, I made 802 assays, viz. :—

Gold.	Silver.	Copper.	Mercury.	Lead.	Antimony.	Zinc.	Tin.	Coal.
720	19	35	4	2	3	1	10	8

and that during the six months ending 30th June, 1896, I have made 691 :—

Gold.	Silver.	Copper.	Tin.
672	3	15	1

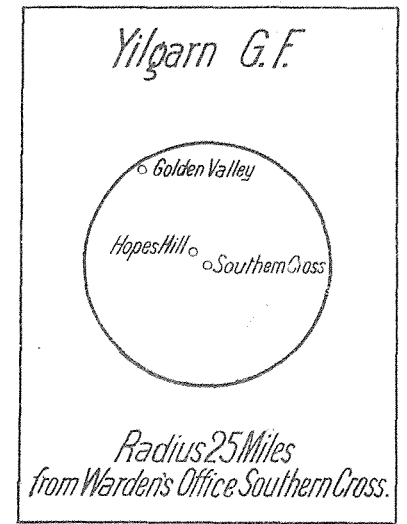
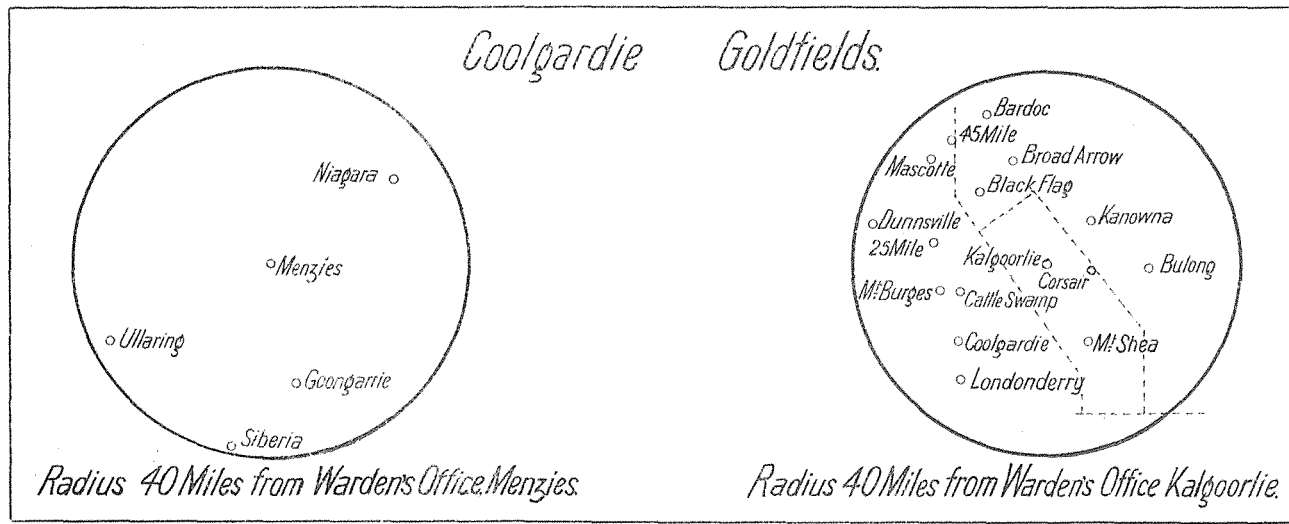
A few specimens of *mica, asbestos, steatite, garnets, &c.*, have been submitted to me during the time but none of them were particularly good.

The most remarkable feature has been the discovery of the "so called" formations carrying up to 60oz. of gold, and even more than that, to the ton. These "formations" consist of highly decomposed rock, sometimes much ironstained with angular fragments of quartz; in other places they are composed chiefly of kaolin and magnesian silicate, interspersed with grains of quartz. The gold is, as a rule, in light, "feathery" particles, although, in some localities, it is coarse and heavy; specks occur weighing occasionally as much as a pennyweight. These deposits are often of great superficial extent, and of considerable depth.

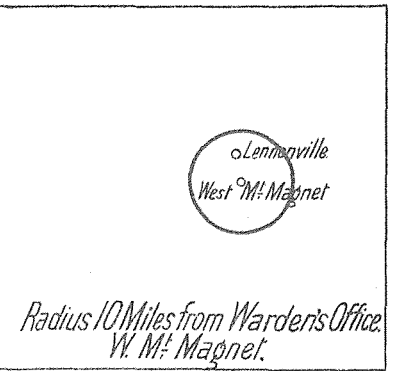
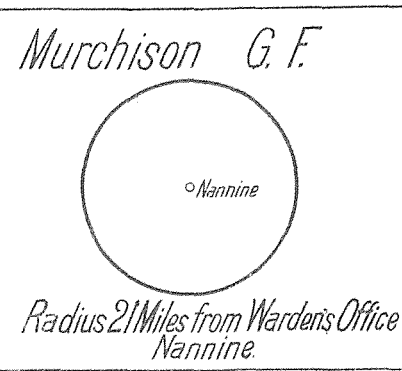
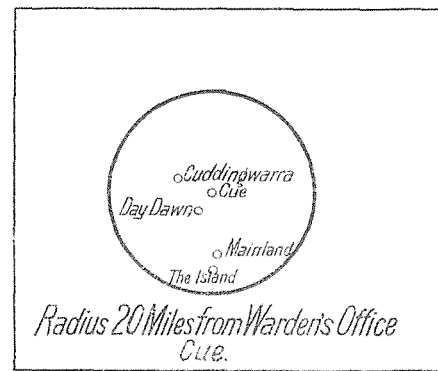
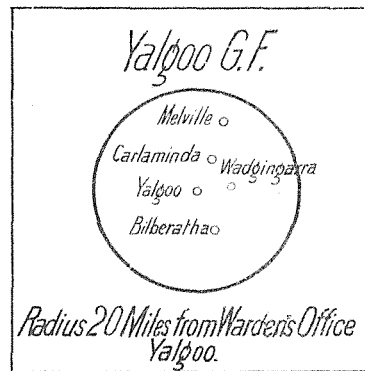
BERNARD H. WOODWARD,
Government Assayer.

11th July, 1896.

