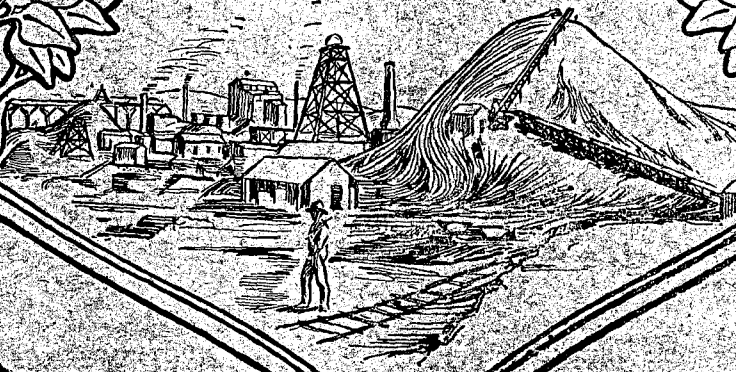




REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1923 · AUSTRALIA



PRESENTED TO BOTH HOUSES OF PARLIAMENT

BY HIS EXCELLENCY'S COMMAND



H.D.C. HIGGINS

1924.

WESTERN AUSTRALIA.

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE YEAR

1923.

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

[FIRST SESSION OF THE TWELFTH PARLIAMENT.]

PERTH :

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1924.

ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1923.

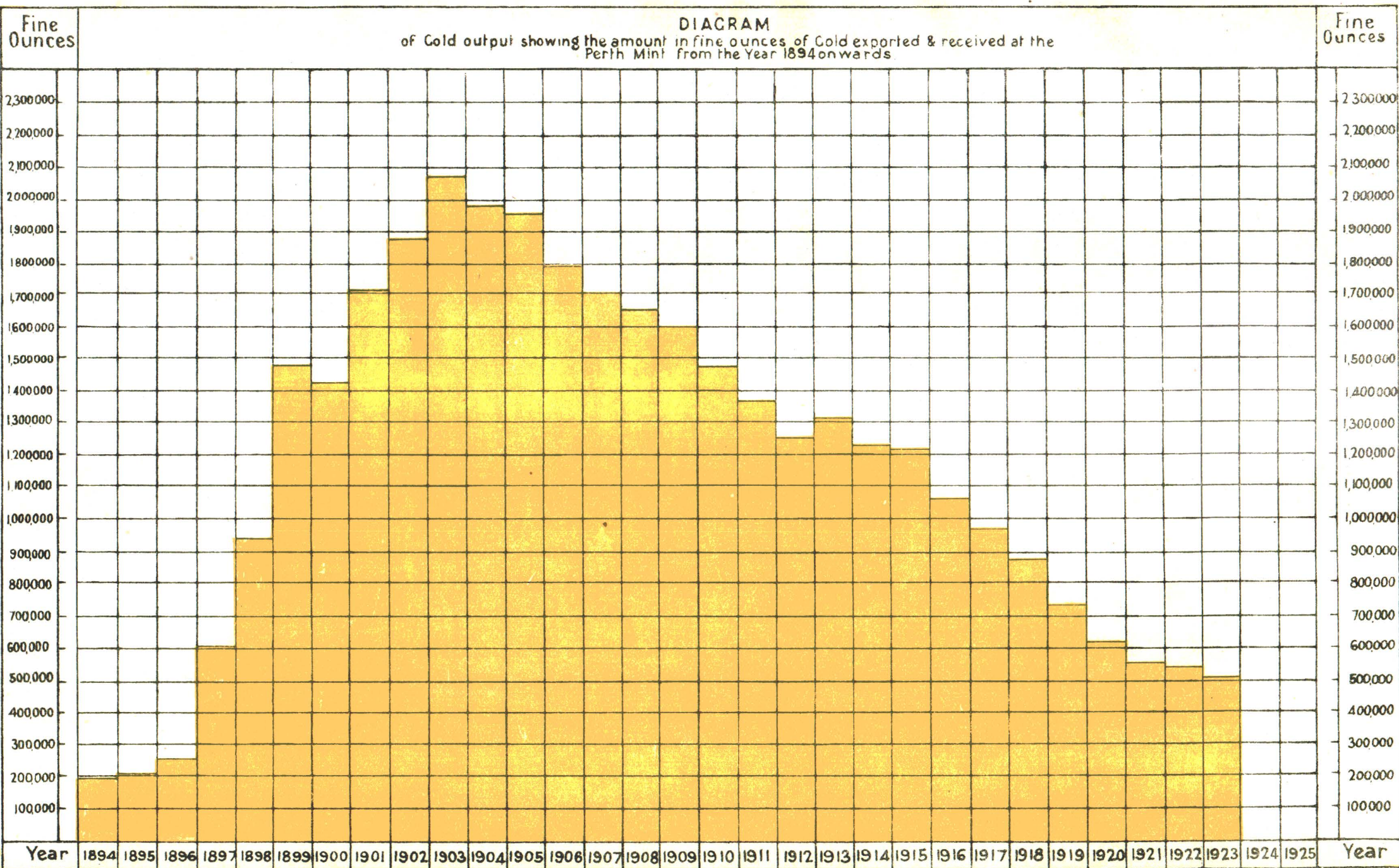
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STATE OF WESTERN AUSTRALIA.

**Report of the Department of Mines for the State of Western
Australia, for the Year 1923.**

To the Hon. the Minister for Mines.

Sir,—

I have the honour to submit the Annual Report of the Department for the year 1923, with summaries of reports from the Wardens and other officers, together with various comparative tables furnishing statistics relating to the mining industry of the State.

Reports from the officers controlling the various sub-departments are also submitted.

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 31st March, 1924.

DIVISION I.

Summary by the Under Secretary for Mines.

PART. I.—GENERAL REMARKS.

II.—MINERALS RAISED.

III.—LEASES AND OTHER HOLDINGS UNDER VARIOUS ACTS RELATING TO MINING.

IV.—MEN EMPLOYED.

V.—ACCIDENTS.

VI.—STATE AID TO MINING.

VII.—REMARKS ON THE GOLDFIELDS AND MINERAL DISTRICTS AND SUMMARIES OF WARDENS' AND OTHER OFFICERS' REPORTS.

VIII.—EXISTING LEGISLATION.

IX.—INSPECTION OF MACHINERY.

X.—SCHOOL OF MINES.

PART I.—GENERAL REMARKS.

The value of the mineral output of the State for the year 1923 was £2,657,950, being £143,676 less than for the previous year.

Copper ore exported showed an increase of 3,042 tons, and copper ingot, matte, etc., an increase of 397 tons.

Coal showed a decrease, also Silver, but Tin an increase.

The value of the Gold yield was £2,143,028, being 80.63 per cent. of the total output.

The value of the Coal output was £368,949; Copper, £65,100; Silver, £16,036, and Tin, £15,095.

The dividends paid by mining companies amounted to £73,750, and in the preceding year £191,251; a decrease of £117,501.

The total dividends paid to the end of 1923 amounted to £28,380,706. To the same date, the total mineral production was £159,331,789, and the total gold production £150,135,505.

GOLD.

The gold yield again shows a decline, being 33,735 fine ounces less than in 1922, which was 15,485 fine ounces less than in 1921.

The average value per ton of ore treated in the State as a whole has risen from 53.17 shillings in 1922 to 53.28 shillings in 1923, and in the East Coolgardie Goldfield, which produced over 70 per cent. of the State's reported yield, it rose from 48.63 shillings to 52.13 shillings.

Comparing the tonnage of ore treated in 1922 and 1923, there was a decrease of 68,353 tons in the latter year, during which 781,769 tons were treated.

There were decreases in all the fields excepting West Pilbara, East Murchison, Murchison, Mt. Margaret, North-East Coolgardie, and Coolgardie, where there

were increases of 16, 2,404, 967, 6,872, 1,318, and 7,787 tons respectively.

The largest decreases were in Peak Hill, Yalgoo, and East Coolgardie fields, viz., 9,290, 9,230, and 53,124 tons respectively.

It is difficult to get reliable figures as to working costs, but, so far as can be ascertained, there has been an improvement during the year. The Government rendered substantial help in this direction by reducing the price of water to 3s. per thousand as from 1st July.

There were increases in the outputs from North-East Coolgardie and Kimberley, but all other fields reported decreases.

The acreage held under mining lease for all minerals is 60,270 acres, being an increase of 3,936 acres when compared with 1922.

The area leased for gold mining is lesser by 8 acres, but for other minerals greater by 3,944 acres.

The area held under prospecting areas is 29,292 acres, including 10,720 acres for coal. This is a decrease of 14,751 acres on the area held in 1922.

The number of men engaged in all classes of mining was 6,497; a decrease of 279 on the number employed in 1922.

The number of men engaged in mining for minerals other than gold decreased by 47, principally in lead and coal mines.

In asbestos mining there was an increase.

In mining for other minerals the figures were practically the same as in the preceding year.

In gold mining there was a decrease of 232 men, but in Kalgoorlie there was an increase.

The average value of gold produced per man employed on gold mines has fallen from £408.16 in 1922 to £389.52 in 1923.

The average tonnage raised per man was 146.21 tons, and in the previous year 153.53 tons.

In the East Murchison field there was a falling off. At Lawlers the temporary closing down of the "Daisy Queen" Mine affected the output, but otherwise there was little change. In the Black Range district there was for a little while quite a revival consequent on reported rich discoveries which, unfortunately, did not come up to expectations.

In the Wiluna district there was a small increase, and a good deal of interest is being manifested in the locality consequent on an option over several mines having been taken by English investors who propose to carry out extensive boring, and should this disclose good values ample working capital will be made available.

It will be many months before a definite conclusion can be reached.

The Murchison field had a decrease, due to a smaller output from the Fenian Mine, now worked by tributaries, in the Meekatharra district. In this district there was little change.

In the Cue district there was a decrease and mining was very quiet, the principal producer being the "Big Bell," which closed down at the end of the year. In the Day Dawn district practically the only mining is on the old Fingall Mine, where a party is actively working with encouraging prospects.

In the Mt. Magnet district there was a decrease, but prospecting was very active and some new discoveries were very promising.

The Mount Margaret field had a small decrease. In the Mt. Margaret district there was little change, and although work is proceeding on the new find reported last year the remoteness of the locality militates against any rapid progress.

In the Mount Morgans district there was little change, the principal producer being the Westralia Mt. Morgans Mine.

In the Mt. Malcolm district there was an increase consequent on the resumption of milling operations on the Sons of Gwalia Mine, where a new 30 head mill commenced crushing in October. Prospecting throughout the district was active.

The Coolgardie field had a decrease, practically wholly attributable to a lessened output from the "Carbine" Mine in the Kunanalling district.

In the Gibraltar district the "Lloyd George" Mine was a steady producer for most of the year, but towards its close operations were suspended and the mine let on tribute. An effort is to be made to raise more capital to further develop the property. At Widgiemooltha there was no improvement.

In the St. Ives district work progressed steadily, and several mines are opening up promisingly.

A plant is being erected on the Ives Reward Mine.

The North Coolgardie field had a small decrease.

In the Menzies district the principal producer was the Menzies Consolidated Mine at Yunndaga, where work proceeded steadily. This mine is receiving help from the Government.

At Comet Vale matters were very quiet, but an early improvement is expected. At Mt. Ida the position improved slightly. In the Ularring, Niagara, and Yerilla districts mining was exceedingly quiet.

The North-East Coolgardie field had a small increase. No new developments were reported, but a good many prospectors were out.

The Broad Arrow field had a decrease, but prospecting was active and one or two promising finds were made. At Ora Banda a good development on the Orinda Mine was recorded, and indications point to permanency.

In the East Coolgardie field the number of men engaged in mining was 2,902, and in 1922, 2,787; an increase of 115. The goldfield gave employment to 50 per cent. of the number of men engaged in gold mining, and the reported production during the year was 370,670 fine ounces, over 74 per cent. of the total reported yield.

The tonnage treated was 603,297 tons, being 53,124 tons less than in 1922.

The yield showed a decrease of 5,719 fine ounces, but there was little change in the big mines. The average grade of the ore per ton rose from 48.63 shillings in 1922 to 52.13 shillings in 1923.

In the Yilgarn field there was a decrease.

At Southern Cross work in the direction of reopening the old Fraser's Central Mine is still in hand, and the owner, who is being assisted by the Government, is very optimistic as to results. At Burbidge work is proceeding very satisfactorily at the Great Victoria Mine, and a good deal of new plant has been installed. At Manxman the Radio Mine has been a steady producer, likewise the Spring Hill Mine at Parker's Range.

At Greenmount preparations are being made to reopen the Transvaal Mine, which was a good producer in the past. At Bullfinch, Westonia, and Forresteria mining was very quiet.

In the Dundas Goldfield there was a small decrease. The principal producers were the "O.K.," "Mararoa," and "Viking No. 1," and there was little change.

The Phillips River field has a decrease. Mining was stagnant throughout the year consequent on the low price ruling for copper, which is the chief product of the field. An improvement is looked for at an early date consequent on the introduction by a local company of a separation process from which much is expected.

In the Northern goldfields, Kimberley, West Kimberley, West Pilbara, Ashburton, and Gascoyne, nothing of note was reported. In the Pilbara field there was a small decrease. The principal production was from the Marble Bar, Lalla Rookh, and Bamboo Creek Centres, and, generally speaking, the position was little changed.

TIN.

The quantity of Tin exported was 131 tons, valued at £15,095; an increase in tonnage of 21 tons, and in value of £4,165.

The Greenbushes Tinfield produced 28.02 tons, valued at £3,024; an increase in tonnage of 12.16 tons, and in value of £1,631; the Pilbara field 24.40 tons, valued at £2,960; a decrease of .95 tons, but increase in value of £514. None was produced in any other field.

TANTALITE.

Five (5) tons of this mineral, valued at £688, were exported, but none in the preceding year.

COPPER.

The value of the copper exported was £65,100, being £44,721 more than in 1922. The ore raised in the West Pilbara field was 221 tons, valued at £3,500; an increase on the preceding year in tonnage of 57 tons, and in value of £1,019.

The Whim Well Mine was practically the only producer.

In the Northampton field the production was 9,629.29 tons, valued at £59,143; an increase on the preceding year in tonnage of 8,627.63 tons, and in value of £45,708.

In the Phillips River field the output was 26.01 tons, valued at £541; a decrease on the preceding year of 5.83 tons, but increase in value of £324.

COMPARATIVE STATISTICAL DIAGRAMS

RELATING TO
OUTPUT AND VALUE OF GOLD AND OTHER MINERALS, LANDS LEASED FOR GOLD MINING
 IN WESTERN AUSTRALIA
AND THE GOLD PRODUCTION OF AUSTRALASIA FOR THE YEAR 1923.

FIG. 1. Output of Gold from various Goldfields as reported to Mines Dept.

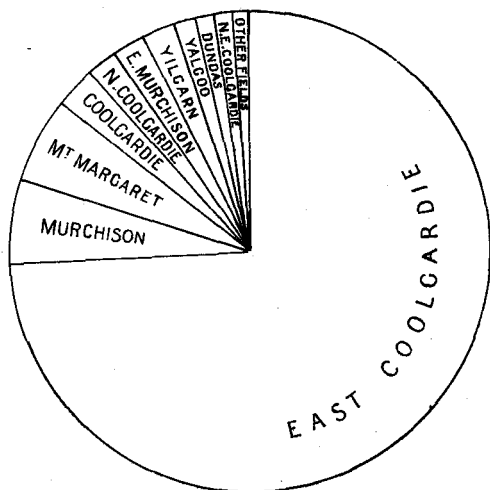


FIG. 2. Gold produced from various Goldfields as given by the Export and Mint Returns.

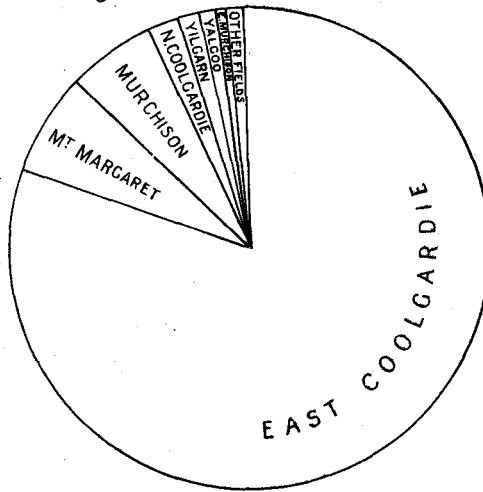


FIG. 3. Value of Gold and other Minerals.

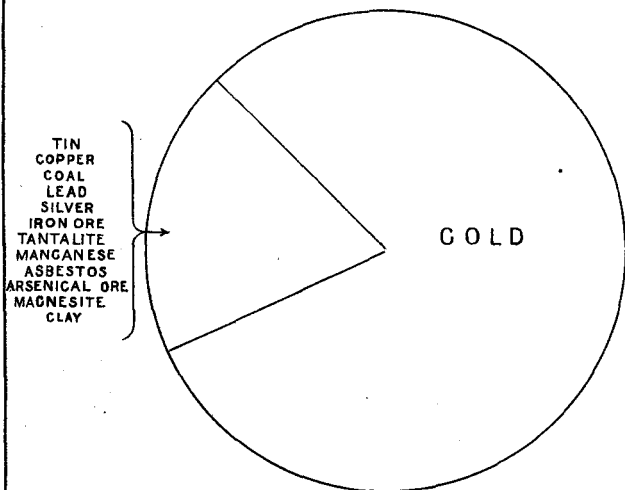


FIG. 4. Value of Minerals other than Gold.

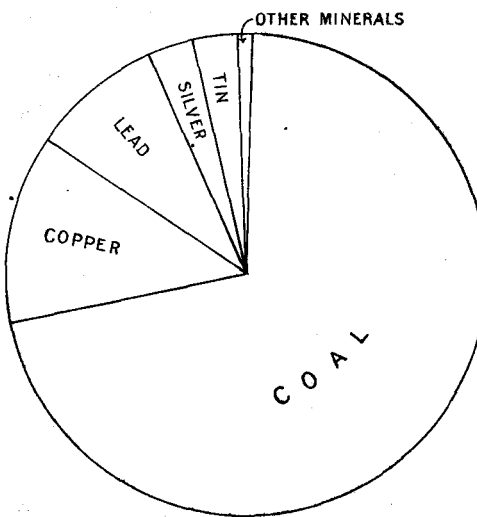


FIG. 5. Areas of Land leased for Goldmining on various Goldfields.

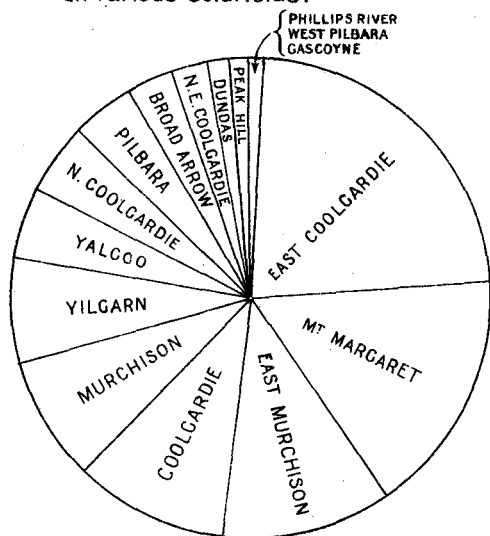
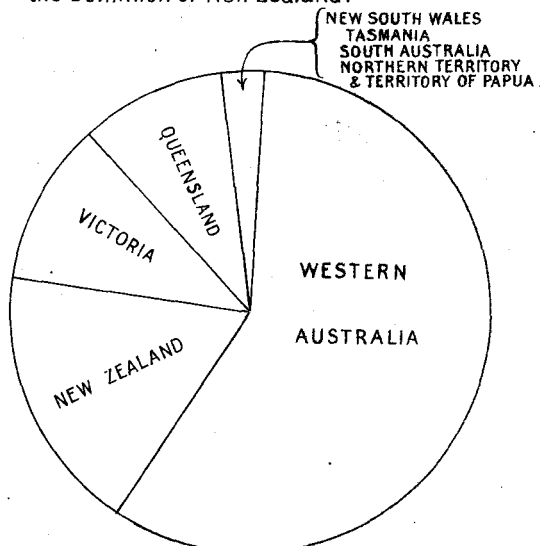
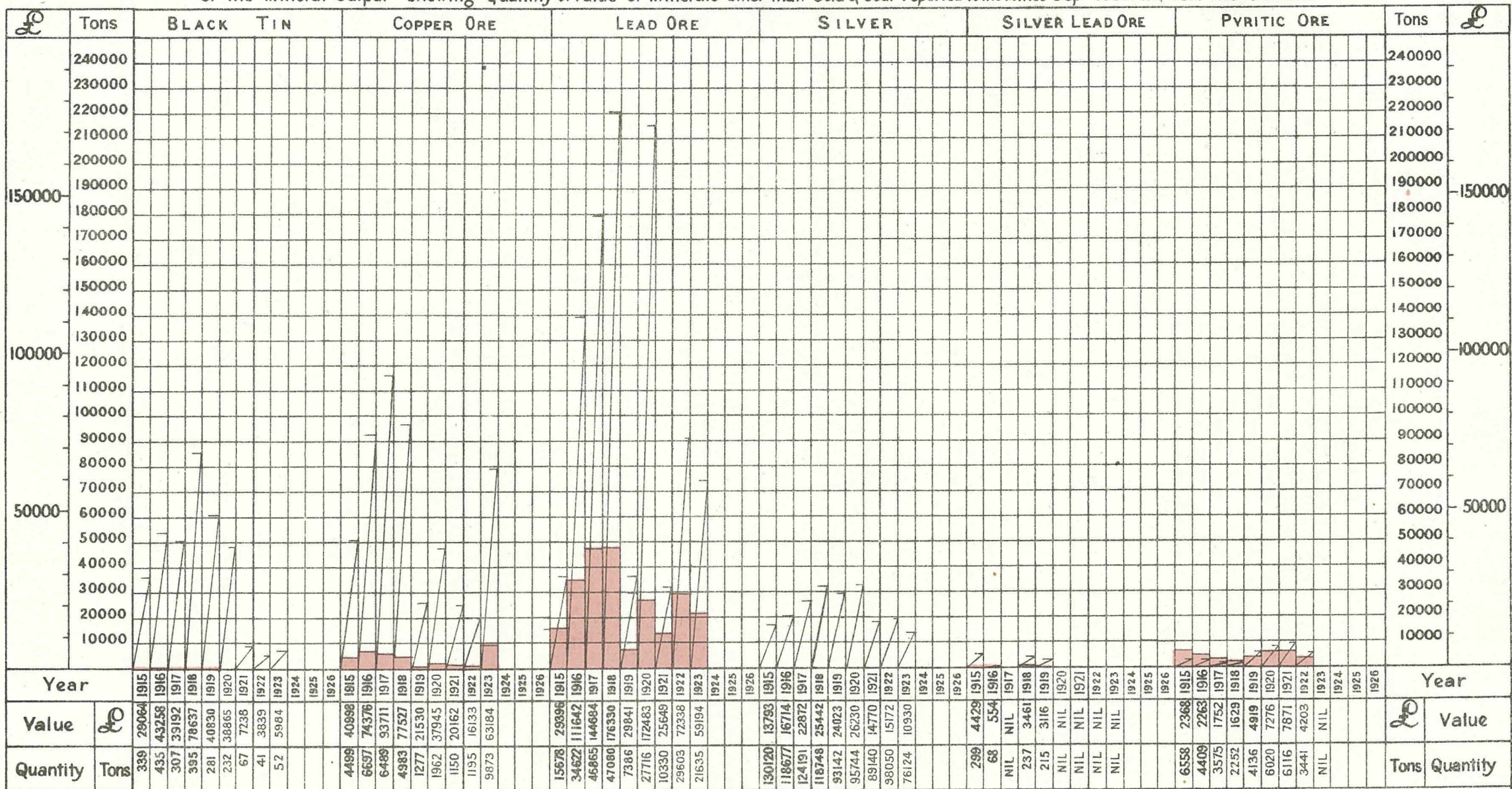


FIG. 6. Output of Gold in the States of Australia and the Dominion of New Zealand.



DIACRAM

of the Mineral Output - showing Quantity & Value of Minerals other than Gold & Coal reported to the Mines Dept from the Year 1915 onwards



NOTE. The Pink denotes Quantities produced and Diagonal lines Values thereof

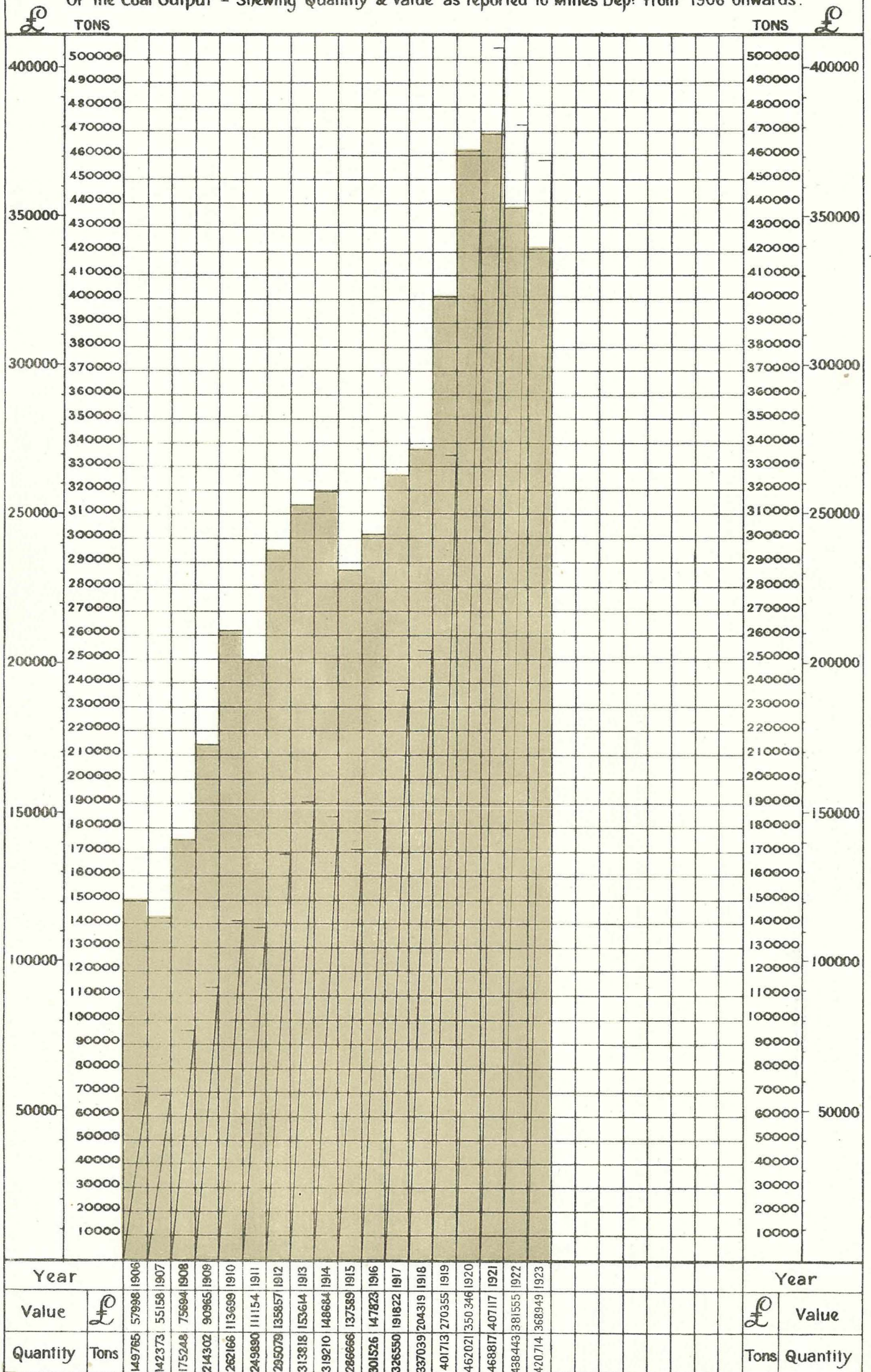
Mineral not shown above.
Asbestos 115 Tons, Value £4032.
also reported in the year 1923.

Previous to 1915 the Quantity & Value of various Minerals reported amounted to

Black Tin ..	14299 Tons	£1,142,902	Silver Lead ..	2064 Tons	£ 22,427
Copper	201879 "	1,254,298	Tantalite	89 "	13,486
Ironstone	57820 "	36,695	Limestone	93706 "	18,290
Lead	61820 "	134,711	Silver	1,537,935 Ozs.	180,846
Asbestos	43 "	1,754	Total		£2,805,409

D I A C R A M

Of the Coal Output - Shewing Quantity & Value as reported to Mines Dept from 1906 onwards.



This field was exceedingly quiet throughout the year.

The number of men engaged in copper mining was 80, and in 1922, 10.

COAL.

The output of Coal was 420,714 tons, being 12,606 tons less than in 1922. There were five (5) collieries producing, all situated at Callie.

At Wilga boring is still in progress, and good seams have been located, but no collieries have yet been opened up. At Irwin River further exploratory work will be put in hand shortly. The number of men employed, 713, is less by 31 than in 1922, and the output per man was in 1922, 589 tons, and in 1923, 590 tons.

OIL.

Boring operations are still proceeding on the areas known as "Freney's" and "Okes Durack" in the Kimberley Division, but it is expected to be some time before any conclusive results will be known.

Several other areas are being geologically examined with a view to deciding whether boring is justified.

ASBESTOS.

In the Pilbara field 114 tons, valued at £4,015, were produced, a decrease on the preceding year in tonnage of 67.68 tons, and in value of £3,585.

In the West Pilbara field the production was .85 tons, valued at £17, but none in the preceding year. Large deposits are known to exist in both these fields, and the Department strives to stimulate production by making advances against the ore pending realisation.

OTHER MINERALS.

The quantity of Silver obtained as a by-product and exported was 109,005 ounces, valued at £16,036, and in the preceding year 118,696 ounces, valued at £18,164; a decrease of 9,691 ounces and £2,128.

Pig Lead to the amount of 20 tons, valued at £609, was exported, also 3,172 tons of Lead and Silver-lead, valued at £43,416; 22 tons of Manganese, valued at £200; 2 tons of Iron Ore, valued at £9; 2 tons of Magnesite, valued at £8; 34 tons of Clay, valued at £94; and Arsenical Ore to the value of £686.

MINING GENERALLY.

The States of Queensland and Tasmania had increases of 8,142 and 253 fine ounces respectively, but New South Wales, Victoria, and South Australia recorded decreases. The Northern Territory had an increase of 385 fine ounces, but the Territory of Papua a decrease.

New Zealand, as in the preceding year, reports an increase.

The Western Australian production was 58.05 per cent. of the total for Australasia, and in the previous year 60.52 per cent. It is undoubted that two factors which most seriously affect mining are taxation and the tariff on many mining requisites. A conference representative of all the States convened by the Federal Government sat in Melbourne in December last and made definite recommendations regarding relief in both these directions. If conceded the result should be a great improvement.

It is also hoped that some concessions may be given in regard to State taxation, the matter being under consideration.

During the year a very considerable reduction in the price of water supplied to the mines connected with the Goldfields Water Supply Scheme was granted, which it is expected will afford considerable relief to the mines affected.

In mining for base metals the low prices obtaining for the greater part of the year have prevented any marked improvement. The assistance to prospectors by way of sustenance, loans of equipment, and transport facilities has been continued, and the Board controlling recommended the granting of assistance to 121 parties, comprising 185 men, and 120 extensions of existing parties at a cost of £4,801, and all were approved. Consequent on the success achieved by the State Prospecting Party reported last year three similarly constituted parties were sent out. One, comprising a leader and five (5) men, operated in the Coobina Belt in the vicinity of Ophthalmia Range, and the other two, comprising a leader and three (3) men each, operated one at Lake Barlee and the other at Hamersley Range. The cost of these was £1,510, and although gold was found in many places, unfortunately nothing likely to permanently benefit the State was discovered.

The area held under prospecting areas for gold and minerals other than coal, viz., 18,572 acres, although less than in 1922 by 8,991 acres, is evidence that a good amount of prospecting is in progress.

As hitherto, a very large amount of financial assistance was rendered to mine owners under the provisions of the Mining Development Act, full particulars of which will be found in the report of the State Mining Engineer, Division II. of this report. Any application that had a reasonable chance of success was approved.

PART II.—MINERALS RAISED.

TABLE 1.

Quantity and Value of all the Minerals produced during 1922 and 1923.

Description of Minerals.	1922.		1923.		Increase or Decrease for Year compared with 1922.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value
1. Arsenical ore (exported), statute tons	1,075	£ 1,784	*	£ 686	...	— 1,098
2. Asbestos (reported), statute tons	181	7,600	115	4,032	— 66	— 3,568
3. Barytes (exported), cwts.	378	73	...	...	— 378	— 73
4. Clay (exported), statute tons	1	16	34	94	+ 33	+ 78
5. Coal (raised), statute tons	438,443	381,555	420,714	368,949	— 17,729	— 12,606
6. Copper { Ore (exported), statute tons	352	5,519	3,394	48,907	+ 3,042	+ 43,388
{ Ingot, Matte, etc. (exported), statute tons	660	14,860	1,057	16,193	+ 397	+ 1,333
7. Felspar (exported), statute tons	60	485	...	...	— 60	— 485
8. Gold (exported and minted), fine ounces	538,246	2,286,325	504,511	2,143,028	— 33,735	— 143,297
9. Graphite (exported), statute tons... ..	...	3	...	...	...	— 3
10. Gypsum (reported), statute tons	63	16	...	...	— 63	— 16
11. Iron Ore, statute tons ... ..	...	...	2	9	+ 2	+ 9
12. Lead and Silver Lead (exported), statute tons ... ..	...	...	3,172	43,416	+ 3,172	+ 43,416
13. Lead, Pig (exported), statute tons	2,796	69,528	20	609	— 2,776	— 68,919
14. Magnesite, statute tons ... ..	...	...	2	8	+ 2	+ 8
15. Manganese (exported), statute tons ... ..	...	...	22	200	+ 22	+ 200
16. Mica (exported), statute tons	2	60	...	...	— 2	— 60
17. Molybdenite (exported), statute tons	51	505	...	...	— 51	— 505
18. Pyritic Ore (reported), statute tons	3,441	4,203	...	...	— 3,441	— 4,203
19. Silver (exported), fine ounces	118,696	18,164	109,005	16,036	— 9,691	— 2,128
20. Tantalite, statute tons ... ..	...	...	5	688	+ 5	+ 688
21. Tin (exported), statute tons	110	10,930	131	15,095	+ 21	+ 4,165
Total Values ... ..	...	2,801,626	...	2,657,950	...	— 143,676

* Contained in Gold ore.

TABLE 2.

Value and Percentage of Mineral Exports in relation to the Value of Total Exports from Western Australia.

Year.	Total Exports.	Mineral Exports (exclusive of Coal).	Percentage.
1901	£ 8,515,623	£ 6,920,118	81.27
1902	9,051,358	7,530,319	83.20
1903	10,324,732	8,727,060	84.53
1904	10,271,489	8,625,676	83.98
1905	9,871,019	7,731,954	78.33
1906	9,832,679	7,570,305	76.99
1907	9,904,860	7,544,992	76.17
1908	9,518,020	7,151,317	75.13
1909	8,860,494	5,906,673	66.66
1910	8,299,781	4,795,654	57.78
1911	10,606,863	7,171,638	67.61
1912	8,941,008	5,462,499	61.09
1913	9,128,607	4,608,188	50.48
1914	8,406,182	3,970,182	47.23
1915	6,291,934	2,969,502	47.19
1916	10,878,153	6,842,621	62.92
1917	9,323,229	5,022,694	53.87
1918	6,931,834	2,102,923	30.34
1919	14,279,240	6,236,585	43.67
1920	15,149,323	3,096,849	20.44
1921	10,331,405	1,373,810	13.30
1922	11,848,025	2,875,402	24.27
1923	11,999,500	3,259,476	27.16
Total since 1900	228,565,358	127,496,437	55.78

TABLE 3.

Showing for every Goldfield the amount of Gold reported to the Mines Department as required by the Regulations; also the percentage for the several Goldfields of the total reported and the average value of the Gold per ton of ore treated.

Goldfield.	Reported Yield.					
	1922.	1923.	Percentage for each Goldfield.		Average Value of Gold per ton of Ore treated.	
			1922.	1923.	1922.	1923.
	fine ozs.	fine ozs.			shillings.	shillings.
1. Kimberley	5	81	...	·01	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara	3,100	2,544	·58	·51	116·01	106·23
4. West Pilbara	94	64	·01	·01	263·60	84·80
5. Ashburton	14	9	·01	·01	...	...
6. Gascoyne	1	...	...	...	...	...
7. Peak Hill	2,160	1,700	·40	·34	13·81	32·73
8. East Murchison	13,051	11,016	2·43	2·22	71·75	53·05
9. Murchison	36,304	27,037	6·77	5·46	54·08	38·31
10. Yalgoo	18,132	7,713	3·38	1·56	75·68	59·68
11. Mt. Margaret	27,649	26,876	5·16	5·42	117·12	84·91
12. North Coolgardie	13,624	12,213	2·54	2·46	46·80	53·72
13. Broad Arrow	3,629	2,741	·68	·55	89·31	99·49
14. North-East Coolgardie	4,545	4,714	·85	·95	78·15	64·21
15. East Coolgardie	376,389	370,670	70·15	74·78	48·63	52·13
16. Coolgardie	16,171	13,077	3·01	2·64	86·40	44·75
17. Yilgarn	12,794	8,376	2·37	1·69	78·36	91·71
18. Dundas	8,044	6,353	1·50	1·28	118·90	132·41
19. Phillips River	689	875	·13	·08	51·96	136·58
State generally	144	153	·03	·03	...	...
Totals and averages	536,539	495,672	100·00	100·00	53·17	53·28

The total gold yield of the State is as shown in Table 1, being the amount of gold exported, and also that lodged at the Royal Mint, which total includes alluvial gold and gold not reported to the Department.

When comparisons are made as to the yield from any particular field with the preceding year, the figures reported to the Department are used.

TABLE 4.

Number of Gold-producing Mines in the several Goldfields and Districts during 1922 and 1923.

Goldfield.	District.	1922.		1923.		Increase or Decrease.
		District.	Goldfield.	District.	Goldfield.	
Kimberley ... ..	...	...	...	...	...	...
West Kimberley ... ..	...	...	...	...	...	...
Pilbara	Marble Bar	13	14	12	14	...
	Nullagine	1		2		...
West Pilbara ... ..	...	...	...	...	...	...
Ashburton ... ..	...	...	...	...	...	...
Gascoyne ... ..	...	...	...	...	...	...
Peak Hill ... ..	...	...	7	...	5	— 2
East Murchison	Lawlers	5	...	4	...	...
	Wiluna	9	22	7	21	— 1
	Black Range	8	...	10	...	...
	Cue	9	...	10	...	...
Murchison	Meekatharra	17	43	14	44	+ 1
	Day Dawn	6	...	6	...	...
	Mt. Magnet	11	...	14	...	...
Yalgoo ... ..	...	...	16	...	18	+ 2
Mt. Margaret	Mt. Morgans	11	...	7	...	...
	Mt. Malcolm	8	29	11	24	— 5
	Mt. Margaret	10	...	6	...	...
	Menzies	8	...	7	...	...
North Coolgardie	Ularring	2	19	...	13	— 6
	Niagara	3	...	3	...	...
	Yerilla	6	...	3	...	...
Broad Arrow ... ..	...	...	10	...	13	+ 3
North-East Coolgardie	Kanowna	11	12	10	11	— 1
	Kurnalpi	1	...	1	...	...
East Coolgardie	East Coolgardie	55	59	44	48	— 11
	Bulong	4	...	4	...	...
Coolgardie	Coolgardie	29	38	22	30	— 8
	Kunanalling	9	...	8	...	...
Yilgarn ... ..	...	...	38	...	24	— 14
Dundas ... ..	...	...	12	...	12	...
Phillips River ... ..	...	...	5	...	3	— 2
State generally ... ..	...	...	1	...	1	...
Totals ... ..	...	...	325	...	281	— 44

TABLE 5.

Gold Yield from Registered Gold Mining Companies and Gold Mining Leases for the Years 1920, 1921, 1922, and 1923.

Goldfield	REGISTERED COMPANIES PRODUCING OVER 12,000 OZS.								REGISTERED COMPANIES PRODUCING UNDER 12,000 OZS.								LEASES, EXCLUSIVE OF SUNDRY CLAIMS AND TREATMENT.							
	1920.		1921.		1922.		1923.		1920.		1921.		1922.		1923.		1920.		1921.		1922.		1923.	
	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.	No.	Fine ozs.
Kimberley
West Kimberley
Pilbara	15	3,478	11	1,902	14	2,229	14	1,602
West Pilbara	1	90	1	25	...	...	...	...
Ashburton
Gascoyne
Peak Hill	3	523	8	785	7	1,740	5	558
East Murchison	6	14,229	6	13,462	5	6,483	6	6,494	21	3,289	19	3,264	17	2,599	15	1,356
Murchison	2	6,669	2	5,193	2	1,917	3	425	41	35,200	31	32,059	41	29,423	41	23,436
Yalgoo	1	889	1	1,214	2	3,980	3	5,265	9	1,846	9	914	14	12,040	15	1,446
Mt. Margaret ...	2	67,436	...	...	1	14,890	1	18,533	5	4,544	5	13,443	4	1,999	3	4,037	19	4,236	26	5,705	24	7,363	20	2,636
N. Coolgardie	3	9,499	3	7,502	2	10,318	2	8,038	11	900	17	1,690	17	1,215	11	2,036
Broad Arrow	1	5,174	2	6,048	1	92	1	55	4	1,664	11	1,373	9	2,451	12	1,574
N.E. Coolgardie	2	44	2	1,655	2	2,740	10	1,578	14	3,534	10	1,917	9	1,416
E. Coolgardie ...	9	363,254	8	337,097	8	343,664	8	334,664	14	15,422	14	19,889	12	13,148	10	14,000	37	14,732	38	15,465	39	11,334	30	13,614
Coolgardie	1	43	...	...	1	2,897	3	6,886	29	4,889	36	6,665	37	10,068	27	4,274
Yilgarn ...	1	13,826	...	...	...	...	...	...	8	17,234	11	15,518	9	8,239	6	2,477	23	5,623	18	2,531	29	2,830	18	4,328
Dundas	1	2,647	2	1,425	1	4,150	1	3,789	13	3,196	15	1,786	11	2,119	11	1,811
Phillips River	1	50	1	30	1	12	1	9	10	1,300	5	770	4	587	2	317
State generally	1	7,929	1	32	1	7	...	...	...	...	...	...
Total ...	12	444,516	8	337,097	9	358,554	9	353,197	43	76,400	49	83,768	43	62,819	42	54,247	247	82,551	259	78,468	273	88,415	230	60,404

TABLE 6.

Increase or Decrease in Output of certain producing Gold Mines in 1923 as compared with 1922.

Goldfield.	District.	Name of Mine.	Gold Production.		Increase or Decrease for Year compared with 1922.
			1922.	1923.	
			Fine ozs.	Fine ozs.	Fine ozs.
Pilbara ...	Marble Bar ...	1. Haig ...	198.18	171.55	— 26.63
		2. Homeward Bound East ...	201.56	225.27	+ 50.71
		3. Kitchener ...	403.00	581.20	+ 178.20
Peak Hill ...		4. Evening Star ...	258.59	169.06	— 89.53
		5. No. 1 North leases ...	266.98	296.27	+ 29.29
		6. Wowsler ...	971.44	...	— 971.44
East Murchison	Lawlers ...	7. Queen: Daisy Queen G.M. Co., N.L. ...	938.20	828.29	— 159.91
		8. Waroonga G.M. Co., Ltd. ...	1,156.97	1,540.17	+ 383.20
		9. Yellow Aster leases ...	430.07	182.72	— 247.35
	Wiluna ...	10. Moonlight leases ...	736.14	191.90	— 544.24
		11. Western Machinery Co., Ltd. ...	969.91	1,761.59	+ 791.68
		12. Wiluna Gold Mines, Ltd. ...	2,636.44	1,199.51	— 1,436.93
	Black Range	13. Oroya East ...	603.68	357.24	— 246.44
		14. Yuanmi G.Ms., Ltd. ...	731.06	983.45	+ 252.39
Murchison ...	Cue ...	15. Big Bell ...	1,023.66	2,431.95	+ 1,408.29
		16. Mararoa G.M. Co., N.L. ...	1,669.77	92.87	— 1,576.90
	Meekatharra ...	17. Fenian leases ...	6,088.98	3,512.17	— 2,576.81
		18. Haveluck ...	257.69	280.70	+ 23.01
		19. Ingliston Consols Extended leases ...	12,997.06	13,060.56	+ 63.50
		20. Ingliston ...	4,006.06	264.67	— 3,741.39
		21. Marmont ...	388.64	136.62	— 252.02
		22. Waterloo ...	613.28	199.58	— 413.70
	Day Dawn ...	23. Great Fingall Consolidated, Ltd. ...	247.53	151.93	+ 95.60
	Mt. Magnet ...	24. Galtee Moore ...	303.59	246.19	— 57.40
		25. Moyagee ...	654.23	164.43	— 489.80
Yalgoo ...		26. Brown's Reward ...	861.19	440.23	— 420.96
		27. Carnation ...	575.02	29.45	— 545.57
		28. Gnow's Nest Gold Mine, Ltd. ...	9,766.34	2,707.59	— 7,058.75
		29. Lake View: Payne's Find Development Co., N.L. ...	1,259.94	348.42	— 911.52
		30. Royal Standard: Bullrush Gold Estates, N.L. ...	2,719.65	2,208.56	— 511.09
Mt. Margaret ...	Mt. Morgans ...	31. Big Stone ...	354.83	770.29	+ 415.46
		32. Bindah ...	4,486.48	104.85	— 4,381.63
		33. Torquay leases ...	69.56	615.93	+ 546.37
		34. Westralia Mt. Morgans Mines, N.L. ...	1,873.24	3,629.86	+ 1,756.62
	Mt. Malcolm ...	35. Sons of Gwalia, Ltd. ...	14,889.98	18,533.12	+ 3,643.14
	Mt. Margaret	36. Lancefield G.Ms., Ltd. ...	23.01	346.09	+ 323.08
		37. Nil Desperandum ...	782.50	196.34	— 586.16
North Coolgardie	Menzies ...	38. Gladstone leases ...	41.79	1,301.36	+ 1,259.57
		39. Menzies Consolidated G.Ms., Ltd. ...	9,281.45	7,947.81	— 1,333.64
	Yerilla ...	40. Redbrook G.M. ...	121.21	153.78	+ 32.57
Broad Arrow ...		41. Lady Evelyn ...	695.35	235.65	— 459.80
		42. Orinda ...	650.32	326.56	— 323.76
		43. Oversight ...	403.28	141.86	— 261.42
North-East Coolgardie	Kanowna ...	44. Golden Valley ...	1,103.93	187.84	— 936.09
		45. Kanowna: Red Hill G.M. Co., N.L. ...	1,510.76	2,185.83	+ 675.07
		46. Pride of the Morning ...	278.75	326.51	+ 47.76
		47. North White Feather G.Ms., Ltd. ...	144.19	554.50	+ 410.31
East Coolgardie	East Coolgardie	48. Associated G.Ms. of W.A., Ltd. ...	23,095.62	22,081.83	— 1,013.79
		49. Associated Northern Blocks (W.A.), Ltd. ...	4,616.16	4,102.16	— 514.00
		50. Central ...	2,360.33	3,356.02	+ 995.69
		51. Eureka ...	3,896.57	716.71	— 3,179.86
		52. Golden Hope G.Ms., N.L. ...	39.63	1,338.95	+ 1,299.32
		53. Golden Horseshoe Estates Co., Ltd. ...	62,034.39	52,406.83	— 9,627.56
		54. Great Boulder Perseverance G.M. Co., Ltd. ...	41,581.07	54,165.51	+ 12,584.44
		55. Great Boulder Proprietary G.Ms., Ltd. ...	72,751.55	65,445.64	— 7,305.91
		56. Great Hope ...	195.37	3,006.78	+ 2,811.41
		57. Great Hope North ...	452.20	520.65	+ 68.45
		58. Hampton Celebration (W.A.), Ltd. ...	3,353.26	4,470.44	+ 1,117.18
		59. Hopeful ...	1,504.83	2,164.40	+ 659.57
		60. Idaho ...	463.24	417.30	— 45.94
		61. Ironsides North ...	583.09	273.95	— 309.14
		62. Ivanhoe Gold Corporation, Ltd. ...	71,919.77	59,550.38	— 12,369.39
		63. Lake View and Star, Ltd. ...	25,664.74	21,657.51	— 4,007.23
		64. Mount Martin ...	...	3,429.55	+ 3,429.55
		65. North Kalgurli (1912), Ltd. ...	2,246.34	1,209.85	— 1,036.49
		66. Oroya Links, Ltd. ...	12,675.55	20,218.65	+ 7,543.10
		67. South Kalgurli Consolidated, Ltd. ...	32,941.67	39,137.92	+ 6,196.25
	Bulong ...	68. Transville ...	...	384.86	+ 384.86
Coolgardie ...	Coolgardie ...	69. Brennan's Idough ...	564.50	309.93	— 254.57
		70. Cookshot ...	751.41	6.66	— 744.75
		71. Lloyd George ...	2,897.45	6,708.05	+ 3,810.60
	Kunanalling ...	72. Carbine leases ...	4,930.55	1,355.76	— 3,574.79
		73. Turn of the Tide ...	267.49	189.94	— 77.55
Yilgarn ...		74. Edna May Central G.Ms., N.L. ...	1,238.59	557.90	— 680.69
		75. Edna May Deep Levels G.M. Co., N.L. ...	5,250.79	342.21	— 4,908.58
		76. Golden Butterfly G.M. Co., N.L. ...	478.68	625.15	+ 146.47
		77. Radio ...	415.53	2,625.76	+ 2,210.23
		78. Spring Hill G.M. Co., N.L. ...	348.82	814.34	+ 465.52
		79. White Horseshoe ...	453.74	448.53	— 5.21
Dundas ...		80. Great Boulder Proprietary G.Ms., Ltd. ...	4,150.52	3,789.05	— 361.47
		81. Viking No. 1 leases ...	613.57	608.26	— 5.31
Phillips River ...		82. Hillsborough ...	256.03	168.52	— 87.51

TABLE 7.

Averages of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1922 and 1923.

Goldfield.	1922.				1923.			
	Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.		Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.	
	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.
	tons.	tons.	fine ozs.	fine ozs.	tons.	tons.	fine ozs.	fine ozs.
1. Kimberley ... ..	...	...	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...	...	...
3. Pilbara	48·37	23·60	66·05	32·22	38·23	17·65	47·80	22·06
4. West Pilbara	23·00	11·00	71·37	35·68	39·00	19·50	38·93	19·47
5. Ashburton ... ..	...	...	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...	...	...
7. Peak Hill	680·48	253·51	110·61	41·20	191·51	75·81	73·80	29·21
8. East Murchison	163·79	61·25	138·34	51·79	183·93	83·21	114·86	51·96
9. Murchison	240·95	111·02	153·39	70·67	310·19	138·29	140·29	62·54
10. Yalgoo	199·91	105·71	178·09	94·17	130·49	69·81	91·66	49·04
11. Mt. Margaret	203·22	61·65	280·19	85·01	221·39	70·68	221·18	70·61
12. North Coolgardie	226·78	104·30	124·94	57·46	191·71	94·42	121·21	59·70
13. Broad Arrow	72·90	33·76	76·65	35·50	39·46	17·49	46·21	20·48
14. North-East Coolgardie	115·50	50·04	106·23	46·03	89·58	54·42	67·72	41·14
15. East Coolgardie	400·25	237·83	229·14	136·19	374·25	210·21	229·67	129·00
16. Coolgardie	65·55	31·90	66·67	32·44	89·11	46·52	46·94	24·50
17. Yilgarn	104·28	39·07	96·18	36·03	117·50	49·08	126·85	52·99
18. Dundas	113·52	62·50	158·89	87·48	74·16	41·71	115·60	65·02
19. Phillips River	75·04	36·31	45·91	22·22	23·28	12·93	37·46	20·81
Total Averages	298·81	153·53	187·03	96·09	283·76	146·21	177·97	91·70

The average value of gold produced per man above and under ground was £408·16 in 1922 and £389·52 in 1923. The average tonnage of ore raised shows a decrease from 153·53 tons to 146·21 tons. The average tonnage raised per man is highest in the East Coolgardie Goldfield, viz., 210·21 tons, average value £547·96, the next being Murchison Goldfield with 138·29 tons, average value £265·65.

TABLE 8.

Output of Gold from the several States of Australia, the Northern Territory, the Territory of Papua, and the Dominion of New Zealand during 1923.

State.	Output of Gold.	Value.	Percentage of total Output of Australasia.
1. Western Australia	Fine ozs. 504,511	£ 2,143,028	58·05
2. Victoria	95,403	405,246	10·98
3. Queensland	88,726	376,883	10·21
4. New South Wales	18,833	79,998	2·17
5. Tasmania... ..	3,684	15,649	·42
6. South Australia	949	4,031	·11
7. Northern Territory	556	2,362	·06
8. Territory of Papua	1,015	4,311	·12
9. New Zealand	155,404	660,113	17·88
Total	869,081	3,691,621	100·00

TABLE 9.

Dividends paid by Western Australian Gold Mining Companies during 1923 and Total to date.

(Compiled from information supplied by the Government Statistician's Office and the Chamber of Mines of W.A., Kalgoorlie.)

Goldfield.	Name of Company.	Capital.				Dividends.		
		Authorised	No. of Shares.	Par Value Shares.	Paid up to.	Paid in 1923.		Grand Total paid to end of 1923.
						No.	Total Amount.	
		£		£ s. d.	£ s. d.		£	£
Peak Hill ...	Various Companies ...	...	...	...	...	...	...	160,666
East Murchison...	Various Companies ...	...	...	...	...	...	...	437,968
Murchison ...	Various Companies ...	...	...	...	...	...	...	1,992,670
Mt. Margaret ...	Various Companies ...	...	...	...	...	...	...	1,504,701
North Coolgardie	Various Companies ...	...	...	...	...	...	...	575,032
North-East Coolgardie	Various Companies ...	...	...	...	...	...	...	82,971
East Coolgardie	Golden Horseshoe Estates Co., Ltd.	1,500,000	300,000	5 0 0	5 0 0	1	30,000	3,577,500
Do. ...	Ivanhoe Gold Corporation, Ltd.	1,000,000	200,000	5 0 0	5 0 0	1	7,500	3,971,250
Do. ...	South Kalgurlie Consolidated, Ltd.	150,000	250,007	0 10 0	0 10 0	2	31,250	283,751
Do. ...	Other Companies ...	...	...	...	...	...	...	14,718,878
Coolgardie ...	Various Companies ...	...	...	...	...	...	...	339,495
Yilgarn ...	Edna May Deep Levels G.M. Co., N.L.	75,000	100,000	0 15 0	0 11 6	1	5,000	5,000
Do. ...	Other Companies ...	...	...	...	...	...	...	508,199
Dundas ...	Various Companies ...	...	...	...	...	...	...	222,625
	Total Dividends paid during 1923 ...	...	...	...	...	...	73,750	
	Total Dividends paid to end of 1923 ...	...	...	...	...	...	...	28,380,706

TABLE 10.

Value of Gold Production and Percentage of Dividends paid.

Year.	Value of Gold Production.	Dividends paid by Gold Mining Companies.	Dividends % of Total Production.	Value of Gold Production by Gold Mining Companies only.	Dividends % upon Production by Gold Mining Companies.
Previous to 1914	£ 114,880,573	£ 23,902,677	% 20.81	£ ...	% ...
1914	5,237,353	799,392	15.26	4,094,336	19.52
1915	5,140,228	792,317	15.41	4,109,254	19.28
1916	4,508,532	632,883	14.04	3,518,531	17.90
1917	4,121,645	590,856	14.34	3,310,536	17.85
1918	3,723,183	368,295	9.81	2,914,325	12.64
1919	3,118,113	338,244	10.85	2,337,433	14.23
1920	2,624,427	384,083	14.63	2,212,711	17.36
1921	2,352,098	306,958	13.05	1,787,721	17.17
1922	2,286,325	191,251	8.36	1,789,879	10.69
1923	2,143,028	73,750	3.44	1,730,712	4.26
Total	150,135,505	28,380,706	18.81	*27,805,438	*16.10

* Ten last years only.

TABLE 11.

Quantity and Value of Minerals, other than Gold and Coal, reported to the Mines Department during 1923.

Goldfield, District, or Mineral Field.	1923.		Increase or Decrease for Year compared with 1922.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£
BLACK TIN.				
Pilbara Goldfield (Marble Bar District)	24.40	2,960	— .95	+ 514
Greenbushes Mineral Field	28.02	3,024	+ 12.16	+ 1,631
Total	52.42	5,984	+ 11.21	+ 2,145
COPPER ORE.				
West Pilbara Goldfield	221.00	3,500	+ 57.00	+ 1,109
Northampton Mineral Field	9,626.29	59,143	+ 8,627.63	+ 45,708
Phillips River Goldfield	26.01	541	— 5.83	+ 324
Total	9,873.30	63,184	+ 8,678.80	+ 47,051
LEAD ORE.				
Northampton Mineral Field	21,634.50	59,194	— 7,968.40	— 13,144
ASBESTOS.				
Pilbara Goldfield (Marble Bar District)	3.00	150	+ .50	— 100
Pilbara Goldfield (Nullagine District)	111.00	3,865	— 68.18	— 3,485
West Pilbara Goldfield ... ..	.85	17	+ .85	+ 17
Total	114.85	4,032	— 66.83	— 3,568

The output of black tin shows increases in tonnage of 11.21 tons and in value of £2,145, although Pilbara Goldfield actually recorded a decrease in tonnage of .95 tons but an increase in value of £514. In copper ore there were increases in tonnage of 8,678.80 tons and in value of £47,051. Lead ore shows decreases in tonnage of 7,968.40 tons and in value of £13,144, and asbestos shows decreases in tonnage of 66.83 tons and in value of £3,568.

The production of tin was again confined to Pilbara and Greenbushes fields, and copper ore came

from West Pilbara Goldfield, Northampton Mineral Field, and Phillips River Goldfield. The production of lead ore was confined to Northampton Mineral Field, while asbestos came from the Pilbara and West Pilbara Goldfields.

It will be observed that the figures in this table differ from those in Table 1. The figures above are those reported to the department, and this table is published as an index to the amount of mining in each field named.

TABLE 12.

Quantity of Coal raised during 1922 and 1923, and estimated Value thereof, with Number of Men employed, and Output per Man.

Coalfield.	Year.	Quantity raised.	Estimated Value.	Men employed.		Quantity raised	
				Above ground.	Under-ground.	Per Man employed under-ground.	Per Man employed above and under-ground.
		tons.	£			tons.	tons.
Collie	1922	438,443	381,555	175	569	771	589
	1923	420,714	368,949	167	546	771	590

The number of men employed at collieries has decreased by 31, and the output decreased 12,606 tons.

PART III.—LEASES AND OTHER HOLDINGS UNDER THE VARIOUS ACTS RELATING TO MINING.

TABLE 13.

Total Number and Acreage of Leases held for Mining on 31st December, 1922 and 1923.

Description of Leases.	1922.		1923.	
	No.	Acreage.	No.	Acreage.
Gold mining leases on Crown land	688	10,847	656	10,839
" " " private property ... ..	...	...	...	...
Mineral leases on Crown land	265	45,116	248	49,052
" " private property	11	371	10	379
	964	56,334	914	60,270

The total number of leases held for mining purposes decreased by 50 and the area increased by 3,936 acres, as compared with the year 1922. The number of leases for gold mining decreased by 32 and the area by 8 acres. The number of mineral leases decreased by 18 and the area increased by 3,944 acres.

TABLE 14.

Number and Acreage of Gold Mining Leases in force each year for the Five Years ending the 31st December, 1923.

Goldfield.		District.		1919.		1920.		1921.		1922.		1923.		Percentage of Total Acreage.		Increase or Decrease in Acreage for 1923 compared with 1922.		Goldfield.
Name.	Proclaimed.	Name.	Proclaimed.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	1922.	1923.	Increase	Decrease	
West Kimberley ...	19-3-20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	West Kimberley
Kimberley ...	20-5-86	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Kimberley.
Yilgarn ...	1-10-88	...	...	94	1,697	91	1,584	65	1,080	60	1,032	45	788	9.52	7.27	...	244	Yilgarn.
Pilbara ...	1-10-88	Marble Bar ...	6-11-96	15	125	20	227	14	126	30	435	29	403	4.12	4.05	...	8	Pilbara.
Ashburton ...	11-12-90	Nullagine ...	6-11-96	5	42	3	24	3	24	1	12	3	36	...	...	...	...	Ashburton.
Murchison... ..	24-9-91	Cue ...	7-12-94	37	471	33	474	22	248	18	226	10	105	...	...	...	...	Ashburton.
		Meekatharra ...	7-12-94	36	468	33	451	40	581	48	770	32	501	13.22	8.48	...	515	Murchison.
		Day Dawn ...	10-1-96	19	215	11	116	8	82	15	228	11	122	...	...	...	...	Murchison.
		Mount Magnet ...	7-12-94	16	169	14	144	14	138	21	210	18	191	...	...	...	...	Murchison.
Dundas	31-8-93	...	...	37	416	34	451	23	284	22	253	14	159	2.33	1.47	...	94	Dundas.
Coolgardie ...	6-4-94	Coolgardie ...	7-12-94	43	723	338	7,233	57	1,029	50	865	54	965	9.17	10.19	110	...	Coolgardie.
		Kurnalpi ...	1-9-97	13	155	15	203	12	143	11	130	12	140	...	...	...	...	Coolgardie.
		East Coolgardie ...	7-12-94	168	2,689	380	7,173	233	4,112	135	2,134	121	1,872	22.46	23.07	65	...	East Coolgardie.
East Coolgardie ...	1-10-94	Bulong ...	15-4-96	3	53	15	323	...	...	13	302	30	629	...	...	...	...	East Coolgardie.
Yalgoo	23-1-95	...	...	26	375	25	364	15	259	45	753	29	520	6.94	4.80	...	233	Yalgoo.
		Menzies ...	15-4-96	30	450	26	417	16	293	18	298	19	304	...	...	...	...	Yalgoo.
North Coolgardie	28-6-95	Ularring ...	15-4-96	15	183	16	221	13	161	13	161	5	88	5.42	4.64	...	85	North Coolgardie.
		Yerilla ...	15-4-96	5	78	6	108	9	138	6	81	5	75	...	...	...	...	North Coolgardie.
		Niagara ...	1-4-97	5	72	4	60	2	36	3	48	2	36	...	...	...	...	North Coolgardie.
		Lawlers ...	1-7-04	14	169	18	297	14	213	13	212	11	174	...	...	...	...	North Coolgardie.
East Murchison ...	28-6-95	Black Range ...	1-7-04	18	296	19	326	16	292	15	270	36	664	7.15	11.60	481	...	East Murchison.
		Wiluna ...	1-3-10	23	400	29	517	22	408	16	294	22	419	...	...	...	...	East Murchison.
		Kanowna ...	15-4-96	14	207	29	434	19	315	20	276	17	251	2.76	2.47	...	31	N.E. Coolgardie.
North-East Coolgardie	15-4-96	Kurnalpi ...	15-4-96	3	23	6	47	6	40	4	23	2	17	...	...	...	...	N.E. Coolgardie.
Broad Arrow ...	20-11-96	...	...	47	829	25	415	21	314	26	401	22	341	3.70	3.15	...	60	Broad Arrow.
Peak Hill	1-4-97	...	...	11	90	13	137	14	116	7	69	13	142	0.64	1.31	73	...	Peak Hill.
		Mount Margaret ...	1-4-97	38	712	50	965	20	348	20	364	40	924	...	...	...	...	Mount Margaret.
		Mount Malcolm... ..	1-4-97	57	1,232	59	1,276	32	668	30	627	31	617	11.35	16.52	559	...	Mount Margaret.
Mount Margaret	1-4-97	Mount Morgans... ..	2-4-02	17	283	22	379	16	259	15	241	14	250	...	...	...	...	Mount Margaret.
West Pilbara ...	1-11-95	...	...	1	6	3	36	1	6	2	12	1	6	0.11	0.06	...	6	West Pilbara.
Phillips River ...	14-9-00	...	...	8	118	10	138	8	118	9	108	6	88	1.00	0.81	...	20	Phillips River.
Other Localities	...	...	...	1	12	...	...	...	...	...	...	...	...	...	...	...	...	Other Localities.
Gascoyne	15-4-97	...	...	...	...	...	...	...	...	2	12	2	12	0.11	0.11	...	...	Gascoyne.
Totals ... ..	...	...	...	819	12,758	1,347	24,540	735	11,831	688	10,847	656	10,839	100.00	100.00	1,288	1,296	

Decrease for the year 1923: Leases 32, acres 8. The largest percentage of the area leased for gold mining purposes is in this respective order:—East Coolgardie, 23.07; Mt. Margaret, 16.52; East Murchison, 11.60; Coolgardie, 10.19; Murchison 8.48; Yilgarn, 7.27.

TABLE 15.

Number and Acreage of Mineral Leases in force 31st December each year, for the Five Years ending 31st December, 1923.

Mining District.		Sub-District.		1919.		1920.		1921.		1922.		1923.		Increase or Decrease in Acreage for 1923, compared with 1922.		Mining District.	
Name.	Proclaimed.	Name.	Proclaimed.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Increase.	Decrease.		
Ashburton ...	11-12-90	Cue ...	7-12-94	4	45	3	44	1	10	3	30	1	48	18	...	Ashburton.	
Murchison ...	24-9-91	Meekatharra ...	7-12-94	7	222	4	135	2	63	3	90	...	...	...	...	Murchison.
		Day Dawn ...	10-1-96	1	6	2	54	1	48		90
		Mt. Magnet ...	7-12-94		
Greenbushes ...	7-4-92	...	...	27	409	29	421	18	287	18	282	7	146	...	136	Greenbushes.
Pilbara ...	16-6-92	Marble Bar ...	16-6-92	8	145	11	247	15	415	13	367	10	271	187	Pilbara.
		Nullagine ...	6-11-96	6	120	10	144	14	175	12	125	4	34	...	...
Yalgoo ...	23-1-95	13	284	14	320	10	238	3	132	2	96	36	Yalgoo.
Yilgarn ...	22-3-95	1	48	1	48	1	48	48	Yilgarn.
Coolgardie ...	22-3-95	Coolgardie ...	22-3-95	2	28	2	28	3	76	5	112	2	28	84	Coolgardie.
		Kunanalling ...	1-9-97	...	...	...	...	...	...	...	...	...	...	...	...
East Coolgardie ...	22-3-95	East Coolgardie ...	22-3-95	8	120	2	3	1	1	1	1	1	East Coolgardie.
		Bulong ...	15-4-96	...	...	1	24	...	...	...	...	...	...	...	...
		Lawlers ...	17-4-04	...	...	...	...	...	...	...	...	...	...	...	...
East Murchison ...	28-6-95	Black Range ...	1-7-04	1	6	1	6	1	6	1	6	6	East Murchison.
		Wiluna ...	1-3-10	...	...	...	...	1	48	1	48	1	48	...	...
		Menzies ...	15-4-96	...	...	...	...	...	...	...	...	...	...	...	...
North Coolgardie ...	16-8-95	Ularring ...	15-4-96	North Coolgardie.
		Yerilla ...	15-4-96	...	...	...	...	...	...	...	...	...	...	...	...
		Niagara ...	1-3-97	...	...	...	...	...	...	...	...	...	...	...	...
West Pilbara ...	1-11-95	...	...	14	540	26	751	21	798	18	710	22	826	116	...	West Pilbara.
Dundas ...	27-12-95	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Dundas.
Collie ...	21-2-96	...	...	115	34,981	115	34,979	117	35,621	127	38,671	135	41,108	2,437	...	Collie.
North-East Coolgardie ...	15-4-96	Kanowna ...	15-4-96	6	125	4	71	3	47	1	10	1	10	North-East Coolgardie.
		Kurnalpi ...	15-4-96	...	...	...	...	...	...	...	...	...	...	...	...
Broad Arrow ...	20-11-96	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Broad Arrow.
Northampton ...	1-1-97	(Private Property)	...	17	365	28	637	14	286	12	250	12	238	12	Northampton
		...	...	3	75	8	297	4	167	4	167	4	167	...	...
Peak Hill ...	1-4-97	8	183	12	375	8	261	5	216	1	48	168	Peak Hill.
Mt. Margaret ...	1-4-97	Mt. Margaret ...	1-4-97	Mt. Margaret.
		Mt. Malcolm ...	1-4-97	...	...	...	...	...	...	...	...	...	...	...	...
		Mt. Morgans ...	2-4-02	3	69	3	69	3	69	3	69	3	69	...	...
Gascoyne ...	15-4-97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Gascoyne.
Yandanooka ...	1-12-97	...	...	1	10	1	10	...	...	...	...	...	...	...	...	Yandanooka.
Phillips River ...	1-7-99	...	...	15	397	16	437	16	446	15	485	17	520	35	...	Phillips River.
Other localities ...	...	...	...	29	2,728	18	2,187	15	2,151	13	3,016	20	5,114	...	...	Other localities.
West Kimberley ...	19-3-20	(Private Property)	...	2	72	5	108	7	204	7	204	6	212	West Kimberley.
		...	...	...	...	10	448	10	440	10	448	10	448	...	...
Totals ...	...	...	...	290	40,930	326	41,843	286	41,905	276	45,487	258	49,431	4,712	768	

In the Collie Mineral Field the largest area is held, viz. : 41,108 acres, worked entirely for coal ; then follow West Pilbara, 826 acres for copper, antimony, silver, and lead, asbestos ; Phillips River, 520 acres for copper, manganese ; West Kimberley, 448 acres for iron ; Northampton, 405 acres for coal, lead ; Pilbara, 305 acres for tin, asbestos, tantalite.

TABLE 16.

Number and Acreage of Mineral Leases in force on 31st December, 1923, showing Minerals for which they are worked.

Goldfield or Mineral Field.	District.	MINERAL.																			
		Coal.		Tin.		Copper.		Iron.		Antimony.		Ochre.		Silver and Lead.		Asbestos.		Magnesite.		Clay.	
		Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.
Pilbara	Marble Bar ... ..	...	...	6	155	...	...	...	...	...	...	...	...	...	...	2	96	...	...	...	...
	Nullagine ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	34	...	...	...	...
West Pilbara ... ..	...	...	...	...	...	13	468	...	...	1	48	...	...	1	24	7	236	...	...	...	...
Ashburton ... ..	...	...	...	...	...	1	48	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Yilgarn ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
East Murchison	Black Range ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Murchison	Cue ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	48	...	...
North Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Yalgoo ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Margaret	Mt. Morgans ... ..	...	...	...	...	3	69	...	...	...	...	...	...	...	...	...	...	...	...	...	...
East Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North-East Coolgardie	Kanowna ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Phillips River ... ..	...	...	...	...	...	16	472	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Collie ... ..	...	135	41,108	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Greenbushes ... ..	...	...	...	7	146	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Northampton ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	(Private Property)	1	100	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Outside Proclaimed Fields	(Private Property)	16	4,960	...	...	2	72	...	...	1	48	...	...	1	48	...	...	...	...	...	2 44
West Kimberley ... ..	...	...	...	...	...	...	...	...	...	10	448	...	...	...	...	...	...	...	...	...	...
	Totals	152	46,168	13	301	35	1,129	11	496	1	48	1	48	1	24	13	416	1	48	2	44

Goldfield or Mineral Field.	District.	MINERAL.																Total.	
		Alunite.		Tantalite.		Lead.		Gypsum.		Graphite.		Molybdenite.		Mica.		Manganese.			
		Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.	Leases.	Acres.
Pilbara	Marble Bar ... ..	...	...	2	20	...	...	...	...	...	...	...	...	...	...	...	...	10	271
	Nullagine ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	34
West Pilbara ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	22	826
Ashburton ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	48
Peak Hill ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	48	
Yilgarn ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
East Murchison	Black Range ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Murchison	Cue ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	48
Yalgoo ... ..	...	...	...	...	...	...	...	...	...	2	96	...	...	...	...	...	...	2	96
Mt. Margaret	Mt. Morgans ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	69
East Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	2	28	...	...	2	28
North-East Coolgardie	Kanowna	1	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	10
Phillips River ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	48	17	520
Collie ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	135	41,108
Greenbushes ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	146
Northampton ... ..	...	...	...	...	...	12	238	...	...	...	...	...	...	...	...	...	...	12	238
	(Private Property) ... ..	...	...	...	...	3	67	...	...	...	...	...	...	...	...	...	...	4	167
Outside Proclaimed Fields	(Private Property) ... ..	...	...	...	...	...	...	1	40	1	42	...	...	...	...	...	...	20	5,114
West Kimberley ... ..	...	...	...	...	...	...	...	1	48	1	24	...	...	...	...	...	...	6	212
	Totals	1	10	2	20	15	305	2	88	2	66	2	96	2	28	2	96	258	49,431

TABLE 17.

Number and Acreage of Miscellaneous Leases in force on 31st December, 1923.

Goldfield.	District.	LEASES.										Total.	
		Tailings.		Tramway.		Water.		Machinery.		Residence.			
		No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
Yalgoo ... ..		...	...	...	...	...	...	1	24	...	...	1	24
West Pilbara ... ..		...	...	2	25	...	...	...	...	...	...	2	25
East Murchison	Black Range	2	36	...	...	...	...	...	...	1	2	3	28
Mt. Margaret	Mt. Margaret	1	22	...	...	...	...	...	...	...	...	1	22
North Coolgardie	Menzies	2	15	...	...	1	5	...	...	...	...	3	20
East Coolgardie	East Coolgardie	13	254	...	...	1	34	2	16	...	...	16	304
Coolgardie	Coolgardie	2	12	...	...	1	13	...	...	...	...	3	25
Phillips River ... ..		...	...	3	7	...	...	...	...	...	...	3	7
	Total	20	339	5	32	3	52	3	40	1	2	32	465

TABLE 18.

Claims and Authorised Holdings, under "The Mining Act, 1904," and Regulations, existing on 31st December, 1922 and 1923.

Goldfield or Mineral Field.	District.	Prospecting Areas.				Water Rights.				Lode Claims.	Alluvial Claims.	Mineral Claims.	Dredging Claims.	Residence Areas.	Business Areas.	Machinery Areas.	Tailings Areas.	Garden Areas.	Washing Areas.	Quarrying Areas.														
		Number.		Acreage.		Number.		Acreage.																										
		1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.							
West Kimberley		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Northampton		2	4	36	76	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pilbara	Marble Bar	35	25	877	743	2	2	2	3	2	1	2	2	...	...	1	1	6	6	2	3	1	1	5	5	...	...					
Do.	Nullagine	8	7	98	54	3	4	3	4	4	4	2	2	...	...	...	...	3	3	...	...	...	...	8	3	...	...					
West Pilbara		7	4	144	78	1	1	5	5	1	1	...	...	...	...	...	...	7	6	13	12	1	1	...	...	2	3						
Ashburton		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill		16	8	211	81	1	1	10	10	...	...	...	...	...	...	1	1	...	...	...	...	...	3	3	...	...	...	...		
East Murchison	Lawlers	16	10	259	166	7	6	12	9	...	...	...	1	...	...	...	...	...	...	...	3	4	8	8	3	3	...	...				
Do.	Wiluna	14	7	253	109	6	6	11	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	3	...	...				
Do.	Black Range	17	77	219	1,237	...	...	...	...	...	...	1	...	...	...	3	...	...	...	...	1	5	...	...	2	6	...	...				
Murchison	Cue	22	15	280	188	5	5	18	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	1	...	...				
Do.	Meekatharra	24	21	341	333	1	1	...	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	4	2	3	...	...		
Do.	Day Dawn	11	10	115	123	3	3	4	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	3	...	...	...	...
Do.	Mt. Magnet	19	79	210	1,029	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	1	1	1	1	1	1	1	...	...			
Yalgoo		28	66	478	1,083	1	1	4	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Margaret	Mt. Morgans	18	9	289	171	7	6	11	11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Mt. Malcolm	22	9	370	160	17	18	171	173	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Mt. Margaret	14	118	229	2,689	14	15	25	31	...	...	...	...	...	...	...	...	...	...	...	6	6	10	8	3	3	3	1	8	8	...	...
North Coolgardie	Menzies	13	15	143	221	3	3	15	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Ularring	5	2	84	27	5	6	5	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Niagara	2	2	18	18	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Yerilla	12	15	189	266	4	4	7	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Broad Arrow		93	27	1,253	491	8	7	21	23	6	6	...	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
N.E. Coolgardie	Kanowna	29	14	528	256	1	1	3	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Kurnalpi	9	2	97	30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
East Coolgardie		214	67	3,823	1,101	9	7	31	25	4	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Bulong	80	43	1,655	970	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie		78	111	1,500	2,281	10	10	41	40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do.	Kunanalling	15	11	260	189	6	6	40	40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Yilgarn		46	58	826	989	4	2	12	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dundas		16	12	167	154	11	6	23	13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Phillips River		4	6	66	97	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Collie		...	...	12,000	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Greenbushes		...	...	...	...	...	2	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gascoyne	
Outside Proclaimed Fields		26	22	17,022	13,882	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals		916	871	44,043	29,292	131	126	477	471	17	15	3	13	17	21	4	8	360	87	93	83	38	42	45	42	102	106	1	...	...	...	...
Increase or Decrease for 1923 compared with 1922		- 45		- 14,751		- 5		- 6		- 2		+ 10		+ 4		+ 4		- 273		- 10		+ 4		- 3		+ 4		- 1		...	...	...	...

For the year 1922 the number of prospecting areas held was 916, the total acreage being 44,043, which included 9 areas of 16,480 acres for coal. For the year 1923 the number held is 871 of a total acreage of 29,292, including 5 areas of 10,720 acres for coal.

TABLE 19.

Miners' Rights issued during 1922 and 1923.

Place of Issue.	Miners' Rights.		Place of Issue.	Miners' Rights.	
	1922.	1923.		1922.	1923.
Albany ...	35	11	Mullewa ...	5	1
Boulder ...	31	30	Narrogin ...	4	12
Bridgetown ...	4	1	Norseman ...	61	41
Broome ...	21	10	Northampton ...	25	23
Bunbury ...	...	2	Northam ...	14	11
Busselton ...	4	...	Nullagine ...	32	26
Carnarvon ...	24	24	Onslow ...	21	35
Collie ...	12	9	Ora Banda ...	61	35
Coolgardie ...	170	185	Payne's Find ...	24	13
Cue ...	168	121	Peak Hill ...	23	27
Derby ...	13	11	Perth ...	360	311
Esperance ...	2	...	Port Hedland ...	3	10
Geraldton ...	11	26	Ravensthorpe ...	21	24
Greenbushes ...	42	52	Roebourne ...	54	35
Half's Creek ...	32	30	Sandstone ...	36	86
Kalgoorlie ...	766	694	Southern Cross ...	91	149
Lake Darlot ...	6	...	St. Ives ...	22	10
Laverton ...	133	219	Wagin ...	17	15
Lawlers ...	39	40	Westonia ...	41	46
Leonora ...	103	82	Wiluna ...	28	38
Linden ...	6	7	Wyndham ...	8	2
Marble Bar ...	118	86	Yalgoo ...	89	77
Marvel Loch ...	23	25	Yarri ...	9	8
Meekatharra ...	184	155	York ...	5	6
Menzies ...	101	111	Youanmi ...	26	17
Mount Magnet ...	107	143			
			Total ...	3,235	3,132

TABLE 20.

Number and Acreage of Miners' Homestead Leases in force on 31st December, 1922 and 1923.

Goldfield.	District.	1922.		1923.		Increase.		Decrease.	
		Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.	Leases.	Acreage.
West Pilbara ...		...	...	...	...	...	...	...	...
Greenbushes ...		7	733	7	733	...	...	...	...
Pilbara ...	Marble Bar	...	...	...	...	...	...	...	...
	Nullagine ...	...	...	...	...	...	...	...	...
Dundas ...		28	1,365	28	1,365	...	...	...	...
Broad Arrow ...		3	44	3	44	...	...	...	...
Yilgarn ...		13	410	13	410	...	...	...	...
Mt. Margaret ...	Mt. Malcolm	5	1,239	4	1,039	...	...	2	210
	Mt. Margaret	15	381	14	371	...	...	...	...
	Cue ...	5	1,244	5	1,244	...	...	...	...
Marchison ...	Day Dawn	3	30	3	30	...	...	3	175
	Meekatharra	14	1,850	13	1,700	...	...	...	...
	Mt. Magnet	3	261	1	236	...	...	...	...
Yalgoo ...		3	690	4	1,184	1	494	...	...
Coolgardie ...	Coolgardie	27	1,101	27	1,101	...	...	1	20
	Kunanalling	3	540	2	520	...	...	...	...
East Coolgardie		92	3,266	89	2,726	...	...	3	540
Phillips River ...		141	19,720	141	19,720	...	...	...	...
Peak Hill ...		4	247	4	247	...	...	...	...
North-East Coolgardie ...	Kanowna	13	722	14	742	1	20	...	...
	Menzies	5	690	5	690	...	...	...	...
North Coolgardie	Yerilla	1	10	1	10	...	...	...	...
	Niagara	1	20	1	20	...	...	...	...
	Ularring	1	20	1	20	...	...	...	...
East Murchison...	Lawlers	6	1,115	6	1,115	...	...	...	...
	Black Range	4	380	1	300	...	...	4	110
	Wiluna	4	69	3	39	...	...	...	...
	Total ...	401	36,147	390	35,606	2	514	13	1,055

As compared with the year 1922, the number of leases held has decreased by 11 and the area by 541 acres.

PART IV.—MEN EMPLOYED

TABLE 21,

Average number of Men engaged in Mining during 1922 and 1923.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1922.	1923.	1922.	1923.	1922.	1923.
1. Kimberley ...				6	5	6	5
2. West Kimberley ...							
3. Pilbara ...	Marble Bar ...	60	82	12	16	72	98
4. West Pilbara ...	Nullagine ...	22	22	36	28	58	50
5. Ashburton ...		2	2	6	1	8	3
6. Gascoyne ...				2	2	2	2
7. Peak Hill ...		51	48	4	9	55	57
8. East Murchison ...	Lawlers ...	81	62	1	1	82	63
	Wiluna ...	69	58			69	58
	Black Range ...	96	90			96	90
	Cue ...	84	74	3	1	87	76
9. Murchison ...	Meekatharra ...	286	203	24	23	310	226
	Day Dawn ...	45	42	3	3	48	45
	Mt. Magnet ...	82	87	1	2	83	89
10. Yalgoo ...		191	157	1	2	192	159
	Mt. Morgans ...	110	87	1		111	87
11. Mt. Margaret ...	Mt. Malcolm ...	159	238	1		160	238
	Mt. Margaret ...	54	54			54	54
	Menzies ...	156	144			156	144
	Ularring ...	30	10			30	10
12. North Coolgardie ...	Niagara ...	21	15			21	15
	Yerilla ...	30	32			30	32
		95	88	11	4	106	92
13. Broad Arrow ...		79	85	8	4	87	89
14. North-East Coolgardie ...	Kurnalpi ...	11	22	4	2	15	24
	East Coolgardie ...	2,695	2,822	18	25	2,713	2,847
15. East Coolgardie ...	Bulong ...	65	48	9	7	74	55
	Coolgardie ...	420	436	83	58	503	494
16. Coolgardie ...	Kunanalling ...	65	64	11	5	76	69
		355	158		1	355	159
17. Yilgarn ...		89	96		4	89	100
18. Dundas ...		31	18	3	3	34	21
19. Phillips River ...		3	3			3	3
State generally							
Total—Gold Mining		5,537	5,347	250	208	5,787	5,555
MINERALS OTHER THAN GOLD.							
Tin ...	Greenbushes ...	6	12			6	12
	Marble Bar ...	5	7	*20	16	25	23
Copper ...	West Pilbara ...	5	15			5	15
	Phillips River ...	5	6			5	6
Pyritic Ore ...	Northampton ...		59				59
	Mt. Morgans ...	14				14	
Lead Ore ...	Northampton ...	152	96			152	96
Coal ...	Collie River ...	744	713			744	713
Asbestos ...	Nullagine ...	34	18			34	18
Gypsum ...	State Generally	4				4	
Total—Other Minerals		969	926	20	16	989	942
GRAND TOTAL		6,506	6,273	270	224	6,776	6,497

*Classified elsewhere as employed at mines.

TABLE 22.

Average Number of Men employed at Mines during 1923.

Mineral.	Above ground.	Under ground.	Total.	Percentage of total men employed.	Increase or decrease compared with 1922.
Asbestos	10	8	18	·28	— 16
Coal	167	546	713	11·34	— 31
Copper	22	58	80	1·27	+ 70
Gold	2,592	2,755	5,347	85·02	— 190
Gypsum ... ..	...	...	...	...	— 4
Lead	31	65	96	1·53	— 56
Pyritic Ore ... ..	...	...	...	...	— 14
Tin	* 32	8	35	·56	+ 4
Total	2,854	3,435	6,289	100·00	— 237

*As the tin obtained is principally "stream tin" the average number of alluvial workers has been, in this case, included in the heading "above ground."

The above table deals with men working their own mines, or employed on wages, and is compiled from returns furnished to the Department by mine-owners.

TABLE 23.

Average Number of Men employed at Gold Mines during 1923, classified according to the several Goldfields and the proportion of Men employed in each Goldfield.

Goldfield.	Above Ground.	Under Ground.	Total.	Increase or Decrease compared with 1922.	Percentage of total men employed.	
					1922.	1923.
1. Kimberley ... ..	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara	56	48	104	+ 22	1·48	1·94
4. West Pilbara	1	1	2	...	·04	·04
5. Ashburton ... ..	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...
7. Peak Hill	29	19	48	— 3	·92	·90
8. East Murchison	115	95	210	— 36	4·44	3·98
9. Murchison	225	181	406	— 91	8·98	7·59
10. Yalgoo	73	84	157	— 34	3·45	2·94
11. Mt. Margaret	258	121	379	+ 56	5·83	7·09
12. North Coolgardie	102	99	201	— 36	4·28	3·76
13. Broad Arrow	49	39	88	— 7	1·72	1·65
14. North-East Coolgardie	42	65	107	+ 17	1·63	2·00
15. East Coolgardie	1,258	1,612	2,870	+ 110	49·85	53·67
16. Coolgardie	239	261	500	+ 15	8·76	9·35
17. Yilgarn	92	66	158	— 197	6·41	2·95
18. Dundas	42	54	96	+ 7	1·60	1·79
19. Phillips River	8	10	18	— 13	·56	·34
State generally	3	...	3	...	·05	·06
Total	2,592	2,755	5,347	— 190	100·00	100·00

TABLE 24.

Alluvial Gold Workers.

Goldfield.	1922.	1923.	Increase or Decrease compared with 1922.
1. Kimberley	6	5	— 1
2. West Kimberley ... ..	...	...	...
3. Pilbara	48	44	— 4
4. West Pilbara	6	1	— 5
5. Ashburton	2	2	...
6. Gascoyne	2	2	...
7. Peak Hill	4	9	+ 5
8. East Murchison	1	1	...
9. Murchison	31	29	— 2
10. Yalgoo	1	2	+ 1
11. Mt. Margaret	2	...	— 2
12. North Coolgardie ... ..	...	...	...
13. Broad Arrow	11	4	— 7
14. North-East Coolgardie	12	6	— 6
15. East Coolgardie	27	32	+ 5
16. Coolgardie	94	63	— 31
17. Yilgarn ... ..	...	1	+ 1
18. Dundas ... ..	...	4	+ 4
19. Phillips River	3	3	...
Total	250	208	— 42

TABLE 25.

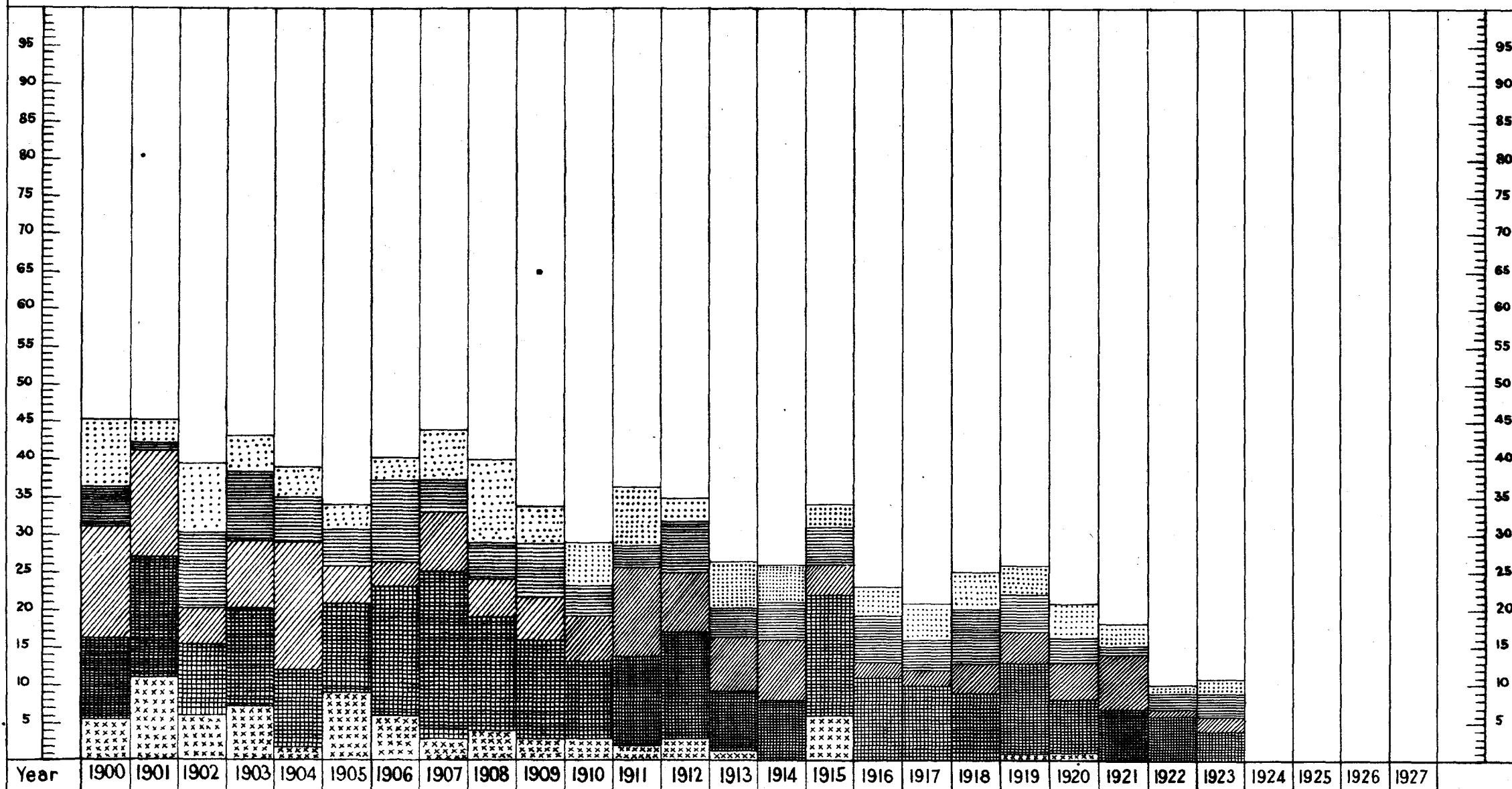
Table showing Rate of Wages Payable in the Mining Industry at the 31st December, 1923.

Class of Employee.	Yilgarn, Coolgardie, Dundas, E. Coolgardie, N.E. Coolgardie, N. Coolgardie, Mt. Margaret, and East Murchison Goldfields.		Mookatharra and Youanmi Districts.		Cue and Day Dawn Districts.		Northampton.		Norseman.		Murrin, Gwalia, Hampton Plains, Mt. Monger, Laverton, St. Ives.		Lawlers and Wiluna.		Mulline, Riverina, Yundamindra and Lenden.		
	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	Rate per Shift.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	
Rock Drill Men in Shafts	16	10	18	10	18	1	18	1	...	...	...	...	...	...	...	...
Rock Drill Men in Rises	16	4	18	4	17	7	17	7	...	...	...	...	...	...	...	...
Rock Drill Men in Winzes	16	0	18	0	17	3	17	3	...	...	...	...	...	...	...	...
Rock Drill Men in Other places	15	8	17	8	16	11	16	11	...	...	...	...	...	...	...	...
Hand Miners in Shafts	16	0	18	0	17	3	17	3	15	10	15	10	15	10	15	10	
Hand Miners in Rises	15	6	17	6	16	9	16	9	15	4	15	4	15	4	15	4	
Hand Miners in Winzes	15	2	17	2	16	5	16	5	15	0	15	0	15	0	15	0	
Hand Miners in other places	14	10	16	10	16	1	16	1	14	8	14	8	14	8	14	8	
Shaft Timbermen	16	10	18	0	17	3	17	3	16	8	16	8	16	8	16	8	
Timbermen	16	0	18	0	17	3	17	3	15	10	15	10	15	10	15	10	
Mullockers, Truckers, Shovellers, etc.	14	0	16	0	15	3	15	3	13	10	13	10	13	10	13	10	
Bracemen, Platmen, and Skipmen	15	0	16	6	15	9	15	9	14	10	14	10	14	10	14	10	
Man in charge Explosives Magazine	15	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Platelay (Underground)	15	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Soalers (Underground)	16	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sampler	15	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rock Breaker—Crackermen	14	6	16	6	15	9	15	9	14	4	14	4	14	4	14	4	
Battery Feeders and Mill Hands	13	6	16	0	15	3	15	3	...	...	...	...	...	...	...	...
Battery—Repairers, etc.	15	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mechanic's Labourer	14	0	16	0	15	3	15	3	13	10	13	10	13	10	13	10	
Iron Furnacemen	15	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Castings Dresser	14	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pitman and Pumpman	16	0	15	10	15	10	15	10	15	10	15	10
Fireman, Leading	15	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fireman, Steam or Roaster	14	6	14	4	14	4	14	4	14	4	14	4
Wood Trimmer	14	0	13	10	13	10	13	10	13	10	13	10
Pumpman on the Surface	15	0	14	10	14	10	14	10	14	10	14	10
Greaser, Cleaner, and Oiler	14	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Motorman	15	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bell Mill Hand	14	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mill Hands	13	4	13	4	13	4	13	4	13	4
Boiler Cleaners	16	0	15	10	15	10	15	10	15	10	15	10
Filterpress Filler	15	4	18	0	17	3	17	3	...	...	...	...	...	...	...	...
Cyanide and Filterpress Men	14	6	16	6	15	9	15	9	...	...	...	...	...	...	...	...
Amalgamator	15	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wilfley Tablemen	13	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Grinding Panman	14	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vacuum Plant Hands (Top)	15	6	18	0	17	3	17	3	...	...	...	...	...	...	...	...
Vacuum Plant Hands (Bottom)	14	2	16	6	15	9	15	9	...	...	...	...	...	...	...	...
Timber Dresser, Sawyer, etc.	15	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jigman	14	1	14	1	14	1	14	1	14	1
Tool Sharpeners	15	6	18	0	17	3	17	3	15	4	15	4	15	4	15	4	
Holman Hoist (aboveground)	15	4	15	2	15	2	15	2	15	2	15	2
Holman Hoist (underground)	15	10	15	8	15	8	15	8	15	8	15	8
Blacksmith's Striker	14	0	16	4	15	7	15	7	13	10	13	10	13	10	13	10	
Platelay on Surface	14	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Roper and Rigger	15	6	17	6	16	9	16	9	15	4	15	4	15	4	15	4	
Sailor Gang Men	14	0	13	10	13	10	13	10	13	10	13	10
Conveyor Belt Men	13	6	13	4	13	4	13	4	13	4	13	4
*Horse-driver	13	6	16	0	15	3	15	3	13	4	13	4	13	4	13	4	
Sanitary Man	16	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Watchman	15	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Smelter (Gold Room)	15	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
General Labourer	13	6	16	0	15	3	15	3	13	4	13	4	13	4	13	4	
†Winding Engine Drivers	18	0	17	3	...	...	...	...	...	...	...	...	...	...	...	...
†Winch Drivers	17	0	16	2	...	...	...	...	...	...	...	...	...	...	...	...
Other Engine Drivers	16	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
‡Locomotive Drivers	17	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sand Shovellers, Surface residues	17	0	17	3	13	4	13	4	13	4	13	4	13	4

Forty-eight hours on surface and forty-four hours underground constitute a week's work.

* 1s. per day extra for feeding and grooming horse. † 6d. per day extra if they raise or lower human beings.
‡ 1s. per day extra if carrying passengers.

DIAGRAM SHEWING THE NUMBER OF DEATHS FROM ACCIDENTS ARRANGED IN FIVE CLASSES, IN THE MINES OF WESTERN AUSTRALIA DURING THE YEARS 1900 AND ONWARDS.



EXPLOSIONS

FALLS OF GROUND

IN SHAFTS

MISCELLANEOUS UNDERGROUND

ON SURFACE INCLUDING MACHINERY

1923.

PART V.—ACCIDENTS.

TABLE No. 26.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1922 AND 1923.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1922.	1923.	1922.	1923.	1922.	1923.
1. Kimberley ... ..	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara ... ..	...	...	...	2	...	2
4. West Pilbara ... ..	...	...	...	...	...	...
5. Ashburton ... ..	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...
7. Peak Hill ... ..	...	...	...	...	...	...
8. East Murchison ... ..	...	1	...	4	...	5
9. Murchison ... ..	...	...	19	11	19	11
10. Yalgoo	2	2	2	1	4	3
11. Mt. Margaret ... ..	...	...	5	19	5	19
12. North Coolgardie ... ..	...	...	3	2	3	2
13. N.E. Coolgardie ... ..	...	...	...	...	...	...
14. Broad Arrow ... ..	...	...	1	...	1	...
15. East Coolgardie	3	7	240	198	243	205
16. Coolgardie	1	...	1	1	2	1
17. Yilgarn ... ..	...	...	1	1	1	1
18. Dundas ... ..	...	...	...	2	...	2
19. Phillips River ... ..	...	...	...	...	...	...
MINING DISTRICTS—						
Northampton	1	1	...	4	1	5
Yandooka ... ..	...	...	...	...	...	...
Greenbushes ... ..	...	...	...	...	...	...
Collie	1	...	63	62	64	62
Swan	1	...	1	...	2	...
Kendenup ... ..	...	...	...	...	...	...
Roelands ... ..	...	...	...	...	...	...
State generally	1	...	...	...	1	...
Total	10	11	336	307	346	318

From the above table it will be seen that the total number of fatal accidents for the year 1923 was 11 as against 10 for 1922. The number injured shows a decrease of 29 compared with the preceding year. Details of these accidents will be found in the report of the State Mining Engineer, published as Division II. to this report.

B.—According to Causes of Accidents.

	1922.		1923.		Comparison with 1922.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives ... ..	...	2	...	5	...	+ 3
2. Falls of Ground	6	41	4	34	— 2	— 7
3. In Shafts	1	13	2	6	+ 1	— 7
4. Miscellaneous—Underground	2	199	3	159	+ 1	— 40
5. Surface	1	81	2	103	+ 1	+ 22
Total	10	336	11	307	+ 1	— 29

Of the fatal accidents 10 occurred in gold mines and one in a lead mine. The death rate per 1,000 men employed in gold mines was 1.68 as against 1.08 in 1922.

TABLE No. 27.

Deaths from Accidents of Persons employed at Mines during 1922 and 1923.

	1922.						1923.					
	Number of Persons killed.			Death Rate per 1,000 men employed.			Number of Persons killed.			Death Rate per 1,000 men employed.		
	Above Ground.	Under Ground.	Total.	Above Ground.	Under Ground.	Total.	Above Ground.	Under Ground.	Total.	Above Ground.	Under Ground.	Total.
Coal Mines ... ..	...	1	1	...	1.76	1.34	...	...	...	...	...	...
Men employed	(175)	(569)	(744)	...	...	...	(167)	(546)	(713)	...	...	...
Gold Mines ... ..	...	6	6	...	2.11	1.04	...	8	9	36	2.90	1.62
Men employed	(2,942)	(2,845)	(5,787)	...	...	...	(2,800)	(2,755)	(5,555)	...	...	...
Other Mines ... ..	...	2	2	...	14.59	8.16	...	1	1	...	7.46	4.37
Men employed	(108)	(137)	(245)	...	...	...	(95)	(134)	(229)	...	...	...
Total for all mines ...	...	9	9	...	2.53	1.33	1	9	10	.33	2.62	1.54
Total number of men employed	(3,225)	(3,551)	(6,776)	...	...	...	(3,062)	(3,435)	(6,497)	...	...	...

TABLE No. 28.

Deaths from Accidents of Persons employed at Quarries during 1922 and 1923.

Mining District.	Number of Persons employed.				Number of Persons killed.				Death Rate per 1,000 men employed.			
	Above Ground.		Total.		Above Ground.		Total.		Above Ground.		Total.	
	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.	1922.	1923.
Swan	262	308	262	308	1	...	1	...	3.82	...	3.82	...
Roelands	5	18	5	18	...	...	...	...	...	...	...	...
Total	267	326	267	326	1	...	1	...	3.75	...	3.75	...

TABLE No. 29.

Deaths from Accidents of Persons Employed in Gold Mines during 1923, and the Death Rate per 1,000 Men Employed and per 1,000 tons of Gold Ore raised during 1922 and 1923. (Number of men taken as in Table No. 23, not including Alluvial Gold Workers.)

Goldfield.	Number of Deaths.			Death Rate per 1,000 men employed.				Number of Deaths per 1,000 tons of Gold Ore raised.	
	1923.			1923.			1922.	1923.	1922.
	Above Ground.	Under Ground.	Total.	Above Ground.	Under Ground.	Total.	Total.		
1. Kimberley
2. West Kimberley
3. Pilbara
4. West Pilbara
5. Ashburton
6. Gascoyne
7. Peak Hill
8. East Murchison	1	...	1	8.69	...	4.76	...	.057
9. Yalgoo	1	1	2	13.70	11.90	12.74	1.47	.182
10. Mt. Margaret
11. North Coolgardie
12. North-East Coolgardie
13. East Coolgardie	6	6	...	3.72	2.09	1.09	.010
14. Broad Arrow
15. Coolgardie	2.06	.065
16. Murchison
17. Yilgarn
18. Dundas
19. Phillips River
Total	2	7	9	...	.77	2.54	1.68	1.08	.008

The number of deaths per 1,000 men employed shows an increase from 1.08 in 1922 to 1.68 in 1923, and that per 1,000 tons of gold ore raised shows a slight increase also, being .008 as against .007 for the preceding year.

PART VI.—STATE AID TO MINING.

The number of State Batteries existing at the end of the year was 29.

From inception to the end of 1923, gold and tin to the value of £5,768,930 have been recovered from the State plants; 1,383,769 tons of auriferous ore have been treated and have produced £4,705,006 by amalgamation, £704,662 by cyanidation, £256,917 worth by slimes treatment, £9,353 worth from residues, and 80,068 tons of tin ore produced tin to the value of £92,420, and in addition a sum of £572 has been recovered from residues.

During the year the gold ore treated was 29,714.75 tons for 21,876.14 ozs. bullion.

The working expenditure for all plants for the year totalled £38,408 4s. 9d., and the revenue £28,335 5s. 4d., which shows a loss of £10,072 19s. 5d. on the year's operations.

The capital expenditure since the inception of the scheme has been £397,589 9s. 1d.; £305,608 7s. 5d. from General Loan Fund, and £91,981 1s. 8d. from Consolidated Revenue.

The cost of administration for the year was £3,511 0s. 7d., as against £4,070 0s. 10d. for 1922.

The working expenditure from inception to the end of the year exceeds the revenue by £124,126 7s. 5d.

GEOLOGICAL SURVEY.

The work of the Survey during the year was not large consequent on the small staff now employed. The field work carried out was:—

1. A geological examination of the Stirling Range district, South-West Division.
2. An examination of the Tallering Range iron ore deposits in the Yalgoo Goldfield.
3. An examination of the Peak Hill Goldmining centre.
4. The completion of the detailed geological examination and survey of the Youanmi Goldmining centre, East Murchison Goldfield.
5. A reconnaissance survey of the Paynesville auriferous belt in the Murchison Goldfield, and a detailed geological survey of the main group of leases at Paynesville.

6. An examination of the Gypsum deposits at Hines' Hill, South-West Division.

Full reports and detailed information of all work carried out will be found in the report of the Government Geologist, published as Division IV. of this report.

ASSISTANCE UNDER MINING DEVELOPMENT ACT, 1902.

The following statement shows the sums advanced during the year 1923 under "The Mining Development Act":—

	£	s.	d.
Advanced in aid of mining work and equipment of mines with machinery ..	33,913	13	8
Subsidies paid on stone crushed for the public	256	6	9
Boring	759	0	4
Providing means of transport and equipment to prospectors	6,306	1	9
	£41,235	2	6

In addition to the above, amounts totalling £14,060 12s. 4d. were expended from Mining Development Vote on various matters for the assistance of mining, such as water supply, subsidies to assist carting of ore long distances, and subsidies for development work done below 100 feet level in small mines, and rebates to prospectors working low grade mines. The subsidies paid on stone crushed for the public, amounting to £256 6s. 9d., are subsidies paid to owners of plants crushing for the public, the conditions being that they crush at fixed rates; in most cases a further requirement being imposed as to purchasing or treating tailings. The ore crushed at such plants during the year amounted to 2,035.50 tons. The receipts under the Mining Development Act exclusive of interest payments amount to £3,262 9s. 4d., and include:—

	£	s.	d.
Refund of advances	1,664	9	8
Sale of securities	323	7	0
Miscellaneous refunds	1,274	12	8
	£3,262	9	4

PART VII.—REMARKS ON THE GOLDFIELDS AND MINERAL DISTRICTS AND SUMMARIES OF THE WARDENS' AND OTHER OFFICERS' REPORTS.

ASHBURTON GOLDFIELD.

Nine (9) fine ounces of gold were reported, and in the preceding year fourteen (14) fine ounces, got presumably by fossickers. No mining has been carried out on this field for years.

BROAD ARROW GOLDFIELD.

The output of gold was 2,741 fine ounces, and in the preceding year 3,629 fine ounces; a decrease of 888 fine ounces. In most of the centres a fair amount of prospecting was carried out, and one or two promising finds have been made.

At Ora Banda a good development was reported from the Orinda Mine, and the indications point to permanence.

At Broad Arrow the Oversight Mine is being vigorously developed in the deep levels. A revival in this field is predicted.

COLLIE COAL FIELD.

The output of coal for the year was 420,714 tons, and in the preceding year 438,443 tons; a decrease of 17,729 tons. Five (5) collieries were producing, viz., the Proprietary, Co-operative, Cardiff, Westralian, and Premier.

Any of these collieries could, if the demand for coal warranted it, considerably increase the output. The production is maintained at the figure corresponding to the market requirements.

During the year a serious fire broke out in the Co-operative Colliery, but no time was lost in combating it, and a few hours after discovery it was under control.

A local syndicate, known as the Griffin Syndicate, which holds some coal leases on the field, exposed an 8ft. 3in. seam of coal of good quality on its property, but at present further work is suspended.

The district generally is in a fairly prosperous condition.

COOLGARDIE GOLDFIELD.

The output of gold was 13,077 fine ounces, and in the preceding year 16,171 fine ounces; a decrease of 3,094 fine ounces.

In the Kununalling district the falling off in output practically accounted for the decrease in the field. Mining was very quiet and the principal mine, the Carbine, had a much lessened output.

At Gibraltar the Lloyd George Mine was a steady producer, but towards the close of the year operations had to cease, and it is understood was to be let on tribute. It is intended to endeavour to raise further capital with a view to further developing the property, which at one time gave much promise.

At Widgiemooltha there was not any improvement.

At St. Ives work has progressed steadily, and several mines are opening up promisingly, although a dry season and consequent shortage of water were retarding factors.

In the other centres there was not much change.

DUNDAS GOLDFIELD.

The output of gold was 6,358 fine ounces, and in the preceding year 8,044 fine ounces; a decrease of 1,686 fine ounces.

The chief producers were the "O.K.," "Mararoa," and "Viking No. 1." Towards the end of the year a new find was reported at Bremer Range, about 60 miles S.W. of Norseman. Reports indicate that the reef is small, and until more work is done it is impossible to judge its importance. Apart from this, there was little change.

EAST COOLGARDIE GOLDFIELD.

The output of gold was 370,670 fine ounces, and in the preceding year 376,389 fine ounces; a decrease of 5,719 fine ounces. On the large mines work continued steadily, and the results generally were satisfactory.

At the North end of the field the old Hannans North Mine was acquired by the Great Boulder Company, and it is understood that so far the sampling has been satisfactory. A new and up-to-date treatment plant has been installed on the Lake View Mine, the economic advantage of which is already apparent. The Great Boulder Perseverance (in liquidation) has been reconstructed and the new company, the Boulder Perseverance, Limited, has commenced to re-open up the mine.

At the South end of the field the deep boring carried out has not yet disclosed anything noteworthy.

In the outside centres, including the Bulong district, matters were very quiet,

EAST MURCHISON GOLDFIELD.

The output of gold was 11,016 fine ounces, and in the preceding year 13,051 fine ounces; a decrease of 2,035 fine ounces.

In the Black Range district there was considerable activity at Sandstone in the early part of the year consequent on reported rich discoveries on certain mines. Unfortunately expectations were not realised.

At Youanmi tributaries have been working on the big mine, and towards the end of the year an option of purchase was given over the property, the purchasers intending to endeavour to re-open and actively work it. At Curran's a party, assisted by the Government, is endeavouring to place the Red, White, and Blue Mine on a producing basis.

In the Lawlers district there was a small decrease consequent on the temporary closing down of the Daisy Queen Mine; otherwise there was practically little change.

In the Wiluna district there was an increase, and, although there has not been any marked advance in actual mining, a great deal of attention is being focussed on this centre as the result of an option being taken over most of the mines by English investors, who undertake to raise a large amount of working capital to open up the known large lodes should boring operations prove their size and value. The Government has agreed that when the capital is available to carry on development this centre will be connected up with the railway system. If the boring is satisfactory the future for this district is most promising.

GASCOYNE GOLDFIELD.

There is practically no mining on this field. No gold was reported.

GREENBUSHES MINERAL FIELD.

The output of black tin was 28.02 tons, valued at £3,024, and in the preceding year 15.86 tons, valued at £1,393; an increase in tonnage of 12.16 tons, and in value of £1,631.

For the greater part of the year, consequent on the low price ruling for tin, mining was almost at a standstill. An improvement towards the end caused a slight revival, which it is hoped will be more pronounced during the coming year.

KIMBERLEY GOLDFIELD.

Thirty-one (31) fine ounces of gold were reported, and in the preceding year five (5) fine ounces. A few prospectors were out in various parts of the field, but nothing payable was reported.

MOUNT MARGARET GOLDFIELD.

The output of gold was 26,876 fine ounces, and in the preceding year 27,649 fine ounces; a decrease of 773 fine ounces.

In the Mount Margaret district there was a decrease, and nothing of importance occurred.

The new find about 78 miles north-east of Laverton reported last year is being developed, but the remoteness of the locality precludes very speedy progress.

In the Mt. Morgan district there was also a decrease.

The principal producer was the Westralia Mt. Morgans Mine.

A few mines in outlying portions of the district give promise of future improvement.

In the Mt. Malcolm district there was an increase consequent on the resumption of milling operations on the Sons of Gwalia Mine. A new 30-head mill was erected, and crushing commenced in October.

No new finds were reported, but many parties of assisted prospectors were out.

MURCHISON GOLDFIELD.

The output of gold was 27,037 fine ounces, and in the preceding year 36,304 fine ounces; a decrease of 9,267 fine ounces.

In the Meekatharra district there was a falling-off attributable to the smaller output from the Fenian Mine, which was being worked by tributers. Otherwise there was little change.

In the Cue district there was likewise a decrease, and mining was very quiet. The principal producer was the Big Bell, on which, however, operations ceased at the end of the year, and the property is to be sold.

In the Day Dawn district there was a small decrease, and practically the only mining is on the old Fingall mine, where a party is actively at work with encouraging prospects.

In the Mt. Magnet district there was a decrease, but throughout the district prospecting was fairly active, and some new discoveries were very promising.

NORTHAMPTON AND YANDANOOKA MINERAL FIELDS.

No minerals were reported from Yandanooka, and during the year the proclamation of this Mineral Field was cancelled.

In the Northampton field the output of lead ore was 21,634.50 tons, valued at £59,194, and in the preceding year 29,602.90 tons, valued at £72,338; a decrease in tonnage of 7,968.40 tons, and in value of £13,144. Copper ore to the extent of 9,626.29 tons, valued at £59,143, was also produced, and in the preceding year 998.66 tons, valued at £13,435; an increase in tonnage of 8,627.63 tons, and in value of £45,708. In the early part of the year the low price ruling for base metals was a retarding factor, but there was an improvement which, if maintained, should considerably stimulate production. The Surprise Mine at Galena was the chief, and a consistent, producer of lead, and is opening up well. Several other shows are promising.

NORTH COOLGARDIE GOLDFIELD.

The output of gold was 12,213 fine ounces, and in the preceding year 13,624 fine ounces; a decrease of 1,411 fine ounces.

In the Menzies district there was a small decrease. The principal producer was the Menzies Consolidated Mine at Yunndaga. At Comet Vale matters remained very quiet, but a resumption of work on the Gladsome Mine is hoped for in the New Year.

At Mt. Ida there was a slight improvement.

In the Ularring, Niagara and Yerilla districts there was no improvement, mining being very quiet.

NORTH EAST COOLGARDIE GOLDFIELD.

The output of gold was 4,714 fine ounces, and in the preceding year 4,545 fine ounces; an increase of 169 fine ounces.

No new developments were reported from this field, but a good many prospectors were at work in different centres and getting fair returns.

PEAK HILL GOLDFIELD.

The output of gold was 1,700 fine ounces, and in the preceding year 2,160 fine ounces; a decrease of 460 fine ounces. This decrease is wholly attributable to the destruction by fire early in the year of the battery on the principal mine. The only discovery reported was an alluvial patch at Mt. Egerton, but this was practically worked out by the end of the year, only the original prospectors remaining.

Nothing definite was done in the direction of opening up the large Manganese deposits at Horseshoe, but some definite action in this direction is pretty certain before long. When this takes place this field should experience a revival.

PHILLIPS RIVER GOLDFIELD.

The output of gold was 375 fine ounces, and in the preceding year 689 fine ounces; a decrease of 314 fine ounces.

Copper ore amounting to 26.01 tons, valued at £541, was produced, and in the preceding year 31.84 tons, valued at £217; a decrease in tonnage of 5.83 tons, and increase in value of £324.

Mining was stagnant throughout the year consequent on the low price ruling for copper, which rendered its production unpayable. Until an improvement in this direction takes place little change is expected.

PILBARA GOLDFIELD.

The output of gold was 2,544 fine ounces, and in the preceding year 3,100 fine ounces; a decrease of 556 fine ounces.

Black tin to the amount of 24.40 tons, valued at £2,960 was produced, and in the preceding year 25.35 tons, valued at £2,446; a decrease in tonnage of .95 tons, and increase in value of £514.

Also 114 tons of asbestos, valued at £4,015, and in the preceding year 181.68 tons, valued at £7,600; a decrease in tonnage of 67.68 tons, and in value of £3,585.

In gold mining the principal production was from the Marble Bar, Lalla Rookh, and Bamboo Creek centres.

In tin mining there was little change, operations being practically confined to a few fossickers.

Asbestos mining was confined to Dalton, formerly known as Soanesville, in the Marble Bar district, and Lionel in the Nullagine district; but the reduced market for this mineral is reflected in the production.

On the whole this field is holding its own, but an unusually dry year militated against much prospecting being undertaken.

WEST PILBARA GOLDFIELD.

The output of gold was 64 fine ounces, and in the preceding year 94 fine ounces; a decrease of 30 fine ounces.

Copper ore amounting to 221 tons, valued at £3,500, was produced, and in the preceding year 164 tons, valued at £2,481; an increase in tonnage of 57 tons, and in value of £1,019.

Asbestos to the amount of .85 of a ton, value at £17, was also produced, but none in the preceding year.

The low market price for copper resulted in mining being at a very low ebb, and an early improvement is hoped for.

WEST KIMBERLEY GOLDFIELD.

In this field boring for oil is still being actively pursued with very promising results.

Nothing has yet been done on the iron deposits at Yampi Sound, but a commencement may be made in the near future.

YALGOO GOLDFIELD.

The output of gold was 7,713 fine ounces, and in the preceding year 18,132 fine ounces; a decrease of 10,419 fine ounces. This is largely attributable to a lessened output from the Gnow's Nest Mine.

At Field's Find a fair number of prospectors have been at work with varying results.

At Payne's Find there was a falling-off, and prospects are not too bright.

At Yuin the effort made to re-establish the Royal Standard Mine was unfortunately not successful, and operations have ceased.

Throughout the other centres prospecting was fairly active.

YILGARN GOLDFIELD.

The output of gold was 8,376 fine ounces, and in the preceding year 12,794 fine ounces; a decrease of 4,418 fine ounces.

At Southern Cross work in the direction of re-opening up the old Fraser's Central Mine is still in hand. The Government has considerably assisted this project, as it is realised that it means much to the field.

At Manxman the Radio Mine has been a steady producer, likewise the Spring Hill Mine at Parker's Range. At Greenmount the Transvaal Mine is to be re-opened with a view to working the large deposit of arsenical pyrites therein.

At Burbidge the Great Victoria Mine has been equipped with additional plant, and a considerable amount of development work done. Much is expected of this mine.

At Marvel Loch a good deal of prospecting was in evidence and some satisfactory crushings obtained.

At Bullfinch mining was almost at a standstill, only two parties of tributers being at work.

At Westonia and Forrestania matters were very quiet.

TABLE 30.

Value of Mining Machinery and Number of Stamps and other Mills erected on the 31st December, 1923, compared with the previous Year.