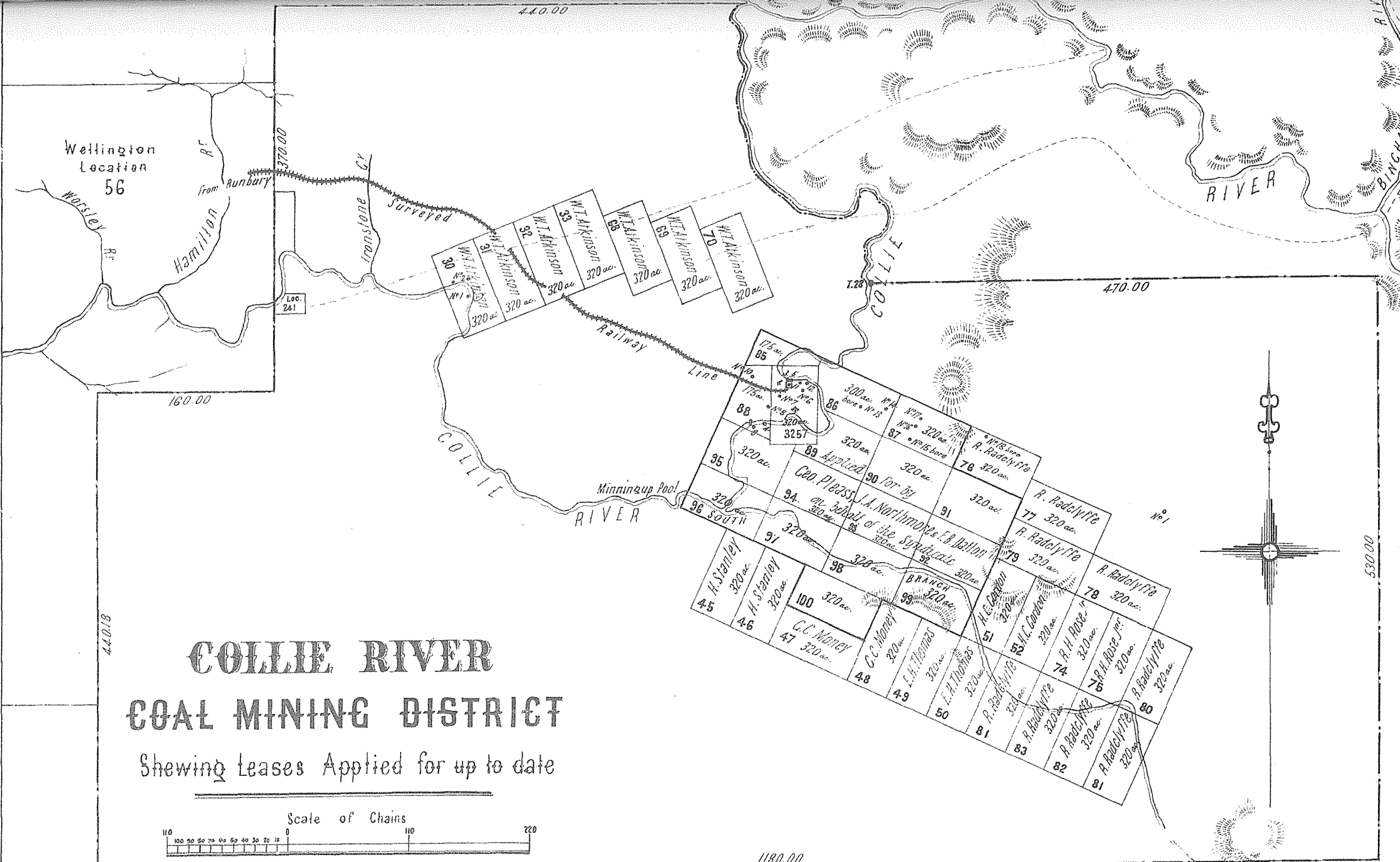
Districts under the control of MR T. FOWLER, Inspector of Mines, - Eastern Goldfields.



Districts under the control of MR F. REED, Inspector of Mines, - Central Goldfields.



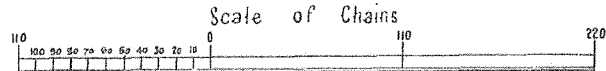
Wellington
Location
56



COLLIE RIVER

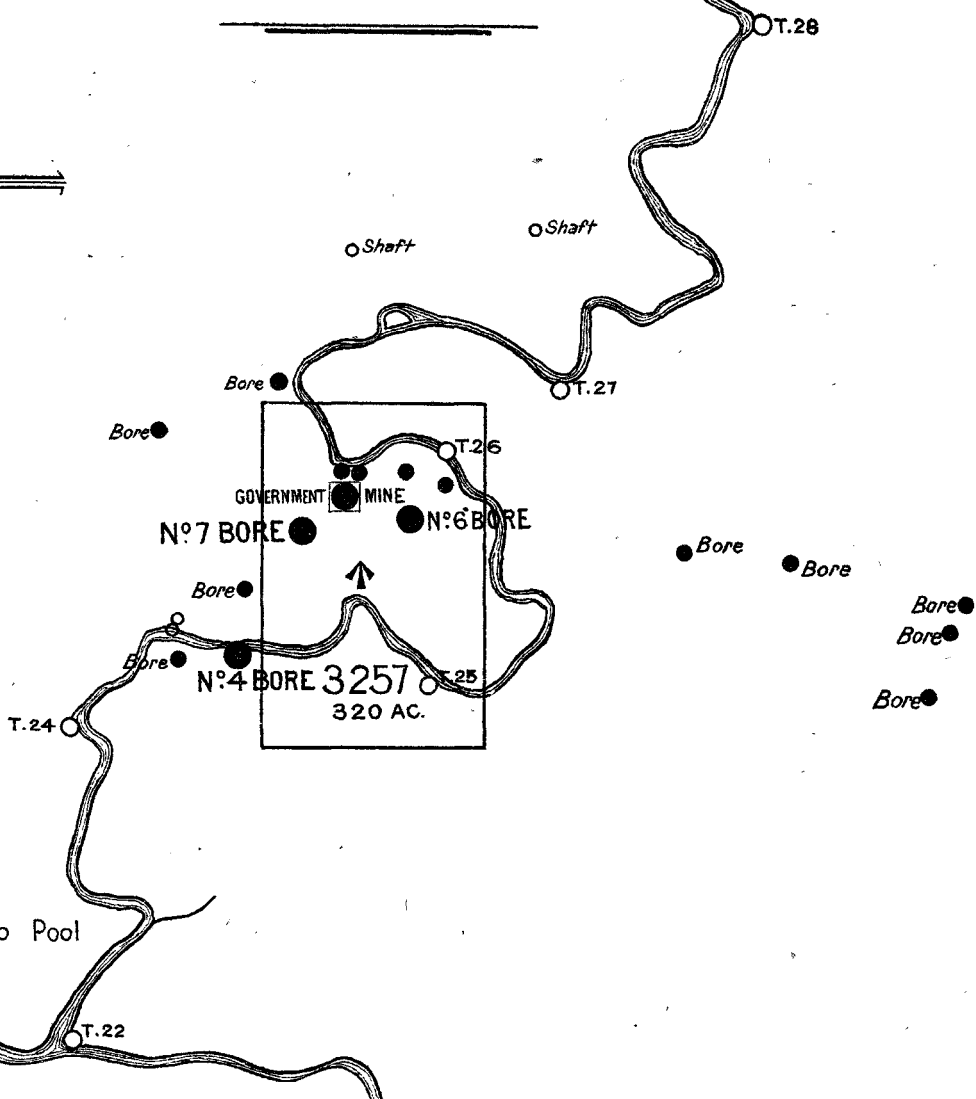
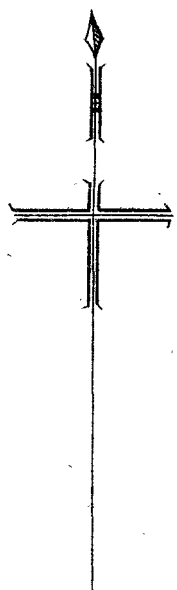
COAL MINING DISTRICT