Goldfield.	District.	Value of Mining Machinery.		Batteries, Number of Stamps.		Mills.																			
		1922.	1923.	1922.	1923.	1922.								1923.											
						Prospecting.	Ball.	Griffin.	Huntington.	Puddlers.	Other Crushers.	Flint.	Grinding Pans.	Prospecting.	Ball.	Griffin.	Huntington.	Puddlers.	Other Crushers.	Flint.	Grinding Pans.				
1. Kimberley ...	...	£	£																					
2. West Kimberley ...	...	...	...	...	...															
3. Pilbara ...	Marble Bar	11,360	16,714	48	50																				
	Nullagine	3,339	2,989	25	25																				
4. West Pilbara ...	...	2,525	2,281	20	20	1																			
5. Ashburton ...	...	...	...																			
6. Gascoyne ...	...	...	...																			
7. Peak Hill ...	...	9,534	2,842	20	10																				
8. East Murchison ...	Lawlers	14,556	19,443	40	40						1														
	Wiluna	23,829	22,954	65	65								1												
	Black Range	95,606	95,808	73	73																				
	Cue	35,359	28,707	63	65																				
9. Murchison ...	Meekatharra	57,655	48,870	77	70						5														
	Day Dawn	6,310	4,850	50	63								3												
	Mt. Magnet	15,673	15,883	20	20	1	1																		
10. Yalgoo ...	...	32,341	35,031	63	60	1																			
	Mt. Morgans	10,505	9,988	45	45																				
11. Mt. Margaret ...	Mt. Malcolm	246,044	283,175	65	85																				
	Mt. Margaret	20,479	5,200	30	30		5																		
	Menzies	23,726	17,028	65	55																				
12. North Coolgardie ...	Ularring	27,712	2,539	30	20																				
	Niagara	3,436	3,216	15	15		1																		
	Yerilla	2,663	3,328	20	20																				
13. Broad Arrow ...	...	63,420	63,528	35	35		1		2	3	2														
14. North-East Coolgardie ...	Kanowna	6,200	8,750	40	40																				
	Kurnalpi	150	200	5	5	1																			
15. East Coolgardie ...	East Coolgardie	1,108,702	1,142,351	455	430	1	40	13	2	6	30	30	155	1	43	13	4	6	28	25	146				
	Bulong	...	...																				
16. Coolgardie ...	Coolgardie	23,584	27,688	63	73				1																
	Kunanaalling	7,480	7,800	30	32																				
17. Yilgarn ...	...	68,652	54,772	145	125				2																
18. Dundas ...	...	14,336	10,336	17	17																				
19. Phillips River ...	...	10,300	9,800	50	50																				
	State Generally	30,000	30,100	...	...		1																		
Total, Gold-extracting Machinery ...		1,975,449	1,954,491	1,679	1,638	5	50	13	9	9	44	43	262	8	48	13	11	9	33	32	236				
Total, Machinery, other than Gold-extracting ...		343,163	334,387	...	...	...	...	...	2	...	28	4	3	...	...	...	2	...	25	4	3				
TOTAL, MINING MACHINERY ...		2,318,612	2,288,878	1,679	1,638	5	50	13	11	9	72	47	265	8	48	13	13	9	58	36	239				

PART VIII.—EXISTING LEGISLATION

At the close of the year the Acts in force relating to Mining were:—

1. The Mining Act, 1904.
2. Mining Act Amendment Act, 1919.
3. Mining Act Amendment Act, 1920.
4. Mining Act Amendment Act, 1921.
5. Mining Act Amendment Act, 1923.
6. Sluicing and Dredging for Gold Act, 1899.
7. Mines Regulation Act, 1906.
8. Mines Regulation Act Amendment Act, 1915.
9. Coal Mines Regulation Act, 1902.
10. Coal Mines Regulation Act, 1915.
11. Mining Development Act, 1902.
12. Mines and Machinery Inspection Act, 1911.
13. Gold Buyers Act, 1921.

The following alterations, etc., regarding Regulations were gazetted under *The Mining Act, 1904*:—

- Amendment of Form No. 59 in the Schedule.
- Amendments of Regulation 192d and Form No. 59 in the Schedule.
- Amendment of Regulations 5, 6, 7, 10, and 16.
- Cancellation of Regulation 192b.
- Amendment of Form No. 59 in the Schedule.
- Amendment of Regulation 40b, Clause (1), and Clause (8a).
- Amendment of Regulation 214a.

Under "*The Coal Mines Regulation Act, 1902*":—

- Amendment of Regulation 24—Part I.
- Amendment of Regulation 24—Part I.

Under "*The Mines Regulation Act, 1906*":—

- Amendment of Regulation 8 by the addition of Sections 7 and 8 of the Code of Signals.

PART IX.—INSPECTION OF MACHINERY.

The Chief Inspector of Machinery reports that the number of useful boilers at the end of the year totalled 3,135, as against 3,073 total for the preceding year, showing an increase, after all adjustments, of 62 boilers.

Of the total 3,135 useful boilers 1,480 were out of use at the end of the year; 1,494 thorough and 154 working inspections were made, and 1,519 certificates were issued.

Permanent condemnations totalled 20, and temporary condemnations 62. There were no conversions, and 12 boilers were exported.

The total number of machinery plants in use was 5,215, against 4,978 for previous year, showing an increase of 237.

Inspections made total 3,935, and 3,935 certificates were granted.

416 applications for engine-drivers' and boiler attendants' certificates were received and dealt with, and 372 certificates, all classes, were granted as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60)	4
First Class Competency (including certificates issued under Regulations 40 and 45, and Sections 60 and 63)	14
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	28
Third Class Competency (including certificates issued under Regulation 45 and Section 63)	28
Locomotive Competency	10
Traction Competency	6
Internal Combustion Competency	5
Internal Combustion Service	85
Crane and Hoist Competency	4
Crane and Hoist Service	8
Boiler Attendant's Competency	18
Boiler Attendant's Service	47
Interim	6
Copies	10
Transfers	99
Total	372

Total mileage travelled was 42,663 miles, of which 17,126 were by rail, 24,331 by road, and 1,206 by water.

PART X.—SCHOOL OF MINES.

During this, the twentieth year of the School's existence, good progress was maintained.

The attendance was satisfactory, and at the end of the year there were 144 on the rolls. Students generally were regular in attendance and attentive to the class work. The work at the School is referred to in detail in the report of the Director, published as Division V. of this Report.

The system of free assays for prospectors was continued, and during the year a total of 553 assays and mineral determinations was made.

CONCLUSION.

In dealing with the operations of the various departments, I have only briefly commented on the principal items.

Full and detailed information will be found in the reports of the various responsible officers, published as Divisions II. to VIII. of this Report.

In conclusion, I desire to acknowledge the loyal support received from all officers of the department during the year.

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 31st March, 1924.

DIVISION II.

REPORT OF THE STATE MINING ENGINEER FOR THE YEAR 1923.

Office of the State Mining Engineer,
Perth, 31st January, 1924.

The Under Secretary for Mines, Perth.

Sir,

I have the honour to forward, for the information of the Hon. the Minister, my Annual Report for the year 1923.

INSPECTION OF MINES UNDER "THE MINES REGULATION ACT, 1906," AND "THE COAL MINES REGULATION ACT, 1902."

There was no change in the personnel of the Inspection Staff during the year.

WORKMEN'S INSPECTOR OF MINES.

Mr. Goggin, Workmen's Inspector of Mines for the Murchison and Northampton Districts, tendered his resignation, and concluded his service with the Department on 31st December, 1923.

REPORTS OF INSPECTORS OF MINES.

REPORT OF MR. W. F. GREENARD, INSPECTOR OF MINES, KALGOORLIE.

I have the honour to submit my Annual Report, for the information of the Hon. the Minister for Mines, on the working and administration of the Mines Regulation Act and Amendments in the East Coolgardie, North-East Coolgardie, North Coolgardie, Coolgardie, Broad Arrow, and Dundas Goldfields.

A systematic routine inspection of all working mines on the above goldfields has been maintained through the year.

The ventilation in all mines has received the sole attention of one inspector.

The dust, underground and on surface, has also received constant attention; damping appliances have been made available in all working places. Shrink stopes are still difficult to deal with effectively from a dust and firing standpoint.

The storage of dynamite and detonators, and the receptacles for holding same in the mine workings, have been constantly under supervision.

Cages, ropes, and hooks are carefully inspected, and a record is made of all tests.

The change rooms have been constantly inspected and kept in good order.

The sanitation of both surface and underground workings has been kept up to a good standard.

During the year there have been several snaps of pillars, which created a great noise and caused the immediate neighbourhood to tremble. This must be expected. Similar conditions have arisen wherever mining has been carried on in length and depth. Where the mined ground has been filled there is little to fear, but, where shrink stoping has been permitted, serious falls may occur any day.

The Great Boulder Proprietary, Ivanhoe, and Golden Horseshoe Mines have continued to deplete their reserves of ore. The Golden Horseshoe is now engaged in sinking the main shaft from 3,200 feet.

The Great Boulder Perseverance Company has been reconstructed, and is doing a good deal of exploration in the old workings.

The South Kalgarli Company continues to open up some good ore in 16 and 17 levels, and is installing new winding engines and additional boiler plant.

The Lake View, Star, and Chaffers are now equipped with a dry crushing and roasting plant, and are being partly worked by tributers.

At the North end of the Kalgoorlie and Boulder belt the Great Boulder Proprietary has taken over from Mr. Raven the Golden Zone, Hannans North Leases, etc., and is busily engaged putting a pump into the main shaft. Several leases are being reopened in this locality. Some excellent values have been met.

At Broad Arrow, Bardoc, and Ora Banda a good deal of prospecting has been done.

At Kanowna a good deal of prospecting and testing of various mines has been done.

The Red Hill Company has been working good payable ore, and the outlook for this property is much brighter.

At Bulong and Mt. Monger a fair amount of prospecting has been carried on. McCahon's Great Hope Mine has been equipped with winding and crushing plants.

The Hampton Plains Mines have continued to be developed. The Celebration Mine has an improved development at the 400ft. level.

There has been a considerable amount of development work done at Coolgardie and Gibraltar.

At Widgiemooltha and Logan's Find good prospecting has been done.

At Norseman the O.K. Mine is being worked by the Great Boulder Proprietary, the ore being trucked to Boulder for treatment. A good deal of general prospecting is being done at Norseman.

Mining is suffering from high costs. The auriferous areas are still wonderfully productive. With a fall in costs we could reasonably expect renewed activity and increased development.

REPORT OF MR. E. J. GOURLEY, INSPECTOR OF MINES, KALGOORLIE.

I have the honour to submit to you my Annual Report for the year ended 31st December, 1923.

Complete inspections have been made of the following mines and districts:—Ivanhoe 4, Great Boul-

der 6, Horseshoe 4, Associated 4, Perseverance 6, Lake View 4, South Kalgurli 8, Kalgurli 5, North Kalgurli 2, Paringa 2, Brown Hill, North Blocks 3, Associated Northern 2, Croesus 1, Eclipse 2, Union Jack 2, South End Mines 2, North End Mines 2, Williamstown Leases 2, Menzies Consolidated 6, Waverley District through Broad Arrow-Ora Banda Mines 7, Coolgardie-Kunanalling Mines 8, Kanowna 6, Gibraltar-Bulla Bulling Mines 3, Mt. Ida 1, Golden Promise 1, Norseman 4, Kurnalpi-Vosperton 2, Binti Binti 1, 37-Mile 2, Jones' Concession 1, Golden Ridge 2, Carbine 2, Mt. Monger 2, Hampton Plains 2, Mulline and Riverina 1, Bulong 2, Grosmont 2, Dry Crushing Mills 4, Lake Eva Oil Find 1.

DEVELOPMENT.

The South Kalgurli Mine has been vigorously opening up the 1,600ft. and 1,700ft. levels by crosscuts, drives, and winzes, and a large tonnage of exceptionally high grade ore over a width of 25ft. has been opened up in the South end of the 1,600ft. level, and payable ore found in the North of both 1,600ft. and 1,700ft. levels; the South end of the 1,700ft. level is still developing well, but is not quite as rich as the 1,600ft. level. In addition to this work from the main shaft, Morty's shaft has been cut down and retimbered from the 1,000ft. to 1,100ft., and a diagonal crosscut put out South-West. This cut the lode, which is payable, and opened up a large tonnage of ore. This mine, owing to the satisfactory developments during the past year, appears to have years of profitable ore reserves in sight.

Lake View Mine.—During the year a crosscut west of shaft at 2,300ft. has cut the lode approximately at 420ft., but this crosscut also cut what is known as the Bullfinch lode about 100ft. nearer the shaft. Both these lodes have been driven on a considerable distance North and South on ore that is payable, and these lodes are now being developed at the 2,100ft. and 1,800ft. levels with pay values. The plant, as far as treatment is concerned, has been closed down for six months of the year and a new plant erected on the Chaffers Mine, owned by the same company. This is now in operation and doing good work, treating ore from the Star, Lake View, and Chaffers Mines, including tributers' ore from these mines, and a small tonnage bought on assay value from outside sources. In my opinion the outlook for the ensuing year is very bright for this group of mines.

Perseverance Mine.—A change of management has occurred during the year. Mr. Ernest Williams taking the place of Mr. D. Cleland. While the tributers are still doing the bulk of the mining to keep the plant going, which has increased from two furnaces to three, the new management has been making a very exhaustive sampling of the mine, and I am informed that in quite a number of places pay ore has been discovered, and work is being proceeded with in some of these places; also development work in sinking winzes, crosscuts, and driving is being done, and a large quantity of residues are being poured into the old empty shrink stopes from the surface down to the No. 3 and No. 4 levels. The position of this mine looks very hopeful.

Ivanhoe Mine.—The development of the 3,000ft. level is being proceeded with on payable ore, but the management appear to be satisfied with that work, for in the levels above no development work of any consequence is going on.

Associated Mine.—Development work done in this mine has been chiefly at the 1,600ft. and 1,500ft. levels, and pay ore has been discovered in several places, but is on the whole somewhat disappointing, as the shoots of ore have been very narrow and short. Up to date they have not cut the rich ore driven on in the South Kalgurli Mine up to their boundary, but as there is a difference of about 40ft. in levels they will probably get this good ore in stoping over their 1,600ft. level. Monthly yields have been poor.

Great Boulder Mine.—A considerable amount of development work has been done from Lane's shaft end of the mine and leading stopes taken off, and timbering of these stopes is going on. Also No. 12 level, Hamilton shaft, has been timbered, and a start made to shrink stope so that the ore opened up must be payable. However, the main stopes from Edwards and main shaft are getting up very close to the different levels, and in quite a large portion of the mine the levels have been taken out entirely.

This company has taken over the Hannans North Mine from Mr. H. Raven, who erected a winding engine, 6-drill compressor, boiler, etc., some months ago, and unwatered this mine down to the 600ft. level. The sampling of the lode at this level gave satisfactory results, and the purchase price has been paid. I understand that ore breaking over the 600ft. will be started as soon as the ore bin is erected, but two winzes will also be put in hand below this level.

Kalgurli Mine.—The Oroya Brown Hill Company, having bought this mine and plant, have re-organised it. The mine is let to parties of tributers, but very little development work is being done yet. These tributers have been taking out considerable quantities of highly payable ore, and with the addition of ore from tributers on the Brown Hill, Oroya North Blocks, and parcels from Paringa, North Kalgurli, and other outside sources the plant has been kept going continuously during the year. The Croesus Proprietary shaft has been unwatered down to the bottom, 1,000ft. level, and the mine cleaned up, stopes filled, levels secured where necessary, and several parcels of ore have been mined from the 400ft., 500ft., and 700ft. levels for payable returns. This mine appears to me to have a profitable future before it, providing they select the ore instead of bundling it out over too big a width, which has been done in the past.

Golden Horseshoe Mine.—Development work has been done in the 2,900ft. level and on 3,000ft. to pick up the continuation of the Ivanhoe lode at 3,000 feet, and this has been driven on for some considerable distance on pay values, but in other levels of the mine work has been confined to stoping.

North Kalgurli Mine.—This mine was unwatered and sampled by the Lake View Company during the year with a view to purchase, but up to date no business has been done. The Lake View Company also sampled the Genevieve and Union Jack Leases adjoining on the North. From what I can learn the sampling of these leases was satisfactory, and there are two big shoots of ore opened up at 150ft. and 250ft. levels. At the present time the South Kalgurli and Kalgurli management are putting the winder in order to handle the water coming from the mine and the Brookman's Boulder. This will stop the chief flow from these mines from passing into the Kalgurli, South Kalgurli, and Perseverance Mines.

Paringa Gold Mine.—On my advice this company has started to run out a diagonal crosscut North-East

from the 200ft. level main shaft to try to pick up what is known as Lovelace's lode; several thousand pounds worth of gold have been won from this down to 80ft.

Central Mine.—Mayman and Party have been crushing with their Huntington Mill from the 80ft., 100ft., and 150ft., doing a small amount of driving on the lode in the meantime, and judging from the returns they should be making a profit.

Kunanalling.—Pearce Bros., O'Connor and Bennetts, Keay and Fox, Larkin and Dwyer have been getting good returns from the contact leaders with an indicator which is about four miles in length, but only small parcels were obtained. Gough and Mudjic have also had good returns from the Blackett's old mine. De Gracie and Clegg, who are being assisted under the Mines Development Act, have their new shaft down 130ft. on the Sydney Mint mine, and expect to cut the reef in a few feet. Barry and Pilkington have discovered a reef on the old Catherwood Lease, which gives payable prospects over a width of 10ft. Ware's five-head mill has been kept busy, but shortage of water has been a drawback, the Turn of the Tide Mine supplying most of the ore from a series of rich leaders.

Carbine.—The rich shoot of ore discovered during the early part of the year has cut out, and development work has since disclosed only medium grade ore.

Waverley.—The Deep Lead, which promised well for some time, has not come up to expectations, but as there is plenty of untouched ground in the vicinity I still think there is a good chance of picking up the continuation; seeing over 200ozs. of gold have been obtained it is well worth a further trial. The Paringa Company has taken a nine months' option on the Hazel Mine, and paid a deposit. The Lanarkshire Company has also taken an option on the Hazelmere, which crushed 20 tons for 4ozs. per ton, and paid a deposit. This adjoins on the South. A number of leases have been applied for and a large number pegged both North and South, and on my last visit several mining men were out there examining the lode exposed, so there is a chance of some prospecting work being done there this year.

Correll and Party are still working the Siberia Consols, obtaining small payable crushings.

Ora Banda.—The Victorious and Gimlet Mines have been almost at a standstill, with the exception of a couple of drills developing the Gimlet Mine at and below the 400ft. level. This company had an option on the Orinda Mine, but as developments did not come up to expectations they abandoned it. Since then the owners have taken out a couple of payable crushings, and an Adelaide company has taken an option, and are at work shaft-sinking at present. At the Lady Evelyn shaft sinking is being done, and at a depth of 40ft. on the underlie below the 400ft. the reef has been cut, carrying 2oz. values. A cyanide plant has been erected, and the accumulated sands are being treated at a profit.

Broad Arrow.—This district has been quiet with the exception of the Oversight (Borland and Rudd), who have obtained two good parcels of pay ore. They have since sold out to Mr. Barratt, and he has started to develop this lease from the Tara shaft, which is down 150ft., and is the deepest on the two properties.

Bardoc, Canegrass, Comet Vale.—With the exception of Maher's Lake View Mine no work of any consequence has been done underground, but residues

from the Happy Jack and Gladsome Mine are being treated.

Menzies Consolidated.—Owing to the granting of subsidy to develop this mine below the 1,900ft. level by winzes and driving at the 2,000ft. and 2,100ft., I have visited the mine monthly. The reef appears to be going down but is erratic in width and values, and up to date the length of the shoot has not been determined at the 2,100ft., and the position of the internal shaft cannot be decided on. Other parts of this district are very quiet.

Mt. Ida.—I visited the mines that were at work once during the year, but there was nothing of importance to record, 20 men only being employed in mining.

Assisted Prospectors.—During the year I have paid a good deal of attention to the different parties, and have inspected their work at Kunanalling, Kaipini, Mt. Monger, Mulline, Coolgardie, Bulla Bulling, Bulong, Golden Ridge, and Black Hills. At Black Hills, Polhill and Crowston have found a quartz reef, which they are now developing at 50ft. by driving; the values are too low to pay for carting any distance, but they have a chance of improving, otherwise the assisted men have not discovered anything of importance.

Norseman.—I have inspected the mines in this centre on four occasions; the only mine being worked on wages is the O.K. Mine. This employs about 40 men; values are good but the reef is small and very hard.

Mathieson Bros. are working a reef discovered by them about four miles South of the town, and they have obtained payable crushings at each run of the State Mill; the reef averages 15in. in width. The owners of the Mararoa and Viking mines are also breaking good payable ore from the 600ft. and 300ft. levels. Although this field is practically in the hands of working miners, the returns from the State Mill are probably the best in the State, and in most of the mines they appear to me as if they will continue.

Higginsville and Widgiemooltha are very quiet, but two new finds at Logan's are promising.

In conclusion, the outlook for this year appears to me to be considerably brighter in Kalgoorlie and in one or two outback districts.

REPORT OF MR. W. PHOENIX, INSPECTOR OF MINES, KALGOORLIE.

I beg to submit my Annual Report for 1923.

During the year very careful underground observations have been taken in each of the mines on the Golden Mile. The air currents have been directed by means of bratticing where the air has been found sluggish, and fans have been installed to increase the volume; where the dry bulb exceeded 75° F., it has been found necessary to increase the air motion. This has had a beneficial effect on the health of the miner, as it readily cools off the body temperature.

Air Volume.—As air motion is essential in warm stopes and drives, it is necessary that the air volume should be maintained and passed through the stopes where men are employed. This keeps up the standard of cooling and evaporative power of the air, which means a greater health to the men employed.

During the year attention has been directed to this problem, and endeavours have been made to try to maintain the direction as well as the volume.

Difficult problems had to be overcome owing to men being removed from one section of the mines

to another, due to the value of the ore body becoming unpayable. On the whole a good supply of air has been maintained in each of the mines.

Dust.—During the year greater attention has been given to this subject, and means supplied for water spraying where the ore is found dry. The young miners still show a disregard in the protection of their own health, and often neglect to carry out instructions to keep the ore in a state of dampness so that it would not be possible to give off dust.

Although steady progress has been noted in dust prevention it has not nearly reached the stage of finality, and no relaxation of effort must be shown if we are to protect the general health of the miner of the future and eradicate the Miner's Phthisis. Strict attention must in the future be given to the elimination of the very finest dust from the underground atmosphere.

Temperatures and Air Moisture.—Temperatures and the percentage of moisture have been noted from time to time, and records made of the temperatures at regular intervals with the wet and dry bulb thermometer. It has been found necessary at times to request an increased speed of the air fans, in order to reduce the temperature, as well as increase the air volume. The miners are now beginning to see the advantage of air motion because of its tendency to keep down the body temperature. A great deal of bratticing has been done to direct the volume to the working faces, and a greater interest is shown towards the protection of all air doors.

Sanitation.—The sanitation and drinking water supply underground has been fairly good, and there has been no cause for complaint in this direction.

Explosives.—There has not been any complaint during the year of an inferior explosive, nor any accident due to explosive fumes.

Sand-blasting at shrink stope shoots in an air current, and in shrink stopes is a question that must be solved in the future owing to the tendency of carrying dust and fumes into the underground workings at very frequent intervals.

Hampton Plains, Celebration Mine.—This mine has pushed on development, and has now reached the 400ft. level with encouraging results. This has been noted by those holding properties in this locality, and may eventuate in a revival in mining at a greater depth than has been reached in the past. The contemplated alteration to the mill has been effected, and a satisfactory extraction is being maintained.

Golden Hope Mine.—A ten-head battery and treatment plant is now working smoothly, and arrangements are being made to instal an air compressor plant, after which a vigorous policy of development will be pursued.

The Hampton Proprietary Mine.—The management is pushing on development work with all speed at the 200ft. level. The battery and treatment plant has given satisfactory results, and a large tonnage has been put through during the year. It is expected that during 1924 another level below the 200ft. will be reached.

White Hope Mine.—Work has been confined to stoping between the 100ft. level and surface. This has kept the battery and treatment plant regularly supplied with ore.

St. Ives Field—Ives Reward Mine.—During the year a 6-drill compressor plant has been erected together with a haulage engine and boiler. Work will now be resumed underground at the 200ft. level in

order to get a sufficient ore reserve to warrant the erection of a battery.

Ives Reward Junction.—Stoping and crosscutting at the 90ft. level is being continued with a view of ascertaining the dip and strike of the payable values.

Clifton Lease.—This is in a prospecting stage. A syndicate has been formed and work resumed to open up the mine at water level.

Idough Mine.—Considerable tonnage has been crushed from this mine at the State battery, and the prospectors are now developing at the 130ft. level following a chute of payable values.

Cooee Lease.—The prospectors here have encountered several makes on contacts between two formations near the surface. Very little has been done at depth. It requires a stronger syndicate with capital in order to demonstrate the future possibilities at depth in this locality.

The Koombana Lease.—Several small leaders have been discovered on this lease showing gold, and work is in hand to further develop these new makes already discovered.

Alluvial.—Several parties have been at work during the year dryblowing, and a little gold has been discovered above the cement in the loam on the surface. Very few prospectors are to be found in this locality owing to its distance from Kalgoorlie and the central mines of the Golden Belt.

Coolgardie, Griffiths' Gold Mine.—This mine has been unwatered to the 230ft. level, and the North drive extended a distance of over 200ft. The manager has intersected values, and work is in hand to further develop these values.

Dreadnought Mine.—A syndicate has resumed sinking here with the object of opening up the lode formation at 150ft. vertical depth, and to intersect payable values met with in the level above.

Lady Carmen Mine.—This party discontinued underground operations because of the refractory and dense nature of the sulphide ore. They are now putting through a trial crushing in order to ascertain the best treatment for the future development of the mine.

Several prospectors are at work in the surrounding district, and occasionally get a crushing through the State Mill. These crushings are mostly from the surface and very shallow workings.

There seems to be a hopeful spirit that if capital is encouraged and labour conditions settled, the gold mining industry will revive and a greater output will be assured.

REPORT OF MR. W. M. DEEBLE, INSPECTOR OF MINES,
CUE.

I beg to submit my Report for the year 1923 on Mining in the Peak Hill and Murchison Goldfield and Black Range District of the East Murchison Goldfield.

During the early part of the year a new find was made in the North-West part of Peak Hill Goldfield at a place about seven miles West of Egerton. The prospectors, Gaffney and Party, found loose quartz specimens which, when dollied, returned over 100 ounces of gold. I visited the scene in June and found 30 dryblowers at work, and until the alluvial ground became exhausted reef or lode mining could not be started on the same ground; later, when the alluvial miners ceased work at that point, they were unable to test the surrounding country owing to the difficulty of getting water.

I do not know the rainfall at Egerton, but at Cue $10\frac{1}{2}$ inches was registered during the first seven months of the year, and during the remaining five months only 15 points were registered. The rainfall has been patchy and, in most places, very little, which has had the result of keeping the prospectors close to the permanent water supplies, and therefore they have not had the same chance of opening up new districts as they had with better seasons.

At Horseshoe I travelled over the hills to the North and West, and found they contained considerable deposits of manganese, but nothing so easily and cheaply worked as the part already taken up.

Peak Hill.—There is very little difference in this place noticeable from the previous year, the same men are working in and around the old Peak Hill Mine. The crushings put through the mill have been small but good. There has been a slight decrease in the gold return from this place owing to Mr. C. E. Connolly's mill being destroyed by fire, and this more than accounts for the shortage.

Mt. Padbury and Murphy's Well.—Mining has been very quiet during the latter part of the year at these places; the miners realise that unless they can develop large tonnages and get crushing machinery on the ground they have very little chance of success. This is one of the drawbacks noticeable in a number of places, and I am unable to see how the difficulty can be met. The so-called prospecting batteries do not meet such cases.

Holden's Find.—The Waterloo G.M., situated at this place, has been rather unfortunate in meeting with mineralised ore in the reef at 130ft. depth, with the result that the mill had to be closed down until a suitable plant had been installed to meet the altered conditions. At present the manager is of the opinion that finer grinding and concentrations will give a fair extraction. The last crushing of 480 tons put through the mill gave 199.18 ounces from the plates.

Judge's Patch.—This is an area of country in which alluvial gold was found over 20 years ago, and each year alluvial miners work there in a spasmodic way and obtain a little gold, but have not found any payable reef or lode up to date. There is a large area of this country north-east and south-west of Holden's Find from which alluvial gold has been obtained, and it seems to me possible that the gold has probably been shed from lode matter instead of quartz, and this is possibly the reason why the gold has not been traced to its source.

Mistletoe.—This place is situated 32 miles north-east of Meekatharra, and was found by prospectors Holden and Watson. The prospectors' claim is now known as the "Munarra." Up to the end of the year two shafts had been sunk to water level, which is 72 feet in depth, and these shafts have been connected with a drive at bottom; stoping has been started to enable the owners to secure sufficient capital to erect machinery.

There are over 400 tons of ore at surface in the dumps, and during the year 580 ounces of gold were dollied from specimens. With gold making in a reef like this it would be very difficult to sample the dump and get anything like an accurate result, but it is probably high grade.

Meekatharra.—At this centre the Ingliston Consols Extended Gold Mine still holds pride of place, and during the year under review 26,271 tons were milled for 13,187.12 fine ounces of gold. The manager still believes in the future of the mine, and now the

Fenian mine has been added to the Consols it is expected that there will be an increased output during the coming year. The Fenian mine was taken over about 12 months ago, but subject to the tribute agreement, and this tribute only expired at the end of 1923, and is the reason the management has not been able to carry out the work he has had in view for some time. With the alteration it is expected there will be a large tonnage treated, and consequently a greater number of men employed on these mines.

Other smaller mines have been crushing dirt of average grade, but in no case is there anything outstanding to report.

At the last round of crushing at State Mill, cleaned up during January, the total of $692\frac{3}{4}$ tons were milled for 811 ounces 12 dwts., which shows a very high average value.

Gabanintha.—There is practically no mining in this district at present. In the past the great difficulty has been to get a reasonable extraction from the ore, which contains just enough copper to prevent the extraction of the gold by cyanide. Assays of sand on the Mountain View and Tumbulgum Mines show that poor extraction has been obtained, and if this could be solved and the sands treated profitably there would be a chance of re-opening the mines. With this in view a syndicate was formed at Meekatharra and machinery erected on the Mountain View. The first trial was with fine grinding and concentration, which did not result in high extraction. Mercury was added to the pans and this floured and would not stop even on the concentrators. By examining small globules of mercury under a microscope it was noticeable that each was covered with small angular projections similar in appearance to lead shot that has been rubbed in emery powder. Work has been stopped for the time being to have further tests made. Judging by the minerals associated with the gold it will probably be found that the flotation process will be suitable.

Cull Culli.—At this place only two parties of prospectors have been at work.

The owners of the Cull Culli Mine worked on a leader carrying high values, and milled 40 tons for 167.75 fine ounces. The leader, which has always been very erratic in size, cut out and the men ceased work.

The Turn of the Tide crushed six tons for 101.13 ounces. This district is very suitable for prospectors with little capital, as the leaders, when found, are usually high grade and easily and cheaply worked, the ground being soft kaolin.

Reedy's.—Throughout this district the gold-bearing material worked has been large lodes, and if any mine containing payable values can be found there it should be the means of causing considerable employment.

At about the end of August an option was arranged between the owners of the Emu and Emu North Mines and the Mararoa Company, and since that date development work has been carried out on both leases. The material treated from these leases up to date has been good grade milling ore, but for a company that intends treating largely it is now a question of proving the tonnage that will be available for treatment or can be developed, and it can reasonably be expected that the work now being done will soon prove that beyond doubt.

Tuckanara.—The various prospectors have produced 576.62 fine ounces from this district, and a

considerable number of prospectors have been testing the country to the West at and near Weld Range, but the latter have not met with much success.

Cuddingwarra.—The Big Bell G.M. reported 15,841 tons milled for 2,431.95 fine ounces. The lode in this mine is very large, but the returns shown indicate that it does not bulk well. The mine closed down at the end of the year, but I am of the opinion that it would pay a small party well if the ore were picked, as has to be done in most mines.

Cue and Day Dawn.—At Cue centre only a few prospectors were engaged during the latter part of the year, and at Day Dawn a number of prospectors have been working chiefly to the South of the Great Fingall G.M., but in no case has anything new worth reporting been discovered.

The Fingall South, held by Bastian Bros. and assisted by the Mines Department, seems very promising at present. One crushing of 171 tons returned 133.96 ounces of gold from the plates, and the last crushing of 53 tons 70.18 ounces from plates from practically new ground between Nos. 2 and 4 levels. The owners now intend opening up No. 4 level, and if the values extend to the lower level a large tonnage will be available for milling.

Mainland and Lake Austin.—The Mainland Consols was taken up for the purpose of pumping water for sluicing the surface of the hill with the hope that the gold obtained would meet expenses, and that some rich leaders or lodes would be disclosed similar to those worked in the early days, but unfortunately the pump used was not suitable for the purpose, and work ceased without anything being done.

Moyagee.—There has been very little prospecting done in this centre during the year. The Moyagee Mine crushed 195.8 tons for a yield of 164.43 fine ounces from the plates.

Lennonville.—A number of prospectors have been working at and near this place, but have not found anything encouraging; the best results were from the old Galtee Moore Mine, from which 607.5 tons was milled for 246.19 ounces fine gold recovered by amalgamation.

Boogardie.—There are a number of miners working for themselves at this place, but in no case has any rich contact been met during the year, which is the object of the miners' search in this class of country. Interest at present is being taken in an ironstone lode being opened up by Mr. Hough, about a mile south-west of Mt. Magnet. A crushing of 19 tons gave 10 ounces of gold by amalgamation, and the sands assayed 15 dwts. 18 grains per ton; a second crushing of 6½ tons 2 ounces 1 dwt. by amalgamation, and the sands assayed 16 dwts. 15 grains per ton. As is usual with ironstone material, amalgamation did not extract a high percentage of the gold contents. During November a crushing of 12½ tons was milled from P.A. 970 by Richardson and mate for a return of 58 ounces, equal to 4 ounces 12 dwts 19 grains per ton by amalgamation. The country around this has not been prospected much.

Messrs. Austin and mates have erected a five-head mill about four miles South of Mt. Magnet on P.A. 954, which they consider is a payable proposition with a mill on the ground.

Paynesville District.—A new find was made by Mr. Mitchell at a place situated about seven miles from the Paynesville Siding on the Mt. Magnet-Sandstone railway line. This ground has been taken up as Lease 1196A. A shaft was sunk 29 feet below the natural

surface, and a drive put in North in reef 35 feet when I measured it; since then the drive has been extended several feet. Water at this place has been difficult to get and not very good, and to obtain water on the spot and at the same time cut the reef at a depth, a vertical shaft has been started.

The reef, where worked, will average four feet in width, and the dollied gold reported is 200.54 ounces fine gold.

Two well-known prospectors, Heffernan and Swanson, have been working on ground situated about eight miles South-West of Mitchell's, and obtained excellent prospects, but have not been able to trace the gold to its source.

Between Mitchell's and Heffernan and Swanson's areas some very rich prospects have been found, but the flat country, with its depths of earth covering, makes it difficult to locate any reefs or lodes it may contain.

Youanmi.—Mining at this centre is very quiet at present, but there are signs that a few more miners will be engaged in the near future.

Curran's Find.—The syndicate working the Red, White, and Blue G.M. have fixed up the mill on the mine, and crushed 130 tons for 60.50 ounces fine by amalgamation.

Sandstone.—A fair number of miners working mines for themselves are engaged at this centre, but there is nothing new to record.

Maninga Marley.—The Havilah G.M. has been unwatered with Government assistance, and a parcel of 50 tons milled during December returned 105.7 ounces of gold by amalgamation. This crushing was taken from a drive in which the reef averaged four feet in width, and as it is new ground ahead no one can say what may be developed as the drive is extended.

REPORT OF MR. A. W. WINZAR, INSPECTOR OF MINES,
LEONORA.

I have the honour to submit my Annual Report for 1923 on the East Murchison, Mt. Margaret, and North Coolgardie Goldfields.

The chief events of the year were the restarting of the newly-erected 30-stamp mill on the Sons of Gwalia Mine, which was officially started by the Hon. the Premier who, with the Parliamentary party, visited the Northern fields in October last, and the arrangements made to test the Wiluna lodes by drilling. Should these tests come up to expectations there will be a big inflow of capital to Wiluna, which will benefit the mining industry generally, and railway communication to Wiluna will help to open up centres away from the present terminus of the line. I have little doubt but that the drilling tests will be satisfactory, and look forward with confidence to the future prosperity of the place.

Some sensational reports were published about the values on the Mighty Atom, a property near Laver-ton, acquired under option by the Muturoo Company; the values were found to be in small pipes, and the option has since been abandoned.

A fair amount of attention is being given to these Northern fields by mining investors, and there is likely to be some activity in the near future.

Prospectors have been fairly active during the year, and there are a good number of State-assisted men scattered about the various districts. The season has been unusually dry, which retards the movements of prospectors away from the permanent water supplies.

I have not had an opportunity of visiting the country discovered by the State Prospecting Party East of Laverton, but according to reports some good stone has been opened up but not of large size; the particularly dry season has not helped prospecting in that direction.

The state of the mines generally is good. It is pleasing to note the improvements with regard to ventilation and the suppression of dust, and it will only be a matter of time when the underground conditions will be equally as healthy as the surface; the control of firing time and the abolition of nightshift have been found big factors in keeping mine air fresh and cool.

I am again pleased to report that no fatal accidents have occurred and no prosecutions were necessary for the year.

Mt. Malcolm District.—The output for the district shows a substantial increase owing to the restarting of the Sons of Gwalia. This mine started active mining operations towards the end of the year. A new vertical air compressor has been added to the plant, and additional power machinery is to be put in later on. The 30-stamp mill will crush some 7,000 tons of mine ore per month, and in addition the retreatment of the old dumps will continue.

A few holdings around Leonora are being worked. The State Battery crushed 377 tons for 408 ounces, which is a considerable decrease to the preceding year.

Messrs. Dowson and party worked their lease at *Diorite* continuously, put through 117 tons for 179 ounces, and obtained 15 ounces by dollying; this return is hardly payable considering the hard nature of the country and the smallness of the stone.

The Bannockburn was worked for part of the year, and 46 tons were crushed for 27½ ounces; the owners were not successful in locating any rich patches.

At *Mt. Clifford* no development was done on the Victory; 210 tons of old filling were raised and crushed for a return of .80 ounces. The property changed hands during the year, and the new owners intend to develop the mine and open up the bottom levels. There is a five-stamp mill on the lease, and a cyanide plant is to be erected.

Several prospectors have been working in the country between *Mt. Clifford* and *Wilson's Patch* with very little success.

Nothing has been done at *Wilson's Patch*, and *Darlot* is very quiet; from the *New Discovery* at the latter place 542 tons were crushed for 237 ounces. A few other parcels were crushed for low returns.

Laverton District.—Laverton district shows little difference to the preceding year. The Muturoo Company took an option on the *Mighty Atom* property of W. Allen, but abandoned it later as development work proved that a small pipe of rich ore occurred in a practically buck reef which did not live down. The *King of Creation* was floated and several men employed; a fair amount of development work was done at the 100ft. level, and some nice dish samples were panned off in my presence. The company is not working the mine at present. Very little is doing out *Duketon* way; there are six men on the "Patch" looking for dollying stone and alluvial.

No work has been done underground in the *Lancefield*. A fair return was obtained from cleaning up around the plant, and at present cyaniding is being done; difficulty was experienced with the precipitation owing to foul solutions, but a payable return is reported.

The *Beria Main Reef* did very little work, and crushed only 48 tons for 10½ ounces. A few P.As. were worked around the town of Laverton, but yields were small.

At *Ida H.* Messrs. Taylor and Mengens are working South of the old mine on the *Mohawk*, trying to locate the *Ida reef*. They have found several makes of stone, but so far nothing definite; they crushed 14 tons for 23 ounces, and are doing good prospecting.

At *Burtville* the *Nil Desperandum* showed a big drop in yield from the preceding year, crushing 70 tons for 196 ounces as against 112½ tons for 782 ounces; the stone is patchy and small.

Scott and Saunders are working the "Savage Captain"; they are on a bit of stone and are likely to get a patch of rich ore; one small crushing returned 13½ ounces from 10 tons.

A few men have been prospecting around *Mt. Weld* and adjoining places, but without much success. A few ounces were obtained by dollying from around *Hawk's Nest*, and 29 tons were crushed for 17 ounces.

Options were taken on *Sullivan's* leases at *Jutson's Rocks*, but were abandoned after being tested; values were too low for such isolated places. Several men were employed on *Jones' Concession*, and work was in progress there at the end of the year.

At *Morgans* the *Westralia Mt.* *Morgans Mine* worked all the year and treated 9,930 tons for 3,653 ounces, showing a big increase for the year. There is practically no change in the prospects of the mines.

Mr. Burns had a return of 72 ounces from 19 tons obtained from his P.A.; nothing of importance has been found at the *Margaret*.

Yundamindera.—The *Big Stone* had a good year. In sinking below the 90ft. level a fine ore body was cut, which decreased in going down, though the value remained good. 755 tons were crushed for 770 ounces. This mine is assisted by the Department, and has a nice five-stamp mill, with gas power and cyanide plant, and appears well cared for. Since erecting the mill in 1922 the owner crushed 268 tons for the public, and 1,418 tons for 1,127 ounces from the *Big Stone*; negotiations were in progress at the end of the year for letting the mine on option. Very little other work has been done during the year around *Yundamindera*.

At *Linden* the *Devon Mine* is now the principal producer. Although worked for a considerable number of years it is down only 200 feet, where the level is driven off a winze for 180 feet south and 170 feet north; the chute is almost continuous, and the ore is reported to average three feet, worth an ounce; stopping has been done above this level in addition to pushing on the ends. 698 tons were treated for 605 ounces. A fair amount of water makes, and it is very dense.

The ore is crushed, concentrated, and cyanided. The concentrates have been shipped for treatment, but the manager intends trying cyaniding the raw concentrates. His tests so far have been satisfactory, and a saving in costs shown.

Greenhills.—The syndicate owning this property sunk a new shaft 125 feet deep on the West side North of the old main shaft, and are now crosscutting East to cut the lode below the fault which displaced it in the old workings. The water is easily coped with, and the country, which consists of greenstone schist, is good standing. The mine has a good record, and

should the syndicate succeed in picking up the lode it should again be a good producer.

The Democrat had one crushing for the year, 66 tons returning 221 ounces. The mine has now reached the stage when a lot of exploratory work is necessary before any more stone can be obtained. At present it is being worked.

Nothing is being done on the Bindah, and outside the Devon and Greenhills very little was being done in the way of prospecting at the end of the year.

A fair amount of prospecting was done between Linden and Yundamindera, and also in the country towards Yarri. Two State-assisted prospectors are working on the old Camel back line near the Linden road, and report encouraging prospects.

Lawlers District.—Nothing of importance was found in the Lawlers centre.

The Daisy Queen ceased operations for the time being, and are endeavouring to adjust their financial affairs to again work the mine. Development had reached to an interesting stage when they ceased operations; good values were reported in the winze below the bottom level. They crushed for the year 1,033 tons for 649 ounces by amalgamation.

The Waroonga was worked continuously during the year, practically no development work was done. The bulk of the ore is obtained from the old lodes above No. 4, and a little was obtained below the No. 6. 4,726 tons were crushed for 1,510 ounces.

Lawson and Osborne from the Leviathan had a crushing of 18 tons for 27 ounces; the ore was picked from different shafts about the area, and nothing of importance was opened up.

At *Mt. Sir Samuel* the Vanguard crushed 179 tons for 56 ounces with good values in the sands. This mine has a large lode, which should be of value worked on a large scale. A big tonnage has been crushed in the past and comparatively little work has been done to obtain it.

The Canberra has been equipped with a pumping plant consisting of a lift pump driven by a National 8 h.p. oil engine worked by producer gas generated in a plant made on the lease; the shaft is 60 feet deep, and the quartz varies in size from 6in. to 12in. It is expected to obtain about 40 tons of 3oz. stone from the present workings.

A few other holdings are being worked, and have had small parcels treated.

At *Kathleen Valley* the Yellow Aster crushed 293 tons for 183oz.; not much actual mining was done. The cyanide plant is being put in order, and treatment of the accumulated tailings will be gone on with.

Wiluna District.—Wiluna district remained about the same as the preceding year. The tonnage shows a decrease, but the gold yield increased 455 ounces, the figures being 6,545 tons for 5,848 ounces, showing that a good grade of ore was obtained. Much is expected from this place in the future as the lodes are being tested by the diamond drill, which is working at the time of writing. The proposed railway and influx of capital, with the scientific working and metallurgical treatment of sulphide ore which is known to exist in immense quantities, should make this one of the leading mining centres in the State.

The bulk of the ore treated for the year came from the lodes above water level, and was obtained by tributers from the Violet, Happy Jack, and Moonlight leases.

P.A. 384, owned by J. Gahan, looked very promising, but the crushing turned out very disappoint-

ing, too great a width of lode being taken, it being found that values existed over 4ft. instead of 12ft., which was broken. The lode appears to be a continuation of the Bulletin.

Gayford's P.A., which is part of the old W.A. Mine, returned 49 ounces from 56 tons. A new shaft has been sunk on a quartz reef to 95 feet and driven 40 feet south and 8 feet north; values at present are on the low side.

From the Essex 90 ounces were obtained from 127 tons; this mine should be a good producer in the future. The lode was worked to 70 feet deep, where it was 6ft. wide going underfoot, and assayed 20 dwts.

At the *Diorites* the Brilliant was worked and a little stopping done. 268 tons were carted to the State battery, and gave an assay return of 22 dwts. per ton; about 100 tons are now on the battery site.

From Cale's Find McHugh and Bennett got a crushing from the Cromarty, which returned an assay value of 17 dwts. per ton; this ore was won from 80 feet down, where the lode looks well defined and has a width of 6 feet.

The *Mt. Keith* centre has been neglected during the year, and no one has done any prospecting there.

Niagara District shows no improvement; 250 ounces were obtained in the district. A little alluvial and dollied gold is being obtained at Tampa, where several old dryblowers make a living.

No ore was obtained around *Yerilla* centre. At *Yarri* 507 tons were crushed for 272 ounces, which shows the grade to be comparatively low. The Redbrook had the principal yield, 184 tons returning 154 ounces. From *Eajudina* 174 ounces were obtained from 180 tons, which came from seven holdings. All gold won in the districts came from old workings.

REPORT OF MR. H. P. ROCKET, INSPECTOR OF MINES, SOUTHERN CROSS.

Herewith I present to you my Annual Report for the year ending 31st December, 1923.

Mines Regulation Act.—A few minor breaches of the Act occurred, but as there were not any serious offences it did not appear advisable to prosecute any offenders.

The ventilation of all underground working is good, but owing to various causes it has not yet been possible to completely lay the dust from rock breakers at quarries. The end of the dust nuisance is now in sight, and it is expected that there will be no cause for complaint after the end of the month.

Prospecting.—This year the total fall of rain was normal. Feed for horses and stock has been plentiful, but an unusually large number of rainy days gave a considerably lower average fall per rainy day than is usual, with the result that surface water was scarce; in fact, except for a few favoured places it was absent for the greater part of the year.

This scarcity of surface water adds to the difficulties of the prospector, and restricts the area which he can examine to that in the immediate neighbourhood of permanent waters.

Twenty assisted prospectors, and a large number of others, were at work in my districts, and though several rich "makes" were reported none of the finds were of great importance. The districts worked by prospectors included Ravensthorpe, Kundip, Forretonia, Hatter's Hill, Poulson's, Parker's Range, Nevoria, Marvel Loch, Trafalgar, Southern Cross, Bullfinch, Ennuin, 55-Mile, Marda, Manxman, Wither's

Find, Westonia, Payne's Find, Retaliation, Field's Find, Warriedar, Gnow's Nest, Yalgoo, Rothsay, Gullewa, Carliminda, Noongal, Warda Warra, Yuin, Geraldine, Northampton, Narra Tarra, the Irwin Coal Measures, and Greenbushes.

Mining—Yilgarn Goldfield.—It is pleasing to be able to report a very considerable improvement in the prospects of the industry in the Yilgarn Goldfield for the coming year. The output of gold for the year was 8,420 ounces gold obtained from 7,889 tons of ore.

The yield was due mainly to the increased yield from the Radio Mine at Manxman. Several options of purchase have been taken over the mine, but to date none have been exercised. The 794 tons raised during the year yielded about 3oz. 6dwt. per ton, or in all 2,624 ounces. The output might have been considerably greater had the battery been started earlier in the year.

Messrs. Liddle and Domney's May Queen Mine, one of the Xmas Gift Group, situate near the Marvel Loch road about 14 miles South-East from Southern Cross, has been optioned to a syndicate who propose to erect a battery on the lease at an early date. Although the purchase of the property has not been completed, arrangements have been made by the prospective new owners for the purchase of considerable new plant. The crushing completed lately includes ore mined during the last four months. For various reasons this tonnage is small, but the yield per ton is high, since including gold in the sand and slime the 20 tons crushed will yield more than 100 ounces of fine gold.

But perhaps the best news from the district is that of the re-opening of the Great Victoria Mine at Burbidge. Early in the year a Kalgoorlie syndicate took over the mine from Messrs. Burbidge and McDonald, and immediately commenced remodelling the plant. This work included the repair of the 10-head battery, new mill engine, boilers, a set of agitators, and a Cassell's filter plant of 100 tons a day capacity. The plant is running satisfactorily, and it is expected that the output for 1924 will exceed greatly that for any previous year.

Southern Cross.—Fraser's Central Mine. During the year this, the oldest working mine in the State, was unwatered to the 122 feet level, and the unwatering has been continued to the 180 feet level. It is proposed to take out the water to the 250 feet level, and this work is now in hand. In the early part of the year 294 tons were crushed for 93 ounces.

The Transvaal Mine, which was worked for arsenic ores a few years ago, has been taken up again by its former owners, Messrs. Victor Leggo and Co., and the work of erecting a plant is now in hand. It is proposed to concentrate the ore at the mine and ship the concentrates out of the State for treatment until such time as extensive development has been carried out and the ore reserves calculated to warrant the erection of retorts on the mine or at Fremantle.

An unsuccessful attempt was made to re-open the Mt. Rankin Mine.

Near Kennyville several small shows were worked including the Cornishman and the Leviathan, but the individual yield was small.

The Edna May Battler was worked intermittently by tributers, but very little ore was raised.

The Evelyn, situate about 2½ miles East from the Edna May Battler, produced 640 tons of ore which yielded 182 ounces of gold. In the early part of the year a one-head Nissen Mill was erected and worked satisfactorily. Unfortunately the mine has been idle lately owing, it is said, to dissension between the owners. The ore in the main varies in width between 4 feet and 20 feet with an average in the neighbourhood of 8 feet, and it may be that a little care exercised in the selection of the ore would result in a very much higher grade being produced.

For their own reasons the owners of the May Queen crushed only 24 tons of ore, from which they obtained 180 ounces. In November a Perth syndicate obtained an option of purchase over the mine, and another parcel of 24 tons raised since November was crushed last week for about 100 ounces. It is proposed to erect a 5-head mill at the mine.

The yield of the *Marvel Loch* district is below that of 1922, but lately there has been renewed activity in the region of Donovan's Find as the result of Mr. J. Douglas' discovery of the Salvation Mine (P.A. 1307, G.M.L. 3073), about a mile South of Howlett's Battery. To date the production is 200 ounces obtained from 244 tons of ore. The lode in places is of considerable width. Crosscuts East and West totalling 30 feet are still in lode material, which is very similar to that at the Firelight and Undaunted. The pay ore is being worked at about 4 feet wide.

At about a mile further South the Bohemian produced 280 ounces obtained from 287 tons of ore. Other shows working or being prospected in this district are the Pro Patria, Jacoletti, and some prospecting areas.

Apart from cyaniding tailings very little ore has been raised at Nevoria, only two men being engaged regularly at underground work.

Near the Banker Mine Messrs. Hollow and Heaton, the prospectors of the Banker, and others have done a great deal of prospecting but without success. Messrs. Hatt and party have taken the Banker on tribute, and have obtained 341 ounces to date with good prospects for the future.

The official returns show that at Mr. Patterson's Spring Hill Mine 809 ounces were obtained from 1,692 tons of ore.

Work has gone on steadily in the White Horseshoe, resulting in 448 ounces from 689 tons. An option of purchase has been taken by a Melbourne company.

At *Forrestonia* Mr. William M. Hodges continues to work the Great Southern Mine, his year's work resulting in obtaining 31oz. from 133 tons. A number of applications for Prospecting Areas were made at Ravensthorpe recently as the result of Messrs. Grant's and others good reports of finds at *Bremer Range*, about 60 miles East from Forrestonia. Mr. Grant showed me some hand specimens richly studded with gold, which he said were obtained at *Bremer Range*. He appeared to think there would be something in the nature of a rush to that locality after the next heavy rain. The Great Southern is the battery nearest to Grant's new find, and in addition to keeping the Forrestonia district open may be counted a factor in the development of any mine found at *Bremer Range* in the near future, as the next nearest battery over a practicable route, I am told, is the Flag battery at Kundip.

At *Bullfinch* very little mining was done, but at *Withers' Find* there was some activity in the early months of the year.

The largest producer for the year was the Radio Mine at *Manxman*, the output being 2,624 ounces for about nine months' run with the battery. This return was obtained from only 800 tons of ore. Several options of purchase have been granted, but none have been exercised. With exception of the Radio North, where three men are employed regularly, all the other mines in the district were worked very intermittently. This district should receive a great deal more attention from prospectors than it is doing.

Apart from prospecting to the North and East of *Marau* and along the Southern Cross-Marda Road very little useful work was done in the Mt. Jackson district, though the Butcher Bird mine and battery changed hands several times. It would seem that disagreement between members of the party was largely responsible for the failures.

Several small mines near *Bodallin Soak* were worked, of which the Royal Flush with a yield of 218 ounces from 218 tons was the most successful.

At *Westonia* there was very little mining apart from some tributing on the Edna May Central. Towards the end of the year Mr. G. N. B. Smith took up the Edna May Central and the Myrtle Central leases with the intention of working the "wash." The work of getting the Myrtle battery into going order is now in hand. Granted sufficient capital to provide the necessary plant ready to start the venture should prove profitable. During the year the Edna May Central yielded 481 ounces on treatment of 555 tons.

Total gold yield for Yalgoo Goldfield for 1923 is 8,420 ounces from 7,889 tons.

In the *Phillips River Goldfield* the gold yield for 1923 was 375 ounces from 232 tons as against 686 ounces from 1,125 tons in 1922.

The Hillsborough was the largest producer with 168 ounces, and the Gem next with 145 ounces; Hamerston's (P.A. 184) with 43 ounces from near the old Jim Dunn's Wonder was the only other show whose gold yield reached double figures.

D. Johnston working the Mary Mine about a mile North from the Benson produced the most copper.

The detailed gold and copper yield for the district is as under:—

Mine.	Au. ozs.	Cu. tons.	Ore Tons.
Gem	145.98	1.08	131
Harbour View	9.53	...	20
Hillsborough	168.52	0.54	40
Two Boys	2.51	...	...
Flag	0.89	0.26	14
Hamerston	43.00	...	41
Mary Mine	4.88	6.56	24

When it is remembered that the field has yielded over 8,300 tons of metallic copper, 87,700 ounces of gold, and 15,600 ounces of silver, it seems extraordinary that it is so badly neglected by prospectors and mining men; for neglected it certainly is, there being not more than 20 men employed underground.

The largest producer in the *Yalgoo Goldfield* is the Gnow's Nest Mine. In the early part of the year it became necessary to increase the capacity of the pumping plant so as to cope with an additional flow of water at the bottom level. When this was done and the lode cut, it was found that the size and value

of the lode there were equal to that at the level above, and the owners continue to mine ore profitably.

The principal producers in the Yalgoo Goldfield are:—

	Tons.	Fine ozs.
Brown's Reward	763.75	440.23
Haynes' Gold Mine	32	23.84
Gnow's Nest G.M., Ltd.	3,073	2,678.78
Blue Bell	175	206.89
Lake View	276	348.88
Orchid	162.50	163.21
Sweet William	120	150.57
Revival	430	192.15
Warda Central	90.75	26.78
Highland Chief	130.50	44.49
Bullrush Gold Estates, N.L.	4,733	2,210.56

The production for the field for the year 1923 was 11,017.10 tons for 7,688.85 fine ounces.

Up to the end of August *Payne's Find* had produced 600 tons of ore of about an ounce grade. The largest yield was obtained from Genge's Lake View, which had crushed 275 tons of ore of over ounce grade. In all there are some 12 or 14 parties of two to four men each or about 40 men all told, in this locality.

At *Field's Find* the only yield of importance came from Brown's Reward. This mine is now down to about 120 feet deep.

At the end of August the *Warriedar* battery had crushed 1,028 tons for the year, of which 500 tons were supplied by the Brown's Reward at *Field's Find*. The remaining 500 tons crushed came from about a dozen crushings raised at the *Porcupine*, *Black Jack*, *Highland Chief*, and other shows.

The *Highland Chief* was worked for some months under an option of purchase, but the purchase was not completed.

At *Rothsay* there are three parties at work, but their returns are not available.

Mr. Jenkins is still working his show at *Gullewa*.

At *Meiville* the erection of a 5-head battery on the *Revival* was completed and working satisfactorily. Mr. Neville, the owner, proposed to crush for the dozen or so prospectors in the neighbourhood in addition to his own ore.

In the latter part of 1922 a find at *Warda Warra* caused considerable stir in mining circles, but, like the *Retaliation*, the place was deserted in the early part of 1923.

At the end of August the *Royal Standard Mine* at *Yuin* closed down. A month or two later an attempt was made to work it on tribute, but this too proved a failure.

Two applications for Reward Claims were made for alleged new finds: one was situate about 17 miles East from *Dalwallinu*, and the other about 20 miles East from *Narrembeen*. Both of the applications would seem to have been made by inexperienced men, as no gold could be found at either place.

In the *Northampton District* the rise in the prices paid for lead over those paid last year accounts for the very considerable increase in the value of the output from this field.

Together in 1922 five mines raised 29,600 tons of ore containing 3,039 tons of lead which realised

£51,700. In 1923 there were only four producing mines, with output as under:—

Mine.	Tons Ore.	Tons Lead.	Valued.
Surprise ...	18,215	1,921·81	£ 51,341
Narra Tarra ...	838	48·00	1,330
Wheal Ellen ...	2,397	172·36	4,153
Wheal Ena ...	70	10·71	385
Total ...	21,520	2,152·88	57,213

In addition to lead ore the Narra Tarra yielded 9,411 tons of copper ore containing 878 tons of copper, valued at £60,000. Considerable repairing and remodelling of plant has been done on these mines, and it is expected the value of the output for 1924 will exceed that for 1923.

At *Greenbushes* only five dredging claims were working regularly during the year. This was due, I am informed, in part to a scarcity of water in the early part of the year, and later to the difficulty of getting a new plant into working order before the next dry season, and to a certain distrust of the market. The find on Willow Creek near the Bridgetown-Nannup Road reported last year has not been developed into one of any importance.

A little development was done on the tin-bearing lodes of the Kapanga Mine, but no ore was treated. The total output for the year was 26 tons, to which result five dredging claims contributed, as follows:—

	Tons.
Dredging Claim No. 56 ...	15·25
Dredging Claim No. 64 ...	5·10
Scotia and Gencairn ...	4·50
Champion ...	0·62
Little Wender ...	1·00
Total ...	26·47

Oil.—In September it was reported that a flow of mineral oil had been found near Lake Eva, about 16 miles North of Karalee. This report caused much excitement, but after a considerable sum of money had been spent in testing and reporting on the alleged find, it was proved beyond doubt that the oil was not a natural product of the locality.

The building stone, road metal, and shale quarries in the *Swan Mineral Field* were regularly inspected, as were those at Dennybrook also.

REPORT OF MR. JAS. MCVEE, INSPECTOR OF MINES, COLLIE.

I beg to submit my Annual Report on the Collie Coal Field during the year 1923.

Five collieries were producing coal during the year, viz.:—Proprietary, Co-operative, Westralian, Cardiff, and Premier.

The Griffin Syndicate, who have coal leases on the field, drove a tunnel on to an 8ft. 3in. seam of coal of good quality, but at the present time nothing is being done there.

The total amount of coal produced and sold during the year amounted to 420,893·98 tons valued at £369,144·81.

The average number of men employed was 548 underground and 167 on surface, making a total of 715.

The amount of coal produced in 1922 was 438,442·78 valued at £381,549·99, and the number of men employed was 756.

This shows a decrease of 17,508·80 tons valued at £12,405·19, and 41 men less than in 1922.

The following table shows the amount of coal produced at each colliery during years 1922 and 1923:—

Colliery.	Output in tons.	Output in tons.	Employees.			
			1922.		1923.	
			Surface.	Under-ground.	Surface.	Under-ground.
Proprietary ...	126,290·59	127,039·76	45	150	40	140
Co-operative ...	106,613·36	104,016·05	42	125	45	126
Westralian ...	79,113·93	82,639·34	38	126	30	120
Cardiff ...	82,112·91	60,695·36	30	130	27	106
Premier ...	44,311·99	46,503·47	20	50	25	56
Totals ...	438,442·78	420,893·98	175	581	167	548

The Government Railways took a total of 246,763 tons 4 cwt. 1 qr., as follows:—

Month—1923.	Large Coal.	Nut Coal.	Small Coal.
	tons cwt. qrs.	tons cwt. qrs.	tons cwt. qrs.
January ...	17,963 12 2	246 12 2	...
February ...	20,575 13 0	609 1 2	...
March ...	24,948 13 3	763 3 3	24 18 0
April ...	20,249 15 0	615 8 2	30 8 0
May ...	17,128 13 2	611 19 2	8 14 3
June ...	20,646 17 2	567 8 3	46 7 2
July ...	23,109 0 1	873 2 0	37 3 1
August ...	18,289 9 1	631 15 3	33 15 2
September ...	17,044 5 2	612 10 3	8 14 3
October ...	21,984 14 2	667 15 0	24 14 0
November ...	17,025 19 2	604 12 2	17 18 3
December ...	20,188 6 2	554 1 0	17 17 2
Totals ...	239,155 0 3	7,357 11 2	250 12 0

Strikes.—Through misunderstandings by both parties Cardiff Colliery was thrown idle for three days, but the matter in dispute was easily settled.

This was the only stoppage during the year.

All disputes which have arisen have been settled by local arbitration without the men ceasing work, the number of disputes being nearly 50, and it is to the credit of both parties that decisions are abided by in every instance.

General Progress.—The trade in the industry has not warranted the special development of the mines, as any of the collieries could easily double their output if required.

A serious fire occurred in the Co-operative Colliery on 27th September, 1923, in No. 31 bord, No. 3 section, West side. The fire was discovered by the examining deputy at 6 a.m., who immediately proceeded to the surface and reported same to the manager, Mr. O. R. Howie. No time was lost in combating the fire, and by midnight they had it under control. Valuable assistance was given by the managers from the Proprietary and Westralian Collieries, and also the members of the local fire brigade.

REPORT OF MR. R. C. WILSON, ASSISTANT STATE
MINING ENGINEER.

I beg to submit my Report for the year ended 31st December, 1923.

My duties for the year consisted of the examination of the most important applications for assistance under the Mining Development Act, the inspection of mineral deposits, and the investigation of reported occurrence of indications of mineral oil. In addition I represented the Mines Department on the Board of Control of the Surprise Lead Mine in the Northampton District, in which this Department is largely interested, and assisted in the general work of the State Mining Engineer's office.

Brief details of the principal inspections made are as follows:—

The limestone deposits in the vicinity of Denmark were visited in February in connection with a proposal to establish the paper pulp industry there. Copy of report attached. (Appendix No. 16.)

Fenton's Oil Area, which is also in the Denmark district, was visited at the same time, and a report thereon submitted. (Appendix No. 5.)

The Golden Promise G.M., near Bulla Bulling, was visited in March, and the shoot of ore going underfoot sampled. (Appendix No. 6.)

The Menzies Consolidated G.M. was inspected and reported upon during the same month in connection with an application for a loan for development purposes. Assistance was recommended and granted.

The reported presence of oil in the swamps near Rockingham was investigated and reported upon. (Appendix No. 7.)

Reported oil indications at Jandakot were investigated in May. I observed only the usual occurrence found on swampy ground, and no indication of the presence of petroleum. (Appendix No. 8.)

The Surprise Lead Mine was visited in June, and the general position was carefully gone into: a report was submitted for the information of the Hon. the Minister.

In July I attended conferences in Perth and Kalgoorlie with representatives of the Chamber of Mines and the Hon. the Minister, in connection with an application for a reduced price of Mundaring water for the mines.

A graphite deposit at Martigallup was visited in the same month and reported upon. (Appendix No. 9.)

The Wilga Coalfield was visited in August. Recent boring and development results will be found in Appendix No. 14.

The Kapanga Tin Mine at Greenbushes was visited in August, and a small loan for development purposes recommended.

In September I accompanied Messrs. Cheyne and Paton to Cottesloe and North Beach and inspected some supposed indications of mineral oil. No evidence of its presence was shown me.

The Red, White, and Blue Mine at Curran's Find was visited and sampled in September. (Appendix No. 15.)

A reported oil seepage at Baker's Creek was visited in September, which turned out to be only an iridescent film of oxide of iron on the water.

An oil seepage reported by Robert Rothkehl was visited on 9th October, and again on 24th October. I found oil in and about a borehole. As, however, it consisted of manufactured products, and occurred in granite country, the matter was put in the hands of the C.I.D. Subsequent investigations proved the existence of a tank under Rothkehl's tent containing oil and connected by means of a pipe to the bore. As a result a warrant was obtained for the arrest of Rothkehl and Thompson on a charge of conspiracy to defraud. The former could not be found, but the latter was convicted, and is at present serving a term of imprisonment. (For report see Appendix No. 10.)

A copper deposit at Mt. Agnes, which is about 120 miles inland from Roebourne, was inspected in November to see if assistance could be recommended to erect a treatment plant of the type patented by the Mineral Recovery Company. The amount of copper ore in sight was insufficient to warrant the erection of a plant. (Appendix No. 11.)

Mr. A. Neave's oil prospecting area was visited in November, and a report submitted. (Appendix No. 12.)

Brown's Reward G.M. was inspected in December and reported upon. (Appendix No. 13.)

With regard to the Surprise Lead Mine, I am pleased to be able to report that I have worked in complete agreement with the syndicate's representative on the Board of Control, and we are both satisfied with the year's operations. A new gas engine and compressor are being installed, and are being paid for out of profits. These additions to the plant will increase its efficiency, and it is anticipated that during the ensuing year working costs will be reduced and profits increased.

ACCIDENTS.

The following table gives the number of fatal accidents reported to this office as having occurred on mines, whether to persons employed on the mines or not, for the last five years:—

	1919.	1920.	1921.	1922.	1923.
Total fatal accidents on Mines reported	27	25	18	10	11
Less accidents to persons not engaged in mining, deaths in mines due to natural causes, and accidents to persons which were not due to their occupation as miners	1	4	1	1	1
Fatal accidents to men engaged in mining	26	21	17	9	10
Total men engaged in mining (average)	8,346	8,496	7,084	6,776	6,497
Accident death rate per 1,000 men engaged in mining	3.12	2.47	2.40	1.33	1.54
Total fatal accidents on quarries reported ... ..	...	...	1	1	...
Total men engaged in quarrying	245	195	203	207	326
Accident death rate per 1,000 men engaged in quarrying ... ..	...	...	4.93	3.75	...

In tables 26, 27, 28, and 29 the mining accidents for the year 1923 are classified, the previous year's figures being given for comparison, and are forwarded herewith for inclusion in your annual report, together with diagram of the fatal accidents year by year, and their causes (see report of the Under Secretary for Mines).

Table 26 classifies the accidents according to causes. In 1923 11 persons were killed and 307 persons were seriously injured, as compared with 10 persons killed and 336 seriously injured during the previous year. The diagram shows graphically the totals of fatal accidents year by year since 1891.

The death rate per 1,000 persons employed on surface and underground in gold, coal, and other mines, is shown in Table 27, the general average rate for 1923 being 1.54 as against 1.33 for 1922. The rates per 1,000 are based upon the figures in Table No. 21 (Annual Report, Under Secretary for Mines, 1923), which shows a grand total for 1923 of 6,497 men employed at mines above and under ground, inclusive of alluvial workers.

Table 28 gives the average number of men employed at quarries and the death rate per 1,000 persons employed thereon. The total number of men employed during 1923 was 326 as against 267 for 1922, the death rate for 1923 being nil as against 3.75 for 1922.

Table 29 summarises all the fatal accidents for 1923 above and below ground in gold mines only, with rates per 1,000 men employed and per 1,000 tons of ore raised, similar figures for 1922 being given for comparison. The number of men on which these rates are based is taken from Table 23 (Annual Report, Under Secretary for Mines, 1923), and does not include alluvial workers.

The following table comprises all the fatal and serious accidents reported to this office which occurred during 1923; the accidents are classified according to the gold or mineral field in which they happened, and also as to causes, the totals from each cause for 1922 being shown for comparison.

	Explosives.		Falls of Ground.		In Shafts.		Miscellaneous Under-ground.		Surface.		Machinery.		Total.	
	F.	S.	F.	S.	F.	S.	F.	S.	F.	S.	F.	S.	F.	S.
1.—East Coolgardie	3	3	15	1	3*	3*	108	...	60	...	9	7	198
2.—Mt. Margaret	2	...	15	...	2	...	...	19
3.—Murchison	1	3	...	6	...	1	...	...	11
4.—East Murchison	2	...	1	...	...	1	1	...	...	1	4
5.—Coolgardie	1	...	...	1
6.—Yilgarn	1	...	...	...	...	...	...	1
7.—N. Coolgardie	2	...	...	...	...	...	...	2
8.—N.E. Coolgardie
9.—Broad Arrow...
10.—Dundas	1	...	...	...	...	...	...	...	1	...	2
11.—Pilbara	1	...	1	...	...	...	...	...	2
12.—Peak Hill
13.—Yalgoo	1	...	...	1	...	...	...	1	...	...	...	2	1
14.—Phillips River
15.—Collie	1	...	15	...	...	41	...	5	...	...	...	...	62
16.—Greenbushes
17.—Northampton	1	1	...	...	1	...	1	...	1	...	1	4
18.—W. Pilbara
19.—Swan
20.—Ashburton
21.—Roelands
22.—Kendenup
23.—State generally
Total for 1923	5	4	34	2	6	3	159	2	88	...	15	11	307
Total for 1922	2	6	41	1	13	2	199	2	75	...	6	11	336

* Includes one accident, not a "True Mining" accident.

FATAL ACCIDENTS.

The following are brief particulars of each fatal accident reported to this Department for the year 1923:—

Falls of ground.

At the Great Boulder Proprietary Gold Mine, East Coolgardie Goldfield, two men were examining the sides and back of a stope which had been fired out by the previous shift when about a ton of hard schist fell, killing one of the men and slightly injuring the other. The Coroner's jury returned a verdict of death from shock caused through injuries received from a fall of earth. (85/24.)

A man was killed at the Great Boulder Proprietary Gold Mine, East Coolgardie Goldfield, by a heavy fall of ground caused by a soapy head which was not discernible before the fall. Prior to the accident the stope had been fired, and deceased and his mates were removing the fallen ore when the ground suddenly collapsed, killing one and slightly injuring another man. The Coroner's jury returned a verdict of accidental death. (263/23.)

A fatal accident occurred at the Great Boulder Proprietary Gold Mine, East Coolgardie Goldfield, through a small piece of loose rock falling which had been overlooked when cleaning down the back. Deceased and his mate were experienced miners, and appear to have satisfied themselves that the ground was safe to work under. The Coroner's jury gave a verdict of death from injuries received from a fall of stone. (350/23.)

A very heavy fall of ground occurred at the Narra Tarra Lead Mine, Northampton Mineral Field, whereby one man met his death. At the time of the accident deceased was hand-drilling a side hole in a projecting part of the hanging wall with the object of widening the stope, when a large piece of the wall fell on him. All reasonable precautions appear to have been taken for safety before the accident. A verdict of accidental death, with no blame attributable to anyone, was given by the Coroner's jury. (495/23.)

Surface.

In the East Murchison Goldfield a man was working alone in an open cut of an abandoned mine (the Barrambie Ranges Gold Mine), when he met his death through some large stones falling on him and pinning him to the ground; when found life was extinct. The Coroner's jury returned a verdict of accidental death, no blame being attributable to any person. (1496/23.)

At the Royal Standard Gold Mine, Yalgoo Goldfield, a man riding on a skip gave the wrong signal to the engine-driver, and as the skip failed to stop at the surface deceased jumped off it and sustained fatal injuries. A notice was posted close to the skip forbidding the practice of riding on skips; deceased had also been verbally instructed not to do so. (694/23.)

In Shafts.

At the Golden Horseshoe Gold Mine, East Coolgardie Goldfield, a man was riding in a gig when it hung up and fell down the shaft. As there was no witness of the accident the cause can only be surmised, but it is very probable that when the gig hung up deceased was jerked off it and thrown against the shaft timbers and killed. The Coroner's jury brought in a verdict that deceased met his death while riding in a gig; the jury were unable to arrive at a definite conclusion as to the cause of death. (521/23.)

An engine-driver on the Royal Standard Gold Mine, Yalgoo Goldfield, received a signal to hoist, and while doing so the skip left the line. On investigation the skip was found turned upside down, and the body of its late occupant was recovered from the water at the bottom of the shaft. The Coroner's jury returned a verdict of death from accident through the overturning of a skip on which deceased was riding; no blame being attachable to anyone. (544/23.)

Miscellaneous Underground.

A man lost his life through falling down an open cut on Hannan's Star Gold Mine, East Coolgardie Goldfield. On the 28th September, 1923, deceased informed a hotel-keeper that he was going to investigate a part of the mine with the object of taking a tribute on it. He was not seen again till the finding of his body at the bottom of a stope on the 9th October, 1923. The Coroner's jury found that deceased came by his death on or about the 28th September through falling down open cut while engaged in fossicking, and that there was no blame attachable to anybody. (1612/23.)

At the Ivanhoe Gold Mine, East Coolgardie Goldfield, a man was killed through falling down an ore pass which had been left open. The accident would appear to be the result of forgetfulness of deceased, as he had been warned about the open pass only a few seconds before his death: the pass was lighted. The Coroner's jury found that deceased came to his death at the 700ft. level by falling down a pass left open to 800ft. level, and that better lighting should be provided when using ore passes. (286/23.)

OTHER ACCIDENTS.

The following fatal accident was reported but not classified as a "true mining" accident.

A man was descending a winze at the Lake View and Star Gold Mine, East Coolgardie Goldfield, when he suddenly collapsed and died from heart failure. (28/23.)

SERIOUS ACCIDENTS.

All accidents which incapacitate the sufferer from carrying out his usual work in or about a mine for 14 days or more are classified as "serious."

198 of the 305 accidents during 1923 occurred in the East Coolgardie Goldfield, but only 20 cases were breakages of the larger bones, permanent injury to limbs, or injuries likely to have lasting disabling effects. The balance of injuries were of a less serious nature, such as bruises, cuts, strains, scalds, poisoned cuts, smaller dislocations, wrenches, jars, etc., but of a sufficiently serious nature to cause the injured person to be absent from his employment for 14 days or more.

Explosions and Explosives.

Only two accidents were reported under the above classification during 1923. A man was holding a plug of powder in his hand while lighting a fuse when the powder ignited, and an explosion occurred; another man received very serious injuries from a misfire while sinking a shaft.

Falls of Ground.

34 accidents were due to falling ground. In 4 cases the injuries were sustained while men were engaged in the dangerous but necessary work of pulling down loose ground after firing. In the remaining

30 cases the injuries were due to ground falling on men, or their being struck by falling pieces of stone or coal in the workings of the mines.

In Shafts.

Six accidents were reported during 1923 as having occurred in shafts. Three men were struck by falling stones; one fell from a ladder; one received injury through striking his arm against the shaft timbers, and another man injured his arm through it projecting from the cage he was riding in.

Miscellaneous Underground.

159 serious accidents were classified under above heading during 1923.

In 45 cases the injuries were sustained while handling and loading trucks and skips, through fingers and bodies being jammed against chutes and other trucks, toes and feet run over, bodies struck by upsetting of trucks, men slipping and straining themselves while trucking, or lifting derailed trucks or material into trucks, and so on, the injuries being mostly wrenches, sprains, bruises, jars, fractures of fingers and toes, and cuts.

In 31 cases the injuries were due to falling and rolling loose rocks and stones, such as runs of ore and mullock, while shovelling, or stones running down rills and ore chutes, and 10 men received severe cuts and bruises while handling sharp stones; 10 men were injured handling rock drills, coal cutting machines, and parts of same. Other falls in the workings from stages and ladders, in rills, passes, and so on caused injury to 19 persons, and 16 were hurt by falling tools and pieces of machinery. Flying splinters of stone and steel were responsible for 8 men being injured, and 9 were hurt while handling timber. The remaining 11 cases were due to various accidental causes, jarring of hands and feet, blows from tools, strains, poisoned cuts, and so on.

Surface (including Machinery).

103 persons were seriously injured while working on the surface; 4 men were burnt in various ways; 14 sustained injuries from falls in the course of their work; 11 were hurt by trucks and skips, being jammed or struck by them, by them capsizing, or by men sustaining strains while working them. Flying splinters injured 4 men; falls of timber and pieces of machinery accounted for 27 cases of injury; 21 cases were caused by machinery in motion, 6 of these being caused by handling belts in motion; 5 men were hurt by being struck by tools they were using falling or slipping. Other causes of 17 accidents were strains and sprains from heavy weights falling on them, or from their lifting heavy weights, jarred and jammed hands and feet, poisoned cuts, and so on.

WINDING MACHINERY ACCIDENTS.

(Without serious injury to persons.)

During 1923 six accidents were reported as occurring to winding machinery; brief particulars are as follows:—

A baling tank full of water became detached from a winding rope and fell down the main shaft of the Fenian Gold Mine, causing slight injury to the shaft and destruction of the tank. (1386/23.)

At the Ingliston Consols an engine-driver was engaged in bailing operations when a cage which was acting as a balance jammed in the shaft, causing the rope to become detached, and the cage fell down the

shaft. The safety hook was sheared, slight damage done to the shaft, and the cage damaged beyond repair. (1387/23.)

An engine-driver overwound the north eage at the Oroya Links Gold Mine, but no damage resulted. (46/23.)

Two accidents occurred at the Ivanhoe Gold Mine to cages; in the first case a cage hung up through catching on a stone causing the cage to become jammed at 2,120ft. level, but no damage resulted. In the second case 30ft. of rope had to be cut off owing to the cage gripping the runners, and causing a kink in the rope. (46/23.)

While hauling dirt at the main shaft of the Golden Horseshoe Gold Mine the drum shaft on the engine fractured. The break was evidently owing to a latent flaw in the shaft which increased gradually during a long period, but could not be detected owing to its position. (333/23.)

PROSECUTIONS FOR BREACHES OF THE MINES REGULATION ACTS AND REGULATIONS.

No person was proceeded against during 1923 for contravention of the Act or Regulations.

EXEMPTIONS FROM SECTION 31 SUBSECTION 4 OF THE MINES REGULATION ACT, 1906.

Thirteen exemption permits were issued during the year, nine being for mines in the East Coolgardie Goldfield; one in the Dundas Goldfield; two in the North Coolgardie Goldfield; and one in the Yilgarn Goldfield.

All applicants for these permits were first examined on the particular machinery to which the exemption applied and satisfied the Inspectors of Mines as to their capability of handling it, and that it was not reasonably practicable to insist on employment of a certificated driver.

SUNDAY LABOUR ON MINES.

No permits to work on Sundays were issued during 1923.

AMENDMENTS AND ADDITIONS DURING 1923 TO THE REGULATIONS UNDER THE MINES REGULATION ACT, 1906, THE MINES REGULATION AMENDMENT ACT, 1915, THE COAL MINES REGULATION ACT, 1902 AND 1915, AND THE MINING DEVELOPMENT ACT, 1902.

The Mines Regulation Act, 1906.—Amendment of Regulation 8 by addition of Sections 7 and 8 to the prescribed Code of Signals. (Gazetted 6-7-23.)

The Coal Mines Regulation Act, 1902.—Amendment of Regulation 24 relating to Fees to be paid to Members of Trust or Accident Committees. (Gazetted 8-6-23.)

Amendment of Regulation 24 under Part I: Accident Relief Fund, by insertion before the word "Committee" in last line, the words "Trust or." (Gazetted 29-6-23.)

The Mining Development Act, 1902.—Extension of Operation of Regulations, published in *Government Gazette*, 25th August, 1911, relative to subsidies on production of merchantable mica and manufactured mica goods for further term of 12 months from 1st January, 1923. (Gazetted 31-8-23.)

ADVANCES ON ORES.

The following table shows the minerals on which advances were made to owners of ores suitable for shipment outside the State to enable them to carry on their operations.

ADVANCES ON ORES.

STATEMENT OF TRANSACTIONS FOR YEAR 1923.

Miscellaneous Minerals.

Mineral.	File.	Tonnage.	Amount Advanced		Expenses in Shipping.		Balance of proceeds remitted to Owners.		Total Amount realised during year.		Remarks.
			£	s. d.	£	s. d.	£	s. d.	£	s. d.	
Lead (concentrates)	1034/23	2974.55	38,050	0 0	...	...	...	...	39,952	17 2*	
Asbestos	1916/22	21.00	1,000	0 0†	...	...	...	...	861	15 7	Further proceeds to come.
Do.	2050/22	21.00	1,050	0 0†	...	...	...	...	812	12 3	do.
Do.	2254/22	24.00	1,200	0 0†	...	...	...	...	221	14 6	do.
Do.	81/23	13.40	670	0 0	...	...	...	...	40	9 4	do.
Do.	146/23	8.75	437	0 0	...	...	...	...	258	13 7	do.
Do.	402/23	12.00	600	0 0	...	...	...	...	...	...	Proceeds not to hand.
Do.	99/23	3.425	68	0 0	19	17 2	...	...	2	10 0	Further proceeds to come.
Do.	742/23	5.05	252	10 0	4	5 8	...	...	...	...	Proceeds not to hand.
Do.	856/23	3.15	250	0 0	4	5 8	...	...	...	...	do.
Do.	1103/23	3.25	150	0 0	3	9 4	...	...	...	...	do.
Do.	1098/23	2.50	75	0 0	...	...	...	...	...	...	do.
Do.	1216/23	.70	...	...	1	14 6	...	...	...	...	do.
Do.	1308/23	2.20	109	0 0	...	...	...	...	...	...	do.
Do.	1537/23	5.125	245	0 0	...	...	...	...	...	...	do.
Do.	1764/23	4.925	239	0 0	...	...	...	...	...	...	do.
Manganese	392/23	12.00	96	0 0	2	16 1	52	6 10	151	2 11	
Do.	1303/23	5.00	40	0 0	...	...	...	...	...	...	Proceeds not to hand.
Do.	1564/23	51.20	409	12 0	...	...	...	...	...	...	do.
Copper Ore	1896/22	7.40	50	0 0	2	1 0	...	...	...	...	do.
Do.	1871/23	300.00	2,271	0 0†	380	16 4	...	...	...	...	do.
Do.	471/16	4.80	...	...	4	8 10	...	...	...	...	do.
Tantalite	736/23	.048	4	1 4	...	...	...	...	...	...	do.

* Includes recoup of advances made during 1922.

† Advance made in 1922.

‡ Includes

£2,050 advanced in previous years.

LOANS AND SUBSIDIES UNDER THE MINING DEVELOPMENT ACT, 1902, AND FROM THE MINING DEVELOPMENT VOTE.

Dealing with these cases has taken up a great deal of my time and that of the Assistant State Mining Engineer and the Inspectors of Mines. All applications have to be carefully looked into before loans or subsidies can be recommended. The transactions for the year are tabulated in Appendix No. 1.

Field Work.—The report of Mr. R. C. Wilson, B.E., Assistant State Mining Engineer, above quoted gives particulars of the various mines examined by him, and reports on many of the more important are given in the appendices to this report.

As has become unavoidable of late years from constant pressure of administrative office work, I have not been able to do much field work personally during the year. A visit was made in January and February to the new gold finds by the State Prospecting Party at Jutson's Rocks and Lang's Rocks near Mt. Shenton, a report on which was published in the daily newspapers on my return to Perth, and is now herewith as Appendix No. 2, together with Inspector Gourley's report (Appendix No. 3). Returning from Mt. Shenton to Kalgoorlie by motor car occasion was taken to notice the condition of the various mining centres passed through, Laverton, Mt. Morgans, Murrin Murrin, Malcolm, Kookynie, Niagara, Menzies, Comet Vale, and Broad Arrow, all of which were in a most depressed condition. From Kalgoorlie I went to the new discovery at Mt. Juglah, which seemed promising, but has since been abandoned by the option holders, and also visited the Griffiths G.M. at Coolgardie. (Appendix No. 4.)

In July a visit was made to the Collie Coalfield to a conference on amendments of the Coal Mines

Regulation Act, and in September I went to Kalgoorlie to meet Dr. Watkins-Pitchford of South Africa and Dr. R. R. Sayers of the United States Mining Bureau in connection with the question of dust prevention in mines and measures for prevention of Miner's Phthisis.

Experimental Metallurgical Work.—Much attention has been given during the year to arranging for Research work at the Government Analyst's Laboratory and the Kalgoorlie School of Mines Experimental plant on the Copper Separation Company's proposed process, and on flotation treatment of gold-bearing sulphide ores. Interesting and valuable results have been obtained which will be made available for publication when sufficiently worked out. The Copper Separation process seems likely to be capable of development into an important new departure in the hydro-metallurgy of copper, and may possibly be applied to treatment of refractory gold ores by mixing them with ores of copper and recovering the values in both by the process, using copper to collect gold and silver in a floated slime product.

The flotation method of concentration of sulphides and gold from crushed auriferous ores has given extremely promising experimental results, pointing to a great probability that this process will come into very general use in gold ore treatment, as a very important improvement on present-day practice. The experiments are being continued, and results will doubtless be published when the time is ripe to do so.

I have, etc.,

A. MONTGOMERY,

State Mining Engineer.

APPENDIX No. 1.

Summary of Expenditure from Mines Development Vote from 1st January to 31st December, 1923.

<i>Advances in aid of Mining Work and Equipment—</i>	Amount.		<i>Boring—</i>	Amount.	
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Golden Mile Ore Channel Extended, Limited, Kalgoorlie	747	9 3	Boring for Coal, Wilga	...	167 2 6
F. Sonnenschein, Sandstone	169	13 3	Purchase of a Calyx Boring Plant	...	518 6 7
Pilgrim's Rest, G.M., West Pilbara	3	12 6	Boring for Oil, Lake Eva	...	73 11 3
Polson Bros., Parker's Range	0	10 0	<i>Providing Transport and Equipment for Prospectors—</i>		
Good Luck G.M., Roebourne	5	14 6	Prospecting, etc.	4,801	15 4
Faraday & Tasker, Southern Cross	28	15 0	State Prospecting Party, No. 1	93	9 3
Stevens & Party "Red, White, and Blue" G.M., Youanmi	675	16 10	State Prospecting Party, No. 2	720	14 7
Parkinson & Dunn, Ravens-thorpe	50	0 0	State Prospecting Party, No. 3	426	16 0
Ives Reward G.M., N.L., St. Ives	712	2 6	State Prospecting Party, No. 4	263	6 7
E. B. Laver, Kalgoorlie	174	12 3			6,306 1 9
Green Hills G.M. Co., N.L., Linden	117	17 6	<i>Miscellaneous Expenditure—</i>		
Yews, Bennetts & Carlisle, Kalgoorlie	150	0 0	Investigations, Mineral Industry	88	8 2
E. Griffiths, Coolgardie	850	0 0	Maintenance of Securities	47	1 6
F. G. Greenhill, St. Ives	10	9 3	Preliminary Investigations		
H. H. Bean, St. Ives	70	5 0	Sampling Mines	546	11 7
C. Sparks, Coolgardie	99	9 10	Payment to Dept. Works, Water for Lloyd George Gold Mine	112	18 11
Jones & Party, "Butcher Bird" G.M., Southern Cross	12	0 3	Amount required for Advances on Ores other than State Smelters	6,000	0 0
Golden Hope G.M., N.L., Kalgoorlie	2,000	0 0	Purchase of Specimens for Loan to British Empire Exhibition	357	10 7
C. R. Prosser, Coolgardie	150	10 0	Amount required to adjust other Ores Advances Suspense Account	35	3 7
Johnston & Gretchen, Northampton	128	6 4	Expenses in connection with obtaining samples of Ironstone from Yampi Sound for British Empire Exhibition	114	6 6
Fliegeltaub & Manning, Coolgardie	49	17 6			7,302 0 10
Wilga Coal Prospecting Co., Ltd., Wilga	582	9 6	<i>Water Supplies—</i>		
D. J. McManus, Kalgoorlie	68	8 0	<i>Mt. Monger Water Supply—</i>		
W. M. Hodges & Party, Forresteria	676	19 8	Construction of Water Supply Battery	73	3 8
Maher & Party, Comet Vale	100	0 0	Domestic and Boiler Water	38	19 11
C. J. Peterzen, Leonora	20	0 0	<i>St. Ives Water Supply—</i>		
M'Auley & Party, Canegrass	174	0 8	Construction of a covered tank	3,516	18 1
Mooney & Osborn, Marvel Loch	55	17 6	<i>Tuckanarra Water Supply</i>	22	13 6
Triffett & Winter, Tuckabianna	85	7 6	<i>Warda Warda Water Supply</i>	157	4 11
A. B. Harris, Broad Arrow	143	18 1	<i>Boring, Clearing Tracks, and Sinking for Water, Jutson's Find (Cosmo-Newbery)</i>	1,739	13 8
O'Connor & Hayes, Northampton	20,000	0 0	<i>Gnow's Nest Water Supply</i>	178	8 10
Griffin Syndicate, Collie	247	15 0			5,727 2 7
C. R. Prosser, Coolgardie	93	15 5	<i>Rebates to Prospectors crushing at War Rates</i>	...	838 5 3
Inglinton Junction G.M. Co., N.L., Meekatharra	98	7 6	<i>Subsidies Development Work—</i>		
W. Tasker, Southern Cross	891	6 0	E. A. Hoffmann, Norseman	...	17 2 6
Henderson & Balmer, Menzies	2	6 7	<i>Subsidies to Batteries Crushing for the Public—</i>		
J. Dwyer, Laverton	0	15 0	W. H. Scott, 90 tons, Kundip	9	0 0
Scott & Saunders, Laverton	50	0 0	Branson Bros. & Co., 50 tons, Lawlers	6	5 0
Bastian, Riddle & Bastian, Day Dawn	798	15 0	G. H. Howlett, 244 tons, Marvel Loch	18	6 0
Snell & Party, Marble Bar	171	0 0	W. R. Grant, 375 tons, Westonia	56	5 0
S. C. Lang, Southern Cross	68	5 0	S. C. Lang, 149 tons, Bullfinch	18	12 6
Redemption G.M. Co., N.L., Coolgardie	350	0 0	W. M. Hodges, 65 tons, Forresteria	13	0 0
Menzies Consolidated G.M., Ltd., Yundaga	1,474	5 3	Branson Bros. & Co., 27 tons, Lawlers	3	7 6
Orr & Richards, Bullfinch	50	0 0	W. R. Grant, 456 tons, Westonia	68	8 0
McLelland, Rowe & Hehir, Coolgardie	60	0 0	W. A. Patterson, 116 tons, Parker's Range	11	12 0
Scotson & Party "Mopoke" G.M., Ora Banda	194	8 4	S. C. Lang, 80 tons, Bullfinch	10	0 0
T. E. Job, Coolgardie	64	0 0	W. A. Patterson, 131 tons, Parker's Range	13	2 0
Rich & Wigglesworth, Youanmi	500	0 0	S. C. Lang, 76½ tons, Bullfinch	9	11 3
J. DeGracie, Kunanalling	68	8 11	W. A. Patterson, 125 tons, Parker's Range	12	10 0
Lonsdale & Howard, Kalgoorlie	81	0 0	Branson Bros. & Co., 51 tons, Lawlers	6	7 6
Jenkins & Black, Southern Cross	350	0 0			256 6 9
Thorley & Fox, Greenbushes	41	5 0			
Cook, Harse & Wakefield, Coolgardie	112	0 0			
A. H. Williams, Kalgoorlie	31	18 0			
		33,913 13 8			

APPENDIX No. 1—continued.

<i>Subsidies Carting Long Distances to Batteries—</i>	Amount.		£ s. d.	£ s. d.	<i>Advances Refunded—continued.</i>	Amount.		£ s. d.	£ s. d.
	£	s.				d.	£			s.	d.
J. Dance, Wallbrook	6	10	6		Job, T. E.	11	18	0	
R. Luestner, Edjudina	2	14	9		Lalla Rookh G.M.	305	14	1	
J. Stoppani, Edjudina	0	18	9		Mt. Monger Proprietary G.M.	3	4	8	
F. W. Vance, Edjudina	0	10	6		Mac's Lucky Ridge	44	0	0	
T. H. Potts, Edjudina... ..	0	14	3		Maher & Party	5	13	6	
T. Reilly, Edjudina	0	16	6		Mayman, G.	149	2	11	
D. Brewer, Edjudina	1	7	0		Murrin Proprietary G.M.	10	0	0	
J. Pope, Mt. Padbury	24	0	0		Norma G.M.	14	11	7	
H. Wansbrough, Mt. Padbury	16	13	4		Patterson, W. A.	165	2	9	
A. Probert, Burtville	14	5	0		Premier Coal Mining Co.	484	2	8	
D. Brewer, Edjudina	1	5	6		Reynolds & Scott	11	19	5	
R. Luestner, Edjudina... ..	0	17	3		Snook, F. H.	21	17	6	
J. Dance, Wallbrook	5	3	6		Scots Greys	0	10	0	
E. Mollonga, Edjudina	1	4	9		Scott & Sanders	5	16	0	
J. Stoppani, Edjudina	1	2	10		South Fingall	26	17	0	
J. Thomas, Edjudina	1	5	6		Wheal Ina	29	10	0	
R. Anderson, Yilgangi	0	7	6						1,674 9 8
R. Anderson, Yilgangi	0	18	0		<i>Recovered from Sales of Securities—</i>				
T. Love, Wallbrook	0	15	0		Chunderloo G.M.	10	0	0	
J. Dance, Wallbrook	8	12	6		Edna May Consolidated	80	0	0	
R. Anderson, Yilgangi	1	4	0		Edwards & Grant	9	5	6	
D. Brewer, Edjudina	2	11	0		Globe G.M.	10	3	4	
F. W. Vance, Edjudina	1	10	0		Ironclad Mine	1	1	0	
E. Mollonga, Edjudina	1	13	0		Kirton's South Lead Mine	95	0	0	
J. Thomas, Edjudina	1	7	9		Klondyke Boulder	10	0	0	
Bankier & McParlin, Waverley	6	15	0		Mott & Matthews	22	12	6	
W. H. Smith, Burtville	22	2	6		Maori Lass	75	4	8	
W. Gaston, Burtville	20	5	0						313 7 0
H. Richards, Burtville	9	15	0		<i>Miscellaneous Refunds</i>				1,110 3 8
R. Sproule, Burtville	11	5	0		<i>Prospecting</i>				164 9 0
D. Scott, Burtville	7	10	0						£3,262 9 4
				176 1 2					
Total (according to net Treasury figures for the year) ...				£55,295 14 10					
<i>Advances Refunded—</i>									
Digger's Luck	60	5	6		THE MINING DEVELOPMENT ACT, 1902—ADVANCES WRITTEN OFF TO 31ST DECEMBER, 1923.				
Emu Gold Mine	25	16	10			£	s. d.	£	s. d.
Green, D. M. and O. S.	109	0	0		Previously reported	32,855	15 9		
Great Southern G.M.	32	4	4		Year 1923	961	11 6		
Howlett, G. H.	22	10	6						£33,817 7 3
Ives Reward G.M.	47	2	5						
Jenkins & Black	87	10	0						

MINING DEVELOPMENT EXPENDITURE.

Advances Outstanding, 31st December, 1923.

Name of Lease, Mine, or Borrower.	No. of Lease.	District.	Amount authorised.	Principal Moneys advanced			Principal Moneys		Interest		Total Principal and Interest outstanding at 31st December, 1923.
				Previously to 1923.	During 1923.	Repaid, including Sale of Securities, etc.	Balance outstanding.	Paid.	Outstanding.		
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
A.—PIONEER MINING AND PROSPECTING.											
Alicia	254F	Mt. Morgans	245 0 0	195 0 0	...	...	195 0 0	4 2 6	54 14 8	249 14 8
Ard Patrick	197	Phillips River	1,331 16 4	1,331 16 4	...	...	1,331 16 4	...	105 11 11	1,437 8 3
Ard Patrick	197	Phillips River	270 0 0	268 8 8	...	...	268 8 8	...	32 4 9	300 13 5
Allen & Beaton	P.A. 1054z	Menzies	250 0 0	250 0 0	...	...	250 0 0	5 5 7	7 1 3	257 1 3
Allen & Beaton	P.A. 1054z	Menzies	100 0 0	99 17 6	...	...	99 17 6	...	0 19 3	100 16 9
Bulletin	795	Marble Bar	600 0 0	427 19 5	...	25 8 10	402 10 7	43 15 2	82 14 11	485 5 6	
Baneyon North	2113T	Laverton	150 0 0	200 0 0	0 15 0	...	200 15 0	14 5 3	18 16 6	219 11 6	
Britannia	953M	Mt. Magnet	150 0 0	114 12 6	...	43 10 0	71 2 6	...	9 4 6	80 7 0	
Bickerton	378	Phillips River	150 0 0	148 12 6	...	...	148 12 6	...	14 18 2	163 10 8
Black Princess	5166E, 5247E	Kalgoorlie	150 0 0	148 4 8	...	...	148 4 8	...	12 3 4	160 8 0
Bull Oak	1179Y	Bulong	60 0 0	27 2 6	...	...	27 2 6	...	2 1 7	29 4 1
British Flag	5310E, 5316E, 5324E	Kalgoorlie	500 0 0	325 7 9	174 12 3	...	500 0 0	3 13 1	24 14 3	524 14 3	
Bayley's Reward	5127	Coolgardie	100 0 0	...	99 9 10	...	99 9 10	1 18 10	3 3 6	102 13 4	
Champion, South	817N, 1039N	Nannine	400 0 0	400 0 0	...	353 0 0	47 0 0	29 11 8	19 19 8	66 19 8	
Clarkson & Son	P.A. 186	Ravensthorpe	150 0 0	119 7 6	...	...	119 7 6	...	16 19 8	136 7 2
Clifford & Richards	P.A. 1182	Yilgarn	30 0 0	25 18 6	...	...	25 18 6	...	0 11 6	26 10 0
Cumpston, T. B.	P.A. 1564E	Kalgoorlie	39 0 0	39 0 0	...	...	39 0 0	...	0 9 3	40 9 3
Curtis, R.	P.A. 456E	Niagara	50 0 0	30 18 9	...	...	30 18 9	...	0 9 5	31 8 2
Chrysolite, No. 1 and No. 2	274, 275	Pilbarra	250 0 0	250 0 0	...	...	250 0 0	7 16 5	23 10 1	273 10 1
Coolgardie Redemption	5135	Coolgardie	500 0 0	500 0 0	...	...	500 0 0	...	38 15 1	538 15 9
Coolgardie Redemption	5135, 5136, 5137	Coolgardie	350 0 0	...	350 0 0	...	350 0 0	...	6 9 10	356 9 10	
Central	5251E	Kalgoorlie	1,000 0 0	1,000 0 0	350 0 0	149 2 11	850 17 1	84 19 0	28 16 9	879 13 10	
Clan McLeod	283	Pilbarra	150 0 0	55 0 0	...	...	55 0 0	3 15 11	3 8 9	58 8 9
Christie, J. M.	Dry Dredge Area 1w	Waverley	100 0 0	100 0 0	...	...	100 0 0	0 8 7	6 10 0	106 10 0
Croesus Venture Syndicate	P.A. 1730E	Kalgoorlie	300 0 0	145 9 11	...	...	145 9 11	...	4 19 6	150 9 5
Dawn of Hope	1504C	Leonora	100 0 0	100 0 0	...	...	100 0 0	0 3 11	...	100 0 0
Daley & McDonald	1051N	Nannine	100 0 0	57 5 0	...	...	57 5 0	0 3 11	...	57 5 0
Dupuy, Kemp & Hughes	P.A.'s. 1628 and 1647E	Kalgoorlie	75 0 0	75 0 0	...	...	75 0 0	0 1 8	...	75 0 0
Dreadnought	4555, 4561, 5190	Coolgardie	300 0 0	...	112 0 0	...	112 0 0	...	0 5 7	112 5 7	
Digger's Luck	1895W	Cane Grass	175 0 0	...	174 0 8	60 5 6	113 15 2	...	1 8 10	115 4 0	
Emily	1510L	Cue	400 0 0	372 1 9	...	...	372 1 9	...	44 7 10	416 9 7
Elverdton	M.A. 95	Ravensthorpe	3,500 0 0	3,498 17 10	...	3,841 4 10	157 13 0	462 15 3	28 8 8	186 1 8	
Edna May Battler	911 3170, 3171	Yilgarn	3,000 0 0	2,253 2 9	...	8 6 8	2,244 16 1	86 18 9	310 5 5	2,555 1 6	
Eclipse	1047X	Gindalbie	498 19 1	493 19 1	...	267 5 0	231 14 1	62 8 11	...	231 14 1	
East Collie Coal Mining and Briquetting Co.	294/299, 300/303	Collie	1,000 0 0	790 5 2	...	...	790 5 2	98 15 6	24 17 11	815 3 1
Emu G.M.	1977	Cue	850 0 0	840 4 8	...	30 7 6	809 17 2	68 4 5	26 13 11	836 11 1	
Falkiner & Lavery	P.A. 1150	Yilgarn	150 0 0	122 10 3	...	0 6 0	122 4 3	3 14 11	...	122 4 3	
Firelight & Undaunted	3217, 3222	Yilgarn	414 11 0	334 11 0	55 17 6	0 5 0	390 3 6	3 2 0	39 9 3	429 12 9	
Field's Find Extended	902	Yalgoo	361 2 3	361 2 3	...	99 19 0	261 3 3	22 8 3	38 11 4	299 14 7	
Flag Leases	136, 137, 138	Phillips River	3,500 0 0	3,080 18 9	...	0 15 0	3,080 3 9	...	177 9 6	3,257 13 3	
Flag Tributaries (Grant & Edwards)	...	Phillips River	450 0 0	450 0 0	...	0 13 1	449 6 11	15 8 0	38 13 1	488 0 0	
Flag Tributaries (Grant & Edwards)	...	Phillips River	150 0 0	148 16 10	...	16 12 3	132 4 7	1 2 9	4 7 6	136 12 1	
Flynn & Ide	P.A. 1743E	Kalgoorlie	16 0 0	16 0 0	...	...	16 0 0	0 15 3	...	16 0 0
Flegeltaub & Manning	P.A. 2095	Coolgardie	50 0 0	...	49 17 6	...	49 17 6	...	0 18 2	50 15 8	
Franklin	841	Pilbarra	525 0 0	...	171 0 0	...	171 0 0	...	1 18 9	172 18 9	
Globe	912N	Nannine	500 0 0	444 12 9	...	156 1 6	288 11 3	77 17 10	15 8 1	303 19 4	
Gallagher, H. J.	M.L. 145	Northampton	50 0 0	25 0 0	...	...	25 0 0	6 14 6	...	25 15 9
Gem	G.M.L. 184	Phillips River	500 0 0	500 0 0	...	52 9 5	447 10 7	84 14 8	26 4 2	473 14 9	
Gem Consolidated	151, 156	Phillips River	1,000 0 0	1,000 0 0	...	...	1,000 0 0	0 18 8	203 14 3	1,203 14 3
Gem Consolidated	151, 156	Phillips River	150 0 0	99 19 1	50 0 0	...	149 19 1	...	11 12 4	161 11 5	
Golden Lizard	1067R	Edjudina	366 7 4	366 7 4	...	...	366 7 4	45 18 6	12 0 1	378 7 5
Great Southern	2909	Yilgarn	630 0 0	630 0 0	...	...	630 0 0	7 14 0	164 7 7	794 7 7
Great Southern	2909	Yilgarn	500 0 0	374 10 0	...	...	374 10 0	...	45 10 4	420 0 4
Great Southern	2909	Yilgarn	800 0 0	...	644 15 4	...	644 15 4	...	27 10 1	672 5 5	
Golden Mile Ore Channel Extended, Ltd.	5128E	Kalgoorlie	5,000 0 0	2,888 13 10	747 9 3	...	3,636 3 1	...	415 19 4	4,052 2 5	
Griffin Syndicate	306/13	Collie	348 0 7	348 0 7	...	...	348 0 7	22 12 5	11 8 1	359 8 8
Griffin Syndicate	306/13	Collie	250 0 0	...	247 15 0	...	247 15 0	...	7 19 6	257 14 6	
Gibbs, J.	P.A. 1688E	Kalgoorlie	30 0 0	15 0 0	...	...	15 0 0	...	0 3 1	15 3 1

MINING DEVELOPMENT EXPENDITURE—Advances Outstanding 31st December, 1923—continued.

Name of Lease, Mine, or Borrower.	No. of Lease.	District.	Amount authorised.	Principal Moneys advanced		Principal Moneys		Interest		Total Principal and Interest outstanding at 31st December, 1923.
				Previously to 1923.	During 1923.	Repaid, including Sale of Securities, etc.	Balance outstanding.	Paid.	Outstanding.	
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Greenhills G.M. Co., N.L.	383F	Linden	350 0 0	144 14 8	117 17 6	...	262 12 2	6 17 2	8 6 8	270 18 10
Golden Promise	P.A. 2053	Coolgardie	300 0 0	150 0 0	150 0 0	...	300 0 0	...	20 13 7	320 13 7
Griffiths Gold Mine	4567	Coolgardie	1,000 0 0	150 0 0	850 0 0	...	1,000 0 0	10 2 4	23 12 8	1,023 12 8
Garden Gully	5147, 5148	Coolgardie	300 0 0	112 10 0	...	...	112 10 0	...	9 5 6	121 15 6
Golden Hope Gold Mines, N.L.	68, 86	Hampton Plains	2,000 0 0	...	2,000 0 0	...	2,000 0 0	50 4 5	65 10 8	2,065 10 8
Havilah...	345B	Black Range	600 0 0	553 2 1	...	424 18 1	128 4 0	163 14 6	9 12 11	137 16 11
Havilah...	345B	Black Range	500 0 0	279 17 6	169 13 3	...	449 10 9	8 13 4	30 10 7	480 1 4
Hawk	725G	Desdemona	120 0 0	116 12 2	...	22 5 11	94 6 3	...	3 7 10	94 6 3
Harbour View Gold & Copper Co., Ltd.	M.L. 52 & 94	Kundip	2,886 11 0	2,886 11 0	...	74 16 7	2,811 14 5	8 18 11	620 18 3	3,432 12 8
Hamilton & Congdon	Tributers "Flag" Mine	Ravensthorpe	150 0 0	150 0 0	...	...	150 0 0	...	13 3 8	163 3 8
Holt & Rowe	P.A. 1454E	Kalgoorlie	50 0 0	50 0 0	...	...	50 0 0	...	0 10 11	50 10 11
Hamerston, O. A.	P.A. 184	Ravensthorpe	100 0 0	100 0 0	...	...	100 0 0	...	...	100 0 0
Hobby & Party	...	Youanmi	125 0 0	117 15 10	...	11 0 0	106 15 10	...	...	106 15 10
Humphries & Reid	Dry Dredge Area	Bulong	100 0 0	100 0 0	...	...	100 0 0	4 4 0	3 5 10	103 5 10
Ingliston Junction G.M. Co., N.L.	1475N, 1491N	Nannine	200 0 0	...	98 7 6	...	98 7 6	...	3 4 10	101 12 4
Ives Lake View Reward Junction	4732, 5154	St. Ives	500 0 0	...	64 0 0	11 18 0	52 2 0	...	0 11 10	52 13 10
Johnston & Stennett	Temp. Res. 218H	Ravensthorpe	150 0 0	150 0 0	...	0 17 3	149 2 9	17 14 2	4 12 8	153 15 5
Kuhlmann & Buckle (Ironclad Tribute)	Reserve 196H	Ravensthorpe	300 0 0	263 8 0	...	...	263 8 0	18 8 0	2 17 3	266 5 3
Kuhlmann & Buckle (Ironclad Tribute)	Reserve 196H	Ravensthorpe	403 17 3	403 17 3	...	...	398 16 3	...	...	398 16 3
Kingdom Come	M.L. 112	Northampton	204 14 0	204 14 0	...	110 0 0	94 14 0	5 8 0	15 11 0	110 5 0
Klondyke Boulder	604	Warrawoona	1,000 0 0	999 10 7	...	178 5 6	826 5 1	34 5 4	150 12 7	976 17 8
Kapanga	M.L. 515	Greenbushes	80 0 0	...	41 5 0	...	41 5 0	...	0 4 6	41 9 6
Lake View Extended	4536E	Kalgoorlie	1,050 0 0	892 15 5	...	803 0 0	89 15 5	...	54 11 1	144 6 6
Lorna	4554	Coolgardie	100 0 0	98 15 4	...	4 0 0	94 15 4	2 17 6	11 17 8	106 13 0
Lady Carmen	4556	Coolgardie	500 0 0	500 0 0	...	5 0 0	495 0 0	12 19 1	46 12 2	541 12 2
Lady of the Lake	5083, 5173, 5174, 5177, 5178, 5226E	Kalgoorlie	1,100 0 0	1,068 2 0	31 18 0	...	1,100 0 0	1 7 6	150 12 2	1,250 12 2
Lewis, D.	...	Bulla Bulling	32 8 0	18 18 0	...	...	18 18 0	...	...	18 18 0
Lyons & Bacon	P.A. 1037C	Mt. Malcolm	33 10 0	29 5 0	...	...	29 5 0	...	0 9 10	29 14 10
Lloyd George G.M. Co., N.L.	4580, 4726, 4727	Coolgardie	1,750 0 0	1,750 0 0	...	...	1,750 0 0	198 6 7	55 2 9	1,805 2 9
Lupton, Chesson, & Mathers	...	Day Dawn	600 0 0	600 0 0	...	...	600 0 0	...	...	600 0 0
Lake View Reward	4720, 4721, 4722, W. Right, 553, 554	Coolgardie	5,675 0 0	961 6 7	712 2 6	102 14 9	1,570 14 4	79 4 10	8 11 5	1,579 5 9
Lonsdale & Howard	P.A. 1822E	Kalgoorlie	100 0 0	...	81 0 0	...	81 0 0	...	0 9 11	81 9 11
Lake View	5410Z	Comet Vale	100 0 0	...	100 0 0	...	100 0 0	...	4 3 11	104 3 11
Millenium	3256	Yigarn	70 0 0	...	68 5 0	...	68 5 0	...	1 17 0	70 2 0
Mindeloo	1518	Mindoolah	300 0 0	198 17 0	...	10 0 0	188 17 0	...	8 1 1	196 18 1
Mt. Rankin Gold Mines, N.L.	2416	Yigarn	535 6 3	535 6 3	...	368 0 0	167 6 3	60 10 0	13 9 10	180 16 1
Mt. Rankin G. Mines, N.L.	3135, 3136	Yigarn	1,000 0 0	911 19 9	...	10 0 0	901 19 9	0 8 3	47 8 4	949 8 1
Mt. Iron	G.M.L., 198	Kundip	200 0 0	194 0 0	...	...	194 0 0	...	35 3 7	229 3 7
Melba	G.M.L., 1053R	Yerilla	575 0 0	496 18 10	...	90 0 0	406 18 10	...	43 2 9	450 1 7
Mott & Matthews	P.A. 164	Roebourne	750 0 0	483 6 6	...	38 15 11	444 10 7	1 1 10	45 10 7	490 1 2
Munday, Livingstone, & Austin	P.A. 1527E	Kalgoorlie	60 0 0	25 0 0	...	...	25 0 0	...	0 4 5	25 4 5
Mt. Magnet Prospecting and Dev. Synd.	1190M	Mt. Magnet	250 0 0	122 5 6	...	6 15 6	115 10 0	7 11 0	3 12 9	119 2 9
Mills & Barnes	P.A. 570X	Kanowna	65 0 0	65 0 0	...	4 4 1	60 15 11	1 18 1	...	60 15 11
Mohr, John	P.A. 1522E	Kalgoorlie	150 0 0	143 5 7	...	...	143 5 7	0 7 6	20 3 3	163 8 10
Manners, W. G.	P.A. 572X	Kanowna	120 0 0	73 5 0	...	...	73 5 0	...	1 10 5	74 15 5
Maw, E. L.	P.A. 452	Marble Bar	100 0 0	12 18 0	...	...	12 18 0	...	0 19 10	13 17 10
Meekatharra Prospecting Co., N.L.	P.A. 1021N	Meekatharra	150 0 0	77 5 3	...	...	77 5 3	2 6 4	...	77 5 3
Murrin Proprietary G.M. Co., N.L.	372F	Mt. Morgans	550 0 0	550 0 0	...	40 2 0	509 18 0	...	54 8 6	564 6 6
Murrin Proprietary G.M. Co., N.L.	372F	Mt. Morgans	413 3 6	413 3 6	...	15 0 0	398 3 6	...	36 11 6	434 15 0
Mt. Monger Proprietary G.M. Co.	4770E	Kalgoorlie	300 0 0	196 10 0	...	3 4 8	193 5 4	...	...	193 5 4
Mt. Zion	1013M, 1183M, 1189M	Mt. Magnet	2,000 0 0	1,949 16 10	...	...	1,949 16 10	82 2 7	111 10 2	2,061 7 0
Mt. Zion	1013M, 1183M, 1189M	Mt. Magnet	500 0 0	500 0 0	...	...	500 0 0	9 15 9	29 14 10	529 14 10
Menzies Consolidated Extd., Ltd.	4931Z, 4934Z, 4935Z, 4936Z, 5074Z, 5075Z, 5315Z, 5260Z, 5261Z, Garden Area 25Z, 35Z, Tailings Area 55Z	Yundaga	5,000 0 0	...	1,474 5 3	...	1,474 5 3	...	28 19 0	1,503 4 3

Mopoke Syndicate	...	P.A. 1182W	Broad Arrow	200 0 0	...	194 8 4	...	194 8 4	...	1 14 10	196 3 2
McGregor & Grylls	...	P.A. 1177	Yilgarn	100 0 0	38 2 6	...	...	88 2 6	...	3 0 9	91 3 3
McManus, D. J.	...	P.A. 1742E	Kalgoorlie	100 0 0	...	68 8 0	...	68 8 0	...	1 7 0	69 15 0
McLelland, Rowe, & Hehir	...	P.A. 2162	Coolgardie	60 0 0	...	60 0 0	...	60 0 0	...	1 5 0	61 5 0
Norseman Prospecting Syndicate	...	1261	Norseman	515 3 8	415 3 8	...	...	415 3 8	6 10 3	94 16 2	509 19 10
North Harbour View	...	M.L. 370	Phillips River	100 0 0	100 0 0	...	...	100 0 0	0 8 1	21 1 0	121 1 0
North End	...	4632E	Kalgoorlie	150 0 0	149 5 0	...	...	149 5 0	...	19 15 8	169 0 8
Norma	...	1460N	Nannine	220 0 0	220 0 0	42 8 7	...	177 11 5	15 7 3	11 2 4	188 13 9
North-West Reward	...	5162	St. Ives	250 0 0	70 6 0	70 5 0	...	140 11 0	3 15 0	4 12 1	145 3 1
New Glideaway	...	3248	Yilgarn	200 0 0	126 10 0	...	...	126 10 0	7 18 11	4 2 11	130 12 11
New Victory	...	5159	St. Ives	300 0 0	...	150 10 0	...	150 10 0	...	6 13 10	157 3 10
New Victory	...	5159	St. Ives	115 0 0	...	93 15 5	...	93 15 5	...	3 9 9	97 5 2
Oates & Party	...	P.A. 1022Z	Menzies	90 0 0	90 0 0	...	4 19 6	15 0 6	...	...	85 0 6
Owen & Brown	...	M.L. 184	West Pilbara	100 0 0	56 3 0	...	...	56 3 0	4 6 4	1 16 9	57 19 9
Orr & Richards	...	3249	Yilgarn	50 0 0	...	50 0 0	...	50 0 0	...	1 1 4	51 1 4
Oversight, South	...	1905W	Broad Arrow	200 0 0	...	143 18 1	...	143 18 1	0 2 3	2 19 10	146 17 11
Pearl	...	1095M	Mt. Magnet	76 0 0	76 0 0	...	...	76 0 6	...	24 18 2	100 18 2
Pyx	...	789B	Sandstone	600 0 0	571 4 8	...	82 10 7	488 14 1	12 14 5	24 15 0	518 9 1
Pilgrims' Rest G.M. Co.	...	165, Mach. Area 14	West Pilbara	1,500 0 0	500 0 0	3 12 6	...	503 12 6	...	69 2 5	572 14 11
Pinder, A.	...	2102T	Duketon	100 0 0	100 0 0	...	2 2 0	97 18 0	...	9 6 8	107 4 8
Peterzen, C. G.	...	P.A. 1109C	Malcolm	20 0 0	...	20 0 0	...	20 0 0	...	0 15 7	20 15 7
Quistini & Kinnane	...	941W	Broad Arrow	75 0 0	70 2 6	...	...	70 2 6	...	3 16 4	73 18 10
Red Guard	...	M.L. 113E, 117E, 118E, Machinery Area 68E	Kalgoorlie	150 0 0	150 0 0	...	34 3 6	115 16 6	10 0 4	11 12 11	127 9 5
Rainbow Gold Mining Co.	...	5091	Coolgardie	230 0 0	182 10 0	...	1 8 4	181 1 8	6 1 7	38 13 0	219 14 8
Riverina South G.M. Co.	...	G.M.L. 324U, etc.	Mulline	2,000 0 0	2,000 0 0	...	...	2,000 0 0	1 0 0	211 6 9	2,211 6 9
Riverina South G.M. Co.	...	G.M.L. 324V, etc.	Mulline	3,600 0 0	1,438 0 0	...	...	1,438 0 0	...	80 3 5	1,518 3 5
Raven, H. C.	...	P.A. 1712E	Kalgoorlie	85 0 0	74 19 2	...	...	74 19 2	...	1 3 2	76 2 4
Rich & Wigglesworth (Sub-lessees)	...	G.M.L. 863/864B, 942/943B	Black Range	2,500 0 0	...	500 0 0	...	500 0 0	...	7 6 0	507 6 0
South Cornwall	...	M.L. 567	Greenbushes	1,170 2 0	1,170 2 0	...	86 0 0	1,084 2 0	...	...	1,084 2 0
Stanley	...	1271X	Kanowna	150 0 0	112 0 0	...	...	112 0 0	2 6 0	39 14 8	151 14 8
Scots Greys	...	2801	Yilgarn	200 0 0	200 0 0	...	...	200 0 0	...	67 6 8	267 6 8
Scots Greys	...	2801	Yilgarn	200 0 0	200 0 0	...	...	200 0 0	...	62 6 6	262 6 6
Scots Greys	...	2801	Yilgarn	120 0 0	15 0 0	0 10 0	0 10 0	15 0 0	...	1 18 2	16 18 2
Smith, W. F.	...	G.M.L. 196	Phillips River	300 0 0	300 0 0	...	...	300 0 0	...	15 19 1	315 19 1
Surprise	...	M.L. 342	Ravensthorpe	600 0 0	327 4 1	...	11 9 0	315 15 1	1 5 1	28 5 0	344 0 1
Snelgrove & Mendis	...	P.A. 1880	Widgiemooltha	100 0 0	100 0 0	...	...	100 0 0	...	0 10 4	100 10 4
Stevens & Party (Tributers)	...	...	Curran's Find	1,285 0 0	556 7 6	675 16 10	...	1,282 4 4	...	72 9 0	1,304 18 4
Stevens & Party (Tributers)	...	...	Curran's Find	1,047 13 0	...	1,047 13 0	...	1,047 13 0	...	102 8 6	1,150 1 6
Stevens & Party (Tributers)	...	...	Curran's Find	200 0 0	...	200 0 0	...	200 0 0	...	26 0 0	226 0 0
Scott & Sanders	...	P.A. 977T	Laverton	50 0 0	...	50 0 0	5 16 0	44 4 0	...	0 13 11	44 17 11
South Fingall	...	G.M.L. 569D	Day Dawn	1,750 0 0	...	798 15 0	26 17 0	771 18 0	...	19 18 7	791 16 7
Sydney Mint	...	8958	Kunanalling	200 0 0	...	68 8 11	...	68 8 11	...	0 8 9	68 17 8
Suhard & Simpson	...	Reward M.L. 220	West Pilbara	100 0 0	50 0 0	...	1 15 0	48 5 0	0 17 8	3 2 10	51 7 10
Surprise Lead Mine	...	Mineral Leases, 148, 150, 154, 158, and 20PP	Northampton	25,000 0 0	...	20,000 0 0	...	20,000 0 0	609 0 11	217 5 3	20,217 5 3
Thomas & McDonald (Tributers)	...	...	Kalgoorlie	40 0 0	35 0 0	...	...	35 0 0	...	3 10 9	38 10 9
Thorn, A.	...	P.A. 1918	Widgiemooltha	50 0 0	50 0 0	...	...	50 0 0	1 13 10	1 11 6	51 11 6
Triffitt & Winter	...	P.A. 1452	Tuckabianna	150 0 0	...	85 7 6	...	85 7 6	0 13 11	2 10 0	87 17 6
Unexpected	...	5480, 5481	Mt. Ida	640 0 0	640 0 0	2 6 7	3 10 4	638 16 3	8 19 8	69 17 4	708 13 7
V's United	...	271F	Mt. Morgans	500 0 0	406 14 1	...	...	406 14 1	1 11 2	25 7 9	432 1 10
V's United	...	271F	Mt. Morgans	172 2 0	172 2 0	...	170 0 0	2 2 0	...	9 6 4	11 8 4
Victory	...	Reserve 334H	Marvel Loch	175 0 0	147 8 3	...	...	147 8 3	1 0 0	14 10 2	161 18 5
Victorian	...	5121	St. Ives	85 0 0	85 0 0	...	10 11 0	74 9 0	...	3 1 6	77 10 6
Venture...	...	5160	St. Ives	100 0 0	48 14 11	10 9 3	...	59 4 2	0 3 1	3 13 10	62 18 0
Williamson & Pender	...	...	Kanowna	180 0 0	180 0 0	...	...	180 0 0	7 0 0	12 18 1	192 18 1
Western Graphite Co.	...	M.L. 2PP	Plantagenet	300 0 0	190 0 0	...	...	100 0 0	8 14 8	12 10 0	112 10 0
Wheal May	...	Loc. 6	Northampton	302 4 6	302 4 6	...	50 0 0	252 4 6	5 15 9	14 9 3	266 14 2
Wilson & Son.	...	P.A. 1108W	Broad Arrow	26 0 0	26 0 0	...	...	26 0 0	...	0 16 0	26 16 0
Wiga Proprietary Coal Prospecting Co., Ltd.	...	P.A. 406H	Wilga	1,000 0 0	...	582 9 6	...	582 9 6	...	20 7 8	602 17 2
Wheal Ina	...	M.L. 23PP	Northampton	180 0 0	...	128 6 4	29 10 0	98 16 4	2 1 8	4 1 0	102 17 4
Totals	...	...	...	...	57,397 12 8	33,841 6 7	7,504 2 7	83,734 16 8	2,787 13 10	5,517 19 4	89,252 16 0

Mining Development Expenditure—Advances Outstanding 31st December, 1923—continued.

Name of Lease, Mine, or Borrower.	No. of Lease.	District.	Amount Authorised.	Principal Moneys advanced.		Principal Moneys.		Interest.		Total Principal and Interest outstanding at 31st December, 1923.
				Previously to 1923.	During 1923.	Repaid, including Sale of Securities, etc.	Balance outstanding.	Paid.	Outstanding.	
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
B.—ASSISTANCE IN ERECTING BATTERIES AND TREATMENT PLANTS TO BE USED FOR CRUSHING FOR THE PUBLIC.										
Big Stone	357F, 369F	Yundamindera	500 0 0	484 2 1	...	...	484 2 1	37 18 0	30 5 1	514 7 2
Big Stone	357F, 369F	Yundamindera	1,438 0 0	1,438 0 0	...	418 6 3	1,019 13 9	...	384 6 3	1,404 0 0
Butcher Bird No. 1	1933	Yilgarn	1,863 14 2	1,863 14 2	...	17 16 2	1,845 18 0	172 3 10	89 6 5	1,935 4 5
Butcher Bird Tributaries (E. A. Cox)	...	...	76 8 4	76 8 4	...	26 4 9	50 3 7	...	...	50 3 7
Butcher Bird Tributaries (Jones & Party)	...	...	12 0 3	...	12 0 3	...	12 0 3	...	...	12 0 3
Butcher Bird Tributaries (Ogden & James)	...	...	26 4 9	...	26 4 9	...	26 4 9	...	...	26 4 9
Bunker	3069	...	350 0 0	...	350 0 0	87 10 0	262 10 0	...	1 9 7	263 19 7
Chunderloo	1048N	Nannine	2,032 12 8	1,730 10 2	...	646 4 2	1,084 6 0	...	218 16 2	1,303 2 2
Donovan's Find	768	Yilgarn	1,000 10 0	1,000 10 0	...	270 12 0	729 18 0	541 3 4	18 8 0	748 6 0
Donovan's Find	768	Yilgarn	150 0 0	150 0 0	...	...	150 0 0	37 2 9	4 14 6	154 14 6
Donovan's Find	768	Yilgarn	433 0 0	433 0 0	...	...	433 0 0	57 15 0	13 12 10	446 12 10
Donovan's Find	768	Yilgarn	100 0 0	78 0 9	...	...	78 0 9	7 19 2	2 9 2	80 9 11
Fraser's Central	3228, 3232	Yilgarn	2,971 16 4	2,971 16 4	...	...	2,971 16 4	17 0 0	403 16 7	3,375 12 11
Fraser's Central	3228, 3232	Yilgarn	636 17 8	608 2 8	28 15 0	...	636 17 8	...	62 14 1	699 11 9
Fraser's Central	3228, 3232	Yilgarn	891 6 0	...	891 6 0	...	891 6 0	...	18 15 10	910 1 10
Great Victoria	719, 944/5, 1227	Yilgarn	2,000 0 0	1,643 3 0	...	1 7 9	1,641 15 3	812 18 3	164 3 6	1,805 18 9
Great Southern	209	Yilgarn	...	3,977 12 7	...	...	3,977 12 7	13 0 0	802 4 3	4,779 16 10
Hodder, E.	M.A. 64Y	Bulong	253 3 2	253 3 2	...	148 13 0	104 10 2	6 8 4	35 11 3	140 1 5
Kirton's South	M.L. 127	Northampton	2,050 0 0	2,028 12 9	...	193 2 4	1,835 10 5	537 3 10	146 3 0	1,981 13 5
Kirton's South	M.L. 127	Northampton	200 0 0	200 0 0	...	...	200 0 0	15 8 5	14 19 9	214 19 9
Kirton's South	M.L. 127	Northampton	500 0 0	500 0 0	...	...	500 0 0	8 14 1	46 16 8	546 16 8
Lalla Rookh	112, 786, T.A. 10	Marble Bar	...	3,114 3 1	...	459 13 11	2,654 9 2	622 10 6	66 16 4	2,721 5 6
Malcolm Prospecting Co.	1175c	Mt. Malcolm	1,550 0 0	1,550 0 0	...	15 0 0	1,535 0 0	410 6 10	723 4 9	2,258 4 9
McCahon & Party	...	Mt. Ida	400 0 0	400 0 0	...	7 0 0	393 0 0	...	27 14 5	420 14 5
Neta	1011R	Edjudina	200 0 0	200 0 0	...	17 11 7	182 8 5	44 19 2	40 4 3	222 12 8
Phoenix	622N	Quinn's	250 0 0	250 0 0	...	39 12 0	210 8 0	17 12 1	17 5 11	227 13 11
Randwick	978c	Mt. Malcolm	584 14 0	577 3 5	...	54 4 6	522 18 11	...	45 3 5	568 2 4
Red, White and Blue	641B	Curran's Find	2,676 9 0	2,676 9 0	...	1,216 5 2	1,460 3 10	856 18 10	121 10 1	1,581 13 11
Rocklee	...	Yaloginda	350 0 0	350 0 0	...	38 0 0	312 0 0	12 2 0	21 14 1	333 14 1
Ravensthorpe Battery Co.	...	Ravensthorpe	1,300 0 0	1,038 8 2	...	125 0 0	913 8 2	...	326 1 2	1,236 9 4
Southern Cross Leases	1067Y, 1076Y	Bulong	1,000 0 0	1,000 0 0	...	770 15 3	229 4 9	78 9 6	155 11 10	384 16 7
Spring Hill Leases	724, 2633	Parker's Range	655 16 5	655 16 5	...	251 4 11	404 11 6	550 18 2	11 7 8	415 19 2
Triplicate	1914	Tuckabianna	730 0 0	608 17 7	...	116 13 10	492 3 9	51 0 8	39 14 7	531 18 4
Totals	...	...	...	31,857 13 8	1,308 6 0	4,920 17 7	28,245 2 1	4,909 12 9	4,055 1 5	32,300 3 6
C.—MISCELLANEOUS.										
Bligh, R. N. W. (Testing Dryblower)	...	...	75 0 0	59 12 0	...	...	59 12 0	...	8 16 0	68 8 0
D.—BORING.										
Irwin River	...	...	...	3,817 5 10	...	...	3,817 5 10	...	...	3,817 5 10
Wilga	...	...	...	5,870 9 11	167 2 6	...	6,037 12 5	...	...	6,037 12 5
Totals	...	...	...	9,687 15 9	167 2 6	...	9,854 18 3	...	...	9,854 18 3
A.—PIONEER MINING AND PROSPECTING										
B.—ASSISTANCE ERECTING BATTERIES, ETC.										
C.—MISCELLANEOUS										
D.—BORING										
Totals	...	...	...	99,002 14 1	35,316 15 1	12,425 0 2	121,894 9 0	7,697 6 7	9,581 16 9	131,476 5 9

APPENDIX No. 2.

Gold Discovery by State Prospecting Party, near Mount Shenton.

By A. MONTGOMERY, State Mining Engineer, 27th February, 1923.

The Under Secretary for Mines.

I have the honour to report, for the information of the Hon. the Minister, on my recent visit to the State Prospecting Party's discovery of auriferous country near Mount Shenton, about 100 miles to the north-east of Laverton.

Leaving Laverton on 25th January last, the journey was made without serious difficulty in two Ford cars, the party consisting of the Hon. R. Ardagh, M.L.C., Mr. Inspector of Mines Gourley, Mr. Bregenzer of the Water Supply Department, Mr. Deshon (representing the State Prospecting Party), Mr. Melnes, motor driver, and myself, and Mount Shenton was reached before mid-day on 26th. We then went *via* Rutter's Soak and Lang's Rocks to the principal gold discovery made by the Prospecting Party near Jutson's Rocks.

Lang's Rocks and Jutson's Rocks are two large island-like protuberances of bare granite rocks rising from plains of sand covered with spinifex. They are about 13 miles apart with a considerable stretch of plain between them. South of Lang's Rocks about five miles there is another similar outcrop of bare granite rocks near Rutter's Grave, the burial place of an early prospector who died there on 9th July, 1894, as shown by a granite slab fixed at the head of the grave by his mates. These granite outcrops are on a line running north-north-westerly, parallel to the Mount Shenton Range, which is about five miles further west.

The district was described in Geological Survey Bulletin No. 24 in 1906 by the Assistant Geologist, Mr. C. G. Gibson, B.E., and was again visited in 1918 by Field Geologist H. W. B. Talbot, whose notes upon it are published in the Annual Report of the Geological Survey for 1919. It was these reports and the geological maps prepared by these geologists showing the existence of country favourable for gold on the east side of Mount Shenton which led to choice of this part of the country for the operations of the State Prospecting Party. They showed that there was a considerable belt of country composed of the old granite and greenstones in which our goldfields usually are found, and Mr. Gibson reports having found a little gold, although on the whole the results of his tests were quite unfavourable. It does not appear from his brief description whether he actually visited the localities where the State Prospecting Party have made their discoveries.

The maps show Mr. Talbot's 1919 route as passing Jutson's Rocks, but in the report of 1919 he does not describe this part of the field.

On the north-west side of Jutson's Rocks there is a small soak which contained a little water when dug out, but probably at no time is capable of giving more than a small supply. To mark the soak a small cairn has been erected. Here the country is all granite, similar to that of the outcropping rocks, but about half a mile to the north-north-east the country changes to a gneissic schist with its lamination running about north-west and south-east. There is a belt of this schist about 1,200 feet wide running north-west and south-east between the massive granite and a hill of serpentine. The main outcropping mass of Jutson's Rocks makes a quick turn to the east and appears to be cutting through the schist, and it is not certainly clear yet whether the latter is a marginal area of the granite altered to a schist by pressure, or a rock much older than the massive granite, the latter being a much later intrusion. From the relations of the granite to the greenstone schists at Lang's Rock and Rutter's Grave it seems pretty clear that the former is intrusive through the latter, and it is most likely that the gneissic schist is portion of the older complex and much older than the massive granite. The question, however, is as yet a very open one, and no doubt will be decided easily enough later on when the country has been better opened and more fully studied. Mr. Gibson must have formed a like conclusion as to the

age of the granite, for he says "This granite is a coarse-grained pink-coloured variety and appears to be newer than and intrusive into the main body of granite which occupies the greater portion of the eastern half of this State."

The gneissic schist at Jutson's Rocks is penetrated by several strong dykes of pegmatite running with the lamination of the schist, and in the vicinity of these dykes there is a large amount of loose surface quartz, among which numerous "floaters" carrying gold have been found by the Prospecting Party. The surface soil, however, so obscures the actual outcrops of the quartz veins yielding the quartz that these are not at all easy to follow, and the small amount of costeening which has been done has been mostly on small outcrops which have come to the surface.

The auriferous veins found up to the present are in the eastern half of the belt of schist, the first hole seen being about 170 yards from the western edge of the belt. Here an excavation about a foot deep shows a small vein of quartz dipping easterly rather flatly, but apparently unimportant in size and value. A sample (No. 1) from this hole returned only $1\frac{1}{2}$ dwt. of gold per ton on assay.

Some 45 yards further to the north-east we come upon a hole about 10ft. by 8ft. by 5ft. deep, with quartz showing in it on all sides. There seem to be at least 4ft. to 5ft. in thickness of quartz, but no walls of the quartz-body have been cut into and neither its direction of strike nor of underlay could be certainly ascertained, though it seemed to be running more or less north and south, and to be going down nearly vertically. A sample taken across 3ft. of quartz in the South end of the hole returned (Sample No. 2) gold at the rate of 2ozs. 15dwt. 7grs. per ton. Another (Sample No. 3) from a 12in. vein of quartz in the north end of the hole on the west side, gave 1oz. 8dwt. 5grs. of gold per ton on assay. A third (Sample No. 4) from a mass of rubbly quartz in the north-east side of the hole returned 6oz. 9dwt. 8grs. of gold per ton. A fourth (Sample No. 6) taken from the dumps of quartz thrown out of the hole gave 5oz. 7dwts. 6grs. of gold per ton. These good results were not unexpected, as fine specks of gold could be seen pretty freely in the stone, and the State Prospecting Party's samples had already given similar results. This outcrop should be sunk upon and the size and direction of the vein properly ascertained, and it should then be traced along its course. The assays are very promising.

Ninety-six feet north 15deg. east from this hole there is an outcrop of quartz into which a small hole has been picked without enough being done to reveal either size or direction of the vein. A sample (No. 7) of the quartz returned on assay 4dwt. 6grs. of gold per ton.

North 75deg. east 69 feet from the main hole is another outcrop very slightly cut into, which returned on assay (Sample No. 8) 2oz. 9dwt. 2grs. of gold per ton, and within 70 feet north-east to east from this there are three other small cuts on outcrops of quartz, but the samples (Nos. 9, 10, and 11) from these gave only poor results, a trace, $1\frac{1}{2}$ dwt. per ton, and 14grs. of gold per ton respectively.

Going south 65deg. east from this point a distance of 480 feet we pass over a large dyke of pegmatite running north-west and south-east, and a second smaller one parallel to it, and then come to a strong outcrop of quartz, on which an excavation has been made showing a thickness of about 6ft. of quartz without proving the walls. The outcrop runs about north 10deg. west with probable easterly underlay. Sample No. 14 taken from his cut returned on assay gold at the rate of 7dwt. 3grs. per ton.

Forty-two feet south 65deg. east further on a small shaft has been sunk about 14ft. on a reef parallel to the last-mentioned one and underlying easterly about

45deg. This reef seems to lie between the schist and another pegmatite dyke, and quartz is found along the edge of the latter for some distance to the south-east. The quartz contains a little galena and pyrites, and shows specks of fine gold rather freely. Sample No. 13 from the dump at surface gave on assay gold at the rate of 1oz. 8dwt. 12grs. per ton, but another sample (No. 16) from the bottom of the shaft, where the quartz is 22in. wide was disappointing, giving only 21grs. of gold per ton on being assayed.

The quartz scattered about the surface often shows specks of gold, and probably numbers of other veins exist which have not yet been located. A lot of prospecting work by costeening and sinking is required in order to find and trace the veins. There seem to be at least four gold-bearing quartz veins already discovered, and as shown above there are some excellent assay results. The samples were all carefully taken so as to be fairly representative of the values at the spot tested.

There is some similarity in the appearance of the quartz to that in the Edna May group of mines at Westonia, and the schist in which they occur has a rather strong resemblance to some of the "Edna May gneiss" at surface. Samples of the schist were taken from the schist in the lode from which samples 2 to 6 were taken, and from the shaft and sent to the Acting Petrologist of the Geological Survey, whose report on these and other rock samples obtained on this trip is appended hereto. It will be seen therefrom that Samples 5 and 15 are described as "granulitic biotite gneiss" and "granulitic hornblende gneiss," and that there is a really strong resemblance to the Edna May gneiss. The occurrence of numerous pegmatite dykes is also a feature of this discovery which it has in common with the Westonia field.

About 100 feet north-east from the prospectors' shaft across a small valley a hill of dark greenstone rock comes in, showing schistose structure in places. Sample No. 12 submitted to the Acting Petrologist has been determined by him as a tremolite serpentine. The very short time at the disposal of the party did not allow of this being traced further eastward.

It is evident that in the vicinity of the Jutson's Rocks discovery prospecting should be carried on carefully wherever the schist and greenstone country is to be found. Our visit was much too short to ascertain the extent of the likely gold-bearing area.

Running south from Jutson's Rocks the way lies over granite at first and then over sand plains with no rock showing until we come to about three miles from the big outcrop of granite known as Lang's Rocks. Then the surface soil begins to show a lot of loose quartz, and gradually fragments of the bedrock become visible. Some costeening has been done, in which the country rock is seen to be a greenstone schist with numerous small veins of quartz. Here, I am informed by Mr. Deshon, the State Prospecting Party could get gold by loaming and a few "floaters" were picked up which gave gold by panning, but no definite reef had yet been found. To the east of this schist country, however, and about a mile north 15deg. west from Lang's Rocks the country rises into a hill of hard greenstone, sometimes schistose, and here two small gold-bearing reefs have been found almost on the top of the hill. One is a quartz vein 12 to 24 inches wide running north 60deg. east and with a very slight underlay to the south. A trench has been cut on the vein about 10ft. long and 6ft. deep. The foliation of the country runs with the hill, at about north 10deg. west, and the vein cuts across it. A sample taken (No. 17) from the east end of the trench gave an assay return of gold 6oz. 13dwt. 20grs. per ton, and another (No. 19) from the dump gave gold 1oz. 19dwt. 15grs. per ton. Fine specks of gold were easily found in the stone, together with some copper pyrites in pieces up to the size of hazel nuts.

About 80 to 100 feet north-north-east from this outcrop a cut has been made on another vein of quartz about 8in. wide, also cutting across the country with a strike of north 65deg. east and slight northerly underlay. Gold is seen rather freely in the stone, and my sample (No. 20) from this place returned gold 5ozs. 6dwt. 7grs. per ton.

These two lodes though small show high values, and are very distinct fissure veins cutting through the hard greenstone country. They should be followed along

their strike and sunk upon, and the area near them should be very carefully searched for other and larger lodes.

The greenstone country of these reefs (Sample No. 18) is described by the Acting Petrologist as a "typical unalutised dolerite or dolerite amphibolite (epidiorite)."

From Lang's Rocks south to Rutter's Grave we travelled over granite and sand plain, but Mr. Deshon tells me that the greenstone schist country persists southward between our route and Mt. Shenton. It comes in again a short distance west of Rutter's Grave and continues to close to the foot of Mt. Shenton. A little gold was found by the State Prospecting Party in this greenstone country, and numerous quartz veins are visible, from some of which a little gold is said to have been dollied by the party. Samples 21 and 23 taken from two of these outcrops, however, only yielded a trace and 1dwt. 10grs. of gold per ton respectively when assayed at the Geological Survey Laboratory. Sample No. 22 of the greenstone country rock is described in the Petrologist's report as a hornblende schist.

The probably auriferous country is described by Mr. Gibson in Geological Survey Bulletin 24 as extending south-south-east to Mt. Grant and Mt. Venn and northward with interruptions to Mts. Warren and Cuming, while another patch further north-east surrounds Mt. Gill. Mt. Shenton itself is described by Mr. Gibson as having for the axis of the range "a large belt of hematite-bearing quartz," which is also seen at Mt. Grant. This appears to be quite similar to the hematite-bearing quartzites of Laverton, Mt. Morgan, and many other of our goldfields districts.

The Mt. Shenton auriferous district is therefore describable as probably 50 miles or more in linear extent, but rather narrow in width as a rule, and interrupted by plain country in which the bedrock is not seen. It has the usual structure of the Murchison and Mt. Margaret Goldfields for the most part with unusual features of its own at Jutson's Rocks, and from Mr. Gibson's description I should say also round Mt. Venn. The work of the State Prospecting Party has demonstrated that a number of reefs exist which carry good assay values in gold, and it is now necessary to prove these values further by mining work, and to search for other lodes. It is evident that the district is well worth prospecting. Probably it would be advantageous for prospectors to do a good deal of loaming prospecting with dry blowing machines.

The route by which Mr. Deshon took our party to the field proved quite practicable for motor cars, keeping on country in which the spinifex had been burned off except for occasional narrow belts of unburned, which were hard on the cars. The sand plains were fairly hard, but roads would easily become very sandy if much wheeled traffic went over them. The route avoided the sandhills which are said to be formidable further north, passing over them at a point where they were very low and easy to cross. This route struck the south end of Mt. Shenton, and must have been a good deal longer than the direct route to Jutson's Rocks taken in 1919 by Mr. Talbot and later by the State Prospecting Party. Probably the direct route could be made a quite practicable road with some expenditure on the worst sandy places.

If the field should develop enough to warrant a more direct route to it than by way of the Cosmo Newberry Hills there seems nothing to prevent it being obtained, except that wells would have to be found and made along it, but this is the case with practically all available routes. Mr. Axford, at Cosmo Newberry Station, has been very fortunate in obtaining a large supply of excellent water by sinking, but along the rest of the route the water supplies are small and soon fail when dry weather sets in. There seems much hope, however, that in the old valleys in the bed-rock underlying the sand plains it will be possible to find by boring good and plentiful supplies of water, which will make the country much more accessible.

Round Mt. Shenton there is a good deal of fair grazing country, some of which has already been taken up for pastoral purposes though not yet settled upon.

Before much can be done at the new goldfield it will be necessary to get a good well somewhere near the Jutson's Rocks discovery, and another about half-way on the selected route out from the Cosmo Newberry Hills. Others will be required as the field is opened up.

COSMO NEWBERRY HILLS.

We did not hear of any prospecting being in progress at the Cosmo Newberry Hills, and did not make any attempt to examine that district, but in passing through it one could not fail to be struck with the similarity of the country to that of most of the Eastern Goldfields. There is a considerable area of greenstone country with much superficial quartz of the usual gold-fields description.

Several reefs have been prospected from time to time, especially on the western side of the Hills near the "Split Rocks," but the eastern portion seemed to me to be well worth carefully prospecting also. The district was described by Mr. C. G. Gibson in Survey Bulletin No. 24, and also by Mr. E. D. Cleland in the Annual Report of the Mines Department for 1909, when some work was in progress. It is now much more accessible than it was at that time, and prospecting should not be attended with so much difficulty. The direct road from Laverton is badly watered in the summer time for prospectors' horses, but Mr. Axford takes his cattle out over a dry stage of about 21 miles to the Laverton-Duketon road near the Little Doris mine, from

which point onward to Laverton water is obtainable at workable stages.

INSPECTOR GOURLEY'S REPORT.

Mr. Inspector Gourley has made a separate report of the trip to the State Prospecting Party's discoveries, which is appended hereto, and describes the route more fully.

ASSAY REPORTS AND PETROLOGICAL NOTES.

Appended hereto also are the assay reports of the Government Mineralogist and Analyst on the samples submitted to him, and the petrological notes of the Acting Petrologist, Dr. C. O. G. Larcombe.

SUMMARY.

The discoveries are very promising and deserve to be followed up and proved by an adequate amount of mining work, and the district appears to me quite to warrant some Government expenditure upon it in improvement of the tracks to it and finding of water supplies.

APPENDIX No. 3.

Trip to Jutson's Rocks.

By E. J. GOURLY, Inspector of Mines, Kalgoorlie, 6th February, 1923.

The State Mining Engineer, Perth.

I beg to submit the following report of the journey and of the finds discovered by the State Prospecting Party.

Leaving Kalgoorlie by train on 24th January the party left Laverton at 10 a.m. on the 25th January, via Axford's or Cosmo Newberry Station.

We found the road for the first 30 miles in fair order, being chiefly hard mulga country with occasional break-aways with belts of spinifex; owing to recent rains there were small supplies of water in soaks and gnamma holes, which we passed at, approximately from Laverton, seven miles, 20 miles, and 30 miles. These distances are as estimated and marked on boards by Mr. Axford. We camped for lunch at the 30 mile and had a look at a breakaway of some interest, with a drop of about 80ft. Further on about 24 miles we came to another rock hole, with a fair supply of good water, and Mr. Axford's notice said, "14 miles to the next water, all sand." This we found to be correct, for the road was through spinifex and very hard pulling for the cars.

We reached Mr. Axford's homestead about 4.30 p.m. We filled all our water cans from his well, which is very good water, and he says the supply seems inexhaustible so far.

We then went on through the Cosmo Newberry Ranges to a soak seven miles from the homestead and camped for the night. This well was covered and contained good water.

Leaving at 6.30 a.m. next morning we ran down an old road for about five miles and then branched off into the spinifex virgin country, the going for the car since leaving the station being rough and stony through the hills, but worse through the spinifex, which we did not get out of practically all the way to Rutter's Grave or Soak. The only thing of note we passed was a patch of blackboy trees, a few sand hills that gave us some trouble to negotiate, and small belts of mulga. The timber is very stunted, and the trees are desert gum in the spinifex.

We reached Rutter's Soak at 12.45 p.m., and greatly to our relief it contained about 3ft. of water. This relieved the situation, for on account of the cars running for the whole 35 miles practically on starting or low gear and the water in the radiator boiling continuously we would not have had sufficient to stay any time on the finds, and make the return journey in safety.

We then proceeded on to Lang's Rocks five miles north and cleaned out the soak there, but it was dry. We had a preliminary look at the find north of Lang's, and then decided to push on to Mt. Jutson, 13 miles from Rutter's, passing over good pastoral country all the way, but these 13 miles are very long ones, and I would say it is easily 16 miles. The soak at Jutson's was filled in with sand and stones, but after being cleaned out made about 10 gallons an hour of very good water. We camped at this soak for the night.

Find at Jutson's.—Leaving camp at 6.30 a.m. the inspection of the work done by the party was proceeded with. It is situated about half a mile N.N.E. of the soak, and on the East side of the granite outcrop or range, a distance of 200 yards, the quartz reef in the first pothole appears to be about 3ft. in width and both foot and hanging wall is in schist country, but not sufficient work has been done to show the strike and dip of this ore body. However, while sampling this, fine gold was seen freely in the stone, and on cleaning out the pothole it is going down strong underfoot. There is a big shed of quartz floaters covering an area

of ground for some distance north, east, and west, but going south this belt of quartz sheddings appears to contact with a huge granite outcrop or hills about half a mile away. To the east of the first pothole several quartz reefs varying in width from 6in. to 2ft. have been opened up on the surface by potholes about a foot in depth, and gold was seen in the stone thrown out of three of them. There is also a strong pegmatite bar passing through the area and a shaft has been sunk to a depth of 15ft. on a reef on the eastern side of this pegmatite bar, the former workings being on the western side. The reef in this shaft averages 2ft. in width, and coarse colours of gold can be seen in some of the stone with a mineral which is galena. The walls of this reef are schist, but greenstone is outcropping close by on the adjoining hill east.

I am of the opinion that Jutson is an important discovery, the surrounding country being somewhat similar to the Kookynie belt, but until further work is done it is difficult to pass any definite opinion.

State Prospecting Party's Find near Lang's Rocks.—Leaving Jutson's camp at 2 p.m. we proceeded to the find north of Lang's Rocks, about two miles. A costean about 8ft. deep has been dug on a quartz leader, almost on the top of a greenstone hill. This leader is about 18in. in width and appears to cut the combs of the country rock, which is running north and south, therefore the leader runs east and west, with a slight bend in it. The stone on the dump shows fine colours of gold. About 80ft. north-east another leader 10in. in width has been opened up with a costean 6ft. in depth. This also runs east and west and shows gold in the stone; the walls of this leader are soft for about 3in. in width on either side, and these two leaders look as if they may be off-shoots from something larger in this hill of greenstone, but nothing has been done to prove this theory. However, on the western fall of this hill there is a big shed of quartz and ironstone, which extends on to a low hill near Lang's Rock, on which the party have done a little work opening up quartz reefs in similar schist country to Jutson's, and Mr. Deshon informs me some good prospects were obtained.

I am of the opinion that there is a good chance of alluvial gold being found on this area, and the quartz veins discovered are well worth further prospecting.

We then proceeded back to Rutter's Soak, reaching this camp about 5 p.m., and had a look round the auriferous belt of country half a mile north-west of the soak. There are a number of quartz reefs outcropping, but up to the present no work of any consequence has been done, and while this bit of country looks favourable both for alluvial and quartz reefs, it requires further prospecting, and I would strongly recommend that the next party that goes out should take a dryblower with them.

Return Journey.—Leaving Rutter's at 6.15 a.m. we made good progress, following our own tracks for about four hours. Then car 2148 refused to pull, the clutch bands being worn out. This caused a delay of 3½ hours, having to take the back portion of the engine to pieces and put in new bands. Then a fire in the spinifex caught a box wrapped up in a bag on the side of car 2149, and we had an exciting time for a few minutes getting it out.

Our run back to Cosmo-Newberry Station, although rough, was without incident, and we pushed on the same evening another 20 miles and camped. We left for Laverton at 6 a.m., which was reached at 9.30 a.m. The roads now being good we decided to drive through to Kalgoorlie and reached Kookynie at 7.45 p.m. on 29th January and Kalgoorlie at 4 p.m. 30th January.

Assays for Gold of 18 Samples from near Mount Shenton for the State Mining Engineer.

By EDWARD S. SIMPSON, Government Mineralogist and Analyst, 14th February, 1923.

(MF. 1669/22, SF. 265/23.)

State Prospecting Party's discoveries near Mt. Shenton:—

L. No.	Mark.	Gold per ton.	L. No.	Mark.	Gold per ton.
		ozs. dwts. grs.			ozs. dwts. grs.
418/23	No. 1	0 1 12	429	No. 14	0 7 3
419	" 2	2 15 7	430	" 16	Quartz with a little iron hydrates and galena:
420	" 3	1 8 5			0 0 21
421	" 4	6 9 8	431	" 17	6 13 20
422	" 6	5 7 6	432	" 19	1 19 15
423	" 7	0 4 6	433	" 20	5 6 7
424	" 8	2 9 2	434	" 21	Trace
425	" 9	Trace	435	" 23	0 1 10
426	" 10	0 1 12			
427	" 11	0 0 14			
428	" 13	Quartz, iron hydrates, a little galena and blende:			
		1 8 12			

Report on Rocks Collected by the State Mining Engineer at the State Prospecting Party's Discoveries near Mount Shenton.

(By Dr. C. O. G. LARCOMBE, Acting Petrologist, 21st February, 1923.)

No. 12.—From a greenstone hill a short distance East of the deepest shaft at Jutson's Rocks (2 specimens).

A dark grey massive and somewhat "blocky" rock with a ferruginous crust. A lens shows it to be very finely granular and to contain very minute brightly reflecting facets.

Under the microscope the rock consists of an antigorite form of serpentine mixed with minute scales of tremolite. Throughout the admixture numerous brightly polarising prismatic plates of tremolite about 1/50 inch long and 1/100 inch wide are distributed, and lie in all azimuths. Small grains of black magnetic iron ore are not uncommon. The rock is a *tremolite serpentine*.

No. 18.—Country containing auriferous reef on Deshon & Trelease's Reward, near Lang's Rocks.

A slightly mottled, medium-grained dioritic looking rock.

Under the microscope it is seen to consist of a holocrystalline aggregate of vertical and cross-sectioned plates of bluish-green and dark-straw hornblende (which forms more than 70 per cent. of the rock) and clouded well shaped plates of plagioclase with a refractive index greater than balsam and a maximum extinction angle of 30° in sections about perpendicular to the plane of symmetry. It is near labradorite. Relicts of ophitic and subophitic textures are common.

The rock is a typical unaltered dolerite or *dolerite amphibolite* (Epidiorite of English Committee).

No. 22.—Country of a Reef near Rutter's Soak.

A black hornblende-looking rock, somewhat schistose, and with a slightly mottled appearance, due to pale brownish ironstained patches.

Under the microscope about 70 per cent. of the rock is seen to consist of a dark bluish-green to pale-straw brown hornblende which is, in most places, packed very densely. In other places the denseness is relieved by ironstained clouded felspathic areas, and the distribution of small hornblende rods and prisms throughout a very fine-grained quartz-felspar mosaic. Some apatite prisms and grains of black oxide of iron are present. The rock is approaching a *hornblende schist*, though the possible orthoclastic nature of the clouded felspar suggests a hornblende gneiss.

No. 5.—Schist which forms the country of the auriferous quartz veins at Jutson's Rocks.

The rock in hand specimens may be called a finely foliated quartz-biotite schist with the foliation planes coated with innumerable spangles of biotite. Small quartz veinlets lie along the planes of schistosity.

Under the microscope the rock consists of a coarse mosaic of quartz and felspathic material, the individuals in which measure about 1/100 inch in average width. The ferromagnesian constituent—biotite—is uniformly distributed throughout the mosaic. Each of the constituents, quartz, felspar and biotite, are in about equal

proportions. The felspar is heavily clouded by kaolinisation and is much cracked. In places the felspar forms large clouded and cleavable plates which show (1) small extinction angles measured from the traces of the cleavages; (2) one axis of a biaxial interference figure, and (3) a refractive index less than Balsam. It is therefore orthoclase. There is also some plagioclase. It is possible that the general structure of the rock was originally holocrystalline, and its present granitic appearance is due to the breaking up and granulation of the original plates. The rock is a finely foliated granitic biotite gneiss, and is preferably to be regarded as of igneous origin. It could be called a biotite-quartz schist.

No. 15.—Sample of wall schist of another vein at Jutson's Rocks.

An ironstained, pale vitreous granular sugary rock with minute black hornblende prisms which tend to take on a parallel arrangement, and in places to segregate into patches.

Under the microscope the rock is a medium grained granular to granitic mass of rounded or polygonal mosaic plates of clear quartz and clouded felspar, some of which may be orthoclase, the remainder being plagioclase. The individuals which make up the mosaic are about 1/50 inch in average width. Throughout the mosaic are numerous prisms and cross sections of a dark-green to pale-brown hornblende. The junction lines between the various mineral grains of quartz and felspar are frequently ironstained. The hornblende prisms are in places, 1mm. long.

The rock is a *granulitic hornblende gneiss* and is evidently of igneous origin.

General remarks and comparison of Nos. 5 and 15 with the gneiss from Edna May, Hill End and Battler in the Westonia District.

It is quite possible that Nos. 5 and 15 belong to the same rock mass, a mineralogic change resulting in the formation in 15 of hornblende instead of biotite.

It would appear as if there is a good deal to be said in favour of a resemblance between No. 5 and the gneiss from Edna May, as described by Mr. Farquharson in Bulletin 71, pp. 287 to 295. Both rocks are similar in texture and mineral contents. Rock No. 5 is, if anything, more felspathic and contains more biotite than the gneiss from Edna May. Slides from the Edna gneiss at depths of 180, 182ft. 6in., 200, 209, 320, and 503 feet all contain biotite, those from 550 and 674 feet contain hornblende only, and at 786 feet both hornblende and biotite are seen in the one slide. The appearance of hornblende in No. 15 is not therefore so remarkable, and does not affect the correlation made.

The gneisses from Hill End and Battler appear to be more acidic than those from Jutson's Rocks, and it is not possible to suggest any connection between the two series of rocks.

APPENDIX No. 5.

Fenton's Oil Area.

By R. C. WILSON, Assistant State Mining Engineer, 19th April, 1923.

When examining the limestone in the Denmark District in February last I visited Mr. Fenton's Oil Area at his request and have to report as follows:—

Location.—The area held by Mr. Fenton is indicated in the litho. attached.* That portion to which he directed my special attention, and which forms the principal subject of this report, is situated in the bed of a small creek practically on the eastern boundary of P.U. 2004 and about half a mile from the coast.

Geology and General Description.—The fundamental rock in the district is a granite which varies in texture and is frequently porphyritic. Its surface is most irregular, rising in places to form high hills as at Mt. Hallowell, while the hollows are often below sea level. These hollows have been filled to some extent by sedimentary beds. Amongst these it is probable that the marine beds of tertiary age which are found near Albany are represented, but in many places the coastal sandstones with their capping of limestone rest directly in the underlying granite. These sandstones, in which false bedding is strongly developed, are usually regarded as being old consolidated sand dunes.

In the creek bed to which Mr. Fenton directed my special attention a small waterfall has exposed a natural section as follows:—

- A.—From three to four feet at surface of sand.
- B.—A five feet seam of brown coal shale.
- C.—From four to five feet of puggy clay.
- D.—A small seam of fine sand.

Samples of all these seams were examined by Dr. Simpson, Government Mineralogist and Analyst, with the following result:—

A.—Quartz sand with a considerable amount of organic matter and a little garnet, ilmenite, and zircon. This also contained some diatoms. Mineral oil, nil.

B.—Sample No. 1 from top six inches of brown coal shale.

A low grade brown coal shale with strings of marcasite (sulphide of iron). This marcasite is generated *in situ* in one or other of two ways:—

- (1) By interaction between bog iron ore and sulphur-bearing organic compounds in the vegetable matter which latter is converted into coal.
- (2) By interaction between bog iron ore, organic matter, and soluble sulphates (magnesium sulphate, etc.), which latter are readily reduced to sulphides by organic matter, with or without the intervention of bacteria.

Nodules and strings of marcasite are very common in all sedimentary beds which carry much organic matter.

Sample No. 2, from remainder of brown coal shale:—

By extraction test:

Mineral oil—nil.

By destructive distillation test:

Gas	15.35 per cent.
Oil	1.65 "
Water	23.00 "
Total volatile	40.00 "
Ash	45.98 "

Remarks.—This material contains no free petroleum and is valueless as a source of tar-oils or gas.

C.—A plastic clay in which no trace of mineral oil could be detected.

D.—Sand consisting mainly of quartz with some felspar and mica.

Sizing test:—

Over 30 mesh	1.52 per cent.
Over 60 "	32.06 "
Over 90 "	18.30 "
Under 90 mesh	48.12 "

This is too fine-grained for a glass sand.

(Sgd.) E. S. SIMPSON,
Government Mineralogist and Analyst.

The conclusion that these determinations indicate is that beds of sand and clay, both of which could be derived from the disintegration of the granite, have been laid down in shallow water. Coals are described in text books as being the more or less completely carbonised remains of woody and other vegetable matter. This brown coal shale would represent the incompletely carbonised remains of such plant life as would be found

in a swamp combined with a proportion of the clay bottom of such swamp. All coals give mineral oil when subjected to destructive distillation. Collie coal, for instance, would probably yield about 6 or 7 per cent.

The absence of any free petroleum indicates that no mineral oil has found its way from external sources into the bed of shale and the oil in the analysis is the combined oil which has been formed during the carbonisation of the woody matter, and not introduced mineral oil which would be extractable by solvents.

In case the difference between free and combined oil is not quite clearly understood, I might explain that if a piece of coal were soaked in oil any oil that it absorbed would be free oil and could be dissolved out again by ether or other solvents, but the combined oil which is really part and parcel of the coal would be quite unaffected and could only be extracted by destroying the coal, *i.e.*, by destructive distillation. Dr. Simpson's determination of the sand and clay seams are self explanatory and do not call for any further comment.

Probable Thickness of Sedimentary Beds.—This is a matter of considerable importance in regard to oil possibilities, and while we have no direct evidence in the shape of bore-holes there is a granite outcrop about a quarter of a mile to the North-West of the site under review and another on the coast roughly half a mile South. Other granite outcrops were also noticed at Mt. Hallowell and near Wilson's Head (see plan attached). These outcrops in such close proximity suggest a shallow thickness of sedimentary beds resting on a granite bottom.

Zircon Sands.—An interesting deposit of heavy grey sands containing zircon and other minerals enumerated below occurs as a layer on the sea shore, at a point indicated on the plan.

These minerals would in all probability occur in the granite near its contact with the basic dyke, and upon disintegration of the granite would tend to concentrate into a layer on account of their greater specific gravity than the ordinary sand. As a commercial proposition it might possibly be used as an abrasive in place of emery. Dr. Simpson's determination of the mineral contents of this sand was as follows:—

"A heavy grey sand composed of the following minerals arranged in descending order of abundance:

Zircon (silicate of zirconium), forms 41 per cent. of the whole sand.
Ilmenite (oxide of iron and titanium).
Quartz.
Leucoxene (hydrated oxide of iron).
Rutile (oxide of titanium).
Tourmaline (borosilicate of aluminium, etc.).
Garnet (silicate of aluminium and iron).
Staurolite (silicate of aluminium, iron, and magnesium).

The sample contained no tin. There is a small market for zircon, but before marketing it would have to be concentrated up to a high degree of purity (90 per cent. or more), and this would require an elaborate and expensive concentrating plant."

Conclusion.—In my opinion the prospects of oil being found at the site inspected are, I regret to say, by no means encouraging. The coal shale which was looked upon as an indication proves to contain no free petroleum and only indicates the former presence of an accumulation of vegetable matter, whereas the proximity of granite outcrops is a distinctly unfavourable indication, as it suggests a shallow thickness only of sedimentary beds.

Mr. Fenton informed me that this was almost certainly the site visited by Capt. de Hautpick, the Russian Oil Geologist, and selected by him as one of his boring sites. He certainly recommended boring near Edward Point. I found granite outcropping strongly along the coast at no great distance from this point (see plan). In the absence of Capt. de Hautpick's full report I do not know upon what evidence he based his opinion that deep sedimentation would be found in the vicinity. I certainly saw none in the vicinity visited by me.

APPENDIX No. 6.

P.A. 2053, Coolgardie, "Golden Promise."

By R. C. WILSON, Assistant State Mining Engineer, 21st March, 1923.

As instructed, I visited this P.A. on 5th March, and beg to report, as follows:—

Location.—It is situated 12 miles south-west of Bulla Bulling, being part of the old Prince of Wales group, and takes in old G.N.L. 3529.

Main Shaft Workings.—A main vertical shaft has been sunk to a depth of about 220 feet, and levels have been driven at the 90ft., 150ft., and 200ft. levels. See plan by Mr. Jowett attached.*

A shoot of ore about 70ft. in length at the surface and pitching to the south appears to have been worked out down to the 200ft. level, where it has been stoped for a length of about 30ft. At this level a west crosscut from the shaft intersected the lode at a distance of 30ft., where a south drive was started and was driven

a distance of 39ft. The principal object of my visit was to sample the lode going underfoot at this level.

This was the only place likely to show good values, as the previous owners had apparently stoped out all the best ore between this level and the surface.

Mr. Jowett in his report, to which I would refer you for a more detailed description of the mine, explained that it was most unfortunate that when he was about 3ft. from completely unwatering the winze there was a breakage with the winch, and so he was unable to sample this most important part of the lode.

At the time of my visit it was not an easy matter to get reliable samples, as there was a good deal of loose material on the floor of the drive and a stream of water was running along the drive out to the shaft. Every care was taken, however, and the following is a complete list of the results obtained:—

No. of Sample.	Location.	Width of Section.	Value per ton.	Total Width.	Average Value.	Remarks.
		Inches.	Dwts.	Inches.	Dwts.	
	<i>200ft. Level Main Crosscut.</i>					
1	North side of Crosscut	HW 24	1.2	24	1.2	Omitting FW section.
2	do. do.	FW 24	Nil	...	...
	<i>200ft. Level Main South Drive.</i>					
3	2ft. South of Crosscut	64	Nil	64	Nil	Lode overhead.
15	7ft. " "	36	54.9	36	54.9	Lode underfoot.
6	14ft. " "	67	7.5	67	7.5	do.
4	19ft. " "	HW 36	1.5	...	...	do.
5	19ft. " "	FW 36	3.9	72	2.7	do.
7	24ft. " "	HW 36	0.4	...	...	do.
8	24ft. " "	FW 36	1.3	72	0.8	do.
9	29ft. " "	84	12.2	84	12.2	do.
10	34ft. " "	HW 30	Nil	...	...	do.
11	34ft. " "	FW 30	1.3	60	0.6	do.
13	39ft. " "	HW 30	4.4	...	...	do.
14	39ft. " "	FW 30	1.1	60	2.7	do.
12	39ft. " "	30	0.7	30	0.7	Face of drive.

It will be noted that at a point 7ft. south of the crosscut the lode assayed 54.9dwts. per ton for a width of 36in. At 14ft. 7.5dwts. for 67 inches, and at 29ft. 12.2 dwts. for 84 inches, and that elsewhere it was unpayable.

New Shaft Workings.—At a distance of about 50ft. south of the main shaft another shaft known as the new shaft has been sunk to a depth of 100ft., the first 25ft. being vertical and the remainder on the underlie. At this depth a level has been driven north a distance of 200ft. There is evidence at this end of the mine of faulting and movement of the walls of the lode on one another, resulting in the formation of lenses of

ore. In the present face of the north drive there is a lense of quartz 30in. wide in the middle of the face, which, however, pinches right out at the top and again at the bottom of the face. I did not take any samples from these workings. Mr. Jowett's sampling indicates that although payable results are obtainable in places, up to the present there has been no continuity of values.

General Remarks.—With regard to the property as a whole, one might say that while further prospecting appears justified, the only known shoot of gold is too short to supply a sufficient tonnage of ore to pay for the sinking of the main shaft another lift.

* Not published.

APPENDIX No. 7.

Paton's Oil Area, No. 95.

By R. C. WILSON, Assistant State Mining Engineer, 27th April, 1923.

I have to report having made two visits to this oil area. On the first occasion I was accompanied by Messrs. Paton, Duffell, Paterson, and Cheyne, all of whom are interested in the area. On my second visit, on 11th April, I was accompanied by Dr. Simpson (Government Mineralogist and Analyst) and by Messrs. Paton and Duffell.

Location and General Description.—The location of Paton's oil area is indicated on the small scale map attached.* It has an area of 2,450 square miles, Rockingham being approximately at its north-west corner.

The portion of the area in which I was specially interested was the eastern edge of White Lake and the swamp which forms its southern continuation. Mr. Duffell showed me several assay certificates signed by a chemist in private practice, showing varying quantities of mineral oil, the highest being roughly 0.8 per cent. of mineral oil, the balance showing smaller amounts, but all containing some. He pointed out to me where these samples had been obtained, and I decided to take samples at three of these places. Sample No. 1 was taken at the eastern edge of White Lake; Sample No. 2 was taken at the eastern edge of Salt Lake, and Sample No. 3 in the marshy ground between the two lakes. These samples were submitted to Dr. Simpson for examination, and his report was as follows:—

No. 1, White Lake.—A calcareous marl containing a considerable amount of organic matter. On extraction and evaporation this sample yielded 0.007 per cent. of oily-looking substance which was only partly saponified, the residue, amounting to .005 per cent., having an oily appearance and being apparently a hydrocarbon of mineral origin.

No. 2, Salt Lake.—Black calcareous marl containing a large amount of decayed vegetable matter. An extraction test yielded a residue of .005 per cent. After saponification a residue of 0.003 per cent. was obtained similar in appearance and properties to No. 1.

No. 3, between White and Salt Lakes.—Black swamp oil. First yield from extraction test, 0.004 per cent.; final yield after saponification, 0.002 per cent. This residue was similar to that obtained in No. 1.

The results taken in conjunction with the fact that Dr. Simpson had obtained quite a considerable amount of a thick mineral oil resembling vaseline in an unofficial sample which was submitted to him for examination, were, I considered, such as to warrant further investigations, and as the locality can be reached in a little over two hours in a motor car, I suggested that Dr. Simpson should accompany me on my second visit to the site. He agreed to do so and together we took an additional six samples. A full report by Dr. Simpson of this visit, including the results of the analyses of our samples, is attached. The location of these is indicated on the lithograph* accompanying this report, and the following excerpt is taken from Dr. Simpson's report:—

"The points from which oil-bearing units had been collected were pointed out, and fresh samples were taken close to these and immediately sealed. Two of these points were on the eastern edge of White Lake, three on the eastern edge of the swamp which forms a continuation of this lake, and one from a small swamp between Salt Lake and Stake Hill. The samples taken were all of the same nature, viz., swamp soils from the surface, or a few inches below it, down to a depth of about 12 inches.

Of these samples the first and second were considered to be the most crucial ones, as they were

taken on either side of the previous rich sample, and quite close to it.

The results obtained on analyses were:—

1006/23, Mark I., eastern edge of White Lake.—Dark grey marl, mostly calcium carbonate with small gasteropod shells and much organic matter.—Non-saponifiable extract, 0.003 per cent. The very small extract was white and appeared to be a mixture of wax and oil. It was not at all like the large extract obtained some time previously from an unofficial sample from this locality.

1007/23, Mark II.—Similar material to I., taken about 30 feet away. Non-saponifiable extract, 0.008 per cent. The extract was similar to that from I.

1008/23, Mark III., eastern side of swamp, south of White Lake.—Nearly black marl with much organic matter, including partly decayed vegetable matter. Non-saponifiable extract, 0.011 per cent. This extract was partly a heavy yellow oil, partly more solid matter, including probably both vegetable wax and resin.

1011/23, Mark VI., one quarter mile south of III.—Coarse white sand with much decayed vegetable matter. Non-saponifiable extract, 0.011 per cent. Similar to extract from III.

1009/23, Mark IV., one half mile south of III.—Sandy marl with much vegetable matter. Non-saponifiable extract, nil.

1010/23, Mark V., small swamp between Salt Lake and Stake Hill.—Sandy marl with much humus. Non-saponifiable extract, nil.

The hydrocarbon oil in these six samples therefore ranges from nil up to 0.01 per cent., a very small amount, only one-fifteenth of that obtained from the best unofficial sample. Hydrocarbon oils result from the decomposition of many kinds of vegetable and animal debris, and such traces must be looked upon as probably quite usual constituents of swamp soils so heavily charged with organic matter. There is nothing whatever in the facts so far adduced to indicate that anything in the nature of an oil seepage has been discovered in the country lying between Rockingham and Mandurah."

The first thing that will probably occur to the casual reader is that in Dr. Simpson's analyses there is little or no mention of mineral oil, whereas, in most instances, a small percentage of non-saponifiable extract is shown.

It might be well to explain here that any liquid substance which is soluble in petroleum spirit and is non-saponifiable (i.e., is not converted into a soap by the action of caustic alkalis) is almost certainly a hydrocarbon or mineral oil. However, some resins and vegetable waxes which are soluble in petroleum spirit are also unsaponifiable, and Dr. Simpson's analyses of samples No. 3 and No. 6 showed that probably both these constituents were present as well as hydrocarbon oil.

Geology.

White Lake, where the supposed seepage occurs, is situated on the coastal plain lying to the west of the Darling Range. According to Mr. A. Gibb Maitland, Government Geologist, the line of demarcation of the coastal plain and the hill ranges to the east is marked by what is termed the Darling Fault Scarp, averaging 1,000 feet in height and traceable to the north and south for over 300 miles.

* Not published.

The coastal plain consists of a very considerable thickness of sedimentary beds. The South Perth bore had not reached bed rock when it was stopped at a depth of 1,860 feet 6 inches. Details of the bore were as follows:—

SOUTH PERTH BORE.

Nature of Strata.	Thickness.	Depth.	Remarks.
	Ft. in.	Ft. in.	
Sand (incoherent sandstone)	75 0	...	Output, 372,384 gallons per diem. Pressure in lbs. per square inch 44.5. Static head above surface in feet 103.75. Surface of ground above sea level 18.01 feet. Depth of principal water-bearing strata, 1,837 feet.
Calcareous shale	142 0	75 0	
Sand (incoherent sandstone)	263 0	217 0	
Calcareous shales with five (5) hard bands	1,351 0	480 0	
Sand (incoherent sandstone)	29 6	1,831 0	
Total	1,860 6	1,860 6	

HAMPTON ROAD BORE, No. 2.

Nature of Strata.	Thickness.		Depth.	
	Ft.	ins.	Ft.	ins.
Limestone	160	0	...	...
Hard sand (no sample)	1	0	160	1
Mudstone	196	0	161	0
Grey sand and gravel	41	0	357	0
Mudstone	32	0	398	0
Quartz, gravel and sand (calcareous)	25	0	430	0
Very soft calcareous sandstone	38	0	455	0
Quartz, gravel and boulders	55	0	493	0
Sandy mudstone	141	0	548	0
Hard calcareous grit	1	0	689	0
Sandy and calcareous mudstone	116	3	690	0
Hard grey limestone	0	9	806	3
Soft sandy mudstone	50	0	807	0
Hard mudstone and shell fragments	2	0	857	0
Soft sandy mudstone	20	0	959	0
Shaley mudstone	39	10	879	0
Hard mudstone cemented with carbonate of lime	1	8	918	10
Mudstone with shell fragments	50	11	920	6
Hard mudstone cemented with carbonate of lime	0	4	971	5
Mudstone with shell fragments	17	3	971	9
Granite boulder	0	3	989	0
Mudstone with shell fragments	77	9	989	3
Very hard fine-grained mudstone	1	0	1,067	0
Mudstone with shell fragments, also pyrites, nodules, and boulders of granite and diorite	28	0	1,068	0
Coarse sand and mud (? soft sandy mudstone)	57	0	1,096	0
Quartz, gravel and grey sand	12	0	1,155	0
Grey clay	7	0	1,165	0
Grey sandy clay	24	0	1,172	0
Grey clay shale	11	0	1,196	0
Yellow sand	115	0	1,207	0
Total	1,322	0	1,322	0

The mouth of this bore is 68 feet above sea-level; the principal water-bearing horizons are at 490 and 1,246 feet respectively. The static head of the water from the first horizon is 24.5 feet above sea-level, and the second 110 feet. The supply of artesian water from 1,246 feet when allowed to flow uncontrolled is 120,000 gallons per day. A sub-artesian supply of 1,227,000 gallons per diem can be pumped from the 490 feet level.

As pointed out by Dr. Simpson, this great thickness of sediments of comparatively recent geological age is favourable at any rate for the generation, if not for the storage, of petroleum. The occurrence of a seepage along a chain of lakes running approximately north and south would have been possible, and would have suggested that the oil had made its way to the surface along a fault parallel to the Darling Range fault.

I do not attach any importance to the surface undulations of the ground. These are due to sand hills and to irregular outcrops of coastal sandstones and limestones. These latter rocks are usually considered to be old consolidated sandhills, from which lime has been dissolved out and re-deposited at the surface to form a hard capping of limestone.

It would not be possible at present to select a favourable site for boring. This can only be done when some knowledge of the structure of the deep-seated sedimentary rocks can be ascertained. In the present instance,

such structures are completely obscured, being covered by more recent sediments, and there are no deep bores in the vicinity.

General Remarks.

The occurrence of even minute traces of hydro-carbon oil in this swamp mud is extremely interesting, and, in my opinion, worth further investigation. Dr. Simpson has expressed the opinion that such traces must be looked upon as probably quite usual constituents of swamp soils heavily charged with organic matter. This is, of course, quite probable, but I am unaware that the presence of hydrocarbon oil in swamp soils has previously been demonstrated positively.

If this fact can be established, it will have an important bearing on our conceptions of the origin of mineral oil; but, until it is so, there still seems to me to be some chance that these traces of oil may have found their way into the swamp from below.

APPENDIX No. 8.

Supposed Indications of Petroleum at Jandakot.

By R. C. WILSON, Assistant State Mining Engineer, 10th September, 1923.

As instructed, I visited Mr. Lyon's Block No. 214 at Jandakot on the 18th May last, and have to report as follows:—

This block is on the coastal plains lying between the Darling Range and the coast line, and consequently there will be a thickness of sedimentary beds here of at least 3,000 feet. As explained by Dr. Simpson in a report upon this block in 1903, immediately behind the coastal limestone hills there are a series of large swamps in a valley parallel to the coast, and on the eastern side of them low hills of drift with occasional small swamps in the hollows, one of which is included in Mr. Lyon's selection. The bed of this swamp is composed of clayey and peaty sand, and as is common in swampy ground a certain amount of gas is given off. Dr. Simpson says that this gas proved to be mainly sulphuretted hydrogen with a little marsh gas, both given off from a layer of peaty soil undergoing decomposition.

Mr. Lyon looked upon these occurrences as indications of the presence of petroleum. Dr. Simpson in his report stated that no asphalt or other indication of the presence of petroleum was observed either on Mr. Lyon's selection or elsewhere in the vicinity.

On 18th April of this year Mr. Lyon reported that since Dr. Simpson's visit other indications were notice-

able, notably the finding of a wax in one of the scums that the bees were collecting. He stated having sent a sample of this to a dispensing chemist in Fremantle, who found that the sample contained paraffin wax (a petroleum derivative).

A sample taken by me at this place was examined by the Government Mineralogist and Analyst, who found that the sample contained an inconsiderable amount of unsaponifiable matter in the form of a white waxy scum which he considered to be of vegetable origin, and no indication of the presence of petroleum.

Samples Nos. 2 and 6 were swamp soils taken alongside two small springs.

Sample No. 3 is a sample of decomposing vegetable matter in a trench which was cut to drain the ground, and

Sample No. 4 is a sample of discoloured water from a well.

Like Sample No. 1, these all contain traces of unsaponifiable matter, considered by Dr. Simpson to be of recent vegetable origin.

As the result of my visit therefore I have to report that I observed only the usual occurrences found on swampy ground, and no indications of the presence of petroleum.

APPENDIX No. 9.

Graphite at Martigallup.

By R. C. WILSON, Assistant State Mining Engineer, 23rd October, 1923.

Acting upon official instructions I visited Herbert and Coombes' P.A. 11PP for graphite on 26th July, 1923, and have to report as follows:—

Location.—Martigallup is situated about six miles south by west from Tenterden, on the Albany line, and is connected with that siding by a road three chains in width. The exact position of the P.A. under review is shown on the lithograph attached.

Nature of Deposit.—The graphite occurs in flat shallow undulating beds of kaolin or clay. These graphite bearing seams generally vary from 6 inches to 24 inches in width, and do not appear to be continuous for any very great distance. In No. 1 shaft a bulge seems to have occurred, there being 8ft. of lode showing.

At the bottom of the deeper shafts the country rock, which still consists of kaolin, seems to have lost its bedded character, and this may possibly represent the weathered portion of a more or less basic rock.

The surface rock consists of hard ironstone laterite in which graphite can be seen in places.

A sketch accompanying this report shows the extent of the workings and also the position and width over which my samples were taken. These were reported upon by the Government Mineralogist and Chemist as follows:—

"L. 1791/23 No. 1, weathered rock, interspersed with completely kaolinised material, containing a small amount of flake graphite.

L. 17920/23 No. 2. Almost completely kaolinised rock containing a little flake graphite.

L. 1793/23 No. 3. Completely kaolinised material with a little flake graphite.

"The remaining samples contained varying amounts of graphite flake and consisted for the most part of soft, kaolinised material.

"Ore Assay.

Lab. No.	1794.	1795.	1796.	1797.	1798.	1799.	1800.
Mark	4	5	6	7	8	9	10
Carbon	% 5.94	% 4.40	% 10.94	% 2.18	% 2.26	% trace	% 4.24
Volatile	14.58	17.00	17.04	13.10	13.04	...	9.80
Ash	79.48	78.60	72.02	84.72	84.70	...	85.96
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

"A mixed sample of these, omitting No. 9 in which only traces of graphite could be detected, was subjected to a concentration test with Morgan's Model Flotation Plant.

"The first concentrate obtained was obviously too low grade. After repeated regrinding and refloating a recovery was made of 3.00 per cent. of graphite over 80 mesh in size.

"Assay of Concentrate:

Carbon	71.84 per cent.
Volatile	5.60 "
Ash	22.56 "
	100.00 "

"The ash contained a considerable amount of mica.

"The recovery of graphite is very poor and the concentrate is too low grade to be of commercial value."

General Remarks.—As far as the deposit has already been opened up it would seem to be too small to be worked on a large scale, but to be one which would allow a few prospectors to keep going if the product were marketable.

In this connection it is interesting to note that comparatively low grade mines are worked in Canada. At the Elmsley mine graphitic limestone containing 5 per cent. graphite is sent to the mill, and the average treated is about 8 per cent. In this instance a recovery of 62 per cent. has been obtained by dry concentration. At the Peerless mine the average value is stated to be about 8 per cent. of graphite. The mill is equipped with flotation units and electrostatic separators for the elimination of mica from the final products. Some experimental work on these lines might, I think, with advantage be carried out upon the graphite deposits of this State. As pointed out by Mr. Blatchford in a report published in the Annual Report, Department of Mines, for 1921, this deposit deserves notice in that it is more or less on the same line as the Munglinup, Kendenup, and Donnelly River deposits.

The owners are to be commended for their genuine effort to develop the deposit, which up to the present has yielded no return.

Note.—The sample mentioned by Mr. Herbert in his letter of 29th September is now to hand, and appears to be a little better than some of the others. I am sending it over to the Government Mineralogist for examination.

— HERBERT AND COOMBE'S GRAPHITE P.A. II ^{P.P.} —

— MARTIGALLUP —

— abt. 6 Miles South by West of Tenterdon —

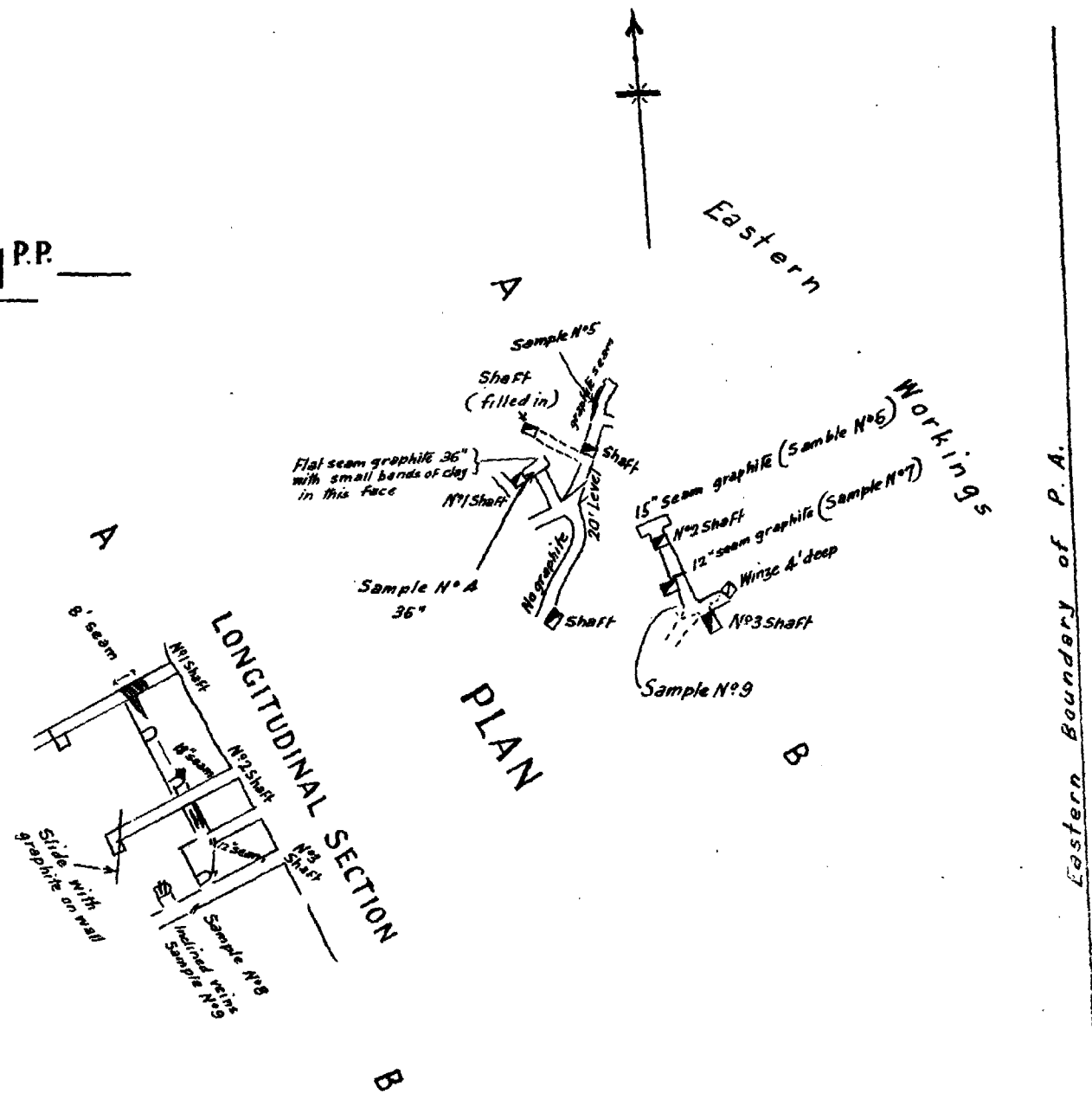


Shaft (50')
(inaccessible)
(Sample N°2)

Shaft 14' (full of water)
(Sample N°9)

Pothole (full of water)
(Sample N°1)

Western Workings



APPENDIX No. 10.

Reported Oil at Lake Eva, near Southern Cross.

By R. C. WILSON, Assistant State

Mining Engineer, 31st October, 1923.

Acting on official instructions I twice visited Lake Eva, near Southern Cross, where an oil seepage was reported by Mr. Rothkehl.

expected that these would contain at least traces of oil. No trace of mineral oil was detected in these samples. Dr. Simpson's report upon them was as follows:—

First Inspection.

My first inspection was made on the 2nd inst. I travelled to Lake Eva via Yelladine, where there is a conspicuous granite outcrop. The country between Yelladine and Lake Eva is mostly of the sandy nature which overlies granite, and another large outcrop occurs 10 miles from Lake Eva. No outcrop nearer than this was seen on this visit, but I might mention here that on my second visit I found another granite outcrop on the northern side of Lake Eva at a distance of half a mile from the site of the bore in which oil was reported to have been found.

“Lab. No. 2343/23. Mark ‘B.’ Sandy clay from an auger hole put down to 3 feet by Mr. Wilson about 25 feet west of the private bore.

“This contained no trace of oil of any description. Lab. No. 2344/23. Mark ‘C.’ Sandy clay from an auger hole put down to 2½ feet by Mr. Wilson about 15 feet west of the private bore.

“This contained no mineral oil whatever, but a trace of a highly aromatic essential oil of vegetable origin.”

Second Inspection.

This bore was on the edge of the lake on the southern side. Undoubtedly oil of some sort was floating on the surface of the water, which was about 3ft. 6in. below the ground level, and oil could also be seen on the surface of the water but in diminished quantity after pumping out the bore hole and allowing the water to rise again.

On this occasion oil could still be seen floating on the water in the bore, and on the surface of the ground in its vicinity. In order to further test the genuineness of the reported seepage a check bore was started at a point 7ft. 6in. west of the original bore, and was put down to a depth of 39ft. 3in. The bore passed through a mixture of clay and sand of varying hardness and bottomed on hard unyielding granite. No sign of any oil was visible on the surface of the water after allowing it to stand over night.

Mr. Rothkehl informed me that the oil appeared to find its way into the bore principally at a depth of from 28 to 30 feet.

A second borehole was started at a point 4ft. 3in. south of the original one, and was sunk to a depth of 32ft. At this depth the boring party were unfortunate enough to drop one of the boring rods in the hole. No oil could be seen on the surface of the water although this depth was below that at which the prospectors' bore was reported to have found oil. As there was just time by leaving to catch Saturday night's train, I left the foreman to get the rod out, and to complete the borehole.

A sample of this oil was taken and submitted to the Government Analyst and Mineralogist for examination. His report was as follows:—

“I have now completed my examination of the three samples collected by Mr. Wilson at the supposed find of petroleum at Lake Eva to the north-East of Southern Cross:

“Lab. No. 2342/23. Mark ‘A.’ This was a bottle of water with about 5 cubic centimetres of a brown oily emulsion floating on its surface. It was stated to have been taken from the original bore hole. A strong odour of kerosene was observed. Light petroleum spirit was added to collect the oil, and whilst this was proceeding small lumps of a greasy yellow material were noted. These were separated and weighed; they amounted to 0.4 gram, and dissolved in water with frothing, giving a strongly alkaline reaction. They were undoubtedly composed of soap, apparently originally present in the form of a lubricating grease.

I might mention that there was so much oil all about the surface that great care had to be exercised to avoid contamination of the bore holes. Every care was taken, and the hole was securely covered and sealed whenever it was necessary to leave it.

“The oil extracted with petroleum spirit was fractionated with the following results:—

Boiling temperature °C.	Per cent. of Oil.	Nature.
Below 150°	Nil	
150 - 200	17.43	Kerosene.
200 - 250	3.05	
250 - 300	23.53	
300 - 350	4.14	Lubricating oil.
Over 350	36.60	Vaseline.
Still residue	15.25	Vaseline with traces of asphalt.
	100.00	

Both the prospectors were present when the first bore was started, but both left before its completion.

When the hole had reached a depth of 30ft. Mr. Rothkehl collected a sample of the water and then left, stating that it would be more satisfactory to me if he were not present, and that he would sleep at the rocks. He seems, however, to have changed his mind and left for Yelladine, about 20 miles away, and caught the train for Perth that night.

Samples of water and of the clay passed through in boring were taken, and have been left with Dr. Simpson for examination. The results, however, are not likely to alter my present opinion.

“The facts are to be noted that this oil contained no fraction lighter than kerosene, and was associated with lumps of lubricating grease, one constituent of which was a soap, a purely artificial compound. These facts lead one to doubt if this oily mixture is of purely natural origin.”

Two samples were taken from the surface clay near the bore, and were tested for mineral oil contents. Unless the ground was extremely impervious it was to be

Conclusion.

1. The analysis of the oil taken from the bore hole has proved it to contain manufactured products, viz., kerosene, vaseline, and soap.

2. My own observations and the check borehole show geological conditions inconsistent with the presence of natural mineral oil.

I am therefore of opinion that the oil present in the bore hole did not find its way there by any natural process.

APPENDIX No. 11.

Mt. Agnes Copper Deposit.

By R. C. WILSON, Assistant State Mining Engineer, 13th February, 1924.

Acting on official instructions, I visited this copper deposit on 8th November last, and beg to report as follows:—

Location.—It is situated in the Ashburton Goldfield about eight miles south of Mt. Elizabeth, and is roughly 120 miles by road from Onslow, the nearest port.

Geology and General Description.—The Ashburton Beds in which this deposit occurs consist of ancient quartzites, conglomerates and metamorphic sedimentary rocks of undetermined age closely resembling the Mosquito Creek series of rocks. The country generally is extremely hilly and rough, large slabs of schist, or slate as it is usually termed, commonly protruding above the ground. These beds, which are now more or less vertical, were no doubt originally laid down horizontally, and have been folded and tilted into their present position. Quartzite bands between the bedding planes are common, and frequently form the ridges of hills. The copper deposits consist of schist which has been impregnated with solutions carrying copper and silica. The original solutions no doubt came from below, but there has since been a great deal of secondary action causing an enrichment over a large width at and near the surface. This secondary action gave the deposit an attractive appearance, and the work carried out by the company was, I consider, quite justified.

The main lode forms a ridge which at the highest point is 45 feet above the ground level. It is nearly vertical, and its strike is approximately east and west. At the surface copper can be seen over a width of 50 feet and for a length of about 100 feet.

At the time of my visit the average grade of the ore could not be ascertained as, owing to the surface leaching which had taken place, representative samples could

not be obtained. I strongly recommended that a tunnel be driven through the hill to serve as an indication of the values below the surface. Before I left this tunnel had been driven 3 feet in micaceous schist with malachite and atacamite assaying 4.85 per cent. of copper, 13dwts. 14grs. per ton of gold, and 3dwts. 1gr. per ton of silver (sample No. 3).

The manager informs me that since I left the tunnel has been driven into the hill a distance of 40ft., and that the copper values gave out almost immediately.

He also put a costean across the lode at a distance of about 100ft. west of the main shaft without disclosing any payable ore.

It had been the intention of the company to sink the main shaft to water level, and crosscut through the lode at this depth. The results obtained in the tunnel, however, were so disappointing that they discontinued the work, and have, I understand, abandoned their option over the property.

On the occasion of my visit I took a few samples of the ore, and had them examined by the Government Mineralogist and Analyst with the following results:—

A more or less picked sample taken over a width of 20 feet on top of the hill consisted of biotite schist with quartz, malachite, calcite, and iron hydrate, and gave an assay result of 6.73 copper, 1dwt. per ton of gold, and 2dwts. 9grs. per ton of silver.

Samples taken across the eastern slope of the ridge gave low results only. This was expected owing to surface impoverishment, which was quite marked here. Often where no copper is showing at all at the surface copper stains are found where a few inches of hard silicious ore have been broken away. The results obtained were as follows, measurements being taken from the centre of the main shaft:—

No. of Sample.	Distance from Shaft.	Width of sample.	Copper Contents.	Gold contents per ton.	Silver contents per ton.	Remarks.
3	18ft. S. to 21ft. S.	3ft. 0in.	4.85	oz. dwt. gr. 0 13 14	oz. dwt. gr. 0 3 1	Micaceous schist with malachite and atacamite.
1	36ft. S. ,, 44ft. S.	8ft. 0in.	1.83	0 0 14	0 0 21	Micaceous schist with quartz stringers impregnated with malachite.
4	44ft. S. ,, 73ft. S.	29ft. 0in.	0.23	0 0 5	0 0 5	Micaceous schist with quartz and copper stains.
2	73ft. S. ,, 79ft. S.	6ft. 0in.	2.85	0 2 16	0 1 16	Micaceous schist with quartz malachite and a little atacamite.

NOTE.—From 21ft. S. to 36ft. S. consisted of impoverished silicious ore which was not sampled.

Reference to the plan accompanying this report will show that there are several other lines of lode, which however are quite undeveloped. A picked sample from a pot hole on top of the north and south ridge gave an assay result of 10.30 per cent. of copper, 21grs. per ton of gold, and a trace of silver. This sample consisted of micaceous schist, iron hydrates, and a little oxide of manganese.

A sample of broken ore from the main lode assayed 6.64 per cent. of copper, 5dwts. 9grs. per ton of gold, and 4dwts. 15grs. per ton of silver.

Treatment.—It was proposed to try out the Australian Mineral Recovery Company's process in this mine if developments had warranted the erection of a plant.

This process consists of treatment of oxidised ore with a mixture of ferrous sulphate, common salt, and sponge iron in the presence of water at a temperature of 70deg. C. for about a quarter of an hour. By this time the copper is reduced to the metallic state, and is then separated out in a flotation unit after the addition of blackboy mixture (2 parts of distillate to 1 of crude tar). A little sulphuric acid is sometimes added before sending the pulp to the flotation unit.

Mr. C. F. Bown, the company's metallurgist, has tested the ore from Mt. Agnes and supplied me with the

following information. The ore tested is the highly silicious variety of which the big blow is composed. It contains 5.7 per cent. Cu., and lends itself readily to the metallic contact process.

The following is the result of a test:—

Took 1000 CC. of water.

400 grs. of ore.

8 grs. of common salt, NaCl.

14 grs. of ferrous sulphate, FeSO₄·7H₂O.

22 grs. of 70 per cent. iron.

Treated in the usual way and ordinary time taken.

Residue contained 0.8 per cent. copper.

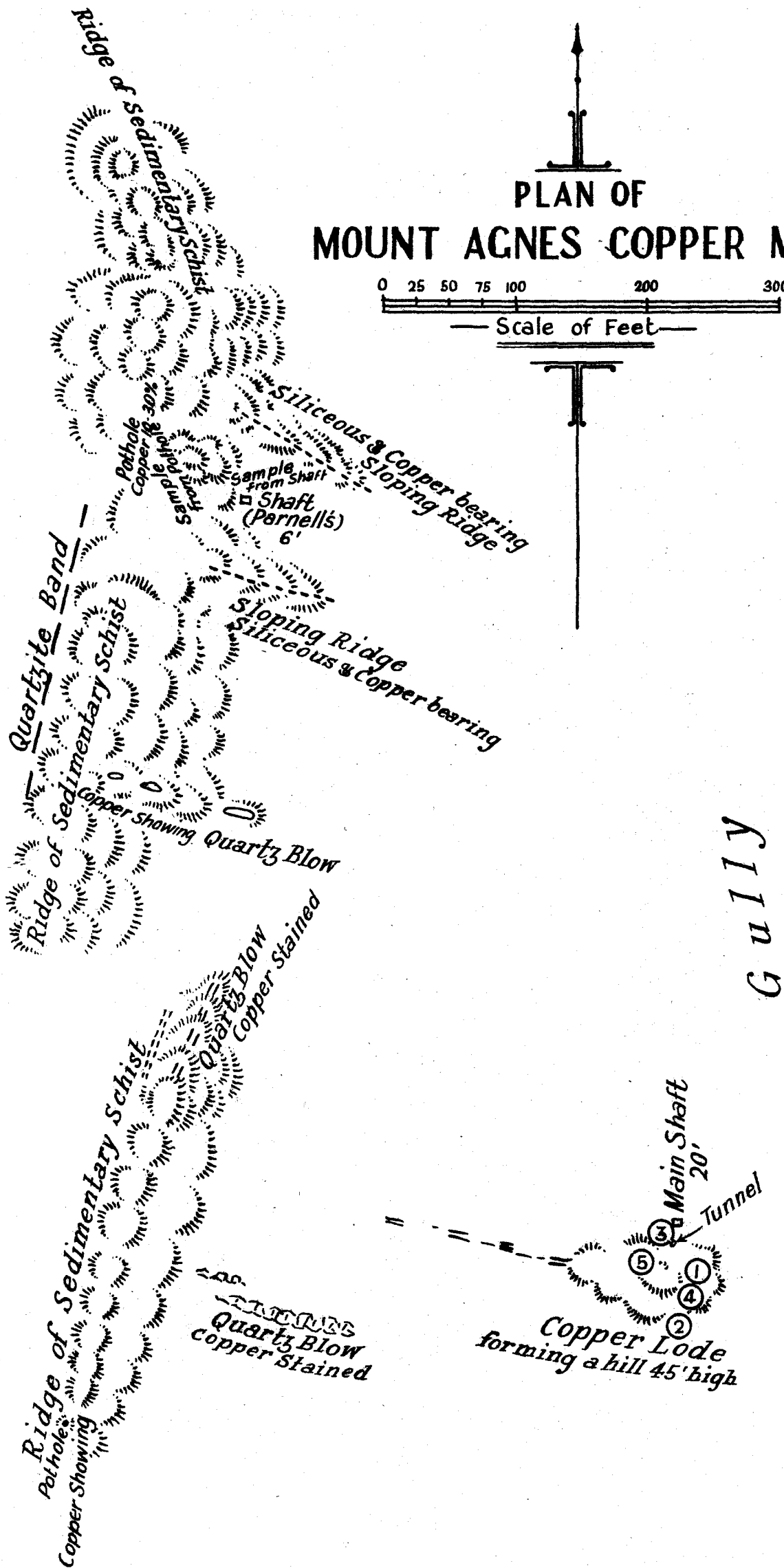
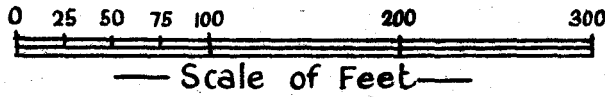
Recovery 86 per cent.

Value of precipitate about 66 per cent. copper.

Firewood.—There is no firewood available except alongside the creeks and rivers; a quantity of gum timber can be obtained from the Ashburton River about 15 miles away.

Water.—At the time of my visit this was a serious item as the weather was extremely hot and the water had to be carted about 12 miles. The company had just begun to bore for water, and anticipated that a supply could be obtained in a creek bed about two miles from the deposit.

PLAN OF MOUNT AGNES COPPER MINE



General Remarks.—The general position may be summed up as follows:—

The deposit looked attractive in the first place on account of the great width over which copper could be obtained at the surface.

A tunnel into the hill which was put in to serve as a guide as to the real width and value of the lode gave most discouraging results, and led me to think that

the apparent large width of the lode is really due to secondary leaching and redeposition of the copper for a shallow depth only in the schist country.

Mr. Bown's results indicated that the ore is amenable to treatment by the company's process.

Very little development work has been done.

The results so far, however, do not indicate that a tonnage of ore sufficient to warrant the erection of a treatment plant is likely to be obtained.

Assays of thirteen Samples for the Assistant State Mining Engineer.

By EDWARD S. SIMPSON, Government Mineralogist and Analyst, 15th January, 1924.

Lab. No.	Mark.		
2840/23	Robe River Copper Mine	...	Gold 5 grs. per ton; Silver, 8 dwts. 12 grs. per ton. Copper, 9.76 per cent. Schistose rock with quartz, malachite, iron hydrates.
2841	Cane River Copper Mine	...	Gold, trace; Silver, 7 dwts. 10 grs. per ton. Copper, 14.09 per cent. Quartz with chalcopyrite, pyrite, malachite and iron hydrates.
2842	Mt. Agnes No. 1	...	Gold, 14 grs. per ton; Silver, 21 grs. per ton. Copper, 1.83 per cent. Micaceous schist with quartz stringers impregnated with malachite.
2843	Mt. Agnes No. 2	...	Gold, 2 dwts. 16 grs. per ton; Silver, 1 dwt. 16 grs. per ton. Copper, 2.85 per cent. Micaceous schist and quartz, malachite, and a little atacamite.
2844	Mt. Agnes No. 3	...	Gold, 13 dwts. 14 grs. per ton; Silver, 3 dwts. 1 gr. per ton. Copper, 4.85 per cent. Micaceous schist with malachite and atacamite.
2845	Mt. Agnes No. 4	...	Gold, 5 grs. per ton; Silver, 5 grs. per ton. Copper, .28 per cent. Micaceous schist and quartz with copper stains.
2846	Mt. Agnes No. 5	...	Gold, 1 dwt. 0 grs. per ton; Silver, 2 dwts. 9 grs. per ton. Copper, 6.73 per cent. Biotite schist with quartz, malachite, calcite, iron hydrate and little oxide of manganese.
2847	Mt. Agnes, Parnell's Shaft	...	Gold, trace; Silver, trace. Copper, 1.72 per cent. Biotite schist with calcite, malachite, and little manganese oxide.
2848	Mt. Agnes, Pot hole in Hill	...	Gold, 21 grs. per ton; Silver, trace. Copper, 10.30 per cent. Mica schist impregnated with malachite. Iron hydrates, little oxide of manganese.
2849	Mt. Agnes, Broken Ore	...	Gold, 5 dwts. 9 grs. per ton; Silver, 4 dwts. 15 grs. per ton. Copper, 6.64 per cent. Schistose material impregnated with malachite and atacamite, limonite and weathered felspar.
2850/23	Black specimens from Pot hole in hill, Mt. Agnes	...	Copper, nil. A mixture of haematite, limonite and quartz with a little calcite.
2851	Lead ore. 21 miles N.E. of Bangemall. Stringers in marble overlying Mosquito Creek slates	...	Gold, trace; Silver, 28 ozs. 19 dwts. 1 gr. per ton. Lead, 81.46 per cent. Galena with a little anglesite, cerussite, quartz and limonite.
2852	Lead ore, Uaroo. From mine with tunnel	...	Gold, 5 grs. per ton. Silver, 18 ozs. 16 dwts. 9 grs. per ton. Lead, 75.90 per cent. Galena and quartz.

APPENDIX No. 12.

Oil Indications on A. Neave's O.P.A., No. 20H.

By R. C. WILSON, Assistant State Mining Engineer, 5th February, 1924.

I visited Oil Prospecting Area No. 20 H on 15th of November last in company with Mr. A. Neave, and have to report as follows:—

Starting out from Balmoral Station the Fortescue River was followed in a southerly direction till a point was reached about 25 miles from the coast, where the river makes a sharp bend to the east. At this point Bulloonoora Creek empties into the river. This creek was then followed for a distance of about 10 miles also in a southerly direction.

Flanked on either side of the river are hills composed of ferruginous laterites, quartzites, conglomerates, and lavas, either horizontally bedded or inclined at a low angle, and evidently representing the Nullagine series of rocks. These continue until a point is reached 10 miles up Bulloonoora Creek, when the high hills give place to a somewhat extensive flat.

At this point a change was noticeable in the nature of the rocks in the creek. These were found to consist of sandstone and soft clay shales dipping in a westerly direction at an angle of 30deg. to 40deg. from the horizontal.

I was not able during my brief stay to form any definite opinion with regard to the age of these rocks,

but they are quite possibly also part of the Nullagine formation.

The series of rocks which form the Nullagine Formation of A. Gibb Maitland covers 60,000 square miles of country in the North-West. The beds are usually more or less horizontal, and consist for the most part of shales and sandstones together with limestones, dolomite, and coarse conglomerates. In places dykes and sills of dolerite are common, and on the hill tops cherts and ferruginous laterites are notable features.

In a paper read before the Royal Society in March, 1923, Dr. Simpson says:—

"The geological age of the Nullagine beds has not yet been fixed with certainty. No fossils have been found in them, though many of the shale beds are more or less highly carbonaceous, some being in fact quite black in colour, indicating the contemporaneous existence of living organisms. Furthermore, thin limestone beds and concretions of both calcite and marcasite are widespread, and in the genesis of these living organisms often play an important part." "Our present knowledge indicates that the Nullagine beds are post-Huronian and pre-Carboniferous, and are later than the main metallogenetic epoch in Western Australia. Further, they are not greatly metamorphosed structur-

ally and chemically, and belong to an age in which advanced living organisms were not abundant. The evidence available points to their being of Keeweenawan, Cambrian, or Ordovician Age, probably the first named, though Talbot prefers to correlate them with the Ordovician of South Australia."

Dr. Simpson's conclusion is in accordance with the age given to these rocks by the Government Geologist, Mr. A. Gibb Maitland, viz., that they are of pre-Cambrian age.

The Nullagine beds are therefore older than those in which oil is usually found.

Mr. Neave informed me that a piece of bitumen, about the size of a large meat-dish, apparently washed down the river had been obtained in the Fortescue River bed. A sample of this had been sent to the Department of Mines, Victoria, for analysis with the following result:—

"Physical tests.

Colour—Black.
Fracture—Conchoidal.
Lustre—Dull to bright.
Streak—Black.
Specific gravity—1.12.
Hardness—Under 1.

"Chemical tests.

(a.) Proximate analysis:	
Moisture at 105 G.	0.80 per cent.
Volatile matter	63.40 "
Fixed carbon	33.90 "
Ash	1.90 "
Total	100.00 "

"Sample burns with long smoky flame. Coke is hard and vesicular.

"(b.) Distillation test:

Crude oil	50.0 per cent.
Coke	40.0 "
Gas and loss	10.0 "
Total	100.00 "

"(c.) Solubility:

Carbon bisulphide—Largely soluble.
Benzol—92 per cent.

"(d.) Ultimate analysis:

Carbon	88.13 per cent.
Hydrogen	8.05 "
Sulphur	1.56 "
Ash	1.22 "
Oxygen and nitrogen	1.04 "
Total	100.00 "

"(e.) Diazo test.—The sodium hydroxide extract when tested with diazo-benzol chloride solution gave a negative test for phenol, showing the material was not a wood tar pitch, shale tar pitch, lignite pitch, or a coal tar pitch.

"The above test would indicate that the material is a native asphalt."

It will be seen from the above that a piece of undoubted bitumen was obtained by the holders of the P.A., but no more has been found, although I understand that a diligent search up the river has been made. Mr. Neave says he believes that the natives know where there is more of it up the river, but up to the present he has not succeeded in getting them to disclose its exact locality.

I understand that in the early days Californian whalers brought considerable quantities of Californian asphaltum for caulking purposes, so that the possibility of some of this having been picked up and taken inland to where it was found by Mr. Neave must be borne in mind.

It will be noted that Mr. A. Gibb Maitland's opinion of the prospects of this locality is as follows:—

"There is nothing in the geological constitution of the lower reaches of the Fortescue River Valley known to me which would lead to the belief that the occurrence of petroleum is likely."

APPENDIX No. 13.

Brown's Reward Gold Mine.

By R. C. WILSON, Assistant State Mining Engineer, 24th January, 1924.

Acting on official instructions I visited this mine on 12th December last, and have to report as follows:—

Location.—The mine is situated at Field's Find a few chains to the North of the old Field's Find G.M.

Nature of Deposit.—A greenstone of the usual type in the Murchison Goldfield forms the country rock of the district. Striking north-east through this greenstone is a strongly developed banded quartzite or jasper bar 40ft. to 50ft. in width, with which the lodes are intimately associated.

This quartzite bar is in places much shattered and brecciated, and it is where such shattering has taken place that percolation of auriferous solution has been rendered possible, and subsequent gold deposition has occurred.

I might here mention that it is a remarkable fact that although these quartzite bars are apparently devoid of gold contents themselves, lodes and quartz veins in them are frequently phenomenally rich. Notable instances of this occur at Boogardie, near Mt. Magnet, where pockets of specimen stone have frequently been found when a small quartz vein causes a break in the bar.

Brown's lode practically forms the footwall of the bar, and the rich portion consists of ironstone gossan, which no doubt was originally deposited in the form of pyrites.

Ryan's lode is simply shattered quartzite with gold in the cracks which is clearly of secondary origin.

Gold deposited under these conditions is usually in irregularly distributed patches. I know of no reason why such patches should exist near the surface only, but such has been the experience in the case of similar deposits at other mining centres, as for example at Tuckabianna and at Hancock's near Sandstone.

Brown's Lode Workings.—This is the main lode, and it has been worked at intervals for a length of 500 feet. In this distance four short shoots of ore, or patches as they may be termed, were taken out. In each instance high values are reported to have been obtained at or near the surface, which, however, give out at a shallow depth.

The principal shoot, namely, that at the main shaft, is roughly 60 feet in length, and pitches to the north. It has been worked down to the 44ft. level, at which depth, I understand, values completely gave out. The ore won was unusually high in grade. It was from this shoot that Mr. Brown obtained his famous crushing of 309.5 tons yielding £61.19 fine ounces of gold over the plates, or 2ozs. 15dwts. 16grs. per ton, and 3ozs. 14 dwt. 11grs. per ton in the tailings, making a total return of 6oz. 10dwt. 3grs. per ton.

Driving and crosscutting under this shoot of gold at the 100ft. level, however, disclosed nothing of value.

A few values were met with about half way down a winze connecting the 44ft. level with the 100ft. level. At Mr. Loftus Connor's request I took three samples at this locality, and obtained the following results:—

Sample No.	Distance down winze.	Section (inches).	Value.	Remarks.
2	34	Hanging wall 18in.	oz. dwt. grs. 1 3 18	North side.
4	34	Footwall 24in.	0 0 21	do.
3	30	Hanging wall 18in.	2 11 2	South side.

These results indicate a small seam of payable ore crossing the winze on the hanging wall side. It is, however, of very limited extent, as no continuation was met with either at the 44ft. level above or in the 100ft. level below.

My attention was drawn to the fact that water level is at 104ft., and that pumping would probably be necessary if any deeper prospecting work was to be carried out. At No. 4 shaft ore averaging 5ozs. per ton is said to have been met with in a trench for a length of 50 feet. These values mostly give out, however, at a few feet below the surface, and nowhere continued to a greater depth than 20 feet. Crosscutting from this shaft at a depth of 57 feet disclosed nothing of value.

At a small trench 70ft. north of this shaft a similar occurrence is reported. Values up to 2oz. per ton are said to have been obtained at the surface which gave out at a depth of a few feet only.

At No. 5 shaft the lode is nearly vertical, and is on schist country away from the quartzite bar. Greater uniformity of value might reasonably have been expected here; values, however, seem to have given out at a shallow depth here as elsewhere.

Ryan's Lode.—This lode which is parallel to Brown's lode, being about 30ft. to the east, consists for the most part of shattered quartzite.

A shoot of ore 60 feet in length has been worked out to the 25ft. level, below which I understand no values were met with. Just at the 25ft. level, however, I sampled 12 inches of lode and obtained an assay result of 1oz. 3dwt. 13grs. per ton in value.

In view of the fact that the shoots of ore dip to the south a little prospecting work might be profitably carried out here, to see if this represents the top of another shoot.

Crushings.—The ore crushed from the mine was as follows:—

Date.	Tons crushed.	Gold from Amalgamation.		Value of tailings.	Total Value.
		Fine ozs.	Value per ton.		
March, 1922	309.50	861.19	ozs. dwts. grs. 2 15 16	ozs. dwt. grs. 3 14 11	ozs. dwt. grs. *6 10 3
January, 1923	260.75	268.86	1 0 15	2 3 0	†3 3 15
July, 1923	503.00	171.37	0 6 19	0 9 0	‡0 15 19
	1,073.25	1,301.42	1 4 6	1 16 3	3 0 9

* Obtained from Brown's lode.

† 200 tons obtained from Brown's lode, and balance from Ryan's lode.

‡ Obtained from Ryan's lode.

General Remarks.—The general position may be summarised as follows:—

Brown's lode consists of ironstone gossan, which forms the footwall of a banded quartzite bar. Ryan's lode consists for the most part of shattered quartzite with secondary gold in the cracks.

More than ordinary interest has been taken in this mine on account of the unusually rich crushing first obtained by Mr. Brown.

The rich patches have, however, now been taken out and development work below them has failed to disclose anything of value. These patches of ore are not cut

off by faults but simply pinch out, without leaving anything to indicate where others which may exist will be found. Consequently systematic driving and crosscutting is the only means of locating them. A good deal of such development work has been carried out without success, and the present prospects hardly seem to warrant the expense of exploratory work below water level (104 feet).

Other shoots of rich ore may be found along the line of lode above water level, but present indications do not point to the mine ever producing any great tonnage of ore.

APPENDIX No. 14.

Report on the Wilga Coalfield.

(Continued from 1921 Annual Report, Department of Mines.)

By R. C. WILSON, Assistant State Mining Engineer, 17th October, 1924.

In our last Annual Report it was mentioned that the Wilga Proprietary Coal Prospecting Co., Ltd., started a Calyx deep bore 60 chains North-West of No. 3 deep bore and sunk it to a depth of 500ft. at their own expense, and that they then applied for Government assistance and were allowed £1 for £1 on the cost of sinking the remaining 191ft., making the bore a total depth of 601ft. As, however, the analyses of the coal met with in the bores were not available, details of the bore were reserved for this year's report.

In addition to this deep bore, the company put down two series of hand bores; one series following a line North-East of No. 3 deep bore, and the other following a line East of this bore.

The secretary of the company has kindly supplied me with details as to the position of these bores, and of the different strata met with. This information has been embodied in the accompanying plans and sections. In these plans the probable relationship of the coal seams met with is indicated. It will be noted that the coal seams in the different bores agree very fairly well, and that their strike is apparently approximately north and south.

The log of No. 4 deep bore forwarded by the foreman in charge of the boring operations is as follows:—

No. 4 DEEP BORE (60 chains N.W. of No. 3 deep bore).

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
	6 0	6 0	Ironstone gravel
6 0 to	21 0	15 0	Grey puggy clay
21 0 "	29 0	8 0	Clay with ironstone bands
29 0 "	36 6	7 6	Dark shale
36 6 "	37 6	1 0	Ironstone
37 6 "	50 0	12 6	Soft sandy shale with shale bands
50 0 "	54 0	4 0	Black puggy shale
54 0 "	64 0	10 0	Soft sandy shale
64 0 "	71 0	7 0	Dark puggy shale
71 0 "	104 0	33 0	Dark compressed sand
104 0 "	106 0	2 0	White puggy clay
106 0 "	120 0	14 0	Soft coarse sandstone
120 0 "	127 0	7 0	Soft coarse sandstone with sandy clay bands
127 0 "	129 0	12 0	Soft coarse sandstone with quartz boulders
139 0 "	163 0	24 0	Soft coarse sandstone
163 0 "	164 0	1 0	Soft sandstone and quartz boulders
164 0 "	173 0	9 0	Soft coarse sandstone
173 0 "	174 0	1 0	White sandy clay
174 0 "	326 0	152 0	Coarse sandstone
326 0 "	335 6	9 6	Yellow sandstone
335 6 "	363 6	28 0	Coarse sandstone
363 6 "	364 0	0 6	Yellow sandstone
364 0 "	370 0	6 0	Coarse sandstone
370 0 "	375 0	5 0	Hard sandy shale
375 0 "	379 0	4 0	Fine sandstone
379 0 "	391 6	12 6	Sandstone
391 6 "	392 0	0 6	Coal, No. 1 seam
392 6 "	396 0	3 6	Hard black shale
396 0 "	398 0	2 0	Sandy shale
398 0 "	403 0	5 0	Sandstone
403 0 "	405 0	2 0	Sandy shale
405 0 "	437 0	32 0	Sandstone
437 0 "	439 6	2 6	Fine sandstone
439 6 "	443 2	3 8	Carbonaceous shale
443 2 "	443 8	0 6	Coal, No. 2 seam
443 8 "	444 7	0 11	Black shale
444 7 "	445 10	1 3	Fine sandstone with shale seams
445 10 "	446 5	0 7	Coal, No. 3. seam
446 5 "	447 3	0 10	Black shale
447 3 "	458 9	11 6	Coarse sandstone
458 9 "	460 9	2 0	Fine sandstone and shale seams
460 9 "	500 3	39 6	Sandstone
500 3 "	510 9	10 6	Coal with 2in. shale band at 508ft., No. 4 seam

No. 4 DEEP BORE, ETC.—continued.

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
510 9 to	513 0	2 3	Hard sandy shale
513 0 "	513 6	0 6	Carbonaceous shale
513 6 "	518 0	4 6	Fine hard sandstone
518 0 "	520 6	2 6	Hard sandy shale
520 6 "	521 6	1 6	Carbonaceous shale with coal bands
521 6 "	524 0	3 6	Hard sandy shale
524 0 "	531 0	7 0	Coarse sandstone
531 0 "	535 0	4 0	Hard sandy shale
535 0 "	537 6	2 0	Sandstone with shale bands
537 0 "	541 0	4 0	Coal, No. 5 seam
541 0 "	544 0	3 0	Hard sandy dark shale
544 0 "	554 6	10 6	Sandstone
554 6 "	555 6	1 0	Sandy shale
555 6 "	563 0	7 6	Sandstone
563 0 "	570 0	7 0	Coal, No. 6 seam
570 0 "	571 0	1 0	Hard shale
571 0 "	572 8	1 8	Sandy shale
572 8 "	573 2	0 6	Carbonaceous shale
573 2 "	578 2	5 0	Coal, No. 7 seam
578 2 "	578 9	0 7	Hard sandy shale
578 9 "	591 0	12 3	Sandstone
591 0 "	600 1	9 1	Coal, No. 8 seam
600 1 "	601 7	1 6	Hard sandy shale
601 7 "	615 2	13 7	Sandstone
615 2 "	618 0	2 10	Hard sandstone band
618 0 "	627 0	9 0	Sandstone
627 0 "	628 0	1 0	Coal, No. 9 seam
628 0 "	629 6	1 6	Hard sandy shale
629 6 "	636 0	6 6	Sandstone with shale seams
636 0 "	643 8	7 8	Sandstone
643 8 "	652 3	8 7	Coal, No. 10 seam
652 3 "	653 0	0 9	Shale
653 0 "	654 6	1 6	Sandy shale
654 6 "	660 0	5 6	Sandstone
660 0 "	663 9	3 9	Coal, No. 11 seam
663 9 "	665 0	1 3	Sandy shale
665 0 "	665 6	0 6	Carbonaceous shale
665 6 "	666 6	1 0	Sandy shale
666 6 "	687 0	0 6	Sandstone
687 0 "	688 0	1 0	Sandy shale
688 0 "	691 0	3 0	Carbonaceous shale

Five cores left by Mr. T. D. Briggs, of the Wilga Proprietary Coal Prospecting Co., Ltd., with the Government Geologist and stated to be from seams No. 4, No. 5, No. 6, No. 7, and No. 8, as set out hereunder, were submitted to the Government Mineralogist and Analyst for examination. His report upon these was as follows:—

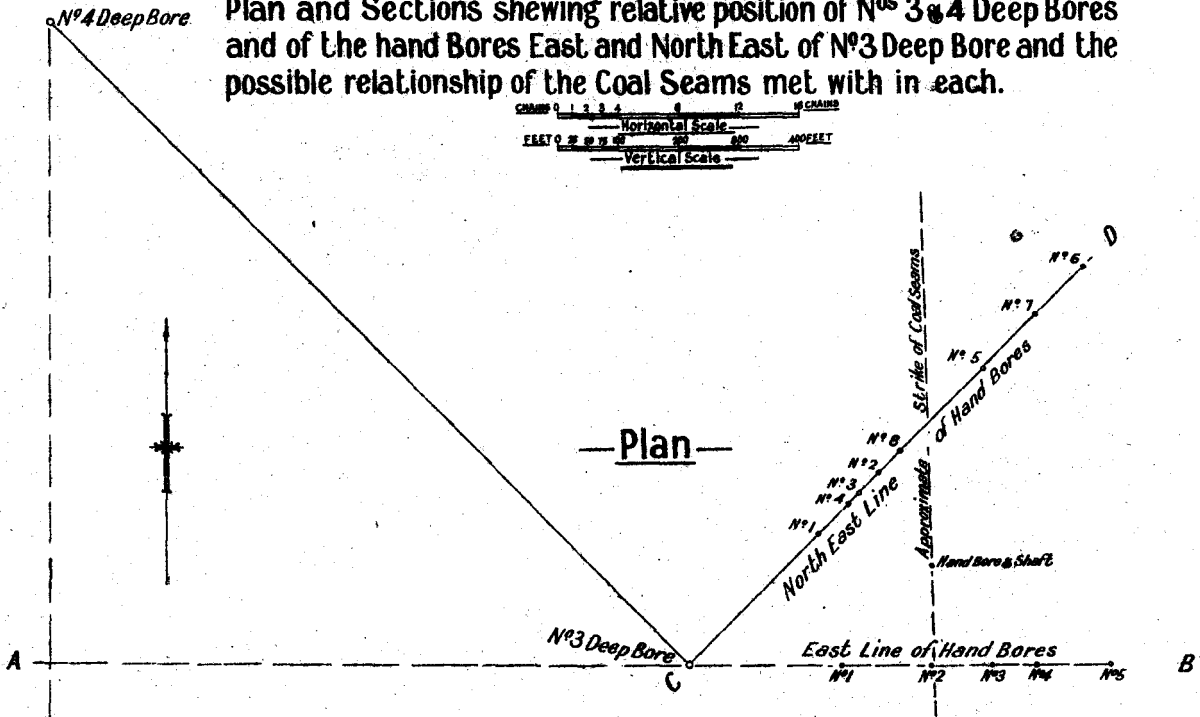
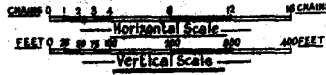
No. 4 CALYX BORE.

No. 4 SEAM, 503ft. 3in. to 510ft. 9in. (10ft. 6in.)—Two inches of shale discarded and then divided into three equal proportions.

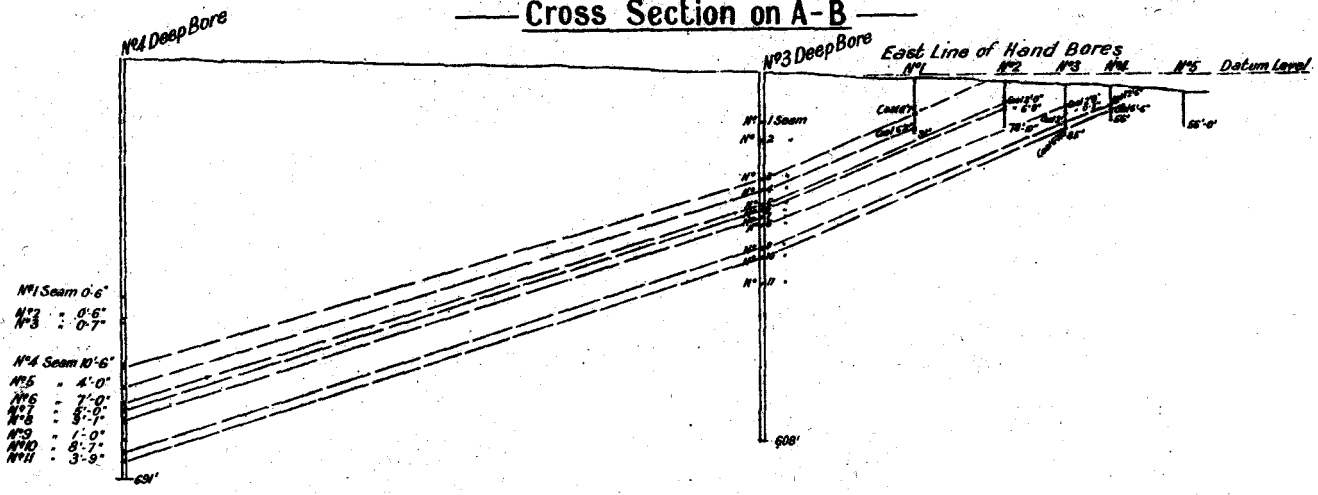
Lease No. ...	Top	Middle	Bottom
	portion.	portion.	portion.
	1260.	1261	1262
<i>Proximate Analysis—</i>			
Moisture	per cent. 12.31	per cent. 11.89	per cent. 11.79
Volatile Hydrocarbons ...	36.62	33.39	34.38
Fixed Carbon	43.31	46.27	47.79
Ash	7.76	8.45	6.04
	100.00	100.00	100.00
<i>Calorific Value—B.T.U.</i>			
Colour of Ash	9,271	9,394	9,990
	Reddish brown	Reddish brown	Reddish brown

— WILCA COAL FIELD —

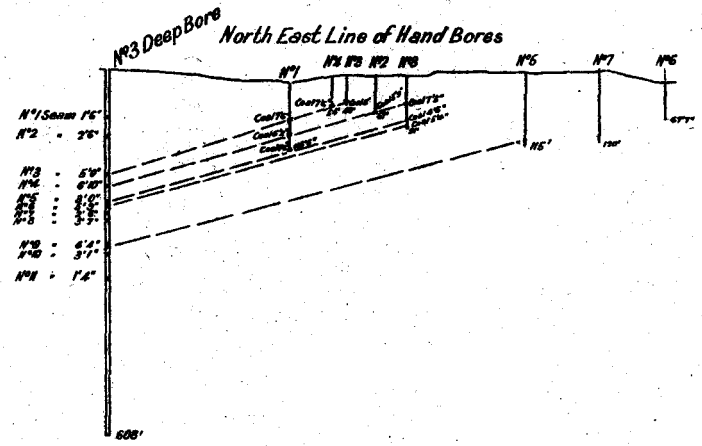
Plan and Sections showing relative position of Nos 3 & 4 Deep Bores and of the hand Bores East and North East of No 3 Deep Bore and the possible relationship of the Coal Seams met with in each.



— Cross Section on A-B —



— Cross Section on C-D —



NO. 4 CALYX BORE—*continued.*

No. 5 SEAM, 537ft. to 541ft. (4ft.)—Divided into two equal proportions.

Lease No. ...	Top half. 1263	Bottom half. 1264
<i>Proximate Analysis</i> —		
Moisture	per cent. 11.62	per cent. 11.78
Volatile Hydrocarbons	35.04	39.41
Fixed Carbon	46.31	43.88
Ash	7.03	4.93
	100.00	100.00
<i>Calorific Value</i> —B.T.U.	9718	10138
Colour of Ash	Reddish brown	Reddish brown

No. 6 SEAM, 563ft. to 570ft. (7ft.)—Divided into three equal proportions.

Lease No. ...	Top portion. 1265	Middle portion. 1266	Bottom portion. 1267
<i>Proximate Analysis</i> —			
Moisture	per cent. 11.76	per cent. 11.41	per cent. 11.60
Volatile Hydrocarbons	34.39	29.72	36.20
Fixed Carbon	48.01	43.40	39.12
Ash	5.84	15.47	13.08
	100.00	100.00	100.00
<i>Calorific Value</i> —B.T.U.	9892	8567	9126
Colour of Ash	Reddish brown	Light brown	Light brown

No. 7 SEAM, 573ft. to 578ft. (5ft.)—Divided into two equal proportions.

Lease No. ...	Top half. 1268	Bottom half. 1269
<i>Proximate Analysis</i> —		
Moisture	per cent. 10.57	per cent. 12.04
Volatile Hydrocarbons	37.19	37.66
Fixed Carbon	42.45	42.79
Ash	9.79	7.51
	100.00	100.00
<i>Calorific Value</i> —B.T.U.	9563	9728
Colour of Ash	Reddish brown.	Reddish brown.

No. 8 SEAM, 591ft. to 600ft. lin. (9ft. lin.)—Divided into three equal proportions.

Lease No. ...	Top portion. 1270	Middle portion. 1271	Bottom portion. 1272
<i>Proximate Analysis</i> —			
Moisture	per cent. 12.41	per cent. 12.00	per cent. 12.74
Volatile Hydrocarbons	37.13	34.44	33.88
Fixed Carbon	41.60	46.10	48.06
Ash	8.86	6.46	5.32
	100.00	100.00	100.00
<i>Calorific Value</i> —B.T.U.	9471	9392	10011
Colour of Ash	Reddish brown	Reddish brown	Reddish brown

HAND BORES.

The first series of hand bores was put down along a line North-East of No. 3 deep bore. At the time it was thought that this line was at right angles to the strike of the coal seams. The results, however, showed that the strike was really nearer North and South, and consequently the second series of hand bores was put down along an East and West line.

FIRST SERIES OF HAND BORES NORTH-EAST OF No. 3 DEEP BORE.

No. 1 HAND BORE SECTION (11 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 25ft. below Datum Level.

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
2 6 to	2 6	2 6	Clay and gravel
4 6 "	4 6	2 0	Ironstone
27 0 "	27 0	22 6	White sandy clay
50 0 "	50 0	23 0	Red sandy clay
55 0 "	55 0	5 0	Yellow sandy clay
57 6 "	57 6	2 6	Sandstone
57 6 "	65 0	7 6	Coal
65 0 "	72 6	7 6	Dark shale
72 6 "	74 0	1 6	Carbonaceous shale
74 0 "	78 0	4 0	Sandy shale
78 0 "	81 10	3 10	Sandstone
81 10 "	88 0	6 2	Coal
88 0 "	90 10	2 10	Sandy shale
90 10 "	99 0	8 2	Sandstone
99 0 "	110 0	11 0	Sandy shale
110 0 "	114 6	4 6	Coal
114 6 "	116 6	2 0	Sandy shale
116 6 "	undeterm.	2 0	Coal

Water struck at 30ft.

No. 2 HAND BORE SECTION (17 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 14ft. below Datum Level.

6 0 to	6 0	6 0	Ironstone
8 0 "	8 0	2 0	Yellow clay
30 6 "	30 6	22 6	Sandy clay reddish colour
33 0 "	33 0	2 6	Yellow sandy clay
35 6 "	35 6	2 6	Coal smut
42 0 "	42 0	6 6	Dark shale
43 6 "	43 6	1 6	Carbonaceous shale
43 6 "	49 0	5 6	Sandy shale
49 0 "	53 0	4 0	Sandstone
53 0 "	58 9	5 9	Coal
58 9 "	61 0	2 3	Dark shale

Water struck at 43ft. 6in.

No. 3 HAND BORE SECTION (15 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 15ft. below Datum Level.

2 6 to	2 6	2 6	Ironstone gravel
7 0 "	7 0	4 6	Ironstone
9 0 "	9 0	2 0	Yellow clay
41 0 "	41 0	32 0	Sandy clay (reddish colour)
46 0 "	46 0	5 0	Coal
46 0 "	49 0	3 0	Dark shale

Water struck at 40ft.

No. 4 HAND BORE SECTION (14 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 16ft. below Datum Level.

2 9 to	2 9	2 9	Ironstone gravel
7 0 "	7 0	4 3	Ironstone
10 0 "	10 0	3 0	Yellow clay
45 0 "	45 0	35 0	Sandy clay (reddish colour)
52 6 "	52 6	7 6	Coal
54 0 "	54 0	1 6	Dark shale

Water struck at 39ft.

No. 5 HAND BORE SECTION (27 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 11ft. below Datum Level.

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
	2 3	2 3	Ironstone gravel
2 3 to	11 0	8 9	Hard clay cement
11 0 "	33 0	22 0	Yellow clay
33 0 "	42 6	9 6	White sandy clay
42 6 "	80 0	37 6	Sandy clay
80 0 "	105 6	25 6	White sandy clay
105 6 "	107 6	2 0	Yellow clay
107 6 "	108 0	0 6	Ironstone
108 0 "	110 0	2 0	Brown shale
110 0 "	112 4	2 4	Dark shale
112 4 "	115 0	2 8	Coal
			Water struck at 58ft.

No. 6 HAND BORE SECTION (37 chs. 18ft. N. 42° E. from No. 3 deep bore)—Surface 19ft. below Datum Level.

	1 0	1 0	Ironstone gravel
1 0 to	6 0	5 0	Clay (yellow)
6 0 "	10 0	4 0	Clay (reddish colour)
10 0 "	40 0	30 0	Clay (yellow and white)
40 0 "	60 6	20 6	Clay (yellow)
60 6 "	67 7	7 1	Quartz

No. 7 HAND BORE SECTION (32 chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 19ft. below Datum Level.

	2 6	2 6	Ironstone gravel
2 6 to	4 0	1 6	Ironstone conglomerate
4 0 "	11 0	7 0	Clay (yellow)
11 0 "	20 0	9 0	Clay (reddish)
20 0 "	41 0	21 0	Clay (reddish)
41 0 "	120 0	79 0	White sandy clay
			Water struck at 68ft.

No. 8 HAND BORE SECTION (19chs. 45ft. N. 42° E. from No. 3 deep bore)—Surface 17ft. below Datum Level.

	6 0	6 0	Gravel
6 0 to	28 0	22 0	Clay
28 0 "	33 0	5 0	Ironstone
33 0 "	40 0	7 0	Shale
40 0 "	43 0	3 0	Red clay with pebbles
43 0 "	50 3	7 3	Coal
50 3 "	61 0	10 9	Sandy shale
61 0 "	66 0	5 0	Black shale
66 0 "	73 6	7 6	Sandy shale
73 6 "	78 0	4 6	Coal
78 0 "	80 0	2 0	Shale with coal seams
80 0 "	85 4	5 4	Coal
85 4 "	91 0	5 8	Sandy shale

SECOND SERIES OF HAND BORES EAST OF No. 3 DEEP BORE.

No. 1 HAND BORE E. (10 chs. 21ft. E. of No. 3 deep bore)—Fall in feet of ground from No. 3 deep bore 8ft.