Shewing Leases Applied for up to date



1180.00

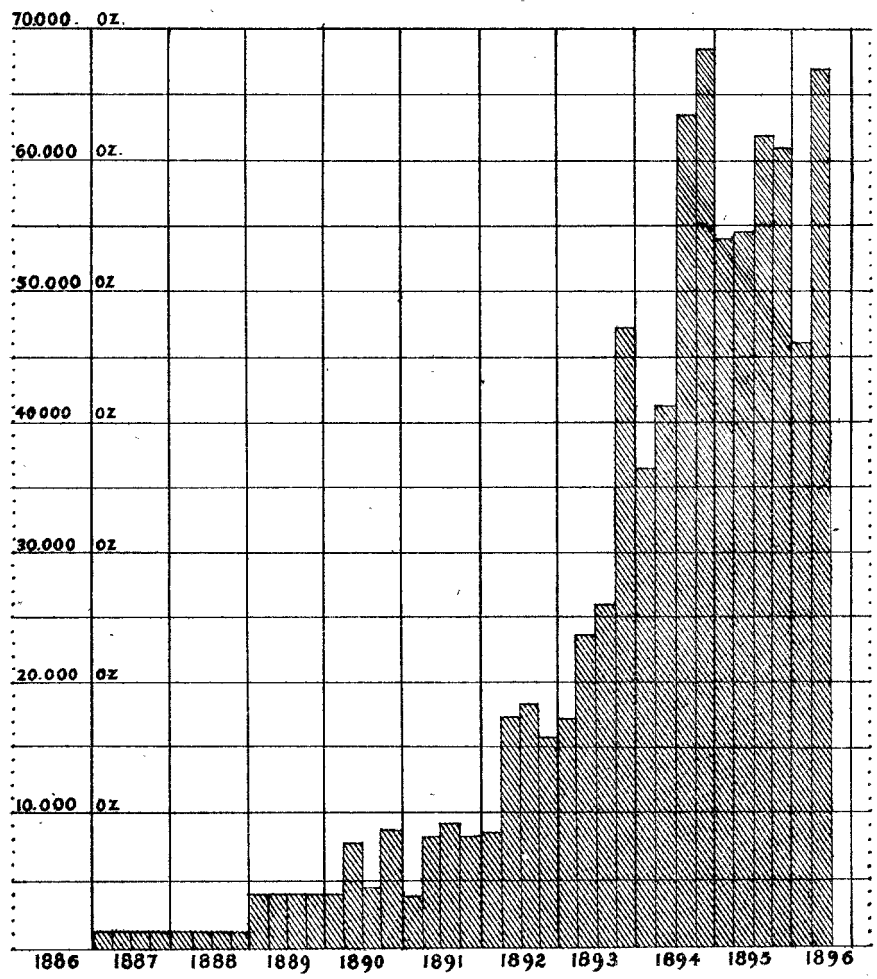
SKETCH SHEWING POSITIONS of Bores N^{os} 4, 6, 7



SECTION OF BORE N^o6 COLLIE COAL FIELD

Depth from Surface		Thickness of Strata		Nature of Strata
Ft.	In.	Ft.	In.	
				White Sand
				Dark Sand
				White Sandstone
3	38	1	38	1
		39	6	1
				Coal
				Sandy Shale with Coal Veins
61	10	22	4	0
		62	4	0
				Coal
				Sandy Shale
72	7	10	3	
		74	7	2
		76	2	1
		79	6	3
				White Sandstone
		85	0	5
				Coal
		92	2	7
				Sandy Shale
		96	2	4
				Grey Sandstone
		102	4	6
				Sandy Shale
		106	4	4
				Grey Sandstone
		110	10	4
				Sandy Shale
				Shale and Sandstone in bands with coal stains
		127	6	16
				8
		192	6	65
		193	0	0
				Grey Sandstone
				Coal
		202	6	9
		203	6	1
				Shale
				Coal
		210	0	6
		211	6	1
				Shale
				Coal
				Shale and Sandstone in bands with coal stains
		299	0	87
		302	0	3
				Shale and Sandstone in bands with coal stains
		306	6	4
				Sandstone
				Shale
		316	5	9
				11
		320	0	3
		321	0	7
		321	6	0
				Shale
		325	6	4
		325	0	0
				Fireclay
				Slate

——— Diagram shewing annual export ———
 ——— OF GOLD ———
 ——— W.A. ———



SECTION OF BORES

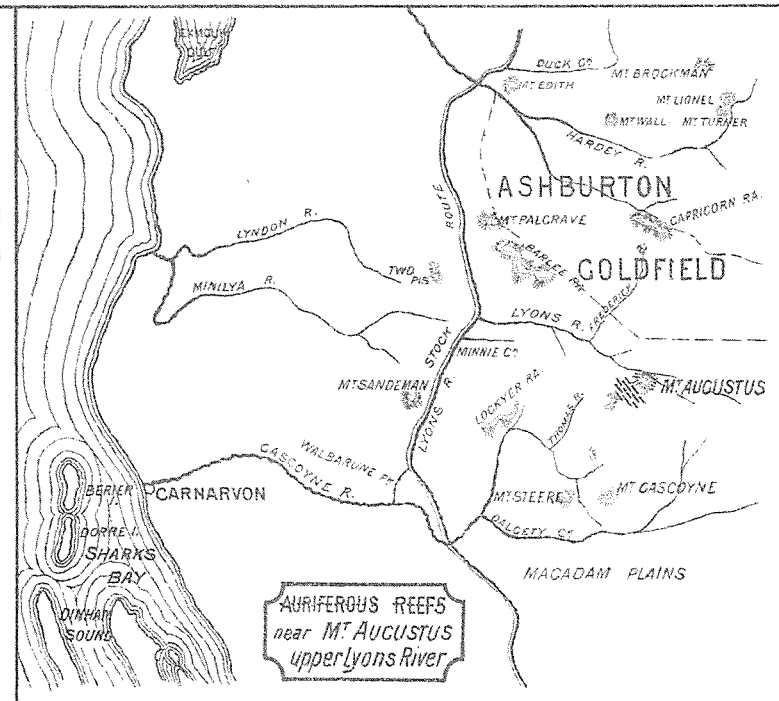
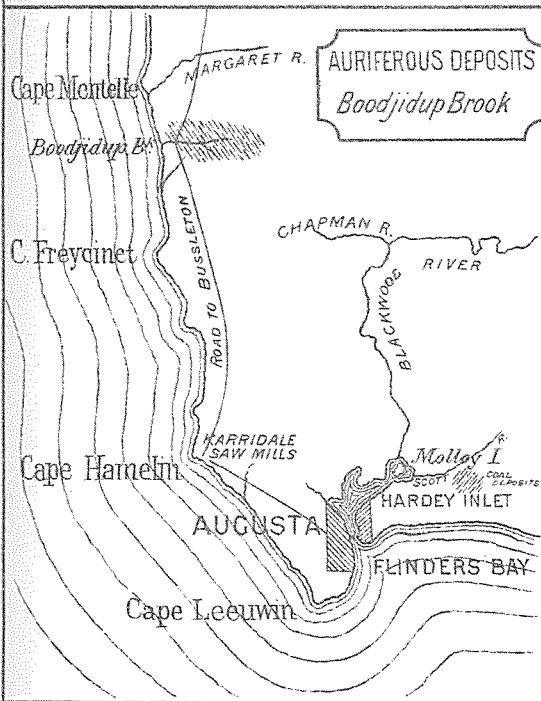
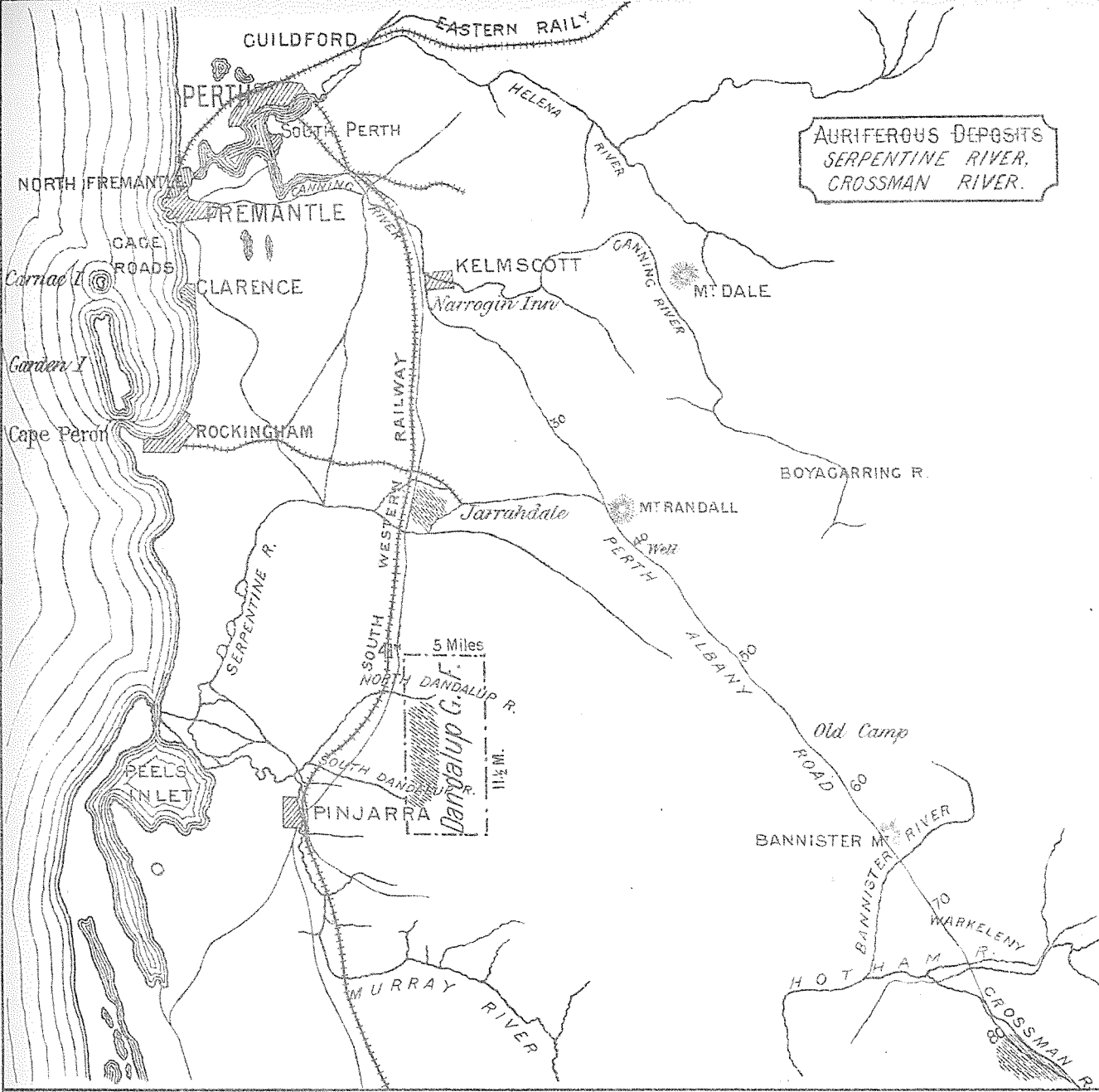
COLLIE COAL FIELD