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
	4 0	4 0	Gravel
4 0 to	10 0	6 0	Ironstone
10 0 "	22 0	12 0	Sandy clay
22 0 "	56 0	34 0	Sandstone
56 0 "	58 0	2 0	Soft coal
58 0 "	64 7	6 7	Hard Coal
64 7 "	70 7	6 7	Shale
70 7 "	77 7	7 0	Sandy shale
77 7 "	82 7	5 0	Sandstone
82 7 "	88 10	6 3	Hard Coal
88 10 "	91 0	2 2	Brown shale

No. 2 HAND BORE E. (16 chs. E. of No. 3 deep bore)—Fall in feet of ground from No. 3 deep bore 14ft.

	4 0	4 0	Gravel
4 0 to	8 0	4 0	Ironstone
8 0 "	28 0	20 0	Yellow sandstone
28 0 "	33 0	5 0	Sandstone
33 0 "	36 0	3 0	Soft coal
36 0 "	41 6	5 6	Hard shale
41 6 "	48 2	6 8	Hard coal
48 2 "	50 2	2 0	Hard shale
50 2 "	57 10	6 10	Sandstone
57 10 "	61 10	4 0	Coal
61 10 "	65 10	4 0	Shale
65 10 "	78 10	13 0	Sandstone

No. 3 HAND BORE E. (19 chs. 57ft. E. of No. 3 deep bore)—Fall in feet of ground from No. 3 deep bore 19ft.

Depth.		Thickness.	Description.
ft. in.	ft. in.	ft. in.	
	4 0	4 0	Gravel
4 0 to	9 0	5 0	Ironstone
9 0 "	34 0	25 0	Sandstone
34 0 "	36 0	2 0	Soft Coal
36 0 "	38 0	2 0	Shale
38 0 "	48 0	10 0	Sandstone
48 0 "	48 3	0 3	Coal
48 3 "	57 6	9 3	Sandy shale
57 6 "	59 6	2 0	Hard shale
59 6 "	62 6	3 0	Hard coal
62 6 "	64 0	1 6	Hard shale
64 0 "	71 0	7 0	Hard sandstone
71 0 "	77 10	6 10	Hard coal
77 10 "	83 0	7 2	Hard sandstone

No. 4 HAND BORE E. (23 chs. E. of No. 3 deep bore)—Fall in feet of ground from No. 3 deep bore 22ft. 6in.

	6 0	6 0	Gravel
6 0 to	14 0	8 0	Clay
14 0 "	18 0	4 0	Sandstone
18 0 "	18 9	0 9	Hard band sandstone
18 9 "	26 0	7 3	Sandstone
26 0 "	23 0	2 0	Shale
23 0 "	31	2 6	Coal
30 6 "	32 0	1 6	Shale
32 0 "	37 6	5 6	Sandstone
37 6 "	44 0	6 6	Coal, lft., soft on top
44 0 "	56 0	12 0	Sandstone

No. 5 HAND BORE E. (23 chs. E. of No. 3 deep bore.)

	4 0	4 0	Gravel
4 0 to	10 0	6 0	Yellow sandstone
10 0 "	25 0	15 0	Ironstone
25 0 "	30 0	5 0	Hard sandstone
30 0 "	36 0	6 0	Clay
36 0 "	56 0	20 0	Ironstone
56 0 "	64 0	8 0	Yellow sandstone

No. 6 HAND BORE (6½ chs. N. of No. 2 E. hand bore.)

	3 0	3 0	Sand
3 0 to	9 0	6 0	Ironstone
9 0 "	16 0	7 0	Sandy clay
16 0 "	19 0	3 0	Soft coal, No. 5 seam
19 0 "	24 0	5 0	Shale
24 0 "	30 4	6 4	Coal, No. 6 seam
30 4 "	32 0	1 0	Shale

A shaft was sunk by the company alongside No. 4 hand bore of the North-East Series, and we are informed that at a depth of 42ft. 6in. two feet of decomposed coal was met with, followed by 8ft. of fairly hard coal. A sample of coal taken by me from the dump alongside this shaft gave the following result:—

Lab. No. 1986/23.

Mark No. 1.

Moisture	19.18 per cent.
Volatile hydrocarbons ...	31.48 "
Fixed carbon	45.88 "
Ash	3.46 "
	100.00 "

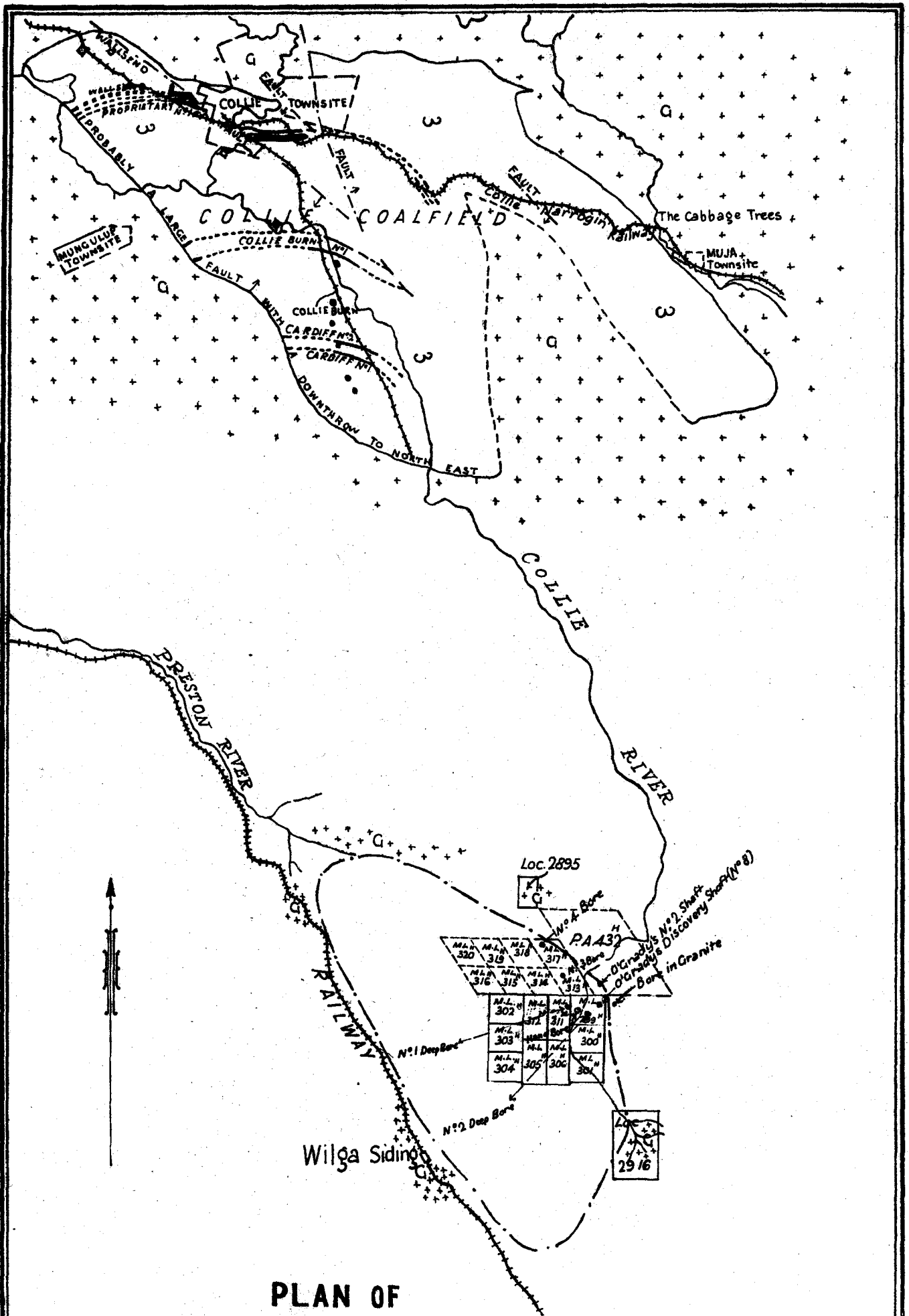
Colour of ash ... White, no coke on heating.

Mr. T. D. Briggs informed me that since my visit to the field in August, 1923, a hand bore has been put down at a point 6½ chains north of No. 2 hand bore on the eastern line of bores, which cut three seams, the bottom one being No. 6 seam, which was 6ft. 8in. of hard coal at a depth of 24ft. As No. 2 hand bore is considered to have met No. 6 seam at a depth of 41ft. 6in., which was also 6ft. 8in. thick, additional evidence is supplied of the north and south strike and dip to the west.

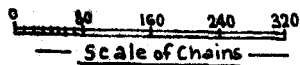
THE WILGA PROSPECTING COMPANY'S OPERATIONS.

This company, whose holdings include O'Grady's Discovery shaft and No. 1 and No. 2 deep bores, have sunk two additional shafts. On the occasion of my visit, the water was up in the shafts and, consequently, they could not be inspected. At my request for information concerning them, Mr. A. E. Morris, secretary of the company, wrote to me as follows:—

"Following on our conversation by telephone re Wilga Coalfield, I have pleasure in forwarding you the following



**PLAN OF
WILGA COALFIELD**
shewing relation to Collie Coalfield



Collie River Beds -- Granite --
 Coal Seams -- Bores Diamond Drill Colyx Bore

Possible extent of Coal bearing area - - - - -
at Wilga

particulars of workings, in order that you may complete your report over the whole field. Since the extract from the Annual Report of the Mines Department of 1921 was made, dealing with the Wilga Coalfield and the shaft that was sunk by Mr. M. O'Grady, and which opened up on a fault at the 105ft. level, other development work has been done.

A shaft, known as the river shaft, was sunk about 415 yards East of the No. 1 bore, to a depth of 38ft., piercing a seam of coal 5ft. 6in. in thickness, having a roof or cap of 18in. to 24in. The size of the shaft was 6ft. x 3ft. This shaft was driven to the northward for 8ft., and then driven again west, and the body of coal was then removed, leaving us with a 14ft. face to start future operations. Approximately 15-20 tons of coal were raised for testing purposes.

Particularly noticeable was the fact that as the drive to the north was made so the indications showed that the coal was rising towards the surface, which seems to bear out the report that the coal is dipping towards the south-west. Tests with regard to heating and steaming purposes have been made, and gave highly satisfactory results.

Blacksmiths who have used the coal have reported that it burns with a fierce white heat under blast, and have to be particularly careful as it burns iron and steel in a very short time. In fact, they assure us that they would sooner use Wilga Coal if available than any other.

A test was made for steaming purposes after the coal had been out of the ground for ten weeks, and the result was all that could be desired with a full head of steam, thus proving that the coal does not deteriorate as quickly as other coals.

I have samples of coal in the office that have been out of the ground for 18 months and two years, and they are still hard and firm.

This seam of coal seems to correspond with the 5ft. seam of coal as shown in the No. 1 bore at a depth of 87ft. The dip of the coal seems to be 1 in 8.

Assays made from coal from this seam are as follows :—

Govt. Lab., 23rd Jan., 1923, No. 190—	Proximate Analysis.
Moisture	13.83
Volatile hydrocarbons	37.55
Fixed carbon	46.25
Ash	2.00
	<hr/>
	100.00
	<hr/>
Calorific value	10406 B.T.U.

Another shaft has been sunk about 1,600 yards in a N.N.E. direction from the No. 2 bore and about 600 yards from the outcrop. The size of this shaft was 7 x 3. Up to a depth of 26ft., the report received was : Passing through solid sandstone ; 26ft. to 30ft. soft sandstone and water at the 50ft. level. The next 14ft. was very bad and soft country, and required timbering. At 48ft. the ground again became firmer, but at 52ft. a white pipe clay was struck, which runs like quicksands. The shaft had to be close timbered and packed to keep this back. Shortly after this coal was struck, and several shots were fired and a few tons raised. The jumper was then put in, which pierced the coal at 65ft. from the surface. The seam was 7ft. in thickness, with a cap of 18in. A sample of this coal was sent to the Government Laboratory. Before sending same I placed the coal in water so as to wash the white pipe clay from it, which probably accounts for the high moisture in the analysis. The following is the result :—

24th May, 1923. No. 1146/23.	
Moisture	20.18
Volatile matter	34.81
Fixed carbon	41.90
Ash	3.11
	<hr/>
	100.00
	<hr/>
Calorific value	9981 B.T.U.

Mention in the reports from our working manager states that a small seam of coal was passed through before striking the 7ft. seam. This was reported to us to be about 6in. thick. A sample of this was sent to me and is in the office at the present time. It appears to be of a very hard texture.

The land held by our company originally, known as P.A. 390H., has been taken up as 6 M.L. 299H-306H of 300 acres each, and two leases of 320 acres each, M.L. 311 and 312."

APPENDIX No. 15.

Red, White and Blue Mine (Curran's Find).

By R. C. WILSON, Assistant State Mining Engineer, 17th October, 1923.

As instructed, I visited the Red White and Blue mine at Curran's Find on 17th September in order to finalise our agreement with the syndicate holders, and also to ascertain the general prospects of the mine.

The position seems to be somewhat as follows:—The previous leaseholders of the mine stoped out the available ore above the No. 1 level and abandoned the mine. The present syndicate sunk the shaft to the 200ft. level, and have driven north and south on the reef at that depth with the following results:—

From a point 10ft. north of the shaft to the face of the south drive at 107 feet the reef was sampled wherever it was exposed between the timbers. In all twelve samples were taken, averaging 21dwts. per ton for a width of 29 inches. This average includes two very

high samples. If these are omitted the average value is 15½dwts. per ton for a width of 32 inches.

At a point about 15ft. north of the shaft porphyry makes its appearance on the western wall of the reef, and from this point to the north face at 60ft. no payable values were met with.

A winze 60ft. south of the main shaft has been sunk from the No. 1 to the No. 2 level alongside the reef, which has not been broken.

A winze 72ft. north of the main shaft has been sunk about 45 feet below the No. 1 level. Two reefs each 15 inches in width are exposed in the face, but are poor and unpayable.

The position and value of the individual samples taken is indicated upon the sketch accompanying these notes.

APPENDIX No. 16.

Limestone Deposits near Denmark.

By R. C. WILSON, Assistant State Mining Engineer, 12th April, 1923.

As instructed, I visited these deposits on 16th, 17th, and 19th February, and beg to report as follows:—

Location.—The limestone is situated on a promontory on the western side of the mouth of Wilson's Inlet, approximately 5¼ miles south by west from Denmark.

Nature of Deposit.—According to the late H. P. Woodward,* "this promontory is formed by high calcareous sand hills resting upon a foundation of granite, which latter rock outcrops along the beach, and also rises into a bold prominence known as Mt. Halliwell (2,000 ft.) about a mile to the northward. This ridge, where seen in section, may be seen to possess the usual false bedded structure so characteristic of dune origin, while its antiquity would seem to be demonstrated by the occurrence of well defined and fairly thick beds of cap-stone. Beneath the cap-stone are beds of calcareous sandstone, containing little carbonate of lime."

In addition to the granite along the beach, I found granite outcropping at Wilson's head on the hills some 250 feet above sea-level. It would seem, therefore, that the granite floor on which the latter sandstones and sand dunes are resting has a very irregular undulating surface. These have filled up the depressions and will be of varying thickness, but granite rock will probably be met with at a comparatively shallow depth all over this area.

The sandstones show marked current or false bedding and are capped by a few feet of limestone (cap-stone) which has been formed by the action of water carrying

carbonate of lime in solution, which is drawn to the surface and deposits its lime contents on evaporation. It is in a precisely similar manner that a capping of laterite ironstone is formed when the underlying rocks are iron bearing.

Blown sand has since covered sandstone, limestone, and granite indiscriminately, outcrops of which can now only be seen at intervals. The removal of this overburden of sand will be quite an item to be considered in any estimate of the cost of obtaining supplies of limestone.

Quantity and Quality of Limestone.—The area over which limestone can be seen outcropping have been roughly surveyed by Senior Staff Surveyor Parry, and a copy of his plan is attached. It will be noted that the area of limestone exposed at the surface is approximately 140 acres.

He estimated that on the average the thickness of the cap-stone would be about 18 inches. In the absence of any shafts or quarries, this seems to be more or less a matter of conjecture, but it is probably nowhere more than a few feet.

A number of samples were taken in order to indicate the quality of the limestone. It should be explained that they were taken right at the surface by breaking off pieces of the outcropping cap-stone.

Dr. Simpson's report upon these samples was as follows:—

Number.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Insoluble matter ...	3.51	3.32	7.74	11.08	5.68	4.40	7.49	8.08
Iron and Alumina ...	0.57	0.26	0.44	0.50	0.28	0.50	0.24	1.36
Organic, moisture, etc. ...	†	†	†	†	†	2.61	4.02	1.66
Calcium Carbonate ...	93.91	91.56	87.04	84.14	89.16	90.14	86.04	87.88
Magnesium Carbonate ...	1.81	1.22	2.42	2.99	2.55	2.35	2.21	1.02
Total, Carbonates ...	95.72	92.77	89.46	87.13	91.71	92.49	88.25	88.90

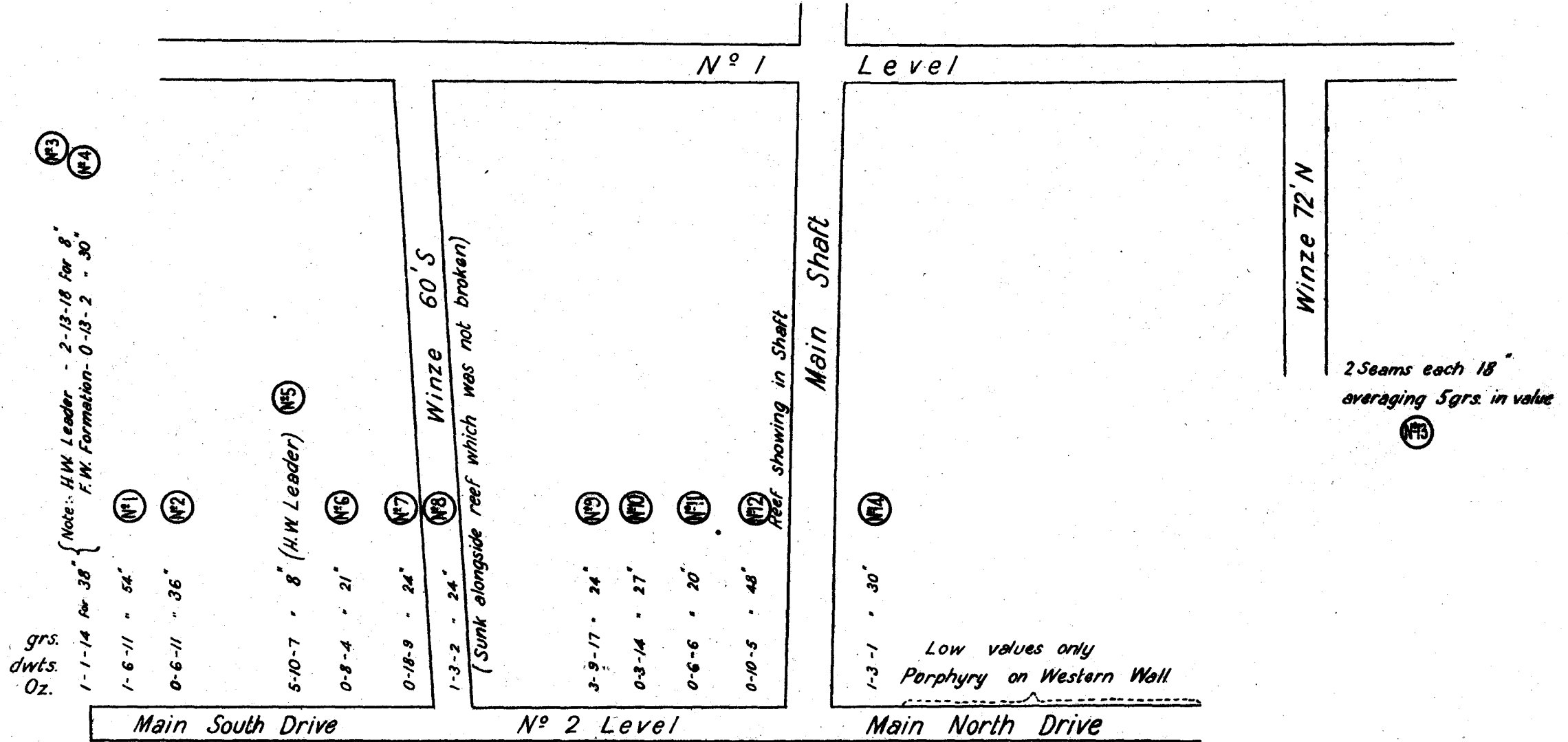
* Annual Report Department of Mines for 1915, page 112.

† Each sample contains one or two per cent. of organic matter with traces of salt, etc. These limestones are all of excellent quality for agricultural purposes. Some of them, however, are harder than others, and the softer ones will naturally be the cheaper to use for producing ground limestone.

RED WHITE AND BLUE MINE

Sketch showing sampling of 200' Level

Scale 20 chns. = 1 inch



grs.
dwts.
Oz.

Note: H.W. Leader - 2-13-18 For 8"
F.W. Formation - 0-13-2 - 30"

Face 107'

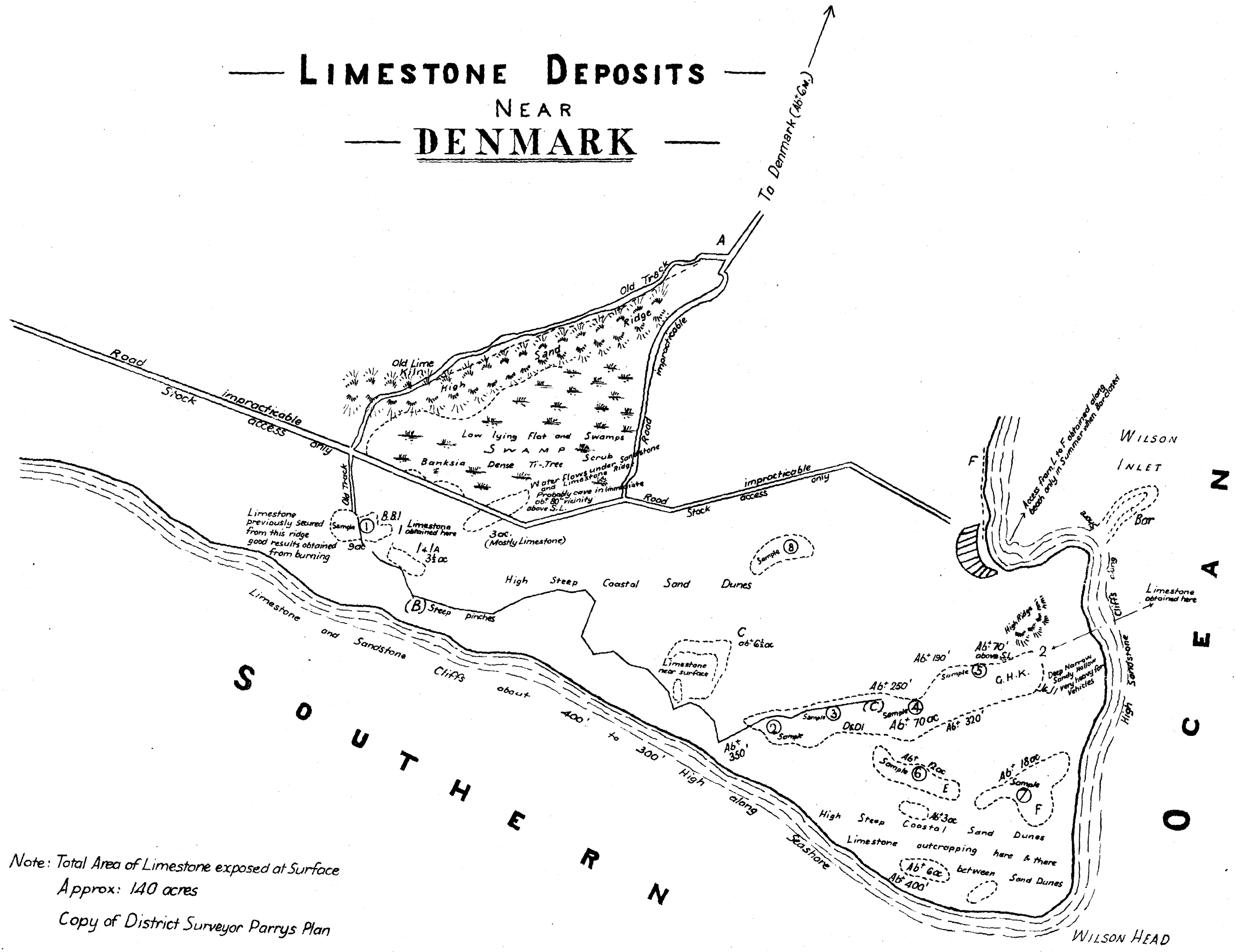
Average value 21 dwts. for 29"
Average value omitting samples N°5 & N°9 15½ dwts. for 32"

Face 60'

— LIMESTONE DEPOSITS —

NEAR

— DENMARK —



Note: Total Area of Limestone exposed at Surface
 Approx: 140 acres
 Copy of District Surveyor Parrys Plan

— Scale 20 Chs = 1 inch —

A sample of burnt lime was taken from the kiln to see what lime has actually been obtained. It had only a very poor covering, and it was only to be expected that it had suffered from exposure. Dr. Simpson's report is as follows:—

Lime, free	...	..	..	15.02
„ combined	..	..	..	41.38
Magnesia	..	..	..	1.56
Iron and alumina	..	..	..	0.61
Silica, etc.	..	..	..	3.42
Loss on ignition	..	..	..	38.27
				<hr/>
				100.26

This has probably been a good lime when freshly burnt, but has now been almost wholly reconverted to carbonate.

Accessibility of Deposits.—This matter was gone into somewhat carefully by Mr. Parry. He found that as the outcrops generally occur on the crest of the ridges, the limestone is practically inaccessible to vehicles drawn by horses, due to the fact that the approach must be across numerous steep coastal sand dunes and deep hollows. The small quantity of limestone which had already been collected and burnt was obtained at the points marked (1) and (2) on the plan attached. The limestone at the latter place is only accessible in the summer months when Wilson's Inlet is closed.

Mr. Parry explains in his report that a fair road for the rough nature of the country could be secured to B (see plan) with practically little formation. From B onward to C the grades would embrace short steep pinches; side cuttings, small cuttings and embankments would be necessary to secure reasonable grades and a safe road. The road would be very heavy, and probably when the natural surface of the sandhills became broken sand drifts would be frequent and rapid.

Firewood.—There is little or no firewood in the vicinity of the lime deposits; there is, however, a large quantity within Location 2238 in the neighbourhood of the old lime kiln, which seems to be in about as good a site as could be selected.

General Remarks.—I have no doubt that a large quantity of limestone of good quality exists in the area examined, which would be suitable for agricultural, paper pulping, or other purposes. The deposit, however, is not at all easily accessible, nor does it appear to be one which could be cheaply worked, on account of its probable shallow depth, and the fact that the surface is nowhere flat but consists everywhere of sand-covered hills and hollows.

This conclusion is in accord with that of the late H. P. Woodward, who expressed himself as follows:—

“Although this deposit is of considerable extent and of undoubted high grade in places, it would not lend itself to working upon economic lines, while its situation would render transport costly.”

Annual Report of the Board of Examiners for Colliery Managers' and Under-Managers' Certificates under "The Coal Mines Regulation Act, 1902."

The Under Secretary for Mines, Perth, W.A.

Sir,

The Annual Report of the Board of Examiners for the year 1923 is submitted for the information of the Hon. the Minister for Mines.

Board meetings were held on the 26th April and 24th October, 1923, at which all members were present.

April Examinations for First and Second Class Certificates of Competency.

In response to advertised examination to be held at Collie on the 4th, 5th, and 6th April, three candidates presented themselves for examination for Second Class Certificates of Competency. All three failed to gain the requisite number of marks for a Pass. Copy of Examination Papers herewith.

October Examination for First and Second Class Certificates of Competency.

An examination was advertised to take place at Collie on the 3rd, 4th, and 5th October. Four candidates

Office of the State Mining Engineer,
Mines Department, Perth, 23rd April, 1924.

sat for examination for First Class Certificates of Competency, and one for a Second Class Certificate of Competency. Copy of Examination Papers herewith.

Messrs. Z. Rogers, H. M. Sweeney, S. Annesley, and T. Burgess gained First Class Certificates of Competency, and J. Marshall a Second Class Certificate of Competency.

Mr. McVee, Inspector of Mines, Collie, supervised the examinations both written and oral, and the examinees' papers were dealt with by the full Board.

We have, etc.,

A. MONTGOMERY,
State Mining Engineer, Chairman.

JAS. McVEE,
Inspector of Mines, Member.

A. GIBB MAITLAND,
Government Geologist, Member.

F. A. LANE,
Secretary.

THE COAL MINES REGULATION ACT, 1902.		Possible Marks.
EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.		
Subject: ARITHMETIC.		
Wednesday, 3rd October, 1923, 10 a.m. to 11 a.m.		
Possible Marks.		
20	1. 600 safety lamps are used every day at a Colliery that works 11 days per fortnight. On pay Saturday only 40 lamps are used, the refills each absorb 5 cubic inches of oil. What is the average weekly oil bill at 10d. per gallon of 277½ cubic inches?	30
20	2. Assuming dimensions of colliery wagons to be as follows:—12ft. long by 6ft. wide at top and 6ft. by 4ft. at bottom, and 6ft. deep. How many of these could be filled out of a coal box 180ft. by 40ft. when it is 25ft. deep at one end and 20ft. deep at the other end.	35
15	3. Calculate the amount received for the under-noted quantities of coal sold, and the overhead average price per ton— 18,750 tons at 27s. 6d. per ton. 12,500 „ „ 23s. per ton. 5,840 „ „ 16s. 1d. per ton. Also calculate percentage of the whole sales formed by each class of coal.	35
15	4. ½ of an acre in a 7ft. seam is 75 per cent. full of water, find volume and weight of the water.	200
15	5. In 4 acres 2 roods 21 poles of a coal seam 6ft. thick how many tons are contained at 19 cwt. to cubic yard?	
15	6. Calculate quantity of earth removed in excavating a rectangular pond 60ft. x 30ft. at bottom and 8ft. deep, sides slope 1 vertical to 2 horizontal surface level. Give answer in cubic yards.	
100		
THE COAL MINES REGULATION ACT, 1902.		
EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.		
Subject: SURVEYING.		
Wednesday, 3rd October, 1923, 11 a.m. to 1 p.m.		
Possible Marks.		
40	1. Give a concise description of the methods and instruments employed in the conduct of a surface and underground survey of an extensive colliery.	
30	2. What are the methods employed in carrying out underground levelling operations with a level and staff.	100
THE COAL MINES REGULATION ACT, 1902.		
EXAMINATION FOR FIRST CLASS CERTIFICATES OF COMPETENCY.		
Subject: GEOLOGY.		
Wednesday, 3rd October, 1923, 2 p.m. to 4 p.m.		
Possible Marks.		
20	1. Give a brief account of the principal ways and conditions in which coal-forming plant remains accumulate.	
16	2. How may coals be classified so as to combine scientific accuracy with utilitarian requirements?	
16	3. Enumerate the effects which faults have upon coal seams. How may faults be detected upon the surface?	
16	4. Define the terms: Dyke, Heave, Washout, Unconformity, and shale.	
16	5. Enumerate the characteristic fossils associated with the Permo-Carboniferous Coals of Australia.	
16	6. Give a succinct account of the sequence and structural relations of any Australian Coal-field with which you are acquainted and illustrate your answer by a geological section.	
100		

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR FIRST CLASS CERTIFICATES
OF COMPETENCY.

Subject: THE COAL MINES REGULATION
ACT, 1902.

Wednesday, 3rd October, 1923, 4 p.m. to 5 p.m.

Possible
Marks.

- 18 1. What are the duties and responsibilities of a Manager under the Act?
- 18 2. What does the Act require as to publication of Abstract of Act and Copy of Special Rules?
- 16 3. What are the stipulations in the Coal Mines Act concerning the support of roof and sides in working places and roadways?
- 16 4. What are the provisions of the Act regarding inspection of machinery, etc., above and below ground?
- 16 5. What is the penalty for interference with office of Check Inspector or Check Weigher?
- 16 6. What are the Regulations governing the use of safety lamps in mines?

100

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR FIRST CLASS CERTIFICATES
OF COMPETENCY.

Subject: MACHINERY.

Thursday, 4th October, 1923, 10 a.m. to 1 p.m.

Possible
Marks.

- 30 1. The safety valve of a boiler is 3in. diameter and the pressure is 120lbs. per square inch. A lever 26in. long has the fulcrum 4in. from the valve spindle, and the weight of lever is 20lbs. Weight of valve 5lbs. Distance to centre of gravity 13in. What weight on end of lever will just allow steam to blow off?
- 30 2. State what parts of a boiler are most affected by an impure water supply, and explain in what way they are affected. How often should boilers be overhauled, cleaned, and examined?
- 30 3. You have to make an examination of the wire rope conductors in a shaft 600ft. deep. What points would you specially attend to and why? State how the examination should be made.
- 30 4. A cross measure drift is to be driven 300 yards rising 1-5. What mechanical arrangements are necessary in driving and in the conveyance of the debris, so that the work may be done expeditiously and economically?
- 30 5. Calculate size of haulage engine to haul 600 tons of coal in 7 hours along an incline 1,200 yards long rising 1-10. Rope speed 8 miles per hour. Effective steam pressure 80lbs. Friction $\frac{1}{3}$ direct haulage.
- 30 6. Describe the precautions you would employ in fixing the cables in a mine for an electric coal cutting service to avoid risk of accident to men employed in the mine.
- 30 7. Describe any type of coal cutting machine, state the depth of cut, and the rate of cutting (either in feet or square feet per hour or per shift) and the horse-power required.
- 30 8. In an endless rope haulage where would you put the apparatus for taking up slack. Sketch a wheel mounted on tension carriage showing your arrangement for tension weight.
- 30 9. Describe the working of an electrically driven three-throw plunger pump.
- 30 10. Show by sketch how wire conductors for shaft winding are tightened and secured above and below.

300

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR FIRST CLASS CERTIFICATES
OF COMPETENCY.

Subject: MINING OF COAL.

Thursday, 4th October, 1923, 2 p.m. to 5 p.m.

Possible
Marks.

- 30 1. A district of bord and pillar workings is being worked between the abandoned workings of the old mines. One on the rise side and one on the dip side. What are the dangers likely to be met with in each case, and what precautions would you take?
- 30 2. What is meant by systematic timbering? Compare this with setting timber in a staggered fashion without order. Give the advantages of one system over the other, if any.
- 30 3. Draw a section of the coal, roof, and floor of the seam worked at your colliery. Describe the method of working and the advantages or disadvantages of the present method of working as compared with any alternative method.
- 30 4. You have to tunnel through a heavy and running fall, describe with sketches how you would do so in a drive 10ft. wide and 6ft. high.
- 30 5. Explain with sketches how you would extract pillars 30 yards long by 15 yards broad in seam 6ft. thick, dipping 1-12 500ft. deep shale roof and strong floor.
- 30 6. In a seam 14ft. thick you have the choice of working it by—
- (a.) Taking the lower 6ft. of coal forward and bringing back the tops.
- (b.) Taking the lower coal forward and subsequently the top coal in the same direction.
- (c.) Working the top coal forward slightly in advance of the bottoms.
- Which would you adopt as the safest, explaining reasons for your choice?
- 30 7. How would you arrange the panels in a seam of coal 16ft. thick, average grade 1-10; the seam being very liable to spontaneous combustion?
- What number of working places would you arrange for when working in the solid, and how would you remove the pillars with a minimum of loss?
- 30 8. A comparatively shallow seam of coal is being worked and the face is approaching a point, where an old shaft was formerly sunk from the surface through the shallow seam to a lower seam, the shallow seam being left unworked, the old shaft is filled with water to the surface, how would you guard against an inundation?
- 30 9. What conclusions would you come to if in working a coal seam you found it getting broken and rusty in appearance, and what course would you adopt?
- 30 10. The roadways in a coal seam have a tendency to lift, and there is considerable side weight. Give illustrations how you would timber them.

300

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR FIRST CLASS CERTIFICATES
OF COMPETENCY.

Subject: VENTILATION AND DANGEROUS GASES.

Friday, 5th October, 1923, 10 a.m. to 1 p.m.

Possible
Marks.

- 30 1. Specify the conditions which must be fulfilled in order to secure good ventilation in a mine.
- 30 2. If 100,000 cubic feet of air per minute be split into three airways—
(a.) 10ft. x 6ft. x 300 yards long,
(b.) 7ft. x 12ft. x 1,500 yards long,
(c.) 8ft. x 8ft. x 1,200 yards long. What quantity would pass in each?
- 30 3. What are the conditions which would determine you to substitute safety lamps for naked lights in any mine?
Answer fully, stating whether naked lights should be used on the main intakes, and if so, where the caution boards should be used.
- 30 4. In some workings the ordinary ventilation of the mine is insufficient, and must be supplemented by additional power. What power can be applied for this purpose? Show, by sketches, a pair of places so treated.
- 30 5. There is a current of 95,000 cubic feet per minute in the return airway of a mine $3\frac{1}{2}$ per cent. of which is $C.H_4$. How many cubic feet of this gas are being generated in the mine, and what is the total quantity of air in the current?
- 30 6. Ventilate accompanying plan with due regard to haulage, etc.
- 30 7. A fan is circulating 150,000 cubic feet per minute, and is about at its maximum, the working faces a mile away are getting only 40 per cent. of this, what is the probable trouble, and how would you improve matters?
- 30 8. What is carbon monoxide gas? How is it formed, and what are its properties? What effect has this gas on animal life?
- 30 9. Explain the construction and use of the water-gauge.
- 30 10. Taking P. as pressure in lbs. per square foot—
A. as sectional area in square feet.
R. as rubbing surface.
V. as velocity in 1,000ft. per minute as unit of velocity.
C. as coefficient of friction.
Show formulae expressing each of these symbols in terms of the other four.

300.

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR SECOND CLASS CERTIFICATE OF COM-
PETENCY AS UNDER MANAGER OR OVERMAN.

Subject: VENTILATION AND DANGEROUS GASES.

Wednesday, 4th April, 1923, 10 a.m. to 11.30 a.m.

Possible
Marks.

- 50 1. How is the air in a ventilating district measured?
Illustrate your answer by an example, and give the number of miners, wheelers, and horses with the average quantity of air in cubic feet for each.
- 50 2. A mine heading is nearing a down throw fault where explosive gas is likely to be liberated, what precautions would you take in shot firing, lighting and ventilation?
Could you do anything to relieve the gas pressure before the fault is reached?
- 50 3. 550 cubic feet of firedamp are being given off at a uniform rate in a longwall face 1,800 feet long, what quantity of air is required to reduce the proportion of firedamp to 1.5 per cent.
Show, by means of a sketch, how you would propose to apply it, so as to have a moderate velocity at the face.

Possible
Marks.

- 50 4. On the plan of a mine which accompanies this paper, show how you would ventilate the working faces. Show the direction of each air current, and the position of air crossings, doors, stoppings, and regulators (if required).
- 50 5. Name and describe the properties of the principal gases met with in coal mines.
- 50 6. Detail the handling of a safety lamp from the time it enters the lamp cabin at the end of a shift till it passes the caution board next day.

300

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR SECOND CLASS CERTIFICATE OF COM-
PETENCY AS UNDER MANAGER OR OVERMAN.

Subject: MINING OF COAL.

Wednesday, 4th April, 1923, 11.30 a.m. to 1 p.m.

Possible
Marks.

- 50 1. What are the advantages to be derived from systematic timbering?
Describe, with sketches, the various systems you are acquainted with.
- 50 2. A heading 1,200 yards long falls 350ft. 6 inches—
(a.) What is the gradient of the road?
(b.) What kind of haulage would you instal on such a road to get up 400 tons in 7 hours?
Give reasons for and describe the salient points of the installation.
- 50 3. Large areas of coal have been lost owing to "creep" and "crush" taking place in bord and pillar workings. Describe and illustrate "creep" and "crush" and give your opinion as to their cause and occurrence.
- 50 4. In the flat seam 6ft. thick bords have been driven 6 yards wide leaving pillars 16 yards wide by 40 yards long. Explain and show by sketch how you would extract a section of pillars, and show in what rotation they would be extracted.
- 50 5. On going to fire a shot the shot firer finds—
(1.) The shot hole deeper than the holing.
(2.) The shot hole bored into a fast corner.
(3.) A feeder of gas issuing from the shot hole.
What should he do in each case.
- 50 6. In a mine with the board and pillar system of working the immediate roof of 2ft. 6in. is very much intersected with slips. Describe, with sketches, the method of timbering you would adopt.

300

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR SECOND CLASS CERTIFICATE OF COM-
PETENCY AS UNDER MANAGER OR OVERMAN.

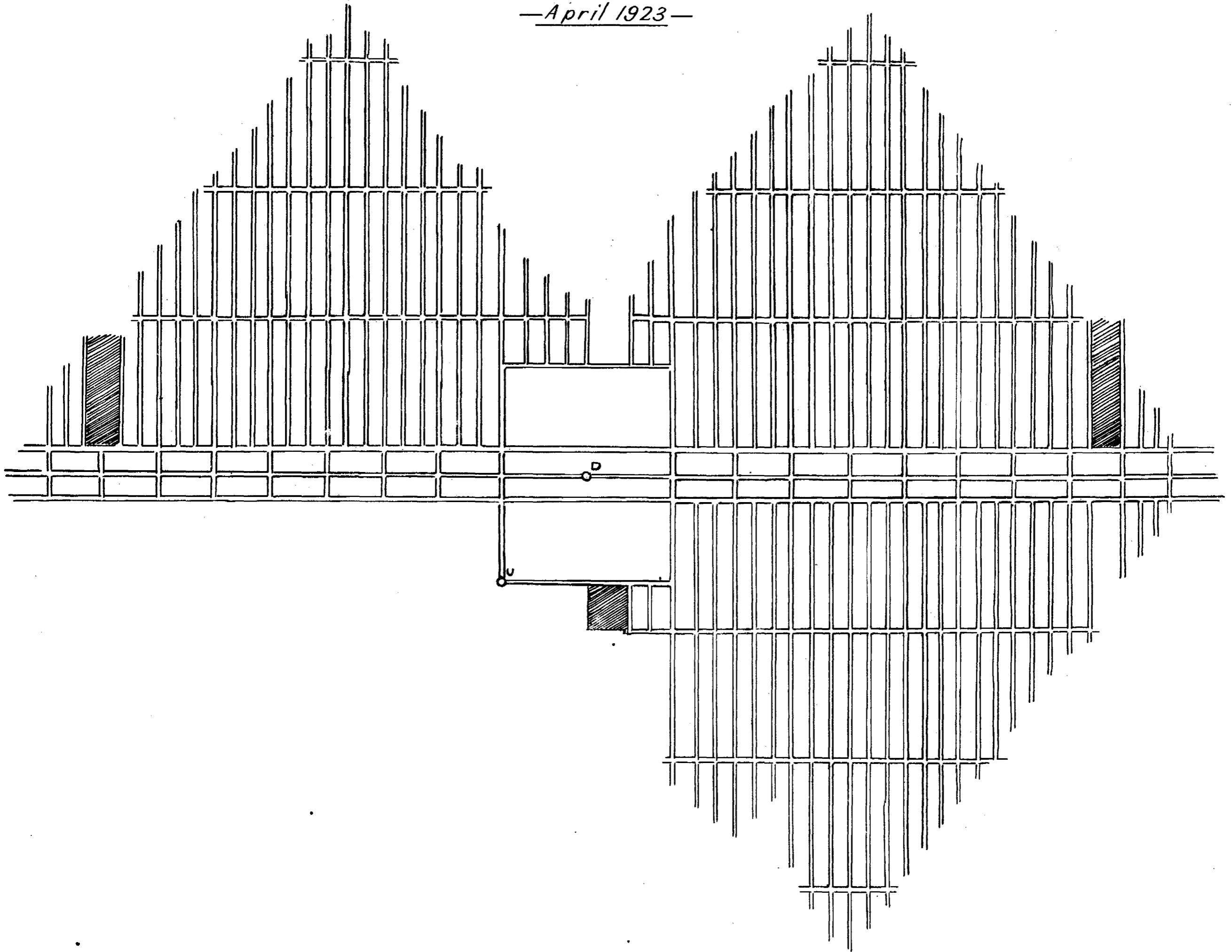
Subject: ARITHMETIC.

Wednesday, 4th April, 1923, 2 p.m. to 3 p.m.

Possible
Marks.

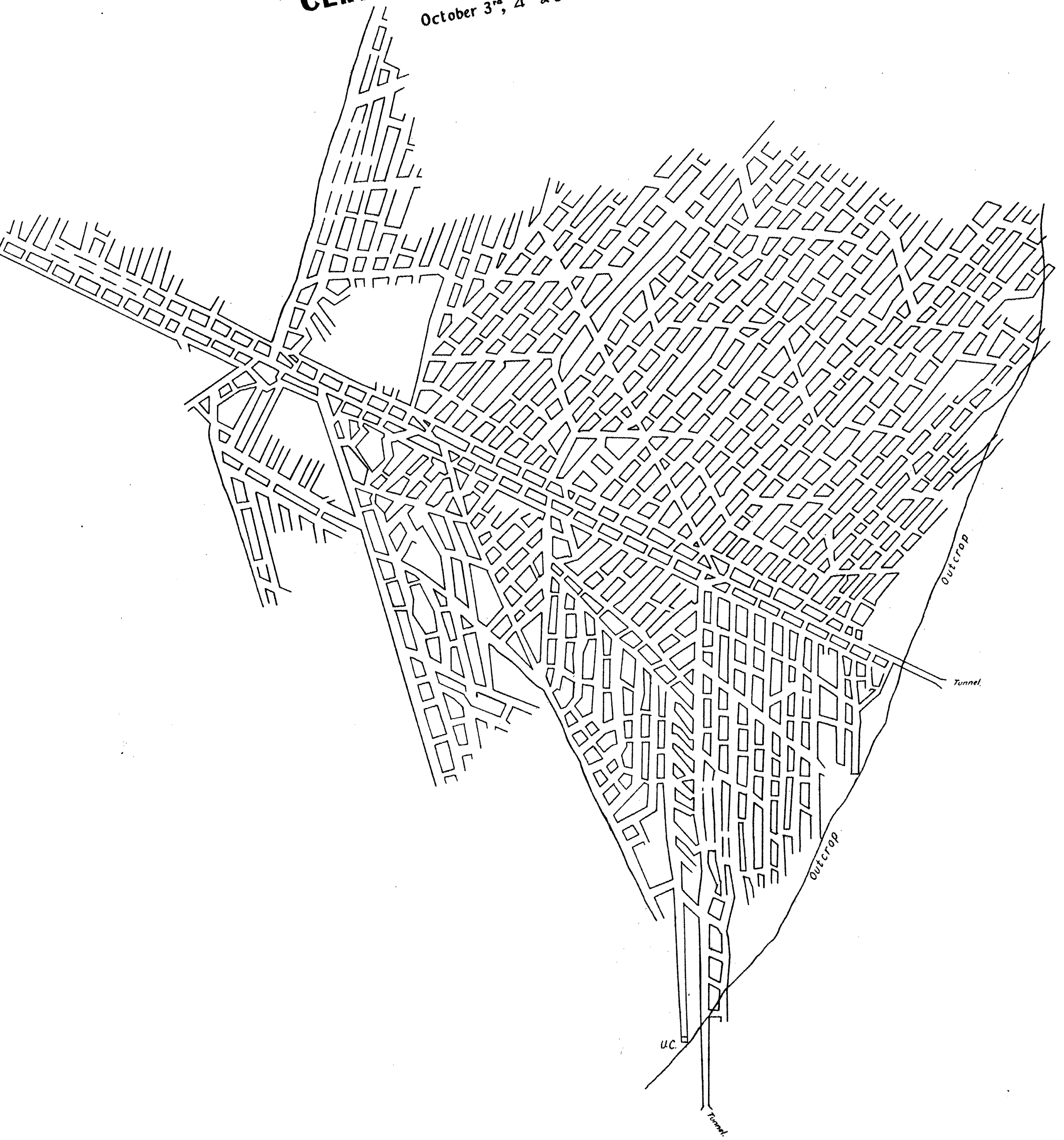
- 17 1. A mine pump lifts 450 gallons per minute while running, after the pump has been standing 3 hours it runs 10 hours to reduce the water in the sump to the same level as at the beginning of the 3 hours stoppage. What is the feeder of water per minute?
- 16 2. A seam of coal yields 18 cwts. to the cubic yard, 140 cubic yards are sent to the surface and there screened, 35 per cent. is small coal, worth 6s. 3d. per ton, the remainder is large coal, worth 13s. 9d. per ton, what is the value of 140 cubic yards?

Examination for Second Class Certificates
of Competency
— Coal M.R. Act 1902 —
— April 1923 —



THE COAL MINES REGULATION ACT 1902
EXAMINATION FOR FIRST & SECOND CLASS
CERTIFICATES OF COMPETENCY

October 3rd, 4th & 5th 1923.



Possible
Marks.

- 16 3. An output of 350 tons per day is coming from each of two seams and treated by one screening plant. The coal from one seam gives 52 per cent. slack, and 2 per cent. dirt, while that from the other gives 33½ per cent. slack and 4 per cent. dirt. Find tons of saleable large and small, and average percentage of small.
- 18 4. A seam 8ft. thick is worked longwall, the gateways are 10ft. wide and 25 yards apart centre to centre. The gateway packs are each 16ft. wide and cost 2s. 9d. per cubic yard. How much do the packs cost per ton of coal got? A cubic foot of coal weight 80lbs.
- 17 5. What is the cost of 16 tons 7 cwt. 3 qrs. 14lbs. of a material at £6 13s. 6d. per ton? If the cost goes up 9 per cent., what is the new cost?
- 16 6. Find the value of $3\frac{1}{2}$ of $5\frac{1}{2}$ + $3\frac{1}{2}$ + $\frac{1}{2}$ of $3\frac{1}{2}$.

100

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR SECOND CLASS CERTIFICATE OF COMPETENCY AS UNDER MANAGER OR OVERMAN.

Subject: ROADWAYS.

Wednesday, 4th April, 1923, 3 p.m. to 4 p.m.

Possible
Marks.

- 50 1. An undulating roadway has to be prepared for an endless rope road. Explain in sequence the necessary work to be done.
- 50 2. Describe with sketches how you would replace broken timbers in a road which is heavily weighted.
- 50 3. A special drive is started and it is required to be kept straight and at an even grade of 3 inches per yard. How would you carry out this work if it was placed in your charge?

Possible
Marks.

- 50 4. Show by sketches how you would timber a horse road where the roof is very friable, but the sides fairly strong.
- 50 5. The haulage roadways of a deep, hot, and dry mine are exceedingly dusty, what practical method would you suggest as to dealing with the dust?
- 50 6. Compare the two methods of endless rope haulage "Circular" with single road, and the ordinary double road system. State which you prefer, and why.

300

THE COAL MINES REGULATION ACT, 1902.

EXAMINATION FOR SECOND CLASS CERTIFICATE OF COMPETENCY AS UNDER MANAGER OR OVERMAN.

Subject: "THE COAL MINES REGULATION ACT, 1902."

Wednesday, 4th April, 1923, 4 p.m. to 5 p.m.

Possible
Marks.

- 17 1. What steps are to be taken on the abandonment of a mine?
- 17 2. Give a list of the several examinations and reports necessary under the Coal Mines Regulation Act below ground.
- 16 3. Under what circumstances does it become necessary to withdraw the workmen from a mine or any part thereof.
- 16 4. What does the Act require in the matter of width between tubs and sides of planes?
- 16 5. State the requirements of the Act regarding fencing of old workings and abandoned shafts.
- 18 6. What are Special Rules?
How are they established at Mines?

100

DIVISION III.

Report of the Superintendent of State Batteries.

Department of Mines,
State Batteries Branch,
Perth, 5th April, 1924.

The Under Secretary for Mines.

Sir,

I herewith submit my report upon State Battery operations for the year 1923—being the twenty-sixth Annual Report.

MILLING.

Ore was milled at 20 State batteries under departmental management. These mills have an aggregate of 135 stamps. Four batteries were leased (35 stamps) and four plants (25 stamps) were idle.

Tonnage.—Less ore was milled than during the previous year. Altogether, 513 parcels were handled, the total tonnage being 29,714¾, thus the mean weight per parcel was just under 58 tons. During 1922 there were 35,722¼ tons crushed in 647 parcels, or 55.21 tons per parcel. The decrease in tonnage was 6,007½ tons. With two batteries less in operation than during 1922, the tonnage kept 20 mills employed 18 per cent. of full time. The largest tonnages were crushed at Wiluna 7,653¾ tons, Sandstone 2,405 tons, Meekatharra 2,177¾ tons, Youanmi 2,030¾ tons, Warriedar 1,842 tons, Norseman 1,728¾ tons, and Cue 1,674¼ tons.

Stamp Duty.—At 5-stamp batteries (13) the duty per stamp per 24 hours was 4.98 tons—a good result. At 10-stamp batteries (6), excluding Wiluna, the duty was only 3.26 tons. Most of these batteries are very old and are slow crushers. At Wiluna the duty was high as usual, but there is not sufficient data to quote accurate figures. As over 81 per cent. of the ore milled was handled at 5-stamp batteries and Wiluna, the mean duty was good.

Amalgamation.—23,071¾ tons of ore were treated by amalgamation in the first instance. 18,570½ ounces of bullion, estimated to contain 15,743 ounces fine gold, were recovered. This recovery represents 73.5 per cent. of the gross value of ore worth 78s. 10d. per ton. During 1922 the recovery was 74.4 per cent. from ore worth 99s. 8d. per ton. Throughout the centres in which our operations are conducted, the proportion of lode matter to quartz has increased greatly in recent years, and, as a rule, lode matter does not yield such a high percentage of recovery by amalgamation.

Charges.—From the 1st January, 1923, charges for crushing were made uniform—with the exception of those batteries in the North-West. Minor alterations were necessary at several centres, but the small increases on the one hand were balanced by the decreases on the other. The 10-stamp and 5-stamp batteries were classed alike relative to clauses dealing with tonnage required to start and for purposes of allowing rebates for low-grade ore. Hitherto, 10-stamp batteries were not started until 250 tons were booked, and 5-stamp batteries until 150 tons were booked. We now start any idle battery when 150 tons have been booked. Similarly, rebates for low

grade ore are granted now at all batteries after 250 tons have been crushed. Previously, rebates were not granted at 10-stamp batteries until 500 tons had been crushed, or 250 tons at 5-stamp batteries.

Our charges since the beginning of 1923 have been:—Batteries in North-West: per ton, 12s.; per hour, 10s. All other batteries: per ton, 10s. 6d.; per hour (10-stamp), 16s. 6d. minimum; (5-stamp) 8s. 6d.; 5s. per ton.

On account of having received revenue in several instances of under 2s. per ton when crushing ore at the rate per hour, we found it imperative to make a minimum of 5s. per ton. These alterations and concessions seem to have given considerable satisfaction to prospectors.

Rebates were allowed on 5,533½ tons of low grade ore, amounting to £745 1s., compared with 5,822¾ tons and £854 15s. 8d. during 1922. Rebates are paid from the vote to "Development of Mining."

Expenditure.—The total expenditure incurred in milling operations, including proportion of administration and renewals and repairs, was £25,263 1s. 7d. The cost per ton 17s. 0.45d.

During 1922 the expenditure was £30,280 0s. 3d., and the cost per ton 16s. 11.28d. for 35,722¼ tons.

Revenue.—The total revenue collected amounted to £14,218 12s. 3d. or 9s. 6.84d. per ton, compared with £16,417 14s. 3d. or 9s. 2.16d. per ton during 1922.

The loss was £11,044 9s. 4d., compared with a loss of £13,862 6s. during 1922 (Schedules 1, 5, and 8).

TAILING TREATMENT.

As was the case last year, tailing was treated at 12 plants. For reasons mentioned in the report of the inspector, we were unable to handle the tonnage desired. 14,307 tons were put through the vats, the mean value before treatment being 6.602 dwts. per ton, whilst the value of the residue was 1.417 dwts. per ton. The actual recovery agreed with the theoretical recovery, and was 78.5 per cent. We now get much tailing which is not clean treating, and our extraction can be considered very satisfactory. The residue contained gold to the value of 6s. per ton. Probably half that value could be recovered as a result of finer grinding, but the cost of doing so would be prohibitive.

During 1922 the mean head value of 24,234 tons treated was 6.024 dwts. per ton, whilst the actual recovery was 79.3 per cent.

Expenditure.—£8,201 10s. 1d. was the amount spent, including administration and renewals. Vats at four plants were reinforced with cement, the work being a charge against working costs. Altogether, repairs and renewals cost £1,076 4s. 8d. or over 1s. 6d. per ton. The cost per ton was 11s. 5.56d., compared with 9s. 11.71d. during 1922, when 24,234 tons were treated.

Revenue.—This account was credited with £10,144 9s. 1d. as revenue, including £1,573 5s. on account of gold premiums since March, 1919. The profit was £1,942 19s. (Schedules 2, 4, and 9.)

SLIME TREATMENT.

At Wiluna, 8,848 tons were treated, the mean head value being 11.7 dwts. per ton. The residue had a value of 2.66 dwts. per ton, and the theoretical extraction was 79.76 per cent., while the actual recovery was 80.53 per cent.

During 1922 the tonnage treated was 7,492, having values of 11.359 dwts. and 2.216 dwts. per ton before and after treatment, the actual recovery being 80.4 per cent.

The plant at Wiluna was damaged by a cyclonic storm during the third week in December and put out of commission for several weeks.

Expenditure.—Treatment cost £4,917 12s., including £351 15s. 3d. for repairs, and amounted to 11s. 1.36d. per ton. Last year the cost of treating 7,492 tons was 11s. 10.56d. per ton.

Revenue.—Receipts amounted to £3,972 4s., or 8s. 11.73d. per ton, compared with £3,178 16s. 11d., or 8s. 5.83d. during 1922. The loss was £945 8s. (Schedules 2, 3, and 9.)

REPAIRS AND RENEWALS.

To maintain the plants, £4,600 4s. 8d. was spent on repairs and renewals. £3,172 4s. 8d. was spent on batteries and the balance on treatment plants, most of it for reinforcing vats at four plants.

During 1922 the sum of £5,680 8s. 9d. was spent.

TOTAL OPERATIONS.

52,869 $\frac{3}{4}$ tons were treated in all departments at a cost of £38,408 4s. 9d., or 14s. 6.35d. per ton. The figures for 1922 were 67,448 $\frac{1}{2}$ tons at a cost of 13s. 9.77d. per ton.

The revenue was £28,335 5s. 4d., or 10s. 8.61d. per ton, compared with 11s. 5.61d. per ton in 1922.

The loss on all operations was £10,072 19s. 5d.

Comparative Synopsis of Results at State Batteries for 12 months ended 31st December, 1922 and 1923.

	1923.			1922.		
	Tonnage.	Expenditure.	Revenue.	Tonnage.	Expenditure.	Revenue.
Milling	29,714 $\frac{3}{4}$	s. d. 17 0.45	s. d. 9 6.84	35,722 $\frac{1}{2}$	s. d. 16 11.28	s. d. 9 2.16
Tailing Treatment	14,307	11 5.56	14 2.16	24,234	9 11.71	15 8.90
Slime Treatment	8,848	11 1.36	81 11.73	7,492	11 10.56	8 5.83
Tin Treatment ... ..	...	...	...	...	...	...

Receipts and Expenditure, 1923.

	Tonnage.	Expenditure.	Revenue.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Milling	29,714 $\frac{3}{4}$	25,263 11 7	14,218 12 3	...	11,044 9 4
Tailing Treatment	14,307	8,201 10 1	10,144 9 1	1,942 19 0	...
Slime do.	8,848	4,917 12 0	3,972 4 0	...	945 8 0
Tin do. ... ..	...	26 1 1	...	...	26 1 1
	52,869 $\frac{3}{4}$	38,408 4 9	28,335 5 4	1,942 19 0	12,015 18 5
				Less Profit ...	1,942 19 0
					£10,072 19 5

PURCHASE OF TAILING.

21,911 tons of tailing were purchased during the year for £21,612 9s. 8d. net to owners. During 1922 the department purchased 20,809 tons for £25,339 13s. 5d. (Schedule 7.)

OUTPUT SINCE INCEPTION.

Tons of Auriferous ore milled	1,383,769
Production—	£
By Amalgamation	4,705,006
„ Tailing treatment	704,662
„ Slime treatment	256,917
„ Residue treatment	9,353
	£5,675,938
Tons of Tin Ore treated 80,068—	
Production	92,992
	£5,768,930

STAFF.

During the year two managers were retired and Mr. W. E. Eyres was appointed to the North-West circuit. Hence a reduction of one manager was effected, following upon a reduction of two during 1922.

At several of the isolated centres in which we operate we are dependent entirely upon our own resources, there being no other plants to render assistance in cases of mishaps to machinery or equipment. Each year now brings greater difficulties in this regard, and I desire to congratulate the Staff for the capable manner in which they have handled the business.

GENERAL REMARKS.

The gross tonnage handled showed a decline from 67,448 $\frac{1}{2}$ tons to 52,869 $\frac{3}{4}$ tons, a decrease of 14,578 $\frac{1}{2}$ tons. The principal decrease was in tailing treatment, 9,927 tons less than last year being handled.

A shortage of water at two centres and shortage of labour at two other centres were the chief causes of the decrease. There was also a decline of 6,007½ tons in the quantity of ore milled, and for the first time since 1901 the tonnage fell to under 30,000. The falling-off was almost entirely at batteries on the "Eastern" Goldfields, all of them being situated at Sandalwood centres.

The smaller tonnage had an effect upon the cost of treatment. Milling costs rose 1.17 pence per ton and tailing treatment 1s. 5.85d. per ton. The vats at four plants, however, were reinforced with cement, the expenditure of several hundred pounds being charged to working costs. There are several more plants to renew in a similar manner. One of the most insistent causes of unavoidable expenditure is maintenance of plants, which cannot be kept in anything like continuous operation through lack of ore supplies. At the present time there are no indications that the tonnage offered for treatment will increase.

During the year we were able to bring to account only £1,573 5s. from gold premiums. Our actual loss

on all operations was £11,646 4s. 5d., whilst the actual losses during 1921 and 1922 were £14,801 14s. 11d. and £14,200 13s. 1d. respectively. These figures were reduced to £10,072 19s. 5d. in 1923, £7,801 14s. 11d. in 1921, and £8,200 13s. 1d. in 1922 by allotment of gold premiums received from March, 1919, to 31st December, 1923.

Our three Ford cars were in constant use, and covered thousands of miles of country roads in conveying officers and employees from centre to centre. We will be obliged to procure an additional car as soon as possible to enable our operations on the Eastern Goldfields to be conducted with the reduced staff now employed.

Appended are twelve schedules relating to the details of operations and the Report of Mr. D. F. Browne, Inspector of State Batteries.

I have, etc.,

Your obedient servant,

H. M. HOWE,
Superintendent of State Batteries.

Report by Mr. D. F. Browne, Inspector of State Batteries.

The Superintendent of State Batteries.

Herewith please find my report on State Battery operations for the year ending 31st December, 1923.

The total tonnage milled and cyanided has fallen off considerably during the year. 52,869.75 tons were handled in all sections of our plants as against 67,448½ tons in the previous year.

A falling off in the tonnage milled was anticipated, but not to the extent of 16 per cent., which is the actual amount of the decrease.

Of the 6,007.5 tons decrease in tonnage milled, the nine batteries operating on the Eastern Goldfields were responsible for 5,406.25 tons, so that our plants on the Murchison showed little decline. This, I am sure, is mostly due to high prices obtained for sandalwood in the first-mentioned goldfields. In places like Niagara, Linden, Laverton, etc., practically the whole of the male population is engaged directly or indirectly in the sandalwood business, and will continue to do so until the wood within reasonable distance from the line is cut out. The loss on all operations for the year was £10,072 19s. 5d., as against £8,200 13s. 1d. in 1922.

MILLING.

Including Siberia and excluding Wiluna, six 10-stamp mills and 14 5-stamp mills were available for public crushing, and were all patronised more or less with the exception of Siberia, and were engaged for 18.33 per cent. of the full time available.

COST AND EXPENDITURE.

29,714.75 tons were crushed at an expenditure of £25,263 1s. 7d., and a cost per ton of 17s. 0.45d., being almost identical with that of the previous year, viz., 16s. 11.28d.

REVENUE.

The total revenue was £14,218 12s. 3d. This includes refunds of £745 ls. to cover low grade rebates allowed. The revenue per ton was 9s. 6.84d., or 4.68d. more than that received in 1922. See Schedule I. The fixing of a minimum charge of 5s. per ton would account for increased revenue per ton. The total loss was £11,044 9s. 4d. In 1922 our loss on milling was £13,862 6s.

COST PER HOUR STAMP DUTY.

On Schedule 3 the hours run for each battery are shown, also cost per hour and stamp duty. No 10-stamp mill crushed sufficient ore to give good cost per hour figures, but Norseman (11.08 shillings), Warriedar (12.66 shillings), Payne's Find (13.25 shillings), and St. Ives (13.82 shillings) show economical working.

Stamp duties at 10-stamp mills were fair, but most of the plants are old and tonnage poor.

5-stamp mills showed excellent duties with the average of 4.98 tons per stamp per day.

The best figures are Peak Hill (6.37), Youanme (6.36), and Meekatharra (6.05).

FUEL CONSUMPTION.

Schedule 5 shows the cost per H.P.H. and the fuel consumption per H.P.H. for each battery, and also the cost figures for the previous year.

Sandstone burning mulga firewood shows the best steam figure, namely, 9.11lbs. per H.P.H.

Payne's Find with 0.91lbs. of charcoal per H.P.H., and Norseman, Bamboo Creek, and Ora Banda with 3.25lbs., 3.30lbs., and 3.48lbs. of wood per H.P.H. respectively, show excellent results.

The best costs per B.H.P. are as follows: Yarri (steam) 0.78 pence, Payne's Find (charcoal producer) 0.44 pence, and Ora Banda (wood producer) 0.22 pence.

Low Grade Rebates.—Rebates amounting to £745 ls. were allowed on 5,535.25 tons of low grade ore, compared with 5,822.75 tons crushed and £854 15s. 8d. allowed in 1922.

Repairs and Renewals.—The cost per ton milled for repairs and renewals was 2s. 1.60d., as against 2s. 4.08d. in 1922.

TAILINGS TREATMENT.

The tonnage of tailings treated for the year was very disappointing, and was due to a variety of causes over which we had no control.

Norseman and Ora Banda accumulations were untreated owing to lack of water supply, whilst at other centres such as Sandstone and St. Ives, lack of labour prevented the plants from running at their full capacity.

Only 14,307 tons of tailings were treated for the year at a cost of 11s. 5.56d. and a revenue of 14s. 2.16d., as against 9s. 11.71d. and 15s. 8.90d. respectively in 1922.

The higher cost is due to overhead charges increasing automatically as the tonnage decreased; large expenditure paid out of working for reinforcing vats and tanks, and ever increasing cost of handling due to inefficient labour.

Extraction.—The following schedule shows details of extraction at all batteries. Excluding Wiluna slimes treatment, the head value of tailing was 6.602 dwts., as against 6.024 dwts. in 1922, and notwithstanding the higher value, the extraction fell from 79.3 to 78.5 per cent.

The gold called for and recovered agreed very closely, the total shortage being £3.

Repairs and Renewals.—Excluding Wiluna £1,076 4s. 8d. was spent on repairs and renewals to tailings plants, equal to 1s. 6.05d. per ton, as against 1s. 1.15d. in 1922. The profit on the treatment was £1,942 19s.

TAILINGS TREATMENT AND EXTRACTION.

For Year ended 31st December, 1923.

Battery.	Tons Treated.	Head Value.	Contents.	Tail Value.	Con- tents.	Extraction.	Short- age.	Sur- plus.
		dwts. grs.	ozs.	dwts. grs.	ozs.	%	£	£
Bamboo Creek	600	13 10	402.5	2 18	82.5	78.2	196	...
Coolgardie	1,077	5 0	2.8.3	1 0.4	54.75	80	...	10
Cue	1,800	4 17	243.6	0 22.5	84.35	80.09	7	...
Laverton... ..	360	5 13	99.7	0 23	17.25	82.7	...	15
Leonora	3,769	6 14	937.9	1 14.4	220.00	76.6	...	40
Meekatharra	2,030	5 16	575.6	1 4	118.90	79.3	37	...
Norseman	540	8 9	223.1	2 7	61.85	72.6	...	...
Payne's Find	336	2 15	44.1	0 20	14.60	67	16	...
Sandstone	380	12 9	235.1	2 22	55.40	77.5	...	116
St. Ives	1,020	4 14.5	235	0 19.7	47.00	80	111	...
Warriedar	1,610	12 15	1,017.4	1 23	156.90	84.5	...	105
Youanme	785	11 4	438.7	2 13	101.80	76.8	...	18
	14,307	6.602	4,724	1.417d.	1,015.3	78.5	3	...
Wiluna	8,848	11.293	4,996.3	2.275d.	1,006.50	79.85	...	145

Comparative figures, 1923 and 1922.

		1923.	1922.
Average Head Value	...	6.602 dwts.	6.024 dwts.
" Tail Value	...	1.417 "	1.216 "
" Theoretic Extraction	...	78.5 per cent.	79.8 per cent.
" Actual Extraction	...	78.5 per cent.	79.3 per cent.

WILUNA SLIME TREATMENT.

During the year 8,848 tons were pressed at a cost of 11s. 1.39d. per ton, a decrease of 9.16 pence per ton over the 1922 figure, when the tonnage treated was 7,492 tons.

Revenue amounted to 8s. 11.73d. per ton, and a net loss of £945 8s. was made.

Head values dropped from 11.359 to 11.293 dwts., and an extraction of slightly over 80 per cent. was made.

ORE DRESSING.

Our tin plant at Greenbushes remained idle for the whole year, notwithstanding the gradual rise in the price of tin.

Our Coolgardie plant was only used for concentrating a small tonnage of refractory sulphide ore.

STAFF.

Managers W. J. Wright and J. A. McLean retired from the service during the year, and Mr. W. E. Eyres was appointed to the North-West circuits in place of Manager McLean.

The gradual curtailment of the outback staff, which now includes 10 Managers and one part-Manager, has resulted in economy though most of the Managers have had increased difficulties to contend with. The outback staff, notwithstanding the inadequate supply of efficient labour and the decreasing standard of comfort due to the decline in the different districts, have done good work.

It is with regret that I have to place on record the death of Mr. J. Ferguson, our Clerk-in-Charge, on the 5th of June last, after a long illness. No new appointment was made, his work being shared by the rest of the staff. The appointment of a junior to take the place of Mr. C. Moore, transferred to our work in the Accounts Branch, has further reduced the administrative costs.

ERECTION.

No new mills were erected during the year. The only work done under the above heading and charged to loan, was the erection of St. Ives tailings plant, and the part construction of railway siding at Coolgardie. Reconstruction from working account included the reinforcement of vats and tanks at Youanme, Norseman, Meekatharra, and Boogardie, and the installation of the Ruston Proctor engine from Wiluna at Linden.

CONCLUSION.

The prospects of increased tonnage for 1924 are poor. At Wiluna work on the Gwalia Consolidated and other lodes now under option has almost ceased, and if the supplies of ore from these leases cease, the question of the re-organisation of this plant will have to be considered.

The tonnage of tailings treated should be appreciably greater—a reflection of our reconditioned plants, and as there is some hope of a revival in tin-mining at Greenbushes, there is a prospect of our dressing plant being again in operation.

The installation of a siding at Coolgardie will, I feel sure, result in increased tonnage to that mill, a considerable saving in costs to customers, and will obviate the necessity of their waiting for sufficient tonnage to start up other plants on the railway, should they be in a hurry to get their results.

With a good siding at Cue to serve the Murchison, and Coolgardie the Eastern Goldfields, prospectors can now prospect in many moribund centres with the certainty of having crushing facilities at a reasonable cost, and the department will be saved the expense of starting up on prohibitively small tonnages, and the otherwise constant agitation to re-open mills closed down through want of patronage.

D. F. BROWNE,
Inspector of State Batteries.

8th April, 1924.

Schedule 4.

Sand and Tailing Treatment since Inception to 31st December, 1923.

Battery.	Tons.	Yield.	Value.
		Fine ozs.	£
Bamboo Creek	8,638	3,119.22	13,261.94
Boogardie	51,678	13,620.47	57,268.92
Burtville	18,788.75	5,464.13	22,793.78
Coolgardie	68,799	10,417.70	44,088.71
Cue	10,170	2,229.55	9,456.15
Laverton	18,536	2,943.45	12,307.30
Leonora	40,908.5	9,951.39	41,499.54
Linden	16,917	5,619.01	23,833.68
Meekatharra	53,174	10,647.84	45,054.58
Mt. Keith	7,053	816.70	3,468.72
Mt. Sir Samuel	5,988	1,367.56	5,809.39
Mulline	44,794.5	12,261.27	49,863.24
Mulwarrie	23,809.25	4,675.53	19,220.31
Niagara	44,828	6,839.37	28,471.79
Norseman	47,899.5	10,967.81	45,854.15
Ora Banda	8,372	1,734.05	7,366.66
Payne's Find	17,959	1,973.41	8,469.40
Quinn's	7,486	686.56	2,916.43
Sandstone	47,448	13,854.02	58,563.46
Sandy Creek	11,496.25	3,512.53	14,639.07
Siberia	5,550	1,201.56	5,105.20
St. Ives	1,020	162.54	690.16
Warriedar	6,116	3,391.62	14,404.04
Wiluna	17,852	7,930.79	33,590.87
Yarri	44,180	4,197.75	17,567.84
Youanme	13,120	3,568.43	15,154.94
Batteries closed	134,971.5	25,074.55	103,894.98
	773,552.25	168,223.81	704,661.81

Residue Treatment from Inception to 31st December, 1923.

Battery.	Tons.	Yield.	Value.
Linden	670	Fine ozs. 95.14	£ 346.34
Mendes	24,279	1,579.28	6,670.01
Mulwarrie	4,618	546.85	2,325.02
	29,558	2,221.25	9,353.37

Slime Treatment from Inception to 31st December, 1923.

Battery.	Tons.	Yield.	Value.
Mulwarrie	4,733.50	Fine ozs. 751.79	£ 3,194.22
Wiluna	92,169.0	35,700.83	151,612.33
Slimes Plants closed	111,196.25	25,088.87	102,110.62
	208,098.75	61,541.54	256,917.17

Tin Residue Treatment from Inception to 31st December, 1923.

	Tons.
Greenbushes, Bunbury End	315
Greenbushes, Salt Water Gully	1,444
	1,759

Schedule 5.

Return showing Number of Parcels treated and Tons crushed at State Batteries for Year 1923.

Number of Parcels crushed.	Battery.	Tons.	Yield by Amalgamation.		Yield by Amalgamation.		Gross Contents of Tailings.		Total Contents of Ore.		Average per ton.		Gross Value of Ore per ton.
			Bullion.	Fine Gold.	Fine Gold.	Fine Gold.	Fine Gold.	Fine Gold.	Fine Gold.				
7	Bamboo Creek	381½	ozs. dwt. gr.	905 2 0	767 4 0	153 9 4	920 13 4	dwt. gr.	48 6	£ s. d.	10 5 1		
33	Boogardie	1,041½	674 10 0	571 16 4	408 4 18	980 0 22	18 19	3 19 11					
48	Coolgardie	1,483½	1,233 6 12	1,037 18 19	316 7 10	1,404 6 5	18 22	4 0 5					
55	Cue	1,674½	1,248 4 0	1,058 3 9	298 0 2	1,356 3 11	16 14	3 8 9					
13	Laverton	250½	462 16 0	392 6 19	97 15 21	490 2 16	39 2	8 6 1					
13	Leonora	357	505 14 0	428 14 4	137 12 4	566 6 8	31 17	6 14 9					
8	Linden	233½	352 9 0	298 15 19	80 0 15	378 16 10	31 17	6 14 9					
12	Marble Bar	507½	743 8 0	630 4 9	80 4 6	710 8 15	27 23	5 18 10					
58	Meekatharra	2,177½	1,709 4 0	1,448 19 14	453 18 6	1,902 17 20	17 11	3 14 3					
12	Mt. Ida	507	196 4 0	166 6 14	123 12 2	239 18 16	11 10	2 8 6					
25	Norseman	1,728½	2,656 9 0	2,252 0 9	585 5 10	2,837 5 19	32 19	6 19 4					
21	Ora Banda	1,115½	1,008 14 11	855 3 0	229 13 18	1,034 16 18	19 10	4 2 7					
21	Payne's Find	902½	1,088 9 0	922 14 19	59 9 14	982 4 9	21 18	4 12 5					
17	Peak Hill	1,319	743 16 0	630 11 4	169 19 16	800 10 20	12 3	2 11 6					
22	Sandstone	2,405	1,397 11 0	1,184 15 4	449 1 22	1,633 17 12	13 14	2 17 9					
17	St. Ives	1,412	808 4 0	685 3 3	124 15 7	809 18 10	11 11	2 8 8					
36	Warriedar	1,922	1,066 12 0	904 4 5	972 15 10	1,876 19 15	19 12	4 2 11					
18	Wiluna	930½	527 3 0	446 17 19	381 1 19	827 19 14	17 18	3 15 5					
21	Yarri	686½	548 18 12	465 7 0	121 18 5	537 5 6	17 2	3 12 7					
20	Youanme	2,030½	643 15 0	545 14 19	431 1 9	976 16 4	9 15	2 0 11					
477		23,071½	18,570 9 11	15,743 1 11	5,674 7 2	21,417 8 13	18 13	3 18 10					
36	Wiluna Lode	6,723	No amal	gamation	3,895 11 5	3,895 11 5	11 14	2 9 3					
518	Less tonnage not completed, 31st December, 1922	80											
		29,744½											
		29,714½											

Schedule 6.

Expenditure from Consolidated Revenue Vote and Loan Expenditure Funds on Erection of State Batteries, for year 1923, and Totals since inception.

Battery.	From Revenue.	From Loan.	Total.
	£ s. d.	£ s. d.	£ s. d.
St. Ives—Battery Installation and Water Supply	...	19 16 8	19 16 8
Segregation of Machinery ...	...	2 14 0	2 14 0
St. Ives—Cyanide Plant ...	...	454 11 8	454 11 8
Norseman Frontier Pump ...	...	0 10 6	0 10 6
Purchase two Motor Cars ...	...	586 8 0	586 8 0
Reconstruction Tailing Battery, Yarri	...	852 17 8	852 17 8
Installing Leaching Vats, Ora Banda	...	194 4 9	194 4 9
Installing Siding, Coolgardie	...	263 6 7	263 6 7
Equipping Cyanide Plant, Peak Hill	...	70 2 10	70 2 10
Erection of State Batteries—Expenditure to 31st December, 1907	91,981 1 8	2,444 12 8	2,444 12 8
Loan Expenditure to 31st December, 1922	...	303,163 14 9	305,144 16 5
Totals ...	91,981 1 8	305,608 7 5	397,589 9 1

Schedule 7.

Direct Purchase of Tailings for year 1923.

Battery.	Tons.	Amount.
		£ s. d.
Bamboo Creek ...	858½	1,227 14 4
Boogardie ...	588½	706 13 3
Coolgardie ...	943½	558 10 9
One ...	983½	446 13 1
Laverton ...	565	512 11 5
Leonora ...	504½	650 18 8
Linden ...	202½	154 5 8
Meekatharra ...	1,453½	770 7 0
Niagara ...	...	2 0 9
Norseman ...	1,431½	1,843 15 5
Ora Banda ...	742½	547 1 8
Payne's Find ...	42½	13 4 11
Peak Hill ...	319½	203 5 0
Sandstone ...	1,147	698 9 2
St. Ives ...	968½	349 10 0
Warriedar ...	1,400½	2,151 8 7
Wiluna (Lode) ...	7,517½	9,892 7 1
Yarri ...	486½	247 6 11
Youanme ...	1,753½	1,126 6 0
	21,911	21,612 9 8

Schedule 7a.

Return showing Tailing payable and unpayable and Gross Contents for year 1923.

Battery.	Tailing payable.		Tailing unpayable.		Totals.	
	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.
		ozs. dwts. grs.		ozs. dwts. grs.		ozs. dwts. grs.
Bamboo Creek ...	805½	153 9 4	...	...	805½	153 9 4
Boogardie ...	759½	384 8 15	116½	23 16 3	876½	408 4 18
Coolgardie ...	838	286 8 19	884½	30 3 15	1,722½	316 7 10
One ...	740½	248 18 22	570½	54 1 4	1,311	298 0 2
Laverton ...	208½	97 15 21	...	...	208½	97 15 21
Leonora ...	303	137 12 4	...	...	303	137 12 4
Linden ...	202½	80 0 15	...	...	202½	80 0 15
Marble Bar ...	368	80 4 6	38½	4 0 2	406½	84 4 8
Meekatharra ...	1,188½	386 7 17	543½	67 10 13	1,736½	453 18 6
Mt. Ida ...	200½	102 1 17	204½	21 10 9	405½	123 12 2
Norseman ...	1,144	584 6 16	7½	0 18 13	1,151½	585 5 10
Ora Banda ...	584	186 5 18	389½	43 8 0	923½	229 13 18
Payne's Find ...	57	13 8 2	491½	46 1 12	548½	59 9 14
Peak Hill ...	319½	114 10 20	584½	55 8 20	904½	169 19 16
Sandstone ...	1,346	424 17 13	202½	24 4 9	1,548½	449 1 22
St. Ives ...	224½	77 7 19	393½	47 7 12	622½	124 15 7
Warriedar ...	1,520½	965 11 14	61	7 3 20	1,581½	972 15 10
Wiluna ...	673	369 8 1	103½	11 13 13	781½	381 1 19
Yarri ...	335½	100 12 15	247½	21 5 14	583½	121 13 5
Youanme ...	1,273½	481 1 9	...	...	1,273½	431 1 9
	12,548	5,219 13 3	4,806½	458 14 1	16,854½	5,673 7 4
Wiluna Lode ...	6,723	3,895 11 5	...	...	6,723	3,895 11 5
	19,271	9,115 4 8	4,806½	458 14 1	23,577½	9,573 13 9

Schedule 9.

Statement of Receipts and Expenditure for Year, 1923.

TAILING AND SLIME TREATMENT.

Plant.	Tonnage.	Management.	Wages.	Assays.	Stores.	Total Working Expenditure.	Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek ...	600	86 3 4	156 10 0	56 14 7	128 2 9	427 10 8	14 3-00	75 3 5	86 15 4	589 9 5	19 7-77	523 15 5	17 5-49	...	65 14 0
Boogardie ...	...	28 0 3	4 11 6	0 7 0	1 4 7	34 3 4	...	252 7 11	0 7 6	286 18 9	...	20 13 0	...	...	266 5 9
Coolgardie ...	1,077	70 1 9	192 19 3	54 17 8	84 0 7	401 19 3	7 5-56	14 2 0	99 5 7	515 6 10	9 6-84	799 6 10	14 10-12	284 0 0	...
Cue ...	1,800	101 9 10	305 14 9	30 17 11	164 1 6	602 4 0	6 8-28	18 18 10	138 0 8	758 18 6	8 5-18	1,037 7 7	11 6-31	278 9 1	...
Laverton ...	360	48 2 3	88 8 11	14 9 2	25 9 5	176 9 9	9 9-64	1 12 0	46 0 6	224 2 3	12 5-40	257 12 1	14 3-72	33 9 10	...
Leonora ...	3,769	247 16 9	658 9 4	79 5 0	377 9 6	1,358 0 7	7 2-47	60 11 3	338 3 11	1,756 15 9	9 3-86	1,042 1 9	5 6-35	...	714 14 0
Linden ...	...	...	...	2 2 1	...	2 2 1	...	...	...	2 2 1	...	...	...	...	2 2 1
Meekatharra... ..	2,030	113 16 6	411 3 6	29 2 5	204 11 3	758 13 8	7 5-68	199 7 6	150 1 8	1,108 2 10	10 10-99	984 18 11	9 8-42	...	123 3 11
Norseman ...	540	58 5 6	98 1 0	10 5 10	55 10 6	222 2 10	8 2-73	255 8 5	72 18 11	550 10 2	20 4-65	452 16 10	16 9-26	...	97 13 4
Payne's Find ...	336	18 8 0	48 1 8	5 14 8	72 5 4	144 9 8	8 7-20	...	27 18 3	172 7 11	10 3-13	126 5 10	7 6-19	...	46 2 1
Sandstone ...	380	25 4 6	73 1 6	19 11 3	167 19 6	285 16 9	15 0-52	46 9 9	31 16 0	364 2 6	19 1-06	535 19 1	28 2-49	171 16 7	...
St. Ives ...	1,020	85 15 9	175 12 4	53 1 2	143 11 1	458 0 4	8 11-76	16 1 8	96 2 9	570 4 9	11 2-17	448 10 2	8 9-52	...	121 14 7
Warriedar ...	1,610	130 18 7	260 14 4	37 5 8	214 16 4	643 14 11	7 11-95	...	196 6 9	840 1 8	16 5-23	1,783 12 2	22 1-87	943 10 6	...
Yonanme ...	785	29 14 2	106 4 3	21 12 6	95 12 3	253 3 2	6 5-40	136 6 11	72 16 7	462 6 8	11 9-33	521 12 5	13 3-45	59 5 9	...
Niagara ...	...	...	...	...	...	...	...	...	...	...	...	36 12 0	...	36 12 0	...
Transferred from Revenue Suspense Account	...	...	...	...	...	...	...	...	...	...	...	1,573 5 0	...	1,573 5 0	...
Wiluna Slimes ...	14,307	1,043 17 2	2,574 12 4	415 6 11	1,734 14 7	5,768 11 0	8 0-76	1,076 4 8	1,356 14 5	8,201 10 1	11 5-56	10,144 9 1	14 2-17	3,380 8 9	1,437 9 9
	8,848	289 10 3	1,482 11 0	568 6 2	1,372 6 3	3,712 13 8	8 4-70	351 15 3	853 3 1	4,917 12 0	11 1-39	3,972 4 0	8 11-73	...	945 8 0
	23,155	1,333 7 5	4,057 3 4	983 13 1	3,107 0 10	9,481 4 8	8 2-25	1,427 19 11	2,209 17 6	13,119 2 1	11 3-96	14,116 13 1	12 2-30	3,380 8 9	2,382 17 9

Schedule 12.

State Battery Statistics from Inception to 31st December, 1923.

Year.	Milling.				Sand and Tailing Treatment.				Slime Treatment.				Tin Treatment.				Gross Loss. ‡
	Tons.	Expenditure per ton.	Revenue per ton.	Loss.	Tons.	Expenditure per ton.	Revenue per ton.	Profit.	Tons.	Expenditure per ton.	Revenue per ton.	Loss.	Tons.	Expenditure per ton.	Revenue per ton.	Loss.	
		s. d.	s. d.	£		s. d.	s. d.	£		s. d.	s. d.	£		s. d.	s. d.	£	£
1899	18,806	...	...	2,827	...	...	...	...	...	...	...	...	...	...	...	...	2,827
1900	22,675	22 10.1	17 4.5	7,611	...	...	...	...	...	...	...	...	...	...	...	...	7,611
1901	26,775	18 0.0	16 6.0	1,983	9,534	16 9	...	1,337	...	...	...	...	...	...	...	...	646
1902	39,516	14 8.6	14 8.2	169	9,721	22 3	...	724	...	...	...	...	1,170	12 2	...	286	‡269
1903	49,233	13 6.8	12 10.6	1,250	33,369	7 7	...	1,442	...	...	...	...	2,009	8 2	...	153	‡2,539
1904	71,616	14 4.4	12 6.5	6,423	43,251	7 10	...	1,448	...	...	...	...	2,337	8 2	...	165	5,141
1905	85,018	12 4.0	12 2.5	957	54,420	7 3	9 8.5	6,689	7,028	12 1	...	410	3,697	5 8	5 0.3	324	‡3,342
1906	95,831	12 2.0	11 3.8	4,076	65,159	7 4	9 2.1	5,549	4,737	11 8	12 1.1	‡2,254	11,428	4 2	4 3.3	‡156	‡2,880
1907	95,280	12 6.0	11 4.8	8,724	64,514	6 8.7	9 2.8	6,474	8,220	8 7.6	13 5.5	‡1,983	10,496	4 4.4	4 8.8	‡191	1,688
1908	95,628	12 1.9	9 3.6	13,669	62,272	6 4.7	8 11.0	8,017	5,818	12 0.9	11 8.0	120	5,573	4 5.2	3 6.3	254	7,278
1909	94,218	11 1.7	9 6.6	7,568	61,032	6 5.8	8 9.7	7,096	16,848	10 0.7	9 6.7	423	5,043	4 8.2	3 7.5	267	1,965
1910	89,278	11 3.3	9 6.6	7,709	43,391	6 2.9	8 6.1	4,903	28,600	8 9.1	9 11.5	‡1,723	3,769	5 5.5	3 4.1	401	2,365
1911	59,373	12 6.9	9 10.3	8,058	27,362	6 5.9	8 9.7	3,173	28,183	10 10.5	9 5.3	1,666	6,061	4 0.3	3 4.9	188	7,490
1912	56,636	12 9.2	9 8.7	8,616	18,600	8 3.5	8 8.6	397	8,085	11 8.6	10 5.2	519	5,330	4 5.1	3 7.6	210	9,786
1913	60,573	12 5.6	9 5.4	9,155	31,378*	7 5.0	9 5.2	3,160	6,089	12 4.1	9 6.1	862	8,032	5 5.1	4 1.7	513	7,711
1914	56,570	12 6.8	9 2.9	9,413	38,942	6 6.5	8 2.2	3,202	6,246	10 10.2	9 0.0	578	3,340	7 10.6	4 6.6	557	7,418
1915	49,595	11 10.7	9 2.6	6,642	31,887	6 9.3	8 0.6	2,041	3,454	12 6.2	9 10.1	462	1,767	8 1.2	3 11.7	364	5,415
1916	47,304	12 6.7	9 1.9	8,018	35,665	7 1.7	8 7.3	2,510	15,536	8 8.2	8 7.3	56	943	11 11.6	4 0.3	374	5,982
1917	42,947	12 1.5	9 0.0	6,714	24,674	8 3.3	8 10.3	727	15,408	9 8.5	8 3.1	1,104	1,118	11 2.9	3 8.2	422	7,554
1918	39,330	13 2.9	8 11.4	8,442	24,364	8 3.7	9 5.7	1,420	11,892	9 4.8	7 9.0	982	5,985	4 10.2	3 0.2	558	8,650
1919	40,290‡	12 4.1	8 2.0	8,426	15,764	9 2.4	9 3.8	91	12,780	9 1.1	7 4.6	1,089	1,204	10 0.9	3 11.2	369	9,925
1920	46,494‡	12 6.4	7 11.5	8,954	15,437	9 0.4	13 4.1	3,325	11,525	9 11.2	8 8.4	713	737	8 11.2	9 3.5	‡12	6,363
1921	34,761	17 3.8	9 0.7	14,361	19,763	10 0.8	17 10.0	7,677	7,370	10 11.6	8 5.7	918	54	82 0.5	8 0.4	200	7,802
1922	35,722	16 11.8	9 2.3	13,862	24,234	9 11.7	15 8.9	6,988	7,492	11 10.5	8 5.8	1,271	...	...	...	55	8,200
1923	29,714	17 0.4	9 6.8	11,044	14,307	11 5.5	14 2.1	1,943	8,848	11 1.3	8 11.7	945	...	...	...	26	10,072

* Tailing Treatment commenced 1913.

† Profit.

‡ Details of Ore dressing and Residue Treatment not shown, but financial result included in the figure of this column.

DIVISION IV.

ANNUAL PROGRESS REPORT

OF THE

GEOLOGICAL SURVEY

FOR THE

YEAR 1923.

With Three Plates.

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Annual Progress Report of the Geological Survey for the Year 1923.

The Geological Survey has, during the year 1923, despite the smallness of the staff, been able to accomplish a considerable amount of useful and constructive work.

Field work, such as is possible with the present restricted personnel, has been carried out at Youanmi, Paynesville, Talling Range, the Pallinup River Valley, and in the central portion of the Peak Hill Goldfields.

The petrographical work has been carried out by the Acting Petrologist, Dr. C. O. G. Larcombe, who in addition to other duties has devoted the greater portion of his time to the investigation of problems which arise during the course of the work of the geological field staff. By far the larger portion of Dr. Larcombe's petrographical duties were carried out in Kalgoorlie. The present arrangement, it is to be hoped, is only to be regarded as a temporary one.

All the analyses and assays required in connection with the work of the department have been made in the Government Chemical Laboratory under the direction of Dr. E. S. Simpson.

Fossil collecting has been carried on, principally in the Kimberley Division, as part of the investigations which have been in progress in connection with the search for petroleum. There is no palaeontologist on the staff, and the services of specialists outside the ranks of the Survey have had to be enlisted from time to time. The necessity for a systematic description of the fossils occurring in Western Australian rocks has been recognised for many years past. In view of the increased attention which is being paid to those important applications of geological work relating to petroleum, coal, artesian water, and other useful mineral deposits occurring in the Palaeozoic and later formations, which cover such extensive areas in the State, it has become increasingly necessary that steps should be taken to have a palaeontologist added to the staff. Much material has accumulated during the last few years which needs systematic investigation by an officer trained and experienced in this special branch of geological work.

THE STAFF.

The work of the year 1923 has been carried out by six classified officers.

To the clerical staff there has been added the work required by the Inspector of Explosives, who has been provided with temporary accommodation in the building.

ADMINISTRATIVE AND OTHER DUTIES OF THE GOVERNMENT GEOLOGIST.

As in the past, personal field work has been curtailed or prevented owing to the ever-increasing calls upon my time necessitated by work at headquarters.

The only field work it was possible for me to undertake during the year was a traverse from Cunderdin to the mouth of the Pallinup River and along the northern slopes of the Stirling Range to Cranbrook. This occupied my time from the 16th of April to the 16th of May.

The period between the 28th of June and the 3rd of August was devoted to a preliminary examination of the Talling Range Iron Deposits on the Greenough River, followed by a traverse from there to Paynesville, where an inspection of the geological field work carried out at that centre by Mr. Feldtmann was made. After a short sojourn at headquarters I left for Peak Hill on the 25th of October for the purpose of carrying out geological investigations in the lesser known portions of the goldfield, and returned to Perth on the 4th of December. Work on the Peak Hill Goldfield was greatly hampered by considerations of grass and water as well as the lateness of the season at which the investigations were taken in hand.

The want of a general account of the geology and the actual and potential mineral resources of Western Australia within the compass of a single volume having become acute, a reprint of Bulletin 50—The Geology and Mineral Industry of Western Australia—was authorised. The last twelve years having witnessed a considerable amount of investigation relating to the general geology and mineral resources of the State, it became necessary to rewrite some of the subsections in order that the information might be made available in such detail as the present condition of existing knowledge would admit and the limits of the bulletin would allow. The volume contains a brief account of the systematic and structural geology of the State, whilst under the heading of Economic Geology there is given a *résumé* of the facts bearing upon the areal distribution, mode of occurrence, and geological relationships of the known mineral deposits and such inferences as follow directly from them. The only plan appearing in the original edition of the bulletin was the Geological Sketch Map of Western Australia; a second map showing the chief localities at which useful minerals and artesian wells occur has been specially prepared and added with the view to rendering the descriptive portion relating to the economic geology of the State intelligible. The preparation of this volume took up a considerable portion of my time during the year.

FIELD WORK.

The attached table shows the distribution of the field work during the year and the names of the officers, together with the different districts in which they were engaged.

Table showing the Distribution of Field Work during the Year 1923.

Goldfield or Land Division.	F. R. FELDTMANN.		A. G. D. ESSON.	
	No. of days in the field.	Percentage of working days.	No. of days in the field.	Percentage of working days.
South-West Division	4	1.1	...	...
Murchison Goldfield	17	4.66	115	31.5
East Murchison Goldfield	152	41.64	...	...
Total	173	47.40	115	31.5

F. R. Feldtmann, Field Geologist.

The early portion of the year, up to the 26th of March, was spent by Mr. Feldtmann on multifarious official duties, including the writing up of the report of his work during 1922 and the preparation of the maps and sections required in connection with the geological survey of Youanmi. On the 26th of March this officer returned to Youanmi, and on the 22nd of July completed the detailed survey of the main mining area at Youanmi. The period between the 23rd of July and the 10th of September was spent at Paynesville, on the Murchison Goldfield, and devoted to an examination of the auriferous belt at that centre and a detailed survey of the main group of mining leases, in addition to an examination of the Elsie Gold Mining Lease and neighbouring claims at Mitchellton. Office duties occupied Mr. Feldtmann between the 11th of September and the beginning of October. An examination of the Hines Hill Gypsum Deposits occupied Mr. Feldtmann's time between the 8th and 12th of October, whilst the remainder of the year was devoted to the preparation of reports and maps and those multifarious duties in the office during my absence. Mr. Feldtmann spent 173 days in the field.

Alex. G. D. Esson, M.A., Temporary Field Geologist.

Mr. Esson, after the termination of his annual and accrued recreation leave for the year 1922, was occupied at headquarters in the preparation of the annual report on his previous season's field work and the completion of his final report and maps of Noongal (Melville), Yalgoo, and Mugga Mugga on the Yalgoo Goldfield, in addition to assisting in those multifarious duties which devolve upon such an office as the Geological Survey. On the 23rd of August Mr. Esson proceeded to Paynesville for the purpose of carrying out geological investigations of all mines and prospecting shows at that centre to which access could be obtained, in addition to making a general reconnaissance of as much of the surrounding country as was necessary for obtaining a knowledge of the structural and other relationships of the various rock masses and their bearing upon the occurrence of the ore deposits. This work occupied the time of Mr. Esson until the 18th of December, when his annual leave for the current year was commenced. Mr. Esson spent a total of 115 days in the field, the whole of them being on the Murchison Goldfield.

PRINCIPAL RESULTS OF THE YEAR'S OPERATIONS.**1.—NOTES ON THE IRON ORE DEPOSITS OF TALLERING RANGE, YALGOO GOLDFIELD.**

(A. GIBB MAITLAND.)

The importance of obtaining as full a knowledge as possible of the Iron Ore Resources of Western Australia was early recognised, and in the year 1919 the condition of our knowledge relating to such was set out in a report entitled *The Iron Deposits of Western Australia*, which forms Part 3, Section 5, of Chapter 2 of the *Mining Handbook* (Geol. Sur. Memoir I.).

Since that publication was made available further information concerning one of the important deposits on the Greenough River watershed at Tallering Range has been obtained.

That iron ore occurs in the Tallering Range district has been known for more than half a century, though no detailed data regarding the deposits were available. The first reference to the presence of iron ore in this locality was in a report by Mr. H. Y. Lyell Brown published in 1871; later on in the year 1902 a sample of iron ore collected by Mr. Lander was received at the Geological Survey office from a locality given as 30 miles north of Mullewa and which it now appears was from the Tallering Range.

The first geological notes on the Tallering Peak and Range appear in the report by Mr. H. Y. Lyell Brown, at that time the Government Geologist, containing an account of his reconnaissance of that portion of Western Australia.* The official report pointed out that the higher portion of Tallering Range, which rose to some 500 feet above the surrounding country, was made up of beds of bluish quartz schist, trending generally N. 30° E. and inclined at high angles to the north-west, associated with a rock composed of alternate bands of quartz and iron ore, whilst the lower flanks were formed of highly inclined beds of slate, sandstone, and mica schist, with quartz along the bedding planes. A hill called Murra Murra, situated about half a mile from Tallering Peak, is stated by Mr. Brown to be made up of blue schist with a large proportion of magnetic oxide of iron. Similar ironstone ranges were described by Mr. Brown as occurring about 30 miles to the north 30° east of Tallering Range, and in them the rocks are stated to exhibit magnetic polarity. The flanks of the hills, the same author stated, were often covered with accumulations of rock fragments

* Further Report on the Tallering District, H. Y. Lyell Brown, Perth. By Authority, 1871.

cemented together into a solid concrete by oxide of iron.

The analysis and report by Dr. E. S. Simpson upon the sample received at the Geological Survey in 1902 from Mr. Lander were as follow:—

"Iron	...	...	...	...	65.06
Silica	...	...	...	...	1.78
Sulphuric anhydride	...	...	...	...	.13
Phosphoric anhydride	...	...	...	...	.09

The ore is a massive haematite of very high grade, eminently suited for smelting iron from or for use as a flux in lead smelting."

The Talling Range, of which Talling Peak is the highest summit and most conspicuous hill in the district, forms the westernmost angle of the Yalgoo Goldfield, and lies about 100 miles east of the port of Lynton and in the watershed of the Greenough River. It is situated about 30 miles north of Mullewa on the Northern Railway line from Geraldton to Meekatharra and 331 miles from Perth.

Talling Peak is situated not far from the main channel of the Greenough River, which in this locality flows in a fairly deep channel in which highly inclined sedimentary rocks are exposed; these are lithologically identical with those which make up the mass of the range itself.

The rocks forming the range consist of vertical and steeply inclined quartzites highly charged with ferruginous material and sandstone interbedded with siliceous conglomerate. These rocks are all highly tilted or very intricately folded, whilst in certain parts they have been so highly metamorphosed that a virtual recrystallisation of their constituents has taken place. Microscopical examination shows that the beds have undergone considerable dynamical alteration since their deposition.

Some of the more friable sandstones contained iron pyrites, the cubical cavities now being partly filled with its oxidation product, limonite.

The beds are traversed with a network of quartz veins.

The rocks have been severely folded, faulted, or compressed, in addition to having been subsequently invaded by granitic rocks.

The effect of the compression and other concomitant structural alterations has been to break up the formation into segments of varying dimensions and trending in different directions.

A series of low though fairly conspicuous hills occupy the country to the west of Talling Peak and the Stock Route Reserve 9701 (Lands and Surveys Department 80 chains, litho 161). These hills are made up of highly inclined contorted and banded magnetite-bearing quartzite [1/3607] associated with metamorphic grits. Some varieties of these siliceous rocks are made up of alternate bands of a yellowish-brown ferruginous clay and black bands of more or less shapeless aggregates and grains of magnetite. One sample [1/3607] was found on analysis to contain 30.35 metallic iron, 56.09 of silica, and .014 of titanium dioxide.

The iron-bearing members of the formation outcrop along the crest of a ridge, forming the Talling Range, about 800 or 900 feet above the general level of the surrounding country.

The northern peak on the Talling Range, which rises to a height of about 630 feet above the general level of the country to the west, is made up of a mass of plicated and highly contorted banded quartzite with huge interbedded masses and bands of iron ore. One very large lens of practically solid haematite measures in one part of its mass about 90 feet across; it has, however, no very defined walls, merging gradually into the surrounding quartzite. Huge boulders of almost pure ironstone strew the surface. Along the highest parts of the Talling Peak Range the banded iron ore stands out in bold relief. The bands are highly contorted, slickensided, and faulted. They contain drusy veins and cavities which at times are lined with quartz crystals.

Near the centre of the range and towards its southern extremity there are two bands of iron-bearing quartzite separated by a belt of somewhat sandy and friable sandstone, and interbedded with siliceous conglomerate. The beds, which are traversed by a network of quartz veins, are vertical, containing cubical cavities of limonite pseudomorphs after pyrites. A creek has eaten out a deep channel along the strike of the sandstone and conglomerate; it exposes good sections of the strata and their associates.

The beds have been eroded to such an extent that those portions of the formation which have proved to be the most resistant to erosion stand up as serrated ridges, of which the Talling Range forms the highest and most prominent in the district, and which trends generally north-east and south-west.

The rocks in all probability represent closely compressed synclinal folds, the depths of which are not determinable without detailed geological mapping, supplemented by a well thought out scheme of boring operations.

The formation which contains the iron-carrying rocks is of considerable geological antiquity, and there is some reason for believing it to be of Proterozoic (Pre-Cambrian) age.

The most remarkable and outstanding feature in the Talling Range and its vicinity is its bodies of iron ore. These consist of fine-grained sedimentary rocks which have been silicified and highly charged with ferruginous material. In some cases pure siliceous beds alternate with others containing the bulk of the iron ore, passing by all gradations through varieties of jaspilite to pure iron ore.

The ferruginous bands generally follow very closely the bedding planes, though at times they cut across them, indicating that the solutions responsible for the deposition of the iron ore were to a very large extent controlled by the stratification.

The constituent minerals of the iron ores are not of great variety; the bulk of the ore is haematite, which by surface hydration often passes into the brown oxide, limonite.

Magnetite is of frequent occurrence in many parts of the range, though the greater part is haematite. The bulk, however, of the deposits contain variable amounts of silica mixed with practically pure iron oxides. Some of the ore [1/3613] is virtually a breccia in which the contained silica has been wholly replaced by haematite.

Partial analyses were made in the Government Chemical Laboratory of samples of ore, and asso-

ciated rocks collected by myself, the results of which are set out in tabular form:—

Laboratory Number.	Geological Survey Number.	Metallic iron.	Silica.	Titanium oxide.
L. 2197/23 ...	1/3611	% 12.38	% 82.38	% 0.008
2194/23 ...	1/3608	15.16	78.61	0.005
2193/23 ...	1/3607	30.35	56.09	0.014
2195/23 ...	1/3609	35.79	49.02	0.003
2198/23 ...	1/3612	57.81	17.95	...
2196/23 ...	1/3610	68.08	3.02	0.005
2199/23 ...	1/3613	71.15	0.50	...

Portions of these lenses of more or less massive haematite were selected which seemed to be of high grade and sufficiently large to contain workable quantities of ore. These partial analyses show that the bulk of the rocks [1/3607, 3608, 3611, and 3609] contain fairly large proportions of silica mixed with apparently pure iron oxides of a grade suitable for the production of iron and steel or for fluxing purposes. The results of the analyses do not of course claim to be representative of the iron content of the whole of the Tallering Range beds, but they do clearly indicate that local concentration of iron has taken place, and while the greater portion of the deposits are of low grade and much of the ore too lean for present use, there are very considerable quantities of ore running over 55 per cent. of metallic iron.

An analysis of a two ton sample of clear iron ore, consisting of haematite with a little magnetite, from Tallering Peak, which had been collected for the State Committee of the British Empire Exhibition Commission and made in the Government Chemical Laboratory gave the following result:—

L. 1161/23.—Metallic Iron (Fe)	per cent.
...	69.18
Sulphur (S) ...	.044
Phosphorus (P) ...	.017
Silica ...	1.89

It is difficult if not impossible, in the absence of detailed geological surveys, to make any definite estimate of the amount of iron ore commercially available in the Tallering Peak Range; the quantity, however, is considerable, amounting to several millions of tons. The larger bodies of iron ore occur in lenses situated along the limbs of the folds into which the sedimentary rocks have been thrown. It may be that the great width of some of the deposits as exposed on the surface is due to repetition by folding.

The greatest length of one of the ore lenses is at the southern end of the range where in places it measures as much as 33 feet across with a length of over 1,000 feet and rising to a height of several hundred feet above the general level of the surrounding country. The lens obviously contains a considerable quantity of ore.

The iron ores of Tallering Range have certain geological features in common with those of other portions of the State. Extensive and detailed surveys together with other collateral investigations will have to be carried out before the origin of the iron ores can be definitely stated. The ores themselves are merely metamorphosed portions of the sedimentary rocks of so extensive a nature as to virtually amount to a recrystallisation of their constituents.

In the light of such knowledge as is at present available it may be reasonably inferred that the deposits owe their origin to the weathering and re-depositing of iron-bearing minerals, possibly derived from basic igneous rocks.

The iron ores are practically situated on the crest of the Tallering Range in such a way as to facilitate cheap working. The availability of the iron ores of the Tallering Range is a function of the costs of (1) mining, (2) transport, and (3) metallurgical treatment, though the most important problem, however to be encountered at the present stage appears to be that of transport.

Summarising the present condition of our knowledge it appears that: There is a large deposit of Iron Ore in the Tallering Peak Range of a grade suitable for the production of iron and steel; as well as other purposes, so situated as to facilitate cheap working, distant about 30 miles from one of the main trunk railway lines and not far from the port of Geraldton.

The occurrence of this ore makes a valuable addition to the known iron resources of the State, which constitute one of the most valuable of its unexploited mineral assets.

2.—GRAPHITE ON THE LOWER PALLINUP RIVER.

(A. GIBB MAITLAND.)

During the course of a visit to the lower reaches of the Pallinup River in the Kent District, opportunity was taken to examine a deposit of graphite, upon which some desultory prospecting work has been carried out.

The Pallinup River near the locality of the deposit has cut a deep channel, exposing gneissic rocks, which trend east and west. The rocks contain some dark black bands of hornblende gneiss [1/3665].

Upon the highly inclined gneiss the horizontal basal beds of the Plantagenet series rest and form a conspicuous escarpment, about a mile distant from the bank of the river. The beds are only thin, however; in the vicinity of the graphite lode the thickness is only about 100 feet. The rock [1/3664] forming the basal portion of the series at the Lower Pallinup River is a light porous creamy white sandy silt, containing numerous sponge spicules. The beds resemble in their lithological characters those of the same series as developed in other portions of the South-Western Division.

Prospecting on the graphite deposit has been carried out over a length of 190 feet along an almost vertical graphite vein trending in a general direction of 98 degrees. The principal operations centred on sinking a prospecting shaft to a vertical depth of 38 feet on a vein of amorphous graphite which varies in width from two to three feet.

The granite is very soft in addition to being minutely scaly, whilst the carbon content reaches 76.45 parts per hundred. Some of the graphite seems to be well suited for the manufacture of pencils.

It is stated that a similar graphite deposit has been met with on the northern side of the river in such a position as to suggest the possibility of the two forming part of the same ore-channel. No opportunity, however, presented itself of examining the deposit in question.

3.—RESULTS OF BORING ON THE WILGA COALFIELD.

In the Annual Progress Report for the year 1921 details have been given as to the results of the boring carried out on the Wilga Coalfield. Since the date of that report operations have been continued and a bore (No. 4) has been put down to a depth of 691 feet. The site of the No. 4 bore is approximately 60 chains north-west of No. 3, the site of which is indicated on Figure 3 and Plate I. of the Annual Progress Report for 1921.

The log of the bore as supplied by the authorities in charge is as follows:—

SECTION OF NO 4 BORE—WILGA.

Depth.		Thickness.		Description of Strata.
ft.	ins.	ft.	ins.	
6	0	6	0	Ironstone gravel.
21	0	15	0	Grey puggy clay.
29	0	8	0	Clay with ironstone bands.
36	6	7	6	Dark shale.
37	6	1	0	Ironstone.
50	0	12	6	Soft sandy shale with shale bands.
54	0	4	0	Black puggy shale.
64	0	10	0	Soft sandy shale.
71	0	7	0	Dark puggy shale.
104	0	33	0	Dark compressed sand, coarse.
106	0	2	0	White puggy clay.
120	0	14	0	Soft coarse sandstone.
127	0	7	0	Soft coarse sandstone with sandy clay bands.
139	0	12	0	Soft coarse sandstone with quartz boulders.
163	0	24	0	Soft coarse sandstone.
164	0	1	0	Hard sandstone and quartz boulders.
173	0	9	0	Soft coarse sandstone.
174	0	1	0	White sandy clay.
326	0	152	0	Coarse sandstone.
335	6	9	6	Yellow sandstone.
363	0	28	0	Coarse sandstone.
364	0	0	6	Yellow sandstone.
370	0	6	0	Coarse sandstone.
375	0	5	0	Hard sandy shale.
379	0	4	0	Fine sandstone.
391	6	12	6	Sandstone.
392	0	0	6	Hard fine sandstone.
392	6	0	6	Coal.
396	0	3	6	Hard black shale.
398	0	2	0	Sandy shale.
403	0	5	0	Sandstone.
405	0	2	0	Sandy shale.
437	0	32	0	Sandstone.
439	6	2	6	Fine sandstone.
443	2	3	8	Carbonaceous shale.
443	8	0	6	Coal.
444	7	0	11	Black shale.
445	10	1	3	Fine sandstone with shale seams.
446	5	0	7	Coal.
447	3	0	10	Black shale.
458	9	11	6	Coarse sandstone.
460	9	2	0	Fine sandstone and shale seams.
500	3	39	6	Sandstone.
510	9	10	6	Coal (2in. shale band, 508 feet).
513	0	2	3	Hard sandy shale.
513	6	0	6	Carbonaceous shale.
519	0	5	6	Fine hard sandstone.
520	6	1	6	Hard sandy shale.
521	6	1	0	Carbonaceous shale with coal bands.
524	0	2	6	Hard sandy shale.
531	0	7	0	Coarse sandstone.
535	0	4	0	Hard sandy shale.
537	0	2	0	Sandstone with shale bands.
541	0	4	0	Coal.
544	0	3	0	Hard sandy shale (dark).
554	6	10	6	Sandstone.
555	6	1	0	Sandy shale.
563	0	7	6	Sandstone.
570	0	7	0	Coal.
571	0	1	0	Hard shale.
572	8	1	8	Sandy shale.
573	2	0	6	Carbonaceous shale.
578	2	5	0	Coal.
579	2	1	0	Hard sandy shale.
591	0	11	10	Sandstone.

Section of No. 4 Bore—Wilga—continued.

Depth.		Thickness		Description of Strata.
ft.	ins.	ft.	ins.	
600	1	9	1	Coal.
601	7	1	6	Hard sandy shale.
615	2	13	7	Sandstone.
618	0	2	10	Hard sandstone band.
627	0	9	0	Sandstone.
628	0	1	0	Coal.
629	6	1	6	Hard sandy shale.
636	0	6	6	Sandstone with shale seams.
643	8	7	8	Sandstone.
652	3	8	7	Coal.
653	0	0	9	Shale.
654	6	1	6	Sandy shale.
660	0	5	6	Sandstone.
663	9	3	9	Coal.
665	0	1	3	Sandy shale.
665	6	0	6	Carbonaceous shale.
666	6	1	0	Sandy shale.
687	0	20	6	Sandstone.
688	0	1	0	Sandy shale.
671	0	3	0	Carbonaceous shale.

The analyses of the coal from three of the seams, respectively, 10 feet 6 inches, 7 feet, and 4 feet in thickness, as made in the Government Chemical Laboratory, under the direction of H. Bowley is as follows:—

PROXIMATE ANALYSIS AND CALORIFIC VALUE OF COALS FROM NO. 4 BORE, WILGA.

No. 4 Calyx Bore.

Seam 500ft. 3in.—510ft. 9in. (10ft. 6in.), 2 inches of shale discarded and then divided into three equal proportions.

L. No. ...	Top Middle Bottom		
	portion.	portion.	portion.
...	1,260	1,261	1,262
<i>Proximate Analysis:</i>			
Moisture ...	12.31	11.89	11.79
Volatile Hydrocarbons...	36.62	33.39	34.38
Fixed Carbon ...	43.31	46.27	47.79
Ash ...	7.76	8.45	6.04
<hr/>			
...	100.00	100.00	100.00

<i>Calorific Value, B.T.U....</i>	9,271	9,394	9,990
Colour of Ash ...	Reddish brown.	Reddish brown.	Reddish brown.

Seam 537ft.—541ft. (4ft.). Divided into two equal proportions.

L. No. ...	Top half. Bottom half.	
	1,263	1,264
<i>Proximate Analysis:</i>		
Moisture ...	11.62	11.78
Volatile Hydrocarbons...	35.04	39.41
Fixed Carbon ...	46.31	43.88
Ash ...	7.03	4.93
<hr/>		
...	100.00	100.00

<i>Calorific Value, B.T.U.</i>	9,718	10,138
Colour of Ash ...	...Reddish brown.	Reddish brown.

Seam 563ft.—570ft. (7ft.). Divided into three equal proportions.

L. No. ...	Top Middle Bottom		
	portion.	portion.	portion.
...	1,265	1,266	1,267
<i>Proximate Analysis:</i>			
Moisture ...	11.76	11.41	11.60
Volatile hydrocarbons	34.39	29.72	36.20
Fixed Carbon ...	48.01	43.40	39.12
Ash ...	5.84	15.47	13.08
<hr/>			
...	100.00	100.00	100.00

<i>Calorific Value, B.T.U.</i>	9,892	8,567	9,126
Colour of Ash ...	...Reddish brown.	Light brown.	Light brown.

4.—THE YOUANMI GOLD-MINING CENTRE, EAST MURCHISON GOLDFIELD.

(F. R. FELDTMANN.)

INTRODUCTION.

A preliminary report on the geology of the Youanmi area, with a description of the lodes and later shear zones, was given in the annual report for 1922. During 1923, the tacheometer survey of the most important leases, including those of the Youanmi mine and the Three Mugs, United, and Hill End leases, to the north, as well as the Golden Crown, from half to three-quarters of a mile south of the town, was completed. The general survey of the auriferous area was continued, to include a total area of four square miles, and, in addition, much of the surrounding country was briefly examined.

The principal facts disclosed by the work done in 1923 are that the jaspers are more numerous and extensive than was at first apparent, also that the large buck quartz reef described on page 6 of the previous report represents but one, and by no means the largest, of a series of huge cross faults.

GEOLOGY.

As stated in the previous report, the Youanmi goldmining centre is situated in the northern portion and close to the eastern margin of an extensive greenstone belt, probably more than 20 miles in length, and enclosed by granite of relatively later age. A number of tongues run from the granite on the eastern edge of the belt, which strikes generally northnorthwest, into the greenstones.

The greenstones are separable into three main types, all probably of different ages, not including the post-gold dolerite dykes, which are but poorly represented and were not mentioned in the previous report.

The eastern portion of the belt consists of medium to fairly fine-grained epidiorites, from dolerites, which in the more easterly portion of the area occupied by them have been intensely sheared and converted into fine-grained hornblende and in places quartz-chlorite and chlorite-carbonate schists. The lodes are confined to the highly sheared rocks.

Near the townsite and mining area the total width occupied by the epidiorites and their derivatives is about $1\frac{1}{2}$ miles, that occupied by the main belt of highly sheared rock being probably about 20 chains, but this belt of sheared rock is irregular and doubtless other smaller areas occur to the west.

The more complete evidence afforded by the work done in 1923 indicates that these rocks are to be correlated rather with the Younger Greenstones of Kalgoorlie than with the Older Greenstones as was first suggested, and that the gabbros and amphibolites described below belong to still later series.

The western portion of the belt appears, so far examined, to be occupied by fairly fresh diagraph gabbros. The freshness of these rocks indicates that they are much younger than the epidiorites and that they may be post-gold.

The third type consists of fine-grained massive amphibolites, containing occasional hornblende phenocrysts of fair size. These rocks were described in the previous report as occurring about a quarter of a mile west of the Anketell telegraph line at a point about four miles north of Youanmi. There is little evidence to show the relative age of these rocks, but

they are cut by acid dykes and are therefore probably older than the gabbros, but their respective freshness and massive structure suggest that they are younger than the epidiorites.

The occurrences seen of post-gold dykes of fine-grained basaltic epidiorite were limited to a few erratics, two of which were picked up at widely separated points well within the granite area.

The granite east of the greenstone belt is somewhat more acid than the normal type, the mica present being almost wholly muscovite or the secondary variety sericite. The dykes intruding the greenstones are mostly of similar type, but in a few a moderate proportion of biotite is present. The strike of the dykes ranges from north to northwest, most striking about northnorthwest. A brief description of the dykes was given in a previous report. They are numerous in the mine workings.

As stated the jaspers are more numerous than was at first supposed. The lines are much obscured, and some could only be detected by close examination. Though occupying zones of intense shearing, they are not confined to the schistose rocks on the eastern edge of the greenstone belt, but several lines occur in the massive epidiorites in and near the Golden Crown group, and near the eastern portion of the Rifle Range Reserve, where the rock is probably also massive epidiorite.

Lines of jasper of varying length occur in the Commonwealth Group, $1\frac{1}{2}$ miles northnorthwest of the town; in and southeast of the Rifle Range Reserve; in the Golden Crown group and through a small laterite hill to the east; and in the main group of leases. Those in the Golden Crown group are much broken by cross faults of the "buck" reef period, but do not appear to have been affected by later shears. Those in the main group of leases have been broken by cross faults, both large and small, by the lodes, and by the later shear zones, and many are now represented only by disconnected short lenses. In and immediately west of the main group of leases there appear to have been 18 different lines, including a large line consisting of several individual "bars," which runs through former G.M.Ls. 603B and 91SM and ends in the United G.M.L. 886M. Eight or nine lines of jasper, now broken in lenses, averaging about 17 feet in length, run through the Three Mugs G.M.L. 873B into the Youanmi Company's leases to the south, where they are almost entirely obscured by superficial deposits. There is little doubt that the bodies of magnetite rock cut in the mine workings are the representatives of these jaspers at depth.

The strike of the jaspers ranges from about north-northwest to northeast, averaging a few degrees east of north. Near the granite margin they bend slightly to the east, to cut the margin nearly at right angles. Few penetrate the granite for more than a few feet, most stopping at the margin. The dip is usually east at a steep angle, but the angle of dip varies greatly, particularly where the country is much sheared, and in places the bars dip west.

The great cross reefs and shear zones form one of the most important features of the area. They represent immense normal faults which cut the boundary between the granite and the greenstones. The average strike is approximately east, and the dip, so far as could be determined, south at angles ranging between 60° and 70° . The larger faults are wide shear zones up to 60 feet in width. In the granite

they are mostly filled by quartz of a pegmatitic character, which, in places, has a tendency towards a comb or tooth-like structure. In the greenstones the shear zones are usually only partly filled, containing numerous small reefs or veins of similar quartz.

The largest reef observed is one which extends east from the northernmost lease—G.M.L. 652B—of the main group for about a mile. Its maximum width is 60 feet. It faults the granite boundary for a horizontal distance of about 450 feet. As the faulting was normal the actual displacement along the dip of the fault was probably much greater. The second largest reef is that described in the previous report running close to the south boundary of the Hill End lease. The survey carried out in 1923 shows that the fault represented by this reef branches not far from the southwest corner of the Hill End and extends westward through G.M.Ls. 873B and 603B and north of the Hospital Reserve, to be obscured by the alluvial ground near the main creek. The fault displaces the granite boundary for a horizontal distance of 160 feet. In the greenstones it is mainly represented by wide shear zones with numerous lenses and stringers of buck quartz.

There is little doubt that the main creek, where it runs through the two southern leases of the Youanmi mine and eastward towards Water Reserve 11542, marks one, and probably the largest, of these faults. The ground near the creek is unfortunately obscured by superficial deposits for a considerable width, but judging by the position and strike of the nearest outcrops of granite north and south of the creek the horizontal displacement would appear to be nearly 3,000 feet.

Numerous smaller cross faults occur in the main group of leases, particularly in G.M.L. 873B, and also complementary fissures now partly filled by quartz veins, at right angles to them, as well as nearly diagonal fissures.

The relative chronological position of this series is, through lack of evidence, difficult to determine. It is undoubtedly younger than the jaspers, but such evidence as is available indicates that it is older than the lodes. From information supplied by Mr. Williams, the former manager of the Youanmi mine, it would, however, appear that cross faulting on a much smaller scale took place subsequently to lode-formation, but prior to the later shearing along lines parallel to the lodes.

The lodes, which, according to the available evidence, follow the cross faults in chronological order, are described under a separate heading. They are confined to the zone of weakness along the granite margin, but auriferous quartz veins occur in the Golden Crown group, $1\frac{1}{4}$ miles west of the margin. The lodes strike, on the average, a few degrees west of north and dip west at varying angles.

Subsequently to ore deposition, intense shearing, mainly confined to the zone of weakness along the granite margin but occurring both in the granite and the greenstones, took place at several periods. These shears, of which two main series have been determined, were briefly described in the previous report. The series which could be definitely determined are (a) one striking, on the average, a few degrees east of north and dipping west at angles ranging from about 44° to 56° , and (b) one striking approximately parallel to the lodes, the strike ranging from north to $N. 20^\circ W.$, and with dips ranging from $64^\circ W.$

to vertical and averaging between 70° and $80^\circ W.$ A third series, described in the previous report as striking approximately $N. 60^\circ W.$ and dipping S.W. at about 70° and observed in the Youanmi mine at the southern end of G.M.L. 863B, probably does not belong to a period subsequent to ore deposition, but may form part of a series of diagonal shears, of which those observed in the Three Mugs lease form part and which were probably formed during the period of cross faulting.

The shear zones of the first series appear to be mainly confined to the northern portion of the Youanmi mine, where, according to Mr. Williams, a number were met in the main workings. Their effect on the ore bodies does not appear to be so serious as that of the second series, and the displacement of the lode along them appears to be mostly small. Along some of these shear zones the faulting was normal, along others apparently reversed. A feature that is probably due to reduplication along a number of parallel planes of this series is the great width of the main lode at the 714 feet and 778 feet levels, between co-ordinates 400 feet and 500 feet north (from a datum line on a bearing of $N. 75^\circ E.$ through the main shaft).

The second series is the more important, both numerically and on account of the length and width of some of the shear zones as well as the intensity of shearing. A great number run through the Three Mugs lease, where they can be traced through the exposed and partly laterised rock at the surface. A number of important shear zones of this series have been met in the workings of the Youanmi mine, where they have seriously affected the continuity of the ore shoots. In this mine, however, they are, except in the northeast portion, almost entirely obscured by superficial deposits at the surface. The largest shear zone of this series appears to extend from the northern boundary of the Three Mugs lease, through that lease and G.M.L. 863B, to well within G.M.L. 864B to the south. At the surface it is, for nearly half its length, a few feet east of the Youanmi main lode. Towards the northern end of G.M.L. 863B, near No. 1 Shaft, it widens going north and gradually cuts across and obliterates the lode.

The P Shaft lode at the southern end of the Youanmi mine has been affected by several shear zones of this series, of which there appear to be at least five at this end of the mine.

Apart from their effect on the lodes, these shear zones have proved misleading, owing to their resemblance to true lodes, particularly in the oxidised zone, where a little gold, probably of secondary origin, is present in places.

THE ORE DEPOSITS.

The Lodes.—The lodes represent zones of intense shearing altered by mineralising solutions, with the resultant deposition of gold and the formation of sulphides. The ore bodies of the Youanmi mine are characterised by the presence of stibnite as well as, in the main lode, arsenopyrite in large quantities. It is not certain whether the stibnite and arsenopyrite were deposited with the gold or whether they were deposited by subsequent solutions. The presence of these sulphides has greatly increased the difficulty and cost of treatment.

The payable lodes so far discovered are those of the Youanmi mine and of the United and Hill End

leases to the north. No ore bodies of any size have been discovered in the Three Mugs lease which separates the Youanmi mine from the other two leases. The lodes of the Youanmi mine include the Main Lode, West Lode, East Lode, Prospect Shaft Lode, and the ore bodies collectively known as the P. Shaft Lode.

The Main Lode has been proved for a length of about 900 feet, and a formation cut about 250 feet farther south in the crosscut joining Prospect Shaft and V Shaft, is most probably its southerly continuation. It is not necessary to repeat the description of the Main Lode given in the previous report.

The bodies of payable ore worked in the West Lode, East Lode, and Prospect Shaft Lode have so far proved to be only small.

It is probable that the East Lode, Prospect Shaft Lode, and the middle portion of the P Shaft Lode are really parts of one lode which has been broken by later shears of both series but particularly by those of the steeper series.

The P Shaft Lode has been worked over a length of about 650 feet at the surface, and at the 91 feet level (from the surface at P Shaft) the drives extend for a distance of 900 feet, but the lode was by no means continuous over that length. As seen in the open cuts it appears at the surface as three detached lenses, the line of each of the two southerly lenses being about 50 feet west of the next lens to the north. The two northerly lenses have a steep but varying westerly dip, but the southernmost lens has a marked easterly dip at its northern end at the surface, changing to a very slight westerly dip near its southern end. As the lode, as far as worked, is continuous at the 193 feet and 294 feet levels from P shaft, it would appear that the two southern lenses, at any rate, are really portions of the one lode and that their position at the surface may be largely due to a rotary fault, of which, however, no other trace could be detected. The northernmost lens may be a separate body.

At the 91 feet level the lode appears to split on meeting a large granite dyke at about co-ordinate 1,060 feet south (about 400 feet north of P Shaft), the eastern branch continuing on much the same line as Prospect Shaft Lode, of which, as stated, it may be the southerly continuation. The west branch has not been followed north of the dyke and no data are available as to whether it rejoins the east branch farther north, or continues as a separate body, but judging by the assays it does not appear to exist as a separate body in the crosscut between Prospect Shaft and V Shaft.

Owing to the presence of shear zones of series (b) and of granite dykes, the ore shoots at the 91 feet level were much broken and the lode difficult to follow. Fair but erratic values were obtained between co-ordinates 1,060 feet south and 1,330 feet south.

At the 193 feet level the lode was cut at about 1,260 feet south, and was driven on to about 840 feet south, but north of co-ordinate 925 feet south only very low assays were recorded.

At the 294 feet level the lode was cut at co-ordinate 1,250 feet south, and was driven on to about co-ordinate 965 feet south. At 1,005 feet south a very large granite dyke was encountered, in which the drive ended without cutting the northeastern edge; a crosscut driven east for about 25 feet from the face of the drive also failed to cut this edge. The same dyke was met at the 193 feet level between

co-ordinates 935 feet and 1,000 feet south, but it appears to end in a blunt nose close to the lode, at this level, and may be found to end in similar fashion a few feet west of the drive at the 294 feet level.

The main drive at each of the levels from P Shaft was started on a shear zone of series (b), which in each case was taken for the lode, which, however, was not cut till about co-ordinate 1,260 feet south.

As stated in the previous report, two lodes have been worked in the United and Hill End leases. The more easterly lode outcrops in the Hill End lease, and is approximately parallel to, and about 50 feet east of the western boundary of that lease. Towards its northern end it runs into the main granite mass about 300 feet SSE. of the northwest corner of the lease and apparently only continues northwards for a short distance as a narrow shear zone. It has been worked from a large open cut, in which its dip is about 57°, near the southwest corner of the lease, and from the United Main Shaft to the west of the open cut and about 90 feet west of the lode at the surface. A good deal of work has been done from this shaft, the workings from which connect with a shaft 125 feet south, just inside the Three Mugs lease. But little work has been done below water-level, the flow of water being too great for the prospectors to handle. The lode probably averages about four feet in width at the surface, but I was informed that in the stopes as much as 20 feet of ore was taken out in places; this was probably due to secondary impregnation in the oxidised zone. Nothing payable was found south of the large cross reef, by which it was thought that the lode was faulted. What appears, however, to be the southerly continuation of the lode, was found to cut through the cross reef and to continue for some distance south. It is, however, narrower, and appears to carry little, if any, gold.

The second lode is situated in the northern portion of the United lease and has been worked from a large open cut and from a shaft, said to be 140 feet deep, 120 feet west of the west side of the cut. This lode has been worked for a distance of nearly 300 feet at the surface, the northernmost point being about 100 feet south of the north boundary of the lease, at which point it is entirely in granite. It strikes approximately northnorthwest at the surface. The dip varies, ranging from about 70° at the southern end of the open cut, to about 50° or less at the northernmost point worked. Near the southern end of the open cut the lode splits, the two branches being separated by a long wedge of granite, and near the middle of the open cut they are about 18 feet apart. The west branch is in schist for the greater part of its length, the east branch in granite.

A good deal of prospecting has been done to the north of the United lease, particularly in G.M.L. 795B, adjoining the United, and in G.M.L. 731B farther northwest. A long narrow zone of shearing, with some quartz, runs through the eastern portion of G.M.L. 795B and for some distance north, on which three shafts have been sunk. This formation, which is entirely in granite, is nearly vertical at its southern end, but in places farther north its dip is only about 50°. Some gold is said to have been obtained from one of the shafts, about 130 feet south of the north boundary of G.M.L. 795B. In the middle and western portions of this lease a number of shafts have also been sunk, mostly in granite, including several on a lode approximately on the line

of the northerly projection of the west boundary of the United. A little gold is said to have been obtained from this lode, near its junction with a jasper.

Gold is also said to have been obtained from a line of shearing which runs in a northwesterly direction through the western portion of G.M.L. 731B. This lode or shear zone, which from its appearance at the surface is probably highly pyritic at depth, cuts through a very large granite dyke. The gold is said to have been got from a shaft south of the dyke. Apparently it only occurred in a small patch.

The Reefs.—A few small auriferous reefs occur in and east of the Golden Crown group. In the Golden Crown lease, a narrow reef striking northeast and mainly dipping northwest at a steep angle, but vertical in places, has been worked from a number of shafts. This reef cuts and apparently faults a line of jasper which runs through the lease, but does not appear to have been affected by the numerous cross faults which cut the jasper. The gold was probably obtained near the junction of the reef with the jasper.

I was informed that small but rich patches were obtained from two small reefs or veins which cut a line of jasper at points respectively 7 and 9 chains SE. of the south corner of the Golden Crown. The gold was obtained at or close to the junction of the reef with the western side of the jasper.

It was not found possible to survey the Commonwealth group of leases, north of the town, in detail. A long, irregular line of jasper runs through these leases, close to, and in places along, the eastern edge of a large, wide tongue of granite, which runs in from the north. The gold-bearing formation, which does not appear to be well defined, is on the eastern edge of the jasper.

SUMMARY.

The Youanmi centre is situated in the northern portion and close to the eastern margin of an extensive greenstone belt, which is probably more than 20 miles in length and which is composed of rocks of three different types and possibly of three ages.

The oldest rocks consist of massive epidiorites with hornblende and chlorite schists and possibly correspond in age to the Younger Greenstones of Kalgoorlie. These rocks occupy, in the neighbourhood of Youanmi, the eastern portion of the belt, the schistose rocks, which represent the more highly sheared portions, occupying a zone of weakness adjoining the granite.

The western portion of the belt appears to consist mainly of fresh coarse-grained dioritic gabbro, which is probably among the youngest rocks of the district.

At the extreme northern end of the belt is an area of fine-grained massive amphibolite with hornblende phenocrysts. These rocks are cut by granitic dykes and are therefore probably older than the gabbros but younger than the epidiorites.

The greenstone belt is enclosed by granite from which numerous tongues run into the greenstones in the zone of weakness along the margin.

During, and for a long period subsequent to, the granite intrusion, intense earth movements took place. The earlier movements apparently affected a wider area than those later, but the area most affected was a belt from half a mile to a mile in width, west of the granite forming the eastern boundary of the greenstone belt.

Immediately subsequent to the granite intrusion, intense shearing took place along lines striking nearly north and south, or slightly east of north and dipping east at a fairly steep angle. These shear zones are now represented by jaspers at the surface and by magnetite bodies at depth.

The formation of the jaspers was followed by normal faulting on a large scale along east and west lines, with complementary minor fissuring along north and south lines and probably also along lines striking approximately east-southeast. The downthrow of the main faults was to the south. The main faults, which are wide shear zones rather than simple fissures, were subsequently filled or partly filled by quartz of a pegmatitic character, being now mainly represented by large "buck" reefs in the granite and by shear zones with lenses and stringers of quartz in the greenstones.

Shearing next took place in the zone of weakness along lines mostly striking a few degrees west of north and dipping west at varying, but usually steep angles. Along these lines mineralising solutions found their way and deposited gold and sulphides. It is not certain whether the deposition of stibnite and arsenopyrite took place during this or a subsequent period. The shear zones along which ore deposition took place are relatively few in number and are confined to a narrow zone on both sides of the granite margin. The greater number occur mainly in the greenstones, but owing to the irregularity and different strike of the granite margin, several of these run into the granite at their northern ends. Those in the granite do not as a rule carry gold in payable quantities.

The most important lodes are those of the Youanmi Mine, in particular the Main Lode and the P Shaft Lode, and those of the United and Hill End leases.

Owing to the presence of numerous granite dykes, which have caused impoverishment at the junctions, and to subsequent shearing, the ore bodies are much broken. Nevertheless payable ore has been obtained over a considerable length, particularly at the 558 feet and 657 feet levels on the Youanmi Main Lode, and there is every reason to expect that a considerable length of payable ore occurs below the depths yet reached. The presence of stibnite and arsenopyrite in the sulphide zone has complicated ore treatment.

In addition to the lodes in the main group of leases, and the ore bodies in the Commonwealth group which occur close to the margin of a long granite tongue, auriferous quartz veins occur in and east of the Golden Crown group at a considerable distance from the granite, the gold occurring in patches at the junctions of the veins with jaspers; it is possible that similar patches may be found to the south along the same jaspers and also along those near the Rifle Range Reserve and north of the Commonwealth group.

During at least two periods subsequent to ore deposition, further shearing took place in the zone of weakness on the eastern margin of the greenstone belt. That of the first of these periods resulted in the formation of relatively small shallow-dipping faults or shear zones, along some of which the faulting was normal, along others reversed. These faults, which strike approximately north, affect a comparatively small area, including the northern portion of the Youanmi Mine. The shearing of the second

period covered a wider area and was much more intense, the individual shear zones being wider and of greater length. The strike of this series is approximately parallel to that of the lodes, but the shear zones are, as a rule, steeper, being nearly vertical in places. This movement was apparently associated with carbonation and possibly also with a second deposition of sulphides.

These later shear zones have greatly affected the continuity of the ore shoots.

5.—THE PAYNESVILLE GOLD-MINING CENTRE, MURCHISON GOLDFIELD.

(F. R. FELDTMANN.)

INTRODUCTION.

The following description of the Paynesville belt is the result of a brief examination carried out between the 24th of July and the 8th of September. The examination included a reconnaissance of the country between and including the Nyiung and Carron groups of hills. Owing to the limited time, investigation of the mining areas was confined to a detailed survey of the main group of leases at Paynesville, and a brief examination of the Elsie lease at Mitchellton and the prospecting areas—now the L.P.S. group of leases—2½ miles southsouthwest.

GEOGRAPHY.

Location.—The Paynesville gold-mining centre is situated in the Mount Magnet District of the Murchison Goldfield, on the Mount Magnet-Sandstone railway, 40½ miles east of Mount Magnet, as the crow flies, and 43 miles by rail.

The mining areas are scattered, there being several groups of leases, as well as isolated leases, situated at a considerable distance from each other. The principal groups are the Lady Maud, immediately north and northeast of Paynesville townsite, the Killarney, 4¾ miles NNW., and the Windsor Castle, 4½ miles ENE.—the leases composing these groups are no longer held. Other leases, now voided, are the Sampey's Hidden Secret Group, 1 mile NE. of the town, the Hannah May, Surprise, and South Australian leases, respectively half a mile S., 1 mile SE., and 1¼ miles SW. of the town, and the Lady Margaret leases, 3¾ miles SW. of the town. Existing leases which, owing to the rich patches found therein, have recently attracted attention are the Elsie, at Mitchellton, 7 miles WSW. of Paynesville, and the L.P.S. group, 2½ miles SSW. of the Elsie.

Topography.—Paynesville townsite is situated at about the narrowest portion and near the northern edge of a long, irregular flat which extends west and eastnortheast for many miles, widening considerably in both directions. Several groups of steep rocky hills rise from the flat. These groups, which are mostly separated by fairly wide valleys, appear to be roughly arranged along a general line, striking approximately northnortheast and extending from about 11 miles SW. to about 7 miles N. of Paynesville. Individual hills composing the groups are separated from each other by narrow valleys or gullies. Among the most important of these groups is that of which Mount Ford (Nyiung Trig. S. 15), 1¼ miles NW. and about 200 feet above the level of the town, is the southernmost and highest hill. Another prominent hill, of more or less hog-back shape, is situated

about 2¾ miles SSW. of the town. A group of smaller hills is situated from about half a mile to 1½ miles south of the town, between the South Australian and Surprise leases.

The largest and most important group is that of which East Mount Magnet (Carron Trig. K9), 9 miles SSW. of Paynesville forms the highest point. Two other large hills are situated about 4½ miles NE. of Carron. Other prominent hills are situated some distance south of Carron.

Between Carron and the L.P.S. group of leases, the country is more undulating, and there are several laterite breakaways. The L.P.S. group is situated near the southern side of the flat extending west from Paynesville. The country here has a slight slope to the north.

Vegetation.—The main timber of the district consists of the larger type of mulga, which is confined to the lower-lying ground and which is fairly thick in places. In the immediate vicinity of the mining leases, however, most of the timber has been cut out. A few kurrajong occur on the lower slopes of some of the hills. The vegetation of the rocky hills, which are mainly composed of quartz-porphry, is more varied than that of the flat, but consists mainly of small flowering bushes.

Water.—The supply of water for the town is obtained from a windmill well, a quarter of a mile away, on Reserve 13266, formerly G.M.L. 414M. Other wells have been sunk on the flat near the railway, including one which is equipped with a windlass and troughs, between the town and the cemetery. Several shafts on the leases have been sunk below water-level, which is at depths ranging from 38 feet to about 60 feet from the surface. The water is of good quality.

At Mitchellton water was, at the time of my survey, obtained from a large pool on the road to Paynesville, but a tank has since been erected near the railway, from which the supply for this portion of the district is now obtained.

GEOLOGY.

General Description.—The main country rock of the Paynesville belt is greenstone in the form of massive epidiorite from gabbro or quartz-dolerite. The greenstone occupies practically the whole of the lower-lying ground. Intruding the greenstone are a number of large dykes of quartz-porphry, which form the larger—including Nyiung and Carron—as well as most of the smaller hills, presenting the appearance of archipelagoes of quartz-porphry in a sea of greenstone, with the individual islands separated by narrow straits of greenstone. A good example of this island-like structure occurs about 35 chains ENE. of the South Australian lease, where a small but conspicuous, steep-sided hill of quartz-porphry rises from the flat, the hill being separated from a cluster of other hills by a narrow strait of greenstone.

A later period of igneous activity, probably post gold, is represented by small dykes of fine-grained epidiorite similar to those found at other centres of the goldfields. A small dyke of this type was found intruding the quartz-porphry on the eastern slope of Nyiung.

The Paynesville greenstone belt is very large, but its boundaries have not yet been determined with any certainty. They have been broadly indicated by Gibson,* according to whom the belt has a length

* Gibson, C. G., The Black Range District: W.A. Geol. Survey, Bull. 31, pt. 2, frontispiece, 1908.

of about 47 miles, and a maximum width of about 20 miles. The belt appears to extend only for a short distance north of the Killarney group of leases, but southwards apparently extends unbroken as far as Wyemadoo Hill, near the 200-mile peg on the Rabbit-proof Fence.

The rocks are cut by a number of "bars" or lenses of jasper, but many of these jaspers differ in composition and mode of occurrence from the normal type. Though usually of considerable width, but few of the individual lenses appeared to be of any great length. Some of the jaspers occur along the junctions of the epidiorite and the quartz-porphry dykes, and more closely resemble the normal Murchison type in appearance, but most occur wholly in the porphyry and these are more highly siliceous than the normal type and in many the iron ore present is wholly hematite. Rich patches are not infrequently found at the junctions of quartz reefs, or fault lines, with jaspers, but none of the auriferous deposits so far found in this area is of this type, though it is possible that such occur.

Jaspers of normal composition occurring along the contact of the greenstone and the porphyry were seen about three-quarters of a mile SE. of the South Australian lease. Lenses of highly siliceous jasper occurring wholly in the porphyry were found between Nyiung and the Lady Maud group. These appear to have been faulted in places and have been completely brecciated and subsequently recemented by vein quartz. One line of jasper, now practically a quartz reef, forms the backbone of the southern slope of Nyiung. A number of jasper lenses of very similar type to those east of Nyiung occur immediately west and south of Carron Hill.

Quartz reefs, usually of no great length and ranging from a thread to about five feet in width, occur both in the greenstones and in the porphyry. The reefs carrying payable gold, so far discovered, are confined to the greenstones.

In the greenstones the reefs occur at relatively short lenses along narrow zones of intense shearing, in which the epidiorite has been altered to hornblende or chlorite schist. In the main group of leases most of the shear zones are situated close to the margins of porphyry dykes, to which they are approximately parallel. The reefs were noticed, in places, to cut across the planes of schistosity of the shear zones, suggesting a reopening along the lines of shearing prior to the introduction of the quartz. The direction of strike and dip of the reefs varies considerably, but the dip is usually steep, whatever the direction.

The reefs in the quartz-porphyrines are very similar to those in the greenstones. Large reefs are not so numerous, but small veins and stringers are common in places. Those seen were practically vertical. None of those tried appears to be auriferous, or, at any rate, to carry gold in payable quantities.

The Greenstones.—The greenstones of this area are, for the most part, characterised by their massive structure and fresh appearance. A large part of the area occupied by them is covered by superficial deposits, but outcrops of unweathered rock are common in the mining areas and near the edges of the quartz porphyry dykes. Some of the outcrops consist of large tor-like boulders of massive epidiorite.

The rocks range from fairly coarse to fine in texture, but the type rocks are of medium grain. Occa-

sional small veinlike lenses of a coarse pegmatite facies occur, a particularly fine specimen being obtained from a pothole on the southern boundary of Lot 25 of the townsite.

In the hand specimen the epidiorites are hard, compact mottled dark-green and white rocks, of varying texture. In some, traces of pyrite are visible in places. Specimens typical of the coarse-grained variety were obtained from a tor-like outcrop on a surveyed line west of the main group of leases, at a point 15 chains E. of survey peg W.17. The rock is described by the Acting Petrologist, Dr. Larcombe, as follows:—

A holocrystalline aggregate made up of uralite, pyroxene, saussurite, zoisite, albite, epidote, chlorite, and ilmenite. A large part of the section consists of well-cleaved prismatic and cross sections of uralite, which is in places quite fibrous. The pyroxene is a pale plum-coloured augite, somewhat schillerised, and intimately associated with the uralite which was derived from it. In some places the pyroxene is surrounded by penumbral margins of pale green chlorite; in others it is almost completely broken down into chlorite, without, apparently, any intermediate uralite stage. The felspathic areas are now represented by dull saussuritic patches, mainly zoisite, water-clear albite, epidote grains, and some chlorite. There is evidence of ophitic texture where the felspathic areas penetrate the augite. Irregular-shaped patches of ilmenite are not uncommon.

The rock is a coarse-grained epidiorite or gabbro-amphibolite.

A fairly typical specimen of the medium-grained variety was obtained from an outcrop near the middle of the northwest boundary of G.M.L. 381M. Of this, Dr. Larcombe states that:—

The minerals observed were uralite, saussurite, clear felspar, quartz, epidote, zoisite, a little chlorite, patches of ilmenite, and small rods of apatite. Uralite forms the major part of the rock. . . . The felspar is water-clear, somewhat saussuritized and in places strongly epidotised. The amount of zoisite is small. The quartz is very irregular in shape, presents an interstitial aspect, contains minute rods of apatite, and in places is micropegmatitically intergrown with the felspar. The rock is a micropegmatitic quartz-epidiorite or micropegmatitic quartz-dolerite amphibolite.

Outcrops of a hornblende-quartz-epidote variety approaching an epidosite in composition, are not uncommon in the mining area.

A peculiar creamy white or mottled white and green rock, which, according to Dr. Larcombe, is due to the alteration of felspathic segregations in the epidiorite, occurs in more or less lenticular areas, a few feet in extent, at Lewis's L.P.S. lease, southwest of Mitchellton. The rock consists mainly of basic plagioclase felspar crowded with zoisite, with patches of chlorite in varying proportions, and a little epidote.

The rock forming the shear zones, in which the quartz reefs occur, consists in places of hornblende schist, in places of highly pyritic chlorite schist. The planes of schistosity are somewhat contorted.

The Quartz Porphyries.—The rock comprising the main dykes of quartz porphyry is much sheared and, in spite of the numerous large exposures of these rocks, unweathered outcrops are not common. A relatively unweathered specimen from one of the southern spurs of Nyiung consists of a compact, fine-grained purplish-gray felsitic rock, with numerous small phenocrysts of quartz. According to Dr. Larcombe the ground mass consists of a microcrystalline aggregate of quartz and felspar, stained a dirty greenish colour by chlorite in the form of a pigment. The quartz phenocrysts show signs of absorption and replacement by the ground mass. Specimens of the more highly sheared rock are of a fairly pale-gray

colour, and break with a more irregular fracture. In section, according to Dr. Lecombe, evidence of shearing is shown by the arrangement of the chlorite and the presence of sericite.

In places on the southern slopes of Nyiung, the rock presents, at first sight, the appearance of a conglomerate with pebbles of quartz up to 9 inches in length. The "pebbles" are, however, "frozen" onto the enclosing rock and consist of vein quartz, and some have a small cavity lined with quartz crystals, in the centre. Their formation may be due to the irregularity of the lines of shearing, which were subsequently filled with quartz, the quartz forming pebble-like masses in the open spaces. They may, on the other hand, be due to the presence of original amygdaloidal cavities in the rock. The rock contains numerous stringers of quartz similar to that forming the "pebbles." Another peculiar and somewhat similar occurrence was found on a small hill, half a mile ENE. of Nyiung. The rock here is completely weathered and somewhat lateritised. It consists, in places, of a reddish brown matrix, showing signs of schistosity, in which are set numerous small pebble-like masses of cream-coloured or pale bluish-gray quartz similar to that of the previously described "pebbles," and ranging in size from that of a small pea to that of a marble. The "pebbles" are mostly spheroidal, but a few are dumb-bell-shaped. No quartz stringers were found associated with the rock. The pebbles may be either lateritic or amygdaloidal in origin, but the evidence afforded by the previously mentioned occurrence is against the first alternative.

In a few places the quartz-porphyry consists of rock of somewhat fragmental appearance, owing to the presence of numerous dark grey, in places almost black, patches of varying size and mostly lenticular, though somewhat irregular in shape. These patches consist of chlorite and probably represent xenoliths of greenstone caught up in the quartz-porphyry magma.

The smaller dykes vary somewhat in appearance and are usually more felsitic, as are, in places, the marginal portions of the larger dykes. A specimen from the edge of a quartz reef in a small pothole in G.M.L. 367M, and in, and close to the western boundary, of a fairly large dyke, consists of a compact, even and very fine-grained, felsitic pale yellowish-gray rock, with phenocrysts of clear quartz. An interesting feature is a somewhat irregular selvage, averaging about half an inch in width, of felspar crystals, between the rock and the quartz reef; a few small clusters or veinlets of cream-coloured felspar occur also in the reef, indicating the quartz was a final product from the cooling mass of porphyry. Similar areas of felspar were also observed in a reef, in greenstone, in G.M.L. 381M, indicating a similar origin.

A small dyke, a few feet west of and approximately parallel to Lewis's reef in the L.P.S. group, differs somewhat from those previously described. It consists of a very fine-grained, felsitic dark-grey rock, in which a few small phenocrysts are discernible. The weathered surface of rock has a banded appearance, resembling a flow structure. In section the rock consists of a very dense microcrystalline groundmass consisting mainly of sericite and calcite, in which are set a few large phenocrysts now mainly biotite or chlorite from hornblende, with a very few of completely sericitised and carbonated felspar. A few grains of pyrite are also present. The rock was probably originally an acid hornblende porphyrite.

The Epidiorite Dykes.—The only representative of these rocks seen, namely, the small dyke on the eastern slope of Nyiung, is composed of a very fine-grained, even-textured, greenish-gray rock, breaking with a fairly even fracture. It closely resembles but appears to be of even finer grain than fragments from such dykes obtained at Youanmi. It is evidently an epidiorite from a fine-grained basaltic dolerite.

The Jaspers.—The jaspers of this district present several unusual features. Although, as previously stated, some of the "bars" occur at the junctions of porphyry dykes with the greenstones and are of the type most common in the Murchison Goldfield, the greater number of those seen occur wholly in the porphyry, and differ in appearance and are more siliceous than the normal type. They consist for the most part of a number of short, wide lenses apparently discontinuous, probably owing to faulting. Those near Nyiung Hill are mostly mottled red and white rocks, the red portions representing the original jasper and their colour being due to hæmatite. These jaspers have been subjected to intense movement and have been completely brecciated and subsequently recemented by vein quartz, probably during the reef-forming period. The jaspers near Carron Trig. have been similarly brecciated and recemented, but the fragments of original jasper are of a black or grayish colour. As stated, the bar forming the backbone of the easternmost southern spur of Nyiung might be classified as a reef rather than a jasper, as it now consists almost wholly of white quartz, the only traces of original jasper being a few patches of red streaks, in places, and the very finely granular, flinty appearance of some of the quartz. Some of the original jaspers evidently contained small segregations of practically pure iron ore. No examples were seen *in situ*, but small fragments of dark-red jasper with thin bands of black iron ore were picked up between Nyiung and the main group of leases.

THE REEFS.

Owing to the limited time available, as well as the inaccessibility of most of the old workings in the main group of leases, it was found impossible to examine the reefs underground. Exposures at the surface were, however, sufficiently numerous to give a good idea as to the extent and relationships of the reefs.

The reefs, whether in the greenstones or the porphyry, appear to be all of the same type. They range from a thread to about 5 feet in width, averaging, probably, a foot or 18 inches. A tendency towards a sheeted and jointed structure is noticeable, and many of the reefs contain vughs of fair size, lined with quartz crystals. Some of the reefs are compound, consisting of irregular veins of quartz separated by bands or irregular masses of schistose rock. In some of the workings that have penetrated the sulphide zone, the reefs are heavily pyritised.

Traces of copper, associated with quartz reefs or veins, were seen in two places in the quartz porphyries. One in a small vein in a pothole 2½ chains S. of the south corner of G.M.L. 438M—the north-west lease of the main group—where the copper was in the form of the oxide and the silicate; the other in a reef, about 20 inches wide, in an open cut on the eastern slope of a small hill about 40 chains E. of the South Australian G.M.L. 382M. In this reef traces of the green carbonate were visible,

The Lady Maud Group.—As stated, the main reefs in this group occur as comparatively short lenses along zones of intense shearing, usually a few feet in width, and roughly parallel to and no great distance from the margins of quartz porphyry dykes. In the Lady Maud group there are three main zones of shearing, as well as several subsidiary lines. The strike and dip of the reefs vary. Broadly speaking, there appear to be three main directions of strike, namely, northwest, northeast, and east, the corresponding dips being southwest or northeast, southeast or, more rarely, northwest, and north or south; in each case the angle of dip is steep. Of the three main lines, one, striking approximately northwest, runs along G.M.Ls. 443M and 414M, and probably also through G.M.L. 438M to the north. These are the westernmost leases of the group. The second, striking northeast, runs through G.M.Ls. 415M, 381M, and 367M, northeast of the first mentioned leases. The third, striking nearly northwest, runs through the old Lady Maud G.M.L. 366M, of which part was later taken up as G.M.L. 1139M, Aftermath.

The first line, which may be termed the "Maori" from the first lease, 367M, taken up thereon, is about a chain from and approximately parallel to the eastern end of the northeastern boundary of the large area of quartz-porphyry which includes Nyiung Hill to the northwest. A fair amount of work has been done on this line, along which the reefs, apparently three in number, can be traced for a distance of about 10 chains in G.M.Ls. 443M and 414M. This line could not be followed through G.M.L. 438M, but there are three shafts, close to the line of its strike, with some quartz as well as fragments of jasper on the dumps of the two more southerly shafts. The jasper probably marks the junction between the epidiorite and the quartz-porphyry. In addition to the main line there is a parallel reef, about 120 feet NE., in G.M.L. 414M, which, owing to the covering of soil, could not be followed for any distance. There are also, in G.M.L. 414M, several fairly large reefs striking east and dipping north. In places a herring-bone structure is apparent in these last reefs, the backbone being formed by the eastward-striking reefs, the ribs by veins striking northwest and northeast.

A fair amount of alluvial gold appears to have been obtained in these leases, as the ground has been dry-blown for a distance of about 20 chains, and for a fair width, along the main line. This line has produced 131.12 fine ozs. of gold from 167 tons of ore—from G.M.L. 414M.

The second line, which may be termed the "Christmas Gift," from the northeasternmost of the three leases through which it runs, is represented, so far as could be determined by two small nearly vertical reefs in G.M.L. 415M; a reef, dipping SE. at 70°, in G.M.L. 381M; and a fairly long reef, dipping NW. at angles ranging from about 65° to 80°, in the southwest portion of G.M.L. 367M. There is also another reef along much the same line, in quartz-porphyry, in the northern portion of G.M.L. 367M. All have been worked in shafts, trenches, and potholes, and in addition there has been a fair amount of loaming or dry-blowing. These reefs are approximately parallel to the southeastern boundary of a quartz-porphyry dyke north of G.M.L. 381M and to a portion of the western boundary of a long dyke which runs through the Aftermath, southeast of the Christmas Gift. This line has been responsible for the production of 838.75

fine ozs. of gold from 441.30 tons of ore, of which the greater portion was from G.M.L. 415M.

The reefs of neither the Christmas Gift nor the Maori lines appear to contain much pyrite.

The third, or "Lady Maud," line extends nearly diagonally through the northern and greater portion of the original lease, close to the margin of the large porphyry dyke which occupies the eastern half of the lease. There appear to be three reefs, two dipping southwest, the third northeast, in this shear zone, but the most southerly portion of the shear zone contains little or no quartz. A few feet east of the southern end of the shear zone, a somewhat flinty reef, apparently barren, runs into the porphyry dyke at a very acute angle. About 3½ chains southwest of the main line in G.M.L. 1139M is a parallel reef, with a slight dip northeast, on which are three deep shafts. The quartz and adjacent schist of this and the main line are heavily pyritised, the pyrite being in the form of imperfect cubes up to half an inch across. A return of 26.19 fine ozs. of gold from 9.75 tons is recorded for G.M.L. 1139M.

On the former Jubilee G.M.L. 488M, southeast of the Lady Maud, is a line of reef striking approximately northnorthwest and practically vertical. The quartz of this reef contains numerous small cavities of cubical shape, indicating the former presence of pyrite, since leached out by surface waters. There is one shaft below water-level, as well as several potholes, on this reef.

The Elsie G.M.L. 1196M.—Owing to the covering of superficial deposits, the full extent of the reef on the Elsie lease had not been determined at the time of my examination. It had been worked from a shaft 30 feet deep and shafts were being sunk to cut its northerly extension. From the bottom of the 30 feet shaft a drive extended northwest for about 40 feet. The strike of the reef is approximately northwest and the dip is northeast at angles ranging from 62° to 70°, averaging about 68°. In the shaft, the reef was 18-20 inches wide at the surface, narrowing to about 8 inches at the bottom of the shaft. Going northwest, in the drive, the reef widens and at about 13 feet from the centre of the shaft is joined by a branch or spur reef about one foot wide, and, in places, by other irregular small veins. In the face of the drive the reef was about four feet wide, and appeared to be widening underfoot. The quartz is clean and white, and shows a few cross joints and parting planes; a little chloritic material was visible along the parting planes. On both walls of the reef was a casing, from six to eight inches in width in the face of the drive, of highly sheared rock. The reef was said to be poor at the bottom of the shaft, where it was small, the rich shoot starting about nine feet northwest. Much gold, both coarse and fine, was visible in the face, particularly in a narrow veinlet, from half an inch to an inch in width, between the main body of the reef and the footwall casing. The gold was said to be, as a rule, fairly evenly distributed, but in places more on one wall, in places on the other. At the surface the reef is much shattered and jointed. Much gypsum was present in the enclosing rock at the surface, particularly on the hanging-wall side. Judging by the somewhat decomposed rock on the dump of a shaft to the north the Elsie reef, like those of the Lady Maud group, is close to an acid dyke. Up till April, 1924, the Elsie lease had produced 460.84 fine ounces of gold, of which

101.95 fine ounces was from 0.25 tons of ore, the remainder from specimens.

The L.P.S. Group.—At the time of my survey this group of leases had not been surveyed, but two prospecting areas were being worked, one by H. Lewis, and one by Phillips and Marshall, north of and adjoining Lewis's prospecting area. Phillips and Marshall's workings were situated near the track from Mitchellton and close to an old shaft near the track. Both parties appeared to be on the same line, there being a fairly long line of loaming on the two areas. Lewis's workings consisted of a few potholes, of which one was on a much shattered-looking reef possibly three or more feet in width. Another pothole, to the south, was on narrow veins, apparently on the footwall (eastern) side of the reef. The gold was said to occur in the footwall portion of the reef, chiefly in veinlets, but in places, associated with a staining of iron ore, over half the reef. The gold is both fine and coarse and hackly. Much gypsum was visible at the surface. I was shown a pickle-bottle full of small fragments of quartz, carrying a large proportion of coarse gold. But little of the reef or of the previously mentioned acid dyke was exposed at the surface, owing to the covering of detrital material, but as they are situated between two outcrops of epidiorite, approximately parallel to the reef and at no great distance apart, the line should not be difficult to trace. The type of occurrence appeared to be similar to that in the Elsie lease. Up till April, 1924, 43.39 fine ounces was obtained from 0.79 tons of ore from the L.P.S. G.M.L. 1210M, 25.99 fine ounces being from specimens.

SUMMARY AND CONCLUSIONS.

The Paynesville centre is situated to the north of the centre of an extensive greenstone belt, consisting mainly of massive epidiorite from gabbro or dolerite.

The boundaries of this belt have not yet been determined, but it is possibly 47 miles long by 20 miles wide.

The greenstones have been intruded by a number of quartz-porphry dykes, which forms groups of steep conspicuous hills, of which Carron and Nyiung Trig. hills are among the most important.

The porphyry magma has caught up and dissolved portions of the greenstones now represented in places by chloritic patches, giving the rock a fragmental appearance. In places the porphyry shows signs of intense shearing.

Several series of jaspers occur, chiefly as short lenses either at the junctions of quartz-porphry dykes with the greenstones, or wholly in the porphyry. Those in the quartz-porphry are more highly siliceous than the normal type.

Since their formation many of the jaspers have been intensely brecciated and subsequently recemented by vein quartz.

The auriferous reefs so far discovered are confined to the greenstones, but are usually in close proximity to porphyry dykes.

A few reefs and, in places, numerous narrow veins of quartz occur in the quartz-porphyrines, in which traces of copper ore were seen in two places.

The auriferous reefs mostly occur as comparatively short lenses along narrow zones of intense shearing, along which the epidiorites have been altered to hornblende or chlorite schist. The presence of feldspar in a few of the reefs points to their origin as a final product from the porphyry magma.

Some of the reefs are heavily pyritised. The gold content is patchy, and many of the reefs have evidently proved unpayable.

In the Elsie lease, seven miles WSW. of Paynesville, the reef was unpayable where small, but the wider portion, from about two to nearly five feet in width, was exceptionally rich, 359 fine ounces of specimen gold having been obtained in addition to a quarter of a ton crushed for 102 fine ounces.

At the time of my survey specimen gold was being obtained from this reef, and from Lewis's reef 2½ miles SSW. from which 26 fine ounces has been obtained in specimens.

Owing to the large area covered by the Paynesville belt and the obscuring of much of the lower-lying ground by superficial deposits, the district cannot be regarded as thoroughly prospected, and there is little doubt that further prospecting would reveal reefs similar to those of the Elsie and the L.P.S. group.

Most of the reefs so far discovered are in close proximity to quartz-porphry dykes and the ground near the junctions of such dykes with the greenstones should be carefully examined.

Owing to the erratic gold content of the reefs, and their comparatively short length, they are not suitable for large companies, but the richer reefs should prove highly remunerative to small parties.

(A. G. D. ESSON, M.A. (Aberd.), Field Geologist.)

INTRODUCTORY REMARKS.

In accordance with instructions, the writer proceeded to Paynesville, Murchison Goldfield, in August, 1923, for the purpose of making an examination and geological survey of all the mines and prospecting shows in active operation and others to which access can be obtained, in addition to a general reconnaissance survey of such of the surrounding country as is necessary for the purpose of obtaining a grasp of the structural and other relationships subsisting between the different rock series.

Despite the fact that prospecting and mining operations have been carried on at Paynesville centre as far back as 1898, it would found that very little information was available regarding the early rise and history of this centre. It would appear that Tom Payne, after whom the centre is named, was one of the first prospectors of it, although it is not certain if he or the Colreavy Brothers were first on the field. At any rate the widespread prospecting shafts and crabholes and the bush tracks testify to the labours of the early pioneers, whose large-hearted efforts gave a measure of prosperity to the district.

From records in the Mines Department it would appear that the centre first started in 1898, when it was named after Tom Payne. Early in that year he was prospecting here to the northeast of East Mount Magnet Hill and was successful in finding gold near the South Australian reef, to which he ultimately traced the gold. The South Australian lease he pegged out and worked in company with a man named Waldeck. Shortly after this a gold rush to the centre took place, and Ford found gold upon the Mt. Ford lease situated about a quarter of a mile

north of the present siding. More men were attracted to the centre, and it is upon record that in 1899 there were 250 men in and around it. During this time and up to 1903 there was a period of comparative prosperity and boom. By that time most of the leases had got down to and below water level, but the want of proper machinery to keep the water down was responsible for the closing down and voiding of a number of shows.

From 1903 onwards there were at various times a few diggers at or near this centre, but it was not until 1920 that a slight revival took place, when Mr. Joseph Mitchell found a rich leader which ultimately led him to his present rich shoot in the "Elsie" Gold Mine. Later came the finds of Lewis and others at the "Patch."

Of recent years more prospectors have been attracted to the centre, the bulk of them working near Mitchellton. Up to the end of December, 1922, the gold production of Paynesville has been:—

Alluvial.	Dolled and Specimen.	Ore treated.	Gold therefrom.
63.29oz.	1,301.99oz.	5,784.38 tons	3,638.69 oz.

giving a grand total of gold produced 5,003.97oz.

LOCATION, TOPOGRAPHY, SUPPLIES.—The centre is situated in the Murchison Goldfield at the Paynesville siding some fifty miles from Mount Magnet on the Magnet-Sandstone railway line. Mines and prospecting shows, being far spread, give the centre an area of close upon fifty square miles.

In topography, the country consists of large thickly wooded mulga scrub flats, deep gullies and groups of steep hills at isolated intervals. There are also a number of parallel low ridges with gullies in between.

These rough areas contribute to make travelling and transport both rough and expensive. There are a number of bush tracks and cut lines through the centre. Some of these cut lines have been utilised as roads, which are little more than bush tracks very often.

There is a fortnightly train service from Mount Magnet and Sandstone, by courtesy of Mr. Simpson, mails are carried on alternate weeks by motor car.

There is plenty of firewood but very little timber suitable for mining. The country is thickly wooded with mulea scrub of stunted growth.

Good water is rather scarce. There are a number of wells which have utilised old mining shafts. The water is highly mineralised in these shafts, but not so as to be poisonous, although in some cases it is decidedly saline and unpalatable and has a bad effect upon the human system. Three miles northeast of Paynesville is an old native shallow well named Nyiung, which consist of a cavern in the cement. The Government have improved this well and placed a reserve around it. The water obtained from it is of excellent quality and is potable. In the early days of the centre Nyiung was the only well. In the extreme western portion of the centre, around Mitchellton, the want of potable water has been a serious question for prospectors and others. This drawback will be to a certain extent alleviated by the 3,000 gallon tank, which the Government have erected on the railway line near Mitchellton and which, it is understood, will be kept filled from the Government dam further west. This innovation should do much to encourage more extensive work by prospectors,

The working season is in the winter, spring, and early summer when rain water may be found in rock holes and clay pans. As soon as the hot weather starts water has to be carted from the nearest well usually for a few miles.

GEOLOGICAL RELATIONS.—The geological relations of the rocks series of Paynesville may be briefly summarised as follows: The rocks are igneous and of different ages. The older rocks are the basic gabbro-amphibolites or epidiorites with pegmatitic and felspathic segregations. Intruding these and forming the prominent hill features are acid porphyries. As a general rule basic rocks form the valleys and plains and porphyritic rocks the hills. That the porphyry, a comparatively soft and easily weathered rock, should form the prominent hill systems, is sufficient proof of the relative ages of the basic and acid rocks. Dr. Larcombe, Acting Petrologist, considers the epidiorite to be of an age contemporaneous with that of the North End of Kalgoolie. Dr. Larcombe has examined a few of the specimens collected in and around Paynesville by the writer. He considers the oldest rock of the centre to be basic igneous coarse-grained epidiorite derived from a magma which was of dolerite-gabbro composition. Later than this come the acid igneous rocks, acid porphyry and dyke albite porphyry. Latest of all is a gabbro which is decidedly fresh and quite distinct from the older gabbroid rock and which is in his opinion quite similar petrographically to the post-gold gabbros of Norseman and Hampton Plains. If this is the case it is obvious that it will affect gold deposits by cutting off values.

How far the similarity of Paynesville and Kalgoolie extends is a question that can only be decided by underground exploration.

BASIC IGNEOUS ROCKS.—In all, seven specimens of basic rock from different parts of the centre were examined by Dr. Larcombe. These were designated A, B, C, D, E, F, H. He concludes that all of them, though they may differ now somewhat in composition, excepting E and F, were derived from the same dolerite-gabbro magma and that any variations are probably due to segregation in the main parent mass and by later alteration as a result of zoisitisation and epidotisation.

A characteristic specimen from the "Patch" south of Mitchellton was determined as:—

A very coarse-grained mottled rock, consisting of dull white saussurite and dark green uralite. In section it consists of large and more or less prismatic individuals of pale green uralite. In places the uralite has been altered to aggregates of chlorite and epidote. The felspathic areas have been completely converted into epidote, zoisite and a water-clear substance—possibly albite. In one place there is some micropegmatite. Irregularly shaped plates of ilmenite are common. The rock is a grade of pegmatitic variety of epidiorite with micropegmatite, or in other words, a pegmatitic micropegmatitic gabbro amphibolite.

E is a specimen of fresh gabbro dyke of latest age found running through Lewis's northerly lease. This was determined as:—

A coarse-grained crystalline igneous rock, consisting of honey-coloured vitreous to resinous lusted plagioclase, showing in places good repeated twinning, and a black ferromagnesian constituent. In section there is a large portion of water-clear cracked plagioclase. The cracks are bordered by yellowish brown strains, caused by hydrated iron oxide. The felspar shows carlsbad, albite and pericline twinning and from measurement made on sections perpendicular to (010), it proved to be labradorite (Ab₁An₁). Some of the labradorite show

straight edges and is quite hypidiomorphic. The next most abundant mineral is a pale pinkish to plum-coloured augite, somewhat cracked and showing a distinct parting along the length of prismatic sections. In places the parting planes contain numerous dark-brown and non-pleochroic microlitic interpositions, which are insufficient to make the mineral a true diallage. It may be regarded as a schillerised augite. The black iron-bearing mineral is magnetite. The rock is a fresh gabbro.

F is an indeterminate structureless rock consisting mainly of chlorite, and is the altered form of the epidiorite at its junction with the acid porphyry.

INDETERMINATE TO ACID IGNEOUS ROCKS.—Of these we have (1) acid porphyry forming the hills of the centre and (2) albite porphyry dykes found at the "Patch" (Lewis, L.P.S. South, etc.). A specimen G was examined by Dr. Larcombe, who considers it to be similar in general appearance to the keratophyres of the Kalgoorlie Goldfield.

There has been a certain amount of movement throughout the centre, especially near the contacts which are near the following leases: "Havela," "Lady Maud," "Mount Ford," "Johnson's Treasure," etc.

Secondary and primary laterites largely obscure rock relations. In the western portion of the centre the laterite is primary, and forms a prominent feature in the landscape in the form of breakaways and flat-topped plateau remnants with steep sides. In places gamma holes in the laterite have been utilised as native wells. Secondary laterite (ironstone gravel) is found in outlying and higher parts as well as in the centre itself, and largely obscures the rocks.

Under the Breakaways was found pseudo bitumen or bituminous matter formed from the excreta of bats.

A certain amount of metamorphism has affected the rocks of this centre.

As stated above, zoisitisation and epidotisation have affected certain zones in the epidiorite. North of the siding are a number of shear and contact zones. Laterisation has played its part as well as ordinary weathering. The greenstones weathered in concentric layers and occasionally in tabular masses to produce finally a clayey loam. The porphyries have a characteristic tabular weathering. Primary laterite has been broken down to produce secondary laterite ironstone gravel which differs in accordance with the rock from which it is formed. The detritus, produced by weathering, largely obscures rock relations except in persistent outcrops among the hills and gullies.

ORE DEPOSITS.

"Elsie" Gold Mine 1196M.—Mr. J. Mitchell prospected for a number of years in Paynesville district, and ultimately found the reef of the present "Elsie" G.M.L. 1196M. This lease is upon schistose coarse-grained epidiorite. The reef in which the gold occurs is a very persistent one, being traced on the surface for about a mile. In places it has been faulted, particularly about $\frac{1}{4}$ mile south of the lease.

The main shaft is an underlay shaft following the reef dipping at 68° east. At the bottom of the shaft in a drive 40 feet long along the reef westwards, and showing increasing values from the shaft to the end of the drive. The shoot is situated upon a bend in the reef. At its present depth (about 40 feet) very rich values were obtained. At the end of the drive the face of the reef exposed is five feet two inches wide.

The quartz of the reef is somewhat fractured, and contains metamorphosed fragments of the surround-

ing country rock (coarse grained epidiorite), which have been silicified by the quartz in solution. Gold occurs associated with these fragments in coarse hairs and pieces as well as, in places, finely disseminated throughout the stone. The quartz is very vuggy, and shows vughs with crystals of quartz coated and penetrated by gold. Hence it may be concluded that gold and quartz were both deposited from solution at the same time.

A feature of the "Elsie" is the gypsum associated with the oxidised zone. Percolating waters have evidently carried gypsum in solution and deposited it in fractures in the reef. In one case a beautiful specimen of gold in crystallised gypsum from the top of the reef was shown to the writer by Mr. Mitchell. It is evident that surface waters have done much to concentrate gold along fractures, but, apart from that, rich gold is found in the reef itself. About 50 tons of good ore, much of it showing coarse gold, are already upon the surface.

It would be advisable to deepen upon the present rich shoot before attempting extension work. The lease is situated upon an old dryblown area from which a number of good specimens have been obtained.

South Australian G.M.L. 382M, situate about $\frac{3}{4}$ mile west of the siding. This 12-acre lease was the first lease of the centre. It was near the South Australian reef that prospector Tom Payne first specked gold. There is here a very solid quartz reef running north and south through the lease, with a number of shafts to water level along the reef and drives connecting them. The gold obtained was mainly specimen gold or dollied gold. During the time that the lease was held as 382M, from 1898 to 1901, 272.55 ounces of dollied and specimen gold were obtained and 81.4 ounces from 103.5 tons of ore. In 1901 the lease was voided and was again taken up as 599M in 1902, when 7.5 tons of ore were treated for 2.5 ounces. The lease again lapsed at the end of 1902. This gives a total of 272.55 ounces of dollied and specimen gold and 83.9 ounces from 111 tons of ore, or a grand total of 356.45 ounces.

Since 1902 various prospectors have tested this reef with indifferent success. Evidently the gold does not live at depth. The quartz of the reef is very similar to that seen throughout the centre. It is very vuggy, and shows large and small vughs, of beautifully crystallised hexagonal prisms and pyramids, and at times is almost transparent.

Windsor Group of Leases 340M, 352M, 451M, 468M.—This group of leases is situated some five miles from Paynesville to the east. When closed down in 1903 the gold won was 2.05 ounces dollied and 1,090.90 ounces fine from the treatment of 3,670.7 tons. The country rock is very hard coarse-grained epidiorite or gabbro amphibolite similar to that found at the other end of the centre. The epidiorite is unweathered. The reef is probably a fissure reef, showing slight shearing in the epidiorite along the fissure.

The workings in this group of mines are fairly extensive, consisting of a number of underlay and vertical shafts, the deepest being 200 feet, with drives at the various levels.

The reef is a north and south reef dipping westwards. The gold seems to have been found in shoots of no great depth and of patchy values. Water level is at 50 feet from the surface, and at present the

main shafts are 150 feet under water so that it will not be possible to examine lower than the fifty-foot level. There is a plentiful supply of water, which is utilised by Mr. Moses on his Windsor station.

The pegmatitic coarse-grained epidiorite is very hard, and this combined with the fact that the main shafts were put down on the footwall instead of the hanging wall, must have cost the Windsor Consolidated Company a great deal of money, and must have helped to close the mines down in 1903 after working for five years and producing a total gold amount of 1,092.95 ounces.

A 20-head battery was utilised upon these leases, and judging by mine works and buildings, much must have been expected of them, but these expectations were never fully realised.

A feature in this mine is the amount of copper carbonates—malachite and azurite—present in the quartz of the reef. Beautiful specimens of these were collected, and I am informed that one beautiful specimen of it showing good gold was sent to the Franco-British Exhibition.

Lady Margaret Leases 471M and 272M.—These are two 6-acre leases now abandoned, and situated four miles southwest from Paynesville. They were later known as the "Robe." From surface and other indications it is concluded that these two leases are upon the greenstone at the junction with porphyry. This might account for the patchy nature of the gold deposition. The rock is very much sheared, and relations are largely obscured by clay detritus and ironstone gravel.

The workings consist of three main shafts down upon a vuggy mineralised quartz reef, with drives along the reef, and later prospecting potholes north of the reef following a stringer.

The officially reported gold for these two leases is 24.06 ounces of doliied and 6.31 ounces from four tons of ore. Decidedly the gold found here was a patch at the junction of the greenstone and porphyry. Doubtless other patches may be found along the same line.

Heffernan and Swanson's Prospecting Area.—This is situate about two miles due west of East Mount Magnet Trig. Prospector Quann first picked up a two-ounce nugget near the east and west fence running through this area. Later Messrs. Worthington Brothers did some loaming by costeans here but failed to pick up the reef from which the gold was shed, although finding payable values. Messrs. Heffernan and Swanson next took up the present 9-acre prospecting area, on which they have been potholing and costeaning, and have now picked up a fairly rich leader showing good values of fine gold as well as specimen stone. Upon this they have sunk a shaft 20 feet deep.

There are two main east and west reefs of fairly bucky quartz running almost parallel at the east end, but probably meeting at the west end. Between these are a number of stringers, which may lead on to a fairly settled ore body. The quartz is very vuggy, and some of the gold is associated with fractures in the reef. It is highly probable that the country rock will not definitely be met at less than 50 feet below the surface. It is probable that this P.A. is upon the coarse-grained epidiorite of the centre, and it lies well within the mineral belt in this rock running northwards.

Lewis's leases and various prospecting areas at the "Patch."—For convenience it will be best here to

consider these as a whole. They are situate some 2½ miles south of Mitchellton.

The country rock in these is basic coarse-grained and pegmatitic epidiorite. There are finer grained segregation areas and veins in this. Intruding the country rock are: (1) A very persistent albite-porphry bar, 24 feet wide, which can be followed on the surface for about a mile in an east and west direction. This is probably associated with the great acid porphyry inclusion. (2) A fresh gabbro dyke, post-gold, probably having the effect of cutting off values.

A number of shafts, underlay and vertical, and potholes are down upon quartz leaders and reefs and fair values have been obtained. It is found, however, that in none of these shows has the gold shown any signs of permanence at depth. All the deposits found are of this nature and are patchy. Probably they are surface enrichments. More dabs may be expected and should be looked for by diggers.

In Lewis L.P.S. South lease a promising gossan ironstone cap carrying beautiful gold was found, and much was expected in accordance with the Cornish idea that—

"A lode will ne'er cut rich and fat,
Unless it have an iron hat."

The values, however, pinched out at depth.

More examination is necessary upon this portion of the centre before the writer can give his final opinion regarding it.

Alluvial Patches.—Close to the siding and south of Mt. Ford a great amount of alluvial work has been done from time to time and good gold found. Some of it was undoubtedly shed from the reefs upon the Havela, Mount Ford, Johnson's Treasure, etc., leases. Southwest of the siding is a belt of low-lying ridges, among which is Maori Gully. Here also there is an alluvial patch, where the gold has evidently been shed from the faulted ends of a laminated jasper bar. One specimen, a slug of 29½ oz., was found here by Prospector Barker. I would suggest that it is to be expected that a patch of good values may be found at one of the noses of the faulted bar, but it is probable that the deposit will be just a dab. Evidently the noses have not been examined with this idea in view.

General Conclusions regarding the Centre.—It would be premature to state conclusively a definite opinion regarding the possibilities of this centre, considering the fact that the examination—and hence knowledge—of the centre is by no means complete; but, after careful examination of a number of the leases and prospecting areas, past and present, as well as portions of the surrounding country, the conclusion has been reached that gold has been and will be somewhat patchy. Rich shoots are found and should still be found by careful prospecting and loaming, but from our present state of knowledge of the district it is not expected that these shoots will be very extensive. Probably rich patches will pinch out at depth.

A number of the ore deposits are associated with contacts between epidiorite and porphyry. This is particularly so at the centre itself in such mines as Mount Ford, Lady Maud, etc. It appears that rich shoots were found here, but the main difficulty was the want of capital and suitable machinery for keeping down the heavy incoming water to enable proper exploratory work to be undertaken below water level.

For this reason, little is known of what has happened at any great depth below the surface.

Nevertheless, the writer would state that he considers that yet many rich patches may be found and that the district is well worth the attention of prospectors and syndicates. In proof of this, we have good specimen and other gold still found throughout the centre, particularly at the Patch and at Mitchellton, where payable deposits were obtained.

Therefore rich patches should be looked for, but without sure evidence no attempt should be made to follow these up when they pinch out.

The writer is favourably impressed with the country in the vicinity of East Mount Magnet Hill and to the west of it, where a number of quartz reefs are to be found. There seems to be a zone of mineral deposition, running from west of East Mount Magnet, through the "Patch" to Mitchell's "Elsie" and probably beyond that again to the north. This zone is worthy of careful testing and examination by prospectors and others interested.

In the centre itself the attention of these gentlemen is directed to the contacts of the porphyry and greenstone and to the fault in the jasper bar near Maori Gully workings. Very careful systematic work will be necessary in this regard.

6.—THE GYPSUM DEPOSITS ON MINERAL CLAIMS 27H and 28H, HINES HILL, AVON DISTRICT, SOUTH-WEST DIVISION.

(F. R. FELDTMANN.)

GEOGRAPHY.

Location.—Hines Hill township is situated in the Avon District on the Eastern Goldfields Railway, approximately 156 miles east of Perth. It is close to the southeastern edge of a long, wide, and irregular chain of lakes, which extends west to Baandee Siding and runs in a general southwesterly direction. This chain of lakes appears to form part of a long drainage system which includes Lake Deborah, north of Golden Valley in the Yilgarn Goldfield, and Lake Brown, west of No. 1 Rabbit-proof Fence, thence turning south towards Hines Hill. Thence it runs generally southwestward towards the Avon River, east of Mount Kokeby on the Great Southern Railway.

Mineral Claims 27H and 28H are situated north of the townsite. Mineral Claim 27H being approximately 70 chains NNE. of the townsite and within Reserve 11439,* and Mineral Claim 28H about 40 chains north of the townsite and within and close to the north boundary of Reserve 3891.

Topography.—The area is one of low relief, the country near the townsite, particularly that south of the railway, being almost flat. The only hill near the town is that after which the place is named, situated 1¼ miles W. of the townsite. This hill is a small low ridge, mostly bare, striking nearly east.

The lake system apparently splits about a mile north of the hill, the main branch running towards Baandee, the smaller branch between the hill and Hines Hill townsite. The system includes, in addition to the main channel, a number of small isolated clay pans of more or less elliptical shape. These isolated clay pans, particularly those north of the

railway, are mostly separated from each other and the main channels by fairly high sand ridges.

Vegetation.—Prior to settlement, the district was evidently fairly well timbered. The chief timber is salmon gum, with some morrell and gimlet.

GEOLOGY.

The country rock is almost entirely obscured by superficial deposits. These include: red, somewhat sandy soil; sand in the form of ridges, separating the clay pans, and also small areas of sand plain; and clay forming the beds of the lakes and in other low-lying areas. Without doubt the country rock of the district is granite, but the only outcrop seen was that forming Hines Hill, which is composed of fairly fine-grained, even-textured biotite granite.

THE GYPSUM DEPOSITS.

Mineral Claim 27H covers part of a small enclosed lake of elliptical shape. Mineral Claim 28H, the northern corner of which is about 9 chains WSW. of the southern corner of 27H, is on the southeastern corner of a relatively long and narrow lake, which extends northnorthwest for about 40 chains, and near the southern boundary of the claim bends sharply to the west. It appears to extend westward for a considerable distance.

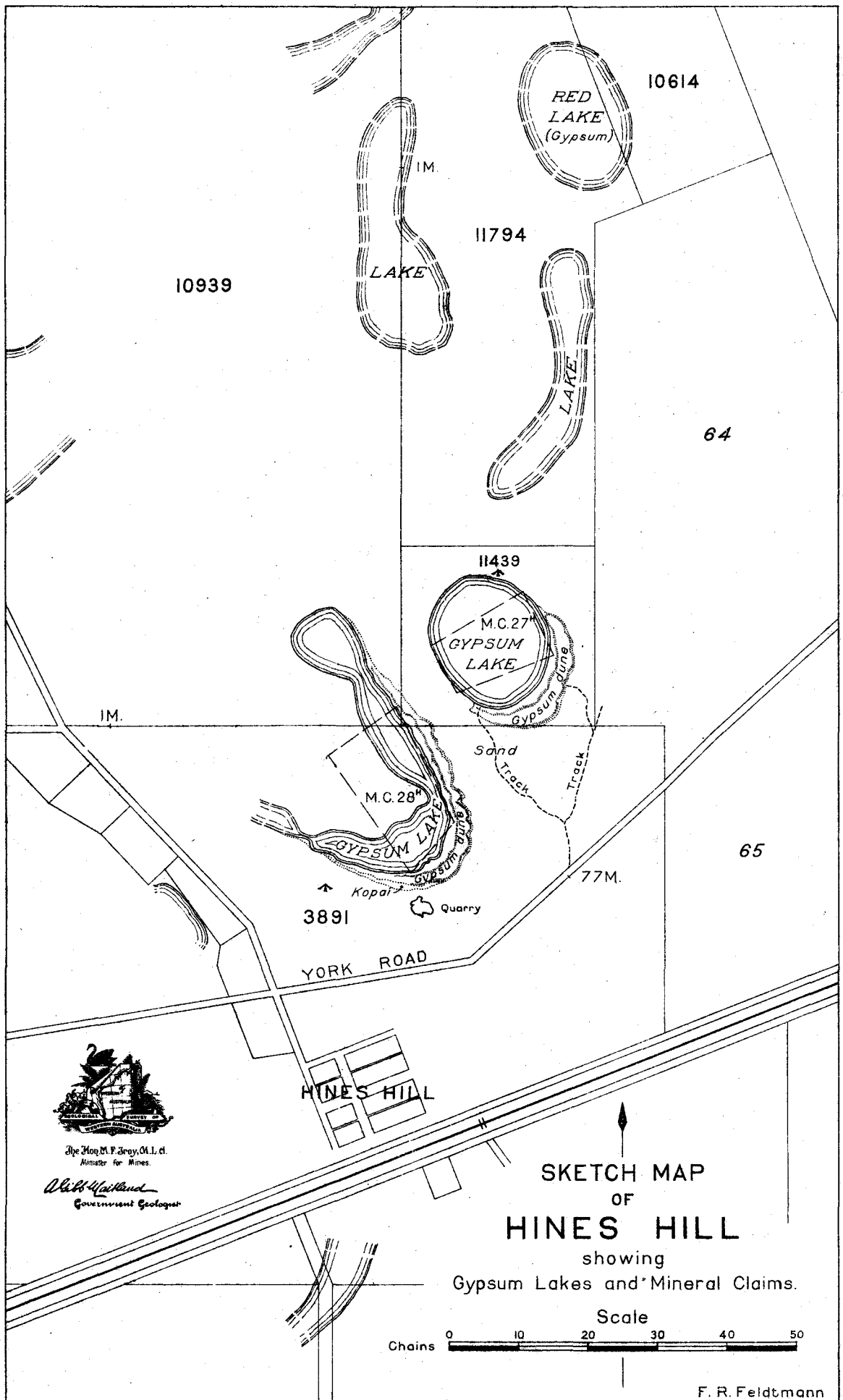
On the boundary between Locs. 10614 and 11794 and about a mile north of Mineral Claim 27H is a third lake, of elliptical shape, which has also been worked for gypsum. Another somewhat larger lake separates the last mentioned lake from that on which Mineral Claim 27H is situated, but apparently it has not been worked, and owing to the limited time available was not examined.

Owing to the quantity of water in these lakes it was impossible to examine their beds in detail, but they appeared to consist of a thin layer of gypsum, ranging from the merest film to five or six inches in thickness. I was informed that in a few places this layer attains a thickness of nine inches. The gypsum is underlain by a fine puggy grey clay. In the lake on the boundary between Locations 10614 and 11794—known as the "Red Lake" on account of the reddish tinge of some of the gypsum and also, in places, of the underlying clay—the gypsum appeared to be mainly confined to the southern half of the lake, and in the other lakes the gypsum is probably mainly concentrated in the southern or southeastern portions.

The shores of the lakes, particularly the southeastern portions, are covered by a very thin layer of white seed gypsum, in places mixed with a little coarse sand. Underlying this layer is a deposit of fine gypsum of a pale brownish colour, owing to the presence of a small proportion of fine clay. I was unable to ascertain the total thickness of this layer, but on the southeastern sides of the lakes it exceeds nine inches in places.

Fringing the southeastern portion of the lakes on which Mineral Claims 27H and 28H are situated are small white dunes rising to a maximum height of about 12 feet, and having a maximum width of about five chains. These dunes appear to consist almost wholly of fine-grained somewhat discoloured gypsum, probably mixed with a little sand and clay. Coarse sand is present on the surface of the dune fringing the more northerly of the two lakes. The

* Vide Lands Department Map, 25/80.



The Hon. M. F. Gray, O.L.C.
Minister for Mines.
Walter H. Mackenzie
Government Geologist

growth of bushes on the dunes and the consequent presence of numerous rootlets in the gypsum renders it difficult to work this deposit.

At their northern and western ends, the gypsum dunes merge into low banks consisting mainly of coarse sand. Some kopai (gypsum earth) is present near the northern end of the dune fringing the more southerly lake, and a strip of kopai, 30 and 40 feet wide in places, adjoins the southern side of the dune on the south side of this lake for a distance of about 18 chains.

From about four to six chains SSE. of the south corner of Mineral Claim 28H is a small quarry on the top of a low ridge. On the floor of this quarry is a layer of sand and gypsum. The walls of the quarry consist mainly of sand with a little gypsum, but in places at the southern end are small areas of more compact material, consisting of a friable pale-grayish traventine-like mass apparently composed of carbonate of lime, sand, and a trace of gypsum.

The gypsum of these lakes is nearly all of fine grain, the average length of the crystals being probably about one-fifth of an inch. Good specimens of gypsum were obtained from a point near the eastern corner of Mineral Claim 28H. A very few crystals of the arrowhead type, about two inches in length, were obtained from the more southerly lake. On the Red Lake the gypsum consists for the most part of larger crystals than those of the other lakes, but even here the proportion of crystals exceeding an inch in length is very small.

7.—THE DEEP LEAD AT WAVERLEY (SIBERIA).

(C. O. G. LARCOMBE, D.Sc.)

INTRODUCTION.

In accordance with instructions from the Hon. the Minister for Mines, I left Kalgoorlie on Tuesday, April 17, with Mr. E. J. Gourley, Inspector of Mines, and made an inspection of the Deep Lead at Waverley (Siberia.)

We arrived at Waverley about midday. In the afternoon the Deep Lead was visited. I discussed matters generally with the prospectors, and made an inspection of numerous shafts. On Wednesday a map was made—Plate II.—of the shafts where work was being carried out. On Thursday a general geological examination and traverse of the country between Waverley and the Deep Lead (see Plate I.) was made. Friday was spent in making a detailed investigation of the material from each shaft and in gaining information about the geological origin of the Deep Lead. We returned to Kalgoorlie on Saturday.

Much valuable information, that may throw considerable light on the economic aspects of auriferous deposits in this State, was gained during my visit to Waverley and the intervening country. The details are indicated in this report.

GEOLOGY OF AREA BETWEEN WAVERLEY AND THE DEEP LEAD.

There is not a great variation in the rock formations of this area. The most important are:—

1. *Greenstone*.—The greater part of the country consists of greenstone, which belongs to the fine-grained amphibolites, so commonly met with in gold-

field areas. Good outcrops of this rock may be seen in the low range of hills between the Reward mine and Christie's ground.

2. *Schist*.—A well defined band of talcose schist was seen outcropping at four places, marked blue on the map—Plate I. Three of these belts of talcose schist appear to lie along the same line of strike, and may be connected. The fourth is evidently a parallel band—seen near the cemetery.

The general strike of the schist zone is N. 24° E., and it may be traced from near the Reward mine to the Deep Lead ground.

There would seem to be little doubt that these schists have been derived from the breaking-down and crushing of the fine-grained amphibolites.

The importance of these schistose rocks lies in the fact that they are directly connected with the metaliferous province—described later—which forms the axis of the Siberia goldfield, and which probably carries most of the primary auriferous deposits of that region.

3. *Felspar-Porphry*.—This is the only intrusive dyke rock on the field, and it is important, because of its direct connection with the talcose schist belt, which forms the main metaliferous province. The dyke may be well seen in a small coveen at the head of the Prospectors' gully, ten chains south 24 degrees west from Christie's shaft. The rock is fine-grained, dense, and dirty-gray in colour, with numerous well-formed, dull white crystals of felspar. The microscope shows that the phenocrysts (or crystals) of felspar are mostly plagioclase, much clouded, altered, and set in a finely crystalline, granulated base, consisting of a mixture of quartz and felspar in mosaic form. This dyke is 20 feet or more in width. It is shown in red on the map—Plate I.

4. *Laterite*.—This material is essentially hydrated oxide of iron, formed by extreme weathering of the fine-grained amphibolites. The iron in these rocks is taken into solution, and carried by some form of capillary action to the surface, where it is precipitated in the form of hydrated oxide on evaporation of the ferruginous (*i.e.* iron-bearing) solutions.

Laterites not infrequently carry free alumina, and grade into bauxites, which are a source of aluminium. But the small cappings of laterite in the Siberia district did not warrant a special analysis for the determination of free alumina.

Two forms of laterite are conspicuous:—(a) Primary or true laterite, formed *in situ*, *e.g.*, the hill capping of massive, dark brown and somewhat cellular ironstone (laterite by virtue of its mode of origin), 37 chains N. 22° W. of Waverley townsite (all directions in this report referred to Waverley townsite were measured from the northeast corner of the town blocks), and the well-defined laterite bar in Prospectors' gully. At this place the laterite is very massive, slightly cellular, a couple of feet thick, and possesses quite a smooth surface, due apparently to the intermittent passage of water over it.

(b) Secondary or detrital laterite found in beds a foot or more thick in the made ground covering the so-called deep lead. The "Gorge," Prospectors' gully, Nuggety gully: in fact all the shallow alluvial ground, contains numerous redistributed pebbles of ironstone (*i.e.*, secondary or detrital laterite). The surface mantle to be next described is, in most places, covered with pebbles of detrital laterite, about the size of marbles or smaller.

5: *Surface mantle*.—One of the most characteristic features in the geology of the ancient tableland of the goldfields, strewn as it is with the wreckage of geologic time, is what may be termed a surface mantle.

My visit to the Siberia region impressed on me the importance of taking notice of this surface mantle, because it is a veritable nightmare to the prospectors, by reason of the fact that it covers up and obliterates everything beneath it, and when shoots, patches, or veins of gold-bearing material exist below, they can only be found by the most diligent and careful loaming, panning, or washing of this surface mantle.

This surface mantle, which really consists of a dark brown soil, several inches or even several feet thick, full of redistributed pebbles of laterite, and often underlain by cement, is well seen in the low hills between the "Gorge" and Prospectors' gully.

THE ORE DEPOSITS.

Primary Deposits.

Primary deposits, such as lodes and vein fillings, are those for which we know, for the gold, no prior state of combination and no former locus in the earth. That primary deposits existed, and still exist, there is no doubt, because over a distance of at least three miles they have been worked, southwesterly, as far as the Cave Hill lease, and northeasterly, as far as the Invincible lease.

These deposits have been well described by Mr. A. Montgomery, M.A.,* State Mining Engineer, in his report on the Siberia district in 1909. They are all situated along the schisted belt, which is described in his report as the Siberia Metalliferous Province.

This province has a general trend N. 24° E., and has typical felspar-porphry dykes associated with it. It really forms the main axis of the Siberia goldfield, and all the alluvial gullies between the townsite and the Deep Lead are intimately related to and head into it.

During the short period spent at Siberia, no attempt was made to examine the primary deposits. However, it is customary for the schisted zones of such metalliferous provinces to contain many rich gold shoots like the plates of gold I saw in some talcose schist shown to me by Mr. Correll. There must also be vein-fillings of quartz and gold, which have not been sufficiently concentrated throughout the schist to make it possible to work it in bulk and regard the whole formation as a lode.

Statistics from the Mines Department indicate that up to December 31, 1908, no less than 29,767.61 tons of ore were treated from these primary ore deposits for a yield of 22,371.91 oz. of gold, valued at about £90,000.

Secondary Deposits.

Secondary deposits are those obviously or presumably derived from the disintegration and wearing away of lodes, gold-quartz, and other veins, and the concentration of the products in some area of deposition. These secondary deposits include the mechanically formed shallow alluvial, the alluvial of the Deep Lead, and the chemically formed gold found impregnating the puggy material which surrounds the nuggets in the Deep Alluvial ground.

* Montgomery, A.: Report on the Waverley or Siberia District. Dept. of Mines, Perth, 1909.

SHALLOW ALLUVIAL DEPOSITS (ELUVIAL.)

Areal distribution and description. The shallow alluvial ground includes:—(1) Innaminea Gully, (2) The "Gorge," (3) Prospectors' Gully, (4) New Chum Gully, (5) Nuggety Gully, and (6) The Pearling Ground.

1. *Innaminea Gully*.—This is more in the nature of a "Flat," which lies immediately south of the Reward mine. It starts in the form of a shallow depression, which has its head near Christie's ground, in the schistose area of the Siberia metalliferous province. At this point it is less than a chain wide. For 12 chains it trends in a direction a little east of south, where it opens out into the flat ground, which crosses the road and extends southerly to within 10 chains of the townsite.

At the place examined this alluvial ground consisted of brown soil, which represented the infilling of a shallow depression, with surface mantle material. The soil overlies directly a pale-green rotten greenstone, with no "cement" between the soil and the bed rock.

2. *The "Gorge"*.—This is a shallow gully situated 17 chains due north of the townsite. It is an offshoot from the Innaminea flat, and trends S. 76° E. It is in no place more than three chains wide.

This gully is filled—to a depth varying from two to three feet—with dark brown soil, full of pebbles of fine-grained amphibolite, up to 4 inches in diameter, ironstained glassy quartz, grey chalcedony, ironstone (redistributed laterite) pebbles, and white common opal. "Cement" underlies this soil, and in the centre of the alluvial ground the bed rock is found at a depth of less than 15 feet.

3. *Prospectors' Gully*.—This gully is 35 chains north of the "Gorge," and trends S. 85° E. It takes its rise just south of Christie's ground and is, in most respects, similar to the "Gorge."

4. *New Chum Gully*.—This gully heads into Hawkin's shallow alluvial patch. After crossing the road New Chum gully continues in a westerly direction for a distance of four chains before it junctions with (5) Nuggety Gully, which has its head near Christie's shaft, from which it trends N. 13° E. Ten chains northeast of Dewey's shaft this gully contains two feet of red clay, with a few ironstone pebbles, a little quartz, and lumps of greenstone up to two inches in diameter. Further north, Nuggety gully merges into (6), the Pearling ground, from which it is understood much alluvial gold was won.

Origin and Classification.—These deposits, while referred to as "shallow alluvial," are not true alluvial in the strict sense of that word. They are, in reality, the alluvium of a more or less desert region. The absence of running water has prevented the formation of true alluvial deposits, such as are characteristic of many mining fields of the world. In fact, gold is often found lying on the surface of the ground, as is only to be expected where there is an absence of those agents necessary to concentrate it in the beds of streams or other receptacles, and this is due to the peculiar arid and desert-like conditions under which these shallow alluvial deposits were formed.

In true alluvial deposits we would expect to find an orderly arrangement of assorted material, testifying to the sorting power of water. This is far from being the case; in other words, in these deposits the material is unclassified, and consists largely of a collection of unsorted fragments, pieces of "cement,"

ironstone pebbles, clay, and soil. The detrital gold is irregularly distributed, and it is likely to be found, anywhere and everywhere.

That this is so is shown by the system of prospecting known as "specking," and, as Mr. Rickard* says:

"I have seen as many as a hundred men walking about with their hands in their pockets and their eyes intent on the ground, for all the world as if they were in disgrace. A five-ounce nugget may be found, and everyone hastens to the spot. Perhaps nothing more is picked up; or it may be that sufficient gold is discovered to attract troops of 'dry-blowers' to the place. The 'dry-blower' is the brother of the 'gulch-miner' of America and the 'alluvial-digger' of the eastern colonies of Australia."

In this connection it may be of interest to refer to the classification of Placer Deposits by Beek and Weed, in their standard work, "The Nature of Ore Deposits."

These authorities group placer gravels into two classes, according to their position with reference to the deposit from which they were derived, and in part, also, according to the manner of the original process in which they are derived from the primary ore deposit:—

1. Residual gravels, *i.e.*, of local origin (eluvial gravels), and
2. Alluvial gravels, *i.e.*, formed by washing.

Residual gravels, the rarer of the two groups, and certainly the less extensive, are found in the immediate vicinity of the original ore deposits, and quite independent of water courses. They may occur on mountain slopes, plateaus, and sometimes on mountain summits. As they consist of the residual products produced by the weathering of the original ore-bearing material, they contain almost no foreign matter, and consist of a great uniformity of material when compared with gravels transported and sorted by water.

The foregoing remarks about residual gravels apply, in many respects, to what may be seen in the shallow alluvial deposits, not only at Waverley (Siberia), but in other parts of Western Australia.

The origin of these shallow alluvial deposits may have been somewhat as follows:—"The detrital material in these deposits is the work of air and rain. Changes of temperature undoubtedly played a strong part in the disintegration of the original primary ore deposits, and wind contributed to what sorting of fragments there is.

In this arid region, and under a tropical sky, the extreme difference of temperature between the day with its burning solar heat, and the quickly ensuing night with its tremendous radiation, must have caused an extensive crackling and disintegration of the primary deposits.

The wind starts up the *debris* thus formed, sweeps away the finer particles (much of which are now in the Deep Lead ground), and leaves the larger fragments and the heavier smaller pieces behind. Showers of rain wash the heavy ingredients downward along the gullies or spread them out in all directions on level ground."

Mr. Montgomery, the State Mining Engineer, refers to these shallow alluvial deposits:—"as occurring in flat gullies and depressions on the hill sides."

Lindgren, in his latest classification of "placers," depending on their occurrence, includes:—"gulch and creek gravels." These are the nearest approach to the

shallow alluvial deposits at Siberia, though the term "gravel" does not seem a happy one.

The occurrences at Siberia are really shallow surface detrital deposits of eluvial origin, *i.e.*, those deposits in which wind was a more potent agent than water, filling small and narrow depressions, creeks, and flats. Lindgren* refers to them "as wind-born placers, near the croppings of the West Australian gold veins," and includes them under the heading of "Eolian Deposits," which he describes as follows:—"Deposits concentrated by eolian agencies can, of course, be formed only in dry countries, where long subaerial decay has paved the way for the work of the dust storms; from the decomposed and crumbled outcrops of the lodes the winds blow away the lighter sand, leaving a mass of coarser detritus, which contains the gold."

Source of the gold:—There seems to be little doubt that the gold in these shallow surface eluvial deposits is of local origin, and was derived from the decomposition, disintegration, and general breaking-up of the lodes and veins in the zone which constitutes the Siberia Metalliferous Province.

Microscopic investigations clearly indicate that the fine-grained amphibolite pebbles in the alluvial ground at the "Gorge" are of local origin.

The innumerable pebbles of ironstone in the alluvial ground were originally derived from cappings of laterite, portions of which still remain, such as the ironstone (laterite) hill, 12 chains northeasterly from the Reward mine.

DETRITAL GOLD FILLING CRACKS IN LATERITE "BARS."

The Prospectors' gully, near its head, at a point 54 chains N. 10° W. of the townsite, is crossed by a very massive, dark brown, solid laterite, a couple of feet thick.

In some places the surface of this laterite is quite clean and smooth, in others it is covered by three to six inches of red ferruginous (iron-bearing) sand, on top of which are many redistributed pebbles of laterite about the size of a pea.

The laterite is much cracked and fissured, and the gold was caught in the cracks, fissures, and irregular surfaces as it was washed over the laterite "bar."

DEEP ALLUVIAL DEPOSITS (ELUVIAL).

Location and general description:—The Prospectors' shaft (No. 10, Plate II.), which is about the centre of the so-called Deep Lead ground, is situated a little more than one and three-quarter miles (actually 146 chains) N. 10° E. of the townsite of Waverley (Siberia)—see Plate I.

As the shallow alluvial deposits of Nuggety Gully and the Pearling ground are left, the floor of the made ground dips fairly rapidly from 20 to 45 feet below the surface. A sudden drop then takes place (a little west of the Prospectors' shaft) to the 100-foot level, as shown in the cross section in Plate II.

This sudden drop has been attributed to a possible fault, because in traversing westward from the workings at the 100-foot level, in No. 10 shaft, a steep polished or slickensided and striated wall—against which the so-called wash terminates—was met with.

Shafts 5, 9, 10, 15, 16, and 17 apparently bottom at depths of more than 80 feet.

* Rickard, T. A.: The Alluvial Deposits of Western Australia. Trans. Am. Inst. Min. Eng., vol. xxviii., p. 497. 1898.

* Lindgren, Waldemar: Mineral Deposits, p. 198, 1898.

The Deep Alluvial Deposits therefore, occupies a type of sunkland, bounded along its western wall by a fault. This sunkland, a miniature rift valley, or depression, has been filled with material such as that given in the description of cross sections through the Prospectors (No. 10) and Hamilton's (No. 9) shaft.

The eastern side of this depression or sunkland is not so well defined, and information from results obtained by sinking Woulfe and Party's (No. 18) shaft is necessary before any definite statement can be made.

A gradual rise in the floor of this sunkland trending in an easterly direction, is shown in the cross section, Plate II.

MECHANICAL AND CHEMICAL ORIGIN OF THE GOLD.

The gold in this Deep Lead is (a) of mechanical, and (b) of chemical origin.

(a) *Mechanically formed Gold.*—This gold is in the form of slugs and nuggets of pure gold or of quartz and gold, ranging from small pieces up to pieces weighing nearly two ounces. In all, 22 ounces of gold have been won.

The nuggets are found embedded in the so-called wash, generally within a few feet of the floor of the sunkland. An interesting sample of this so-called wash was shown to me. It came from the face of the workings at a depth of 104 feet in the Prospectors' shaft, and two nuggets of gold were picked out of it. One nugget weighed 22½ dwt., the other 2½ dwt.

This sample of wash consisted of 60 per cent. or more of pale yellowish, somewhat puggy clay, full of minute pebbles of ironstone (redistributed laterite) about twice the size of a pin's head; some larger pebbles of ironstone; a medium number of glassy transparent and evidently polished (aeolian or wind-worn) quartz grains, and occasional distinctly water-worn pebbles of quartz large enough to cover a sixpence.

While I was examining the underground workings in the Prospectors' shaft a nugget was unearthed a few inches above the bed rock at the point marked "a" in Figure 4. The material enclosing this nugget (which weighed 1½ oz.) was similar to that just described from a depth of 104 feet, but showed in addition—(1) small seams (one-eighth of an inch wide) of dark brown limonite, formed by secondary deposition of hydrated oxide of iron contained in circulating iron-bearing solutions, (2) large boulders of laterite, a foot or more through, and (3) great lumps of iron-stained glassy quartz, without any shape whatever.

The nuggets appear to be found in shallow depressions, "rolls," or corrugations—not more than a couple of feet deep, as shown in Figure 4—in the bed rock, which is a decided yellow compact clay.

Figure 4 gives an idea of the actual junction of the bed rock with the so-called "wash." It will be noted that the floor was in places—as at the point marked "b"—cracked and slightly fissured before the deposition of the "wash," which penetrates along these spaces into the bed rock.

The material at the bottom (104 feet) of the Prospectors' shaft is the nearest approach to "wash" on the field, and it appears that in order to contain gold the ground (*i.e.*, the wash) may be expected to be lithologically similar to that described from a depth

of 104 feet, and to show the following features or indications:—

- (a.) quite numerous small glassy quartz grains, evidently both wind and water-worn. About eight or nine of these grains could be placed on a sixpence.
- (b.) Innumerable minute grains of ironstone.
- (c.) Compact, gray to yellowish, "mealy," puggy clay, which forms the bulk of the wash, and
- (d.) Small ochreous patches—apparently rotten bed rock.

If this wash represents the most powerful state of concentration of the material in the Lead, it is but a poor attempt at natural separation of constituents. The sorting power of water must have been small, while aeolian agencies dominated. Wind may have blown the clayey material, the ironstone grains, and the quartz grains, into more or less still water. Torrential rains and flood waters later brought along the gold slugs, ironstone boulders, and quartz lumps, after which water movement brought about the present degree of concentration and sorting.

The material at the bottom (92 feet) of Hamilton's shaft (No. 9, Plate II.), is similar to that at the bottom of the Prospectors' shaft, but so far no nuggets have been found in it.

(b) *Chemically formed gold.*—A very noticeable feature is the presence of minute specks of gold impregnating the puggy clay and coating the minute ironstone pebbles in the wash surrounding the gold nuggets.

This gold is undoubtedly of secondary origin, and the prospectors informed me that it was confined to the vicinity of the nuggets.

It seems quite clear that, owing to the great age of this old alluvial ground, there was abundant opportunity for the gold of the nugget to pass into solution, probably in ferric salts, later to be precipitated in the interstices of the clay and on the surfaces of the ironstone pebbles under the influences of mass action and ferrous salts.

In Figure 3 an endeavour has been made to illustrate a nugget of gold with the secondarily precipitated gold surrounding it. The brightness of some of the nuggets suggests that gold has been redeposited on them; in other words, a kind of gilding process has taken place.

ECONOMIC POSSIBILITIES.

It is unfortunate that, so far, the mode of eluvial origin, by probable dominant wind and general solar action over water action, has not permitted a more perfect concentration of the gold nuggets, in consequence of which the present dead work that has to be carried out in search of slugs makes it tiresome for the prospectors and tends to damp the remarkable ardour which these gentlemen possess.

It has already been pointed out that the "rolls," corrugations, and depressions in the floor of the Lead are not of great dimensions. One would like to see more definite evidence of true gutters or water channels which would tend to promote the concentration of the gold.

If any such gutter exists in this extraordinary sunkland it should be easterly from the Prospectors' shaft—towards Woulfe and Party's (No. 18, Plate II.) shaft—with a trend somewhat east of north.

The chemical origin of some of the gold has already been referred to, but here again experience has shown

that this gold has been formed by solution of the nuggets and its redeposition within an inch or two of its host.

Had there been sufficient gold, sufficient solution, and enough water to bring about a more uniform impregnation of the so-called wash, so that the material could be bulked for a satisfactory and payable yield, these Deep Lead deposits would have been an important asset to the State. So far, there is no indication of this being the case, though a trial crushing would give valuable information in justice to the prospectors.

It is remarkable that the floor of the Lead should be the only auriferous (*i.e.*, gold-bearing) horizon discovered up to date. If other horizons had been proved, more hope would be offered to prospectors, who must find it very disheartening to sink nearly 100 feet before gold is likely to be found.

Classification of the Deposit.—An examination of Figures I. and II. gives a good idea of the nature of the material which collected in this sunkland or depressed area, and filled the ancient valley to a depth of more than 100 feet in its deepest part. The only evidence of any considerable water action is right on the floor of the sunkland, where the nuggets are found.

The following features were revealed from a study of the deposit:—

1. The remarkable abundance of puggy and clayey material of various colours, reminding one of the wind-borne dust deposits (aeolian) of China.
2. The pebbly ironstone bands.
3. The absence of classification of material, such as would result from a powerful sorting action by water.
4. The wind-worn sand grains.
5. The subordinate water-worn pebbles of quartz.
6. The occurrence within a few inches of one another of huge lumps of ironstone (one foot through), of quartz (9 inches through), and of nuggets of gold, surrounded by so much puggy material, minute quartz and ironstone grains.
7. The evidence of chemical action in the deep ground, as shown by the presence of seams of ironstone and chemically deposited specks of gold.
8. The powerful covering of "cement."

The majority of the foregoing features indicate that the infilling of this sunkland was largely brought about by dominant wind, with subordinate water action, under the desert-like conditions which prevailed in this region in past geological times.

The products of decomposition caused by the rotting of the fine-grained greenstones of this area might easily, when intermittently soaked with water, produce the puggy clays which are so commonly met with.

Atmospheric erosion went on for untold ages, and the products were continually being blown and washed into this sunkland. There was no compensating effect, for there is no evidence to show that the ancient topography, or, in other words, the surface features of the country, allowed the waste products to be carried into an ocean or other water area to form sediments.

The so-called alluvial ground is really the deep placer of a country more or less destitute of continuous running water.

These deposits owe their origin to the combined action of weathering by various atmospheric agencies, and insolation (sun-heating) on the surrounding country—especially the lodes, veins, and shoots of the Metalliferous Province—and the transference of these products by the dominant action of wind, with subordinate water action, into the deep sunkland. The corrugations and small depressions in the floor helped to collect and concentrate the gold nuggets.

It has been stated that the shallow alluvial may be referred to Beck-Weed's "Residual gravels of Eluvial origin." The so-called "Deep Lead" at Siberia is really analogous in origin, only much older, and consisting of detrital material of Eluvial origin, in which there has been an attempt at sorting by water.

This is the first time I have become acquainted with a Deep Eluvial deposit, which may be legally defined as a Deep Lead.

Legal Interpretation.—The Mining Act, 1904, section 3, defines "Alluvial," when applied to gold, as:—"Any earth containing or supposed to contain gold and not being a lode, dyke, reef, or vein." "Deep Lead" is not defined by the Mining Act, 1904, but by the Mining Development Act, 1902, Section 3, it means "an ancient water-course or gutter below the surface of the earth containing alluvial deposits at a depth of not less than 50 feet from such surface." The area marked "Deep Ground" on Plate II., must, therefore, come under the heading of "Deep Lead," as defined by the Mining Development Act, 1902, Section 3.

Source of the Gold.—There is abundant evidence to show that the source of the gold is not only local but was probably derived from the country between the Deep Lead and the townsite.

It is more than likely that much of the gold came from lodes, veins, and shoots in the metalliferous province which extends for three miles southwesterly through Christie's ground.

The following facts support these contentions:—

1. The greenstone pebbles obtained from the "made ground" in Hamilton's shaft (No. 9) have been proved by microscopic investigation to be the same as the greenstone from Dewey's shaft and Christie's ground, near the road to the battery.
2. Pieces of pale gray talcose schist found in the so-called wash at the bottom (101 feet) of the Prospectors' shaft are identical with and, therefore, lithologically the same as the schist from the metalliferous province.
3. The metalliferous province strikes under the Deep Lead.
4. There is no reason for believing the quartz lumps in the so-called wash to be different from the quartz veins of the surrounding district.
5. The vein origin of some of the gold, as indicated by the gold-quartz nuggets found in the wash from the Prospectors' shaft.

It is, therefore, reasonable to suggest that the gold in this deposit has been derived over long periods of time by the denudation and breaking-up of the surrounding country—which was at one time considerably higher than it is now—and its contained lodes, veins, and, perhaps, reefs; especially those situated within the metalliferous province. The process was, no doubt, long continued. The large masses of quartz,

the ironstone boulders, and the gold nuggets may have been rolled into this sunken area by heavy flood waters.

DESCRIPTIONS OF CROSS SECTIONS THROUGH HAMILTON'S (No. 9), AND THE PROSPECTORS' (No. 10) SHAFT.

These two shafts are the deepest at present being worked at the Deep Lead, and the Prospectors' shaft is the only one from which gold nuggets are being won. Both shafts are situated in the deepest part of the ground—so far as is known.

From discussions with Mr. Hamilton and Mr. McParlin, and examination of the material they showed me, I was able to draw a rough and approximate—though tentative—diagram, showing the nature of the rock material encountered in sinking these shafts.

A study of the cross sections indicated in Figures 1 and 2 will, because the shafts are in the deepest part of the ground, give a fair idea of the nature of the material filling this sunkenland or old, one-sided, rift valley.

Hamilton's shaft (No. 9 on Plate II.), is 92 feet deep—measured from the grass roots. The following table, together with the cross section in Figure 1, indicates the order and nature of the material passed through when sinking this shaft.

No. in fig. 1.	Nature of material.	ft. in.
1.	Soil and subsoil	5 0
2.	"Cement"—rubbly at bottom	10 0
3.	Ironstone with pebbles of fine-grained amphibolite	3 6
4.	Puggy clay	2 0
5.	Variegated puggy clays—pale green, reddish brown, in places "mealy" and strongly ironstained	49 6
6.	Green waxy chrome-bearing pug of halloysitic nature	0 6
7.	Mottled white puggy rock with yellowish-brown ferruginous patches	20 6
8.	Yellow ochreous clay rock with small quartz grains, and veins of secondarily deposited dark brown limonite. This material carries the gold nuggets, and is the same as that found at the bottom of the Prospectors' shaft.	1 0
Total depth		92 0
9.	Ochreous yellow and slightly reddish compact clay rock. This is bed rock or "bottom."	

McParlin and Banker's (Prospectors') shaft (No. 10, Pl. II.), is 101 feet deep. The cross section shown in Figure 2 gives a fair idea of the nature of the material passed through when sinking this shaft.

No. in fig. 2.	Nature of material.	ft. in.
1.	Soil	1 0
2.	"Cement"	20 0
3.	Variegated puggy clays, pale green, reddish brown, in places "mealy" and strongly ironstained	40 0
4.	Pebbly ironstone	6 0
5.	Pug of various colours—brown, green, and red	5 0
6.	Mottled white puggy rock with yellowish brown ferruginous patches	26 0
7.	Pale gray puggy clay with innumerable small rounded pebbles of ironstone, several times the size of a pin's head, containing small quartz grains, and showing in places minute specks of gold	3 0
Total depth		101 0

RESULTS OF EXAMINATION OF MATERIAL FROM SHAFTS 1—18 ON DEEP LEAD GROUND—PLATE II.

The shafts examined by me on April 22, are shown on Plate II., and marked 1 to 18. The results of my investigations are as follow:—

No. of shaft.	Description.
1.	Bennett and Strickland: Depth 48 feet. Doubtful if on bottom, but probably near it. Material above 48 feet is ferruginous clay of detrital origin, containing ironstone pebbles about the size of a pea. There was little or no quartz.
2.	Correll and G. Fletcher: Depth 60 feet. The bottom of this shaft is in white and brown ferruginous clay—evidently not bed rock, which will probably be reached in less than another 20 feet.
3.	Cullen and Sons: Depth 36 feet. Clearly made ground.
4.	Ducrow and Party: Depth 50 feet. Green common opal was found at this depth and taken to be bed rock. There is no geologic reason why this should be bed rock.
5.	Twenty feet from No. 4. An old shaft of McLellans—supposed to be 80 feet deep. There is no information about this shaft.
6.	Wyatt and Party: Depth 54 feet. This is not bottom. No sand was visible in the made ground.
7.	Calanchini and Rufin: Depth 20 feet. In pebbly ironstone, clearly made ground. This shaft is in good looking material, and in a favourable position. It will probably not be bottomed before 70 feet. Crosscutting easterly when bottom is reached may be advisable.
8.	Ducrow and Party (now Brown Bros.): Depth 46 feet. Green "mealy" clayey material with green common opal. Doubtful if this is bed rock. Sinking might be continued.
9.	Already described.
10.	Already described.
11.	Brown and Party: Depth 35 feet. In yellowish brown clay with "mealy" white clayey patches. It is either bed rock or close to it.
12.	Moran and Party: Shallow shaft not more than 10 feet deep, and consisting largely of a breccia of cement material.
13.	Crane and Party: Bottomed in bed rock at about 32 feet.
14.	Evers and Party: This shaft is about 50 feet deep, and bed rock was apparently encountered at about 43 feet.
15.	McKay and Munroe: Depth 50 feet. In pebbly ironstone. From its position this shaft is in deep ground, and should not be bottomed before 75 feet or so. An easterly crosscut from this shaft might be advisable.
16.	Hamilton and Party's first shaft: Depth 93 feet. Almost surely in bottom.
17.	McLellan and Smythe's old No. 2 shaft. I could not get satisfactory material from this old shaft, which has not been worked for some time. Its position suggests that bed rock would be met with in the vicinity of 90 feet.
18.	Woulfe and Party: This shaft is shallow, and has been sunk about 20 feet in undoubted made ground—very ferruginous and pebbly. It is important to learn at what depth this shaft bottoms, and the nature of the material overlying the bed rock.

PETROGRAPHICAL AND METALLIFEROUS PROVINCES BETWEEN KALGOORLIE AND SIBERIA.

It is now generally recognised that certain districts, which show within themselves a typical set of rocks characterised by a marked "kinship" or "consanguinity," may be termed petrographical (*i.e.*, rock) provinces.

These provinces are due to the relative concentration of the commoner rock-forming minerals in certain parts of the earth's crust.

One cannot help accepting the same theory for the less common elements, *e.g.*, gold, and consequently, those regions characterised by special combinations or amounts of the rarer, especially commercially valuable, metals, have been termed "metalliferous provinces."

This subject of petrographical and metalliferous provinces has, as a result of observation made during my trip to Siberia (Waverley), developed considerable economic significance, and a few remarks thereon may be of some assistance to those engaged in the search for gold.

Some years ago, when examining the Ora Banda goldfield, I came to the conclusion that a petrographical province existed between Kalgoorlie and Ora Banda. The succession of rocks in this province is at Kalgoorlie, taking them from east to west, (a) quartz dolerite amphibolite, which at its southern end contains the famous lodes of the Golden Mile, (b) porphyrite, and (c) gabbro-amphibolite, which passes through the Abattoirs.

This series of rocks extends northwesterly to Ora Banda, where the succession is quite, though not absolutely, similar.

Within this petrographical province we have, at Ora Banda, certain distinct metalliferous (auriferous), *i.e.*, gold-bearing provinces, *e.g.*, (a) the porphyrite (locally termed "native cat" rock), which contains lodes striking, roughly, westsouthwest. These lodes were formed in exactly the same way as the Kalgoorlie lodes, *viz.*, by replacement or change of rock matter into ore along sheared channels. The rock replaced at Ora Banda was porphyrite, not as at Kalgoorlie—quartz dolerite; (b) a narrow band of schisted country on the southern fall of the gabbro-amphibolite range, which is well seen to the north of the old Ora Banda battery. This line of country also contains fractures and fissures which were later, in places, filled with quartz containing gold, *e.g.*, Lady Evelyn, Dark Horse, and the recently discovered fissure vein on Mr. J. Argus's Adelong P.A. (old Ora Banda), and (c) a schisted zone on the north side of the same range, where the gabbro-amphibolite has been broken down, crushed, and drawn out into talc-chlorite schists by powerful earth forces.

The lenticular spaces between the foliation planes in these schists were, in places, filled with gold-bearing quartz. These deposits have been worked from time to time, and may well be termed foliation fissure veins.

It was noted that the gabbro-amphibolite portion, of what it is proposed to call the Kalgoorlie-Ora Banda Petrographical Province, which lies just north of the old Ora Banda battery, extends as far as the 58-mile peg, on the Siberia road. At this point it is at least a mile wide, and the gold won at "Christmas" has clearly been derived from auriferous veins filling fissures in the gabbro-amphibolite, or its schisted forms.

After passing the 58-mile peg, the Kalgoorlie-Ora Banda petrographic and metalliferous province is left, and a huge area of fine-grained amphibolite (a dense compact green rock made up of microscopic crystals of hornblende and some clear felspar) follows.

This is really another petrographical province which, at the 62-mile peg, contains a prominent quartz porphyry dyke, and at Waverley (Siberia), a well defined whitish felspar porphyry dyke.

This petrographical province contains within it a second metalliferous province, which it is proposed to term the Siberia Metalliferous Province. This province is characterised by the development of a well

schisted rock (consisting mainly of talc) associated with the felspar porphyry dyke just referred to.

The dyke may be well seen near Christie's shaft, at the top end of Nuggety gully, 65 chains N. 12° W. of the townsite, as shown on Plate I.

There appear to be two belts of talc schist in this metalliferous province, which is at least 10 chains wide and strikes N. 24° E. It appears to form not only the axis of the Siberia goldfield, but the main source of the gold found in the shallow as well as in the deep alluvial lead.

Strange to say, the strike of the Siberia metalliferous province is directly under the deep lead ground, and pieces of talc schist were identified in the "made ground," near the bottom (100 feet) of the Prospectors' shaft. Nuggety Gully, Prospectors' Gully, and Innamina Gully, all head from different portions of this metalliferous province.

It is quite possible that more gold will be found along the Siberia Metalliferous Province, which strikes N. 24° E., and is defined by the occurrence of talc schists in association with pale coloured felspar porphyry dykes; an association distinctly favourable to the occurrence of gold in Western Australia.

The third province did not concern me during this investigation. It is the Boorara-Broad Arrow Petrographic Province, with its associated metalliferous province. The strike of this petrographical province is approximately N. 37° W.; it consists of basic greenstones with which I am not acquainted, and is separated from the Kalgoorlie-Ora Banda petrographical province by a zone of barren sediments, which occupy the flat valley to the east of the "Golden Mile."

The three petrographical, together with their associated metalliferous provinces, are as follow:—(1) Kalgoorlie-Ora Banda, (2) Siberia, and (3) Boorara-Broad Arrow.

SUPERFICIAL SECONDARY ENRICHMENT AND THE EFFECT OF THE CHANGE IN SURFACE FEATURES IN THE SIBERIA REGION IN PAST GEOLOGICAL TIMES ON (1) THE ASPECT OF GOLD DISCOVERIES *in situ*, AND ON (2) THE GOLD IN THE SECONDARY DEPOSITS.

In any study of gold occurrences in Western Australia, it must be remembered that the surface of the country, as we now see it, is remarkably different to what it was during various periods in the history of the world. The surface may have been many hundreds of feet higher, and the gold that once existed in the overlying rock material is now found (1) in the alluvial and eluvial deposits, (2) in secondarily enriched shoots—some of which are just below the grass roots, or (3) in shoots at some depth beneath the present surface.

Ore shoots are bodies of mineral matter richer in valuable constituents than the enclosing material. They may be of varying size, continuity, and shape, and are the result of chemical and physical influences, such as the surface zones of the Siberia and Kalgoorlie-Ora Banda provinces have been subjected to. These bodies are known as "nests," bunches, or pockets, when of small dimensions; but the larger ones are called ore shoots, sometimes also ore-courses or pay streaks.

Secondary enrichment is directly connected with ore shoots. It is a very important matter in any study of Western Australian ore deposits. The influences to which these ore deposits have been exposed must have been constantly changing during the

period of time which elapsed since the ores were originally precipitated. No doubt this included the period during which erosion reduced this extensive area (including Siberia) to a flat surface near sea level, and elevated it again to its present height of 1,400 feet above sea level.

A state of chemical stability was probably never reached. Throughout the greater part of geological history, the ore deposits have been subjected to the influences of natural agencies, both from above and from below. An arid region of great antiquity like the goldfields of Western Australia, must have been inordinately susceptible to the mechanical disintegration and chemical alteration brought about by the combined action of the atmosphere, surface waters, changes in temperature, and perhaps various organic and inorganic materials contained in the air and water.

The result of these activities has been the formation of ore shoots, or the modification of previous ore shoots by accretion, or by diminution of mineral contents.

Profound changes in the physical and chemical conditions of the ore deposits of Western Australia have naturally arisen through:—(1) the oxidation and hydration of some constituents, (2) the formation of new chemical combinations, and (3) the leaching of certain ingredients and their deposition below.

There was nothing in my recent investigations to show that these remarks do not apply to the Siberia and Ora Banda metalliferous provinces.

There has undoubtedly been a steady removal of the superficial parts of the veins and lodes. In consequence, the lower portions of the veins, which have been enriched at or below the ground-water level, have undergone a relative elevation by being brought nearer the surface. Continued erosion finally exposed the enriched shoots of gold at the surface; and in some localities, as at Dark Horse (and, no doubt, at Siberia), they have been found a few inches beneath the soil.

The rich ore shown to me by Mr. Argus, from his Adelong P.A. (old Ora Banda), probably comes under this heading. The sample consisted of shattered and jointed fissure vein quartz, containing beautiful gold—in part crystallised—that seemed to have been deposited along the joint planes and in spaces caused by shattering. This is exactly the sort of material that would be likely to feed alluvial and eluvial ground, such as that described in this report.

I was informed that 20oz. of gold were recovered from a few pounds weight of stone, in addition to £700 worth already taken from the same ground.

There is little doubt that many shoots still exist in the Siberia and Ora Banda metalliferous provinces. It is possible that during the wearing-down of this region, a great many shoots of auriferous ore were removed, and their contents strewn over the surface, and in part concentrated in eluvial or perhaps alluvial ground.

Many rich shoots formed by secondary enrichment must still exist in this tableland area—strewn with the wreckage of geological time.

The new idea of a Chrysogenetic Epoch for gold origin in Western Australia strengthens the concep-

tion that many auriferous deposits yet await discovery, for, according to this idea, the gold bearing solutions rose in bulk over enormous areas, during one or more periods. These auriferous solutions were probably given off from the great granitic hearth which lies beneath all the rock formations; and wherever the gold solutions found lodgment, rich veins, shoots, or lodes may be expected—and these at not too infrequent intervals.

CONCLUDING REMARKS.

In another part of this report, when dealing with the economic possibilities inferred from geological considerations the opinion was expressed, so far as the Deep Lead was concerned, that the eluvial mode of origin for this class of deposit did not admit of a concentration sufficient to promote anything like extreme optimism.

Nevertheless, the ground requires further testing, and there is still a possibility of finding a gutter in a direction easterly from the Prospectors' shaft, where greater concentration of gold nuggets may have taken place.

Close search should also be made easterly from Hamilton shaft (No. 10). If the ground in Calanchini and Rufin's shaft (No. 7), is "deep," *i.e.*, over 70 feet (which it probably will be), prospects may be brighter in that direction, and a westerly crosscut should be put in. The sinking of Woulfe and Party's shaft (No. 18) will give valuable information about the eastern side of this sunkland.

Another point is that the Siberia metalliferous province strikes directly under this Deep Lead ground, and reasonable attempts should be made to search for shoots, or lodes, or veins, beneath the eluvial ground, because the gold nuggets may be more local in origin than imagined. Drives would have to be put in about S. 70° E. I have seen good results from similar advice in other localities.

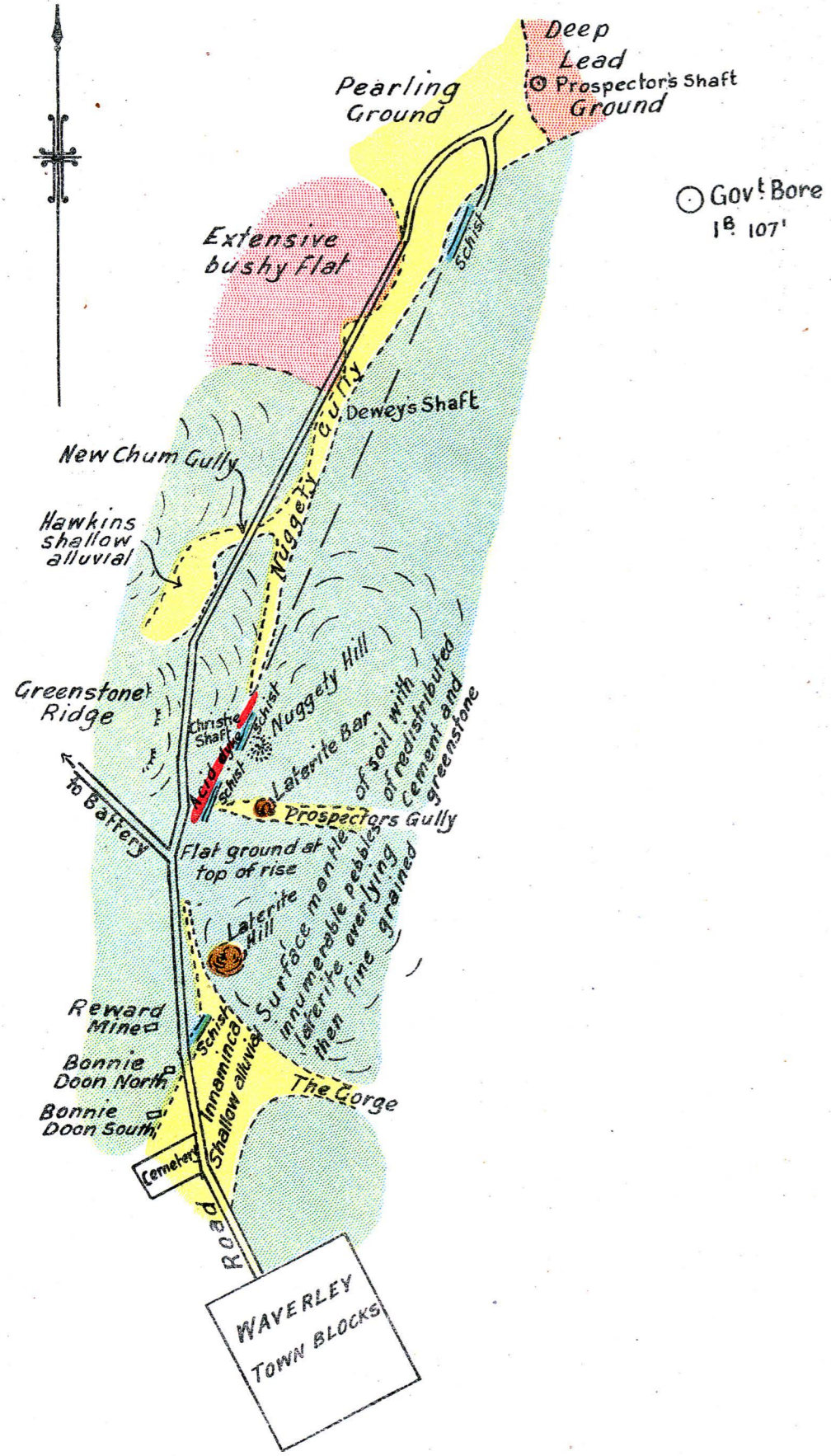
The shallow alluvial ground of this district should still offer possibilities, quite as good as those of the deep ground.

Rich shoots, just beneath the surface, formed by the processes of secondary enrichment already described, might be discovered at any time by careful loaming.

Care should be taken, so far as the "cement" near the surface is concerned, because it occurs (1) overlying the bed rock directly, (2) on the floor of the shallow alluvial (eluvial) ground, and (3) just underneath the soil in the deep eluvial ground, where it may form "false" bottoms.

Perfect loaming may often be necessary before rich discoveries are made.

This report has been made somewhat lengthy, with a special view to creating an interest in the search for gold in this remarkably auriferous country for, in my opinion, Western Australia, in all probability, contains much more gold than has yet been discovered. Moreover, as a result of the extraordinary vicissitudes through which the goldfields areas have passed in past geologic times, the metalliferous provinces (three only of which have been briefly referred to) lend themselves to the occurrence of auriferous deposits, which should yield valuable returns to the lucky discoverers.