BORE N^o 4

BORE N^o 7

Depth from Surface		Thickness of Strata		Nature of Strata
Ft.	In.	Ft.	In.	
				Yellow and Grey Sandstone
44	6	44	6	Ferruginous Sandstone
46	4	47	10	Grey Shale and Coal Bands
50	8	44	4	Light Shale
				Grey and Yellow Sandstone
84	3	33	7	Shale bands Yellow and Grey Sandstone and Bands of shale
264	7	180	4	Shale & Coal Veins Dark Shale
				and
301	7	37	0	Grey Sandstone Sandstone and Shale
				Grey Sandstone
344	6	42	11	Coal
345	2	42	8	Dark Shale
345	0	42	5	Coal
355	2	42	7	Shale and bands of Sandstone
355	9	42	7	
407	6	51	9	Coal
408	3	51	9	Sandy Shale and Grey Sandstone
455	2	46	11	
472	1	16	11	Black and Grey Shale
481	9	9	8	Sandy and Dark Shale
495	11	14	2	Grey Sandstone
496	5	14	2	Coal
507	5	11	0	Shale
519	5	12	0	Sandstone
519	8	12	3	Coal
526	11	7	3	Shale
541	4	14	5	Conglomerate and Sandstone
545	0	3	8	Light Shale
551	3	6	3	Dark Shale and Coal Veins
564	7	13	4	Sandstone Conglomerate
573	1	8	6	Shale
575	9	2	8	Coal and Shale
581	3	5	6	Dark Shale
587	1	5	10	Sandy Shale
590	2	3	1	Shale
601	2	11	0	Coal
611	10	10	8	Shale and Conglomerate
614	10	2	0	Coal
618	4	3	6	Shale
631	8	13	4	Coal
				Shale and Sandstone
666	6	34	10	Coal
667	0	9	8	Shale
668	8	7	0	Coal
672	6	4	0	Coal
678	6	6	0	Shale and Coal Veins
737	3	58	9	Shale and Sandstone
750	2	12	11	Dark Shale
750	6	0	4	Coal
765	1	14	7	Shale
769	1	4	0	Coal
787	5	18	4	Sandstone
791	3	9	10	Sandstone and Shale
793	11	2	8	Coal
808	6	9	7	Shale
				Bands of Sandstone & Shale
851	2	47	8	Sandstone and Shale
852	10	1	8	Grey Sandstone & Shale
859	6	6	8	Grey Sandstone
862	10	3	4	Sandstone and Shale
893	0	30	2	Shale

Depth from Surface		Thickness of Strata		Nature of Strata
Ft.	In.	Ft.	In.	
10	0	10	0	Peaty Soil with roots
11	0	1	0	Sandy Clay (blue)
				White, Grey and Yellow Sandstone
84	0	73	0	
88	0	4	0	Shale & Coal Veins
90	0	2	0	Sandstone
96	0	6	0	Shale & Coal Veins
215	6	119	6	Grey Sandstone
280	0	64	6	Hard Grey Sandstone
280	9	0	9	Coal
298	0	17	3	Grey Sandstone
305	6	8	6	Shale
315	0	8	6	Grey Sandstone
317	0	2	0	Shale
320	0	3	0	Sandstone
460	0	140	0	Grey Shale
481	0	21	0	Grey Sandstone with bands of Shale & Clay
500	0	19	0	Sandy Shale with bands of Sandstone & Clay