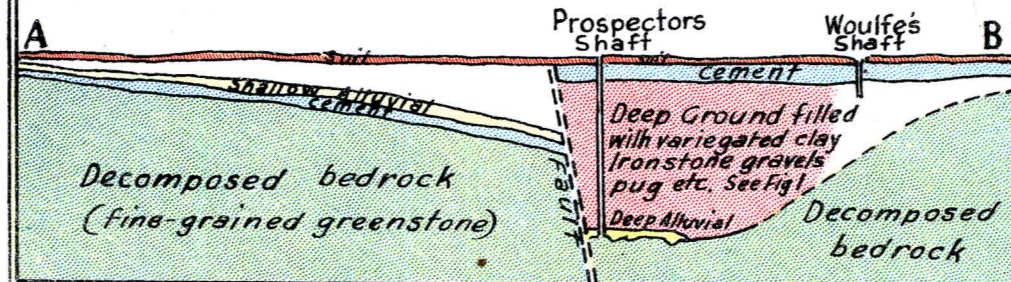
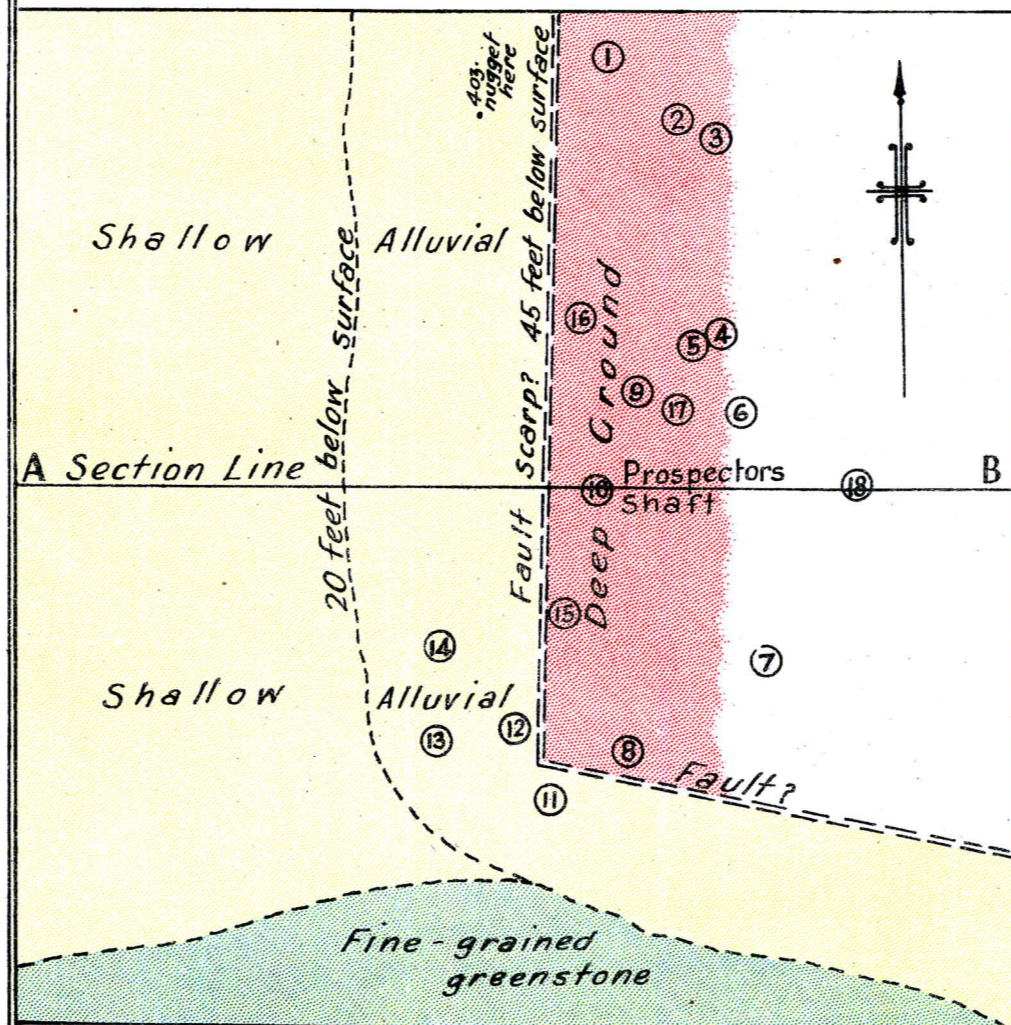


Geology of country between Waverley Townsite & Deep Lead

Scale 0 10 20 Chains

— Plan of Shafts —
— Deep Lead, Siberia —

Scale 0 150 300 feet



— Geologic Section through A-B —

Hor. Scale 0 150 300 feet
Vert. Scale 0 50 100 feet

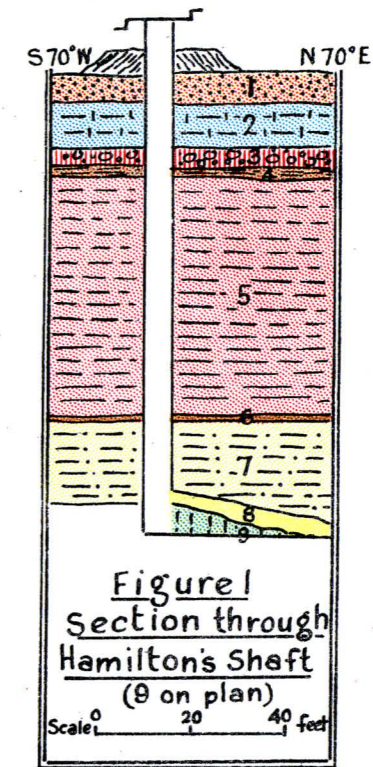


Figure 1
Section through
Hamilton's Shaft
(9 on plan)

Scale 0 20 40 feet

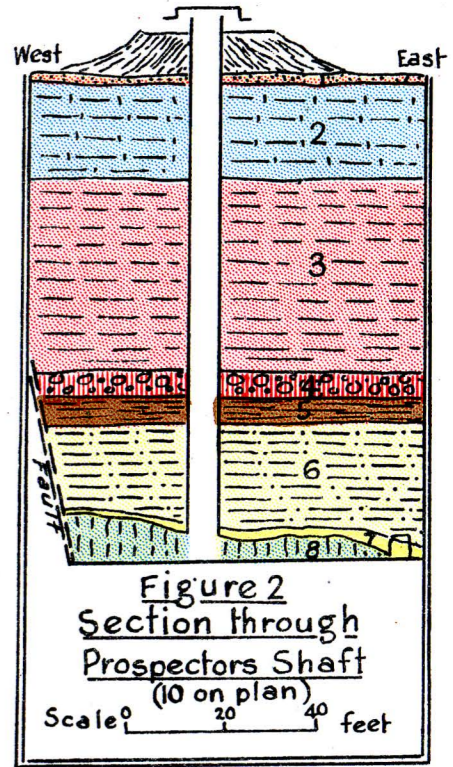


Figure 2
Section through
Prospectors Shaft
(10 on plan)

Scale 0 20 40 feet



Figure 3
(Natural Scale)

Nugget of gold surrounded by "mealy" puggy clay (so-called "wash") full of minute ironstone pebbles (black) and specks of gold.

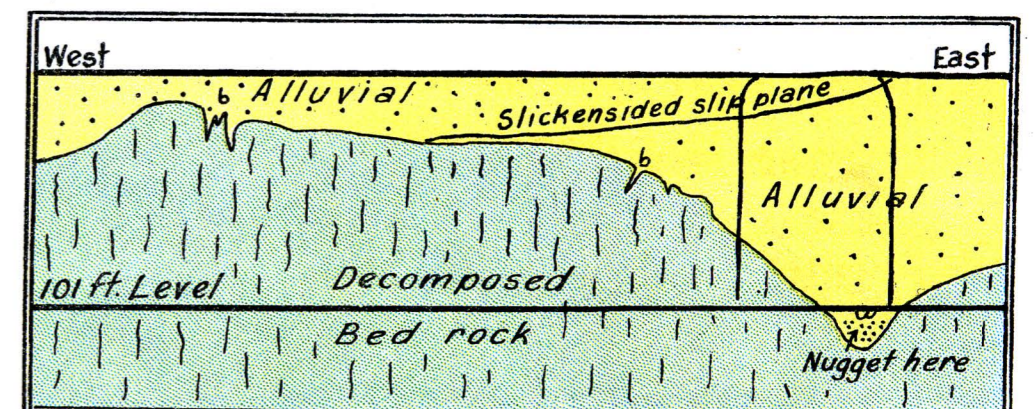


Figure 4
Section through 101ft. Level, Prospectors Shaft
— Showing profile of floor of Deep Lead —

Scale 0 3 6 feet.

8.—BORING AT THE SOUTH END, KALGOORLIE.

(C. O. G. LARCOMBE, D.Sc.)

During the last few years earnest attempts have been made by the Golden Ore Channel Company, Mr. Williams, and Dr. Laver to prospect the southern end of the "Golden Mile" by a series of bores. These bores were put down with a view to proving

				Angle in degrees.	Depth of bore.	Direction of bore.	Mark on Plan.
					ft. ins.		(Plate I.)
1.	Golden Ore Channel	1	...	Vertical	1,075	0	O.C. 1
2.	do.	2	...	79	1,348	6	O.C. 2
3.	do.	3	...	50	956	6	O.C. 3
4.	do.	4	...	45	550	0	O.C. 4
5.	do.	5	...	50	400	0	O.C. 5
6.	do.	6	...	50	313	6	O.C. 6
7.	do.	7	...	50	482	0	O.C. 7
8.	do.	8	...	55	438	0	O.C. 8
9.	Williams	1	...	Vertical	133	0	W. 1
10.	do.	2	...	Vertical	601	0	W. 2
11.	do.	3	...	60	763	0	W. 3
12.	do.	4	...	48	447	0	W. 4
13.	do.	5	...	Vertical	207	0	W. 5
14.	do.	6	...	50	650	0	W. 6
15.	Laver	1	...	47	386	0	L. 1
16.	do.	2	...	55	461	0	L. 2
17.	do.	3	...	70	365	0	L. 3
18.	do.	4	...	70	500	0	L. 4
					10,076	6	

Of the 18 bores put down I examined five only, viz., Golden Ore Channel No. 8, Williams No. 6, Laver's No. 2, No. 3, and No. 4.

The results of the examination of the core from these five bores may be briefly stated as follows:—

Golden Ore Channel No. 8, Lease 5177E:

This bore reached a total depth of 438 feet. The zone of oxidation was comparatively shallow. Solid greenstone made its appearance at 45 feet on the incline.

The core contained three (3) inherently different rock types, viz.:

1. Quartz dolerite amphibolite.
2. Quartz dolerite greenstone.
3. Keratophyre (albite porphyry).

1. *Quartz dolerite amphibolite:*—The bore was in this rock from the surface to 292 feet. The quartz dolerite amphibolite forms the country rock surrounding the "Golden Mile" in northerly, southerly, and westerly directions.

In hand specimens it is massive, dark green, and mottled with numerous plates of hornblends and areas of dull white altered felspar, in addition to small yellowish skeletal patches of leucoxene, which may be well seen after the core has been dipped in water.

An assay of this rock from 227 feet 6 inches yielded 14 grains of gold to the ton. With the exception of small grains of sulphide of iron there was not sufficient mineralisation, and not sufficient shearing to necessitate further assays of the quartz dolerite amphibolite.

2. *Quartz dolerite greenstone:*—From 292 feet to 366 feet the drill was in quartz dolerite greenstone, a rock belonging to the same family, and bearing remarkable affinities to the country rock of all the large lodes on the "Golden Mile." Although slight shearing and considerable alteration were in evidence,

the southerly extension of the lode system characteristic of the "Golden Mile."

Eighteen bore holes were put down. The total depth of boring was 10,076 feet 6 inches. The deepest hole was Golden Ore Channel No. 2, which reached a depth of 1,348 feet 6 inches.

I have made an inspection of the sites of all the bore holes, and drawn a plan (Plate I.) to indicate their relative positions. The following are details of the boring that has been carried out:—

there was not sufficient mineralisation to form a lode. Several assays were made with the following results:—

Depth of core and assay result—

293ft. 6in. to 295ft.—Nil.

316ft. to 316ft. 9in.—Nil.

328ft.—Traces.

339ft. to 340ft.—3 grains of gold per ton.

3. *Keratophyre (albite porphyry):*—At 366 feet the drill penetrated a dyke of keratophyre about 28 feet wide. It is a dense, compact, pale gray to white rock. An assay of the core taken from 374 feet yielded nothing.

The keratophyre belongs to the same series of dykes as those found on the "Golden Mile." In an easterly direction the drill passed into strongly chloritised quartz dolerite amphibolite, so that the limit of possibility of finding lodes has not been reached in this direction. An assay of rock from 437 feet yielded traces of gold.

The geological map (Plate II., G.S.W.A., Bull. 42) shows a porphyrite area (which is closely associated with and is of the same age as the albite porphyry) about 1,200 feet to the eastward of Lease 5177E. Until the bore enters this solid mass of porphyrite all avenues of exploitation have not been exhausted.

Figure 1 is a diagrammatic representation of the nature and relative positions of the different rocks met with in this bore, as well as the depths from which the core was taken for assay.

Golden Ore Channel No. 8 Bore.

Lease 5177E, Kalgoorlie.

Geological Section of Core.

Williams No. 6 Bore, Leases 5177E and 5178E:

This bore was put down to a depth of 650 feet at an angle of 50 degrees from the horizontal. It passed through three varieties of rock, viz., quartz dolerite amphibolite, quartz dolerite greenstone, and

bleached quartz dolerite greenstone. No keratophyre was met with. A noticeable feature in this bore was the continual and repeated passage from quartz dolerite amphibolite to quartz dolerite greenstone. A reasonable explanation for this feature may be sought in the direction the bore took, viz., S. 270° E., a direction very nearly parallel to (a) the strike of the lode formations on the "Golden Mile," and to (b) the irregular contact between these two rocks.

It is evident that the western edge of the quartz dolerite greenstone, where it contacts with and gradually merges into the quartz dolerite amphibolite, forms an area in which extreme alteration has taken place.

At a depth of 532 feet the rock was extremely altered, bleached, carbonated, and silicified. Micropegmatitic textures were strongly in evidence, and the rock contained patches and veinlets of quartz, plagioclase, carbonates, iron pyrites, and pyrrhotite. The alteration at this point (532 feet) was very intense—quite as great as any alteration in the rocks on the "Golden Mile."

Rock of the nature of that found in this bore at depths over 500 feet could, provided it were in the track of gold-bearing solutions, make lode stuff.

In view of these facts no less than 22 assays were made. The highest result was eight grains per ton at a depth of 633 feet. Sixteen assays yielded nothing.

Figure 2 is a geological section of this bore. The section has been drawn vertically because the angle of the depression was 50 degrees, and the direction of drilling S. 27° E., so that the section is more nearly longitudinal than cross. Any attempt to draw a cross section may only have given rise to misleading impressions.

Laver's No. 2 Bore, Lease 5310E, Kalgoorlie:

This bore reached a depth of 461 feet. It was put down at an angle of 55 degrees in an easterly direction.

The core contained four kinds of rock material, viz.:

1. Material from the zone of weathering:
 - (a) Ferruginous clays.
 - (b) Carbonaceous rock.
2. Quartz dolerite greenstone.
3. Albite porphyry (keratophyre).

1. *Material from the zone of weathering*:—The zone of weathering in this bore continued to a considerable depth, viz., 240 feet on the incline. The little core obtained to 191 feet consisted of iron-stained clays. Between depths of 191 feet and 240 feet the bore passed through 49 feet of blackish-brown carbonaceous material.

2. *Quartz dolerite greenstone*:—This rock forms a highly altered zone—26 feet wide—between the carbonaceous rock on the west and the albite porphyry on the east. This zone of quartz dolerite greenstone is as extremely changed as any of the country rock found on the "Golden Mile." Its original mineral constituents have been broken down and changed into carbonates, sericite, chlorite, secondary silica, and leucoxene. Notwithstanding this alteration, all assays yielded negative results.

It should be pointed out that very greatly altered quartz dolerite greenstone has been noted in the vicinity of carbonaceous and graphitic zones, as well as adjacent to the albite porphyry dyke (*e.g.*, in the

Ivanhoe mine) in the auriferous area of the "Golden Mile," though not near any lode formation at all.

The quartz dolerite greenstone from this bore lies between a strongly metamorphic zone of carbonaceous rock on the west and albite porphyry on the east, and this may account for the great alteration. To make ore, the quartz dolerite greenstone must lie in a shear or other track along which gold-bearing solutions passed.

3. *Albite porphyry (keratophyre)*:—The bore entered this rock at 266 feet, and at the bottom (461 feet) was still in it. The albite porphyry is grayish-white, dense, and exceedingly fine-grained. Past experience has indicated that this rock was not conducive to lode formations, and as the bore had passed through 195 feet of it, and was still in it, operations were ceased.

Each of the five assays of core taken from this bore yielded nothing on assaying for gold and silver.

Figure 3 is a diagrammatic geological section indicating the nature and relative positions of the different rock types met with in this bore. The locations from which the core was taken for assay are shown by means of arrows.

Laver's No. 3 Bore, Lease 5310E (British Flag Lease), Kalgoorlie:

This bore was put down at an angle of 70 degrees, and reached a total depth of 365 feet. There was no core to 224 feet. The zone of weathering was very deep. The first fresh unaltered greenstone was met with at 311 feet.

This bore passed through 87 feet of rotten dark carbonaceous material between depths of 224 and 311 feet. From 311 feet to 354 feet the drill was in a highly altered quartz dolerite greenstone which, though by no means highly mineralised, showed evidence of extreme alteration; in fact nearly all the quartz of the original quartz dolerite greenstone had practically disappeared through processes of absorption—mainly carbonation. There was not sufficient evidence of shearing or mineralisation to warrant assays being made of these 43 feet of rock. At 354 feet the drill entered a creamy white albite porphyry (keratophyre) dyke rock, in which it continued to 365 feet. The highest assay was 10 grains of gold per ton from core taken between 310 feet and 311 feet.

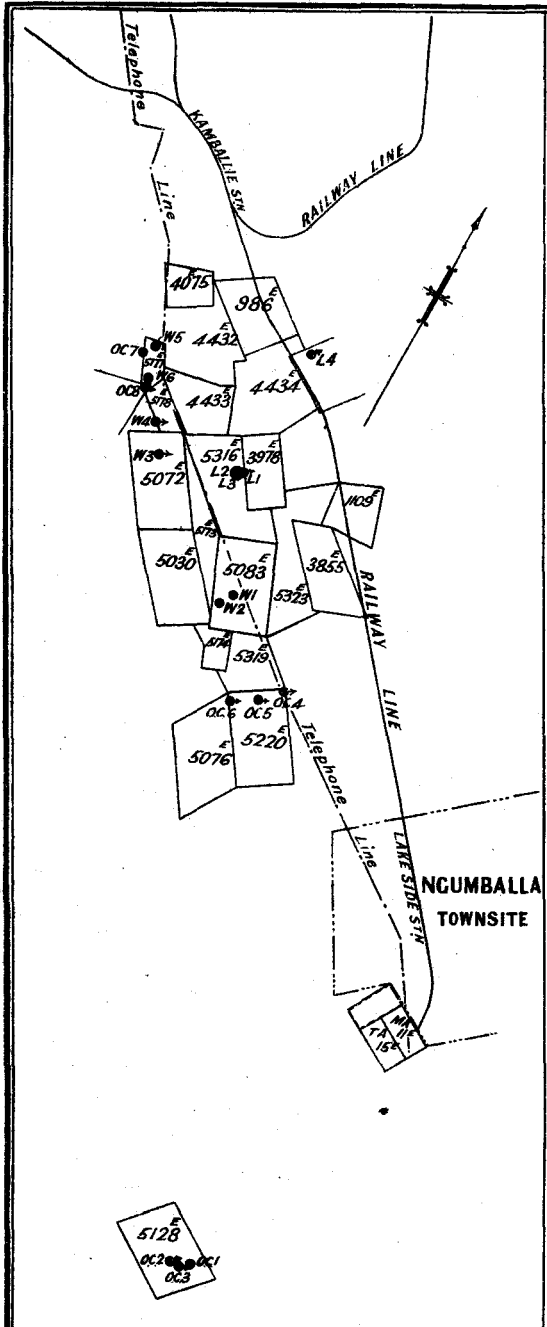
Figure 4 is a geological section through this bore.

Laver's No. 4 Bore, Lease 5157E, Kalgoorlie:

This bore is of interest because (1) it is the most easterly bore of the 18 bores so far put down and is east of the Lakeside Railway Line, (2) it is entirely in fine-grained clayey sediments intruded by albite porphyry (keratophyre), and (3) it does not contain any quartz dolerite amphibolite or quartz dolerite greenstones so typical of many of the other bores.

It reached a total depth of 500 feet, but unfortunately did not core well, only 26 feet of core being saved. This bore evidently started in sediments, as shown by the ashgray shaly rock from 167 feet. Apparently albite porphyry existed between 167 feet and 300 feet.

The samples from this bore are important, because they throw much light on the nature of the sediments of the Kalgoorlie series. A notable feature is their comparatively non-siliceous character, and the abundance of clays, silts, and greywackes in which the fel-



BORES AT SOUTH END

— KALGOORLIE —
 0 10 20 30 40
 — Scale of Chains —

Golden Ore Channel Bores marked O.C.
 Williams " " W.
 Laver " " L.



W. H. Mackenzie
 Government Geologist

SECTION SHOWING ROCK FORMATIONS — PASSED THROUGH IN — WILLIAMS N°6 BORE — Depressed at an angle of 50° — LEASES 5177 AND 5178 —

0 25 50 75 100
 — Scale of feet —

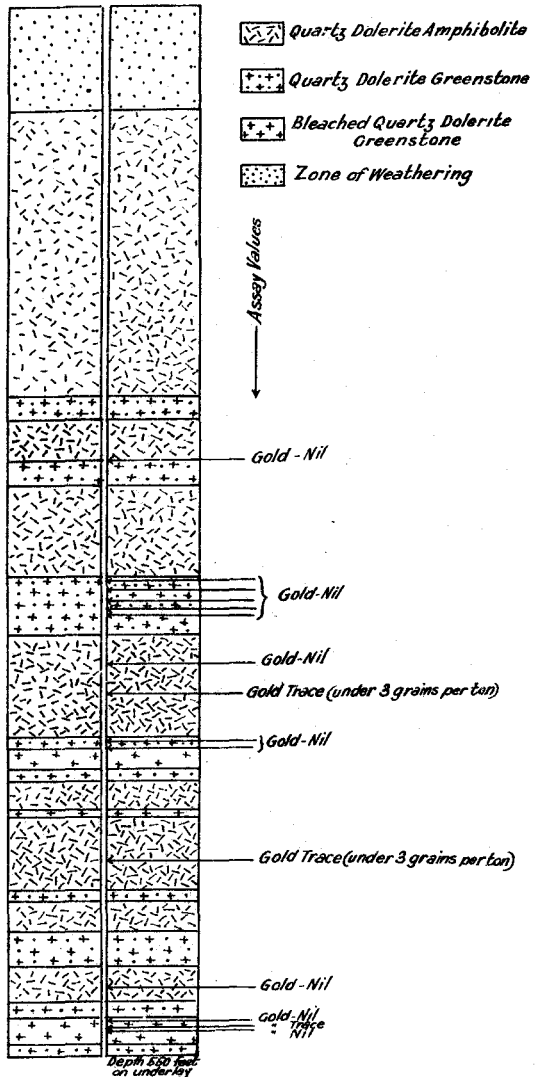


Figure 2.

GOLDEN ORE CHANNEL N° 8 BORE — LEASE 5177 —

0 50 100 150 200
 — Scale of feet —

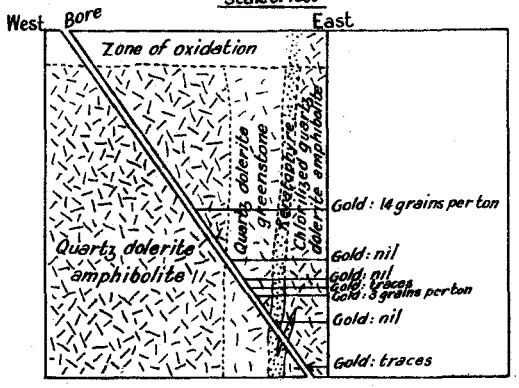


Figure 1.

SECTION OF — DR LAVER'S N°3 BORE — SOUTH END KALGOORLIE —

0 25 50 75 100
 — Scale of feet —

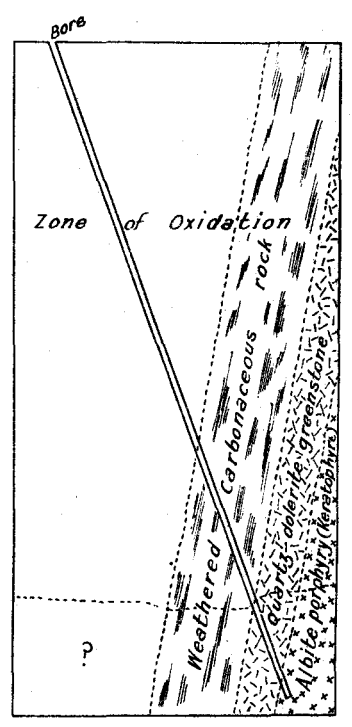


Figure 4.

SECTION OF — DR LAVER'S N°2 BORE — LEASE 5310 —

0 50 100 150 200
 — Scale of feet —

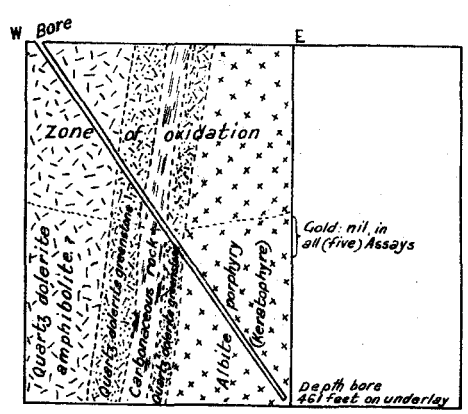


Figure 3.

spars are quite distinct and bear little evidence of attrition.

In view of the fact that the boring was carried out in a distinctly new locality, and in rocks hitherto not met with, nearly the whole of the 26 feet of core was assayed. Five assays were made and the highest return was a trace of gold.

9.—ON THE AGE AND CONTENTS OF LIMESTONE SPECIMENS FROM THE NEGRI SERIES, KIMBERLEY DIVISION.

(FREDERICK CHAPMAN, A.L.S., Palæontologist,
The National Museum, Melbourne.)

The limestone rocks which have been handed to me by Mr. D. J. Mahoney, M.Sc.,* for examination are remarkably well preserved. On their weathered surfaces they show the primitive molluscan and plant fossils standing out in high relief.

The fine mud composing the bulk of the limestone is still calcareous, but has been invariably crystallised, so that the original minute constituents have been obliterated. The coarser particles and the larger organisms, however, have been remarkably well preserved; and this may be due to the presence of a certain amount of phosphoric acid in the rock, which, as in modern deposits, seems to act as a reagent in preventing extreme alteration of the original substance of the shell or other structures representing the hard parts of the organism when living.

Both plant and animal remains occur abundantly in these limestones. Amongst the plants is a peculiar form of blue-green seaweed, which makes rounded ball-like masses, similar to those forming at the present day in the lakes of the Yellowstone Park. Dr. C. D. Walcott has found similar bodies making up great masses in the Middle Cambrian rocks of British Columbia: these he refers to *Sphaerocodium*, *Girvanella*, another pellet-making seaweed, may be also present; this particular genus is also found in the Upper Cambrian of South Australia.

The most abundant of the animal remains is *Salterella*, a conical shell about three-quarters of an inch in length. The thick shell, with the enclosed animal, was probably highly phosphatic in its original living condition, as seems to be proved by the comparatively high phosphoric acid contents of the *Salterella* limestones, wherever found. Thus the South Australian deposits are probably due to this cause, as well as those of New Brunswick and Northern Europe.

Trilobites are represented in these rocks by fragmentary pieces of their carapaces. Foord and others have previously recorded the Genus *Olenellus* from these or similar beds, which fossil has lately been referred to the Upper Cambrian genus *Redlichia*. Other crustacean remains are Ostracoda, which are probably represented by at least two genera.

Radiolaria, of the more primitive types known as *Spumellariana*, or rounded forms, are seen in some abundance. They are globular, and have a distinct lattice structure on the outer envelope, as well as showing short, blunt spines arranged about the tiny siliceous sphere.

Amongst other interesting organisms there are the remains of what appear to be Foraminifera, and

several kinds seem to be here represented. They are rather obscure in structure, but a careful study of them under high powers will no doubt reveal their affinities. Some are adherent to the shells of *Salterella*, whilst others are free and consist of an elongated sandy tube.

From the foregoing fossil remains we may certainly ascribe the limestones of this district to the Upper Cambrian. In its faunal aspect it is fairly comparable to the oldest limestones of South Australia. At the same time it shows certain affinities to farther removed localities, for *Salterella* is abundant in Canada and other parts of North America.

That these limestone rocks were deposited mainly in shallow water is seen in the nature of the component fossil types, as well as in the associated rock structures.

Hardman, in his description of the limestones from the Ord River, states that the limestones are "interbedded with red shales, marls and sandstones, the former of which contain occasionally layers of gypsum, together with traces of rock-salt." This is further corroborative evidence of not only shallow marine conditions, but even of terrestrial and base-levelled country, where such lagoon deposits would naturally have been formed.

LOCALITY LIST OF THE FOSSILS.

ORD RIVER STATION, EAST KIMBERLEY—

Sphaerocodium sp.
? *Girvanella* sp.
? Encrusting Foraminifera.
Salterella hardmani.

Ostracoda (probably several genera).

KELLY'S CREEK, NEAR ORD RIVER, EAST KIMBERLEY—

? Foraminifera (encrusting).
Radiolaria.
Archaeocyathina.
Salterella hardmani.
Ostracoda.

BOTTLE TREE CROSSING, NEAR TEXAS STATION, ORD RIVER, EAST KIMBERLEY—

? *Stromatoporoid*.
Salterella.
Trilobite remains, indet.
Ostracoda.

SUGAR SPRINGS, EAST KIMBERLEY—

Limestone re-crystallised.

Analysis (No. 691) of Limestone, Bottle Tree Crossing, Ord River, near Texas Station, Kimberley Division, Western Australia, made in the Laboratory of the Geological Survey of Victoria under the direction of Mr. J. C. Watson.

	%
SiO ₂	15.76
Al ₂ O ₃	3.92
Fe ₂ O ₃	2.00
FeO	n.d.
MgO	1.68
CaO	41.68
Na ₂ O	n.d.
K ₂ O	n.d.
Loss on ignition (H ₂ O) co. ...	33.86
H ₂ O	0.71
TiO ₂	strong trace
T ₂ O ₃	0.13
MnO	present (n.d.)
	99.74
Sp. Gr.	2.60
Analyst	F. F. Field.

Ether extraction gave 0.008 per cent. oily residue. Sample too small to confirm the presence of mineral oil.

* Of the Geological Survey of Victoria, who visited the Kimberley Division.

PETROLOGICAL WORK.

(C. O. G. LARCOMBE, D.Sc.)

During the year 1923 the time of the Acting Petrologist, Dr. C. O. G. Lacombe, has been engaged on work connected with:—

- A. Reports and determinations for departmental requirements as well as for the general public.
- B. A special investigation and report on the mode of occurrence and origin of the gold in the Deep Lead at Siberia.
- C. The requirements of the mineral display at the British Empire Exhibition at Wembley Park in London.
- D. The petrography of Youanmi.
- E. The results of the boring at the South End of the Golden Mile at Kalgoorlie.

The following are some of the more important results of the petrologist's investigations.

Notes on certain Bore Cores from East Kimberley:

The samples submitted from Okes Durack bore represent rock formations between depths of seven feet and 504 feet from the surface. They are all of sedimentary origin and do not contain any igneous or other matter which would be detrimental to the occurrence of oil. Generally speaking the rocks between the depths of seven feet and 68 feet consist of argillaceous limestones, grading in places into calcareous marls. From 68 feet to 225 feet the rocks are ferruginous arenaceous shales. These pass at 267 feet into ferruginous mudstone, which continues to a depth of 504 feet. For rocks of so great an age they are comparatively free from evidences of great disturbances or pressure. The small amount of quartz sand in this thickness of sediments is remarkable, and when it does occur, as in the limestone between 62 and 66 feet and in the ferruginous shales between 68 and 225 feet, it is very small, the quartz grains seldom exceeding 110th of a millimetre in diameter. The general appearance, physical features, lithological, microscopical and other characters of these rocks suggest that the materials from which they were formed originally were deposited in deep seas far from the shore.

Rock from North of Okes' Find, Kimberley Division:

This most interesting rock proved to be an amygdaloidal melaphyre or altered basalt with amygdaloids of green chlorite and spherulitic growths of delessite. In hand specimens it is a pinkish-brown weathered rock crowded with amygdaloidal cavities filled with dark-green chloritic material in which is set not infrequently whitish to greenish vitreous to silky-lustred spherulites. In section the rock consists of a felted aggregate of clouded and slightly ironstained laths of plagioclase feldspar, around and between which are numerous idiomorphic prisms and granules of chloritised colourless monoclinic pyroxene. The pyroxene in the section examined was mainly of one generation; only one cleavable phenocryst was observed. The amygdaloidal cavities are filled with a dull green subresinous material which is optically a platy to scaly pale green chlorite. The microscopic whitish to pale greenish vitreous to silky spherulites have a slightly higher refractive index, and a somewhat stronger birifringence than the pale green chlorite. These spherulites are made up of radiating aggregates of a beautiful pleochroic mineral. Extension is parallel and normal to

the axes of the fibres. The axis of least elasticity lies parallel to the length of the fibres, and rays vibrating in this direction are dark-brownish-green to almost black. Rays vibrating parallel to the axis of greatest elasticity are light straw to almost colourless. The mineral is delessite, $H_{10}(FeM_2)_4(AlFe)_2S_4O_{22}$, (Johannsen), one of the leptochlorites of Tschermak.

Rock (1/3607.S.4465) associated with deposits of Iron Ore at Talling Range, Victoria District, Yalgoo Goldfield, South-West Division:

In hand specimens this is a compact banded siliceous rock consisting of yellowish-brown and black bands. In section it is made up of a regular mosaic of more or less uniformly sized irregular shaped grains of quartz—in many places studded with specks of magnetite. The black areas consist of shapeless aggregates and grains of magnetite. The yellowish-brown material is a form of ferruginous clay: bright yellow by reflected light. The colour is due to hydrated oxide of iron. There is no indication of secondarily introduced silica between the grains of quartz, though the rock bears general evidence of having undergone powerful compression, as indicated by the interlocking of the grains, and the shadowy extinction of the quartz individuals. This rock is a banded magnetite-bearing quartzite of sedimentary origin, and, in many respects, it appears to resemble the quartzites of the Marquette Range, Penokee Gogebie Range, and Cinjuna Range in the Lake Superior District. The American formations referred to are Proterozoic in Age.

Rock (1/3620 S. 446) from 200 feet level, St. George Mine, Marvel Loch, Yulgarn Goldfield.

This is a crushed and somewhat granulated sphene-bearing hornblende granite, though for field purposes the term "Gneissic hornblende granite" would be quite satisfactory. In section it is seen to consist essentially of hornblende, feldspar, quartz, iron pyrites, and sphene. The hornblende easily forms half of the rock. It is the only ferromagnesian present. It is a grass-green variety, with pleochroic effects ranging from dark green to straw brown. The feldspar has a lower refractive index than the quartz. It is practically all orthoclase, much clouded as a result of kaolinisation. The quartz is water-clear and idiomorphic. Iron pyrites may be seen in grains showing very little sheen. Plum-coloured sphene is common in granules and granular aggregates. During the year the State Mining Engineer made important visits to the goldfields and collected some interesting material. The following is a summary of the more important features in the reports made for him.

Rocks collected at the State Prospecting Party's discoveries near Mount Shenton:

The rock from a greenstone hill a short distance east of the deepest shaft at Jutson's Rocks proved to be a tremolite-bearing serpentine. The country containing the auriferous reef on Deshon and Trelease's Reward, near Lang's Rocks, is a typical uralitised dolerite or dolerite amphibolite (epidiorite of the English Committee). This rock is typical of many of the goldfields in this State. The country rock enclosing the lodes at Kalgoorlie was a quartz dolerite amphibolite. The country of a reef near Rutter's Soak proved to be a hornblende gneiss. The auriferous quartz veins at Jutson's Rocks were found to be enclosed in biotite-quartz schists and hornblende gneiss. It is of interest to learn that the biotite-quartz schist, or more properly speaking,

finely foliated granulitic biotite gneiss, bears a certain resemblance to the Edna May gneiss. Both rocks are similar in texture and mineral contents. The gneiss from Jutson's Rocks is if anything more felspathic and contains more biotite than the Edna May gneiss. Judging from the nature of the rocks at Mount Shenton, the country should be well worthy of thorough examination, because lithologically these rocks are similar to those of many auriferous areas in the State and lode formations, veins, or reefs could be found in them.

Rocks near Five-Mile Well at Cosmo-Newberry:

These consist of hornblende schists and medium-grained epidiorites typical of auriferous areas. It would be of interest to learn whether these hornblende schists—(1) occupy large areas, (2) are confined to sheared channels which may be connected with ore deposits, or (3) have been formed from the crushing of massive amphibolite rocks along the margins of granite areas.

Rocks from the West side of the Mutooroo Company's Northern Lease, Trans. Line:

During the year considerable interest was taken in the ore deposits of the Mutooroo Company, and much controversy prevailed over the nature of the rocks, because not infrequently comparisons were made between these rock formations and those at Kalgoorlie.

All the rocks submitted to me were indurated and gneissic graywackes or fine-grained arkoses. They were originally fine-grained felspathic sandstones which were converted into their present form by powerful metamorphic processes. These rocks no doubt represent some of the most ancient sediments in Western Australia, their probable equivalents being the vertically bedded and folded rocks in the valley to the east of Kalgoorlie. At Kalgoorlie the ancient sediments have not so far yielded any ore deposits. On the Mutooroo lease the ore deposits are not lodes but are of the vein type.

As there is not too much known about the ancient sediments, the following remarks are appended:

These rocks were evidently formed in a zone where great pressure controlled the reactions, and where the changes that took place tended to diminish the volume of rocks. Mass mechanical action dominated. The fine mosaic in the felspathic areas suggests mass static action involving silication and liberation of heat. It is more than likely that granulation preceded recrystallisation, when the felspathic material became broken up and converted into the fine quartz mosaic referred to, while white mica was formed: where impurities existed biotite took the place of muscovite. No new felspar was recognised. All these phenomena suggest very deep burial for these ancient sediments in the Western Australian Shield; in fact the original beds no doubt reached the zone of anamorphism, for there is little or no cementation or growth around the individual quartz grains such as might be expected in the zone of cementation.

Rocks from Mount Agnes, eight miles South of Mount Elizabeth, Ashburton River:

On the new Geological Map (1920) of Western Australia a number of areas are coloured yellow. These are supposed to include the Mosquito Creek and Stirling Range beds. They contain auriferous reefs in places, and have been set down as Proterozoic in age.

Mr. R. C. Wilson submitted two interesting rocks apparently from this Proterozoic formation, eight miles south of Mount Elizabeth. One was a quartzite the other a sericitic chlorite schist. Both are of sedimentary origin. The quartzite is a dark, vitreous, medium-grained rock, with a reddish-brown ironstained crust. In section it consists of a number of shapeless grains of quartz averaging 5 m.m. in diameter. These grains are frequently cracked and broken, and often have shattered margins. The cementing material is made up of a very fine textured mosaic of quartz, sericite, and many wisps, rods, and scales of pale green chlorite and brown biotite, with a little clouded plagioclase. There are a few large pieces of cleavable muscovite and clouded plagioclase. In places there are a few irregular shaped pieces of purplish tourmaline. This rock has a decided cataclastic texture, and has evidently suffered great mass mechanical action. The sericitic chlorite schist may have been originally an arenaceous shale or mudstone. It is a soft, grey to ash-coloured, somewhat platy and schisted rock, with a decided sheen along the planes of foliation. In section it consists of a confused aggregation of countless wisps and scales of pale green chlorite, which, in places, are minutely folded. There is a general tendency for this rock to develop planes of schistosity, along which the chlorite scales are crowded with their axes in one direction. The material between the wisps and scales of chlorite consists of very small grains of quartz and wisps of sericite. There is a fair sprinkling of minute grains of brown rutile.

Samples from Ile's Farm, about five miles south of Jacob's Well; South-West Division:

Mr. R. C. Wilson submitted some interesting rocks and a piece of felspar from this locality. The rocks were determined as:—

1. Fine-grained hornblende granite of aplitic texture.
2. Epidotic aplite.
3. Epidosite.
4. Granophyric granodiorite or, more strictly, a micrographic quartz-augite chlorite.

The sample of felspar is deserving of mention. It consists of a polysynthetic mass made up of lamellae and strips arranged according to two laws of twinning—the albite and the pericline. Basal sections (with twinning axis normal to (010) gave extinction angles—measured from the trace of (010)—of 15 to 16½ degrees. The felspar is microcline. Intergrown with the main mass of microcline is another felspar which, judging by its higher refractive index, stronger birefringence, and higher interference colours, is abite. In sections parallel to (010) the albite is found in narrow bands and patches with irregular outline. The mineral is microcline-perthite.

Samples from Perth M. Mine, Westonia:

Experience in Western Australia has shown that the rock formations enclosing or associated with ore deposits has much to do with the economic importance of the occurrence and its general development. Moreover, the ore body of Edna May is unique in that it consists of a form of silica (quartz) which

represents the residual solutions emanating from an igneous rock (granite); consequently, this class of ore deposit presents many features of interest to mining men.

The following remarks about the specimens submitted by Mr. Falkiner to the State Mining Engineer may therefore be of interest.

(a) This is a white biotite-microcline granite (grading into granite porphyry) cutting through the ore channel at 150 feet. In section the quartz occurs in clear shapeless plates with occasional inclusions of felspar. The bulk of the felspar, which in some places is clear, in others strongly clouded through alteration to kaolin, is microcline.

(b) Country rock and various veins of quartz from the ore channel. These samples consist mainly of clear glassy quartz which, as a result of pressure effects, has developed small joint or sheeted planes. The microscope shows a remarkable development of small fractures in this quartz. The iron pyrites has developed in the form of small patches and thin planes which are not infrequently tarnished. Parts of the country rock have been included in the ore body and converted into an actinolite-biotite schist.

(c) Sample of auriferous quartz from contact of ore channel rock with intrusive granite at 165 feet in depth. This sample is similar to (b), but the effects of pressure have imparted to the quartz an almost "sheeted" appearance. The sheeting planes are more or less parallel, and are filled with small needles of actinolite and biotite. The wall rock is an actinolite-biotite schist, and in one place, where it contacts with the quartz, a couple of specks of free gold were noticed. The iron pyrites occurs in the form of minute grains which are rather sparsely distributed.

The Perth M ore body evidently occurs in highly altered contact greenstone country in the vicinity of granite intrusions. It is not uncommon to find shear channels in these contact areas, and the original greenstone rock of these channels is often broken down under pressure and other metamorphic effects into greenstone schists.

The ore is a typical granitic quartz and could easily represent the residual solutions from granite or pegmatite. The size and characteristic interlocking of the quartz individuals as seen under the microscope show that the silica was deposited from solutions. Ore of this character is of deep-seated origin, and could be found at great depths. There is a resemblance between the ore from the Perth M. mine and the ore from the Edna May group.

From experience at Edna May, the granite bars, though inconvenient from a mining point of view, are of later origin than the lodes, and provided the main mass of granite is not encountered, the ore will generally be found on the other side of these intrusions.

Determinations for Prospectors and for the General Public.

Determinations for prospectors and for the general public formed an important part of the work.

It was often found advantageous to discuss with prospectors and the general public the nature of material that has been collected from time to time.

It is pleasing to record that the public in general take advantage of the information supplied by the department.

It is often possible to help materially those in search of gold and other minerals. One of the most important functions of the Geological Department is the determination of all materials found in Western Australia with a view to helping those who desire to learn the industrial and other applications and uses of our mineral substances.

The following determinations are of interest:—

1. A curious form of saccharoidal salt found in hilly country between Cue and the Weld Ranges.

2. Crystallised epidote near Israelite Bay, Eucla Division.

3. Gypseous ironstone with free gold from Yandiearra Station, Pilbara Goldfield. This is apparently oxidised lodestuff.

4. Molybdenite-bearing granite from 12 miles west of Pingelly.

5. Somewhat columnar pale green serpentine with massive and crystallised rhombic dodecahedra of magnetite, from Mount Satirist Station, near Whim Creek, West Pilbara Goldfield.

6. Graphitic zircon-bearing material from near Northampton. The presence of zircons suggests that the original may have been an acid felspathic rock impregnated with graphite. Graphite has a commercial value which depends entirely on the size of flake, shape of flake and carbon analysis. Samples should be first graded and then analysed. As much as £25 per ton f.o.b. at a deep sea port was offered for the concentrate from the main lode in Stewart's shaft at Munglinup. The graphite in this sample was crystalline and not amorphous, and since some authorities believe the true type of lode is not found until the workings reach a depth of about 50 feet, all deposits of this nature are worth examining with a view of determining their nature, extent, and probable commercial value.

7. A massive mixture of glassy quartz and pale blue-green apatite, with a few flakes of mica from Wodgina. Apatite when pure contains about 90 per cent. tricalcic phosphate, and if found in sufficient quantity would be of commercial value because it is used for fertilising purposes, and phosphorus, which is an ingredient of apatite, plays an important part in military operations as well as in making matches and other substances. Apatite rarely occurs in sufficient quantity or in sufficiently concentrated masses to render its extraction profitable, although apatite has been mined in America and in Spain. Competition with rock phosphate, which is cheaper and more easily ground, has restricted the mining of apatite to a few localities.

8. Massive black spinel—green when viewed in section by transmitted light—from Yandiearra Homestead, Yule River, West Pilbara.

9. Hornblende norite, a variety of gabbro, containing the rhombic pyroxene hypersthene from Kulin. The hypersthene is strongly pleochroic in shades varying from a decided salmon pink to almost colourless with a tinge of green.

10. Pinite from Wodgina. This mineral is soft, pale-green, somewhat resinous lusted, and prismatic

in form. It consists of secondary mica formed by the replacement of some other mineral. In section it is pale-green and cryptocrystalline. It evidently replaced prismatic forms of some other mineral. The prismatic faces are fully an inch long, striated vertically, and coated with a film of hydrated oxide of iron. This mineral is of considerable scientific interest. It is a true pinite forming a pseudomorph after some unknown prismatic mineral with striations parallel to the vertical crystallographic axis. Microscopically it is clearly seen that the original mineral has been wholly converted into a secondary mica which forms a confused aggregate of sericite wisps and scales that in places have been segregated into bunches.

11. Material from 16 miles north-east of Collie Railway Station. In its present form this material evidently represents dried "sludge" obtained from boring. It consists of pale-brownish clay or mud (almost of the consistency of silt) mixed with minute grains of sand. It is quite possible that this mineral was formed by the breaking up of an arenaceous mudstone. There is no definite carbonaceous substance in the sample. The dried sludge is coated with coarse grains of quartz. These are quite angular to sub-angular in form, and could represent either—(1)

an incoherent gritty deposit at the base of the sedimentary series, or (2) grains of quartz resulting from the weathering and decomposition of the underlying granite. Judging from Mr. Wilson's remarks: "Mr. Elias informs me that at the present depth of 51 feet quartz and decomposed granite were met with," I am inclined to support theory (2). It will be advisable to obtain positive proof of the presence of granitic bedrock. From other sediments I have seen from Collie it is quite possible for this bore "sludge" to come from coal measures.

PALÆONTOLOGICAL WORK.

During the course of the geological surveys carried out by Messrs. Blatchford and Talbot on behalf of the Freney Kimberley Oil Company in West Kimberley, a series of fossils from different localities was collected and submitted to Mr. F. Chapman of the National Museum, Melbourne. The whole of the strata from which the fossils were obtained prove to be of carboniferous age, and serve to show the wide extent of these beds.

The following is a list of the localities from which the fossils were obtained and their determinations:—

LIST OF FOSSILS FROM WEST KIMBERLEY.

(FREDERICK CHAPMAN, A.L.S., Palaeontologist, The National Museum, Melbourne.

First Series—Received, 7-12-22.

No.	Locality.	Determination.
2425	Half mile from Noonkanbah Homestead, Fitzroy River (about 110 miles S.E. of Derby)	<i>Productus subquadratus</i> . Morris, sp.
2426	Do. do. do. do. do.	<i>Strophalosia</i> sp. indet.
2428	Do. do. do. do. do.	<i>Productus</i> sp. indet.
2429	Do. do. do. do. do.	<i>Spirifer (Martiniopsis)</i> of <i>darwini</i> . Morris.
2433	Do. do. do. do. do.	<i>Strophalosia clarki</i> . R. Etheridge sp.
2507	12 miles S.W. of Oscar Range Homestead (about 120 miles E.S.E. of Derby)	<i>Seminula</i> sp. nov. (near <i>S. subtilita</i> , J. Hall).
2508	Do. do. do. do. do.	<i>Spirifer</i> cf. <i>byroensis</i> , Glauert.
2510	Do. do. do. do. do.	<i>Seminula</i> sp. nov.
2511	Do. do. do. do. do.	<i>Productus tenuistriatus</i> , De Vern, var. <i>foordi</i> , Eth. Fil.
2512	Do. do. do. do. do.	<i>Pugnax pleurodon</i> . Phillips, sp.
2513	Do. do. do. do. do.	<i>Pugnax pleurodon</i> . Phil. sp.
2514	Do. do. do. do. do.	<i>Pugnax pleurodon</i> . Phil. sp.
2515	Price's Creek, Rough Range (about 180 miles E.S.E. of Derby, S. of Fitzroy River)	<i>Lonsdaleia</i> aff. <i>floriformis</i> , Martin sp.
2516	Do. do. do. do. do.	cf. <i>Hexagonella dendroidea</i> , Hinde. (Requires slicing).
2522	Ditto, approximately (Rough Range about 12 miles S.E. of Price's Bore, which is 15 miles S. of Trig. J6)	? <i>Platycrinus</i> sp.
2523	Ditto, approximately. (6 miles S.W. of Trig. J8)	<i>Hexagonella</i> .
2530	Ditto, (2½ miles N.N.E. of Bore at Price's Creek)	Spicules of ? <i>Hyalostelia smithii</i> , Young & Young, sp. Also shells of <i>Productus tenuistriatus</i> , var. <i>foordi</i> . Eth. fil.
2531	Do. do. do. do. do.	<i>Productus tenuistriatus</i> . De Vern, var. <i>foordi</i> Eth. fil.
2532	Do. do. do. do. do.	<i>Euomphalus</i> sp.
2535	Ditto. ("Selection" Homestead, 5 miles N. by E. from Survey Station G on Christmas Creek)	<i>Productus brachythaerus</i> . Sow. sp.
2538	Do. do. do. do. do.	<i>Productus</i> sp. and <i>Spirifer musakheylensis</i> . Davidson, var. <i>australis</i> , Foord.
2541	Do. do. do. do. do.	<i>Productus semireticulatus</i> . Martin sp.
2545	Do. do. do. do. do.	<i>Productus</i> sp. indet.
2546	Do. do. do. do. do.	<i>Productus</i> sp.
2547	Do. do. do. do. do.	<i>Spirifer</i> sp. indet. and <i>Productus</i> sp. indet.
2548	Ditto. (1 mile N.E. of Bore at Price's Creek)	<i>Murchisonia</i> sp. (2 specimens) indet.
2555	No locality	A laminated sandstone with undulose parallel fittings on surface. ? Organic.

LIST OF FOSSILS FROM WEST KIMBERLEY—continued.

Second Series—Received 17-1-24.

No.	Locality.	Determination.
a.	9 miles N.E. by E. from Trig. Stn. G2, St. George's Range, Kimberley	cf. <i>Protoschizodus</i> .
b.	Lulingi Station, Kimberley	<i>Athyris</i> aff. <i>roysii</i> , P'Ev. sp.
c.	Same locality as a.	<i>Spirifer lata</i> , McCoy and <i>Spirifer byroensis</i> , Glauert.
d.	2 miles S.S.W. of Survey Station G48, Christmas Creek	<i>Spirifer</i> cf. <i>byroensis</i> . Glauert.
e.	Same locality as b.	<i>Spirifer marcovi</i> . Waagen.
f.	Liveringa Ridge, 1-6 miles N.E. of lower Liveringa Station, or 10 miles N.W. of Mount Anderson	<i>Productus semireticulatus</i> . Martin sp.
g.	Location ditto	cf. <i>Pachydomus ovalis</i> . McCoy.
h.	Location ditto	Genus allied to <i>Ambonychia</i> .
i.	Location ditto	<i>Sanguinolites</i> (cast), aff. <i>S.s. triatolamellosus</i> , De Kon.
j.	Location ditto	<i>Sanguinolites</i> sp.
k.	Location ditto	Cast, indet. <i>Parallelodon</i> .
l.	Liveringa Ridge, 1-6 miles E. of Lower Liveringa Station (or 10 miles N.W. of Mount Anderson)	<i>Aviculopecten tenuicollis</i> . Dana sp.
m.	Lulinga Station. Between lowest and middle horizon	<i>Spirifer</i> sp. (cast). cf. <i>S. lineatus</i> , Martin.
n.	Lulinga Station. Ditto	cf. <i>Astartia</i> or <i>Pachydomus</i> .
o.	Lulinga Station. Highest horizon	? <i>Edmondia</i> and ? <i>Strophalosia</i> .
p.	Ditto	<i>Ptychomphalina maitlandi</i> , Eth. fil.
2746	3 miles S.E. of Survey Station C48, Christmas Creek	<i>Productus semireticulatus</i> . Martin. sp.
2747	Locality ditto	<i>Spirifer byroensis</i> . Glauert.
2748	Locality ditto	<i>Productus semireticulatus</i> . Martin sp.
2749	Locality ditto	<i>Strophalosia clarkei</i> . Eth. sp.
2750	N.W. central portion of Price's Creek area. Same ridge as previous similar specimen, but farther along	<i>Euomphalus</i> sp. and brachiopods, indet.
2751	Locality ditto	Cast in "Beekite" of <i>Productus</i> sp.
2752	Locality ditto	<i>Productus</i> cf. <i>tenuistriatus</i> , De Vern. var. <i>foordi</i> , Eth. fil.
2753	Prince's Creek, N. of the bore	<i>Cyathophyllum</i> sp.
2754	Locality ditto	<i>Cyathophyllum</i> sp.
2755	Ditto W. of the bore	? <i>Euomphalus</i> .
2756	Near "Selection" Homestead, 5 miles N.N.E. of Survey Station C44, Christmas Creek	<i>Spirifer tasmaniensis</i> . J. Morris.
2757	9 miles E. by N. from Trig. Station G2, St. George's Range	Mass of polyzoa—including <i>Polypora australis</i> , Hinde and <i>Fenestella fossula</i> , Lonsdale.
2758	Liveringa Ridge, 1-6 miles E of Lower Liveringa Station or 10 miles N.W. of Mount Anderson	<i>Orthoetes crenistria</i> , Phillips sp. and <i>Modiolus</i> sp.
2759	Ditto	? <i>Lima</i> sp.
2760	Ditto	<i>Agathiceras micromphalum</i> , Morris sp.
2761	Ditto	<i>Aviculopecten tenuicollis</i> , Dana sp.
2762	Ditto	{ <i>Palaearca</i> sp. <i>Edmondia</i> .
2763	Ditto	{ <i>Agathiceras micromphalum</i> , Morris sp. <i>Palaearca</i> sp. and <i>Agathiceras micromphalum</i> . Morris sp.
2764	Ditto	<i>Pleurotomaria</i> sp.
2765	Lulingi Station. Upper horizon	<i>Athyris macleayana</i> . Eth. fil.
2766	Ditto Top horizon	<i>A. macleayana</i> . Eth. fil.
2767	Just about middle horizon	<i>Spirifer avicula</i> . G. Sow.
2768	Ditto middle horizon	<i>Productus subquadratus</i> . Morris.
2769	Ditto Between lowest and middle horizon	<i>Productus</i> sp. indet.
2770	Ditto Lowest horizon. Apparently same form is also found in highest horizon	<i>Athyris macleayana</i> , Eth. fil.
2771	Fossil Downs Station, Margaret River	<i>Pugnax pleurodon</i> , Phillips sp.
2772	Lulingi Station. Highest horizon	<i>Productus cora</i> d'Orb
2772A	Ditto	<i>Strophalosia clarkei</i> , Eth. sp.
2773	Ditto	<i>Schizophoria resupinata</i> . Martin sp.
2774	Ditto Upper horizon	<i>Strophalosia clarkei</i> . Eth. sp.
2775	Ditto Doubtful horizon	<i>Leptaena analoga</i> . Phillips sp.
2776	Ditto Doubtful horizon	<i>Spirifer byroensis</i> . Glauert.
2777	Ditto Doubtful horizon	<i>Athyris</i> sp. aff. <i>A. lamellosa</i> . L'Ev.
2778	Ditto Doubtful horizon	<i>Productus tenuistriatus</i> . De Vern. var. <i>foordi</i> , Eth. fil.
2779	Ditto Doubtful horizon	<i>Productus subquadratus</i> . Morris.
2780	Liveringa Ridge, 10 miles N.W. of Mount Anderson	<i>Aviculopecten tenuicollis</i> . Dana sp.

GEOLOGICAL SURVEY MUSEUM AND COLLECTIONS.

The exhibits of economic minerals, rocks, and fossils have continued to increase, there having been added to the collection 151 specimens, bringing the total number registered up to 17,644. The number of micro-sections prepared amounted to 209, of which

141 have not been registered, bringing the total number of registered slides in the Department up to 4,491. Attention has been paid to the re-arrangement, cleaning, and registration of the collections in the additional space provided in the store rooms, thus facilitating ready reference to the material as occasion demands. The very important collection of gold and telluride ores belonging to the Geological Sur-

vey, valued at £3,119, has been lent to the Commissioners for display in the Australian pavilion at the Empire Exhibition in London, where it is certain to attract considerable attention.

LIBRARY.

Additions to the Library continue to be made. The accessions during the year comprise 864 publications from other cognate institutions throughout the world, and include all the more important publications that deal with the wide range of subjects with which the Geological Survey is concerned. Considerable progress was made during the year in cataloguing the collection of process blocks utilised in the published works of the department.

A number of photographs of special geological interest have been taken by the staff in the ordinary course of their scientific duties, bringing the total number of films and negatives in the collection up to 2,035.

The reports and maps issued by the department are in continual demand, and requests for information relating to all phases of the mineral industry are continually being received. The map of Western Australia showing the chief localities at which useful minerals and artesian wells occur in a measure indicates the State-wide character of the mineral industry.

Alib Wairland

Geological Survey Office,
Perth, 24th September, 1924.

GOVERNMENT GEOLOGIST.

DIVISION V.

SCHOOL OF MINES OF WESTERN AUSTRALIA.

School of Mines,
Kalgoorlie, 2nd February, 1924.

The Under Secretary for Mines.

I beg to forward, for the information of the Hon. the Minister, my Report for the year 1923.

Considering the disturbed condition of the Mining Industry and the difficulty which youths experienced in securing suitable employment, the attendance at the School of Mines during 1923 was satisfactory. At the end of the year there were 144 individuals on the rolls. As usual, the Preparatory Classes in Mathematics, Chemistry, Physics, Drawing, and Geology attracted the largest number of students. These junior classes continue to serve a useful purpose in giving youths an introductory knowledge of elementary science.

Students, generally, were regular in attendance and attentive to the classwork. At the annual examinations they acquitted themselves creditably and gained more than the usual number of pass certificates.

Each year it is noticeable that many of those who seek to join the School lack an adequate preparatory knowledge of Mathematics, and such students are seriously handicapped in their subsequent studies. A good working knowledge of Mathematics is essential, and, if the time tables can be re-arranged without unduly encroaching upon the class hours which should be devoted to other sections of the School work, it may be found advisable to give additional lessons in Mathematics.

The general repairs effected at the beginning of 1923, and the erection of an additional classroom and a study room for the students, have proved very beneficial. Much of the previously existing congestion has been relieved thereby, and working conditions have been much improved. The fitting up of one of the rooms as a Junior Physics Laboratory, in which apparatus can be set up in readiness for classwork, has proved a great convenience.

The class work in Physics and Engineering progressed satisfactorily. To local Electrical Engineers in charge of plants and to mine managers and others, the thanks of the School are due for the facilities afforded students of making tours of inspection, during which they had opportunities of viewing the practical application of various matters dealt with in the lectures. The Assistant in Physics, who takes a keen interest in wireless telegraphy, has made arrangements for the meetings of the local Radio Society to be held in one of the lecture rooms of the School, and, as permission has been granted by the Department for the erection of aerials in the School grounds, it is anticipated that a complete wireless installation will be in operation during 1924.

The Mining and Surveying classes were attended by a small number of senior students. Field practices were held fortnightly and steady progress was made in the classwork throughout the year.

The attendance in the Engineering classes was well maintained. Students were diligent and made satisfactory progress. Particularly good work was done in the Drawing classes. Students greatly appreciated the new working models which were secured last year to replace those that had deteriorated under adverse climatic conditions. The Gas Engine and Indicator classes received a fair amount of patronage, and the students showed by the keen interest they took in the classwork that they fully appreciated the value of the instruction given in these essentially practical classes. Owing to lack of students the Engine-driving classes were not recommenced until the beginning of the second term. The Fitting and Turning classes were well attended. Although some additional equipment is still required, the improvements made in the workshops during the year contributed largely to more efficient classwork. Mr. C. E. Roberts replaced Mr. White as Instructor, and, by following the policy of his predecessor, and arranging for the construction of useful articles of particular interest to students, such as scribing blocks, levels, etc., he has made the classwork attractive. The Fitting and Turning classes do not attempt to teach a trade, but the instruction which they give in the use of tools and machines is of considerable value to those whose future work will be connected with mining operations.

Besides carrying on his ordinary classwork at the School of Mines, the Lecturer in Geology performed the duties of Acting Government Petrologist throughout the year. At the request of the Hon. the Minister he visited and made a report upon the Deep Lead at Siberia, and in other ways was kept busily engaged in departmental work. He also devoted a considerable amount of attention to the preparation of two rock models for the British Empire Exhibition. One model represents the geological structure of the western side of the "Golden Mile"; the other shows the Oroya Shoot on the eastern side. Dr. Larcombe personally selected, from underground, a large amount of rock material and supervised the mechanical work of construction undertaken by Wilson, Gray & Co., in Perth. The models, constructed of polished rock and lode material, give an excellent presentation of the structure of the ore-bodies of the Golden Mile, and will attract wide attention. A list of the rock formations and lode-stuff used in the construction of the models is enclosed herewith.

A feature of the classwork in Geology has been the annual trips made by the Lecturer and his students to various centres of geological interest. During 1923 they made a rapid examination of a large area of country between Kalgoorlie, Ora Banda and Siberia, during which the students were given practical in-

struction in the preparation of maps and sections and gained an insight into the methods adopted in reconnaissance surveys. Lectures and field excursions were arranged for, and greatly appreciated by, a party of University students who visited Kalgoorlie in August.

During the latter half of 1923 the Metallurgical Laboratory was utilised for experimental work by students in the metallurgy class, and for investigations of various kinds by members of the Staff. For several mornings each week the Assistant in Chemistry devoted portion of his official time to the work of the laboratory, and during the afternoons of the last three months of the year the Lecturer in Chemistry and his Assistant, by special arrangement with the Department, each devoted 18 hours per week to various investigations relating to ore treatment.

Tests were made on ores from the South Kalgurli Gold Mine to determine whether the gold contents could be concentrated satisfactorily by flotation methods, and whether the value of the residues could be reduced sufficiently to obviate the necessity of further treatment by cyanidation or other process. Although the tests were discontinued before finality was reached, the results obtained were very encouraging.

Concentration tests were made on sands from the Ives Reward Gold Mine. Flotation and cyanide tests, on lines indicated by the owner of the parcels, were made on sulphide ore and residues from the Youanni Gold Mine. The Staff consider that a more extended investigation on somewhat different lines would probably afford data from which a satisfactory method of treatment might be formulated.

A lengthy investigation was made on a parcel from Ravensthorpe to determine the suitability of the ore for treatment by the method of Copper Separation, Ltd. The parcel consisted of oxidised copper ore containing a small percentage of iron pyrites. The tests furnished valuable information concerning the treatment of this ore by flotation, and indicated that

under suitable working conditions it may be possible to secure a high recovery of the values in copper, silver, and gold. An investigation was commenced on another parcel from Ravensthorpe, consisting of dense cupriferous pyrites, but the tests were not continued long enough to afford definite results.

It is hoped that the small air-compressor, for which authority has been given, will be installed early in the new year. Steps are being taken to ascertain the most suitable method of providing facilities for roasting sulphide ores, and it is thought that, at a comparatively small cost, alterations to the existing muffle furnaces will provide the School with a small reverberatory furnace. These additions will considerably extend the scope of the work that can be undertaken in the Metallurgical Laboratory.

By furnishing reports as to assay values, and by indicating means of utilising and disposing of base metal ores, every effort has been made to give prospectors information likely to be of assistance to them. During 1923, 553 free assays and mineral determinations were made for prospectors of material from Crown Lands not held under lease for mining purposes, as follows:—

Assays for gold and silver	..	..	471
Assays for copper	..	..	4
Analyses	..	..	11
Determinations of rocks, minerals, etc.			67
			—
Total	..	..	553
			—

The statistics dealing with the enrolment of students, examination results, etc., are forwarded herewith.

I suggest that the reports which have been handed in concerning the ore treatment in the Metallurgical plant be printed with the Annual Report of the School.

F. B. ALLEN,
Director, School of Mines.

REPRESENTATIVE COLLECTION OF ROCKS AND ORES USED IN THE ROCK MODEL SENT TO THE BRITISH EMPIRE EXHIBITION, TO ILLUSTRATE THE GEOLOGY OF THE "GOLDEN MILE."

- | | |
|--|---|
| 1. (3774) Quartz dolerite greenstone, 1,669ft. level, Ivanhoe. | 11. (3773) Lodestuff, 2,120ft., Ivanhoe Mine. |
| 2. (3777) Quartz dolerite greenstone, 2,630ft. level, Horseshoe. | 12. (3764) So-called "slate," 2,200ft., opposite Main Shaft, Great Boulder Mine. |
| 3. (3769) Quartz dolerite greenstone (Weathered), No. 2 level, Brown Hill Mine. | 13. (3768) Calc schist (weathered), No. 2 level, Brown Hill Mine. |
| 4. (3775) Bleached quartz dolerite greenstone, 1,669ft., Ivanhoe. | 14. (3771) Calc schist (schisted), 460 feet, Associated Northern Mine. |
| 5. (3763) Aphanite (schisted), 2,200ft. level, opposite Edwards Shaft, Great Boulder Mine. | 15. (3772) Calc schist (typical), No. 4 level, Brown Hill Mine. |
| 6. (3767) Aphanite (pyritic), 2,200ft. level, Edwards Shaft, Great Boulder Mine. | 16. (3770) Schistose ore in calc schist, from Middle Fault Plane, 450 feet, Associated Northern Mine. |
| 7. (3765) Lodestuff, 2,230ft., South of Edwards Shaft, Great Boulder Mine. | 17. (3761) Keratophyre (pink), No. 6 level, South Kalgurli Mine. |
| 8. (3766) Quartz vein in (3765). | 18. (3762) Keratophyre (gray), No. 6 level, South Kalgurli Mine. |
| 9. (3779) Lodestuff, 2,120ft. level, Ivanhoe Mine. | 19. (3776) Keratophyre (gray), 2,420ft. level, Ivanhoe Mine. |
| 10. (3778) Lodestuff, 2,780ft., Horseshoe Mine. | |

(Sd.) C. O. G. LARCOMBE.

SCHOOL OF MINES OF WESTERN AUSTRALIA.
EXAMINERS.

The following Examiners conducted the Examinations in November, 1923:—

Subject.	Examiners.
Preparatory Mathematics	F. B. Allen, M.A., B.Sc.; R. Davis, B.Sc., and E. Illidge, B.Sc.
Preparatory Chemistry	A. S. Winter.
Preparatory Physics and Electricity	C. Cecil.
Preparatory Geology	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S.
Preparatory Mechanical Drawing	C. Cecil.
Mathematics I.	E. H. Illidge, B.Sc., and R. Davis, B.Sc.
Mechanics—Theoretical	R. Davis, B.Sc., and E. H. Illidge, B.Sc.
Physics I.	R. Davis, B.Sc., and D. McDougall, A.I.E.E.
Chemistry I.	A. S. Winter and R. R. Baxter, B.Sc.
Engineering Chemistry I. and II.	L. W. Phillips, B.Sc., and B. H. Moore, B.E., F.S.A.S.M.
Assaying I.	A. S. Winter and G. S. Compton, A.W.A.S.M.
Assaying II.	B. H. Moore, B.E., F.S.A.S.M.
Metallurgy I. and II.	G. S. Compton, A.W.A.S.M.
Petrology	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S., and G. S. Compton, A.W.A.S.M.
Mineralogy	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S.
Geology	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S.
Mining Geology	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S.
Practical Mathematics	E. H. Illidge, B.Sc.
Mechanical Drawing I. and II.	J. H. Tate.
Applied Mechanics	B. H. Moore, B.E., F.S.A.S.M., and J. H. Tate.
Mechanical Engineering I. and II.	J. H. Tate and T. Butement, A.O.U.S.M.
Surveying I. and II.	T. Butement, A.O.U.S.M.
Mining I. and II.	D. McDougall, A.I.E.E.
Electrical Engineering I. and II.	C. E. Roberts.
Fitting and Turning I. and II.	C. C. Meredyth.
Engine Driving I. and II.	A. R. E. Bosustow.
Gas Engine	
Indicator	

JUNIOR SCHOLARSHIP.

Subject.	Examiners.
English	B. H. Moore, B.E., F.S.A.S.M.
Physical Geography	C. O. G. Larcombe, D.Sc., F.S.T.C., F.G.S.
Mathematics	F. B. Allen, M.A., B.Sc.

W.A. SCHOOL OF MINES, KALGOORLIE.
ATTENDANCES, 1923.

Subjects.	Effective Enrolment.		
	Terms:		
	1st.	2nd.	3rd.
Elementary Mathematics	20	20	19
Preparatory Mathematics	50	47	37
Preparatory Mechanical Drawing (Thursday)	13	12	11
Preparatory Mechanical Drawing (Friday)	27	36	30
Preparatory Physics	43	38	31
Preparatory Chemistry	46	39	37
Preparatory Geology	9	7	6
Mathematics—First Course	32	31	26
Theoretical Mechanics	9	5	3
Physics—First Course	18	16	15
Chemistry—First Course	27	26	23
Engineering Chemistry I.	5	5	3
Engineering Chemistry II.	3	2	2
Assaying—First Course	2	2	2
Assaying—Second Course	2	2	2
Metallurgy—First Course	1	1	1
Metallurgy—Second Course	1	1	1
Geology	3	4	4
Mineralogy	4	3	3
Mining Geology	2	2	2
Mining I.	2	2	2
Mining II. (Mine Sampling)	4	...	...
Mining II. (Ore Dressing)	2	2	2
Mining II. (Mine Accounts)	...	1	...
Mining II. (Mine Administration)	...	...	1
Surveying I.	3	4	4
Surveying II.	2	2	1
Mechanical Drawing I.	23	20	19
Mechanical Drawing II.	4	4	4
Applied Mechanics	10	9	9
Mechanical Engineering I.	7	6	6
Mechanical Engineering II.	5	4	4
Engine Driving I.	...	7	4
Electrical Engineering I.	4	4	3
Electrical Engineering II.	4	3	3
Fitting and Turning I.	17	19	19
Fitting and Turning II.	9	8	6
Gas Engine	14	15	14
Practical Mathematics	5	5	4
	480	414	383

	1922.			1923.		
	1st Term.	2nd Term.	3rd Term.	1st Term.	2nd Term.	3rd Term.
Total Enrolment	485	426	357	430	414	363
Individual Students	179	160	133	172	160	144

EXAMINATION RESULTS, 1923.

The following table shows the passes obtained by students of the Western Australian School of Mines, Kalgoorlie, at the annual Examinations held in November, 1923, including the Supplementary Examinations held in February, 1923:—

Subject.	Class of Pass.		
	Credit.	Pass.	Totals.
Elementary Mathematics	3	7	10
Preparatory Mathematics	...	9	9
Preparatory Mathematics, Arithmetic	1	8	9
Preparatory Mathematics, Algebra	...	2	2
Preparatory Mathematics, Geometry	1	3	4
Preparatory Chemistry	6	19	25
Preparatory Drawing	8	16	24
Preparatory Physics	11	14	25
Preparatory Geology	...	5	5
Mathematics I.	...	4	4
Mathematics I., Algebra	...	3	3
Mathematics I., Trigonometry	...	4	4
Mathematics I., Geometry	...	4	4
Physics I.	1	9	10
Chemistry I.	...	13	13
Engineering Chemistry I.	...	3	3
Assaying I.	1	1	2
Assaying II.	1	1	2
Mineralogy	...	3	3
Geology	1	2	3
Mining and Economic Geology	...	1	1
Mining Geology (Surveyor's Course)	1	1	2
Mining I.	...	2	2
Mining II. (Mine Sampling)	2	2	4
Mining II. (Ore Dressing)	1	1	2
Mining II. (Mine Accounts)	1	...	1
Mining II. (Mine Administration)	1	...	1
Surveying I.	...	4	4
Surveying II.	...	1	4
Mechanical Drawing I.	5	9	14
Mechanical Drawing II.	1	3	4
Applied Mechanics	2	5	7
Mechanical Engineering I.	1	4	5
Mechanical Engineering I. (Gas Engine)	7	5	12
Mechanical Engineering I. (Indicator)	5	7	12
Mechanical Engineering II.	...	3	3
Building Construction	...	1	1
Engine Driving I.	...	4	4
Electrical Engineering I.	1	3	4
Electrical Engineering II.	1	4	5
Fitting and Turning I.	6	11	17
Fitting and Turning II.	1	4	5
Practical Mathematics	...	3	...
	73	206	281

ASSAYER'S CERTIFICATES.

The following have gained Certificates:—

Adams, H.	...	P.T.S.	...	March, 1904.
Adams, P.	...	P.T.S.	...	February, 1905.
Beech, S. J.	...	K.S.M.	...	November, 1906.
Brown, T.	...	P.T.S.	...	November, 1906.
Brooking, J.	...	P.T.S.	...	November, 1906.
Hutchinson, D. M.	...	K.S.M.	...	November, 1906.
Banks, R.	...	K.S.M.	...	November, 1906.
Gabel, J.	...	K.S.M.	...	November, 1908.
Pike, R. W.	...	P.T.S.	...	November, 1908.
Woolf, M.	...	K.S.M.	...	November, 1908.
Baxter, R. R.	...	P.T.S.	...	November, 1908.
Bradley, W. S.	...	K.S.M.	...	November, 1909.
Burrows, M. F.	...	P.T.S.	...	November, 1909.
Compton, G. S.	...	P.T.S.	...	November, 1909.
Cook, H. J.	...	P.T.S.	...	November, 1909.
Klem, L. G.	...	P.T.S.	...	November, 1909.
Fraser, W.	...	K.S.M.	...	November, 1910.
Rowlidge, H. P.	...	P.T.S.	...	November, 1910.
Benjamin, L. R.	...	P.T.S.	...	November, 1911.
Jackson, L. T. C.	...	P.T.S.	...	November, 1911.
Levers, J. C.	...	K.S.M.	...	November, 1911.
Lapsley, R. G.	...	P.T.S.	...	November, 1912.
Kurth, E. E.	...	K.S.M.	...	November, 1913.
Grace, J. N. A.	...	P.T.S.	...	November, 1916.
Noall, J. C.	...	P.T.S.	...	November, 1917.
Cecil, Clyde	...	K.S.M.	...	November, 1918.
Terrill, J. H.	...	K.S.M.	...	November, 1918.
Nairn, T. W.	...	K.S.M.	...	November, 1918.
Roberts, T. J.	...	K.S.M.	...	November, 1919.
Chapman, E. E.	...	P.T.S.	...	November, 1920.
Lethlean, H. V.	...	K.S.M.	...	November, 1921.
Carrigg, C. G.	...	K.S.M.	...	November, 1922.
Greer, J. H.	...	K.S.M.	...	November, 1922.
Mundie, E. B.	...	K.S.M.	...	November, 1922.

INDUSTRIAL CHEMIST'S CERTIFICATES.

The following have gained Certificates:—

Ozell, O.	K.S.M.	November, 1921.
Chapman, F.	P.T.S.	November, 1922.
Carney, G. G.	K.S.M.	November, 1922.
Bodden, A. N.	K.S.M.	November, 1922.

MINE SURVEYOR'S CERTIFICATES.

The following have gained Certificates:—

Peat, J.	K.S.M.	November, 1909.
Adams, H.	K.S.M.	November, 1910.
Banks, B.	K.S.M.	November, 1911.
Gabel, J.	K.S.M.	November, 1911.
Pike, R. W.	K.S.M.	November, 1912.
Godson, F. W. R.	K.S.M.	November, 1915.
Mundie, E. B.	K.S.M.	November, 1915.
Leavers, J. C.	K.S.M.	November, 1916.
Crutchett, I. A.	K.S.M.	November, 1920.
Powell, T.	K.S.M.	November, 1921.
Agnew, R. J.	K.S.M.	November, 1922.
Crutchett, E. G.	K.S.M.	November, 1922.
Davies, I.	K.S.M.	November, 1922.
Eddy, J. T.	K.S.M.	November, 1922.
Rosenberg, J. M.	K.S.M.	November, 1923.

DRAUGHTSMAN'S CERTIFICATES.

The following have gained Certificates:—

Galt, W.	K.S.M.	November, 1915.
Butement, J. C.	K.S.M.	November, 1915.
Edmondson, F. C.	K.S.M.	November, 1915.
Lang, J. H.	K.S.M.	November, 1915.
Davies, W.	K.S.M.	November, 1917.
Weselman, C.	K.S.M.	November, 1917.
Thompson, E. P.	K.S.M.	November, 1920.
Gill, L. J.	K.S.M.	November, 1921.
Macbeth, R. A.	K.S.M.	November, 1921.
Rosenberg, J. M.	K.S.M.	November, 1921.
Spalding, J.	K.S.M.	November, 1922.
Taylor, H.	K.S.M.	November, 1922.

ELECTRICIAN'S CERTIFICATES.

The following have gained Certificates:—

Galt, W.	K.S.M.	November, 1915.
Butement, J. C.	K.S.M.	November, 1915.
Edmondson, F. C.	K.S.M.	November, 1915.
Lang, J. H.	K.S.M.	November, 1915.
Davies, W.	K.S.M.	November, 1917.
Weselman, C.	K.S.M.	November, 1917.
Thompson, E. P.	K.S.M.	November, 1920.
Gill, L. J.	K.S.M.	November, 1921.
Macbeth, R. A.	K.S.M.	November, 1921.
Rosenberg, J. M.	K.S.M.	November, 1921.
Spalding, J.	K.S.M.	November, 1922.
Taylor, Harry	K.S.M.	November, 1923.

GEOLOGIST'S CERTIFICATES.

Gabel, J.	K.S.M.	November, 1911.
Leavers, J. C.	K.S.M.	November, 1916.
Mundie, E. B.	K.S.M.	November, 1920.
Agnew, R. J.	K.S.M.	November, 1923.

DIPLOMAS.

The following students have gained Diplomas:—

Beech, S. J. (K.S.M.), Diploma in Metallurgy, November, 1906.
 Adams, P. (P. and K.), Diploma in Metallurgy, November, 1907.
 Adams, H. (P. and K.), Diploma in Metallurgy, November, 1908.
 Banks, B. (C. and K.), Diploma in Metallurgy, November, 1910.
 Burrows, M. F. (P. and K.), Diploma in Metallurgy, November, 1910.
 Compton, G. S. (P.T.S.), Diploma in Metallurgy, November, 1910.
 Cook, H. J. (P.T.S.), Diploma in Metallurgy, November, 1910.
 Gabel, J. (K.S.M.), Diploma in Metallurgy, November, 1910.
 Gabel, J. (K.S.M.), Diploma in Mining, November, 1911.
 Pike, R. W. (P. and K.), Diploma in Metallurgy, November, 1911.
 Galt, W. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1915.
 Butement, J. C. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1915.
 Edmondson, F. C. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1915.
 Lang, J. H. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1915.
 Grace, J. N. A. (P.T.S.), Diploma in Metallurgy, November, 1915.
 Bradley, W. S. (K.S.M.), Diploma in Metallurgy, November, 1915.

DIPLOMAS—continued.

Kurth, E. E. (K.S.M.), Diploma in Metallurgy, November, 1916.
 Getty, A. (K.S.M.), Diploma in Metallurgy, November, 1916.
 Le Mesurier, O. B. (K.S.M.), Diploma in Metallurgy, November, 1916.
 Leavers, J. C. (K.S.M.), Diploma in Mining, November, 1916.
 Davies, Watcyn (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1917.
 Weselman, Carl (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1917.
 Nairn, T. W. (K.S.M.), Diploma in Metallurgy, November, 1919.
 Mundie, E. B. (K.S.M.), Diploma in Mining, November, 1920.
 Thompson, E. P. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1920.
 Gill, L. J. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1921.
 Macbeth, R. A. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1921.
 Rosenberg, J. M. (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1921.
 Rowledge, H. P. (P. and K.), Diploma in Metallurgy, November, 1922.
 Taylor, Harry (K.S.M.), Diploma in Mechanical and Electrical Engineering, November, 1923.

ENGINE-DRIVER'S CERTIFICATES.

The following students of the School of Mines passed Examinations held by the Chief Inspector of Machinery, during 1923, for various Engine-driver's Certificates:—

Name.	Class.
Rosenberg, J. M.	First Competency.
Smythe, T. P.	First Competency.
Thrupp, T. W.	First Competency.
Basrnussen, L. P.	Second Competency.
McNeil, J. B.	Second Competency.
Allen, G. W.	Third Competency.
Coxon, E.	Third Competency.
Elsbury, J. A. W. E.	Third Competency.
Bosustow, A. B. E.	Internal Combustion Competency
Bosustow, E. O.	Internal Combustion Competency

W.A. SCHOOL OF MINES.

SCHOLARSHIP EXAMINATIONS, 1923.

JUNIOR SCHOLARSHIP.	
Candidate.	District.
Wynne, W.	Kalgoorlie.
Neville, R. L.	Kalgoorlie.
Nicholson, A. W.	Kalgoorlie.
Hopkins, F. S.	Boulder.
Baker, K. G.	Boulder.
Bosustow, G. E.	Boulder.
Doyle, R. C.	Boulder.
Richards, W. A.	Boulder.

W. Wynne gains the Junior Scholarship.

ENTRANCE SCHOLARSHIP.	
Candidate.	District.
Bell, C. H.	Kalgoorlie.
Ditchburn, A. J.	Boulder.
Woodrow, F. T.	Kalgoorlie.
Norris, C.	Kalgoorlie.

C. H. Bell gains the Entrance Scholarship.

SENIOR SCHOLARSHIP.	
Candidate.	District.
Manners, G. S.	Kalgoorlie.
Golding, H. D.	Kalgoorlie.

G. S. Manners gains the Senior Scholarship.

CHAMBER OF MINES SCHOLARSHIP IN METALLURGY.

Candidate.	District.
Ditchburn, A. J.	Boulder.

Scholarship recommended.

NEIL MCNEIL SCHOLARSHIP.

Candidate.	District.
Laver, A. F.	Kalgoorlie.

THE CRITCHLEY PARKER PRIZE.

The following students have been recommended for the prize offered by Critchley Parker, Esq., Melbourne:—
 R. J. Sinclair—*The Industrial Australian and Mining Standard*.
 N. C. Blurton—*Mining Standard* publication.

SCHOOL OF MINES BURSARY.

R. J. Agnew has been recommended.

MECHANICS' INSTITUTE (KALGOORLIE) FREE MEMBERSHIP PRIZES.

The following have been recommended:—Baker, C. E.; Berry, J. R.; Giles, H. C.; Laver, A. F.; Norris, C.; Pratley, W. J.; Sargent, A. R. S.; Woodrow, F. T.

SCHOOL OF MINES OF WESTERN AUSTRALIA.

ANNUAL EXAMINATIONS, 1923.

(T) Denotes Terminal Pass only.

PREPARATORY CHEMISTRY.

Credit—
 Harbeck, Miss Muriel
 Stevens, Miss Nancy J.
 Moody, Herbert J.
 Mincham, Miss Sylvia A.
 Woodrow, Frank T.
 Bell, Charles H.

Pass—
 Baker, Miss Bertha M.
 Norris, Charles
 Sansom, Jack
 Meyers, John C. W.
 Giles, Hurtle C.
 Baker, Stanley
 Thompson, Arthur F.
 Kellow, Stephen M.
 Baker, Clarence E.
 Baugh, Richard A.
 Ditchburn, Albert J.
 Robertson, William A. H.
 Casey, Gavin S.
 Slee, Cyril D.
 Ford, Thomas H.
 Jones, T. Prynne
 Berry, Jack R.
 Cuthbush, Frank W.
 Sargent, Alan R. S.

PREPARATORY MECHANICAL DRAWING.

Credit—
 Bell, Charles H.
 McQuoid, George A.
 Ditchburn, Albert J.
 Norris, Charles
 Moody, Herbert J.
 Woodrow, Frank T.
 Brown, Charles W.
 Baker, Clarence E.

Pass—
 Davies, Ronald J.
 Jensen, Harold (T)
 Laver, Arthur J. F.
 Sargent, Alan R. S.
 Pratley, William J.
 Casey, Gavin
 Jones, T. Prynne
 Binet, Robert
 Newby, Thomas R. N.
 William Harold E. (T)
 Ford, Thomas H.
 Terrell, Hubert V.
 Baugh, Richard A.
 Mathews, Clifford W.
 Boseley, William G.
 Trembath, Stanley E. J.

PREPARATORY PHYSICS.

Credit—
 Jensen, Harold (T)
 Bell, Charles H.
 Woodrow, Frank T.
 Moody, Herbert J.
 Baker, Clarence E.
 Ditchburn, Albert J.
 Meyers, John C. W.
 Berry, Jack R.
 McQuoid, George A. (T)
 Pratley, William J.
 Weidner, Miss Eileen J.

Pass—
 Norris, Charles
 Jones, T. Prynne
 Sansom, Jack
 McInerney, Brian
 Whitney, Thomas
 Sargent, Alan R. S.
 Boseley, William G.
 Ford, Thomas H.
 Trembath, Stanley E. J.
 Denman, Reuben H.
 Kellow, Stephen M.
 Fyfe, George T.
 Terrell, Hubert V.
 Woolcock, Eric L.

PREPARATORY GEOLOGY.

Pass—
 Rosenbrock, Ernest L.
 Bell, Charles H.
 Woodrow, Frank T.
 Ditchburn, Albert J.
 Norris, Charles

PREPARATORY MATHEMATICS.

(All Sections.)
 Pass—
 Meyers, John C. W.
 Ditchburn, Albert J.
 Sargent, Alan R. S.
 Woodrow, Frank T.
 Bell, Charles H.
 Norris, Charles
 Berry, Jack R.
 Lapham, Edgar H.
 Sansom, Jack

PREPARATORY MATHEMATICS.

(ARITHMETIC SECTION.)
 Credit—
 McQuoid, George A.

Pass—
 Macgregor, Ronald B.
 Robertson, William A. H.
 d'Almeida, Joseph M. B.
 Fyfe, George T.
 Sheppard, Frederick H. (T)
 McInerney, Brian
 Trembath, Stanley R. J.

PREPARATORY MATHEMATICS.

(GEOMETRY SECTION.)
 Pass—
 McQuoid, George A.
 Macgregor, Ronald B.

ELEMENTARY MATHEMATICS.

Credit—
 Moody, Herbert J.
 Baker, Clarence E.
 Pratley, William J.

Pass—
 Boseley, William
 Davies, Ronald J. (T)
 Forbes, George E. (T)
 Weidner, Miss Eileen J.
 Newby, Thomas R. N.
 Ford, Thomas H.
 Whitney, Thomas

MATHEMATICS.

FIRST COURSE.
 (ALL SECTIONS.)

Pass—
 Manners, George S.
 Laver, Arthur J. F.
 Lloyd, Arthur C.
 Johns, Edward N.

MATHEMATICS.

FIRST COURSE.
 (ALGEBRA SECTION.)

Pass—
 Byrne, Kevin P.
 Paterson, Arthur V.
 Davidson, William G.

MATHEMATICS.

FIRST COURSE.
 (TRIGONOMETRY SECTION.)

Pass—
 Paterson, Arthur V.
 Byrne, Kevin P.

MATHEMATICS.

FIRST COURSE.
 (GEOMETRY SECTION.)

Pass—
 Glendinning, Angus R.
 Dighton, Charles A.

PHYSICS.

FIRST COURSE.
 Credit—
 Glendinning, Angus R.

Pass—
 Manners, George S.
 Paterson, Arthur V.
 Lynch, Thomas
 Giles, Hurtle C.
 Lowry, Leonard G.
 Illig, Herbert M. F.

CHEMISTRY.

FIRST COURSE.

Pass—
 Manners, George S.
 Laver, Arthur J. F.
 Browne, Gordon E.
 Moore, Miss Gwen M.
 Golding, Hollis D.
 Moore, Guy J. F.
 Glendinning, Angus R.
 Ede, James M.
 Leslie, Bernard H.
 Cribb, Arthur H.

ENGINEERING CHEMISTRY.

FIRST COURSE.
 Pass—
 Hilbery, Reginald W.
 Weidner, Miss Eileen J.
 Williams, Victor L.

ASSAYING.

FIRST COURSE.

Credit—
 Agnew, Rudolph J.

Pass—
 McDermott, Charles J.

ASSAYING.

SECOND COURSE.

Credit—
 MacLellan, Miss Christina

Pass—
 Brown, Charles W.

GEOLOGY.

Credit—
 Rosenberg, Julius M.

Pass—
 Eadalle, Alexander N.
 Manners, Joseph E.

MINERALOGY.

Eadalle, Alexander N.
 Eddy, John T.
 McDermott, James J.

MINING GEOLOGY.

SURVEYOR'S COURSE.

Credit—
 Rosenberg, Julius M.

Pass—
 Greer, Jack H.

MINING.

FIRST COURSE.

Pass—
 Greer, Jack H.
 Rosenberg, Julius M.

MINING.

SECOND COURSE.

(MINE SAMPLING.)
 Credit—
 Greer, Jack H.
 Rosenberg, Julius M.

Pass—
 Manners, Joseph E.
 McLean, Charles E.

MINING.

SECOND COURSE.

(ORE DRESSING.)
 Credit—
 Agnew, Rudolph J.

Pass—
 Powell, Thomas

MINING.

SECOND COURSE.

(MINE ADMINISTRATION AND ACCOUNTS.)
 Credit—
 Agnew, Rudolph J.

SURVEYING.

FIRST COURSE.

Pass—
 Cliff, William E. F.
 Golding, Hollis G.
 Manners, Joseph E.
 McLean, Charles E.

SURVEYING.

SECOND COURSE.

Provisional Pass pending Plan—
 Greer, Jack H.

SURVEYING.

SECOND COURSE.

Credit—
 Rosenberg, Julius M.
 (Examination 1922; Plan now accepted.)
 Rosenbrock, Ernest L.
 (Examination 1922; Plan now accepted.)

Pass—
 Gibbons, Leo P. J.
 (Examination 1921; Plan now accepted.)

MINING AND ECONOMIC GEOLOGY.

Pass—
 Agnew, Rudolph J.
 (Written Examination 1922; Thesis now accepted.)

MECHANICAL DRAWING.

FIRST COURSE.

Credit—
 Manners, George S.
 McDermott, James J.
 Golding, Hollis D.
 Illig, Herbert M. F.
 Dighton, Charles A.

Pass—
 Lowry, Leonard G.
 Thompson, Arthur F.
 Berry, Jack R.
 Paterson, Arthur V.
 Giles, Hurtle C.
 Johnson, Harold E.
 Lethlean, Hedley V.
 Loxton, Bruce
 Denman, Reuben H.

MECHANICAL DRAWING.

SECOND COURSE.

Credit—
 Yews, Douglas C.

Pass—
 Fulcher, James H. E.
 Lloyd, Robert F.
 Gibbons, Leo P.

APPLIED MECHANICS.

Credit—
 Sinclair, Robert J.
 Agnew, Rudolph J.

Pass—
 Blurton, Norman C.
 Gibbons, Leo P. J.
 Johns, Edward N.
 Fulcher, James H. E.
 Lloyd, Robert F.

MECHANICAL ENGINEERING.

FIRST COURSE.

Credit—
 Laver, Arthur J. F.

Pass—
 Manners, Charles B.
 Yews, Douglas C.
 Cairns, Matthew R.
 Lloyd, Arthur C.

GAS ENGINE.

Credit—
 Brown, Alexander O.
 Baker, Stanley
 Blurton, Norman C. (T)
 Sinclair, Robert J.
 Rasmussen, Lauritz P.
 Bebbington, George A.
 Manners, Charles B.

Pass—
 Sansum, William A.
 Wright, Frank
 Sansum, Harold A. (T)
 Hopkins, Thomas H.
 Nation, Arthur L. R.

INDICATOR.

Credit—
 Brown, Alexander O.
 Rasmussen, Lauritz P.
 Blurton, Norman C. (T)
 Sinclair, Robert J.
 Warner, John P.

Pass—
 Baker, Stanley
 Manners, Charles B.
 Bebbington, George A.
 Sansum, William A.
 Wright, Frank
 Sansum, Harold A. (T)
 Hopkins, Thomas H.

ANNUAL EXAMINATIONS—continued.

(T) Denotes Terminal Pass only.

ENGINE DRIVING. FIRST COURSE. Pass— McNeill, James B. Scott, Thomas C., sen. (T) Allen, George W. Coxon, Frank	BUILDING CONSTRUCTION. Pass— Taylor, Frank (Written Examination 1920 ; Thesis now accepted.)	FITTING AND TURNING. SECOND COURSE. Credit— Johns, Edward N. Pass— Leslie, Bernard H. Lloyd, Arthur C. Lloyd, Robert Sansum, Harold A.	MATHEMATICS I. (GEOMETRY SECTION.) Gibbons, Leo P. J. Fulcher, James H. E. (TRIGONOMETRY SECTION.) Hopkins, Arthur J. Fulcher, James H. E.
ELECTRICAL ENGINEERING. FIRST COURSE. Pass— Laver, Arthur J. F. Agnew, Rudolph J. Martin, Henry R.	FITTING AND TURNING. FIRST COURSE. Credit— Manners, George S. Robertson, William A. H. Golding, Hollis D. Dighton, Charles A. Illig, Herbert M. F. d'Almeida, Joseph M. B.	MECHANICAL ENGINEERING. SECOND COURSE. Pass— Sinclair, Robert J. Blurton, Norman C. Fulcher, James H. E.	CHEMISTRY. FIRST COURSE. Cairns, Matthew R. Lynch, Thomas Lloyd, Arthur C.
ELECTRICAL ENGINEERING. SECOND COURSE. Provisional Passes pending Thesis— Fulcher, James H. E. Rosenbrock, Ernest L. Thrupp, Thomas W.	ELECTRICAL ENGINEERING. SECOND COURSE. Credit— Meredyth, Cyril C. (Written Examination 1919 ; Thesis now accepted.) Pass— Taylor, Harry (Written Examination 1920 ; Thesis now accepted.)	PRACTICAL MATHEMATICS. Pass— Thrupp, Thomas W. Moore, Guy J. F.	PHYSICS I. Davies, Idris Fulcher, James H. E. Yews, Douglas C.
ELECTRICAL ENGINEERING. SECOND COURSE. Credit— Meredyth, Cyril C. (Written Examination 1919 ; Thesis now accepted.) Pass— Taylor, Harry (Written Examination 1920 ; Thesis now accepted.)	ELECTRICAL ENGINEERING. SECOND COURSE. Pass— Forbes, George E. (T) O'Keefe, Kevin P. Giles, Hurtle C. Smethurst, Eric (T) Hopkins, Thomas H. Lapham, Edgar M. Lowry, Leonard G. Mathews, Clifford W. Brown, Somerville (T) Perriman, William T. Thomson, Jack R.	SUPPLEMENTARY EXAMINATIONS (Held in February, 1923). PREPARATORY MATHEMATICS. (ARITHMETIC SECTION.) Lloyd, Robert F. (ALGEBRA SECTION.) Newman, Henry B. Lynch, Thomas	PRACTICAL MATHEMATICS. Spalding, J. SPECIAL EXAMINATION. ELECTRICAL ENGINEERING. FIRST COURSE. Thrupp, Thomas W.

FLOTATION TEST CONDUCTED AT THE SCHOOL OF MINES BY MR. A. S. WINTER, OCTOBER 1922, ON ORE SUPPLIED BY COPPER SEPARATION, LTD.

The investigation was commenced on the 27th September and was carried on continuously for over one month. During this time 46 tests were made and, although the time was far too short, I think that the results that were obtained are very satisfactory.

Practically all the tests were conducted in the Ruth type of machine. One or two were tried in the M.S. type, but on account of mechanical troubles with this machine, I thought it advisable to concentrate on the Ruth, which is a well fitted up machine.

The main points in connection with the tests are as follows:—

CLASS OF MACHINE.

The Ruth flotation machine is composed of a single cell, having an anti-swirl plate mounted above the Spumer (or impeller). The Spumer is so constructed that when it rotates it draws air down the hollow shaft and diffuses it through the pulp in the form of fine bubbles. The anti-swirl plates are perforated and prevent the pulp from taking on a rotary movement. The disadvantage of this machine lies in the oiling, direct oiling being of little use; on that account, the oiling had to be done outside the machine. The capacity of the machine is about 3,000 ccs. The speed at which it has been run has been uniform—1,400 revolutions per minute.

A well fitted M.S. type of machine should give good results, and there would also be an advantage in being able to control the oil.

METHOD OF PREPARING FLOTATION EXPERIMENT.

Immediately after the treatment of the ore in the Pachuca, the reaction mixture, containing the precipitated copper, slimes, and the whole of the salts in solution, was oiled, agitated, and then placed in the flotation machine.

The mixture of pulp in most of the experiments was 500 gms. of ore in 3,000 ccs. of water.

METHOD OF OILING.

On account of not being able to oil directly in the Ruth machine, several other means were adopted:—(1) by oiling in a Pachuca, (2) by oiling in a small earthenware pebble mill. The latter was used most as it seemed to give better results.

EFFECT OF SALTS IN SOLUTION.

The salts in solution gave no trouble at all; in fact, up to a certain point they should accelerate the floating. To make sure of this point and to show that salts would have no ill effects, I had the amount of salts which would be necessary under ordinary conditions of treatment doubled, and the results were not affected.

OILS USED.

- (a.) Eucalyptus.
- (b.) B.B. Tar.
- (c.) B.B. Distillate.
- (d.) Wool grease.
- (e.) C.A. & Co. No. 4.
- (f.) Turps and Stockholm Tar (2:3).
- (g.) Turps.
- (h.) B.B. Tar and B.B. Distillate (1:2).
- (i.) C.A. & Co. No. 4 and B.B. Tar (3:1).
- (j.) B.B. Tar and B.B. Distillate (1:3).
- (k.) Stockholm Tar and C.A. & Co. No. 4 (1:3).
- (l.) B.B. Tar and B.B. Distillate (1:4).
- (m.) Eucalyptus and Coal Tar (3:1).

Most of the above gave floats of copper, but the best results were obtained from (a) Eucalyptus and (h) a mixture of B.B. Tar and B.B. Distillate (1:2). It is more than likely that under conditions of direct oiling the latter mixture would give as good results as any oil. There may be any other mixtures which could be tried, and, as the copper is not difficult to float, I think some very cheap mixture could be made to do the necessary oiling.

TEMPERATURE OF OILING.

Various temperatures were tried for oiling, and little can be said in favour of any one temperature, as good results were obtained both at high and at lower temperatures.

BEST RESULTS OBTAINED.

The best results obtained were from oxidised ores, viz.:

Test No.	1st Float.	2nd Float.	Tails.	Recovery, based on tails assay.
6	58.6	59.6	1.02	85.7
8	64.2	30.8	1.26	82.1
10	83.6	68.2	0.96	86.4
11	65.9	77.0	1.46	79.2
14	71.7	57.0	1.18	82.8
15	58.1	62.1	1.26	81.6
17	80.4	68.2	1.06	84.5
20	89.1	66.9	0.77	88.7
21	75.0	85.8	1.50	78.0
22	74.7	64.6	1.11	83.8
23	81.0	77.0	1.01	85.2
24	69.4	..	1.11	83.8
25	69.4	56.3	1.11	83.8
34	76.7	..	1.06	84.5
36	74.7	..	1.31	80.8
44	61.2	..	0.96	86.0
Average	72.1	64.5	1.13	83.5

From the above it will be seen that the average recovery is based on the tails assay. A check was made on this in Test No. 36 by weighing the copper produced, the result being (*vide* tabulated sheet):—by tails assay 80.8 per cent. recovery; by copper produced 78.3 per cent. This is fairly close considering the number of times the products were transferred, in which losses in copper are sure to occur.

No. 20 test gave both the best head and the best recovery, and the significant fact regarding this test is that the test was tried under similar conditions to No. 10, the idea being to try to repeat the result if possible. The only differences were in the method of oiling and the temperature, and the results compared very well, No. 20 being slightly better. In this test an attempt was made to try to find out if the tails carried the copper wrapped up as unattached copper or if there was still some copper which did not float remaining in the residue. To do this, a sample of pulp was taken, allowed to settle, and the solution poured off. The slime was then panned off carefully and assays made as follows:—Solution—trace of copper only; Slimes—0.76 per cent. Cu; Sand—2.83 per cent. Cu.

The amount of sand in the slime was only 1.7 per cent. of the total weight, so that it would not make any appreciable difference to the original assay of the slime. On these figures it looks as if the copper not recovered by flotation is still in the slime and is not attacked by the reaction.

MOUNT MORGAN ORE.

Tests Nos. 28 to 33 inclusive were done on Mount Morgan ore. I understand from your Mr. Cook that the ore treated was a roasted sulphide and was the product of ten experimental roasts, and that some of these roasts gave extraction by panning from 60 per cent. to 95 per cent. copper. Mr. Cook also informed me that the badly roasted material predominated, which would account for the high value in the tails. Although this material is perhaps not so easily floated on account of the low percentage of copper and the interference of the red oxide of iron, I could not see any real difficulty in producing a good head. The results obtained will confirm this.

FIRST AND SECOND FLOATS.

In nearly every test I have made two floats. This would probably be done on a commercial scale. My reason was to take the last lot of copper off as a second float, as it would probably be lower grade. For averaging purposes, therefore, it would not be fair to average the two floats, because in some cases there were, say, 30 or 40 grams of 1st float and only 2 or 3 grams of 2nd float.

DIFFICULTIES ENCOUNTERED.

We have had many difficulties during the last two weeks, and peculiarly so since we commenced using scheme water instead of ordinary tank water. When we began investigations we used tank water, as it was nearest to our work, but as the supply gave out we had then to turn to scheme water. As the amount of alkalinity in the scheme water is so small, I naturally thought that it would not be possible for it to affect the result; consequently, most other things were tried first in endeavouring to locate the trouble.

The main trouble lay in the fact that we were getting copper in solution at the end of flotation which was not there before the flotation commenced. We also got a yellowish-green froth after the float had been in progress for a few minutes; in some cases it appeared sooner than in others, due no doubt to conditions.

These difficulties naturally gave us a small amount of copper float, very high tails and copper in solution.

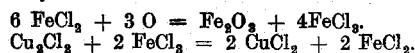
To find out where we stood we started from the beginning so far as flotation was concerned and ran a blank test in the machine consisting of salts of reaction and some finely divided material which carried no copper. This was done with a view to finding out if the salts had any reaction on the brass Spumer of the machine, but nothing happened. We then tried using pure FeSO_4 instead of the very much effloresced commercial salt brought up by Mr. Cook. This had got down to the very fine particles of the salt and consequently it had nearly all effloresced and was to a large extent insoluble in water. The pure salt, however, did not overcome the difficulty to any great extent, although results were better. Varying quantities of salts were also tried without effect.

We then tried using tank water again and, curiously enough, the experiment proceeded to a finish without a sign of any greenish-yellow bubbles appearing. The test was even prolonged to see if they would appear, but the test remained good right to the end and the solution after flotation showed no copper.

We then tried using scheme water with a trace of sulphuric acid (5 ccs. in 3,000 water), and this test proceeded to a finish with no sign of greenish-yellow bubbles, but the solution, after flotation, showed a fair amount of copper, probably due to too much acid and too little iron, as we did not allow for any iron to be consumed by the acid. Anyhow, that could be easily overcome.

As these difficulties cropped up when the investigation was well on the way, my time was far too short to follow them right out, but if the alkalinity of the scheme water, which is very small indeed, is sufficient to upset the reaction, there must be a very sensitive balance in the reaction.

In watching the reactions closely, I found during experiment No. 22, which was a test carried out under ordinary conditions, that on taking a sample of pulp just before adding the iron (*i.e.*, after the salts and the ore had been added at a temperature of 85 degrees) the reaction seemed still to go on slowly with evolution of bubbles. The solution on decanting was distinctly green and showed the presence of a large amount of copper with practically no precipitate of iron. This, of course, shows that some copper goes into solution at this stage: this may be cupric chloride, or cuprous chloride soluble in sodium chloride. But assuming that all the copper does not find its way into solution at some stage and become precipitated by iron as metallic copper before flotation, then probably, on aeration, the cuprous chloride remaining in suspension as insoluble cuprous chloride would be converted into cupric chloride and become soluble, hence copper in solution at the end of flotation. The following may possibly account for this:—



From the above it would appear that some of the iron in solution is lost, being thrown out as Fe_2O_3 ; such seems the case, as the solution, after flotation, carries much less iron than before flotation.

The fact that copper is in solution at the end shows, of course, that there is no metallic iron available to precipitate it. The reason for this is clear, for if the copper is converted to an insoluble cuprous chloride and remains insoluble until the above reaction takes place in flotation by aeration, then by that time all the metallic iron has floated off, as it usually appears first in the float, and so copper remains in solution. I think this little difficulty should be easily overcome, but I would strongly advise that it be followed up to find out just where the trouble lies.

Another point which requires watching in this direction is the amount of metallic iron added for precipitation. We have found the samples of iron filings to be very dirty and the amount of available *metallic* iron very low. Two samples we were working on gave the following available metallic iron results:—

Sample A—59.2 per cent.

Sample B—67.72 per cent.

The iron filings were also tested for copper—result *nil*.

SMELTED COPPER.

I am sending you under separate cover an ingot of metallic copper—the first—produced from an average sample of cement copper. No difficulty was encountered in producing the copper, which would be quite a simple matter on a commercial scale.

CONCLUSION.

I consider that the flotation of copper from your metallic copper contact process presents no difficulty.

I think that the process itself is sound; and speaking from some twenty years' practice in copper smelting and refining and from experience both as a metallurgist responsible for the production of copper and as a manager responsible for its economical production, I cannot but be impressed with a process by which metallic copper is produced in marketable condition within a few hours of being broken from the face.

I consider none the less that such points as I have referred to should be thoroughly investigated in the laboratory before large scale operations are undertaken; with skilfully selected experimentation, the minor difficulties incidental to the initiation of a new process could then be averted without the expense attaching to even minor alterations upon a big undertaking.

In view of the fact that my time, other than the afternoons, is fully taken up with school work, it would have been impossible for me to have got through the amount of work done without the assistance of Mr. H. J. Cook, and I would like to place on record my high appreciation of the amount of energy and skill put forward by Mr. Cook to make these tests a success.

(Sgd.) A. S. WINTER,

27th October, 1922,

FLOTATION TEST.

Date.	Test No.	Reaction Mixture.					Flotation Products.				Recovery.		Temperature.		Kind and amount of oil used, drops.	Class of Float.	Remarks.
		Ore, gms.	FeSO ₄ gms.	NaCl gms.	Fe, gms.	Assay Ore Cu, %.	1st Float Cu, %.	2nd Float Cu, %.	3rd Float Cu, %.	Tails Cu, %.	Based on Tails Assay, Cu. %.	Based on wt. Cu. produced Cu. %.	Oiled.	Floated.			
Sept. 28	1	450	...	...	...	7.02	...	...	...	...	...	...	...	...	...	...	Nos. 1 and 2 carried out more as a preliminary. Used 100 gms. Cement copper (23% Cu.) prepared in Perth. Results negative.
	2	450	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sept. 29	3	600	30	87	35	7.02	51.2	...	...	3.88	...	...	35	35	Excess A & B	Watery ...	These tests run to try to get some set conditions. Each re-action test was divided into 2 parts and 2 flotation tests then made. Direct oiling tried in M.S. and Ruth machine but Ruth found totally unfit for direct oiling.
	4	...	...	...	...	7.02	25.6	...	...	...	...	...	35	35	Excess A	Watery ...	
Sept. 30	5	600	30	87	35	7.02	25.6	...	...	...	...	...	35	35	Various	Oiling unaffected	Oiled in Pachuca with 12 drops. Further 20 added while float coming off. Tails after floating were panned, and showed no copper.
Sept. 30	6	...	...	...	...	7.02	58.6	59.3	...	1.02	85.7	...	30	21	32A	Good ...	
Oct. 2	7	1,000	50	100	50	7.02	64.6	29.0	...	2.88	...	...	85	35	12A	Rapid ...	Oiled in Pachuca at 85 degrees with 5 drops B after re-action. Finished float with 8 drops A.
	8	...	...	...	...	7.02	64.2	30.8	...	1.26	82.1	...	85	37	5B, 8A	Rapid ...	
	9	500	25	60	25	7.02	56.5	70.7	...	2.27	...	...	85	43	26A	Slow at first ...	
Oct. 3	10	500	50	100	25	7.02	38.6	68.2	...	0.96	86.4	...	75	32	28A	Good ...	Oiled in Pachuca at 75 degrees with 8 drops A, finished float with further 20 drops. Float good right to end.
	11	500	25	100	25	7.02	65.9	77.0	...	1.46	79.2	...	85	30	6B, 75A	Slow ...	
Oct. 4	12	500	25	100	25	7.02	74.5	69.4	...	2.88	...	...	85	30	6B, 20A	Very slow ...	Oiled in Pachuca before adding iron with 6 drops D. Float very slow. Necessary to add 20 drops A to continue floating. Incomplete.
Oct. 4	13	500	50	100	25	6.82	80.0	37.4	M.S. 11.6	1.77	...	...	84	30	8A	Slow and watery	Commenced using glass cylinder for reaction instead of copper pachuca. Oiled in cylinder at 84 degrees, but oiling not so effective as in pachuca. Tried to re-treat pulp in M.S. machine without success.
Oct. 5	14	500	50	100	25	6.82	71.7	57.0	...	1.18	82.8	...	85	30	38A	Slow ...	Placed glass tube in cylinder to act as air lift and give better mixing action. Oiled with 4 drops A before and 4 drops after adding iron. Float slow. Necessary to add 30 further drops to complete.
	15	500	50	100	25	6.82	58.1	58.0	71.2	1.26	81.6	...	85	30	10E, 20A	Large bubbles ...	
Oct. 6	16	500	50	100	25	6.82	66.6	...	...	...	...	...	55	55	24A	Slow ...	Test made in M.S. machine. Tried direct oiling. Had trouble with belt. Test had to be abandoned. Oiled in earthenware pebble mill with 8 drops A to try to effect better oiling. Agitated 15 minutes. Further 24 drops A added to complete float.
	17	500	50	100	25	6.82	80.4	68.2	...	1.06	84.5	...	40	30	33A	Rapid and good	
	18	500	50	100	25	6.82	74.7	...	...	1.87	...	...	50	30	34A, 7B	Good ...	

Oct.	7	19	500	50	100	25	6-82	77-7	78-8	...	1-77	...	...	42	30	77, 20G	Very rapid ...	Oiled in pebble mill with 7 drops. F. Float appeared rapidly. Watery towards end. Added further drops G. with no effect.
Oct.	8	20	500	50	100	25	6-82	89-1	66-9	...	0-77	88-7	...	59	32	28A	Rapid and good	Oiled in pebble mill with 8 drops A. Float very rapid but good. Finished float with further 20 drops A.
Oct.	9	21	500	50	100	25	6-82	75-0	85-8	...	1-5	78-0	...	60	32	5B, 20A	Rapid ...	Oiled in pebble mill with 5 drops B. Float appeared rapidly but soon became watery. Added further 20 drops A to complete. 2nd float taken off with A oil.
Oct.	10	22	500	50	100	25	6-82	74-7	64-6	...	1-11	88-8	...	54	30	15C	Rapid at first ...	Oiled in pebble mill with 7 drops C. Float rapid at start, but slowed down. Added further 8 drops to complete.
		23	500	50	100	25	6-82	81-0	77-0	...	1-01	85-2	...	45	30	16H	Very rapid ...	Oiled in pebble mill with 8 drops H. Float appeared very rapidly and showed signs of mixing towards end. Added further 8 drops H but with little result. Oil too thick for direct oiling.
Oct.	11	24	500	50	100	25	6-82	69-4	...	...	1-11	88-8	...	47	31	12B	Slow ...	Oiled in pebble mill with 8 drops E. Float slow, practically no froth at start. Copper looked high grade. Added further 4 drops same oil near end with little result.
		25	500	50	100	25	6-82	69-4	56-8	...	1-11	88-8	...	45	32	8I	Rapid ...	Oiled in pebble mill with 8 drops I. Float very rapid, large bubbles, and appeared mixed towards end.
Oct.	12	26	500	50	100	30	6-82	71-7	59-6	...	2-12	...	...	42	30	9J	Rapid ...	Oiled in pebble mill with 9 drops J. Float very rapid but did not last; soon became mixed.
		27	500	50	100	30	6-82	...	...	...	...	...	...	55	35	9K	Very frothy ...	Oiled in pebble mill with 9 drops K. Float appeared very frothy and watery; no copper showed up at all. Result negative. Ore sample was re-assayed for copper.
Oct.	17	34	500	50	100	30	6-82	76-7	...	...	1-06	84-5	...	45	32	34A	Rapid and good...	Oiled with 9 drops A. Float rapid and continued to float well. Added further 25 drops A. Finished end point, only white bubbles showing at end. Tested solution from pulp after flotation. Quite an appreciable amount of copper found. Up to this point tank water was used for all reactions.
Oct.	17	35	500	50	100	Excess spiral turnings	6-82	...	...	...	...	...	...	70	32	8I, 12A	Very poor ...	Began using scheme water in reactions. Oiled with 8 drops I. Float very slow. Added 12 drops A. No float appeared. (In this test long spiral turnings were used instead of iron filings and reaction allowed to go on for 1 hour). Solution after showed large amount of copper. Test negative.
Oct.	18	36	500	50 Pure	100	30	6-82	74-7	...	...	1-31	80-8	78-8	42	32	39A	Slow ...	Oiled with 9 small drops A. Float appeared slowly but good. Added further 30 drops A. Float continued right up to end. Used very small drops for oiling float, which probably accounts for float coming off slowly. Tested solution after flotation, no copper in solution.
		37	500	50 Pure	100	Excess spiral turnings	6-82	91-1	...	...	1-97	...	...	57	37	8H, 10A	Very rapid ...	Oiled with 8 drops H. Float very rapid, and all copper seemed to come up at once. Float afterwards ceased. Added 10 drops A. No result. In this test long spiral turnings were used instead of iron filings and treatment allowed to proceed for 1 hour. Tested solution after flotation; quite a large amount of copper in solution.

FLOTATION TEST—continued.

Date.	Test No.	Reaction Mixture.					Flotation Products.				Recovery.		Temperature.		Kind and amount of oil used. Drops.	Class of Float.	Remarks.
		Ore, gms.	FeSO ₄ , gms.	NaCl gms.	Fe, gms.	Assay Ore Cu %.	1st Float Cu, %.	2nd Float Cu, %.	3rd Float Cu, %.	Tails Cu, %.	Based on Tails Assay, Cu. %.	Based on wt. Cu. produced Cu. %.	Oiled.	Floated.			
Oct. 19	38	500	25 Pure	10	25	6.82	52.2	...	...	3.9	...	...	44	33	10A	Rapid ...	Oiled with 10 drops A. Float rapid at start, but after float had been in progress a few minutes, yellowish-green bubbles appeared. This was the first test in which they were noticed. Solution tested after flotation showed large amount of copper in solution. In this test large reduction in amount of salts used in reaction and time extended from 20 to 30 minutes for reaction.
	39	500	25 Pure	10	25	6.82	50.0	...	...	4.45	...	...	60	37	8H	Rapid ...	Treatment as in No. 38. Oiled with 8 drops H. Float appeared rapidly at first, and after float had been in progress a few minutes, greenish-yellow bubbles appeared, more pronounced than in test No. 38. Tested solution after flotation: quite a large amount of copper showing. Assay of yellowish-green froth gave 17.2 per cent. copper.
Oct. 28	40	500 Pure	25 Pure	10	30	6.82	...	...	...	...	...	...	60	34	19A	Rapid ...	Treatment 30 minutes with steam agitation only. Oiled with 9 drops A. Float appeared rapidly at first, then yellowish-green bubbles appeared. Tested solution after flotation: large amount copper in solution. Test negative.
	41	500	50 Pure	100	30	6.82	62.6	...	...	2.42	...	...	55	34	34A	Rapid ...	Treatment 30 minutes with steam agitation only. Oiled with 9 drops A. Float rapid, added further 25 drops A to continue floating. Float continued good, no yellowish-green bubbles. Tested solution after flotation: large amount copper showing in solution.
	42	500	25 Pure	10	30	6.82	...	...	...	4.14	...	...	55	33	21A	Rapid ...	Treatment 30 minutes with steam and air agitation. Oiled with 9 drops A. Float rapid at first: added further 12 drops A to continue float. Greenish-yellow bubbles soon appeared. Tested solution after flotation: large amount copper showing in solution.
Oct. 24	43	500	50 Pure	100	30	6.82	62.4	...	...	2.35	...	...	60	34	33A	Rapid ...	Tank water used for this reaction. Treatment as in 42. Oiled with 8 drops A. Float rapid. Added further 25 drops A to continue floating. Good end point. No copper in solution after floating.
	44	500	50 Pure	100	30	6.82	61.2	...	...	0.96	86.0	...	...	...	29A	Very rapid ...	Scheme water used for reaction with addition of 5 drops Conc. H ₂ SO ₄ . Treatment as in 43. Oiled with 9 drops A. Float very rapid; most of float came off in about 5 minutes. Added further 20 drops A, without much effect. Tested solution after flotation: fair amount of copper in solution.

TESTS ON PARTIALLY ROASTED MT. MORGAN ORE.