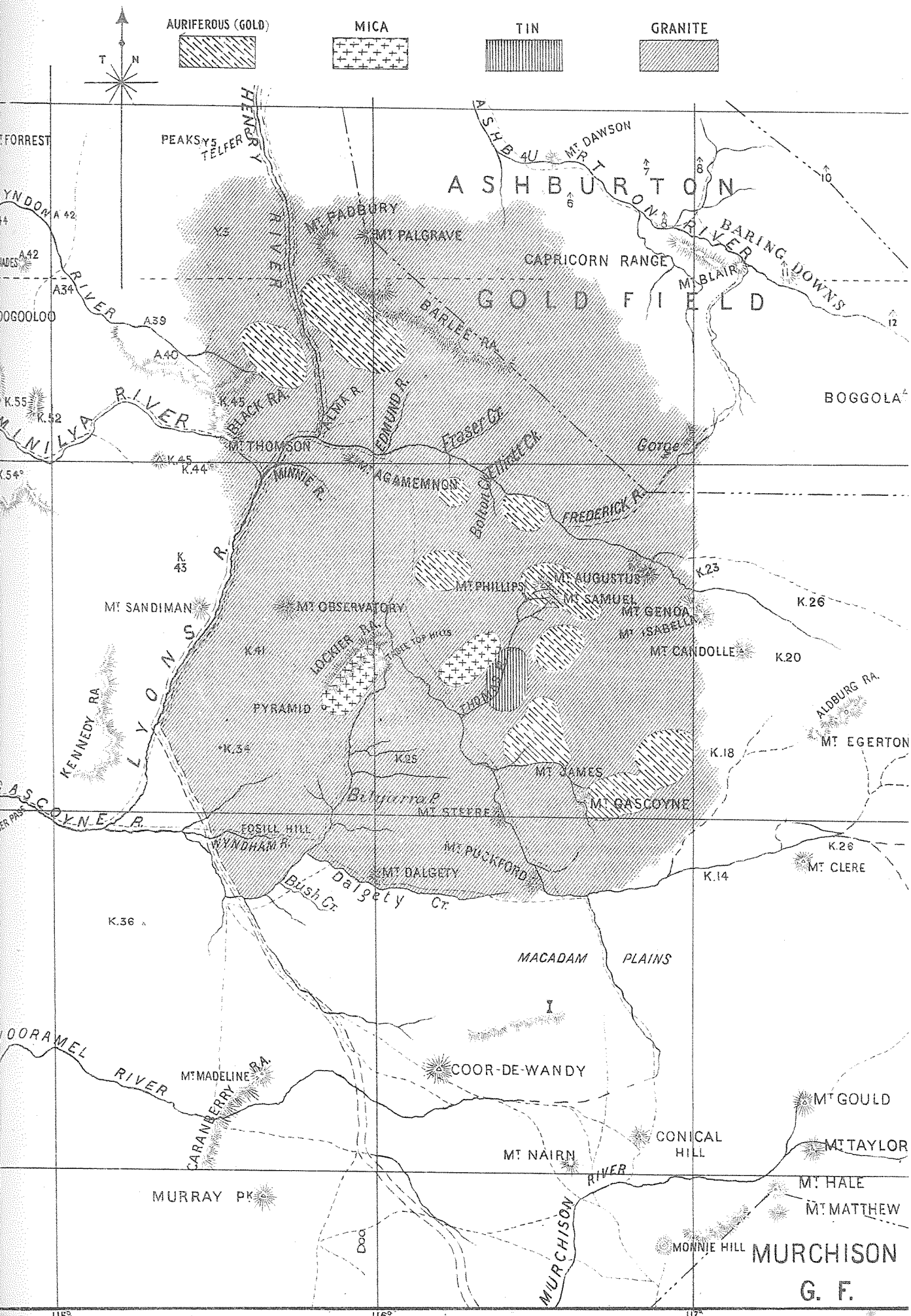
PLANS SHEWING POSITION
of Various Auriferous discoveries outside
GOLD FIELDS.





GEOLOGICAL SKETCH MAP

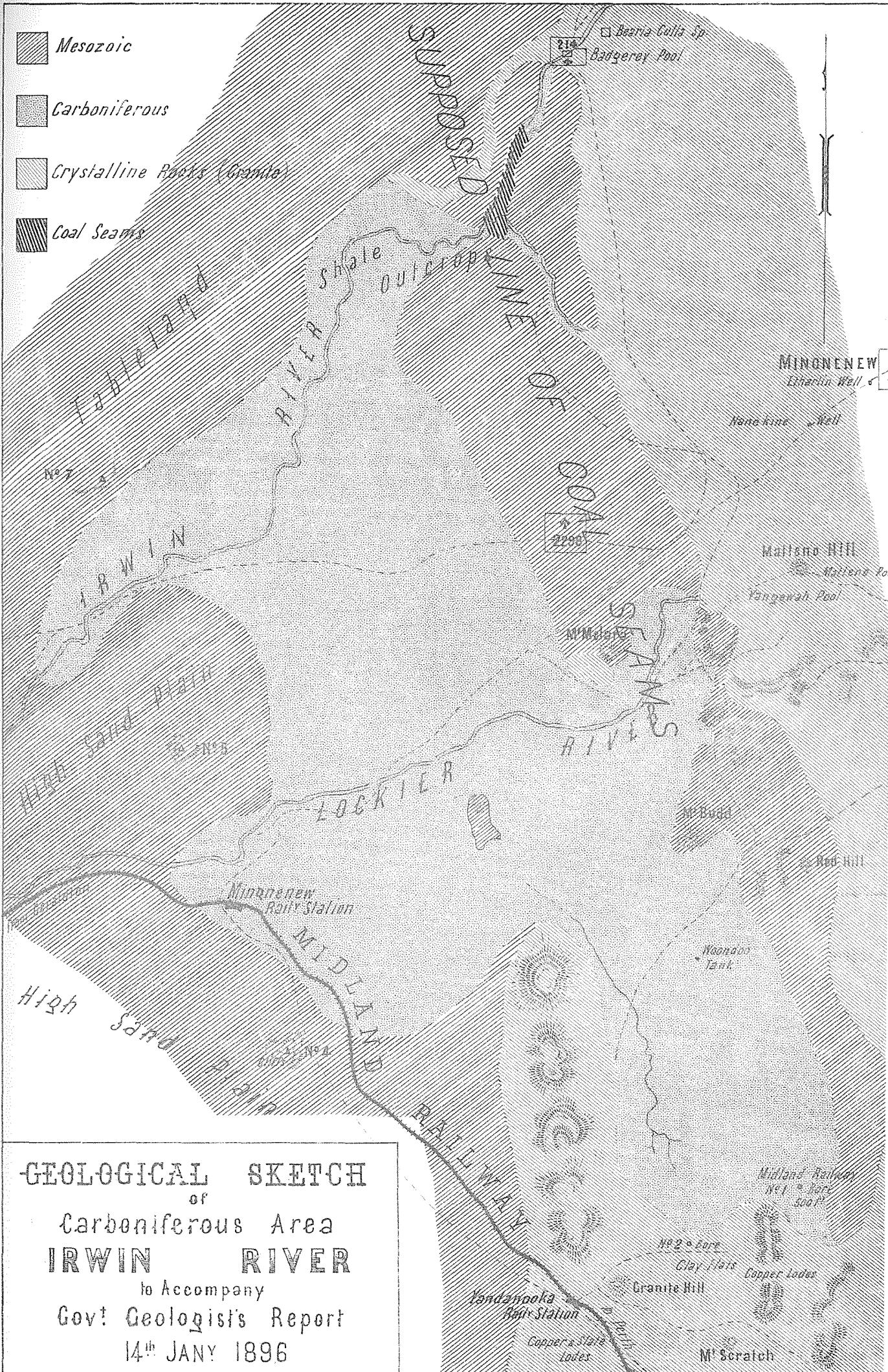
— SHEWING APPROXIMATELY THE DISTRIBUTION OF CERTAIN MINERALS —
 ON THE

UPPER GASCOYNE AND LYONS RIVERS

— REFERENCE —





-  Mesozoic
-  Carboniferous
-  Crystalline Rocks (Granite)
-  Coal Seams

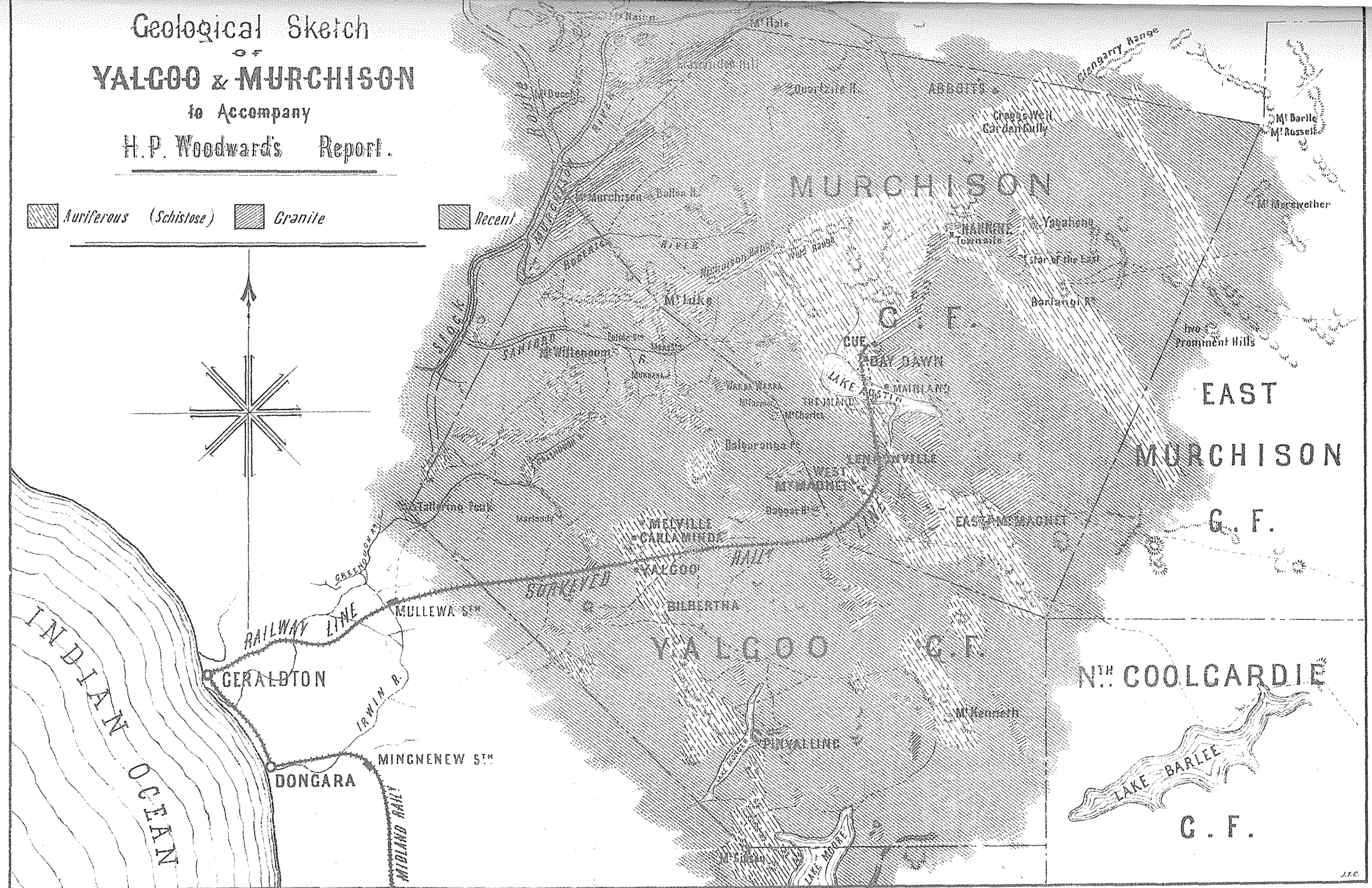
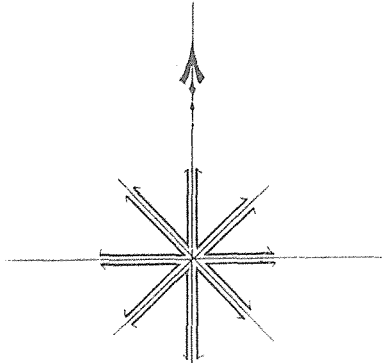


GEOLOGICAL SKETCH
of
Carboniferous Area
IRWIN RIVER
to Accompany
Govt Geologist's Report
14th JANY 1896

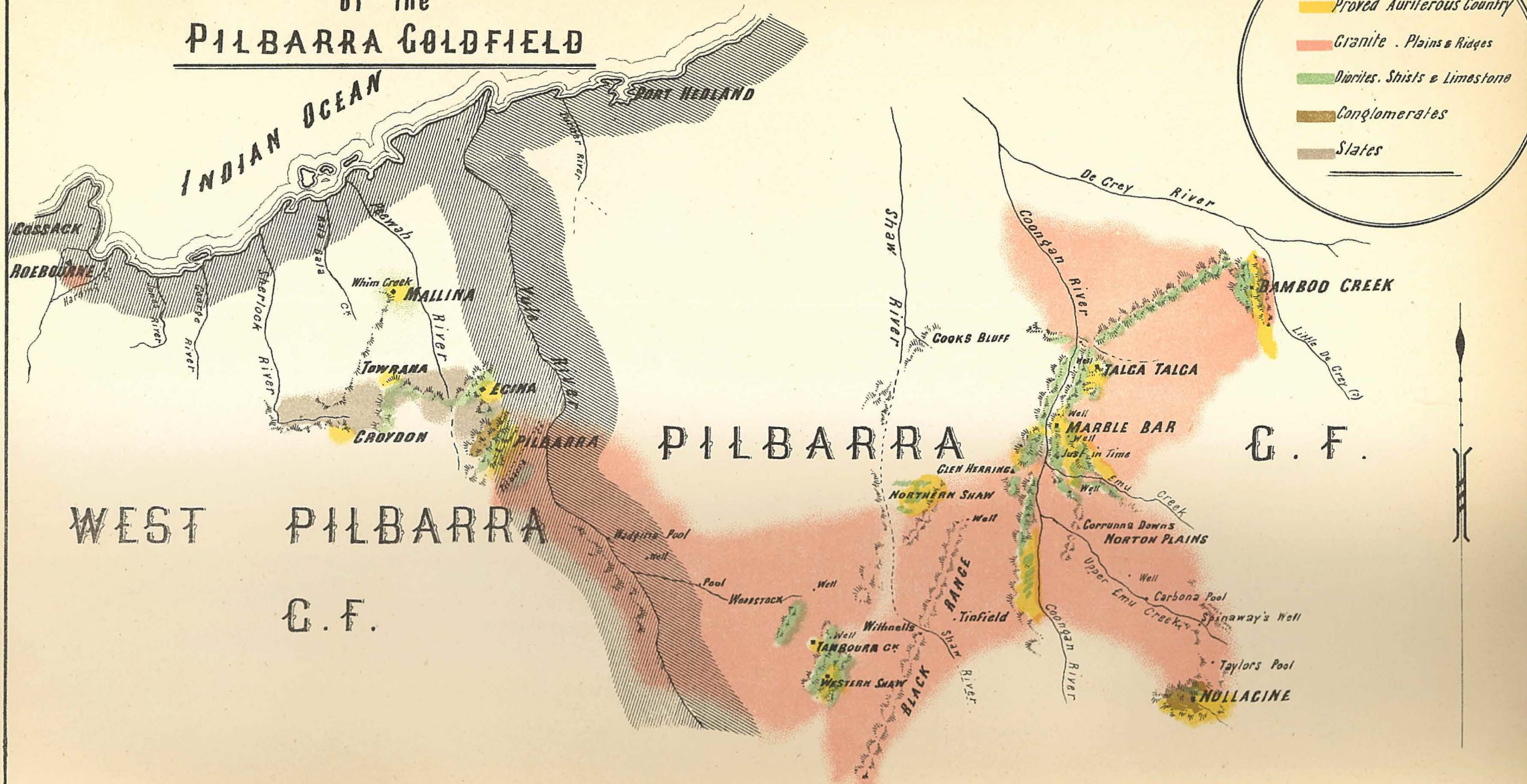
Geological Sketch
 OF
YALGOO & MURCHISON
 to Accompany
 H. P. Woodward's Report.