Oct. 13	28	500	Ni	100	12	2.3	56.1	40.9	...	0.74	68.4	...	45	35	13A	Rapid ...	Oiled with 5 drops A. Float appeared rapidly but on account of the red nature of pulp due to Fe ₂ O ₃ , it was difficult at first to distinguish. Added further 8 drops A and took off 2nd float.
	29	500	Ni	100	12	2.3	53.3	50.7	...	0.65	72.3	...	40	30	5L, 10A	Very rapid ...	Oiled with 5 drops L. Float very rapid and frothy. 2nd float taken off with 10 drops A.
Oct. 14	30	500	Ni	100	12	2.3	78.5	57.7	...	0.56	76.1	...	53	32	16A	Rapid ...	Oiled with 4 drops A. Float rapid. Fe ₂ O ₃ did not show up so much. Added further 12 drops A to take off 2nd float.
	31	500	Ni	100	12	2.3	34.1	21.2	...	0.73	...	...	55	38	4L	Very rapid and watery	Oiled with 4 drops L. Float very rapid and watery towards end.
Oct. 16	32	500	Ni	100	12	2.3	39.6	...	...	0.69	70.6	...	75	32	14M	Rapid ...	Oiled with 4 drops M. Float very rapid and looked mixed. Copper did not show out so well. Added further 10 drops mixture to continue float.
	33	500	Ni	100	12	2.3	50.2	...	...	0.8	65.9	...	70	35	30A	Slow ...	Oiled with 5 drops A. Float appeared slowly at first probably on account of oiling at too high a temperature.

TESTS ON SOUTH KALGURLI ORE CONDUCTED
AT SCHOOL OF MINES.

JUNE 11TH TO 15TH, 1923.

Ore.—Ball mill product, South Kalgurli Gold Mine.
Assay Value.—Gold ... 7 dwts. per ton.
Sulphur 2.92 per cent., equivalent to
5.48 per cent. FeS₂.

Grading Analysis.

Screen.	Per cent.	Assay value.	Per cent. of total gold.
		dwt. gr.	
40 ...	26.44	5 14	21.38
60 ...	11.66	6 19	11.47
80 ...	9.80	6 15	9.40
100 ...	21.45	7 5	22.39
120 ...	7.54	7 5	7.87
150 ...	16.63	6 0	14.45
200 ...	0.50	5 5	0.37
-200 ...	5.25	16 15	12.64
	99.27	6 22.8 (calculated)	99.97

Flotation Tests—Qualitative. Oil used—Eucalyptus.

No.	Ore.	Head.	Concts.	Tails.
		dwt. gr.	oz. dwt. gr.	dwt. gr.
1	As received	7 0	2 0 0	3 15
2	As received	7 0	2 4 0	4 11
3	-100 mesh	7 0	3 4 0	1 05

19th June, 1923.

SUMMARY OF TESTS, 18TH TO 25TH JUNE, 1923.

SOUTH KALGURLI ORE.

Date.	Test No.	Ore.	Oil.	Weight Ore. gms.	Weight Water. gms.	Head Assay. dwt.	Conc. wt. gms.	Conc. Assay. dwt.	Tails wt. gms.	Tails Assay. dwt.	Middlings weight. gms.	Middlings Assay. dwts.	Remarks.
18-6-23	4	-100 mesh ...	Euc.	400	3,000	7.0	57.	33.0	316.5	1.7	...	...	Slimed 1 hour in pebble mill.
	5	Slime ...	"	400	3,000	7.0	63.4	33.0	334.5	3.0	...	...
20-6-23	6	-60 mesh ...	"	400	3,000	7.0	28.95	45.0	354.35	3.6	8.0	28.0	Slimed 2 hours in pebble mill.
	7	-80 mesh ...	"	400	3,000	8.0	30.65	50.0	355.4	3.6	9.95	44.0	
	8	Slime ...	"	400	3,000	7.0	28.55	44.5	365.4	1.8	4.6	40.0	Ore ground wet 1½ hours in pebble mill—all through 200 mesh.
22-6-23	9	-120 mesh ...	"	400	3,000	8.0	7.4	(a) 112.0	237.45	1.85	106.4	4.4	
	10	-100 mesh ...	"	400	3,000	8.0	28.4	(b) 36.0	...	...	...	...	Conc. (a) without oil.
25-6-23	11	-200 mesh ...	"	500	3,000	7.0	9.8	(a) 162.0	242.35	1.65	110.38	4.4	Conc. (a) without oil.
	12	...	"	...	...	...	22.15	(b) 40.0	...	...	...	...	Conc. (b) with oil.
	13	...	"	...	...	...	(a) 57.45	31.0	...	...	...	...	Ore ground wet 1½ hours in pebble mill—all through 200 mesh.
	14	...	"	...	...	...	(b) 12.08	26.0	...	...	...	...	(a) Float removed after additional 6 drops Euc. oil.
	15	...	"	...	...	...	(c) 7.74	22.0	...	...	...	...	(b) Float removed after additional 3 cc. H ₂ SO ₄ ; no further oil.
	16	...	"	...	...	...	(d) 17.50	33.0	...	...	...	...	(c) Float removed after addition of 2 cc. H ₂ SO ₄ additional; no further addition of oil.
	17	...	"	...	...	...	...	...	...	...	...	...	(d) Float removed after addition 10 cc. H ₂ SO ₄ , and 11 drops Euc. oil; both added in successive small quantities.

3rd July, 1923.

SUMMARY OF TESTS, 29TH JUNE TO 4TH JULY, 1923.

SOUTH KALGURLI ORE.

Date.	Test No.	Ore.	Euc. Oil drops.	H ₂ SO ₄ cc.	Weight Ore. gms.	Weight Water. gms.	Head Assay. dwts.	Conc. wt. gms.	Conc. Assay. dwt.	Tails wt. gms.	Tails Assay. dwts.	Middlings wt. gms.	Middlings Assay. dwt.	Remarks.
29-6-23	12	South Kalgurli, No. 1 Sample	27	22.5	500	3,000	7.0	(a) 66.56	46.0	314.02	0.8	102.32	3.0	A.
			6	2.5	...	...	...	(b) 5.69	12.0	...	...	...	...
2-7-23	13	South Kalgurli, No. 2 Sample	27	15	500	3,000	15.8	(a) 45.85	114.0	315.6	1.2	101.82	10.8	B.
			5	5	...	...	...	(b) 7.0	12.0	...	...	...	...
2-7-23	14	South Kalgurli, No. 2 Sample	14	12.5	500	3,000	15.8	(a) 39.85	118.0	300.2	1.3	121.1	7.7	C.
			8	5	...	...	...	(b) 14.05	10.0	...	...	...	...
4-7-23	15	South Kalgurli, No. 2 Sample	14	20	500	3,000	15.8	45.70	110.0	350.4	2.45	72.90	10.8	D.
4-7-23	16	South Kalgurli, No. 2 Sample	16	25	500	3,000	15.8	53.70	96.0	337.9	0.95	79.20	13.6	E.

- A. Slimed 2½ hours in pebble mill with 1,000cc. water and 2 drops Euc. oil. Conct. (a) Float with 27 drops oil and 22.5 cc. H₂SO₄. Conct. (b) Float with final 6 drops oil and 2.5 cc. H₂SO₄.
 B. Ground dry through 100 mesh. Conct. (a) Float with 27 drops oil and 15 cc. H₂SO₄. Conct. (b) Float with final 5 drops oil and 5 cc. H₂SO₄.
 C. Slimed in pebble mill 1½ hours with 1,000 cc. water. Conct. (a) Float with 14 drops oil and 12.5 cc. H₂SO₄. Conct. (b) Float with final 8 drops oil and 5 cc. H₂SO₄.
 D. Ground dry through 100 mesh.
 E. Slimed 2½ hours in pebble mill with 1,000 cc. water.

Note.—All tests made in Ruth Machine. Oil and Acid in all cases added in successive small portions.

7th July, 1923.

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SUMMARY OF FLOTATION TESTS ON SOUTH KALGURLI ORE—9TH JULY TO 6TH AUGUST, 1923.

Date.	Test No.	Gre.	Oil drops.	H ₂ SO ₄ .	Wt. Ore gms.	Wt. water gms.	Head Assay dwts.	Concentrates.		Tailings.		Middlings.		Remarks.
								Wt. gms.	Assay dwt.	Wt. gms.	Assay dwts.	Wt. gms.	Assay dwts.	
9-7-23	17	No. 2	Eu. 10 Tar and Turps 4	2	500	3,000	...	...	...	...	...	...	...	Slimed in pebble mill 3 hours mixed float. Test negative. Ruth machine.
9-7-23	18	No. 2	Eu. 21	25	500	3,000	15.8	66.2	76.0	323.5	1.05	84.3	7.4	Slimed in pebble mill 3 hours; added 3 drops Euc. oil and continued sliming 1 hour. Ruth machine.
25-7-23	19	No. 2	Eu. 17 B.B. tar and Dist. 8	10	500	3,000	15.8	38.8 615.9	100.2 32.0	436.	6.0	...	...	Slimed in pebble mill 4½ hours 100 gm. NaCl added to pulp M.S. Cell. (a) Float with Euc. (b) Float with B.B. Tar and distillate.
25-7-23	20	No. 2	Eu. 7 Eu. 11 Eu. 17	...	500	3,000	15.8	43.75 3.26 25.34	70.0 44.0 54.0	383.	4.0	...	...	Ground dry through 100 mesh.
27-7-23	21	No. 2	Eu. 6	Nil	500	3,000	...	14.4	122.0	...	...	...	...	Slimed 3 hours 45 min. in pebble mill. Heated to 60 deg. at beginning of test. Froth unsatisfactory. Test stopped.
27-7-23	22	No. 2	Eu. 25 Eu. 13	20 10	1,000	...	15.8	27.8 44.3	128.0 76.0	252.0 489.0	17.0 1.8	...	...	Slimed in pebble mill 3 hours. 45 min. with 1,000 c.c. water, diluted, settled 1 min. and decanted; repeated operation. (a) Settled portion 100 gms. NaCl added. (b) Decanted portion.
1-8-23	23	No. 2	Coa tar and Euc. 1:1 8	...	750	3,000	15.8	132.7	64.2	542.2	5.3	...	...	Slimed in pebble mill for 1 hour with 1,000 c.c. water and 4 drops of mixture of coal tar and eucalyptus 1:1. Float very mixed.
3-8-23	24	No. 2	Eu. 30 Eu. 8 Eu. 10	...	500	3,000	15.8	2.55 13.6	320.2 106.0	...	...	...	...	Ground dry to pass 100 mesh. Mixed with 2,000 cc. water. Passed SO ₂ till acid. Test hampered by power fluctuations.
6-8-23	25	No. 2	Eu. 12	...	500	3,000	15.8	Slimed 1 hour in pebble mill with 1,000 cc. water. Passed SO ₂ till acid. Mechanical trouble with cell stopped test.

17th August, 1923.

B. H. MOORE.
A. S. WINTER.

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REPORT ON IVES' REWARD SANDS.

No. 1 Sample—Blue Lode.

Head sample .. Assay value 10.9 dwt. gold per ton.

Concentration Test on Wilfley Table.

Concentrate .. per cent. 10.0
 Assay value 25.6 dwt. gold per ton.
 Tails .. Assay value 10.3 " "

Concentration Test on Re-ground Tails.

Concentrate .. per cent. 5.67
 Assay value 45.0 dwt. gold per ton.
 Tails .. Assay value 7.1 " "

Amalgamation Test on Tails from Second Concentration.

Tails .. Assay value 6.0 dwt. gold per ton.

Note.—It was found impossible to recover the whole of the tails from each concentration owing to the difficulty of completely settling the fine slime, which would have required settling vats of larger capacity than were available.

B. H. MOORE.
 A. S. WINTER.

6th September, 1923.

YOUANMI SULPHIDE (marked "380").

Arsenic and antimony are to be expected. The sample is said to be very finely crushed, and further crushing may be unnecessary.

(a) Make a flotation test on the sample as it was received.

(b) Take a second sample of the same parcel.

Concentrate.
 Assay the concentrates and the tailings (T). If necessary, re-grind the concentrates to pass 150 mesh, make alkaline, and treat with strong cyanide.

Cyanide the tailings (T) without further grinding.

(c) Take a third sample of the same parcel. Slime in the Pebble mill to finest slime. Make a flotation test. Test float for values. Test float by cyanide. Test tailings for values and, if good enough, test them by cyanide.

TAILINGS SAMPLE—PARTLY ROASTED TAILINGS (marked "A").

(a) Make a straight cyanide test for extraction.
 (b) If cyanidation of the tailings is not successful, heat, without actually roasting, another sample of the tailings and try cyaniding again.
 (c) Make a flotation test on the tailings as received.

REPORT OF TESTS ON YOUANMI ORE.

28th September to 9th October, 1923.

Sample "380"—Sizing Test of Ore as received.

Screen (I.M.M.)	Per cent.
+ 40	0.28
+ 60	2.99
+ 80	13.99
+ 100	1.85
+ 120	8.82
+ 150	7.27
+ 200	7.73
- 200	55.58
	98.51
	98.51

CONCENTRATION AND FLOTATION TESTS, YOUANMI ORE.

Test. Conc. C. Flot. F.	No.	Ore. Wt. gms.	Value. dwt. Au.	Concentrate.		Tailings.		Extraction. per cent.	Remarks.
				Wt. gms.	Value. dwt. Au.	Wt. gms.	Value. dwt. Au.		
No. 1C ...	380	800	15.6	168.4	33.4	609.6	7.4	45.07	Concentrated on Wilfley Table.
No. 2C ...	380	1,000	15.6	200.7	35.8	766.0	9.6	46.06	Concentrated on Wilfley Table.
No. 3C ...	A.	1,000	1.8	Amt. negligible	...	...	...	...	Concentrated on Wilfley Table.
No. 1F ...	A.	500	1.8	...	Test negative—no float	...	...	...
No. 2F ...	380	500	15.6	97.8	41.72	379.47	4.89	52.32	Ore as received, floated in Ruth Machine with 0.96 gms. Euc. oil and 2 cc. H ₂ SO ₄ .
No. 3F ...	380	500	15.6	102.3	37.89	391.2	8.2	49.69	Ore as received, floated in Ruth Machine with 26 drops pyridine, 0.64 gms. Euc. oil and 2 cc. H ₂ SO ₄ .
No. 4F ...	380	500	15.6	153.39	20.43	347.0	3.8	40.17	Ore slimed in pebble mill through 200 mesh, floated in Ruth Machine with 1.28 gms. Euc. oil and 2 cc. H ₂ SO ₄ .
No. 5F ...	380	500	15.6	170.95	30.62	337.2	3.89	67.1	Same as No. 4F, except acid added only to finish float.
No. 6F ...	380	500	15.6	93.3	56.0	396.6	7.6	67.03	Ore as received, floated in Ruth Machine with 0.96 gms. Euc. oil and 2 cc. H ₂ SO ₄ .
No. 7F ...	380	500	15.6	78.75	46.3	418.0	9.3	46.7	Ore as received, floated in Ruth Machine with 20 drops pyridine, and 2 cc. H ₂ SO ₄ ; float ceased. Float finished by adding 0.384 gms. Euc. oil.

CYANIDE TESTS.

YOUANMI ORES AND PRODUCTS.

Material.	Ore.	Head Value. dwt. Au.	KCN. soln. % KCN.	Residue Value. dwt. Au.	Extraction. per cent.	Remarks.
Wilfley Concentrate	380	35.8	0.7125	13.2	63.1	All tests vigorously agitated 5 hours, further contact of 11 hours. Total, 16 hours contact.
Wilfley Tails	380	9.6	0.1	7.4	22.9	
Float from Test No. 5F	380	30.71	0.7125	6.8	77.85	In order to obtain sufficient material for cyanide tests, the samples were prepared by mixing similar floats and tailings, respectively; this accounts for head assays in cyanide tests being different from assays of floats and tails shown under concentration tests.
Tails from Test No. 5F	380	4.58	0.1	4.2	8.3	
Half-roasted Tailings as received ...	A.	1.80	0.1	1.8	Nil	
Half-roasted Tailings heated ...	A.	1.80	0.1	1.6	11.1	

Re Ore "380."

Attention is specially directed to flotation test No. 5 and the direct cyanidation of the float. We consider that a further detailed investigation along the lines of this test should be made.

We are of the opinion that the high percentage of sulphides in this ore warrants a combination of gravity and flotation methods of concentration in order to extract as much as possible of the coarser sulphide by the former method and the remainder by flotation after re-grinding the residues from the gravity concentration.

We have no information as to whether this sample is freshly mined and freshly crushed, both of which are essential to successful flotation, for if the ore has been exposed to weathering agencies for any length of time either before or after crushing, the sulphide particles will be more or less superficially oxidised and in that condition will not float. In practice the ore is freshly mined and freshly crushed and these conditions promoting oxidation do not occur.

Re Tailings, Sample "A."

All tests on this sample were practically negative. The very small amount of material obtained by concentration on the Wilfley Table indicated that treatment on these lines would not be economical, and on account of the sample having been partially roasted and its low mineral content, the result of the flotation test, as expected, was negative. Roasting or partial roasting produces greater oxidation of the sulphides than the atmospheric weathering previously referred to. Finer grinding of this sample and straight cyaniding might possibly give better results than those obtained.

B. H. MOORE,
Lecturer in Metallurgy.

A. S. WINTER,
Assistant Lecturer in Metallurgy.

REPORT BY B. H. MOORE AND A. S. WINTER ON THE TREATMENT OF RAVENSTHORPE ORE (SAMPLE E/1), BY THE NEVILL SOANES PROCESS, 1923.

The ore was received in lump form and had apparently been exposed to atmospheric weathering agencies for some time. The ore was essentially an oxidised ferruginous ore containing a small percentage of pyrite, the copper being present in the form of carbonates and oxide. The pyrite present contained no copper, as will be evident from Test No. 60, while the bulk of the gold and silver values was contained in this mineral. The important constituents of the ore are shown in the following analysis:—

Insoluble	28.98 per cent.
Copper	10.08—13.1 per cent.
Iron	25.69 per cent.
Sulphur	4.8 per cent.
Gold	1.3—1.34 oz. per ton.
Silver	1.97—2.1 oz. per ton.

It will be clearly understood from the above that the ore is an oxidised ore containing pyrite. Calculation of the sulphur content to pyrite gives an equivalent of about 9 per cent. of pyrite in the ore. This pyrite is not attacked chemically during the reaction, nor is any claim made by this process that sulphide minerals are attacked by the re-agents used. Hence there are available two distinct methods of treating this ore by this process, viz.:—

1. Roasting the whole of the ore so as to oxidise all the pyrite and bring the ore into the oxidised class, followed by direct treatment by this process.

2. Direct treatment of the ore, without roasting, so as to recover the pyrite by flotation with the cement copper.

As we considered the latter to be the more suitable method of treatment, our investigations have been made along these lines, and as the ore had been exposed to atmospheric conditions for some time, the pyrite had become partially oxidised superficially, a condition which is detrimental to its flotation and opposed to the principles of flotation, and therefore floated slowly. For this reason, the more oxidised portion of the pyrite would not float at all, which accounts for the gold and silver content of the tails being higher than would be the case in the treatment under ordinary conditions of freshly mined ore.

As the ore contains practically equal amounts of copper and pyrite, the latter containing no copper, it follows that by the method of treatment adopted the flotation product cannot be of a high grade in copper, for practically the same ratio between these constituents will exist in the float as in the ore.

TREATMENT OF ORE.

Fineness.—Tests have been carried out on samples of varying degrees of fineness, mainly 100 mesh, but also up to 200 mesh and coarser than 100 mesh. Tests on samples coarser than 100 mesh did not give satisfactory extractions. As tests on 100 mesh samples appeared to give satisfactory results, finer crushing was not considered necessary, although a few tests were carried out on finer material to determine whether an increased extraction could be obtained by this means. The results of these tests, however, indicated that no advantage could be gained by crushing finer than 100 mesh. The ore was crushed dry.

Reaction.—The reactions for the decomposition of the ore were carried out in a Pachuca tank under varying conditions:—

- (a) Varying temperatures.
- (b) High percentages of NaCl and FeSO₄.
- (c) Low " " "
- (d) Medium " " "
- (e) Low percentage of FeSO₄ and high percentage of NaCl.
- (f) High percentage of FeSO₄ only.
- (g) Agitation with air lift and steam pipe.
- (h) " " steam pipe only.
- (i) Varying proportions of Fe.
- (j) Methods of addition of salts and Fe.
- (k) Duration of reaction.
- (l) Different samples of Fe.

Apart from the fact that temperatures of 70 degrees C. and over are necessary for the reactions to take place rapidly, the conditions which appeared to have most influence on the results were variations of the percentages of NaCl, FeSO₄ and Fe.

Use of High Percentages of Salts.

The amount of NaCl used in this series of tests gives a salt solution of slightly higher concentration than that of sea water, so that for commercial purposes these percentages are not outside economic limits. As the ferrous salts used in the process are regenerated and therefore the residual liquors from treatment and flotation will be continuously in circulation, the addition of FeSO₄ is necessary only in amount sufficient to replace that lost by leakage and other unavoidable sources of loss. On account of the necessity of allowing residues from separate tests to settle and in most cases to stand nearly 24 hours, it was found impossible, except in a few cases, to follow out this procedure in the laboratory owing to the oxidation, by exposure to the atmosphere, of the ferrous salts.

A summary of results of tests under identical conditions as regards percentages of salts is given in the accompanying Table "A," which shows that under laboratory conditions, average recoveries can be expected as follows:—

Cu	88.6 per cent.
Ag	75.1 per cent.
Au	75.6 per cent.

These tests were conducted under the same conditions as regards salts, in the endeavour to duplicate results, but conditions were modified by using different oils, different amounts of crude Fe, and different densities of pulp. The variation in the weights of Fe shown in the table is due to the use of samples of crude iron containing different percentages of available metallic Fe. The amounts of available metallic Fe used have been calculated on the assumption that in this process the ratio required of Cu to Fe is 3 : 2.

In tests under these conditions as to salts, it has been conclusively shown that where air agitation is used during the reaction, and the latter is allowed to proceed for a short time before addition of iron, an appreciable amount of copper always goes into solution, either by oxidation of cuprous chloride to cupric chloride, or by solution of cuprous chloride in sodium chloride solution owing to formation of soluble complex double chlorides. If cupric chloride is formed in this way, the amount of iron necessary for precipitation is materially affected.

The recoveries of the valuable metals, copper, silver, and gold, under the conditions shown in the table, have been appreciably higher than under other sets of conditions, noticeably so in the case of silver and gold. As previously stated, the gold and silver are present, for the most part, in the pyrite, and, as some of this is in a partially oxidised state, we have reason to believe that the relatively high concentration of salts has brought about a

cleaning action on the altered pyrite particles, enabling them to be floated, thereby giving tails of consistently lower gold and silver values than those obtained under other conditions as to salts.

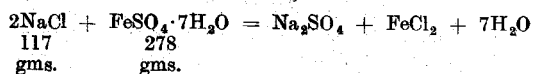
In the tests shown in Table "A," the method of conducting the reaction was as follows:—

- (1.) Addition of salts to water at 70—80 degrees C. in Pachuca.
- (2.) Rapid addition of ore, allowing about 10 minutes for the reaction to proceed.
- (3.) Gradual addition of iron.

Use of Low Percentages of Salts.

The accompanying Table "B" shows a summary of the results obtained by the use of low percentages of salts. As the reactions involved in this process are cyclic, it was considered that, theoretically, the process was capable of being carried out with a minimum amount of salts and the amount of Fe necessary to precipitate the copper and regenerate the ferrous salts.

Assuming that ferrous chloride, FeCl₂, is the active reagent in the decomposition of the copper minerals and as, for the formation of FeCl₂ by reaction between NaCl and FeSO₄·7H₂O, two chemical equivalents of the former are required to one of the latter,



the proportions required are in the ratio

$$\text{NaCl} : \text{FeSO}_4 \cdot 7\text{H}_2\text{O} :: 117 : 278, \text{ or } 8.4 : 20,$$

twenty grams of FeSO₄·7H₂O were taken as a starting point and the equivalent quantity of NaCl was added. This ratio was preserved throughout this series of tests. Except in test 28, the only variations were in the oils and the amount of iron used. The average recoveries of the valuable metals were appreciably lower than those shown in Table "A" and this applies more particularly to the silver and gold. We consider that the lower recoveries of silver and gold are due to the fact that the concentration of salts capable of exerting a cleaning action on the pyrite is not sufficiently high to enable flotation of this mineral to take place to the same extent as in the series using high percentages of salt.

The method of carrying out the reaction differed from that adopted for the tests shown in Table "A," because it is necessary that metallic iron should be present from the commencement of the reaction for the purpose of precipitating the copper from its chlorides as fast as they are formed, reforming the active reagent, ferrous chloride, so that the decomposition of the copper minerals may continue, and also for the purpose of reducing any ferric chloride formed to ferrous chloride. The procedure adopted was therefore as follows:—

- (1.) Addition of ore to water at 70—80 degrees C. in Pachuca.
- (2.) Gradual addition of mixture of Fe and finely ground salts to pulp over varying periods of time.

Up to and including Test 16, the Ruth cell was mainly used, but from Test 17 onwards the M. S. cell was used in all tests. Various kinds and mixtures of oils have been used as frothing and collecting agents, most of which have given satisfactory results. The following oils and mixtures of oils have been used, viz.:—Eucalyptus; Eucalyptus + Blackboy tar + pyridine; Eucalyptus + pyridine; Blackboy tar + blackboy distillate; Coal tar + turpentine; Eucalyptus + blackboy tar + blackboy distillate; Blackboy tar. Of these, coal tar + turpentine has given results equally as good as any of the other oils or mixtures, but has, in addition, produced a more rapid and heavily loaded float. The variations in the amounts of oils used in different tests are due to the fact that it is necessary to add oil in successive small portions until no further mineral or metallic float appears. In some cases where an apparently excessive amount of oil has been used, it has been added in large quantity at the beginning of flotation for the purpose of obtaining, if possible, a rapid flotation of the whole of the copper and pyrite. In other cases it has been necessary to use a large amount of oil, because the production of mineral or metallic float has been slow and oil has been added at intervals until no further float appeared. In most cases the oil has been added to the pulp directly in the flotation cell; in a few cases oiling was carried out by agitation in the pebble mill. The latter method gave no better results than the former and

was subject to the disadvantage that loss of time was incurred and the liability to loss of pulp was increased on account of additional transference.

Treatment of Float and production of Metallic Copper.

As previously stated, the float, by reason of the method of treatment adopted, consisted of a mixture of cement copper and pyrite, and as the latter contained no copper, the copper value of the float was therefore necessarily low. Conversion of the copper float to a commercial form consists of two distinct operations, because of the presence of sulphur contained in the pyrite, viz.:—

- (1.) Roasting to oxidise sulphides.
- (2.) Smelting to produce blister copper containing the gold and silver.

We have produced metallic copper without difficulty by treatment of the float along the lines indicated.

EXTENT OF INVESTIGATION.

In all, sixty-seven distinct tests have been carried out, and in our previous progress reports only five have been classed as "negative," although in many other cases it was evident, as the tests proceeded, that the results would not be satisfactory. Nevertheless, in these cases the products were assayed for the sake of the information they were likely to give, and to enable us to determine what was the actual effect of known adverse conditions. Therefore, the possibility of treating this ore by the method adopted, and the results likely to be obtained can not be

estimated by indiscriminately selecting tests from the tabulated progress reports without a full knowledge of the attendant circumstances, for the reason that in an investigation of this kind numerous variations of working conditions must be tried out. It would be futile to expect that every test would give a satisfactory result, for, if that were the case, the investigation would be unnecessary. The real value of the investigation can be estimated by consideration of Tables "A" and "B," which summarise tests carried out under similar conditions.

CONCLUSION.

Experience has shown that laboratory work can be duplicated and quantities of oil and chemical can be materially reduced, and in nearly all cases the valuable product obtained in the mill is of higher grade than that in the laboratory tests. ("Flotation of Oxidised Ores," by A. W. Hahn, General Manager, Eureka Metallurgical Co., New York—Mining and Metallurgy, September, 1923.) Therefore, it is reasonable to expect that the results shown in Tables "A" and "B" can at least be duplicated, and most probably improved upon in practice.

If further investigation of these ores is decided upon, which we consider necessary, particularly in the light of the results shown in Table "B," we would specially emphasise the necessity of selecting the ore samples in such a way that they may truly represent the ore available for treatment on a large scale.

11th December, 1923.

INVESTIGATION ON RAVENSTHORPE ORE.

Sample No. R/1.

Test No.	Ore Assay.			Fines.	Wt. Ore.	Wt. NaCl.	Wt. FeSO ₄ .	Wt. Fe.	Wt. Oil.	Floats.				Recovery.			Tails.				
	Cu.	Ag.	Au.							Wt.	Cu.	Ag.	Au.	Cu.	Ag.	Au.	Wt.	Cu.	Ag.	Au.	
1	10.08	2.1	1.3	100	500	100	50	70	Euc. 1.12	...	a 56.07	...	...	...	...	...	...	4.10	...	...	...
2	10.08	2.1	1.3	100	500	100	50	70	1.54	...	b 17.96	...	...	...	...	...	...	5.67	...	...	...
3	10.08	2.1	1.3	150	500	100	50	70	BB. T & BB. D. 1: 3, 0.80 Euc. 0.38	...	a 16.38	...	...	...	...	...	...	...	...	...	...
4	10.08	2.1	1.3	150	500	100	50	60	1.8	...	b 41.58	...	...	...	...	...	...	3.15	...	...	...
5	10.08	2.1	1.3	150	500	100	40	A.	0.38	...	...	...	...	...	...	...	...	...	...	...	...
6	10.08	2.1	1.3	100	500	100	40	A.	...	...	...	...	...	...	...	...	...	...	...	...	...
7	10.08	2.1	1.3	100	400	100	40	40	2.24	...	a 34.65	...	...	...	...	...	...	3.78	...	...	...
8	10.08	2.1	1.3	100	400	100	40	40	2.08	9.7	a 49.14	...	...	...	...	...	...	4.88	...	...	...
9	10.08	2.1	1.3	100	400	100	40	30	2.24	30.5	b 49.14	...	...	59.17	...	...	...	6.61	...	...	...
10	10.08	2.1	1.3	100	400	70	20	30	2.24	17.9	c 37.80	...	...	...	...	...	...	3.8	...	...	...
11	10.08	2.1	1.3	100	400	70	20	30	3.20	9.4	a 50.4	...	...	...	...	...	...	4.54	...	...	...
12	10.08	2.1	1.3	100	400	10	10	30	0.64	...	...	...	...	...	...	...	...	...	...	...	...
13	10.08	2.1	1.3	100	400	150	75	35	3.2	47.06	b 61.74	8.3	4.0	71.98	46.5	36.2	...	3.19	0.41	0.20	...
14	10.08	2.1	1.3	100	400	120	60	30	3.52	50.4	a 57.96	7.3	5.1	72.45	43.8	49.43	...	3.17	0.26	0.25	...
15	12.5	2.1	1.3	200	400	120	60	30	3.84	64.4	b 25.2	5.5	3.9	69.6	45.73	55.5	394.4	3.43	0.363	0.19	...
16	10.08	2.1	1.3	100	400	99	50	30	0.64	...	...	...	...	...	...	...	...	...	...	...	...

A: Excess of clean lathe turnings.

INVESTIGATION ON RAVENSTHORPE ORE.

Sample No. R/1.

19/9/23.

Test No. 1.—Reaction in pachuca. Temperature 90 degrees. Added Fe over 15 minutes. Temperature maintained with steam pipe. Air agitated. Commenced floating in M.S. machine. Power very low on account of storm. Transferred to Ruth machine.

19/9/23.

Test No. 2.—Conditions similar to No. 1. Float carried out in Ruth machine. Oiled with 12 drops euc. in pachuca at 80 degrees. Temperature too high for effective oiling.

20/9/23.

Test No. 3.—Conditions similar to No. 2. Commenced adding Fe at 92 degrees. Fe added over 20 minutes without steam pipe. Floated in M.S. machine while hot at 45 degrees in machine. Float slow. Trouble with machine. Float appeared mixed, probably due to excessive oiling from bearings.

20/9/23.

Test No. 4.—Reaction in pachuca. Temperature 70 degrees. Temperature rose while reaction proceeded. Fe added over 15 minutes. Oiled in Pebble mill with 10 drops eucalyptus. Temperature at oiling 64 de-

grees. Agitated in Pebble mill 15 minutes. Floated in Ruth machine. Temperature 35 degrees. Float fair at first but slow. Added 50 drops sulphuric acid (conc.) towards end, no effect on float.

21/9/23.

Test No. 5.—Reaction in pachuca. Temperature 70 degrees. No air. Steam pipe used for agitation. Used Fe turnings from lathe instead of (turnings) filings. Reaction with Fe 1¼ hours. Agitated in Pebble mill with 12 drops eucalyptus 60 minutes. Floated in Ruth machine. Float very poor. Test negative. Thermometer broke in Pebble mill. Hg interfered.

21/9/23.

Test No. 6.—Reaction in pachuca. Temperature 80 degrees. No air. Steam used for agitation. Ore added over 15 minutes. Used Fe turnings, reaction with Fe one hour. Oiled direct in machine. Floated in Ruth. Very bad float. Test negative.

21/9/23.

Test No. 7.—Reaction same as No. 6 but weight of ore reduced to 400 grams. Steam agitated only for half an hour, then air lift 10 minutes. Temperature 80 degrees. Ruth machine used. Float (a) appeared without oil. Float (b) after oiling. Temperature at floating 40 degrees.

22/9/23.

Test No. 8.—Reaction same as No. 7 with exception no air used in agitation. Fe filings of our own preparation used. Float (a) without oil. Float (b) after oiling in machine.

22/9/23.

Test No. 9.—Reaction same as No. 8 but Fe reduced to 30 grams; after adding this amount reaction apparently ceased. Float without oil (a). Float (b) after oiling in machine.

24/9/23.

Test No. 10.—Salts reduced. Steam agitation only. Temperature 90 degrees. Oiled and floated in Ruth machine. Temperature 28 degrees. Float poor colour.

24/9/23.

Test No. 11.—Same as No. 10 with exception reaction carried out rapidly, added large amount at first to try and secure quick float.

24/9/23.

Test No. 12.—Further reduction of salts. Oiled in Pebble mill 15 minutes agitation. Floated in Ruth machine. Good float at first followed by yellowish green scum. Test stopped—negative.

25/9/23.

Test No. 13.—Increased salts and Fe reaction with air and steam. Temperature 70-85 degrees. Oiled 15 minutes in Pebble mill. Float slow.

25/9/23.

Test No. 14.—Reduced salts from No. 13. Reaction with air and steam. Temperature 80-86 degrees. Oiled 15 minutes in Pebble mill. Further oiling in machine. Float very slow. No copper in solution after taking off float.

25/9/23.

Test No. 15.—Same as No. 14. Temperature 75-90 degrees. Oiled 15 minutes in Pebble mill. Further oiling in machine. Float slow.

26/9/23.

Test No. 16.—Roasted ore at red heat. Reaction as for No. 15. Temperature 75-86 degrees. Oiled 15 minutes in Pebble mill. Solution neutral. Very poor float. Test negative.

INVESTIGATION ON RAVENSTHORPE ORE.

Sample No. R/1.

Test No.	Date.	Ore Assay.			Finess.	Wt. Ore.	Wt. NaCl.	Wt. FeSO ₄ .	Wt. Fe.	Wt. Oil.	Floats.				Recovery.			Tails.						
		Cu.	Ag.	Au.							gms.	%	oz.	oz.	%	%	gms.	%	oz.	oz.	gms.	%	oz.	oz.
17	1923. Oct. 10	10.08	2.1	1.3	—100	500	120	60	37.5	1.98	113.6 12.35	32.71 3.675	4.65 3.5	2.7 2.0	80.65 ...	80.9 ...	80.0 ...	398.85 ...	1.95 ...	0.40 ...	0.26 ...			
18	do.	10.08	2.1	1.3	—100	500	120	60	37.5	1.66	65.18 19.07	53.29 22.05	6.7 7.2	2.2 2.4	59.62 ...	66.6 ...	57.7 ...	455.0 ...	4.07 ...	0.70 ...	0.55 ...			
19	do.	10.08	2.1	1.3	—100	500	60	60	37.5	1.6	76.95 7.15	45.57 16.17	8.0 2.2	2.85 2.2	63.6 ...	66.6 ...	49.23 ...	446.8 ...	3.67 ...	0.70 ...	0.66 ...			
20	do.	10.08	2.1	1.3	—100	500	60	60	37.5	1.28	56.80 17.60	42.63 32.34	5.35 7.90	2.8 1.1	70.83 ...	59.05 ...	56.15 ...	462.0 ...	2.94 ...	0.86 ...	0.57 ...			
21	Oct. 12	10.08	2.1	1.3	—100	500	120	60	37.5	1.92	38.0 52.85	45.94 26.09	6.0 4.5	3.85 3.05	84.82 ...	67.6 ...	71.7 ...	436.9 ...	1.53 ...	0.68 ...	0.368 ...			
22	do.	10.08	2.1	1.3	—100	500	120	60	37.5	0.64	31.5 73.1	43.37 11.76	4.30 4.30	3.73 3.30	87.30 ...	76.2 ...	68.5 ...	432.9 ...	1.23 ...	0.50 ...	0.41 ...			
23	do.	10.08	2.1	1.3	—100	500	60	60	45	25 drops	107.5	33.81	5.20	3.45	87.30	73.3	68.46	435.0	1.23	0.56	0.41			
24	Oct. 13	10.8	2.1	1.3	—100	500	Nil	200	45	53 drops	90.4	24.26	6.60	3.45	78.47	78.1	65.0	491.6	2.17	0.46	0.455			
25	Oct. 15	10.8	2.1	1.3	—100	500	120	60	45	25 drops	88.85 21.60	38.96 13.97	7.35 4.20	4.2 1.55	90.97 ...	78.57 ...	78.84 ...	423.9 ...	0.91 ...	0.45 ...	0.275 ...			
26	do.	10.8	2.1	1.3	—100	500	8.5	20	25	28 drops	48.6 21.1	40.79 9.56	8.10 2.3	3.0 1.0	70.83 ...	42.86 ...	46.92 ...	433.7 ...	2.94 ...	1.20 ...	0.69 ...			
27	Oct. 18	11.0	2.1	1.3	—100	500	8.5	20	45	25 drops	66.05 6.35	47.48 28.83	3.50 6.20	2.45 4.00	80.0 ...	57.14 ...	53.07 ...	457.1 ...	2.2 ...	0.90 ...	0.61 ...			
28	do.	11.0	2.1	1.3	—100	500	6.3	15	52	1.44	82.6	43.25	3.95	3.15	87.72	71.43	69.2	401.0	1.35	0.60	0.40			
29	Oct. 19	11.0	2.1	1.3	—100	500	8.5	20	50	45 drops	85.0 11.9	44.94 16.96	4.50 5.50	2.80 8.51	84.68 ...	62.86 ...	63.07 ...	432.6 ...	1.69 ...	0.78 ...	0.48 ...			
30	do.	11.0	2.1	1.3	—100	500	8.5	20	50	28 drops	64.6 17.9	55.96 23.74	2.10 10.5	1.4 22.0	84.68 ...	58.1 ...	67.7 ...	450.0 ...	1.69 ...	0.88 ...	0.42 ...			

Remarks.

Test No. 17.—Oiled direct in M.S. cell with eucalyptus. Speed 1,600-1,800 r.p.m.

Test No. 18.—Same conditions as 17 but less oil.

Test No. 19.—Oiled direct in M.S. cell with eucalyptus for float A. Float B taken off after adding 8 drops of B.B. tar and B.B. distillate 1 : 3. Speed 1,600-1,750 r.p.m.

Test No. 20.—Oiled direct in M.S. machine. Float A with 1.28 grams eucalyptus. Float B with 0.26 grams eucalyptus and 6 drops B.B. tar and B.B. distillate 1 : 3. Speed 1,800 r.p.m.

Test No. 21.—Confirmatory of Test 17. Float B taken off with 8 drops B.B. tar and B.B. distillate 1 : 3. Speed 1,600-1,750 r.p.m.

Test No. 22.—Oiled in pebble mill 30 minutes with 0.64 grams eucalyptus for float A. Float B with 15 drops of mixture of B.B. tar 1 part, pyridine 2 parts, eucalyptus 8 parts. M.S. cell. Speed 1,700-1,800 r.p.m. Mixture gave excellent float.

Test No. 23.—Oiled direct in M.S. cell with mixture used in Test 22. More Fe than previous tests. Speed 1,800 r.p.m. Float rapid.

Test No. 24. Intended to ascertain effect of omission of NaCl. Oiled direct in M.S. cell with previous mixture. Speed very variable.

Test No. 25.—Oiled direct in M.S. cell with previous mixture.

Test No. 26.—Oiled direct in M.S. cell with previous mixture. Reduced amount of salts and Fe used in reaction.

Test No. 27.—Oiled direct in M.S. cell. Used more Fe (—100 mesh). Oiled with previous mixture.

Test No. 28.—Further reduction of salts but more Fe. Oiled direct in M.S. cell with 4 drops B.B. tar then eucalyptus. Final float black. 60 min. reaction.

Test No. 29.—Oiled direct in M.S. cell with mixture of pyridine and eucalyptus 1:10. Speed up to 1,700 r.p.m.

Test No. 30.—Oiled direct in M.S. cell with pyridine-eucalyptus mixture. Speed 1,800 r.p.m.

INVESTIGATION ON RAVENSTHORPE ORE.

Sample No. R/1.

Test No.	Date.	Ore Assay.			Finess.	Wt. Ore.	Wt. NaCl.	Wt. FeSO ₄ .	Wt. Fe.	Wt. Oil.	Floats.				Recovery.			Tails.			
		Cu.	Ag.	Au.							Wt.	Cu.	Ag.	Au.	Cu.	Ag.	Cu.	Wt.	Cu.	Ag.	Au.
	1923.	%	oz.	oz.		gms.	gms.	gms.	gms.	gms.	gms.	%	oz.	oz.	%	%	%	gms.	%	oz.	oz.
31	Oct. 20	11.0	2.1	1.3	—100	500	12.5	30	50	50	7.95	trace	4.6	11.7	...	...	...	...	...	...	...
32	do.	10.6	1.97	1.34	—100	500	4.2	10	50	42	63.9	48.33	3.45	3.4	71.22	58.37	46.27	429.1	3.05	0.82	0.72
							plus liquor from Test No. 30.				11.7	14.41	7.0	6.65	...	...	...	...	...	...	...
33	Oct. 25	10.6	1.97	1.34	See note.	500	...	...	...	1.54	47.7	6.8	3.6	7.65	...	...	...	...	...	...	...
34	do.	10.6	1.97	1.34	do.	500	20	8.5	50	Py—E 1.06 E. 123	52.0	46.64	1.4	0.6	69.62	40.61	40.3	464.3	3.22	1.17	0.8
35	Oct. 26	10.6	1.97	1.34	do.	500	...	...	...	Py—E 1.77	48.9	9.32	4.5	7.8	...	...	...	...	...	...	...
36	do.	10.6	1.97	1.34	do.	500	...	20	50	Py—E 0.83	46.65	50.88	3.7	1.9	55.3	30.3	20.15	449.2	4.74	1.57	1.07
37	do.	Tails from Test 35.	...	...	...	...	8.5	20	55	Py—E 1.0	58.6	50.88	4.4	0.7	76.74	62.94	64.18	410.8	2.54	0.73	0.48
38	do.	10.6	1.97	1.34	do.	500	...	10	60	Py—E 1.18	68.4	43.2	5.4	3.9	76.03	48.22	39.55	467.2	2.88	1.02	0.81
											19.4	8.43	6.05	3.75	...	...	...	...	...	...	...
39	do.	19.6	1.97	1.34	do.	500	8.5	20	60	Py—E 1.47	36.5	39.85	4.9	3.63	80.85	56.34	65.67	434.5	2.08	0.86	0.46
											18.0	9.32	5.8	5.0	...	...	...	...	...	...	...
40	do.	10.6	1.97	1.34	do.	500	5	20	60	Py—E 1.18 1.59	79.15	36.46	5.2	3.65	77.6	56.34	65.67	440.7	2.37	0.86	0.46
											11.9	18.64	5.6	4.1	...	...	...	...	...	...	...

Remarks.

Tests 33-40 were carried out on a sample of ore coarsely pulverised without screening and crushing to pass a definite mesh. The sizing analysis of this ore was as follows:—Plus 60 mesh, 2.1%; plus 80, 5.7%; plus 100, 2.0%; minus 100, 90.2%.

Test No. 31.—Floated pyrite before reaction. Reaction in cell with air and steam pipes. No further float. No metallic Cu in residue. Speed 1,400 to 1,900 r.p.m. Reaction negative.

Test No. 32.—Oiled direct in M.S. cell with pyridine-euc. mixture. Speed 1,750 r.p.m. Used liquor from Test 30.

Test No. 33.—Intended to determine whether any advantage could be gained by separating pyrite by flotation before carrying out the reaction for separation of Cu. Tails accidentally thrown out, hence test negative as regards percentage recovery.

Test No. 34.—Same conditions as Test 30 but with coarser ore.

Test No. 35.—Duplication of Test 33. Tails reserved for reaction in Test 37.

6th November, 1923.

Test No. 36.—Used liquor from Test 34 but as it had been exposed to atmospheric oxidation since the previous day the ferrous iron content of the liquor was very low. At finish of float light yellowish-green froth appeared, containing copper compounds.

Test No. 37.—Tails from Test 35. Cu float in Test 37 low and pyritic float in Test 35 high, indicating that possibly the greater portion of the Au in the ore was present either in the pyrite or as metallic gold. Test 31 also gave similar indication and showed that the pyrite itself contains no copper.

Test No. 38.—Used liquor from Test 36. No NaCl added; FeSO₄ added to bring content up to 20 gram; light green froth at end of float as in Test 36.

Test No. 39.—Ore heated without actually roasting for the purpose of superficially oxidising the pyrite and so preventing its flotation with the Cu. Pyrite floated at finish; hence either oxidation insufficient or reagents during reaction and flotation removed oxide film.

Test No. 40.—Similar to Test 39 but used liquor from Test 37 with addition of FeSO₄ and NaCl.

INVESTIGATION ON RAVENSTHORPE ORE.

Sample No. R/1.

Table 'A.'

Summary of Tests using High Percentage Salts.

Test No.	Assay of Ore.			Finess.	Wt. Ore.	Wt. NaCl	Wt. FeSO ₄	Wt. Fe.	Oil.		Float.			Tails.			Recovery.		
	Cu.	Ag.	Au.						Name.	Wt.	Cu.	Ag.	Au.	Cu.	Ag.	Au.	Cu.	Ag.	Au.
17	10.08	2.1	1.30	—100	500	120	60	37.5	Euc.	1.98	29.86	4.58	2.63	1.95	0.4	0.26	80.6	80.9	80.0
21	10.08	2.1	1.30	—100	500	120	60	37.5	Eu. & B.B. tar	1.92	34.4	4.92	3.38	1.53	0.68	0.37	84.8	67.6	71.7
22	10.08	2.1	1.30	—100	500	120	60	37.5	Euc. B.B. tar & pyr.	0.64	21.28	4.80	3.45	1.23	0.50	0.41	87.3	76.2	68.5
25	10.08	2.1	1.30	—100	500	120	60	45	do.	0.75	34.07	6.73	3.67	0.91	0.45	0.27	90.9	78.6	78.7
55	12.32	1.97	1.34	—100	600	120	60	70	Coal tar turps	1.50	40.80	3.90	3.00	0.41	0.53	0.37	96.6	78.1	72.3
58	12.32	1.97	1.34	—100	600	120	60	70	do.	1.88	44.00	4.15	3.60	1.18	0.52	0.20	90.4	73.6	85.07
64	13.14	1.97	1.30	—100	600	120	60	70	do.	2.00	44.23	3.80	3.30	1.40	0.47	0.35	89.3	76.1	73.1
Average	11.16	2.04	1.31	...	...	...	...	...	...	...	36.69	4.50	3.26	1.22	0.51	0.32	88.6	75.1	75.6

Table 'B.'

Summary of Tests using Low Percentage Salts.

Test No.	Assay of Ore.			Finess.	Wt. Ore.	Wt. NaCl	Wt. FeSO ₄	Wt. Fe.	Oil.		Float.			Tails.			Recovery.		
	Cu.	Ag.	Au.						Name.	Wt.	Cu.	Ag.	Au.	Cu.	Ag.	Au.	Cu.	Ag.	Au.
27	11.00	2.10	1.30	—100	500	8.5	20	45	B.B. tar Euc. & pyr.	0.74	45.80	5.12	2.58	2.20	0.90	0.61	80.0	57.1	53.0
28	11.00	2.10	1.30	—100	500	6.3	15	52	Euc.	1.44	43.20	8.95	3.15	1.35	0.60	0.40	87.7	71.4	69.2
29	11.00	2.10	1.30	—100	500	8.5	20	50	Euc. and pyr.	1.35	41.50	4.62	3.50	1.69	0.78	0.48	84.6	62.8	63.0
30	11.00	2.10	1.30	—100	500	8.5	20	50	do.	0.84	48.90	3.92	5.87	1.69	0.88	0.42	84.6	58.1	67.7
39	10.60	1.97	1.34	See note.	500	8.5	20	60	do.	2.65	35.86	5.00	3.81	2.03	0.86	0.46	80.8	56.3	65.6
61	13.14	1.97	1.30	—100	500	8.3	20	80	Coal tar turps	1.75	43.90	5.90	4.00	1.55	0.97	0.52	88.2	50.7	60.0
Average	11.29	2.06	1.31	...	...	...	...	...	...	...	42.90	4.78	3.84	1.76	0.83	0.48	84.4	59.6	63.3

NOTE ON FINENESS OF TEST 39:—

Screen Analysis	...	...	+ 60 mesh	2.1 per cent.
			+ 80 "	5.7 "
			+ 100 "	2.0 "
			— 100 "	90.2 "

Sample No. R/2.

Summary of Tests.

Test No.	Date.	Ore Assay			Wt. Ore.	Wt. NaCl	Wt. FeSO ₄	Wt. Fe.	Wt. Oil.	Concentrate.			Tails.			Recovery.			Remarks.
		Cu.	Ag.	Au.						Cu.	Ag.	Au.	Cu.	Ag.	Au.	Cu.	Ag.	Au.	
1	Nov. 26	1.39	1.18	1.22	600	...	...	...	...	1.63	1.72	2.16	Reground and floated.			...	...	...	Gravity concentration and flotation.
1a	Dec. 1	Tails from Test	1 reground and floated.																
2	Nov. 26	1.39	1.18	1.22	600	...	...	...	CT — T 0.75 Eu — pyr. 0.9	2.40	2.00	2.08	0.35	0.36	0.56	74.9	69.5	54.1	Direct flotation of sulphides.
3	Nov. 29	1.55	1.22	1.84	500	120	60	30	CT — T 1.25 Euc. 0.3	32.8	7.70	25.30	0.62	1.02	1.12	60.0	16.4	39.1	Roasted R/2.
4	Nov. 29	1.55	1.22	1.84	300	120	60	35	CT — T 1.25 Euc. 1.35	53.04	5.40	8.40	0.13	0.70	0.60	96.8	15.9	34.8	Roasted R/2, Whim Creek oxidised.
		6.8	0.48	0.04	300	...	...	...	...	...	...	...	...	...	...	...	...	...

Fineness of Whim Creek oxidised ore—200 mesh; Roasted R/2 ore + 40 mesh, 5.5 per cent.

+ 60 "	11.4 "
+ 80 "	14.2 "
+ 100 "	4.2 "
— 100 "	63.7 "

PROGRESS REPORT.

Ore Analysis:—

Chemical Composition—	
Cu	1.39 per cent.
Ag	1.18 oz. per ton.
Au	1.22 "
S	17.45 per cent.
SiO ₂	42.87 "
Fe	26.37 "

Mineral Composition (calculated)—	
Pyrite, FeS ₂	30.1 per cent.
Chalcopyrite, CuFeS ₂	4.01 "
Quartz, SiO ₂	42.87 "
Ferric Oxide, Fe ₂ O ₃	15.85 "

The ore consists of dense cupriferous iron pyrites in a gangue of quartz and ferric oxide, and therefore, for treatment by the Nevill Soanes process, roasting is essential.

Tests.

Tests 1, 1a, and 2 were carried out on raw ore to determine what extraction of Cu, Ag, and Au could be obtained by gravity concentration or direct flotation, together with the effect of fine grinding on the extraction. The ore is too heavily pyritic for this method of treatment and therefore an attempt was made to roast the ore for treatment by the Nevill-Soanes process. The roasting of small quantities at a time in the small muffle furnaces available was too slow for experimental purposes and could not be expected to be complete. This was borne out by the fact that in Tests 3 and 4 on ore thus roasted, a certain amount of pyrite was floated with the copper.

If the investigation of ores of this nature is to be continued, it will be necessary to erect a small reverberatory roasting furnace, in which the roasting of a reasonable quantity of ore can be efficiently carried out. Test 3 was made on roasted ore alone, although it was recognised that the amount of copper to be recovered was too small for successful commercial working. Test 4 was therefore made on a mixture of roasted Ravensthorpe ore and Whim Creek oxidised ore of higher copper content. This gave a recovery of 96.8 per cent. of the copper. The incompleteness of the roasting would account for the low recovery of silver and gold. We consider that these difficulties could be overcome by efficient roasting and suitable blending of the roasted ore with oxidised or roasted ore of higher grade, as for example oxidised ores of the type of R/1.

B. H. MOORE.
A. S. WINTER.

DIVISION VI.

OPERATIONS UNDER "THE INSPECTION OF MACHINERY ACT, 1921."

Annual Report of the Chief Inspector of Machinery and Chairman of the Board of Examiners for Engine-drivers, for the Year ending 31st December, 1923, with Statistics.

Office of the Chief Inspector of Machinery,
"The Barracks," St. George's Terrace,
G.P.O. Box 358,
Perth, 18th March, 1924.

The Under Secretary for Mines.

Sir,

I have the honour to submit, for the information of the Hon. the Minister for Mines, the following report on the operations of "The Inspection of Machinery Act, 1921," in the districts proclaimed thereunder, together with statistical tables, for the year ending 31st December, 1923.

The report is divided as follows:—

- (1) Inspection of Boilers.
- (2) Explosions and interesting defects.
- (3) Inspection of Machinery.
- (4) Prosecutions under the Act.
- (5) Accidents to persons caused by machinery.
- (6) Engine-drivers' examinations and kindred matters.
- (7) General.

DIVISION I.

Inspection of Boilers.

The number of useful "boilers" on the register at the end of the year was 3,135, as against 3,073 at the end of 1922, showing an increase of 62 "boilers." There were 84 new registrations during the year, including air receivers and steam jacketed vessels, and one boiler which had been permanently condemned was practically reconstructed and re-instated as a boiler. As against this there were 20 permanently condemned, and 12 were transferred to the Eastern States.

Of the 84 new registrations, 25 were imported from the United Kingdom, 3 from America, 6 from the Eastern States, and 1 originally from Germany. Twelve were made in this State, mostly "boilers" of small capacity. The history of many of the air receivers could not be traced. These have been recorded as "Makers' Name and Age unknown."

Operations in the various Districts.

The following return shows the operations in the various proclaimed districts in connection with boilers as compared with 1922:—

Return showing operations in the Proclaimed Districts (Boilers only) during the year ended 31st December, 1923.

	Totals.	
	1923.	1922.
Total number of boilers registered and capable of being used as steam generators	3,135	3,073
New registrations during the year	84	209
Boilers re-instated	1	11
Inspections for year—		
Thorough	1,494	1,513
Working	154	189
Boilers condemned during year—		
Temporarily	62	89
Permanently	20	16
Boilers transferred beyond the jurisdiction of this Act	12	22
Number of notices issued for repairs during the year	374	480
Number of certificates issued (including those issued under Section 30) during the year	1,519	1,537
	£ s. d.	£ s. d.
Total amount of fees for 1923 ...	2,841 17 2	...
Total amount of fees for 1922 ...	...	3,425 14 0
Total number of Inspectors ...	8	8

The decided fall in revenue from boilers is due to the reduced fees decided on by Parliament.

The number of thorough and working inspections was 1,494 and 154 respectively, making a total of 1,648, showing a decrease of 19 thorough inspections and 35 working inspections.

In the South-Western District 1,226 inspections were made, or over 74 per cent. of the total number made in all districts. The inspections made in this District show a decrease of 46 as against 1922.

In the Kalgoorlie group 314 inspections were made, being 19 per cent. of the total inspections. The inspections in this District showed a decrease of 16.

In the North Coolgardie and Mount Margaret districts 53 inspections were made, or 3.2 per cent. of the total number. The inspections showed a decrease of 8.

In the East Murchison and Murchison and Yalgoo Districts 54 inspections were made, or 3.27 per cent. of the total number, and the inspections showed an increase of 7.

The following table shows the number of boilers temporarily or permanently condemned, as a percentage of inspections made each year, since the inception of the Act controlling boilers:—

Number of Temporarily and Permanently Condemned Boilers per 100 Inspections made since 1899.

Year.	Temporarily.	Permanently.
	per cent.	per cent.
1899	2.64	1.42
1900	2.21	.498
1901	4.34	.511
1902	5.00	.958
1903	2.43	.697
1904	3.08	.389
1905	2.84	.388
1906	3.98	.960
1907	4.36	.802
1908	3.18	.599
1909	2.89	.797
1910	4.49	1.382
1911	3.54	8.070
1912	3.93	2.471
1913	2.64	2.431
1914	2.97	2.178
1915	4.72	1.538
1916	3.97	1.456
1917	3.19	1.301
1918	3.25	1.563
1919	3.14	3.547
1920	3.28	2.171
1921	4.33	1.358
1922	5.22	.940
1923	3.76	1.213

Owing to the scarcity of new boilers, a large number of old boilers have been under repair during the year. During the great war, and for a considerable time afterwards, owing to the impossibility of procuring new boilers or the material for making them, a large number of almost obsolete boilers were repaired, largely with old material, and brought into use again at reduced pressures. It is, however, impossible to obtain supplies from the "scrap heap" indefinitely, and the necessity for replacing large numbers of these old boilers by entirely new ones is rapidly assuming considerable importance.

Many owners during the disturbed period referred to were compelled to resort to patching up boilers which in normal times they would certainly have scrapped, and now that times are better they apparently cannot abandon the habit. But with most things there is a limit to the extent to which they can be repaired, and in the case of steam

boilers the observance of this limit becomes a matter of the greatest importance.

The time has come when owners of many of these much repaired boilers have got to realise that the limit has been reached, and that new boilers have become a necessity. A little careful thought on the matter will show that true *economy* lies in the direction of new plant and not in costly and constantly recurring repairs.

To illustrate the shortage of boilers in this State, quite recently a fairly large boiler belonging to a firm, which owns more boilers than any other firm in the State, had to be permanently condemned. Their shortage of boilers was so acute that they had no single boiler with which to replace the condemned one. They could not procure a new boiler, and were forced to temporarily requisition three smaller boilers borrowed from other jobs in order to carry on. Eventually a larger boiler was procured from the Goldfields, but this boiler was over 20 years old, and consequently cannot be looked on as a profitable investment.

DIVISION II.

Explosions and interesting Defects.

There has been no explosion during the past year in connection with any "boiler" under the jurisdiction of the Act, the Department's good record in this respect being well maintained.

In my Annual Report for 1921 reference was made to peculiar and serious fractures having been discovered at the longitudinal seams at sides of certain locomotive firebox shells. During the past year another similar case occurred. The plates on both sides were found fractured similarly to those previously referred to. These fractures occurred in three boilers, one made in Manchester, one in South Australia, and one in Western Australia. The three were of similar design as far as the seams in question are concerned, and it appears clear that defects were due to bad design rather than faulty material or bad workmanship. Modern practice eliminates the objectionable longitudinal seams at firebox shell plates by making the "wrapper plate" of one plate only. Special care is being taken with any boilers of similar construction, and any repairs executed will be designed in such a way as to avoid the peculiar strains which apparently caused these rather alarming defects.

A case of rapid corrosion was reported during the year. A portable locomotive type boiler was removed from a district, where it had worked satisfactorily for many years, to another locality. When purchased by present owner it was in very fair condition. The feed water used was "from a running stream as clear as crystal and most palatable to the taste." In rather less than four years it was so badly and so generally corroded that it had to be permanently condemned. The feed water, in spite of the good character given to it, was of a highly corrosive nature.

This case points to the necessity for chemical analysis of feed waters, to which I have drawn the attention of steam users on several occasions. The appearance or taste of the water is seldom a trustworthy guide as to its suitability for boiler purposes.

An interesting case occurred early in the year in connection with the water space stays in a portable locomotive type boiler. The boiler was made in 1911 by an English firm of sound reputation. It had been thoroughly well cared for, and the feed water was excellent. The working pressure was 120 lbs. per sq. inch. In January of the year under review, steam from the boiler was just being turned on to the engine when there was a loud report, and one of the firebox shell sides was noticed to be bulging outwards. The engine-driver, with commendable promptness, smothered the fire with ashes, and nothing further happened. When the boiler was opened up 45 contiguous stays in the four top rows at one side were found broken close against the outer shell plate. As the stays were obviously no longer trustworthy, the whole of the water space stays were renewed. Further remarks relative to this accident will be found under the heading "General."

DIVISION III.

Inspection of Machinery.

The following return shows a classification of the power driven machinery in the proclaimed districts.

The total number of groups now registered is 5,215, which shows an increase of 237 for the year.

Electrically-driven groups now number 2,922, showing an increase of 266 during the year. Steam-driven groups have decreased from 1,161 to 1,106, showing a decrease of 55. Suction gas-driven groups have decreased by 3, and ordinary town gas groups have also decreased by 3, hydraulic groups have decreased by 1, and compressed air groups by 2.

Return showing Classification of various sources of power-driven Machinery in use or likely to be used again in Proclaimed Districts during the year ended 31st December, 1923.

Classification.	Totals.	
	1923.	1922.
No of groups driven by—		
Steam engines	1,106	1,161
Oil engines	914	879
Ordinary gas engines	11	14
Suction Gas engines	219	222
Compressed Air engines	34	36
Electric motors	2,922	2,656
Hydraulic pressure	9	10
Totals	5,215	4,978

The following table shows the number and description of all the lifts in this State:—

Passenger Lifts—	
Electrically-driven	74
Goods Lifts—	
Electrically-driven	90
Hydraulically-driven	8
Belt-driven	10
Hoists	63
	<hr/>
	245
	<hr/>

Seven new passenger lifts, seven goods lifts and fifteen hoists were erected during the year.

The total number of lifts and hoists has increased from 216 to 245.

The provisions of the new Act and regulations regarding lifts are being carried out satisfactorily. Collapsible gates on lift shafts, which have proved dangerous and unsatisfactory in the past, are being relegated to the scrap heap, and are now for the most part replaced by good sliding self-closing gates. All passenger lifts and all new goods lifts have their gates in electric circuit with the cage control, and speed governors operating the gripper gear have been supplied with all new lifts, and have also been fitted to a few of the older ones. Many hundreds of feet of new wire ropes were installed during the year, and every care is being taken to render all lifts as fool-proof as possible.

The provision in the new Act that plans and specifications must be submitted to the Department before a permit for the erection of any lift is granted has proved beneficial. Any objectionable feature can now be rectified *before* instead of after erection, thus enabling owners to avoid a good deal of expense and much annoyance. I am glad to say that architects, lift erectors, and contractors have co-operated most cordially in carrying out the new regulations, which, being definite, leave no room for misunderstandings. I anticipate a considerable increase in the number of lifts that will be erected during the current year, as indicated by the number of lift permits already issued.

The following return shows the work done in connection with machinery inspections:—

Return showing Operations in the Proclaimed Districts (Machinery only) during the year ended 31st December, 1923.

	Totals.	
	1923.	1922.
Total registrations of useful machinery	5,215	4,978
Total inspections made ...	3,935	3,838
Certificates bearing fees ...	3,481	3,327
Certificates (steam) without fees	454	511
Extension certificates granted under Section 42 of Act	17	...
Notices issued "Machinery dangerous"	245	260
	£ s. d.	£ s. d.
Total amount of fees for 1923 ...	1,865 7 6	...
Total amount of fees for 1922 ...	...	1,572 8 0
Number of Inspectors ...	8	8

The total number of registrations shows an increase of 237, which, considering that the new Act provides for the exemption of all oil engines of 6 H.P. and under, used by agriculturists, pastoralists, or pearlers, electric motors used exclusively by agriculturists, pastoralists, orchardists or dairy-men, upon which no labour other than that of the owner is employed, and used for irrigation or dairy purposes only, indicates that satisfactory progress is being made in the industries of the State.

In the South-Western District there was an increase of 313 in the number of useful groups registered.

In the other Districts the number of registrations has decreased by 76.

In all districts the number of inspections made was 3,935, as against 3,838 in 1922. This shows an increase of 97, which, considering the number of plants exempted under the new Act, is very satisfactory.

INTERESTING ACCIDENTS TO MACHINERY.

The crank shaft of a large first-motion winding engine fractured early in the year. The fracture occurred between one of the drum cheeks and the clutch disc, where the shaft was 13½ in. diameter. As this part of the shaft is completely covered, the fracture could not be seen without completely dismantling the drums and clutches.

As the fracture occurred in the largest part of the shaft (it measures 13 in., 12¾ in., and 12 in. in diameter elsewhere) it is more than probable that there was an original slight flaw which gradually developed. Fortunately the damage was confined to the shaft, and this was replaced by a new one supplied by the makers of the engine.

In another winding engine a pin "worked out" of one of the post brakes, and rendered the brakes inoperative. Fortunately the engine had a long cut off, and the driver was able to keep control and land two men, who were in the cage, without difficulty. This accident points to the necessity of constant inspection, by competent mine officials, of all working parts of winding engines, and also emphasises the benefit of a long cut off, thus securing ample retardation by steam alone in case of brake failure.

A somewhat unusual accident occurred to a duplex pump. The buckets required renewal, and the man in charge closed the valve to the water column, just above the air vessel, and took off the plunger nuts. As the bucket was difficult to remove he turned on steam, and gave the pump a couple of strokes to loosen the bucket, forgetting that, being duplex, the second pump would be accumulating pressure in the air vessel.

This vessel burst and seriously injured the attendant.

The pump was a powerful one, working against a head of 915 feet, and the pressure in the air vessel at time of rupture must have been very great. The calculated bursting pressure was 2,000 lbs. per sq. inch, and the fractured portion showed no defects.

It is apparent that, under certain circumstances, the very common practice of giving the pump "a kick" to loosen the bucket is fraught with considerable danger.

An accident to a travelling steam crane, which might have been serious, is interesting as it calls attention to the careless way in which these cranes are often used.

The crane was a "3 ton" one, *i.e.*, it was supposed to lift 3 tons with minimum radius (12 feet), and with proper blocks and grabs securing it to the rails. At time of accident this crane was lifting approximately 2,800 lbs. at a radius of 26 feet *without blocks or grabs*. The correct load under these circumstances should have been approximately 1,170 lbs., according to maker's load instructions clearly set out on a plate at base of jib. The result was that the crane and boiler tipped over, and the jib, on hitting the ground, fractured through one side

and bent the other badly. The boiler, curiously enough, was uninjured and no person was hurt. Incidentally the accident disclosed the jib to be badly crystallised and a new one was ordered.

One of the webs of the crank shaft of a 150 H.P. duplex suction gas engine in a suburban electric light station fractured without the slightest warning, and wrecked one of the engines completely. Fortunately no one was hurt, and, as arrangements had been almost completed for taking current from the Perth Central Station, the accident did not cause any serious inconvenience.

A peculiar accident occurred to an air compressor. The inter-cooler is above the two cylinders, and has two upright legs with a horizontal chamber connecting them. It was noticed that air was blowing through the inter-cooler water service pipe leading into an overhead tank. The engine was stopped and the stop valve on the water pipe was closed in order to open up the cooler and effect repairs to the leaky tubes. The driver was leaving the engine room to close the air stop valve on the receiver, when a large portion of the side of one of the upright legs of the cooler was blown off with a loud report. Fortunately no one was hurt.

As the pressure in the inter-cooler tubes is normally from 15 to 25 lbs., closing the water pipe valve should not have caused the accident. Further examination, however, disclosed the fact that the air valves on the H.P. air cylinder were defective, and allowed the full pressure in the air receiver, about 90 lbs., to leak back into the inter-cooler, and the valve on the water pipe being closed this pressure accumulated in the cooler until the accident occurred. Had the receiver stop valve been closed first, probably nothing would have happened.

DANGEROUS MACHINERY.

The number of notices to provide guards, etc., dropped from 260, in 1922, to 245 for 1923, being 6.22 per cent. of the number of inspections made.

The majority of above notices were issued in connection with new plants or changes made in older plants.

It is satisfactory to note that, in almost all cases, the Department's requirements have been cheerfully carried out. No case of seriously dangerous machinery has been reported during the year.

DIVISION IV.

Prosecutions under the Act.

One prosecution was instituted during the year for a breach of Section 17 (3), *viz.*, for erecting a lift without previously applying for a permit, and submitting plans and specifications.

The defendant was fined 40s. and costs.

DIVISION V.

Accidents to Persons caused by Machinery.

During the year accidents to 29 persons were reported, including one which ended fatally. This shows a decrease of 1 as compared with 1922. There has been an increase of 5 in the number of accidents in the Goldfields Districts, and a decrease of 6 in the South-Western District, as against the year 1922.

The following table shows the number of accidents and the percentage of these, based on the total number recorded, caused by the various kinds of machinery mentioned:—

No. of Accidents.	Class of Machinery.	Percentage of total Accidents.
6	Circular Saws	20·7
3	Buzzer	10·24
1	Shaper	3·45
5	Belting	17·24
2	Ore Treating Machinery	6·89
1	Printing Machine	3·45
2	Machine tools	6·89
1	Gas Producer	3·45
(1)	Goods Lift	3·45
1	Air Winch	3·45
1	Leather Roller	3·45
1	Flour Sifter	3·45
3	Pumps	10·34
1	Punching and Shearing Machine	3·46
28 (1)		
Total 29		

NOTE.—Accident marked (1) was fatal.

As usual, "circular saws" head the list, closely followed by "belting," and, as usual, the majority of the accidents was due to momentary carelessness.

The fatal accident occurred to a lad who climbed into a goods lift shaft and crossed it on a girder supporting the cage skids. Just as he arrived at the doorway on opposite side of the shaft, he was caught by the descending cage, and crushed between it and the sill of the doorway. The unfortunate lad appeared to have been trying to take a short cut from the right of way into the warehouse through the shaft—which, of course, he had no right to do—and did not notice the descending cage. The verdict of the coroner's inquest was accidental death, no blame attachable to any person.

Another fatal accident occurred during the year which, though not in any sense an accident caused by machinery, deserves mention. Some test holes were being drilled in a brine tank at a refrigerating works. The deceased had, for lighting purposes, a length of "flexible" wire with an ordinary lamp socket and lamp attached. It is presumed that he laid the lamp down on the tank bottom and, while using a breast drill, picked it up to see his work. He was instantly electrocuted. His right hand and breast were scorched, showing that the current entered his body through his right hand and went to earth through the drill and tank.

Inspectors were circularised asking them to warn the responsible persons at any place where such extension cords and lamps are used for boiler cleaning or inspection. Given a slight electrical fault in the connection of the wire to the lamp socket, or a damp cord, which may easily occur in a boiler or brine tank, the conditions for a serious shock are perfect. No such lights should be used by any person so perfectly "earthed" as a man in a boiler is, unless the insulation of the wire and its connections to socket are beyond suspicion, and lamps provided with wooden handles should always be used. These are procurable at any electrician's store.

DIVISION VI.

Engine-drivers' Examinations and kindred matters.

During the year four examinations were held in Perth, two in Kalgoorlie and two in Bunbury. Examinations were advertised to be held at Albany, Southern Cross, Leonora, Mt. Magnet, and Geraldton, but fell through owing to the necessary number of candidates not being forthcoming.

The following table shows the certificates granted and their classification:—

Return showing total number of Engine-drivers' and Boiler Attendants' Certificates (all classes) granted in 1923, compared with 1922.

Class of Certificate.	No. Granted.	
	1923.	1922.
Winding Competency (including certificates issued under Regulation 40 and Section 60 of the 1921 Act)	4	2
First Class Competency (including certificates issued under Regulation 27 and Section 63 of the 1904 Act)	...	2
First Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the 1921 Act)	14	1
Second Class Competency (including certificates issued under Regulation 27 and Section 63 of the 1904 Act)	...	25
Second Class Competency (including certificates issued under Regulation 40 and Section 60 of the 1921 Act)	28	14
Third Class Competency (including certificates issued under Section 63 of the 1904 Act)	...	36
Third Class Competency (including certificates issued under Regulation 45 and Section 63 of the 1921 Act)	28	4
Locomotive Competency (under the 1904 Act)	...	5
Locomotive Competency (under the 1921 Act)	10	2
Traction Competency (under the 1904 Act)	...	6
Traction Competency (under the 1921 Act)	6	5
Internal Combustion Competency	5	3
Internal Combustion Service	85	166
Crane and Hoist Competency	4	...
Crane and Hoist Service	8	37
Boiler Attendant's Competency	18	8
Boiler Attendant's Service	47	135
Interim	6	8
Copies	10	4
Transfers	99	114
Totals	372	577

In all, during the year there were 416 applications received, and of these 372 were granted certificates.

The number of certificates granted is still very much above the average of the years prior to the 1921 Act. The increase is accounted for by the new certificates provided for by this Act, viz., 85 internal combustion certificates, crane and hoist 12, boiler attendants 65, and transfers 99. There still appears to be a scarcity of applicants for the higher grade certificates.

The revenue from application fees, and fees for granting certificates was £431 2s. 6d., which shows a drop of £237 as against 1922. In all probability

the next few years will show further decreases until the applications for certificates under the new Act become normal again.

INQUIRIES, PROSECUTIONS, ETC.

Only one overwind was recorded for the year, and this was of such slight importance that no formal inquiry was considered necessary. The engine-driver involved was retained on his job. As the head room is so small in many cases that raising the cage a few inches more than it should be constitutes an overwind, this record is considered very satisfactory, and is good evidence of the care exercised by the drivers of winding engines.

One prosecution was instituted, viz., for a breach of Section 67 of the Act in issuing a false testimonial as to the service of an engine-driver. As the issue of a certificate depended on this testimonial, it was considered necessary to take proceedings. The defendant was fined £1 and costs amounting to £2 2s. The defendant appears to have blindly signed the testimonial without ascertaining the true facts, which is, to say the least of it, unbusinesslike and careless.

DIVISION VII.

General.

In the 1922 report reference was made to the new Inspection of Machinery Act of 1921 and its provisions, and the subsequent regulations were commented on. In November, 1923, and as the result of experience in working under the new Act and its regulations, several amendments to regulations relating to lifts and engine-drivers' examinations and certificates were gazetted. Most of the alterations were made with a view of making the meaning clearer, and a few of them were made to render the conditions under which certain engine-drivers' certificates could be granted slightly less stringent.

The work of the Department under the new Act is proceeding smoothly, and with less adverse comment on the part of the public than falls to the lot of nearly all new statutes.

There has been a further decrease in the gold mining industry which, with much of the State still practically unprospected, will, I trust, be only temporary.

Tin, lead, and copper mining is still in a depressed condition, with some slight prospects of a revival in tin mining in view of better prices for this metal being obtainable.

The timber industry has made great strides since the beginning of the year under review, and is now very brisk. Nearly every mill is working, and a number of new companies have erected plants, and additional machinery has been installed at some of the older mills.

Clearing and drainage operations in the South-West district, in connection with group settlement, are providing a lot of work and employing a considerable amount of machinery.

Coal mining continues prosperous, most of the mines being in full work.

No new industry of any importance has started during the year. A commencement has, however, been made with the erection of the woollen mills at

Albany, and it is anticipated that they will be in full working order before the end of the current year.

There has been considerable development in the use of electricity for power purposes during the year, many large plants and hundreds of smaller ones being now supplied by current from the power house at East Perth. This has, of course, thrown out of use many steam boilers and other prime movers at the factories where electricity is now installed.

Nearly all of these boilers, and most of the oil engines, etc., have, however, been absorbed elsewhere in the State. Reference to remarks as to the scarcity of boilers, in Division I. of this report, shows clearly that, practically, there are no boilers available except in the Goldfields areas, which are not affected by the extension of the application of electricity, and the expense of transport of large boilers from the goldfields usually renders their cost prohibitive for use in the South-Western District.

An instructive accident occurred to one of two similar Portable Locomotive Type Boilers erected at a timber mill, and is recorded under "Interesting Defects" in Division (I.) of this report.

The two boilers in question were made in 1911. They have been under regular inspection ever since, their upkeep has been excellent, and the feed water is good. Their design is the standard one of a well known English firm, and similar trouble has not occurred in other boilers by the same maker. Until 1919 there was no trouble, but from then until the beginning of last year broken water space stays began to make their appearance with annoying frequency. In one of the boilers 136 stays were renewed between the end of 1919 and the end of 1922. In the other, 23 stays were renewed in the same time. In the beginning of 1923, 45 stays in the latter boiler broke simultaneously with a loud report, and the side of the firebox shell bulged outwards.

These broken stays all occurred in the four top rows of the left side. Several of them were tested by fixing one end and hitting the free end with a hammer. In most cases one blow broke the stay as if it had been made of porcelain. The fractures appeared to be highly crystalline, and it was difficult to get a stay that would bend through 10deg. without breaking. As it was obvious that the stays were no longer trustworthy, all of them in both boilers were renewed. At first sight it looked as if inferior metal had been used, and samples were forwarded to the maker with the Inspector's comments. A reply was received from them that the stays submitted had been subjected to a tensile test, and that the breaking stress was 23 to 24 tons per sq. inch, with an average elongation of 30 per cent.

It was then decided to have an independent test made, and similar stays were sent to our University Engineering Laboratory, with a request that they should be tested. The report received was in almost identical terms to that received from the makers, and concluded with a remark, which also occurred in the maker's report, viz.:—That the result of the tests was "what might be expected from wrought iron of good quality." The makers claim that the stays were made from a special brand of very mild steel.

In spite of these tests, the bald facts remain that the very stays which gave such good tests failed under ordinary working conditions; that the working con-

ditions were good, and that there was no reduction from corrosion.

The only conclusion to be drawn is a disquieting one, viz., that a tensile test, however satisfactory, cannot be relied upon to secure immunity from failure under ordinary working conditions. The expansion and contraction of fireboxes in this class of boiler must undoubtedly subject water space stays, and especially those in the upper rows, to a constant succession of reversed bendings, which, although slight, will probably, in course of time, fatigue the material to such an extent that finally fracture occurs. It is obvious that the longer the stays can be made the less tendency there will be for these fatigue stresses to have a deleterious effect, and this appears to point to the desirability of making the water spaces as wide as possible, especially at the upper parts. The ease with which these stays broke when bent, and the very bad appearance of the fractures, is mysterious, in view of the good tensile tests obtained, and I fear the matter must remain unexplained for the present. In these days of rapid metallurgical progress, however, an explanation will no doubt be shortly available, and with it a means of overcoming the trouble.

During my recent furlough I visited the Eastern States and New Zealand, and inquired into the methods and working of kindred departments. I returned more than ever impressed with the necessity for standardisation. The qualifications of Inspectors, the grading of engine-drivers' certificates, and methods of their examination, and in particular the formulae for construction of all types of boilers should, in my opinion, all be standardised.

A Committee representing the various interests involved might be formed, with a view of drafting standard regulations and formulae, which could be adopted throughout the States.

I have referred to this matter on several occasions, and in my report for the year 1921 I pointed out that a similar scheme was being formulated in India.

If uniformity of standard construction, inspection, etc., could be agreed upon, importers and owners would know that any boiler constructed to the standard formulae could be used at the same working pressure in any part of the Commonwealth. This would be a great boon to engineering manufacturers and all others concerned.

There is so much divergence of opinion among even supposed authorities on these matters, that it is not surprising that boilers are sometimes constructed with a wonderful disregard to correct design. Take, for instance, the simple matter of designing a riveted seam. The following three cases were discovered on computing boilers working in this State:—

	R_t		R_s
(1)	59 per cent.	..	117 per cent.
(2)	68 per cent.	..	117 per cent.
(3)	58 per cent.	..	151 per cent.

R_t and R_s being the resistance to tearing and shearing respectively, expressed as a percentage of the strength of the plate.

While it is possible for such amazing joints to be put into steam boilers, where so much depends on the correct balancing of the joint, surely it is time that some National Standard should be adopted.

In July last I received a most interesting paper, written by Mr. T. A. Vaughan, Chief Inspector of Machinery in South Africa, and Past President of

the South African Institution of Engineers, on the subject of explosions in Air Compressors, Receivers, and Pipes in connection with them. (See the "Journal of the South African Institution of Engineers," Volume XXI., No. 9, April, 1923). This is an exceedingly interesting paper to mining managers and engineers, and was, therefore, passed on to the Kalgoorlie Chamber of Mines for perusal.

Such explosions appear to have been fairly frequent on the Rand, whilst in this State, I am glad to say, we have been almost entirely free from them.

Previous to Mr. Vaughan's investigations the generally accepted theory was that such explosions were due to using lubricating oil of too low a flash point.

The paper is much too lengthy and too highly technical to quote extensively in this report, but some of the conclusions arrived at are so interesting that I quote them. For instance, it is pointed out that:—

- (a) The amount of current oil in an air compressor cylinder at any given moment is never great enough, even if all of it were vaporised, to cause an explosive mixture in the cylinders.
- (b) The most probable cause of such explosions is carbonaceous deposit in the pipes and intercoolers, and
- (c) Leakage past the valves in the final stage of compression or discharge.

Carbonaceous deposit taken from ten samples from the second stage discharge or receiver on different mines was found to contain fixed carbon, 22.6 per cent.; volatile, 55.7 per cent.; ash (calcined), 21.7 per cent.; iron, 7.5 per cent. Also brass, copper and silica in small quantities. This carbonaceous deposit, besides being a good gas reservoir, is of a nature liable to spontaneous combustion, and it is probable that the presence of metals in a finely divided state accelerates the oxidising process.

The conclusion drawn is that a high flash point oil is unnecessary from the point of view of safety, while the high viscosity of such an oil leads to a greater formation of the deposits referred to. Comparatively low flash point oils were experimented with, and considerable economy resulted, as well as additional safety, and no sacrifice in efficiency. The regulation prescribing a minimum flash point was deleted, and most of the mines are now using oils with a much lower flash point than had been customary. It is reported that there has been a saving of about 40 per cent. of the oil previously used, and that air receivers, pipes and intercoolers were found to be almost free from any carbonaceous deposit.

An extraordinary explosion is referred to in the paper, viz., that of a 12-inch pipe, 3,700 feet in length, in which no less than 52 bursts occurred practically simultaneously, the fiercest explosion being at the end of the line. Such an extraordinary happening obviously could not have anything to do with an explosion in the cylinder, caused by an oil of too low a flash point. An initial explosion occurred in the pipe through an access of heat liberating a large quantity of gas, and then the successive explosions followed as gases were generated in various parts of the pipe.

The whole paper is intensely interesting and instructive, and mining managers and engineers interested in the question cannot do better than procure copies and form their own opinions on the subject after careful perusal.

During my recent visit to the Eastern States and New Zealand, I was instructed to make inquiries as to existing winding engine practice, particularly regarding safety appliances, starting valves, and methods of testing brakes, etc. I found that no definite uniform practice exists. "Adequate Brakes," etc., are specified in the Regulations without defining exactly what an adequate brake is. Certain tests are prescribed, but in the majority of cases the *methods* of testing were left entirely to the discretion of the Inspector. Too much of the personal element is thus introduced, and what might be considered by one Inspector as an adequate brake, or a satisfactory test, might not be so considered by the next Inspector.

It appeared to me that in view of the new "Inspection of Machinery Act of 1921" having just come into operation, and the regulations dealing more particularly with winding engines being still under consideration, that something more definite should be provided for in this State.

For many years past the Department had adopted a uniform method of testing brakes. For the information of Inspectors, and with a view to uniformity, Departmental instructions had been issued. Certain formulae and diagrams were provided in blue print form, but there had been no *regulations* under the Repealed Act of 1904 dealing with these matters.

During the year the instructions have been considerably revised, two new blue prints have been made, one of which contains diagrams of all the most usual types of brakes, with the necessary formulae for calculating brake power, and the other gives definite instructions as to standard methods of conducting tests, and deals with the best and worst starting positions of engine cranks, the effective crank leverage for various points of cut-off, formulae for strength of drum shells, and tables of frictional co-efficients for various types of brake materials.

These blue prints contain much information in condensed form, which show the department's requirements, and should be useful to mine managers and engineers when preparing specifications for new engines.

During the year an important matter in connection with winding engine practice was investigated, viz., the effect of steam retardation in case of brake failure. Several steam engine indicator diagrams were taken, and results tabulated. The conclusions drawn were:—

- (a) That every winding engine should be able to hold its load with "steam against the engine" independently of the brake, and
- (b) That a large number of engines were not able to do so with present valve setting.

Several engines have consequently had their cut-offs altered, so that in case of brake failure there shall be adequate power to hold the load.

Towards the end of the year a set of regulations relative to winding engine safety appliances and methods of testing brakes, etc., was drafted. These were submitted early in the current year to a conference of mining managers and representatives from the Engine Drivers' Association, and agreed to.

They have since been gazetted and are now law.

The new regulations deal with many matters which past experience has proved to be very necessary.

WORK DONE FOR OTHER DEPARTMENTS.

Other departments have, as usual, called on the Department for technical advice, and reports have been furnished as requested. The Department is always ready to advise and report on matters on which, from the nature of its work, it has special knowledge.

INSPECTORIAL STAFF.

There has been no change in the staff during the year. The work at the end of the year was up to date. The staff has carried out the various duties in a very satisfactory manner, and the record for careful work has been well kept up. My personal thanks are due to Mr. H. L. Gill, who occupied the position of Acting Chief Inspector of Machinery during my absence on furlough.

CLERICAL STAFF.

There were three changes amongst the junior clerks during the year, otherwise the staff remains the same. The staff's work was again somewhat heavier than usual, owing to new regulations, and the work consequent on these. The work was well up to date at the close of the year.

REVENUE.

The total revenue from all sources during the year was £5,346 5s. 10d., made up as follows:—

	£	s.	d.
Fees for boiler inspections ..	2,841	17	2
Fees for machinery inspections ..	1,865	7	6
Engine-drivers' fees ..	431	2	6
Incidentals (being fees for special inspections, expenses, etc.) ..	207	18	8
	<u>£5,346</u>	<u>5</u>	<u>10</u>

The revenue for the year shows a decrease of £579 7s. against that of the year 1922, made up as follows:—

	Increase.		Decrease.	
	£	s. d.	£	s. d.
Boiler Fees .. ..	..	..	583	16 10
Machinery Fees	292	19 6		
Engine-drivers' Fees .. ..	..	..	237	0 0
Incidentals .. ..	..	..	51	9 8
	<u>£292</u>	<u>19 6</u>	<u>£872</u>	<u>6 6</u>
	..	..	292	19 6
Total decrease .. ..	..	..	<u>£579</u>	<u>7 0</u>

It will be noted that though the work done in boiler inspection is practically the same as last year, the total decrease is more than accounted for by the loss on boiler fees, which is directly due to the action of Parliament in reducing the fees.

The following is an analysis of the increases and decreases in fees for boilers and machinery in the various districts, and also shows the decrease due to engine-drivers' fees:—

	Increase.		Decrease.	
	£	s. d.	£	s. d.
S.W. Group .. ..	..	..	97	6 7
Kalgoorlie Group .. ..	..	..	147	6 7
North Coolgardie and Mt. Margaret .. ..	..	..	59	10 6
East Murchison and Murchison and Yalgoo .. ..	..	..	42	14 4
Carnarvon	4	11 0		
Engine-drivers' fees .. ..	..	..	237	0 0
	<u>£4</u>	<u>11 0</u>	<u>£583</u>	<u>18 0</u>
			4	11 0
Total Decrease .. ..	..	..	<u>£579</u>	<u>7 0</u>

The loss of revenue to the Department incurred by not charging fees for boilers and machinery belonging to Government non-trading concerns was £59 4s. 6d., and the expenses connected with such inspections amounted to £11 18s. 7d.

During the year the amount written off as bad debts was £8, being about .149 per cent. of the total revenue.

The above amount consisted of a special inspection fee of £7 10s. incurred by a Gold Mining Company, which immediately went into liquidation and paid no dividend, and two 5s. fees in the South-Western District, which could not be recovered.

MILEAGE.

The total distance travelled by Inspectors during the year was 42,663 miles, of which 17,126 were by rail, 24,331 by road, and 1,200 by water. The distance travelled shows a decrease of 3,513 miles as against 1922, with an increase of 43 in the number

of inspections made. The average miles travelled per inspection was 7.64, showing a decrease of .69 miles per inspection as against last year.

Every effort is being made by arranging work carefully to cut down the mileage as far as possible.

CONCLUSION.

In conclusion, I wish to tender my sincere thanks for assistance rendered by officers attached to the Crown Law, Police, and Postal Departments in various districts in connection with the administration of the Act.

My staff have continued to carry out their duties efficiently, and to them also my thanks are due.

I have, etc.,

C. J. MATHEWS, M.Inst.C.E.

Chief Inspector of Machinery
and Chairman of the Board of Examiners.

DIVISION VII.

ANNUAL REPORT OF THE CHEMICAL BRANCH, MINES DEPARTMENT, FOR THE YEAR 1923.

The Under Secretary for Mines.

I beg to submit, for the information of the Hon. the Minister, my report for the year 1923.

GENERAL.

The amalgamation of the two Government laboratories brought about on the 1st March, 1922, was completed during May, 1923, by the transfer of the staff and equipment of the old Geological Laboratory to the Government Analyst's Laboratory, where additional accommodation for them had been provided. The whole staff is now therefore under one roof and conveniently placed for mutual consultation and utilisation of apparatus and library.

The agricultural section of the Branch was strengthened by the engagement of Mr. R. G. Lapsley, a former member of the Government Analyst's staff, who has recently received the University degree of Bachelor of Science in Agriculture.

Mr. Bowley, head of the mineral section, was seconded to the Empire Exhibition Committee for ten months of the year, his place being temporarily filled by Mr. D. G. Murray.

BRITISH EMPIRE EXHIBITION.

The preparations for an effective mineral exhibit of the State at the British Empire Exhibition have thrown a very considerable burden upon the staff. Mr. Bowley, head of the Mineral Section of the Laboratory, was transferred to the Exhibition Committee as officer in charge of collecting, arranging, and despatching the mineral exhibits. From 1st March to the 31st December not only was this branch deprived of Mr. Bowley's services, but in addition a large volume of extra work was thrown upon it in the way of mineral determinations and analyses of exhibits, and valuations of rich gold specimens, of which a large number were purchased by the Government.

Seats on the Mineral Group Committee were allotted to Mr. Bowley and myself, and frequent meetings were held, at which the details of the exhibit were discussed and arranged. The task of preparing a pamphlet descriptive of the State's mineral resources was entrusted to myself, and occupied much of my time towards the end of the year. In this I was ably assisted by contributions from the State Mining Engineer, Government Geologist, and Messrs. E. de C. Clarke, F. H. Moss, and H. Bowley. The manuscript was only completed after the New Year and is now being printed. It should provide a useful *résumé* of the present state of our mineral industry, with many details of our less well known mineral resources, of which no printed account was previously available.

FOODS AND DRUGS.

Several meetings were held of the Food Standards Advisory Committee under "The Health Act, 1911-19." The matter chiefly before this committee was the Report of the Commonwealth and States of Australia third Conference on Uniform Standards for Foods and Drugs. This lengthy and highly technical document was studied in minute detail as to its effect upon the supply of foods and drugs of good quality, and upon interstate trading interests. Amendments suggested by this and other States were carefully considered, and a draft of Standards and Regulations, to be uniform throughout Australia, was finalised, which it is hoped will be approved by the respective Governments and brought into force simultaneously by all at an early date. Applications to permit the use of formic acid and sodium nitrite as preservatives were both disallowed.

Under existing conditions the collection of samples of foods and drugs and the initiation of prosecutions in cases of faulty quality rest with the inspectors of the Health Department, the functions of this Branch under the Health Act being only advisory and analytical. Under these circumstances it is found that no continuous systematic survey of the local food and drug supplies is made, and although a fair percentage of samples analysed does not conform to the regulations, no prosecutions appear to have been initiated during my term of office.

During the year 63 samples of foodstuffs and 13 of drugs were submitted by the Health Department for analysis. In Queensland, during the year ending 30th June, 1923, the corresponding figures were respectively 519 and 93, besides 54 samples of disinfectants, which also come under the Food and Drug Regulations. The proportion of imperfect drugs, four out of thirteen, is again this year dangerously high.

Many interesting details regarding the samples analysed will be found on a later page in Mr. Stacy's report for the year.

SWAN RIVER POLLUTION.

Investigations have been continued into the conditions governing the increased pollution of the waters of the Swan River between the city and the sea. In my last Annual Report figures were made available for the first time regarding the variation of salinity of the river water with seasons and depth, figures greatly affecting the growth of water weeds, whose death and decay have caused so much discomfort to those living on the river banks or spending their leisure hours on its surface. Figures were also published regarding the chief plant foods in solution in

WATER SUPPLIES.

the water. Further evidence regarding these two factors has been collected during 1923, in particular much more extensive data have been obtained regarding the critical plant foods, nitrogen and phosphorus. As a result of a number of tests of the river water made at about fortnightly intervals, the following figures have been obtained:—

Locality.	Organic Nitrogen.			Ammoniacal Nitrogen.		
	Max.	Min.	Average.	Max.	Min.	Average.
	Parts per 100 million.					
Guildford ...	160	82	127	90	4	24
Causeway ...	200	82	147	87	Nil	43
Narrows ...	173	91	128	78	Nil	21
Claremont ...	330*	29	115	268*	Nil	27
Fremantle Har- bour	150	66	107	54	Nil	15

* Abnormal, next highest was organic N, 150; ammoniacal N, 91.

Locality.	Nitrite Nitrogen.			Nitrate Nitrogen.		
	Max.	Min.	Average.	Max.	Min.	Average.
	Parts per 100 million.					
Guildford ...	3	Nil	Trace	165	Nil	42
Causeway ...	66	Nil	10	181	29	59
Narrows ...	4	Nil	Trace	124	Nil	44
Claremont ...	2	Nil	Trace	247	Nil	49
Fremantle ...	Trace	Nil	Trace	214	Nil	41

Locality.	Total Nitrogen.			Total Phosphorus.		
	Max.	Min.	Average.	Max.	Min.	Average.
	Parts per 100 million.					
Guildford ...	333	119	193	21	3	9
Causeway ...	418	150	259	29	9	19
Narrows ...	289	123	193	19	4	10
Claremont ...	812*	78	191	13	4	8
Fremantle ...	342	66	163	18	5	9

* Quite abnormal, next highest was 321.

The salinity figures for Perth water six inches below the surface during the year showed a maximum of 3.6460 per cent. of the total salts on 22nd March, 1923, as against 3.5285 per cent. on 16th April, 1922, and a minimum of 0.0512 per cent. on 28th September, 1923, as against 0.1340 per cent. on 4th August, 1922.

These figures were available for Colonel Longley, the American sanitary engineer, when he paid his second visit to Perth at the end of the year. His report on the river will be awaited with interest.

The prolonged freshness of the water this spring, the much cooler weather in the spring and early summer, and the unusual number of low tides which killed the young weed on the shallow banks, are all in favour of the river being less offensive this year than last. The only permanent cure of the trouble, however, seems to be the filling in of one half of the shallows with dredgings from the other half, thus reducing to a minimum the area covered with six inches to two feet of water, which seems to be the optimum depth for weed growth.

Regular tests continue to be made of the Perth, Fremantle, and Goldfields water supplies. The last remains consistently good from all points of view.

The Perth supply invariably shows complete absence of organic pollution, but an excess of iron is still noticeable at times. The Osborne Park bores appear to be largely responsible for this, the most recent analyses of the three bore waters from that suburb showing ferrous bicarbonate equivalent to 0.0032, 0.0014, and 0.0045 per cent. of ferric oxide. The amount of iron present in the other sources of supply is only the merest trace. In view of the Government's decision to make an immediate start with the necessary dams and pipe lines to supply Perth wholly with stream water from the hills, less time and consideration have been given to the Perth supply than would otherwise have been the case.

The Fremantle supply has involved a considerable amount of analytical and experimental work. Quite early in the year the Water Supply and Health Departments decided that it would be advisable as a precautionary measure to sterilise this supply. For this purpose they established a small plant for the generation of hypochlorite solution from sea water. This plant was very closely studied by Mr. Chapman of this Department, who tested its efficiency under different working conditions. He reported that in a warm climate such as this, using such a weak solution of salt, and one contaminated with magnesium chloride, such a plant would never be effective. Even using a pure salt solution of 10 per cent. strength, the maximum amount of available chlorine in the solution was only 0.5 per cent., after 15 minutes run. The temperature rapidly rose to over 40° C. and above 30° chlorates of little sterilising value were being generated instead of hypochlorites. He recommended the use of imported liquid chlorine or stabilised bleaching powder for sterilising. At present bleaching powder is being used and is found quite effective. Tests of the mixed water and powder at the intake of the reservoir show one part of available chlorine in two million parts of water, which is the amount recommended and now used by the authorities of the London water supply.

Country water supplies, both for individuals and for the irrigation of large areas, have been dealt with in large numbers. In the appended report of the Supervising Chemist for Agriculture, Water Supply, and Sewerage, will be found some important particulars regarding waters available for the irrigation of the Fortescue Valley, an area of great agricultural potentialities.

Much time and expense would be saved to settlers inland if a definitely organised water survey were undertaken by the Government. The Royal Society of Western Australia has recently appointed a committee to deal with the salinity of streams and dams in the South-West, and the information collated by them should be of great value to the country.

One is constantly called upon to decide whether the water from a new well is fit for stock watering. This is a difficult problem to which much thought has been given. Different classes of stock will tolerate different amounts of dissolved salts. The latter in turn vary in their relative proportions, though for the most part they approximate closely to the proportions of oceanic salts in this State. The South

Australian "Journal of Agriculture" in a recent number says that horses will tolerate up to one ounce (437 grains) per gallon of common salt, cattle 1.5 ounces (655 grains), and sheep 2 ounces (874 grains). "The Agricultural Gazette," of New South Wales, however, holds that about 350 grains per gallon is the safe limit for all kinds of stock. The Queensland "Agricultural Journal" considers over 300 grains per gallon unsafe, and over 600 absolutely unfit. Even allowing for different types of water there is therefore plainly no close agreement on this point.

Giving due weight to these official opinions as well as to the opinions of experienced stock breeders in this State, and bearing in mind the impossibility of obtaining pure water supplies in many parts of the salt lake region, the following tentative classification of stock water has been drawn up for use in this laboratory:—

Grains per Gallon.		Remarks.
Total Salts.	Magnesium.	
Up to 150	Up to 6	Excellent for all kinds of stock.
150 to 300	6 to 12	Good stock water.
300 to 600	12 to 24	Poor for sheep and cattle, bad for horses up to 450, useless beyond that.
600 to 800	24 to 32	Bad for all stock.
800 to 1,000	32 to 40	Very bad for all stock.
Over 1,000	Over 40	Useless.

MINE AIR.

During the year several samples of mine air were collected by the Inspector of Mines on the Collie coalfield as the result of complaints made by the miners of the quality of the air in the Westralian Colliery. The results were:—

No.	Oxygen.	Nitrogen.	Carbon Monoxide.	Carbon Dioxide.	Methane.
	%	%	%	%	%
958 ...	20.16	79.40	Nil	0.35	0.09
959 ...	20.24	79.42	Nil	0.34	Nil
1543 ...	20.58	79.20	Nil	0.22	Nil
1544 ...	20.63	79.22	Nil	0.15	Nil
Pure air...	20.93	79.04	Nil	0.03	Nil

Nos 958, 1544. End of district No. 3 Bord.
Nos. 959, 1543. Beginning of district No. 26 Bord.
Pure dry air from Foster & Haldane for comparison.

The analyses show that the mine air is not unduly vitiated.

A sample of air from the 2,100 ft. level of the Lake View Gold Mine was tested for carbon monoxide with negative results.

FUNGICIDES.

Two samples of basic copper carbonate on sale for dry pickling of wheat were examined for purity. One was a high grade product carrying 53.02 per cent. of copper, equal to 92.23 per cent. of the basic carbonate. The other (a foreign brand), however, was a very poor sample, carrying only 20.80 per cent. of copper, equal to 36.18 per cent. of the carbonate. Both were probably prepared by adding chalk to copper sulphate solution, but in the latter case the

whole of the waste products of the reaction were left in the material. These were mainly sulphate of lime and excess of carbonate of lime.

OIL PROSPECTING.

The search for mineral oil is still being carried on with considerable vigour, but except in the Kimberley Division, it is mainly confined to surface inspection of the ground and the collection of soil samples and supposed oils and oil residues for analysis and classification. Except for samples from Kimberley, no others received and tested give any indication of an oil supply.

Certain samples collected privately from the beds of Salt Lake and neighbouring swamps at Rockingham having given extracts up to 0.16 per cent. of unsaponifiable oily matter, Mr. R. C. Wilson, of the Mines Department, and myself visited this area on the 10th April and took further samples in several places. Even in those taken alongside the previously richer samples, the highest unsaponifiable extract obtained was only 0.011 per cent. The others ranged from this figure down to nothing. The exact nature and origin of these oily and waxy substances are uncertain.

Similar results have been noted occasionally in other parts of the Swan coastal plain and in other countries, and it appears probable that these substances are derived from the decaying vegetation which is found so abundantly in the swamps. Arrangements are being made to go more fully into this matter, as it is of great importance to decide whether such traces of oils and waxes are to be looked upon as indications of deep seated oil pools.

Towards the end of the year this Branch helped materially to expose a fraudulent discovery of oil at Lake Eva to the north-east of Southern Cross.

In the Kimberley district systematically organised prospecting for oil is proceeding at favourable localities where genuine asphalts and oil-impregnated rocks have been found.

CLAY.

Investigation of our local clays continues, and has resulted this year in two discoveries of importance. These are a white-ware clay at Wagin, and a Fuller's earth at Jennacubbine.

China Clay, Wagin.—This deposit has been visited by Mr. Bowley, who reports that it appears to be a kaolinised dyke of dolerite traversing kaolinised granite, and covered by a thin bed of laterite. The deposit has been penetrated to a depth of 40 feet. Such conditions are productive in this State of many of our finest white-ware and refractory clays, the rocks having been completely weathered to considerable depths, and practically the whole of the iron leached out and transported to the surface, where it forms a protective cap of laterite, which saves the clay from being denuded away.

The Wagin clay in its natural state is pure white in colour, friable, and extremely fine grained, as the following mechanical analysis shows:—

Clay substance	.. ..	90.7 per cent.
Grit under 90 mesh	.. ..	9.1 "
" " 60 "	.. ..	.1 "
" " 30 "	.. ..	.1 "
" over 30 "	.. ..	trace.

It is practically a natural china clay, requiring no washing before despatching to a pottery. The plas-

ticity is rather low, malachite green adsorption figure 24, which is typical of English china clays. Burning tests have been made in an assay muffle furnace and in an experimental kiln. In both, at temperatures up to 1,200° C., a pure white body is obtained, with fine smooth finish. The air shrinkage observed was 4.2 per cent., and fire shrinkage at 1,150° 4.2 also.

This is destined to be a valuable white-ware clay. The deposit is only four miles from the railway.

Fuller's Earth, Jennacubbine.—What appears to be a large and valuable deposit of Fuller's earth has been discovered eight miles from the railway station at Jennacubbine. It is light grey in colour and waxy looking, swelling and disintegrating freely in water, as a good Fuller's earth should do. Its adsorption figure for malachite green is 296, which compares favourably with the figure 299, given by Ashley for Eimer and Amend's Fuller's earth. Its capacity for decolorising crude Sumatra oil has also been proved.

Samples of this earth and of the Wagin clay have been sent to the British Empire Exhibition.

MINERAL NOTES.

The mineral section of the Department was kept exceptionally busy during the year. 1663 samples were received for treatment, of which 1,048 were gold ores, the remainder requiring more difficult treatment and many mineral determinations. The large collection of mineral specimens got together for the Exhibition was responsible for much of this work, but apart from that prospectors sent in just on 500 samples for examination.

Mr. Murray gives details in his attached report of a number of samples of more than passing importance. In addition the following are noteworthy.

Goongarrite, Comet Vale.—A vein quartz from the shores of Lake Goongarrite, near Comet Vale, was found to give silver assays up to 150 ounces to the ton. This unusual amount of silver was found to be present in a mineral hitherto unknown to science. It was described under the name "Goongarrite," before the Royal Society of Western Australia on the 11th December. It is a black opaque mineral, with density 7.29 and hardness 3.0. In composition it is a double sulphide of bismuth and lead with some silver, an analysis showing:—

Goongarrite, Comet Vale.

Lead.	Zinc.	Iron.	Silver.	Gold.	Bismuth.	Antimony
54.26	.06	.17	1.05	Nil	23.81	.11

Arsenic.	Sulphur.	Selenium.	Tellurium.	Total.
Nil	15.24	.24	Nil	99.94

It forms the third member of the Jordanite Group consisting of—Jordanite, 4 PbS.As₂S₃, meneghinite, 4 PbS.Sb₂S₃; goongarrite, 4 PbS.Bi₂S₃.

Vanadium ores, Gregory Ranges.—In this locality, on the east side of the Oakover River, there is said to be a belt of about 400 square miles of country, carrying numerous veins of lead and copper ore. As long ago as 1913 specimens of vanadinite (chloro-vanadate of lead) were collected there, a sample showing 7.12 per cent. of vanadic oxide, V₂O₅, with 54.7 per cent. of lead. Three further series of samples of lead and copper ores have been received this year from the same area. In the first parcel, one sample carried 16.90 per cent. vanadic oxide with 11.2 per cent. copper, and 40.0 per cent. lead. The vanadium was present as Mottramite, a basic vanadate of lead and

copper, not previously known in Australia.—Of the other two batches of samples, one of nineteen, included five with appreciable amounts of vanadinite, and the other of thirteen samples, included four showing vanadinite. Such ores should be of high value for their vanadium contents, this metal being widely used in the manufacture of spring and axle steels. Recent advices show that the average grade of the South African vanadium ore now being placed on the market is 13 per cent. V₂O₅.

Iolite, Melville.—Numerous specimens of the typical "gigantolite" form of altered iolite were found in a pegmatite vein, near the north-west corner of Harrison's Reward M.L. Microscopic sections revealed a complete alteration of the original mineral into muscovite, with inclusions of biotite, chlorite, and, in one instance, almandite.

Manganese Ores, Horseshoe.—A report was furnished during the year upon the mineralogy of the large manganese deposits at Horseshoe. It was shown that in both deposits the ore consists of an intimate mixture of polanite, psilomelane and limonite, each in turn over limited areas preponderating almost to the exclusion of the other two. Only insignificant amounts of manganite and pyrolusite have been seen. The average composition of the two deposits is:—

	Polianite.	Psilomelane.	Dimonite.	Quartz	Metall. Mn.	MnO ₂ .
Northern	45	44	2.5	1	53.4	79.7
Southern	52	35	6	1	49.1	75.7

Emery, Manjimup.—Some unusual samples of laterite were received from Manjimup to be tested for the presence of emery. These samples contained ragged fragments of a heavy black magnetic mineral of great hardness. This mineral was capable of being concentrated by water, and analyses were made of a typical bulk sample of the rock and of a high grade concentrate. The results were:—

	1821, Rock.	583, Concentrates.
	%	%
SiO ₂	12.96	5.02
Al ₂ O ₃	21.03	32.80
Fe ₂ O ₃	51.85	54.37
FeO	4.13	4.47
TiO ₂	2.53	1.60
H ₂ O +	5.89	1.97
H ₂ O —	2.07	.26
CaO, MgO	Nil	Nil
	100.46	100.49

The concentrate resembled true emery in its hardness and colour, but differed from it in the low proportion of alumina, and in being comparatively readily soluble in acids. Commercially, it would pass as a low-grade emery.

Fluorite, Cooke's Creek.—Fluorite has previously been recorded in this State, in small quantities only, at Mt. Amy and Denham River (Kimberley), Sandy Creek (North-West), Poona (Murchison), Mulgine

(South-West), Mulwarrie (Eastern Goldfields) and Warburton Range (Eastern Division). This year what appear to be commercial deposits have been found in several veins at Cooke's Creek (North-West). The mineral presents a wide range of colours, white, pale green, pale brown, yellow and dark violet, and is associated with a little galena.

EDWARD S. SIMPSON, D.Sc., B.E., F.C.S.,
Government Mineralogist and Analyst.
Perth, 14th February, 1924.

SECTION 1.—TOXICOLOGY, FOODS AND DRUGS.

(C. E. STACY.)

During the year samples were received from the following sources:—

Health Department	213
Police	123
State Saw Mills	105
Departmental	24
State Hotels	17
Explosives	26
Public Works	8
Metropolitan W.S., S., & D.	5
Mines	6
Forestry	6
Tender Board	10
Council of Industrial Development	2
Private	40
Agricultural	7
British Empire Exhibition	2
	594

Samples were as follow:—

Explosives	23
Foods	63
Drugs	29
Spirits	62
Powellising	101
Toxicological	77
Hydrometers	9
Beverages	8
Swan River Pollution	130
Oils	13
Fremantle Water Supply	8
Waters	2
Mine Air	6
Timbers	6
Natural Nitrates	10
Miscellaneous	47
	594

In addition to these, 44 samples of various nature, including limes, fertilisers, waters, and minerals have been analysed for the Mineral and Agricultural Sections constituting overflow work, bringing the total to 638.

A marked falling-off in the number of samples from 1922 will be noticed, and this is due mainly to two reasons. One is the severance of the Explosives Branch and consequent absence of the heat tests. The second reason is that all State trading works have now to pay for the work done, and, naturally, this means that only a minimum number of samples are submitted. This is very noticeable in the powellising samples, which have dropped from 177 to 101.

Foods.—On looking at the figures of samples performed for the Health Department, it may at first sight be thought that a satisfactory increase in the number of food stuffs examined has taken place, but unfortunately this is not so, as no fewer than 138 are river waters and other samples in connection with Swan River pollution and Fremantle water supply. Quite a considerable percentage of the foods

and drugs submitted by the Health Department have been shown on examination to be in some way or another short of the requirements of the Health Act, but so far no prosecutions have been instituted by the Health Department as a result of such analyses. This section of the Government Chemical Laboratory should, I think, be utilised to act in conjunction with the Health Department in protecting the public against unscrupulous vendors and ensuring a pure food and drugs supply.

Only one sample of coffee and chicory was examined throughout the year.

Two samples of cordials contained salicylic acid in excess of that allowed by the regulations, and the manufacturers further erred in not disclosing the presence of this substance on the label.

Another failed to disclose on the label the artificial colouring used. Other breaches of the labelling include the presence of the word "imitation" in very small type instead of the prescribed size, and the use of such designations as "Lemon Squash *Flavour*" in connection with an imitation cordial obviously pretending to be genuine lemon squash. Foreign substances such as sulphate of iron are added to some of these cordials with impunity.

Infants' Food.—A number of these are on the market, several of which are excellent in composition. In some cases, however, where these are diluted according to the directions on the label (that is as far as it is humanly possible to do so) the resulting liquid is calculated to starve the unfortunate infant with remarkable celerity. As an instance I will give the figures of one such milk:—

	Mean average standard for human milk.	Milk in question diluted according to label.
Fat ...	3.5	0.22
Protein ...	1.5	.76
Lactose ...	6.5	2.21
Ash ...	.2	.16
Total Solids	11.2	3.35

Then again the method of recommending so many teaspoons of food to tablespoons of water is faulty in the extreme, because there are both big and small tea and table spoons, and one mother might interpret a spoonful in a lavish way and another in a niggardly way so that no standardisation is possible.

Legislation enforcing the addition of a properly standardised flat measure with the sale of each tin or bottle of food would be of great value and should, I think, be seriously considered by the Advisory Committee.

Butters.—Eleyen samples were examined and were generally satisfactory, two out of the number having excess of moisture, and one a deficiency of fat. All had a Reichert-Meissl figure well over the usually recognised standard for pure butters. This figure indicates the quantity of volatile fatty acids in the sample, butter having a very large amount of these compared with other fats which might be used as adulterants.

No standard Reichert-Meissl figure for butters has hitherto been considered possible. This, I think, is due to the great variation in this figure for European butters. This may not be the case, however, for Australian butters, which all appear to have a uniformly

high figure, and it would at least be a step in the right direction if a butter survey was made throughout the Commonwealth with a view of finding out if it would be possible to create such a standard.

It should be recalled that in the case of *Rex v. Murphy and McCarthy*, in South Australia, in October, 1919, the magistrate dismissed the case, which was one of alleged adulteration by foreign fats, because there was no definite standard Reichert-Meissl figure for butter, although to an unbiassed chemist there does not appear to be any doubt that the sample was adulterated, and there is no doubt that in the absence of such a standard there is but little hope of a successful prosecution for such an offence, and this was pointed out as far back as the 1913 Food Conference in Melbourne.

Margarine.—Of two samples submitted one had an excess of moisture.

Sausages.—Eight samples were examined, and of these five did not comply with the regulations, three being deficient in meat and having a slight excess of starch, whilst two were unfit for human consumption due to advanced lactic acid fermentation.

Cocoas.—Thirteen samples were submitted just before the Christmas holidays, and although the analyses are not quite complete there is no evidence of adulteration.

Jams.—Fifteen samples of jam were examined and proved to be generally satisfactory. Four samples of a local factory were examined in comparison with four samples of an Eastern States brand, and it is satisfactory to be able to state that the local product was, if anything, of slightly better quality.

It is anything but satisfactory, however, to have to say that the departmental analyses were made use of to furnish the local firm with a gratuitous newspaper advertisement. This, to my mind, is taking an improper advantage of the activities of this laboratory.

Spirits.—Sixty-two samples were examined in all. The Inspection of Liquors Branch having been placed under the Police Department, it was expected that, like the proverbial "new broom," a vigorous campaign would be made against adulterated liquor and improper "refilling." Unfortunately, it was not until late in the year that the various spirit merchants could be prevailed upon to pay adequately for the standard sample analyses upon which protection for themselves and the public is afforded against the adulteration of well-known proprietary lines of spirits by other usually less meritorious liquors. Consequently the hands of the Inspection of Liquors Branch were tied; but I hope to see an expansion in this direction in the future.

An interesting case was heard during the year in which a prosecution was instituted for false trade description. These cases are usually dealt with by a magistrate, but the licensee preferred to have it treated as a criminal offence (the first time on record). The jury were quite convinced that sophistication had taken place, but they were unable to prove that the defendant was directly responsible, a proof made necessary by the charge being a criminal one, and the case was dismissed.

Drugs.—Thirteen drugs were submitted by the Health Department, the remainder being from the Police. Ten of these were for the purpose of seeing whether they came up to British Pharmacopœia standard, and four did not comply. One other sample was found to be practically identical with a medicine, the sale of which had been prohibited.

Criminal and Toxicological.

Suicides: attempted suicides and poisoning.—Fifty-two exhibits were received in connection with twenty-five cases of poisoning, and exhibited a very large range of poisons:—

- 6 cyanide.
- 3 lysol.
- 2 veronal (barbitone).
- 2 strychnine.
- 1 arsenic.
- 1 iodine.
- 1 morphine.
- 1 permanganate.
- 1 hydrocyanic acid.
- 1 eucalyptus.
- 1 salts of lemon (oxalic acid).
- 1 bordeaux mixture (copper).
- 4 negatives.

In some cases where no definite poisonous principle could be discovered, life-tests upon guinea-pigs were employed either hypodermically or *per os*, and in all cases the negative results have been confirmed.

The two veronal cases, coming within a few days of one another, again illustrate the "cyclic" run of cases, as this is a poison extremely rarely used with suicidal intent in this country.

A case of wholesale arsenical poisoning, resulting in one death, took place in a country town through white arsenic being used in mistake for baking powder. This is by no means the first time in which arsenic has been used for culinary purposes by mistake. Such carelessness in leaving poisons about unlabelled in kitchens is little short of criminal.

Two interesting cases occurred where bodies of individuals supposed to have been poisoned were found after long intervals in the bush. In neither case could any poison be detected. By the side of one, however, was found a bottle containing a mixture of alkaline carbonates and was similar in appearance to a bottle containing cyanide known to have been purchased by the individual just before his disappearance. Presumably all the cyanide had been converted into carbonate by the action of moist air.

In the other case the stomach was almost entirely converted into adipocere—fatty matter produced by the decomposition of flesh under moist conditions—a very unusual condition under our climatic conditions.

People in rabbit areas are frequently sending in exhibits from cattle presumed to have been poisoned from eating poisoned rabbits. When it is remembered that the lethal dose for, say a cow, would be at least 500 times as great as for a rabbit, the absurdity of such a conclusion is manifest.

A very interesting police case was one in which a man was alleged to have attempted to blow up an hotel. The tin box in which the explosive was put could have been but very loosely tamped with paper and mud, which the Crown attempted to prove had been taken from a place where soapy water had flowed out on to the ground from a bathroom. Had the material been properly tamped in a closed space like a bore hole, there would of course have been nothing left of the tamping after the explosion; but the explosion could only have been incomplete.

A small quantity of this alleged tamping was submitted, and the detectives' theory was borne out by the fact that a small quantity of fatty matter was extracted consisting of 70 per cent. fatty acids, which pointed to the presence of soap in the material examined.

River Pollution Investigations.—One hundred and thirty (130) samples of water have been analysed in this section in connection with this investigation, some being for partial mineral analyses, and some complete and including phosphorus and nitrogen.

Fremantle Water Supply.—Investigations were made upon the best way of sterilising this supply, and a full report was submitted to the Engineer for Metropolitan Water and Sewerage recommending the use of liquid chlorine in cylinders, as this can be imported from America at a comparatively low cost.

Oils.—Thirteen samples were examined, including ten from the Tender Board, to see if they came up to the specifications.

SECTION II.—MINERALOGY, MINERAL TECHNOLOGY AND GEOCHEMISTRY.