 Auriferous (Schistose)  Granite

 Recent



SKETCH GEOLOGICAL MAP of the PILBARRA GOLDFIELD

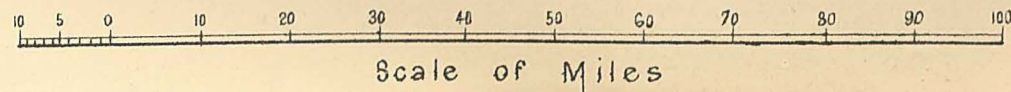


Reference

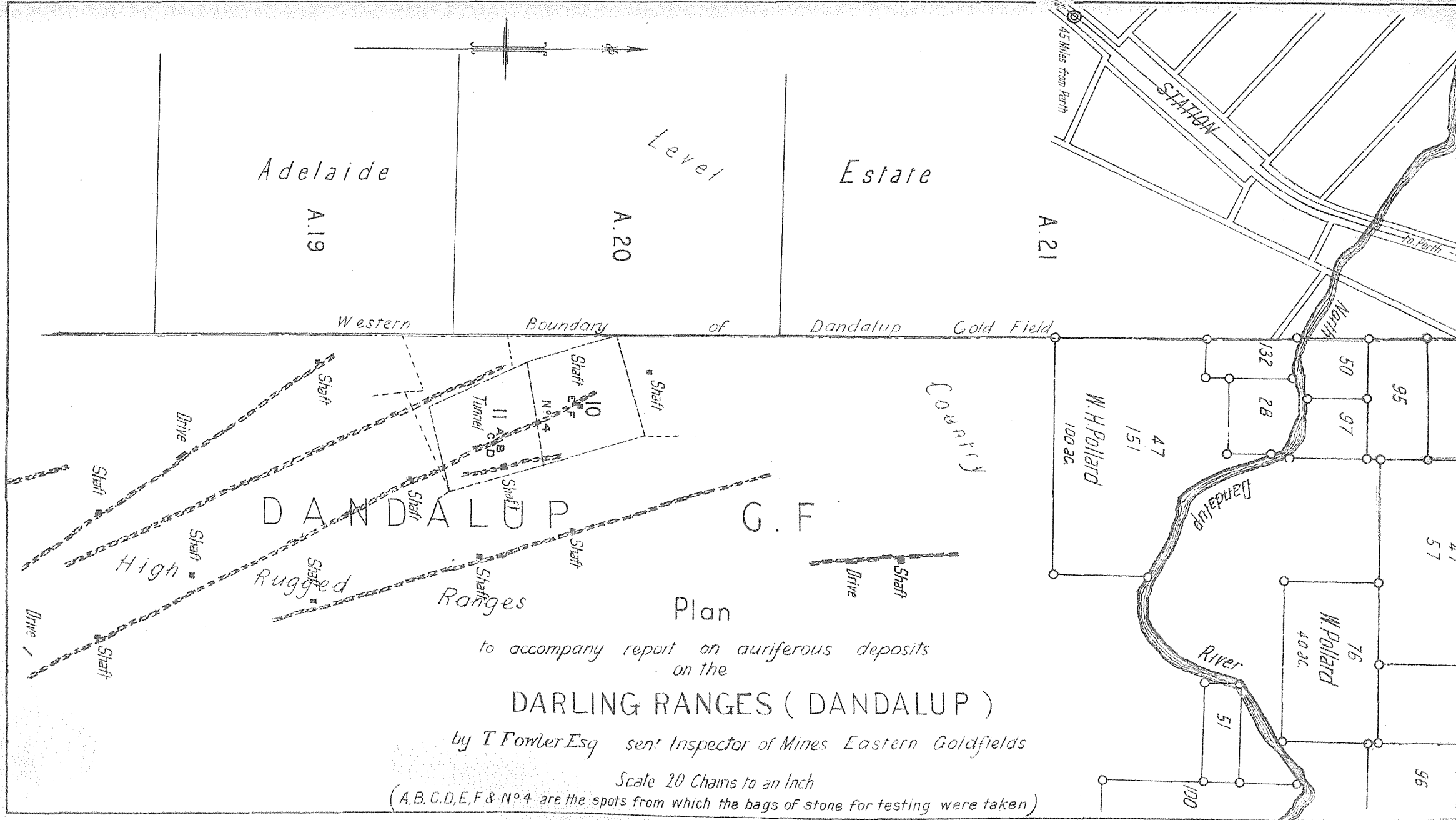
- Proved Auriferous Country
- Granite . Plains & Ridges
- Diorites, Shists & Limestone
- Conglomerates
- Slates

WEST PILBARRA
C. F.

PILBARRA
C. F.

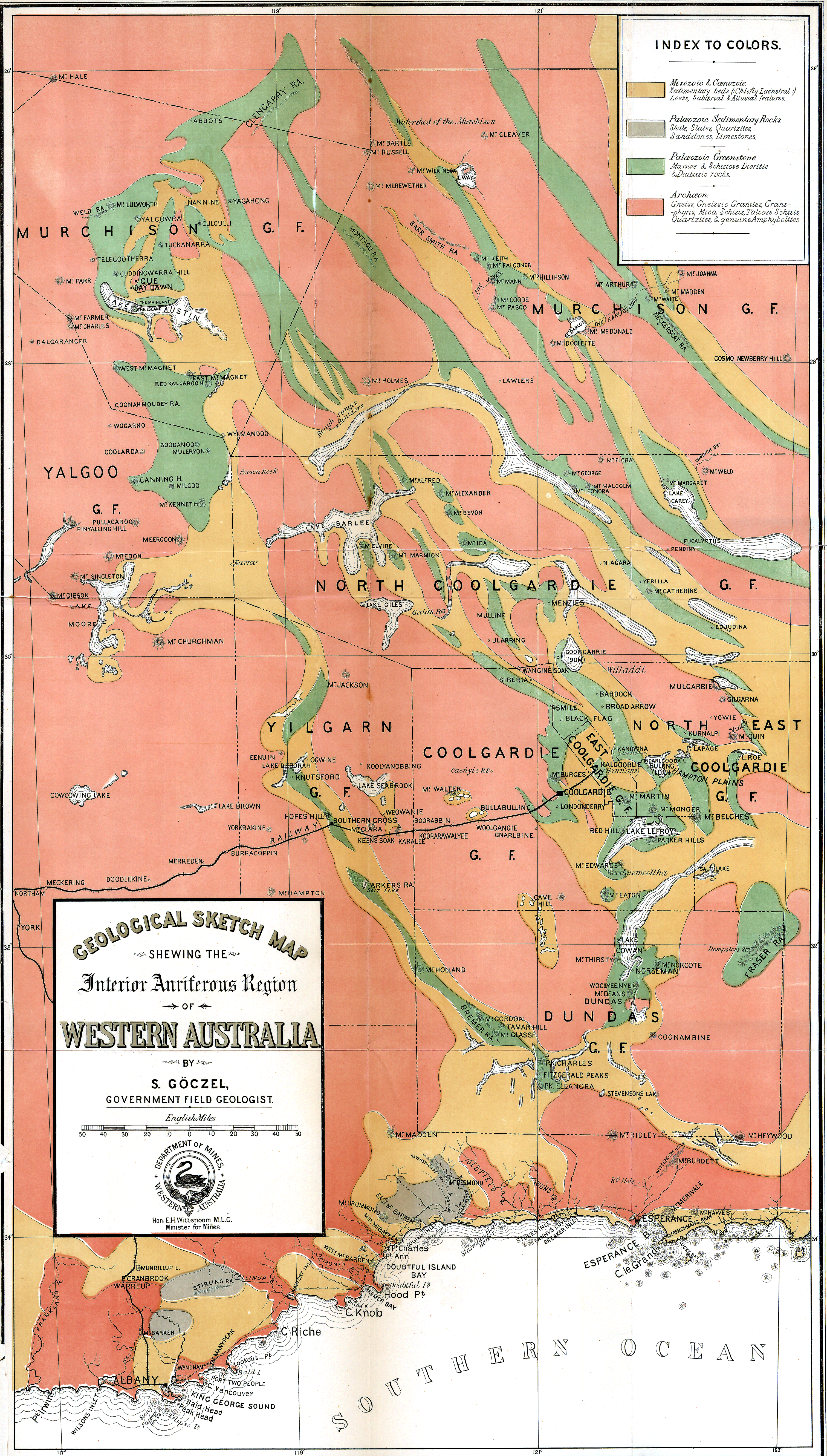


From Notes and Observations By
S. J. BECHER M. E.



INDEX TO COLORS.

- Mesozoic & Cenozoic Sedimentary beds (Chiefly Laenstral) Loess, Suberial & Alluvial Features*
- Paleozoic Sedimentary Rocks. Shale, Slates, Quartzites, Sandstones, Limestones.*
- Paleozoic Greenstone. Massive & Schistose Dioritic & Diabasic rocks.*
- Archæon. Gneiss, Gneissic Granites, Gneissophrys, Mica Schists, Talcose Schists, Quartzites, & genuine Amphibolites.*



GEOLOGICAL SKETCH MAP
 SHEWING THE
Interior Arctiferous Region
 OF
WESTERN AUSTRALIA
 BY
S. GÖCZEL,
 GOVERNMENT FIELD GEOLOGIST.
English Miles
 50 40 30 20 10 0 10 20 30 40 50
 DEPARTMENT OF MINES.
 WESTERN AUSTRALIA
 Hon. E.H. Wittenoom M.L.C.
 Minister for Mines.



Hon. E.H. Witzeloom M.L.C. Minister for Mines.

(SPECIMEN PLAN.) BLACK SWAN GOLD MINING CO. LTD., MURCHISON GOLD FIELDS WESTERN AUSTRALIA.

Showing Sections of Underground Workings.

NOTE

This Plan has been prepared by the Mines Department for the guidance of Mine Managers and Surveyors. All Plans of underground workings should be drawn in a similar style.

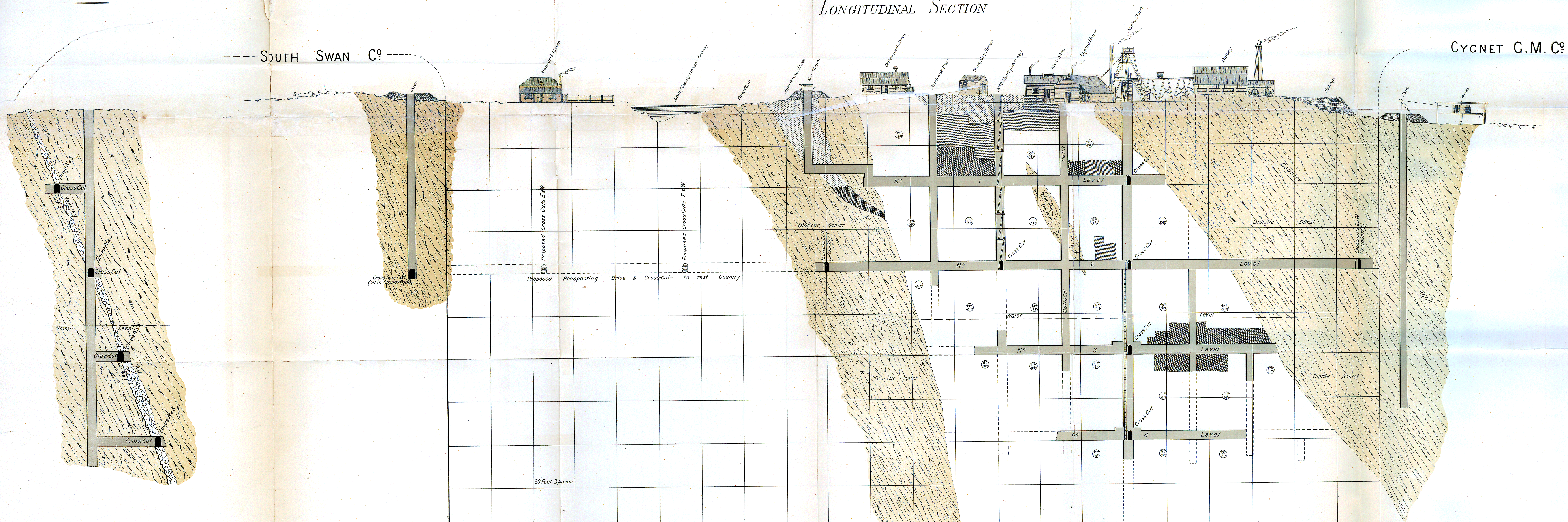
NOTE

The figures in circles thus $\textcircled{10}$ represent the average assay value and width of the lode at points indicated, or representing ounces or pennyweights, or its representing feet or inches. Stopping time by Original Owners shown thus $\textcircled{1800}$ do do do by Company for year ending 30th June 85 shown thus $\textcircled{1000}$ do do do by year ending 31st Dec 85 shown thus $\textcircled{500}$

TRANSVERSE SECTION

of Main Shaft.

LONGITUDINAL SECTION

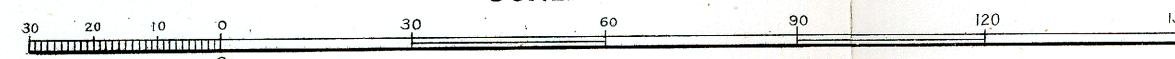


THIS PLAN comprises Sections of all underground workings in
to _____ 18 _____ Mine

Manager.

Licensed Mining Surveyor

SCALE OF FEET



THIS IS COMPILED FROM A SECTIONAL DRAWING KINDLY SUPPLIED BY CAPT. R. PIPER, MINING ENGINEER, M^r MAGNET.
DRAWN BY W.R. THOMAS, SURVEYOR, M^r MAGNET.