D. G. MURRAY.

Samples to the number of 1,663 were received during the year from the sources shown in the accompanying table. The actual number of determinations made was 2,185:—

Mines Department—	
Minister and Under Secretary ..	14
State Mining Engineer	215
Geological Survey	75
Mineral Laboratory	31
State Batteries	693
Agricultural Department	4
Harbour and Lights Department ..	1
Health Department	1
North-West Department	4
Premier's Department	1
Public Works Department	5
Water Supply Department	5
Criminal Investigation Department ..	3
Forest Products Laboratory	1
British Empire Exhibition Committee ..	57
Prospectors	485
Public Pay	68
	1,663

Classification of samples:—	
Gold Ores	1,048
Minerals (Miscellaneous)	227
Manganese Ores	33
Mineral Oils	50
Waters	37
Felspars and Micæ	5
Ochres	18
Coals	27
Magnesites	6
Sands	3
Metallurgical Products	2
Tin Ores	5
Iron Ores	25
Limestones	14
Lead Ores	37
Sulphur Ore	1
Rocks	7
Graphite Ores	17
Copper Ores	52
Gypsum	6
Clays	22
Molybdenum Ore	1
Tantalites	1
Bauxite	3
Asbestos	1
Beryl	1
Miscellaneous	14
	1,663

Oil.—The desire to locate a supply of this valuable commodity was responsible for a number of samples

being received for oil tests, but, unfortunately, no favourable results were obtained.

Ochres.—Numerous samples of ochres were tested, and suitable materials for paint making were received from the following districts: Quairading, Greenhills, Kalgoorlie, Kanowna, Balkuling, and Bullabulling.

An investigation was also made of certain prepared paints of local manufacture.

Clays.—A number of clays of various types from new localities have been dealt with, and further investigations made of known existing clay deposits with a view to improving locally manufactured articles.

A sample of Fuller's earth of good quality was received from Jennacubbine, and there are said to be large quantities of it available.

In connection with the ceramic industry two samples of felspar of excellent quality for use in the manufacture of white ware were received, viz., Albite from Ubini and Microcline micropertite from Moolia-beenie.

Metallurgical Tests.—Concentration tests were carried out on Middlings from Wilfley tables, Surprise Lead Mine, at Galena, with a view to obtaining a sufficiently high-grade lead concentrate. The material submitted consisted almost entirely of galena and barite. The results obtained by grading and panning were discouraging, and the conclusion arrived at was that fine grinding and flotation was the required treatment.

Gold.—The endeavour of the British Empire Exhibition Mineral Committee to furnish a mining exhibit worthy of the State resulted in quite a considerable number of recently discovered gold specimens being received for valuation with a view to purchase for exhibition purposes.

Silver Lead.—Two samples of lead ore from the Bangemall district were found on assay to contain—

L. No. 2023/23	Lead, 78.89 per cent.
	Silver, 32ozs. 10dwts. 20grs. per ton.
L. No. 2024	Lead, 82.86 per cent.
	Silver, 28ozs. 5dwts. 7grs. per ton.

Gypsum.—Samples of high-grade gypsum from various localities were reported on, and several were found suitable for the manufacture of plaster of paris.

A partial analysis of gypsum crystals from a drain on the Peel Estate, Rockingham, is given below:—

L. No. 896/23—Gypsum, CaSO ₄ .2H ₂ O	98.44
Calcium carbonate, CaCO ₃...	.05
Sodium chloride, NaCl	.05
Insoluble in Acid	1.88

This would be an excellent material for plaster making, if available in commercial quantities.

Limestone.—Limestones from various sources have been dealt with during the year, and the figures obtained from the analyses of several are appended:—

Locality, Margaret River, Denmark.

L. No.	280/23	544	545	546	547	548	639	640	641
Kind	CAPSTONE.								
	%	%	%	%	%	%	%	%	%
CaCO ₃	95.80	98.91	91.56	87.04	84.14	89.16	90.14	86.04	87.88
MgCO ₃	1.80	1.81	1.22	2.42	2.99	2.55	2.35	2.21	1.02
Insoluble in Acid	1.80	3.51	3.82	7.74	11.08	5.68	4.40	7.49	8.08
Fe ₂ O ₃ .Al ₂ O ₃	.42	.57	.26	.44	.50	.28	.50	.24	1.36

Copper Ore.—Two bulk samples of average heavy sulphide and low-grade oxidised ore from the Whim Well Mine, at Whim Creek, submitted by the State Mining Engineer, were analysed and the figures are given below:—

L. No. 572/23. Oxidised Ore.			L. No. 573/23. Sulphide Ore.		
	%			%	
SiO ₂ ...	59.96	SiO ₂ ...	12.74		
Al ₂ O ₃ ...	12.40	Al ₂ O ₃ ...	1.82		
Fe ₂ O ₃ ...	9.80	Fe ₂ O ₃ ...	?		
FeO ...	Nil	FeO ...	3.88		
CaO ...	.06	CaO ...	Nil		
MgO ...	.67	MgO ...	Trace		
MnO ...	.14	MnO ...	Trace		
CoO ...	.71	Co ...	.76		
NiO ...	Nil	Ni ...	Trace		
PbO ...	.22	Pb ...	.36		
ZnO ...	Trace	Zn ...	1.32		
CuO ...	7.05	Cu ...	.68		
Cu ...	.36	Fe ...	34.36		
S ...	.09	S ...	40.33		
SO ₂ ...	1.26	SO ₂ ...	3.34		
CO ₂ ...	1.63	H ₂ O— ...	.69		
NaCl ...	.08				
H ₂ O + ...	4.88				
H ₂ O — ...	.78				
	100.09		100.28		
Total Cu ...	5.99	Total Cu ...	.68		
Ag—9dwts. 3grs. per ton.		Ag—5dwts. 21grs. per ton.			
Au—Nil.		Au—8grs. per ton.			

Analyst: W. W. SAW.

Analyst: H. P. ROWLEDGE.

The sulphide ore should be of value for its sulphur contents, as a source of sulphuric acid.

Iron Ore.—Several samples of iron ore from Talerling Peak were forwarded by the Government Geologist for analysis, with the following results:—

Lab. No. ...	2194/23	2195	2196	2197	2198	2199
Mark ...	1/3608	1/3609	1/3610	1/3611	1/3612	1/3613
	%	%	%	%	%	%
Iron, Fe ...	15.16	35.79	68.08	12.38	57.81	71.15
Silica, SiO ₂ ...	73.61	49.02	3.02	82.38	17.95	.50
Titanium oxide, TiO ₂ ...	.005	.003	.005	.008	...	.016
Phosphorus, P ...	...	...	...	...	...	.045
Sulphur, S ...	...	...	...	...	...	.024

Analyst: B. L. SOUTHERN.

Analysis of a sample of iron ore from Clackline, collected by Mr. Bowley for the British Empire Exhibition:—

L. No. 2439/23—	Fe ₂ O ₃ ...	75.01
	SiO ₂ ...	7.97
	S ...	.043
	P ...	.315

Analyst: B. L. SOUTHERN.

This deposit is situated within 53 miles of Perth, and there is an immense quantity of ore available. The phosphorus content of this sample was unusually high, two previous samples showing only 0.009 per cent.

Coal.—In addition to the number of black coal samples dealt with during the past year, an examination was made of a sample of lignite from the Peel

Estate, the results of which are given below:—

Lab. No. 2403/23.

Loss of moisture on air drying—48.05 per cent.

Proximate Analysis of Air-dried sample:

Moisture ...	13.76
Volatile matter ...	49.28
Fixed carbon ...	14.01
Ash ...	22.95
	100.00

Distillation of Air-dried lignite:

Water ...	23.20
Oils ...	2.72
Gases ...	22.58
Residue ...	51.50
	100.00

Analyst: J. N. A. GRACE.

Graphite.—From various districts graphite bearing ores have been forwarded and have been tested by the Morgan Model Flotation Plant installed in the Laboratory. From a new locality, Martigallup, a number of samples were received and submitted to concentration tests, but a marketable product could not be obtained, the concentrated flake being invariably interleaved with mica and limonite.

Building Stones.—A sample of stone from an island off Beadon Point, N.W., submitted by the Engineer in Chief, Department of Works and Trading Concerns, was found to be a tough, dense, fine-grained marble, consisting almost wholly of calcium carbonate. Stone of this quality, if available in large blocks, would be a most valuable stone for building and ornamental purposes.

It might also be possible to successfully use it for lithographic work.

A rock from the Yilgarn district was also reported on favourably as a building stone.

Magnesite.—Samples of high grade magnesite, suitable for the manufacture of Sorel cement or refractories were received from the following localities: Tammin, Marble Bar, Southern Cross and Goomalling.

Miscellaneous Minerals.—A large number of mineral specimens continue to be submitted for determination and report as to their economic value, amongst them being noted the following:—

Coquimbite (hydrous sulphate of iron). A yellow efflorescence, found near the Wooramel River, which was at first taken for native sulphur, was found on analysis to contain:—

L. No. 10317—Mark No. 3.

Insoluble in acid ...	34.66
FeO ...	.73
Fe ₂ O ₃ ...	10.72
Al ₂ O ₃ ...	1.89
SO ₂ ...	21.34
NaCl ...	7.35
Na ₂ O ...	.72
K ₂ O ...	.22
CaO ...	.77
MgO ...	1.68
H ₂ O (by difference) ...	19.92
	100.00

It consisted mainly of coquimbite with a little natrojarosite,

Mirabilite (hydrous sulphate of sodium).—A white powder, said to come from a cave 190 feet below the surface of the Nullabor Plain, on examination was found to contain 86.02 per cent. of sodium sulphate. It would appear to have been originally mirabilite, but had lost much of its water on exposure to dry air.

Beryl (silicate of beryllium and aluminium).—Beryllium is a somewhat rare metal and the best known mineral of which it is a constituent is beryl, which has been located in several portions of the State. An assay was recently made in the Laboratory of a sample of beryl from Balingup, which gave a return of 12.23 per cent. of beryllium oxide.

Ceylonite (Iron magnesia spinel).—A specimen of this mineral, which is of considerable scientific interest, was forwarded from Yandeyarra Homestead in the West Pilbara district and was found on analysis to have the following composition:—

L. No. 288/23.		per cent.
MgO	...	14.64
FeO	...	17.42
MnO	...	.80
NiO	...	.62
CaO	...	Nil
Al ₂ O ₃	...	61.22
Fe ₂ O ₃	...	3.96
Cr ₂ O ₃	...	Nil
SiO ₂	...	1.74
TiO ₂	...	.09
		100.49

Analyst: D. G. Murray.

Mottramite (basic vanadate of lead and copper). The above mineral was recorded from Braeside, Pilbara District. A partial analysis showed the presence of the following constituents:—

		per cent.
PbO	...	43.06
CuO	...	14.04
ZnO	...	trace
Fe ₂ O ₃	...	1.29
Al ₂ O ₃	...	1.24
V ₂ O ₅	...	16.90
P ₂ O ₅	...	1.26
SiO ₂	...	19.04
H ₂ O	...	2.08

This mineral is of economic importance as a source of the metal vanadium.

SECTION III.—AGRICULTURE, WATER, AND SEWERAGE.

(S. C. PALMER.)

The samples received for analysis during the year totalled 874, and were received from the following sources:—

Agricultural Department	...	213
Water Supply Department	...	394
Mines Department	...	5
Lands Department	...	3
Council of Industrial Development	...	1
Geological Department	...	1
Department for North-West	...	1
Dept. of Works and Trading Concerns	...	24
Public Free and Public Pay	...	119
Health Department	...	113*
Total	...	874

* Representing 113 hygienic analyses done in connection with the Swan River pollution waters.

Samples received were classified under the following heads:—

Soils	...	74
Waters	...	319
Fertilisers	...	71
Sewage	...	302
Wheats and Flours	...	88 (including 69 wheats)
Limes and Limestones	...	15
Fodders, etc.	...	5
Total	...	874

SOILS.

Soils and their scientific treatment form the more important part of the work conducted by the staff of our Agricultural Laboratory.

Now that there are so many new areas opening up and group settlements being established, it would be greatly to the advantage of the settler if he solicited the advice of the chemist, who would be able to explain many of the difficult problems arising, and help to dispel mists that so frequently loom up much to the discouragement of the settler. The advice so gained would not only be an immediate benefit to the inquiring individual himself, but the knowledge so obtained becoming disseminated would also benefit surrounding settlers as well. Appended in this report are some interesting analyses of soils from different parts of the State, which serve to show the benefit in seeking timely advice from the chemist as to the fitness of a soil for the raising of any particular crop which a farmer may desire to grow.

Pinjarra.—The subjoined analyses of a soil and subsoil from potato fields at Pinjarra explain the reason for the wilting of potatoes. From the figures of analysis the cause may be found in the high percentage of soluble salts, which no doubt also form the substance of a white incrustation appearing on the soil surface during intensely hot weather.

POTATO SOILS, PINJARRA.

	Lab. No. 2.	Lab. No. 3.
Total soluble salts	0.895	0.990
including Sodium chloride	.696	.696
Alkalinity as cal. carbonate	.040	.030
Calcium	.031	.024
Magnesium	.050	.054
Sulphates (SO ₄)	.029	.090

Analyst: A. J. Hoare.

Dwarda.—Two samples of soil were sent in from Dwarda to ascertain the reason why wheat and oat crops were wilting. The difficulty appeared to be due partly to imperfect drainage, partly to a rather high percentage of soluble salts.

	Lab. No. 75.	Lab. No. 76.
Water soluble salts	0.260	0.250
Sodium chloride	.016	.016
Calcium	.032	.032
Magnesium	.024	.022
Sulphate (SO ₄)	.086	.078
Iron	trace	trace
Nitrate (NO ₃)	trace	trace
Organic matter	.009	.025
Alkalinity as calcium carbonate	.090	.070

Analyst: A. J. Hoare.

West Kimberley.—Four soils were sent in from Port George IV. Mission Station with a view to determining their suitability for cotton growing. They were found to be of poor quality, as the following figures show, the phosphoric oxide in particular being very low. A further series of six samples from the Derby District indicated that although in most instances the mechanical condition was good, the fertilising constituents are all low, and in some cases an excessive amount of salt is present.

COTTON SOILS, PORT GEORGE IV.

	Lab. No. 1420.	Lab. No. 1421.	Lab. No. 1422.	Lab. No. 1423.
Chemical analysis of dried soil—	%	%	%	%
Loss on ignition ...	5.900	4.900	3.400	4.400
Organic carbon ...	2.010 R	1.090 G	.540 N	.650 N
Salt ...	.016 G	.338 E	.053 D	.160 D
Nitrogen ...	.118 N	.050 P	.045 P	.045 P
Lime as carbonate	.070 P	.051 P	.038 P	.032 P
Lime as sulphate, etc. ...	.126	.114	.080	.086
Potash, acid soluble	.119 L	.116 L	.090 L	.102 L
Phosphoric oxide, acid soluble ...	.026 P	.026 P	.031 P	.029 P
Mechanical analysis of dried soil—				
Sand grade ...	16.3	17.1	18.9	19.0
Silt grade ...	54.1	49.5	56.9	50.1
Clay grade ...	29.6	33.4	24.2	30.9
Description ...	Dark chocolate clay loam.	Choco-late clay loam.	Light brown clay loam.	Light brown clay loam.

Analyst: A. J. Hoare.

COTTON SOILS, DERBY DISTRICT.

	Lab. No. 765.	Lab. No. 766.	Lab. No. 767.	Lab. No. 768.	Lab. No. 769.	Lab. No. 770.
Chemical analysis of fine soil on steam-dried sample—	%	%	%	%	%	%
Loss on ignition ...	9.700	9.530	9.860	1.870	2.010	5.950
Organic carbon ...	.642N	.844N	.818N	.860L	.200L	.427L
Salt ...	.350E	1.270E	.874E	.006G	.012G	.064D
Nitrogen ...	.084L	.084L	.067L	.028P	.034P	.078L
Lime as carbonate	.184L	.133L	.368N	.044L	.093L	.121L
Lime as sulphate	.139	.184	.208	...	...	.057
Potash, acid soluble	1.115R	.881R	1.166R	.041P	.069L	.460R
Phos. oxide, acid soluble ...	.068L	.063L	.087L	.014P	.014P	.041P
Mechanical analysis on steam-dried sample—						
Sand grade ...	8	18	5	50	48	20
Silt grade ...	39	42	46	40.5	35	42.5
Clay grade ...	53	40	49	9.5	17	37.5
Description ...	Light drab clay loam.	Light drab clay loam.	Eight drab clay loam.	Red sand.	Red sand.	Light drab clay loam.
Locality ...	Black soil flat, Knowsley.	Knowsley.	Black soil flat, Knowsley.	Red bindan, Knowsley.	Red bindan, Group C.	Black soil, Yeeda Plains.

Analysts: S. C. Palmer and B. L. Southern.

Standards for plant foods.—R, rich; G, good; N, normal; L, low; P, poor.

Standards for salt.—G, good; D, doubtful; E, excessive.

Fertilisers.—The number of fertilisers that have been tested in the laboratory is 71. In connection with these some points of interest are to be noticed with regard to the basic slags that are now upon the market, and the subjoined figures show in a very marked way the difference between the value of the English slag as against that of the Belgian. The dif-

ference lies principally in connection with the degree of fineness between these two slags. This degree of fineness determines, in a great measure, the value of the basic slag, for however great may be the proportion of citric acid soluble phosphoric oxide to the total phosphoric oxide, if the particles are coarse, they will take much longer to dissolve and so the immediate progress of plant growth will be checked. The superiority of the English over the Belgian slag is readily seen from the subjoined figures:—

	English Slag.	Belgian Slag.
Total phosphoric oxide ...	17.89	15.98
Citric soluble oxide ...	15.62	15.49

Analyst: A. J. Hoare.

Fineness test:

No. 1—English.—

90 per cent. will pass through a sieve of 100 meshes to the linear inch.

1.5 per cent. will not pass through a sieve of 60 meshes to the linear inch.

No. 2—Belgian.—

77 per cent will pass through a sieve of 100 meshes to the linear inch.

15 per cent. will not pass through a sieve of 60 meshes to the linear inch.

The Fertilisers Act requires that 80 per cent. pass through a sieve of 100 meshes to the linear inch, and 5 per cent. only must fail to pass through a sieve of 60 meshes to the linear inch.

Superphosphates have not shown much variation in their composition over those of last year, and have been well up to the standard of registration and of a good friable consistency.

During the month of July the local superphosphate manufacturers raised the standard of super in the total phosphoric oxide content from 18 per cent. to 22 per cent. and containing water soluble 20.5 per cent., also stating that the price per ton would not be raised. We have as yet not received any samples of this newly made article, so cannot record any figures. Such good news as this, however, should cheer the hearts of those farmers who have been accustomed to buy heavy supplies, as well as be an incentive to those whose pockets are not so well lined as those of their neighbours to purchase a little heavier than usual.

Mixed manures have also been up to the standard of registration, there being no complaints of any description to record. The few anomalies that appeared in the composition of some of last year's samples have not been repeated this year.

The tins containing the fertiliser samples are if anything a trifle smaller than those of last year, although it was then stated that the tins should be at the least twice the size, in order that the sample taken should be representative of the large bulk of fertiliser from which the sample was drawn. This important suggestion still remains unheeded.

WATERS.

A large number of waters from different parts of the State amounting to a total of 319 have been analysed by the Agricultural section, and include the appended interesting samples which are hereunder tabulated.

Fortescue Valley.—These waters were submitted by the Secretary for the North-West, who desired to find out the possibility of their being used for irrigation purposes as tropical agriculture further advanced. These waters being taken at opposite seasons of the year, a comparison can be made and variations noted in their composition.

The first samples were drawn in April, while the second batch of three was drawn in September. On comparing the figures given in the attached table it will be noted that the difference in composition of Millstream, at the two respective seasons, is too slight to comment upon. In the Palm Pool samples the water drawn in September shows a 40 per cent. increase in figures over those for April, with the excep-

tion of magnesium carbonate and sulphate, where a decrease is shown. In the case of the Deep Reach sample, that drawn in September shows a large increase in figures over those of the water drawn in April, containing also twice as much salt.

The deductions that may be drawn upon the information shown in the Millstream and Palm Pool figures are that these waters are perfectly good and safe for either irrigation or stock purposes at all seasons of the year. With regard to the Deep Reach water it is still an excellent water for stock, but should be used with caution for irrigation purposes during the dry season, as at this period of the year the water would become more saline.

WATERS, FORTESCUE VALLEY.

Source	Millstream Pool.				Deep Reach.				Palm Pool.			
	1,813 24-4-23		2,544 28-9-23		1,811 24-4-23		2,548 28-9-23		1,312 24-4-23		2,546 28-9-23	
	Parts per cent.	Grs. per gal.	Parts per cent.	Grs. per gal.	Parts per cent.	Grs. per gal.	Parts per cent.	Grs. per gal.	Parts per cent.	Grs. per gal.	Parts per cent.	Grs. per gal.
Calcium carbonate ...	0.0190	13.30	0.0210	14.70	0.0087	6.09	0.0257	17.99	0.0150	10.50	0.0285	18.55
Magnesium carbonate ...	.0097	.79	.0084	5.88	.0020	1.40	.0015	1.05	.0056	3.92	.0025	1.75
Magnesium sulphate ...	.0139	9.73	.0137	9.59	.0081	5.67	0.0251	17.57	.0174	12.18	.0139	9.73
Sodium nitrate ...	trace	trace	N/2	N/2	trace	trace	N/2	N/2	trace	trace	N/2	N/2
Magnesium chloride ...	.0008	.56	.0021	1.47	.0023	1.61	.0102	7.14	.0020	1.40	.0086	6.02
Sodium chloride ...	.0296	20.72	.0291	20.37	.0167	11.69	.0458	32.06	.0349	24.43	.0533	37.31
Potassium chloride ...	.0029	2.03	.0025	1.75	.0023	1.61	.0019	1.33	.0081	2.17	.0032	2.24
Aluminium and iron ox- ides, Al ₂ O ₃ , Fe ₂ O ₃ ...	.0002	.14	.0005	.35	.0001	.07	.0007	.49	N/2	N/2	.0007	.49
Silica ... ..	.0008	.56	.0001	.07	.0008	.56	.0002	.14	.0011	.77	.0005	.35
	0.0769	58.83	0.0774	54.18	0.0410	28.70	0.1111	77.77	0.0791	55.37	0.1092	76.44
Extra CO ₂ ... ..	.0130	9.10	...	...	.0093	6.51	...	...	.0102	7.14	...	...
Analysts	J. N. A. Grace.		A. J. Hoare.		J. N. A. Grace.		A. J. Hoare.		J. N. A. Grace.		A. J. Hoare.	

Port Hedland.—Two waters were submitted by the North-West Department with a view to determining their suitability for providing a town water supply for Port Hedland. From the figures given below, it will be seen that the water from the Government well is only fit for stock, and on chemical grounds entirely unsuited for irrigation or human consumption. The water from the private well is good stock water, but too alkaline for general irrigation purposes. If kept free from bacterial pollution, it would be suitable for domestic cleansing and cooking, but slightly unpalatable to drink.

	Lab. No. 2542. Pippingarra Private Well.		Lab. No. 2545. 12½-Mile Govern- ment Well.	
	Parts per cent.	Grains per gall.	Parts per cent.	Grains per gall.
Calcium carbonate ...	0.0175	12.25	0.0170	11.90
Magnesium carbonate ...	.0100	7.00	...	...
Sodium carbonate ...	.0087	6.09	...	...
Calcium sulphate ...	...	...	.0143	10.01
Sodium sulphate ...	.0158	11.06	...	...
Potassium sulphate ...	.0004	.28	...	...
Sodium nitrate ...	trace	trace	trace	trace
Calcium chloride ...	...	...	.0324	22.68
Magnesium chloride ...	...	...	.0435	30.45
Sodium chloride ...	.0807	56.49	.1165	81.55
Potassium chloride ...	...	...	.0029	2.03
Aluminium and iron oxide ... ..	.0008	.56	.0002	.14
Silica ... ..	.0007	.49	.0007	.49
	0.1346	94.22	0.2275	159.25

Reaction, PH ... 8.6, alkaline ... 7.6, faintly alkaline,
Analyst: A. J. Hoare.

Waddouring.—At Waddouring, 12 miles from Trayning railway station, a well at the foot of a

granite island hill yields a remarkably pure water, equal in quality to the best stream water from the Darling ranges. The purity of this well water is substantial evidence that the rains do not act as a salt distributing medium to the extent that is supposed. Analysis as under:—

	Lab. No. 846.	
	Parts per cent.	Grains per gallon.
Calcium carbonate	0.0020	1.40
Magnesium carbonate ... ..	.0014	.98
Potassium sulphate ... ..	.0007	.49
Sodium chloride ... ..	.0057	3.99
Iron and aluminium oxides ... ..	.0002	.14
Silica ... ..	.0009	.63
Total	0.0109	7.63

Analyst: D. G. Murray.

Sewage.—During the early part of the year an anomaly in connection with the Perth sewage problem presented itself. It was the fact of there being a greater putrescibility of the general filtrate after passing the settling pits as compared with the individual filtrates from the separate filters. This appears to be due to deoxidation taking place in the settling pits, and this will continue to take place unless some further means of aeration be adopted. The following figures illustrate this:—

	Average figure for nitrogen as nitrate. Grains per gallon.
Before passing settling pits ...	0.902
After passing through settling pits	.513
Reduction] ...	.389 or 43 %

This was an improvement on the previous year, when the corresponding figure was 50 per cent. There is every reason to suppose that the dissolved oxygen is similarly reduced.

The number of sewage samples analysed has totalled 302, but beyond the items of significance already mentioned, other conditions of sewage remain the same as usual.

Fodders—Kikuyu Grass.—A sample of this grass was sent in for the purpose of ascertaining its fodder value, and being a new grass imported into this colony from Africa, it will no doubt be of interest to farmers to learn something of its composition and feeding value. Subjoined is an analysis of this grass made during the early part of the past year:—

	Kikuyu. No. 306.	Lucerne (Guthrie).
	per cent.	per cent.
Analysis of the air dried grass—		
Moisture	17.62	10.00
Petroleum ether extract	1.06	2.80
Albumenoids	17.41	16.00
Fibre	22.13	24.60
Ash	9.39	8.90
Nitrogen free extract (carbo- hydrates)	42.39	37.70
Unit food value calculated on Guthrie's basis	62.19	60.00

Analyst: S. C. Palmer.

The hay from this grass compares favourably with lucerne hay, an analysis of which, extracted from the New South Wales Farmers' Handbook, is quoted above.

Kikuyu is a drought-resisting grass and readily grows from the cut-up stalks, and having already been experimented with in different parts of this State, proves itself to be a grass of great promise, which may possibly outrival Paspalum. In New South Wales, however, experience in growing this grass has showed that it does not always have the same high food value, under varying conditions of soil and climate.

Tuber of Typhonium sp.—A reputedly edible tuber from East Kimberley was submitted for analysis. This was part of a plant which the Government Botanist considered was probably *Typhonium Brownii*, an aroid described by Maiden in his "Useful Native Plants of Australia." Therein he says that the tubers are eaten by the natives after alternate pounding and baking, repeated several times. In its original state

without this preparation it is thought to be poisonous, so that life tests would be necessary before it could be used as a food. The tuber resembles that of a potato, but the flesh is bright orange in colour. The chief constituents were found to be as under:—

	Tuber as received. per cent.	Dried tuber. per cent.
Moisture	58.70	nil
Petroleum spirit extract ..	1.11	2.69
Proteins	3.52	8.52
Carbohydrates, etc.	34.03	82.39
Fibre ... ..	.53	1.28
Ash	2.11	5.12
	100.00	100.00

Analyst, S. C. PALMER.

WHEATS AND FLOURS.

During the latter part of the year the milling operations and investigations have been performed by Mr. R. G. Lapsley, B.Sc. Ag., and previous to this by Mr. A. J. Hoare, the head assistant of this section. Sixty-nine samples of wheat were milled, and nineteen flours tested for flour strength.

For the purpose of classifying the wheats for judging in connection with the Royal Agricultural Show the wheat belt is divided into three zones, and for each of these zones prizes are offered for white soft and white strong wheats. The points in judging are based on the following milling results:—

1. The percentage of flour from the milled results.
2. The water absorption figure stated in quarts per 200lb. sack.
3. Colour of flour.
4. Percentage of dry gluten in flour.
5. Total lbs. of bread per ton of wheat calculated from water absorption and flour content.

For the complete milling test about $\frac{3}{4}$ lb. (300 grammes) is required.

There were 27 samples submitted for the Royal Show, and out of these sixteen were selected as worthy of milling tests by the judges appointed by the Royal Agricultural Society, viz., Messrs. Sutton, Wilson, and Lapsley.

The wheats selected were clean and splendid samples of their respective varieties. Of the strong white class, Comeback and Pusa No. 4 were exceptionally fine wheats, and Niloc also proved to be a splendid milling wheat. The list of prize winners is given below.

WHEAT MILLING RESULTS FOR THE ROYAL AGRICULTURAL SHOW, 1923.

Zone.	Class.	Variety.	Rain-fall. inches*	Percentage of Products.				Percentage of Gluten.			Water abs. figure qts. per 200lb. sack.	Marks.	Colour marks.	Total marks.	Bushel weight.	lbs. bread per ton of wheat.
				Flour.	Bran.	Pollard.	Marks.	Wet.	Dry.	Marks.						
1	1	Niloc ...	6.38	72.9	21.0	6.1	35.25	27.48	10.02	3.75	55.4	44.25	5.0	88.25	64	2,457
2	2	Florence ...	9.00	71.8	20.6	7.6	31.5	31.08	10.70	3.75	53.6	42.00	3.0	80.25	66	2,388
3	3	Canberra ...	10.00	71.2	22.1	6.7	30.0	25.68	9.28	3.50	48.0	35.00	5.0	73.50	63	2,268
1	4	Comeback ...	5.00	74.3	19.8	5.9	38.75	39.16	14.42	4.75	57.0	46.25	5.0	94.75	66½	2,538
2	5	Comeback ...	10.00	73.1	19.3	7.6	35.75	29.57	11.27	4.00	58.0	47.50	5.0	92.25	65½	2,510
3	6	(No entries)	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Common-wealth	7	Comeback ...	5.00	74.3	19.8	5.9	38.75	39.16	14.42	4.75	57.0	46.25	5.0	94.75	66½	2,538

* Approximate rainfall during the period of growth of wheat.

Prizes:—Class 1.—1st, P. E. Jones, Trayning.
 " 2.—1st, J. F. Lewis, Konongorong.
 " 3.—1st, J. B. Taylor, Kulyaling.
 " 4.—1st and Champion, H. W. Downer, Perenjori.
 " 5.—1st, F. Stuart, Barberton.
 " 7.—1st, H. W. Downer Perenjori.

Wheat Investigations for the Agricultural Department.—Amongst the samples submitted for investigation there were 25 varieties grown at the Merredin State Farm during the season of 1922 and milled by Mr. Lapsley, who reports on them as follows:—

“The milling results of these wheats, and particularly those of the trial and stud plots, give very important information in connection with the judgment, classification, and valuation of the varieties under test, the figures of which are on record in the Agricultural Department.”

A number of flour investigations were made by Mr. Lapsley, who reports as follows:—

“Samples of commercial flour were forwarded during the year by the Agricultural Department in order to obtain the necessary data to fix a standard for Western Australian flour. In all 16 flours were received, and these were examined for (1) water absorption figure; (2) colour; (3) gluten per cent., wet and dry; (4) fineness. The average result of the ordinary commercial grades of flour is as follows:—

Water absorption figure	..	46.5 quarts per 200lb. sack of flour.
Moisture	..	10.13
Colour	..	Very good.
Gluten, % wet	..	28.5
„ % dry	..	10.6

Fineness passing No. 9 silk sieve	100 %
„ „ No. 10	99.3%
„ „ No. 11	94.9%
„ „ No. 12	91.1%

The question of correlating the water absorption figures with the yield in pounds of bread per ton of flour in a commercial bakery, and also with the Eastern States' methods of estimation of it, has received much attention during the year. The introduction of the standard model dough mixer, originating in the Victorian Agricultural Laboratory, for estimating water absorption, has enabled consistent and concordant results to be obtained with the Eastern States.

Investigations were commenced in the early part of the year to establish as nearly as possible the relationship of the water absorption figure (and from this the calculated number of loaves per ton of flour) to the commercial output of bread per ton of flour of the average commercial bakery, and from which samples of flour were obtained during the course of baking operations.

Owing to the dough mixer method of estimating strength not being adopted until July, 1923, and the older method being subject to serious and appreciable errors, no finality has yet been reached in the matter of correlating the laboratory figures with commercial results.

DIVISION VIII.

REPORT OF THE CHIEF INSPECTOR OF EXPLOSIVES FOR THE YEAR 1923

The Under Secretary for Mines.

I have the honour to submit, for the information of the Honourable Minister for Mines, a report on the work of the Department for the year 1923.

The quantity of explosives imported into the State is a substantial increase over the previous year, and Table No. 1 hereunder gives the kinds and quantities imported during the year.

Table No. 2 shows a comparison of the quantities of explosives imported during the past five years.

TABLE I.
Importation of Explosives into Western Australia during 1923.

	Quantity. lbs.	Value. £
Gelignite	997,000	
Gelatine Dynamite	165,000	
Blasting Gelatine	30,000	
Permitted Explosives	2,500	
Blasting Powder	55,000	
Pellet Powder	125,000	
Fireworks ... ..	...	449
Explosives, N.E.L. ... ..	...	6,286
Fuse (coils)	368,640	
Detonators (number)	1,550,000	

TABLE II.

Comparison of Explosives Imported into Western Australia during the past five years:

	1919.	1920.	1921.	1922.	1923.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	950,000	2,035,300	375,325	520,000	997,000
Gelatine Dynamite	180,000	149,050	75,000	110,200	165,000
Blasting Gelatine	64,000	67,950	25,100	60,850	30,000
Permitted Explosives ... ..	...	...	...	65,000	2,500
Powder, Blasting	40,025	172,500	25,000	95,000	180,000
Powder, Sporting ... ..	...	10,675	...	700	...
	£	£	£	£	£
Fireworks (Value)	349	1,144	1,185	923	449
Explosives, N.E.L. (Value)	543	4,449	3,900	2,778	6,286
	coils	coils	coils	coils	coils
Fuse (Coils)	54,000	121,003	4,500	213,600	368,640
	No.	No.	No.	No.	No.
Detonators (Number) ... ..	...	...	...	1,150,000	1,550,000

All shipments have arrived in good condition, and the difficulties presented by sending out large consignments at a time have disappeared; but there is one point with regard to shipments that I am taking up with the Home authorities, and that is: In quite a number of cases the explosives are carried in the No. 2 hold of the ship, which necessitates the lighters into which the explosives are transferred in Gage Roads (an open roadstead) lying right up to the bow of the steamer, which in winter, especially, makes the work more difficult, and at times may cause delay through spray breaking over the lighter. If the explosives were carried in one of the after holds, the steamer itself would afford a greater measure of protection to the lighter during the discharge.

During the year the following licenses have been issued under the provisions of the Explosives Act for the storage of explosives:—

TABLE III.

Licenses issued during 1923.

For magazines situated on Government Explosives Reserves	61
For magazines erected on private property	43
For magazines used by Government Departments, including Group Settlements	55

The total storage capacity of these magazines is 620 tons of explosives.

TABLE III.—continued.

Store licenses for the sale of explosives:—	
Mode A	90
Mode B	6
Licenses for the sale of Fireworks only	256
Importation licenses	3
Licenses for the manufacture of Class II., Chlorate mixtures	2

Quite a number of the magazines on the Explosives Reserves are licensed only for the minimum of one ton, and are not being used for the storage of explosives. The reason for this will be explained later in this report, as it has an important bearing on the efficient inspection and control of explosives.

The following table is of interest as it shows the distribution and consumption of explosives in the different classes of industry:—

TABLE IV.

Distribution and Consumption of Explosives.

	lbs.*	Percentage of Total.
Gold Mining	733,900	53·8
Agriculture and land clearing	487,950	35·7
Government Departments including Railways, Public Works and Water Supplies	41,750	3·1
Quarrying	41,200	3·0
Lead Mining	27,550	2·0
Coal Mining	25,990	1·9
Copper Mining	4,750	·3
Tin Mining	950	·1

*Figures for Nitro Compounds only.

Reserves for explosives magazines number 51, with a total area of 3,056 acres.

At Beadon, about 12 miles north of Onslow, the Government are building a new jetty to serve the Ashburton district, and it is proposed to move the business premises at present situated at Onslow to a site near the new jetty, and while there I selected a site suitable for a reserve for explosives, and this has now been surveyed. The magazine at present on the reserve at Onslow will be removed to the new site.

Whenever possible all magazines and licensed premises have been inspected and the stocks examined at least once during the year. In this connection the following places were visited: Perth and Fremantle, including the whole of the Metropolitan Area, Northam, Westonia, Southern Cross, Coolgardie, Norse-

man, Kalgoorlie, Menzies, Kookynie, Laverton, Leonora, Moora, Geraldton, Northampton, Yalgoo, Magnet, Sandstone, Youanmi, Cue, Day Dawn, Nannine, Meekatharra, Carnarvon, Onslow, Port Hedland, Marble Bar, Derby, Wyndham, Mundijong, Harvey, Bunbury, Busselton, Flinders Bay, Capel, Donnybrook, Greenbushes, Bridgetown, Manjimup, Mount Barker, Wyalcatchem, Darkan, Broomehill, Narrogin, Wickepin, Katanning, Wagin, Albany and Gnowangerup.

One hundred and eighty-four inspections were made of licensed premises, and 30 inspections of ships carrying explosives.

As a result of these inspections it was found necessary to take proceedings for breaches of the Explosives Act as under:—

TABLE V.

Date.	Place.	Offence.	Penalty.
16-7-23	Wyalcatchem	Storing explosives in an unauthorised place	Fined £2. (Costs £3 11s. 10d.)
5-12-23	Southern Cross	Storing explosives in excess of the quantity allowed by license	Fined £4. (Costs 3s.)

A number of notices were served on the owners of licensed premises to remedy defects in connection with their premises, and the following explosives were destroyed as being unfit for consumption:—

TABLE VI.

Destruction of Explosives during 1923.

Date.	Place.	Kind and Quantity.	Remarks.
17-1-23	Fremantle	150lbs. Gelnignite	Owing to exudation.
17-1-23	Do.	50lbs. Blasting Gelnignite	do.
23-1-23	Kalgoorlie	250lbs. Gelnignite	do.
23-1-23	Do.	85lbs. Gelnignite	Chemical deterioration.
9-3-23	Yalgoo	51lbs. Gelnignite	do.
20-3-23	Geraldton	15lbs. Viking Powder	Absorption of moisture.
20-3-23	Do.	1lb. Gelnignite	Chemical deterioration.
13-4-23	Byford	20 detonators	Owing to tubes being corroded and fulminate in damp condition.
9-6-23	Naretha	41,250lbs. Gelnignite	Owing to chemical decomposition and absorption of moisture.
9-6-23	Do.	5,650lbs. Gelnignite	Exudation.
9-6-23	Do.	25lbs. Lig. Dynamite	Owing to absorption of moisture.
9-6-23	Do.	50 detonators	Owing to having been damaged by moisture.
9-6-23	Do.	72 coils of Fuse	Owing to having been damaged by rough handling.
29-6-23	Carnarvon	15lbs. Gelatine Dynamite	Chemical deterioration.
29-6-23	Do.	100 detonators	Owing to having absorbed moisture.
7-8-23	Wyndham	675lbs. Gelnignite	Owing to exudation and chemical deterioration.
25-8-23	Youanmi	475lbs. Sabulite	Owing to having absorbed moisture.
25-8-23	Do.	30lbs. Blasting Gelatine	Owing to exudation.
7-9-23	Moora	5lbs. Gelnignite	Owing to having absorbed moisture.
18-10-23	Cue	1lb. Gelnignite	Chemical deterioration.
9-11-23	Fremantle	25lbs. Gelnignite	Owing to exudation.
9-11-23	Do.	40lbs. Gelnignite	do.
26-11-23	Do.	35lbs. Monobel Powder	Owing to having absorbed moisture.
29-11-23	Byford	½lb. Gelnignite... ..	Chemical deterioration.
12-12-23	Menzies	15lbs. Gelnignite	do.

A further special visit was paid to Naretha on the Trans-Australian Railway for the purpose of examining stocks of explosives stored there in connection with the railway construction. There were found to be 938 cases of gelnignite and 596 cases of lig dynamite. The examination of these stocks occupied four

days, with the result that all the gelnignite was found to be unfit for consumption owing to exudation of free nitro-glycerine and the absorption of moisture, and was accordingly destroyed by burning, this operation taking six days. The lig dynamite was found to be still in good physical condition, and was

replaced in the magazines so distributed as to ensure the best conditions of storage.

There were found in one of the magazines 25lbs. of lig dynamite which had been unpacked and left in a canister and this had absorbed moisture rendering it unfit for consumption; also 50 detonators which were wet, and six dozen coils of fuse damaged by careless handling and storage. These were destroyed with the gelignite.

In a magazine on the Youanmi Reserve there were found 12 cases of blasting gelatine showing free exudation of nitro-glycerine. These were sent to Fremantle and treated by removing the excess of nitro-glycerine by dusting and wiping with Keiselguhr. In this magazine there were also found 87 cases of gelignite showing slight signs of exudation. As the consumption of explosives in this district was very small, a recommendation was made to the owner to have the entire stock transferred to Fremantle and put into immediate consumption for the purpose of land clearing. This was done and no trouble was experienced in its use.

A visit of inspection was made during the year to all centres throughout the North-West, and, as a result, it was found necessary to destroy explosives at two of the ports owing to chemical deterioration, and two of the principal magazines were quite unfit for the storage of explosives owing to the corrosion of the iron of the roofs. If these had not been detected and repaired large quantities of explosives might have been rendered dangerous, due to damage from water. This might not have been noticed by the owners, and the explosives sold by them for consumption in mines.

I am fully convinced that this trip, although costly, should be made at least every third year, and, if possible, once every two years.

While in the North-West I extended my trip to Darwin and made inquiries into the handling and storage of explosives in the Northern Territory, and a report has been made to the Commonwealth Government.

One very undesirable feature of the explosives trade in the Territory is the consignment of comparatively large quantities of explosives to Darwin at one time, this being due to the difficulty in obtaining freight for explosives owing to the infrequency of other than passenger ships calling there. Just prior to my visit a consignment of 150 cases of gelignite was landed by a schooner from Fremantle.

The average normal consumption at the present time is 20 cases per annum, so that there is enough explosive, at the present rate of consumption, to last for seven years. At the time of inspection the gelignite was found to be in good physical condition, but all explosives of the nitro compound class deteriorate on keeping and become very inert to detonation, especially in tropical climates, and hence become a source of danger when used underground. Therefore this explosive should be examined every two years at least.

Some years ago arrangements were made to carry limited quantities of explosives on the s.s. "Bambra" in approved portable magazines, under special permits from the inspector, to the most northern ports of Western Australia, where there was difficulty in obtaining small cargo ships to carry them. There is no reason why this arrangement should not be ex-

tended to Darwin, provided approval is given for the boat to go into Darwin by the Commonwealth authorities and the Chief Inspector of Explosives of South Australia, who administers the Act relating to explosives in the Northern Territory, which would assure the supply of explosives in good condition to the consignees in the Northern Territory.

The following table gives the number of tests and analyses made in connection with the control of explosives:—

TABLE VII.

Heat Tests	497
Burning Tests of Fuse	208
Complete Analyses	26*
Velocity of detonation	27
A.D.C. Tests	33
Miscellaneous Tests	15
	<hr/>
	806
	<hr/>

*The complete analyses were made by the Government Analyst on behalf of this department.

Applications were received to have four new explosives placed on the authorised list of explosives to be imported, manufactured, and stored in this State. After a careful analysis and thorough testing three of these explosives were placed on the list, but authorisation of the fourth had to be refused as I was not satisfied as to the chemical stability of the finished explosive.

The alteration to the fence surrounding the reserve at Kalgoorlie mentioned in the report for last year has been completed, and I think in the absence of a resident caretaker it now affords greater protection owing to trespassers being more readily observed by persons passing the reserve.

During the heavy gales in winter several parts of the fence surrounding the Woodman's Point Reserve were blown down. The damage was repaired at once and the fence made good, but on a careful examination being made it was found that quite a number of the posts and rails were showing signs of weakness. Timber was obtained and the magazine-keeper and staff put in struts wherever it was considered necessary; but I am afraid a lot more timber will be required in the near future in order to strengthen this fence so as to keep it up against the heavy winds experienced on the coast.

As already mentioned, a great number of magazine-situated on explosives reserves throughout the gold-fields are not used for the storage of explosives. This is accounted for by the fact that about three years ago the merchants adopted a different method in the transaction of their business, and instead of carrying stocks in magazines at all the principal centres of gold mining, and making deliveries to the mines as required, they sell f.o.r. Fremantle, and deliveries are made direct from the Explosives Reserve at Woodman's Point to the consumer. This makes the work of inspection and control of explosives very much more difficult, and will necessitate a great deal more travelling, as I consider it absolutely necessary that explosives should be kept under observation after they leave the magazines at Fremantle, and to do this will mean the inspection of stocks in mines and other places where explosives are used. This does not apply to Kalgoorlie, where the old method of delivery is still in vogue, and stocks are inspected regularly

at the magazines on the reserve, from which deliveries are made once or twice a week as required to the mines at that centre.

It will be necessary to go into the question of the most expeditious and cheapest method of doing this increased travelling, as all mines outside Kalgoorlie will have to be regularly visited and the stocks of explosives examined, as explosives stored under conditions as generally found on mines must be more subject to deterioration than if they were stored in magazines specially constructed for the purpose.

This extra travelling will mean increased expenditure, but it is looked upon as absolutely essential in order to assure that explosives being used are in good condition and safe for use underground.

The revenue of the department has fallen from £2,421 in 1920 to £1,627 for the year under review, the principal cause for this drop being brought about by the adoption of the new methods of distributing the explosives mentioned above, which enabled the

merchants to reduce the rents paid on leases for sites on Government explosives reserves on which magazines are erected.

The question of handling and storing inflammable liquids was inquired into during the year, and a report submitted in which it was recommended that the handling and storage of inflammable liquids should be subject to Legislative control, and from further observations I am more firmly convinced that, in the interests of public safety, a Bill should be prepared without delay for the proper control of this trade, and I strongly recommend that early action be taken,

I have to acknowledge and thank the Commissioner of Police and his officers for the valuable assistance they have rendered the department during the year.

The new arrangement brought about by the re-organisation of the department has worked efficiently and economically, and Mr. Maslin and the Magazine Keeper and staff have given loyal services and helped me a great deal in carrying on the work of the department.

T. N. KIRTON,
Chief Inspector of Explosives.

28th February. 1924

WESTERN



AUSTRALIA.

DEPARTMENT OF MINES.

MINING STATISTICS,

1923.

MINING STATISTICS TO 31st DECEMBER, 1923.

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4. Ashburton Goldfield	17	
5. Gascoyne Goldfield	17	
6. Peak Hill Goldfield	18	
7. East Murchison Goldfield	19	
8. Murchison Goldfield	24	
9. Yalgoo Goldfield	29	
10. Mount Margaret Goldfield	31	
11. North Coolgardie Goldfield	35	
12. Broad Arrow Goldfield	39	
13. North-East Coolgardie Goldfield	40	
14. East Coolgardie Goldfield	42	
15. Coolgardie Goldfield	47	
16. Yilgarn Goldfield	51	
17. Dundas Goldfield	53	
18. Phillips River Goldfield	54	
19. Donnybrook Goldfield	55	
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EXPLANATIONS OF SIGNS AND ABBREVIATIONS.

Gf. Goldfield.	M.C. Mineral Claim.
Mf. Mineral field.	M.E.C. Mineral Reward Claim.
D. District.	M.A. Machinery Area.
G.M.L. Gold Mining Lease.	Mach. L. Machinery Lease.
M.L. Mineral Lease.	•P.A. Prospecting Area.
Loc. Location.	T.A. Tailings Area.
L.C. Lode Claim.	T.L. Tailings Lease.
Q.C. Quartz Claim.	W.R. Water Right.
R.C. Reward Claim.	S.L. Special License.
	N.E.I. Not elsewhere included.

WESTERN AUSTRALIA.

SUMMARY OF MINERAL PRODUCTION.

GOLD AND OTHER MINERALS PRODUCED DURING 1923, AND THE ESTIMATED VALUE THEREOF, TOGETHER WITH A COMPARISON FOR PREVIOUS YEARS, AND THE TOTAL PRODUCTION TO DATE.

DESCRIPTION OF MINERAL	1923.		1922.		1921.		1920.		Previously to 1920.		Total to date.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1. Antimony (Exported) statute tons	...	£ ...	...	£ ...	...	£ ...	2½	£ 45	86	£ 1,698	89	£ 1,743
2. Arsenical Ore (Exported) do.	*	686	1,075	1,784	7	16	1,765	4,260	747	3,290	...	10,036
3. Asbestos (Reported) do.	115	4,032	181	7,600	235	13,581	157	7,286	96	3,197	784	35,696
4. Bismuth (Exported) do.	...	...	...	...	...	...	...	...	11	844	11	844
5. Coal (Reported) do.	420,714	368,949	438,443	381,555	468,817	407,117	462,021	350,346	4,609,659	2,323,911	6,399,654	3,831,878
6. Copper { Ore (Exported) do.	3,394	48,907	352	5,519	1,040	16,153	1,511	22,467	69,831	835,097	76,128	928,143
{ Ingot and Matte (Exported) do.	1,057	16,193	660	14,860	206	8,448	137	2,698	11,354	775,780	13,414	817,979
7. Gadolinite (Reported) do.	...	...	...	...	...	...	...	...	1	112	1	112
8. Gold (Exported and Minted) fine ounces	504,511	2,143,028	538,246	2,286,325	553,731	2,352,098	617,842	2,624,427	33,130,549	140,729,627	35,344,879	150,135,605
9. Graphite (Exported) statute tons	...	...	*	3	...	...	13	130	52	563	65	696
10. Gypsum (Reported) do.	...	...	63	16	665	622	...	...	...	...	728	638
11. Ironstone (Reported) do.	...	...	...	...	...	...	...	...	57,830	36,695	57,830	36,695
12. Lead (Ore and Concentrates) (Exported) do.	...	...	...	...	...	...	...	...	44,032	508,748	44,032	508,748
13. Lead and Silver Lead (Ore and Concentrates) (Exported) do.	3,172	43,416	...	...	...	...	3,427	84,743	4,803	66,478	11,402	194,637
14. Lead (Pig) (Exported) do.	20	609	2,796	69,528	2,156	48,863	1,930	69,136	16,150	440,820	23,052	628,956
15. Limestone (Reported) do.	...	...	...	...	...	...	...	...	93,706	18,290	93,706	18,290
16. Magnesite (Exported) do.	2	8	...	...	...	...	...	...	804	1,518	806	1,526
17. Manganese (Exported) do.	22	200	...	...	16	145	...	...	2	7	40	352
18. Mica (Exported) do.	...	...	2	60	...	...	*	120	*	1,177	...	1,357
19. Molybdenite (Exported) do.	...	...	51	505	...	...	½	5	26	355	78	865
20. Pyritic Ore (Reported) do.	...	...	3,441	4,203	6,117	7,871	6,020	7,276	58,470	26,146	74,048	45,496
21. Silver (Exported) fine ounces	109,005	16,036	118,696	18,164	116,151	18,658	130,692	36,605	3,758,704	496,812	4,233,248	586,275
22. Tantalite (Exported) statute tons	5	688	...	...	...	...	...	...	*	18,092	...	18,780
23. Tin Ore (Exported) do.	131	15,095	110	10,930	67	6,485	243	49,449	15,014	1,428,107	15,565	1,510,066
24. Tungsten Ore { Scheelite (Exported) do.	...	...	...	...	...	...	2½	395	18½	2,112	21	2,507
{ Wolfram (Exported) do.	...	...	...	...	...	...	...	...	15	1,441	15	1,441
25. Zinc (Exported) do.	...	...	...	...	...	...	...	...	184	5,437	184	5,437
Unenumerated (Exported) ... ..	...	103	...	574	...	112	...	23	...	6,279	...	7,091
TOTAL VALUES ... ..	...	2,657,950	...	2,801,626	...	2,880,169	...	3,259,411	...	147,732,633	...	159,331,789

* Weight not stated.

The value of gold is calculated at the fixed price of £4.24773 per fine oz. Sales of gold by the Gold Producers' Association averaged £5.825 per fine oz. for the year 1920, £5.314 for the year 1921, £4.693 for the year 1922 and £4.4244 for the year 1923. The amounts of £974,504, £590,428, £239,487 and £89,158, should, therefore, be added to those years respectively, to make up the actual value of such gold.

AUSTRALASIAN MINERAL PRODUCTION.

COMPARATIVE TABLE SHOWING THE OUTPUT OF ALL MINERAL PRODUCTS FROM THE SEVERAL STATES OF AUSTRALIA AND THE DOMINION OF NEW ZEALAND DURING 1923.

DESCRIPTION OF MINERAL.	Western Australia.		NEW SOUTH WALES.		QUEENSLAND.		VICTORIA.		TASMANIA.		SOUTH AUSTRALIA.		NEW ZEALAND.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		£		£		£		£		£		£		£
Alumite Statute tons	...	...	998	3,992	...	...	...	...	...	...	...	...	...	...
Antimony (Metal and Ore)	...	...	...	...	...	...	822	14,112	...	...	...	...	...	...
Arsenical Ore ... do.	*	686	11,493	28,178	610	27,730	...	...	...	...	...	...	...	...
Asbestos do.	115	4,032	204	4,267	...	...	...	...	...	...	7	161	...	...
Bismuth (Metal and Ore)	...	...	6	1,640	...	100	...	...	...	...	...	...	...	...
Coal do.	420,714	368,949	10,478,513	8,607,892	1,060,662	925,227	593,711	563,289	80,718	70,797	...	...	1,939,834	1,969,834
Copper (Ingot and Matte)	1,057	16,193	1,261	82,375	6,242	430,746	...	...	6,065	435,413	3,523	232,172	...	...
Copper Ore do.	3,394	48,907	...	...	...	...	...	...	...	...	...	...	...	...
Gold Fine ounces	504,511	2,143,028	18,833	79,998	88,726	376,883	95,403	405,246	3,684	15,649	949	4,031	155,404	660,113
Gypsum Statute tons	...	...	...	...	...	...	12,761	10,176	...	...	53,405	46,729	...	...
Iron do.	...	...	94,350	707,625	...	...	...	...	...	...	...	...	...	...
Iron Oxide do.	...	...	2,716	3,081	...	...	...	...	...	...	...	...	...	...
Ironstone do.	...	...	...	...	200	150	...	...	...	...	384,434	445,303	...	...
Lead and Silver Lead	3,192	44,025	241,761	2,941,401	5,486	147,233	...	...	4,784	127,542	2	54	...	...
Limestone do.	...	...	40,689	92,387	95,158	35,741	...	...	100,113	122,428	94,020	38,579	...	...
Magnesite do.	2	8	6,130	5,699	...	...	75	225	...	...	165	323	...	...
Manganese Ore ... do.	22	200	2,556	7,748	74	332	...	...	...	...	168	1,581	...	...
Molybdenite do.	...	...	9	1,816	10	2,069	50	6,250	...	...	...	...	...	...
Osmiridium Ounces	...	...	...	...	...	...	...	...	673	19,642	...	...	...	...
Phosphate Rock ... Statute tons	...	...	...	...	...	...	480	713	...	...	446	592	...	...
Platinum Fine ounces	...	...	586	10,204	...	...	...	...	...	...	...	...	...	...
Precious Stones ... ..	...	...	...	3,040	...	23,809	...	...	...	...	...	...	...	...
Tungsten } Scheelite Statute tons	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ores } Wolfram do.	...	...	2	64	...	...	...	...	97	6,150	...	...	5	218.
Shale (Oil) do.	...	...	1,207	2,831	...	...	...	...	1,101	1,094	...	...	...	...
Silver Fine ounces	109,005	16,036	107,682	15,461	469,302	69,412	6,304	963	638,602	91,339	43	6	536,686	77,057
Tin (Ore and Ingot) ... Statute tons	131	15,095	896	180,789	903	114,945	77	10,371	1,160	236,955	...	...	...	...
Zinc (Spelter and Conc.) do.	...	...	426,049	1,411,652	...	...	...	...	...	...	...	...	...	...
Other ... ..	...	791	...	2,099,276	...	46,355	...	3,019	...	91,457	...	125,571	...	381,024
Total Value ...	...	£2,657,950	...	£16,291,416	...	£2,200,782	...	£1,014,364	...	£1,218,466	...	£895,102	...	£3,088,246

* Weight not stated.

PART I.—GOLD.

TABLE I.

MONTHLY PRODUCTION OF GOLD, IN FINE OUNCES, SHOWING THE QUANTITY REPORTED TO THE MINES DEPARTMENT DURING 1923.

GOLDFIELD.	DISTRICT.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		JULY.	
		District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.
Kimberley	...	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.
Pilbara	Marble Bar	...	2·97	...	...	...	...	...	7·78	...	5·27	...	14·53	...	...
Do.	Nullagine	18·55	18·55	16·48	16·48	217·00	278·20	209·42	231·41	58·46	80·73	23·28	29·02	9·44	9·44
West Pilbara	...	...	1·72	...	...	...	12·97	...	·59	...	39·22	...	·64	...	·70
Ashburton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gascoyne	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill	...	...	136·93	...	193·28	...	23·38	...	...	...	...	...	16·72	...	368·76
East Murchison	Lawlers	447·83	...	374·75	...	306·76	...	394·56	...	490·89	...	482·64	...	326·49	...
Do.	Wiluna	274·45	1,015·53	541·83	922·40	700·32	1,303·02	235·77	975·72	619·70	1,185·35	235·96	851·38	213·12	539·61
Do.	Black Range	293·25	...	5·82	...	295·94	...	345·39	...	74·76	...	132·78	...	...	...
Murchison	Cue	298·26	...	104·71	...	171·85	...	478·04	...	324·45	...	320·84	...	214·46	...
Do.	Meekatharra	1,602·77	2,006·68	1,547·62	1,723·03	1,439·04	1,856·95	2,215·19	2,844·94	2,101·52	2,513·23	1,472·06	2,025·18	1,654·63	2,216·17
Do.	Day Dawn	23·27	...	...	...	207·89	...	52·41	...	36·82	...	...	...	30·98	...
Do.	Mt. Magnet	82·38	...	70·70	...	38·17	...	99·30	...	50·44	...	232·28	...	316·10	...
Yalgoo	...	...	625·46	...	124·59	...	754·12	...	15·18	...	1,168·65	...	346·91	...	645·55
Mt. Margaret	Mt. Morgans	309·75	...	440·16	...	585·24	...	331·35	...	337·48	...	604·66	...	756·55	...
Do.	Mt. Malcolm	998·22	1,470·90	1,112·16	1,571·44	1,360·96	1,980·15	1,833·23	2,357·97	1,670·98	2,008·46	1,341·41	1,974·38	1,373·41	2,216·33
Do.	Mt. Margaret	162·93	...	19·12	...	33·95	...	193·39	...	...	...	28·31	...	86·37	...
North Coolgardie	Menzies	580·59	...	838·60	...	857·64	...	898·72	...	1,222·24	...	1,104·54	...	933·01	...
Do.	Ularring	30·08	610·67	...	838·60	94·16	974·68	...	1,117·41	64·50	1,295·06	...	1,104·54	...	933·01
Do.	Niagara	...	...	...	...	...	...	...	...	8·32	...	...	...	...	...
Do.	Yerilla	...	...	...	...	22·88	...	218·69	...	...	...	...	...	...	...
Broad Arrow	...	...	315·15	...	...	...	363·41	...	97·87	...	43·56	...	32·40	...	265·06
N.E. Coolgardie	Kanowna	107·92	108·96	68·51	68·51	678·70	689·55	295·11	295·11	404·12	415·16	559·07	587·21	392·67	392·67
Do.	Kurnalpi	1·04	...	...	...	10·85	...	...	...	11·04	...	28·14	...	...	...
East Coolgardie	East Coolgardie	28,615·14	28,615·14	27,148·49	27,211·07	32,666·13	32,786·07	27,688·42	27,745·45	30,231·02	30,231·02	30,319·66	30,345·34	36,112·82	36,112·82
Do.	Bulong	...	...	62·58	...	119·94	...	57·03	...	...	...	25·68	...	...	...
Coolgardie	Coolgardie	1,104·87	1,263·79	473·28	645·92	808·95	808·95	394·51	563·47	876·19	1,255·64	1,596·34	1,596·34	1,435·81	2,663·48
Do.	Kunanalling	158·92	...	172·64	...	...	...	168·96	...	379·45	...	...	...	1,227·67	...
Yilgarn	...	...	553·50	...	587·41	...	550·99	...	543·68	...	1,013·83	...	711·15	...	874·42
Dundas	...	...	982·32	...	254·00	...	237·81	...	1,151·07	...	552·72	...	314·40	...	606·93
Phillips River	...	...	...	...	...	...	87·46	...	47·43	...	116·60	...	12·05	...	11·07
State generally	...	...	44·87	...	...	...	...	...	...	...	4·24	...	...	...	...
TOTAL	Fine Ounces ...	...	37,773·14	...	34,156·73	...	42,707·71	...	37,995·08	...	41,928·74	...	39,962·19	...	47,856·02
	Sterling Value	£160,450		£145,089		£181,411		£161,393		£178,102		£169,749		£203,279	

TABLE I.—Monthly Production of Gold in Fine Ounces—continued.

GOLDFIELD.	DISTRICT.	AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		Total for 1923.	
		District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.
Kimberley ...	...	...	...	...	...	...	...	...	...	...	...	...	30·55
Pilbara ...	Marble Bar	253·84	253·84	336·44	347·64	751·20	756·38	298·49	298·49	223·44	223·44	2,388·05	2,543·62
Do. ...	Nullagine	...		11·20		...		5·18		
West Pilbara ...	...	...	1·65	...	5·16	...	76	...	...	...	81	...	64·22
Ashburton ...	...	...	...	...	...	...	...	...	...	...	9·24	...	9·24
Gascoyne ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill ...	...	...	352·37	...	103·48	...	182·47	...	246·94	...	75·49	...	1,699·82
East Murchison ...	Lawlers	385·54	603·47	257·84	833·36	480·16	1,286·58	222·68	1,354·69	132·80	145·30	4,302·94	11,016·41
Do. ...	Wiluna		197·48		...		678·48	
Do. ...	Black Range	217·93	...	575·52	...	608·94	...	453·53	...	12·50	...	3,016·36	...
Murchison ...	Cue	411·76	...	318·13	...	624·39	...	278·73	...	609·47	...	4,155·09	...
Do. ...	Meekatharra	1,720·34	2,377·55	1,679·04	2,068·37	1,476·86	2,237·63	1,568·84	2,194·55	1,878·00	2,973·25	20,355·91	27,037·53
Do. ...	Day Dawn	199·08		12·29		2,068·37		6·65		2,237·63		25·79		2,194·55	255·61	2,973·25	860·79
Do. ...	Mt. Magnet	46·37	...	58·91	...	129·73	...	321·19	...	230·17	...	1,675·74	...
Yalgoo ...	...	...	1,239·25	...	988·48	...	526·10	...	654·67	...	624·49	...	7,713·45
Mt. Margaret ...	Mt. Morgans	437·79	2,241·21	604·43	2,242·03	463·74	2,208·65	633·46	3,946·63	51·77	2,658·27	5,556·38	26,876·42
Do. ...	Mt. Malcolm	1,730·46		1,542·39		2,242·03		1,722·20		3,009·22		3,946·63		2,606·50	2,658·27	20,301·14
Do. ...	Mt. Margaret	72·96	...	95·21	...	22·71	...	303·95	...	...	...	1,018·90	...
North Coolgardie ...	Menzies	1,085·97	1,085·97	1,021·10	1,346·42	951·60	975·75	838·30	875·92	946·29	1,054·90	11,278·60	12,212·93
Do. ...	Ularring		24·15		
Do. ...	Niagara	...	...	120·88	...	...	...	37·62	...	102·32	...	269·14	...
Do. ...	Yerilla	...	...	204·44	...	...	...	...	...	...	...	446·01	...
Broad Arrow ...	...	...	439·51	...	62·07	...	537·04	...	423·65	...	161·26	...	2,740·98
N.E. Coolgardie ...	Kanowna	112·26	133·93	696·12	703·14	89·49	118·28	1,188·93	1,201·99	...	...	4,592·90	4,714·51
Do. ...	Kurnalpi	21·67		...		7·02		...		28·79		...	
East Coolgardie ...	East Coolgardie	34,201·56	34,373·22	37,618·70	37,689·27	23,501·86	23,620·33	35,965·17	36,043·22	25,790·87	25,896·91	369,859·84	370,669·86
Do. ...	Bulong	171·66		...		70·57		...		118·47		...	
Coolgardie ...	Coolgardie	880·28	990·35	752·92	752·92	731·93	1,026·00	407·34	464·59	467·39	1,045·36	9,929·81	13,076·81
Do. ...	Kunanalling	110·07			294·07		...	
Yilgarn ...	...	...	797·71	...	1,018·34	...	534·13	...	595·06	...	595·75	...	8,375·97
Dundas ...	...	...	229·85	...	821·05	...	205·20	...	299·29	...	703·21	...	6,357·85
Phillips River ...	...	...	51·92	...	31·25	...	3·58	...	2·49	...	10·73	...	374·58
State generally ...	...	...	...	...	...	...	...	...	...	...	108·63	...	157·74
TOTAL	Fine ounces	...	45,171·88	...	49,042·98	...	34,218·88	...	48,602·18	...	36,287·04	...	495,672·49
	Sterling value	...	£191,878	...	£208,194	...	£145,352	...	£206,449	...	£154,137	...	£2,105,483

The total gold yield of the State is as shown at page 5, being the amount of gold exported and also that lodged at the Royal Mint, which total includes alluvial and other gold not reported to the Department

1923

TABLE II.

TOTAL YEARLY PRODUCTION OF GOLD, IN FINE OUNCES, AS REPORTED TO THE MINES DEPARTMENT, TO 31ST DECEMBER, 1923.

GOLDFIELD.	DISTRICT.	1923.		1922.		1921.		1920.		1919.		1918.	
		District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.
		ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.	ozs.
Kimberley ...	...	...	30·55	...	5·01	...	49·35	...	...	...	150·73	...	15·08
Pilbara ...	Marble Bar ...	2,388·05	2,543·62	2,779·45	3,100·16	2,556·95	2,626·57	3,164·15	4,052·49	2,960·51	3,421·39	2,991·73	3,748·40
Do. ...	Nullagine ...	155·57		320·71		69·62		888·34		460·88		756·67	
West Pilbara ...	...	...	64·22	...	94·33	...	67·10	...	133·91	...	95·26	...	120·37
Ashburton ...	...	...	9·24	...	13·57	...	22·31	...	...	...	...	...	...
Gascoyne ...	...	...	...	...	1·52	...	7·46	...	...	...	...	...	...
Peak Hill ...	...	...	1,699·82	...	2,159·89	...	1,078·53	...	1,655·71	...	2,255·38	...	1,089·31
East Murchison ...	Lawlers ...	4,302·94	11,016·41	4,650·83	13,050·62	3,008·81	18,762·26	2,693·15	19,600·25	4,951·82	27,413·39	4,115·55	29,210·72
Do. ...	Wiluna ...	3,697·11		5,385·30		4,092·30		5,478·99		7,035·72		7,909·60	
Do. ...	Black Range ...	3,016·36	3,014·49	11,661·15	11,428·11	15,426·35	17,185·57						
Murchison ...	Cue ...	4,155·09	4,840·68	7,186·83	9,642·63	9,020·49	10,183·75						
Do. ...	Meekatharra ...	20,355·91	27,037·53	26,953·23	36,304·33	30,046·77	41,256·53	28,163·45	46,604·07	35,436·80	50,569·85	44,119·86	63,285·43
Do. ...	Day Dawn ...	850·79	1,114·58	1,114·58	726·80	726·80	4,671·54	4,671·54	2,383·58	2,383·58	4,176·63	4,176·63	
Do. ...	Mt. Magnet ...	1,675·74	3,395·84	3,296·13	3,296·13	4,126·45	4,126·45	4,126·45	3,728·98	3,728·98	4,804·99	4,804·99	
Yalgoo ...	...	...	7,713·45	...	18,132·49	...	3,579·20	...	2,965·43	...	4,788·38	...	4,397·89
Mt. Margaret ...	Mt. Morgans ...	5,556·38	26,876·42	7,768·38	27,649·19	7,612·89	20,803·51	5,560·87	77,335·84	5,302·34	88,151·93	5,294·03	85,346·97
Do. ...	Mt. Malcolm ...	20,301·14		16,811·82		8,364·49		12,800·83		49,506·74		46,368·64	
Do. ...	Mt. Margaret ...	1,018·90	3,068·99	4,826·13	4,826·13	28,974·14	33,342·85	33,342·85	30,859·22	30,859·22	33,684·30	33,684·30	
North Coolgardie ...	Menzies ...	11,278·60	11,650·21	8,034·25	11,468·50	11,468·50	20,859·22	20,859·22	931·66	931·66	23,019·41	23,019·41	
Do. ...	Ularring ...	219·18	1,401·44	1,605·06	1,605·06	57·53	10,640·08	57·53	12,024·18	931·66	23,019·41	4,791·82	36,829·91
Do. ...	Niagara ...	269·14	197·17	345·17	345·17	223·26	10,640·08	223·26	12,024·18	746·51	23,019·41	1,203·81	1,203·81
Do. ...	Yerilla ...	446·01	375·32	655·60	655·60	274·89	10,640·08	274·89	12,024·18	482·02	23,019·41	489·22	489·22
Broad Arrow ...	...	...	2,740·98	...	3,628·56	...	8,875·01	...	7,445·23	...	11,728·57	...	4,125·88
N.E. Coolgardie ...	Kanowna ...	4,592·90	4,714·51	3,882·13	4,545·10	3,378·29	4,147·98	1,248·14	1,738·80	5,250·96	5,472·08	3,439·60	3,700·25
Do. ...	Kurnalpi ...	121·61		662·97		769·69		490·66		221·12		260·65	
East Coolgardie ...	East Coolgardie... 369,859·84	370,669·86	375,757·25	376,388·69	378,344·62	378,429·92	401,417·01	401,417·01	396,995·28	397,054·89	524,729·46	524,823·36	
Do. ...	Bulong ...	810·02	631·44	85·30	85·30	78·90	378,429·92	78·90	401,495·91	59·61	397,054·89	93·90	93·90
Coolgardie ...	Coolgardie ...	9,929·81	13,076·81	9,662·68	16,170·54	4,629·54	9,547·74	3,482·79	5,986·43	4,222·21	5,814·30	5,334·36	7,962·75
Do. ...	Kunanalling ...	3,147·00	6,507·86	4,918·20	4,918·20	9,547·74	9,547·74	2,503·64	5,986·43	1,592·09	5,814·30	2,628·39	2,628·39
Yilgarn ...	...	...	8,375·97	...	12,793·95	...	19,241·50	...	37,636·51	...	54,002·74	...	70,765·88
Dundas ...	...	...	6,357·85	...	8,043·99	...	5,455·77	...	6,541·18	...	12,529·61	...	15,949·44
Phillips River ...	...	...	374·58	...	688·75	...	865·75	...	1,422·76	...	1,700·12	...	4,478·49
*Donnybrook ...	...	...	...	...	...	...	...	...	...	...	...	...	...
State generally ...	...	...	157·74	...	144·45	...	99·85	...	20·67	...	46·41	...	195·43
TOTAL	Fine Ounces ...	...	495,672·49	...	536,539·28	...	525,556·42	...	626,659·37	...	688,214·94	...	856,045·56
	Sterling Value	£2,105,483		£2,279,474		£2,232,422		£2,661,880		£2,923,251		£3,636,256	

* Abolished 4th March, 1908.

TABLE II.—Total Yearly Production of Gold, in Fine Ounces, etc.—continued.

GOLDFIELD.	DISTRICT.	1917.		1916.		1915.		1914.		Previous to 1914.		Total to December 31st, 1923.	
		District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.	District.	Goldfield.
Kimberley	82·25	...	161·91	...	144·34	...	453·29	...	17,012·75	...	18,105·26
Pilbara ...	Marble Bar ...	2,463·66	5,406·75	3,515·58	5,881·60	6,462·36	8,541·97	3,304·94	5,177·46	104,029·32	172,512·42	136,616·70	217,102·83
Do. ...	Nullagine ...	2,943·09		2,366·02		2,079·61		1,872·52		68,483·10		80,396·13	
West Pilbara	304·77	...	608·84	...	1,507·02	...	1,022·70	...	24,023·13	...	28,041·65
Ashburton	6·50	8,876·74	...	8,928·36
Gascoyne	14·48	...	80·85	...	3·76	...	577·45	...	685·52
Peak Hill	1,743·72	...	2,389·29	...	2,813·13	...	2,602·62	...	241,079·13	...	260,576·53
East Murchison ...	Lawlers ...	4,784·50	32,856·56	6,579·41	46,811·44	6,035·13	58,082·36	4,324·57	70,008·46	876,564·50	1,485,269·86	922,031·21	1,812,882·83
Do. ...	Wiluna ...	9,523·65		14,472·13		6,746·78		6,936·34		37,317·44		108,595·36	
Do. ...	Black Range ...	18,548·41	25,759·90	45,280·45	59,547·55	571,387·92	782,256·26						
Murchison ...	Cue ...	9,689·81	6,011·29	6,185·89	4,491·02	321,258·48	392,665·96						
Do. ...	Meekatharra ...	44,269·00	51,322·56	73,834·57	80,400·07	558,552·67	993,454·89						
Do. ...	Day Dawn ...	23,746·93	18,134·71	19,168·14	18,926·64	1,217,986·03	1,311,886·57						
Do. ...	Mt. Magnet ...	4,600·09	8,954·33	8,861·18	11,904·69	354,684·70	410,033·12						
Yalgoo	5,812·74	...	8,194·69	...	8,841·88	...	6,025·92	...	83,513·98	...	153,966·05
Mt. Margaret ...	Mt. Morgans ...	6,314·21	8,439·99	7,463·52	4,880·95	471,578·11	535,771·67						
Do. ...	Mt. Malcolm ...	59,488·04	57,541·13	63,995·64	66,071·07	1,260,216·34	1,691,465·88						
Do. ...	Mt. Margaret ...	36,072·29	34,631·22	35,103·85	25,840·49	597,658·48	834,221·64						
North Coolgardie ...	Menzies ...	30,725·13	36,756·35	49,096·24	53,789·52	755,769·43	1,019,772·51						
Do. ...	Ularring ...	1,090·35	2,989·66	2,474·10	5,026·09	270,650·77	291,237·66						
Do. ...	Niagara ...	1,185·17	1,790·01	3,155·13	6,724·42	486,864·49	502,704·28						
Do. ...	Yerilla ...	1,794·90	3,610·55	4,787·75	6,648·02	180,872·97	200,437·25						
Broad Arrow	16,518·64	...	22,215·92	...	22,290·03	...	9,285·98	...	393,418·52	...	502,273·32
N.E. Coolgardie ...	Kanowna ...	5,912·39	6,392·00	10,077·23	9,560·02	649,375·79	703,109·45						
Do. ...	Kurnalpi ...	20·78	286·02	783·75	574·08	27,085·48	31,276·81						
East Coolgardie ...	East Coolgardie ...	557,874·83	578,183·41	668,913·16	670,788·24	680,494·61	18,861,375·89						
Do. ...	Bulong ...	108·54	1,160·93	1,875·08	2,400·80	155,507·25	162,811·77						
Coolgardie ...	Coolgardie ...	6,980·68	8,768·13	11,990·23	17,009·37	917,949·15	999,958·95						
Do. ...	Kunanalling ...	3,305·00	4,850·19	6,324·54	3,972·08	186,847·47	226,596·46						
Yilgarn	78,244·77	...	87,993·68	...	91,123·57	...	88,744·72	...	490,104·45	...	1,039,027·74
Dundas	18,419·01	...	21,594·78	...	23,884·18	...	26,590·76	...	488,384·93	...	633,751·50
Phillips River	4,734·52	...	5,418·97	...	3,816·76	...	4,665·42	...	60,827·71	...	88,993·83
*Donnybrook	841·76
State generally	111·41	...	618·78	...	272·59	...	144·16	...	6,318·33	...	8,129·82
TOTAL	Fine Ounces	957,419·78	...	1,031,726·86	...	1,195,498·68	...	1,214,239·19	...	25,814,425·19	...	33,941,997·76
	Sterling Value ...	£4,066,361	£4,382,497	£5,078,156	£5,157,760	£109,652,708	£144,176,442						

* Abolished 4th March, 1908.

TABLE III.

GENERAL RETURN.

RETURN SHOWING, FOR THE RESPECTIVE GOLDFIELDS AND DISTRICTS, THE AREA IN SQUARE MILES, LEASES IN FORCE, PARTICULARS OF PLANT, MEN EMPLOYED AND DIGGERS, ALLUVIAL, DOLLIED, AND SPECIMEN GOLD AND ORE TREATED, WITH GOLD AND SILVER YIELD, IN FINE OUNCES, AS REPORTED TO THE MINES DEPARTMENT FOR THE YEAR 1923.

Goldfield.	District.	Date of Proclamation of Goldfield.				Area in Square Miles.		Leases in force, 31-12-1923.		Particulars of Plant.					Average Number of Men engaged in Gold Mining.			
		Proclamation gazetted.	To take effect from.	Latest Amendment of Boundaries gazetted.	To take effect from.	Goldfield.	District.	No.	Area in Acres.	Milling.		Cyaniding.			Men employed.		Diggers.	
										Stamps	Other Mills.	Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.	Above Ground.	Under Ground.		
Kimberley	20-5-86	20-5-86	31-10-02	1-11-02	33,833	5
West Kimberley	19-3-20	1-3-20	98,600
Pilbara ...	{ Marble Bar ... Nullagine ... }	1-10-88	1-10-88	1-3-07	1-3-07	32,696	{ 25,809 6,887	29 3	403 36	50 25	3 2	10 16	...	...	37 19	45 3	16 28
West Pilbara ...	...	20-9-95	1-11-95	1-3-07	1-3-07	10,843	...	1	6	20	1	...	...	1	1	1	1
Ashburton ...	...	11-12-90	11-12-90	18-10-01	14-10-01	14,230	...	...	...	...	...	...	...	...	...	...	2
Gascoyne ...	...	25-6-97	15-4-97	...	...	5,313	...	2	12	...	...	...	...	...	...	...	2
Peak Hill ...	...	19-3-97	1-4-97	13-11-14	1-12-14	23,650	...	13	142	10	1	4	...	29	19	9	1
East Murchison ...	{ Lawlers ... Wiluna ... Black Range ... Cue ... }	28-6-95	28-6-95	2-2-20	2-2-20	26,058	{ 6,691 10,496 8,871 8,593	11 22 36 10	174 419 664 105	40 65 73 65	2 5 4 2	23 4 14 23	...	40 31 44 56	22 27 46 18	1 ...	1	
Murchison ...	{ Meekatharra ... Day Dawn ... Mt. Magnet ... }	24-9-91	24-9-91	28-11-13	1-1-14	25,474	{ 12,250 896 3,735	32 11 18	501 122 191	70 63 20	9 4 4	8 14 22	6 8 ...	1 33 45	112 9 42	23 3 2	2	
Yalgoo ...	...	8-2-95	23-1-95	30-7-15	9-8-15	23,230	...	29	520	60	12	20	2	5	73	84	2
Mt. Margaret ...	{ Mt. Morgans ... Mt. Malcolm ... Mt. Margaret ... }	12-3-97	1-4-97	2-2-20	2-2-20	59,918	{ 14,007 6,018 39,893	14 31 40	250 617 924	45 85 30	3 4 4	15 6 12	4 1 ...	1 171 42	42 67 12	...	...
North. Coolgardie ...	{ Menzies ... Ularring ... Niagara ... Yerilla ... }	28-6-95	28-6-95	7-9-17	17-9-17	13,746	{ 3,093 688 3,160	5 2 5	88 36 75	20 15 20	1 5 1	...	...	6 9 18	4 6 14	...	...
Broad Arrow ...	...	17-11-96	20-11-96	8-6-06	1-7-06	1,038	...	22	341	35	17	12	4	2	49	39	4
North-East Coolgardie ...	{ Kanowna ... Kurnalpi ... }	20-3-96	15-4-96	27-3-08	1-4-08	20,604	{ 1,094 19,510	17 2	251 17	40 5	3 1	...	...	30 12	55 10	4 2	
East Coolgardie ...	{ East Coolgardie ... Bulong ... }	21-9-94	1-10-94	27-3-08	1-4-08	1,800	{ 810 990	121 30	1,872 629	430 ...	264 ...	109 ...	122 ...	63 ...	1,224 34	1,598 14	25 7	
Coolgardie ...	{ Coolgardie ... Kunanalling ... }	6-4-94	6-4-94	1-3-07	1-3-07	11,702	{ 9,384 2,318	54 12	965 140	73 32	4 3	50 9	4 ...	205 34	231 30	58 5		
Yilgarn ...	...	1-10-88	1-10-88	28-1-16	1-2-16	17,700	...	45	788	125	13	33	8	4	92	66	1
Dundas ...	...	31-8-93	31-8-93	1-3-07	1-3-07	11,430	...	14	159	17	3	10	...	42	54	4	
Phillips River ...	...	21-9-00	14-9-00	28-1-16	1-2-16	5,078	...	...	...	50	1	2	...	8	10	3	
State generally ...	...	...	...	...	...	...	...	6	88	...	2	...	...	3	...	...	...
Total ...	Total ...	...	...	...	...	436,943	...	656	10,839	1,638	390	448	179	82	2,592	2,755	208

TABLE III.—Return showing for the respective Goldfields and Districts, etc.—continued.

Goldfield.	District.	1923 GOLD AND SILVER YIELD—DISTRICTS.						1923 GOLD AND SILVER YIELD—GOLDFIELDS.						
		Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	Silver.	
		Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	
Kimberley	...	...	...	...	...	...	...	30.55	...	...	...	30.55	...	
Pilbara	Marble Bar	32.94	71.83	1,770.25	2,233.28	2,388.05	39.90	}	163.95	85.19	1,835.25	2,294.48	2,543.62	39.90
Do.	Nullagine	81.01	13.36	65.00	61.20	155.57	...		25.29	...	39.00	38.93	64.22	...
West Pilbara	...	...	...	...	...	...	...	}	9.24	...	...	9.24	...	
Ashburton	...	...	...	...	...	...	...		239.69	57.93	3,638.75	1,402.20	1,699.82	...
Gascoyne	...	...	...	...	...	...	...	}	...	...	...	...	...
Peak Hill	...	...	...	...	...	...	...		14.02	91.08	17,473.30	10,911.31	11,016.41	...
East Murchison	Lawlers	...	7.25	6,473.00	4,295.69	4,302.94	...	}	...	...	...	...	...
Do.	Wiluna	1.60	...	6,545.50	3,695.51	3,697.11	...		490.58	1,154.09	56,145.07	25,392.86	27,037.53	...
Do.	Black Range	12.42	83.83	4,454.80	2,920.11	3,016.36	...	}	5.77	7.87	10,960.85	7,699.81	7,713.45	164.83
Murchison	Cue	37.71	95.30	17,019.30	4,022.08	4,155.09	...		19.72	94.33	26,788.32	26,762.37	26,876.42	1,925.95
Do.	Meekatharra	400.95	733.85	35,184.75	19,221.11	20,355.91	...	}	...	...	...	...	...
Do.	Day Dawn	26.52	73.84	1,567.25	750.43	850.79	...		29.70	183.22	18,978.84	12,000.01	12,212.93	...
Do.	Mt. Magnet	25.40	251.10	2,373.77	1,399.24	1,675.74	...	}	...	...	...	...	...
Yalgoo	...	...	...	...	...	...	...		41.20	397.46	1,538.96	1,802.32	2,740.98	...
Mt. Margaret	Mt. Morgans	...	...	11,724.39	5,556.38	5,556.38	...	}	...	...	...	...	...
Do.	Mt. Malcolm	10.51	37.00	14,734.95	20,253.63	20,301.14	1,925.95		28.70	284.06	5,822.79	4,401.75	4,714.51	...
Do.	Mt. Margaret	9.21	57.33	328.98	952.36	1,018.90	...	}	62.33	381.54	603,297.21	370,225.99	370,669.86	61,015.49
North Coolgardie	Menzies	17.16	83.07	18,052.27	11,178.37	11,278.60	...		62.33	381.54	603,297.21	370,225.99	370,669.86	61,015.49
Do.	Ularring	...	6.29	88.25	212.89	219.18	...	}	19.31	806.51	23,258.44	12,250.99	13,076.81	...
Do.	Niagara	12.54	93.86	151.57	162.74	269.14	...		...	3.95	7,755.27	8,372.02	8,375.97	8.17
Do.	Yerilla	...	...	686.75	446.01	446.01	...	}	1.03	114.66	4,004.63	6,242.16	6,357.85	...
Broad Arrow	...	...	...	...	...	...	...		17.52	...	232.79	374.58	374.58	...
N.E. Coolgardie	Kanowna	28.70	283.02	5,768.29	4,281.18	4,592.90	...	}	...	...	...	...	...
Do.	Kurnalpi	...	1.04	54.50	120.57	121.61	...		...	...	...	...	...	...
East Coolgardie	East Coolgardie	...	322.99	602,873.93	369,536.85	369,859.84	61,015.49	}	62.33	381.54	603,297.21	370,225.99	370,669.86	61,015.49
Do.	Bulong	62.33	58.55	423.28	689.14	810.02	...		19.31	806.51	23,258.44	12,250.99	13,076.81	...
Coolgardie	Coolgardie	19.31	58.41	20,468.36	9,852.09	9,929.81	...	}	...	...	...	...	...
Do.	Kunaling	...	748.10	2,790.08	2,398.90	3,147.00	...		...	...	...	...	...	...
Yilgarn	...	...	...	...	...	...	...	}	...	...	...	...	...
Dundas	...	...	...	...	...	...	...		...	...	...	...	...	...
Phillips River	...	...	...	...	...	...	...	}	...	...	...	...	...
State generally	...	...	...	...	...	...	...		...	...	...	...	...	...
Total for 1923	...	...	...	...	...	...	...	1,198.60	4,161.89	781,769.47	490,312.00	495,872.49	76,123.98	

TABLE III.—Return showing for the respective Goldfields and Districts, etc.—continued.

Goldfield.	District.	TOTAL GOLD AND SILVER YIELD—DISTRICTS.						TOTAL GOLD AND SILVER YIELD—GOLDFIELDS.					
		Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	* Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	* Silver.
		Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.
Kimberley ...	...	...	...	...	...	...	...	3,978·01	...	17,597·50	14,127·25	18,105·26	...
Pilbara ...	Marble Bar ...	12,290·29	3,603·82	80,261·18	120,722·59	136,616·70	613·91	} 19,011·10	} 4,063·42	} 120,997·42	} 193,938·31	} 217,012·83	} 613·91
Do. ...	Nullagine ...	6,720·81	459·60	40,736·24	73,215·72	80,396·13	...						
West Pilbara ...	...	...	...	...	...	...	...	} 5,698·41	} 275·00	} 19,281·71	} 22,068·24	} 28,041·65	} 1,331·07
Ashburton ...	...	...	...	...	...	...	...
Gascoyne ...	...	...	...	...	...	...	...	} 8,612·72	} 315·64	} ...	} ...	} 8,928·36	} 7,787·69
Peak Hill ...	...	...	...	...	...	...	...
East Murchison ...	Lawlers ...	5,614·49	7,241·85	2,035,647·36	909,174·87	922,031·21	25,997·48	} 2,223·89	} 4,166·82	} 520,828·76	} 254,185·82	} 260,576·53	} 2,287·63
Do. ...	Wiluna ...	97·37	197·27	212,069·50	108,300·72	108,595·36	232·00						
Do. ...	Black Range ...	1,500·96	15,872·26	1,191,283·84	764,883·04	782,256·26	16,500·57	} 7,212·82	} 23,311·38	} 3,439,000·70	} 1,782,358·63	} 1,812,882·83	} 42,730·05
Murchison ...	Cue ...	1,204·20	5,701·26	475,200·28	385,760·50	392,665·96	508·68						
Do. ...	Meekatharra ...	10,986·76	12,878·17	1,435,871·99	969,589·96	993,454·89	5,028·90	} 16,339·71	} 42,360·76	} 4,428,922·55	} 3,049,340·07	} 3,108,040·54	} 175,922·20
Do. ...	Day Dawn ...	2,346·49	9,215·10	1,969,992·65	1,300,324·98	1,311,886·57	169,210·44						
Do. ...	Mt. Magnet ...	1,802·26	14,566·23	547,857·63	393,664·63	410,033·12	1,174·18	} 1,574·90	} 1,861·47	} 213,566·55	} 150,529·68	} 153,966·05	} 490·29
Yalgoo ...	...	...	...	...	...	...	...
Mt. Margaret ...	Mt. Morgans ...	1,755·83	3,796·75	979,150·04	530,219·09	535,771·67	5,775·05	} 7,857·19	} 19,265·18	} 5,867,529·34	} 3,034,336·82	} 3,061,459·19	} 143,516·64
Do. ...	Mt. Malcolm ...	2,667·28	7,517·86	3,259,993·36	1,681,280·74	1,691,465·88	80,978·06						
Do. ...	Mt. Margaret ...	3,434·08	7,950·57	1,628,385·94	822,836·99	834,221·64	56,763·53	} 3,868·98	} 14,009·72	} 2,636,135·90	} 1,996,273·00	} 2,014,151·70	} 30,863·99
North Coolgardie ...	Menzies ...	1,103·80	3,764·30	1,220,474·90	1,014,904·41	1,019,772·51	19,224·48						
Do. ...	Ularring ...	22·17	1,150·61	298,316·37	290,064·88	291,237·66	5,973·05	} 19,336·82	} 14,969·51	} 853,364·65	} 467,966·99	} 502,273·32	} 2,181·96
Do. ...	Niagara ...	1,496·67	1,522·44	899,229·84	499,685·17	502,704·28	5,603·42						
Do. ...	Yerilla ...	1,246·34	7,572·37	218,114·79	191,618·54	200,437·25	63·04	} 116,480·42	} 17,270·98	} 951,815·74	} 600,634·86	} 734,386·26	} 2,533·34
Broad Arrow ...	...	...	...	...	...	...	...
N.E. Coolgardie ...	Kanowna ...	104,481·67	11,170·40	946,134·33	587,457·38	703,109·45	2,522·12	} 54,334·83	} 48,612·05	} 29,929,425·21	} 18,921,240·78	} 19,024,187·66	} 1,955,485·98
Do. ...	Kurnalpi ...	11,998·75	6,100·58	5,681·41	13,177·48	31,276·81	11·22						
East Coolgardie ...	East Coolgardie ...	27,609·22	33,540·52	29,774,682·69	18,800,226·15	18,861,375·89	1,955,473·06	} 9,838·76	} 17,255·60	} 1,839,960·57	} 1,199,461·05	} 1,226,555·41	} 940·11
Do. ...	Bulong ...	26,725·61	15,071·53	154,742·52	121,014·63	162,811·77	12·92						
Coolgardie ...	Coolgardie ...	9,106·97	11,215·72	1,560,493·58	979,636·26	999,958·95	891·44	} 91·65	} 1,475·35	} 2,258,057·29	} 1,037,460·74	} 1,039,027·74	} 32,288·71
Do. ...	Kunanalling ...	731·79	6,039·88	279,466·99	219,824·79	226,596·46	48·67						
Yilgarn ...	...	...	...	...	...	...	...	} 2,028·15	} 13,965·95	} 905,890·12	} 617,757·40	} 633,751·50	} 36,392·90
Dundas ...	...	...	...	...	...	...	...
Phillips River ...	...	...	...	...	...	...	...	} 472·20	} 781·93	} 92,227·74	} 87,739·70	} 88,993·83	} 15,688·17
Donnybrook †	...	...	...	...	...	...	...
State generally ...	...	...	...	...	...	...	...	} 23·24	} ...	} 1,653·30	} 818·52	} 841·76	} ...
Total to 31st December, 1923 ...	...	...	...	...	...	...	...
								279,455·89	224,273·36	54,096,638·75	33,438,269·01	33,941,997·76	2,481,870·58

* By-product in the treatment of auriferous ore except Ashburton and State generally. † Abolished 4th March, 1908.

TABLE IV.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1923, AND THE TOTAL PRODUCTION TO DATE.

Kimberley Goldfield.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Hall's Creek	Voided leases ...	...	...	...	...	...	...	...	423·00	477·76	...
Do.	Sundry Claims ...	...	...	...	...	...	...	...	94·55	62·68	...
Mt. Dockrell...	...	Voided leases ...	...	...	...	...	...	...	...	44·00	435·93	...
Ruby Well	Voided leases ...	...	...	...	...	...	...	...	12,633·50	9,435·13	...
Do.	Sundry claims ...	...	...	...	...	...	...	...	151·00	127·28	...
The Brockman	...	Voided leases ...	...	...	...	...	...	...	...	1,352·75	1,404·40	...
Do.	Sundry claims ...	...	...	...	...	...	...	...	2,462·00	1,820·33	...
The Mary	Voided leases ...	...	...	...	...	...	...	...	399·00	210·03	...
The Panton	Voided leases ...	...	...	...	...	...	...	...	34·70	138·70	...
Do.	Sundry claims ...	...	...	...	...	...	...	...	3·00	15·01	...
<i>From Goldfield generally:—</i>												
Reported by Banks and Gold Dealers ...			30·55	3,978·01
Total ...			30·55	3,978·01	...	17,597·50	14,127·25	...

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Pilbara Goldfield.

MARBLE BAR DISTRICT.

Bamboo Creek	(834)	...	Bamboo Queen	22·50	24·05	...
Do.	(818)	...	Black Queen	...	...	12·25	8·01	...	...	12·25	8·01	...
Do.	795	...	Bulletin	...	...	18·75	32·86	...	...	104·00	213·95	...
Do.	819	...	Forrest Abbey	...	...	...	...	...	...	35·50	77·64	...
Do.	707	...	Kitchener	...	...	238·00	581·20	...	...	3,301·00	7,017·97	...
Do.	740	...	(Mount Prophecy)	...	...	...	...	...	1·11	1,040·50	1,898·07	...
Do.	740, 794	...	Mt. Prophecy leases	...	...	18·75	32·00	...	...	1,319·50	2,098·18	...
Do.	794	...	(Perseverance)	...	...	...	...	...	...	290·50	584·21	...
Do.	817	...	Prince Charlie	...	...	25·50	138·00	...	...	53·25	243·99	...
Do.	...	...	Voided leases	...	...	...	...	...	508·66	15,168·25	23,225·63	...
Do.	...	...	Sundry claims	...	...	68·25	42·76	...	307·83	1,165·35	1,483·69	...

Boodalyerrie...	...	Voided leases ...	...	...	...	...	...	...	292.07	120.25	587.86	...
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	7.16	...	...	...
Breen's Find...	...	Voided leases ...	...	...	...	...	...	...	...	14.00	66.82	...
Elsie ...	...	Voided leases ...	...	...	...	...	...	...	...	178.00	352.06	...
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	10.25	58.01	...
Lalla Rookh...	786, R.C., 112 ...	Haig ...	...	...	...	425.00	171.55	...	4.78	2,444.00	1,692.79	...
Do. ....	...	Voided leases ...	...	...	...	...	...	...	...	224.50	2,186.65	574.01
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	6,992.00	6,881.04	...
Marble Bar ...	805 ...	Homeward Bound East ...	...	...	...	194.00	252.27	...	...	549.00	682.04	...
Do.	(815) ...	Ironclad ...	...	...	...	60.00	40.25	...	...	424.00	268.20	...
Do.	694 ...	Jo Jo ...	...	...	...	63.00	81.44	...	33.97	2,546.00	2,842.85	...
Do.	845 ...	Outward Bound ...	...	...	...	21.00	26.02	...	...	21.00	26.02	...
Do. ....	...	Voided leases ...	...	...	...	...	...	...	147.90	18,421.45	24,103.50	...
Do. ....	...	Sundry claims ...	...	...	...	292.75	373.70	...	38.68	149.23	5,623.64	...
North Pole ...	...	Voided leases ...	...	...	...	...	...	...	...	474.00	340.75	...
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	50.50	69.56	...
North Shaw ...	820 ...	McLeod's Reward ...	...	...	...	333.00	168.24	...	...	333.00	168.24	...
Do. ....	...	Voided leases ...	...	...	...	...	...	...	7.53	...	351.45	674.72
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	567.06	...	...
Sharks ...	...	Sundry claims ...	...	...	...	...	...	...	145.08	19.37	24.50	93.14
Shaw River ...	...	Voided leases ...	...	...	...	...	...	...	...	...	101.00	49.63
Talga Talga ...	...	Voided leases ...	...	...	...	...	...	...	...	83.83	574.50	975.98
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	50.26	68.99	204.65	520.25
Tambourah ...	(835) ...	Webb's Find ...	...	...	...	...	...	...	...	73.90	...	...
Do. ....	...	Voided leases ...	...	...	...	...	...	...	...	...	1,438.50	1,739.44
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	79.29	639.25	797.44
Warrawoona...	...	Voided leases ...	...	...	...	...	...	...	...	16.99	10,072.80	18,136.84
Do. ....	...	Sundry claims ...	...	...	41.20	...	...	...	44.30	403.70	1,127.04	2,163.74
Western Shaw	...	Voided leases ...	...	...	...	...	...	...	...	...	1,222.50	957.80
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	12.52	67.47	...	...
Wyman's Well	744 ...	Euro ...	...	...	9.31	...	...	...	...	9.31	593.00	595.67
Do. ....	...	Voided leases ...	...	...	...	...	...	...	...	33.55	115.04	493.98
Do. ....	...	Sundry claims ...	...	...	21.32	...	...	...	93	39.41	355.86	592.18
Yandicoogina	...	Voided leases ...	...	...	...	...	...	...	...	140.76	2,733.20	5,824.23
Do. ....	...	Sundry claims ...	...	...	...	...	...	...	...	238.35	103.75	120.34
<i>From District generally :-</i>												
Sundry Parcels treated at :												
State Battery, Bamboo Creek ... 284.98 39.90 ... 2,922.82 39.90												
State Battery, Marble Bar ... 34.06												
Various Works ... 237.95 1,204.91												
Reported by Banks and Gold Dealers 82.94 11,990.99 309.13												
Total ... 82.94 71.83 1,770.25 2,233.28 39.90 12,290.29 3,603.82 80,261.18 120,722.59 613.91												

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

PILBARA GOLDFIELD—continued.

NULLAGINE DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE	TOTAL FOR 1923.					TOTAL PRODUCTION.						
			Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.		
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.		
Eastern Creek	(176L)	(Doherty Reward) ... ..	...	...	...	...	...	...	...	...	...	...	...	...
Do.	(176L)	Doherty Reward... ..	...	...	33·00	31·07	...	...	...	1563·00	2,970·01	...	...	...
Do.	(176L), (177L)	(Doherty Reward leases) ... ..	...	...	...	...	...	...	...	219·00	1,007·68	...	...	...
Do.	215L	Morning Star ... ..	...	...	32·00	30·13	...	...	...	32·00	30·13	...	...	...
Do.	...	Voided leases ... ..	...	...	...	...	...	...	8·19	2,525·75	4,675·63	...	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	...	3·77	315·50	540·22	...	...	...
Elsie	...	Voided leases ... ..	...	...	...	...	...	...	...	408·25	1,323·85	...	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	...	...	24·00	27·48	...	...	...
McPhee's Crk.	...	Voided leases ... ..	...	...	...	...	...	...	...	113·00	137·92	...	...	...
Middle Creek	...	Voided leases ... ..	...	...	...	...	...	...	...	6,211·90	8,433·68	...	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	...	...	286·00	408·82	...	...	...
Mosquito Creek	...	Voided leases ... ..	...	...	...	...	...	1·07	21·42	7,259·80	12,464·00	...	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	...	166·47	2,188·94	3,116·77	...	...	...
Nullagine	...	Voided leases ... ..	...	...	...	...	...	...	13·96	7,453·25	11,335·12	...	...	...
Do.	...	Sundry claims	44·62	13·36	...	...	...	149·32	186·50	3,984·75	9,336·03	...	...	...
20-Mile Sandy	...	Voided leases ... ..	...	...	...	...	...	...	3·20	5,093·70	7,786·99	...	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	33·10	20·55	2,802·65	3,855·08	...	...	...
<i>From District generally:—</i>														
<i>Sundry Parcels treated at:—</i>														
<i>Doherty's Works ... ..</i>			...	...	...	...	...	...	...	...	...	1,177·32	...	...
<i>Fremantle Trading Co., Ltd. ... ..</i>			...	...	...	...	...	...	...	...	...	8·29	...	...
<i>State Battery, 20-Mile Sandy ... ..</i>			...	...	...	...	...	...	...	...	62·00	1,767·60	...	...
<i>Various Works ... ..</i>			...	...	...	...	...	...	...	...	50·50	2,641·67	...	...
<i>Reported by Banks and Gold Dealers</i>			36·39	...	...	...	...	6,537·32	35·54	...	...	...	...	...
Total			81·01	13·36	65·90	61·20	...	6,720·81	459·60	40,736·24	73,215·72	...	...	...

West Pilbara Goldfield.

Osbydon	...	Voided leases ... ..	...	...	...	...	...	...	...	8·00	5·44	...	...
Hong Kong	...	Voided leases ... ..	...	...	...	...	...	...	...	331·00	442·45	...	...
Do.	...	Sundry claims ... ..	...	...	...	...	...	21·40	·02	9·00	3·15	...	...

Lower Nichol	...	...	Voided leases	...	...	...	...	...	...	1-10	653-20	402-22	...
Do.	...	...	Sundry claims	...	...	...	...	...	10-44	2-71	10-00	11-51	...
Mallina	...	...	Voided leases	...	...	...	...	...	...	...	141-60	128-44	...
Nichol	...	...	Voided leases	...	...	...	...	...	...	...	30-00	11-47	...
Pilbara	...	...	Voided leases	...	...	...	...	...	...	48-12	267-00	413-59	...
Do.	...	...	Sundry claims	...	...	...	39-00	38-93	...	1-11	86-24	142-00	224-22
Roebourne	M.L. 174	...	Good Fortune	...	...	...	...	...	...	...	...	3-96	112-83
Do.	M.Ls. 183,	167	Carlow Castle: Roebourne Cop- per Mines, Ltd.	...	...	...	...	...	...	...	...	6-12	...
Do.	...	...	Voided leases	...	...	...	...	...	...	...	113-36	573-91	237-91
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	108-60	93-85	96-53
Station Peak	165	...	Bella Donna	...	...	...	...	...	...	17-93	943-00	262-93	...
Do.	...	...	Voided leases	...	...	...	...	...	177-74	23-44	9,993-00	11,084-49	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	37-50	48-19	...
Towranna	...	...	Voided leases	...	...	...	...	...	...	2-62	3,965-80	5,187-51	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	22-00	12-35	...
Upper Nichol	...	...	Sundry claims	...	...	...	...	...	...	...	6-50	2-57	...
Weerianna	...	...	Voided leases	...	...	...	...	...	...	...	2,436-15	3,079-81	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	64-00	62-90	...
Whim Creek	...	...	Voided leases	...	...	...	...	...	...	...	...	...	883-80
<i>From Goldfield generally:—</i>				...	...	...	...	...	...	...	...	...	...
Reported by Banks and Gold Dealers				...	25-29	...	...	...	5,487-72	92-82	...	7-16	...
Total				...	25-29	...	39-00	38-93	...	5,698-41	275-00	19,281-71	22,068-24	1,331-07

Ashburton Goldfield.

Mt. Mortimer	...	...	Sundry claims	...	...	...	...	...	354-37	315-64	...	...	74-47
Uaroo	...	...	Voided leases	...	...	...	...	...	...	...	...	...	7,713-22
<i>From Goldfield generally:—</i>				...	...	...	...	...	...	...	...	...	...
Reported by Banks and Gold Dealers				...	9-24	...	...	...	8,258-35	...	...	...	...
Total				...	9-24	...	...	...	8,612-72	315-64	...	...	7,787-69

Gascoyne Goldfield.

Bangemal	...	...	Voided leases	...	...	...	...	...	...	6-22	350-70	313-82	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	12-29	6-00	24-01	...
<i>From Goldfield generally:—</i>				...	...	...	...	...	...	...	...	...	...
Reported by Banks and Gold Dealers				...	...	...	...	...	329-18	...	...	...	...
Total				...	...	...	...	...	329-18	18-51	356-70	337-83	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

Peak Hill Goldfield.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.						
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.		
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.		
Egerton	484P	Full Hand	...	19.35	...	...	...	...	...	...	...	...	...	...
Do.	352P	Hibernian	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...	...	...	...
Horseshoe	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...	...	...	...
Mt. Fraser	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill	459P	Altantic	...	...	...	...	...	...	...	...	...	...	...	...
Do.	483P	Atlantic North	...	...	...	...	...	...	...	...	...	...	...	...
Do.	(474P)	Atlantic North	...	...	...	...	...	...	...	...	...	...	...	...
Do.	448P	Evening Star	...	...	...	...	...	...	...	...	...	...	...	...
Do.	5P, 306P	No. 1 North leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	(1P), (2P), (4P), 5P, (6P), (8P), (9P), (13P), (15P), (16P), (26P), (27P), (28P), (29P), (35P), (36P), (43P), (53P), (54P), (63P), (146P), (152P), (190P), (213P), (222P), (239P), (248P), (252P), (262P), (274P), 306P, (313P)	(Peak Hill Goldfield, Ltd.)	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...	...	...	...
Ravelstone	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...	...	...	...
Wilgeena	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Wilthorpe	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...

From Goldfield generally:—

Sundry Parcels treated at:													
Purcell's Works	...	...	...	541.46	...	...	...	...	...	1,066.02	...
State Battery, Egerton	...	...	...	...	...	...	...	...	...	294.87	...
State Battery, Ravelstone	...	...	...	...	...	...	...	3.05	15.00	1,785.94	...
Various Works	...	...	...	...	...	...	...	...	30.00	319.97	...
Reported by Banks and Gold Dealers	...	...	...	...	...	...	1,947.77	345.17	...	...	...
Total	239.69	57.93	3,638.75	1,402.20	...	2,223.89	4,166.82	520,828.76	254,185.82	2,287.63

East Murchison Goldfield.

LAWLERS DISTRICT.

Bronzewing ...	...	Voided leases ...	...	...	...	...	...	...	...	468.00	318.03	1.94
Cork Tree ...	...	Voided leases ...	...	...	...	...	...	...	29.90	3,767.00	3,292.87	...
Do. ...	...	Sundry claims	...	...	...	...	...	...	25.50	13.00	9.32	...
Kathleen Valley	382	(Yellow Aster)	...	...	...	...	...	...	...	37,605.00	27,051.42	...
Do. ...	382	(Yellow Aster)	...	...	...	...	...	...	...	1,714.00	949.04	...
Do. ...	382, 1197	Yellow Aster leases	...	...	293.00	182.72	...	...	...	3,555.00	2,063.65	...
Do. ...	382	(Yellow Aster: Yellow Aster G.M. Co., N.L.)	...	...	...	...	...	...	...	10,359.75	5,425.26	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	141.57	23,291.50	11,350.24	...
Do. ...	...	Sundry Claims	...	...	16.00	4.35	...	...	478.40	1,505.75	879.66	...
Lake Darlot ...	1207, [1515c]	New Discovery ...	...	...	...	...	...	...	...	220.00	84.11	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	4,448.42	65,165.30	48,656.33	...
Do. ...	...	Sundry claims	...	...	...	...	...	1.16	474.45	3,972.64	3,387.61	2.60
Lawlers	(1211)	Donegal ...	...	...	...	...	...	...	...	795.00	467.58	...
Do. ...	(22), (37), 58, 62, (70), (155), (156), (157), (158), (376), (377), (381), (385), (399), (426), (427), (459), (474), (500), (508), (509), (510), (511), (512), (552), (562), (563), (573), (811), (840)	(East Murchison United, Ltd.)	...	...	...	...	...	...	...	291,797.00	155,594.26	900.48
Do. ...	1171	(Great Eastern)	...	...	...	...	...	...	...	927.00	337.72	...
Do. ...	1171	Great Eastern	...	...	...	...	...	...	...	217.00	80.27	...
Do. ...	1171, (1186)	(Great Eastern leases)	...	...	...	...	...	...	...	1,601.74	1,352.43	...
Do. ...	(37), 58, 62, (70), (155), (156), (157), (158), (376), (377), (381), (385), (399), (426), (427), (459), (474), (500), (508), (509), (510), (511), (512), (552), (562), (563), (573), (811), (840)	(London and Western Australian Exploration Co., Ltd.)	...	...	...	...	...	...	...	179,563.00	40,438.14	2,560.31

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

EAST MURCHISON GOLDFIELD—continued.

LAWLERS DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Lawlers ...	(22), (37), 58, 62, (70), (155), (156), (157), (158), (376), (377), (385), (459), (508), (509), (562), (563), (811), (840), 918, (1053), (1106), (1109), (1110), (1123), (1160)	(Northern Mines, Ltd.) ... ..	...	...	...	...	...	...	398,856·50	102,005·52	8,356·89
Do. ...	1212	(Queen) ... ..	...	...	...	...	...	...	168·00	124·30	...
Do. ...	1212	Queen: Daisy Queen G.M. Co., N.L.	...	...	1,033·00	828·29	...	...	4,088·00	2,317·36	...
Do. ...	58, 62, 918, 1178	Waroonga G.M. Co., N.L.	...	...	4,726·00	1,540·17	...	...	52,732·00	12,494·22	...
Do. ...	62, (562), (563) ...	(Waroonga South leases)	...	...	...	...	...	...	42,150·00	14,329·48	...
Do. ...	58	(Waronga: London and Western Australian Exploration Co., Ltd.)	...	...	...	...	...	...	2,438·50	2,755·45	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	687·39	303,813·48	156,992·12	2,533·25
Do.	Sundry claims	7·25	158·00	112·51	...	14·81	255·08	11,369·48	6,960·71	268·34
New England	...	Voided leases ... ..	...	...	...	...	...	57·54	899·00	720·25	...
Do. ...	...	Sundry claims ... ..	...	...	...	...	...	4·32	554·50	465·23	...
Sir Samuel ...	1225	Combine ... ..	...	...	13·00	7·74	...	...	13·00	7·74	...
Do. ...	(1190)	Bellevue South ... ..	...	...	...	...	...	...	254·00	139·13	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	13·49	265,811·50	138,672·86	10,225·58
Do. ...	...	Sundry claims ... ..	...	...	234·00	65·48	...	21·37	4,243·00	2,922·58	...
Wiluna ...	542 [6j], 548, [7j], (550), ([8j]) (906), ([11j]), (930), ([13j]), (931), ([14j]), (932), ([15j]), (937), ([17j]), (938), ([18j]), (943), ([21j]), (944), ([22j]), (952), ([26j])	(Gwalia Consolidated, Ltd.) ... ..	...	...	...	...	...	...	210,230·32	74,536·14	69·03
Do. ...	870 [10j]	(Moonlight) ... ..	...	...	...	...	...	...	1,856·00	787·66	...
Do. ...	917 [12j]	(Squib) ... ..	...	...	...	...	...	...	276·50	67·00	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	537·27	104,086·75	62,811·02	124·00
Do. ...	...	Sundry claims ... ..	...	...	...	...	5·30	...	2,841·15	1,516·76	...

From District generally :—

Sundry Parcels treated at :

Great Eastern Battery ... ..	...	...	...	841.44	...	...	...	4,891.73	151.37
Lawlers Public Battery (Retreatment Works) ...	...	...	...	554.61	...	...	...	1,358.07	...
Queen Works ... ..	...	...	...	...	...	...	...	1,275.11	39.36
State Battery : Lake Darlot ... ..	...	...	...	...	...	...	315.00	1,097.09	...
State Battery : Sir Samuel ... ..	...	...	...	158.38	...	...	23.50	1,535.98	...
State Battery : Wiluna ... ..	...	...	...	...	...	...	390.00	2,047.17	20.00
Western Machinery Co., Ltd. ... ..	...	...	...	...	...	...	80.00	37.25	...
Various Works ... ..	...	...	...	...	...	...	1,619.50	14,563.26	744.33
Reported by Banks and Gold Dealers ... ..	...	...	...	...	...	5,593.22	67.15	5.74	...
Total ... ..	...	...	...	...	...	...	...	...	...
				7.25	6,473.00	4,295.69	...	5,614.49	7,241.85	2,035,647.36	909,174.87	25,997.48

WILUNA DISTRICT.

Collavilla ... ..	...	Voided leases ... ..	...	...	...	...	...	1,518.00	496.28	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	30.00	21.47	...
Gum Creek ... ..	...	Voided leases ... ..	...	...	...	...	...	1,334.50	579.16	...
Mt. Keith	Voided leases	8.29	8,279.50	6,882.05	...
Do.	Sundry claims	78.26	1,595.25	976.93	...
New England ... ..	...	Voided leases ... ..	...	...	...	...	...	952.00	309.11	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	115.00	100.62	...
Wiluna	91j [940]	(Adelaide) ... ..	...	...	...	...	...	401.00	33.29	...
Do.	231j	Brilliant ... ..	...	268.00	70.80	...	...	268.00	70.80	...
Do.	(270j)	Essex ... ..	...	127.25	90.48	...	...	227.00	179.42	...
Do.	(218j)	Great Zig-Zag ... ..	...	70.00	33.70	...	...	871.50	473.97	...
Do.	6j, [542], 7j, [548], (8j), ([550]), (11j), (13j), (14j), (15j), (17j), (18j), (21j), (22j), (24j), (25j), (26j), (39j), (161j), (163j),	(Gwalia Consolidated, Ltd.) ... ..	...	...	...	...	...	29,774.50	10,780.42	20.29
Do.	119j	(Happy Jack) ... ..	...	...	...	...	...	743.00	236.41	...
Do.	(268j)	Hope ... ..	...	28.00	27.52	...	...	176.50	119.72	...
Do.	10j, [870]	(Moonlight) ... ..	...	...	...	...	...	5,181.00	1,078.40	...
Do.	10j, [870], 37j, 91j, 109j, (123j)	Moonlight leases ... ..	...	331.75	191.90	...	...	28,678.75	11,929.51	...
Do.	6j, [542], 7j, [548], (8j), (550), (11j), (13j), (14j), (15j), (17j), (21j), (161j), (163j), (193j), (194j), (256j), (257j)	Western Machinery Co., Ltd. ... ..	...	2,542.75	1,761.59	...	...	69,383.00	33,076.82	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

East Murchison Goldfield—continued.

WILUNA DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Wiluna ...	12j, [917j], (23j), ([946]), (28j), ([954]), (30j), ([959]), (33j), ([967]), (36j), ([975]), (43j), ([1018]), (76j), ([1090]), (113j), 119j, (124j), (137j), 266j	Wiluna Gold Mines, Ltd. (In Liquidation)	...	...	2,396·25	1,199·51	...	...	...	30,975·00	14,587·73	...
Do. ...	...	Voided leases ...	...	...	...	...	...	27·92	22,425·25	10,066·13	...	
Do. ...	...	Sundry claims ...	...	...	781·50	320·01	...	87·59	79·88	8,938·75	4,037·86	... 33
		<i>From District generally:—</i>										
		Sundry Parcels treated at:										
		State Battery, Mt. Keith ...	...	...	...	...	...	...	...	...	781·64	12·68
		State Battery, Wiluna ...	...	...	...	...	...	...	...	202·00	11,482·98	198·70
		Reported by Banks and Gold Dealers	...	...	1·60	...	...	9·78	2·92	...	...	...
		Total ...	...	...	6,545·50	3,695·51	...	97·37	197·27	212,069·50	108,300·72	232·00

BLACK RANGE DISTRICT.

Barrambie ...	...	Voided leases ...	...	...	...	...	...	...	...	455·50	1,862·24	...
Do. ...	...	Sundry claims ...	...	...	57·76	...	13·32	...	77·14	127·05	140·50	...
Bellechambers ...	...	Sundry claims ...	...	...	...	...	...	...	...	45·00	36·62	...
Birrigrin ...	...	Voided leases ...	...	...	...	...	...	...	820·68	12,018·16	15,040·45	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	34·52	744·50	678·89	...
Curran's Find ...	...	Voided leases ...	...	...	...	...	...	18·24	222·89	7,038·50	3,001·02	...
Do. ...	...	Sundry claims ...	...	...	130·00	...	60·47	...	27·20	670·50	288·86	...
Erroll's ...	...	Voided leases ...	...	...	...	...	...	14·17	132·04	72·00	426·68	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	6·53	399·11	228·00	327·90	...
Hancocks ...	(881B) ...	Bounty ...	...	...	92·00	...	13·31	...	...	205·00	76·55	...
Do. ...	(875B) ...	Comedy King ...	...	...	35·00	...	57·96	...	...	216·50	546·89	...
Do. ...	931B ...	Comedy King ...	...	...	63·00	...	48·12	...	...	63·00	48·12	...

Do.	(888B), (889B), (890B), (891B), (892B), 895B, 896B	Empire Gold Prospecting Syndicate, N.L.	...	...	787.00	181.14	...	...	...	787.00	181.14	...
Do.	918B	Kohinoor North Extended	...	...	34.00	6.01	...	...	...	34.00	6.01	...
Do.	...	Voided leases	...	...	...	...	...	...	6,489.84	26,691.25	27,343.04	52.08
Do.	...	Sundry claims	...	...	252.50	72.58	...	4.21	119.02	2,649.50	1,340.96	...
Maninga Marley	203B	(Havilah)	...	...	...	...	...	...	...	1,507.50	2,315.74	...
Do.	203B	(Havilah)	...	...	...	...	...	...	...	638.00	716.05	...
Do.	203B, (249B), (254B), (289B), (350B), (504B)	(Havilah G.M. Co., N.L.)	...	...	...	...	...	...	...	36,508.00	20,052.80	22.55
Do.	203B, (287B), (350B)	(Havilah G.M. Co., N.L.)	...	...	...	...	...	...	...	6,026.00	5,029.69	...
Do.	203B, (249B), (287B), (289B), (305B)	(Havilah leases)	...	...	...	...	...	...	...	2,240.00	2,432.48	...
Do.	203B, 345B	Havilah leases	...	...	...	...	...	...	...	...	127.54	...
Do.	203B, (289B)	(Havilah leases: Tailings Treatment, Ltd.)	...	...	...	...	...	...	...	371.00	2,086.50	...
Do.	...	Voided leases	...	...	...	...	...	...	195.20	11,977.23	14,442.35	...
Do.	...	Sundry claims	...	...	...	...	...	...	158.16	853.50	669.68	...
Montagu	...	Voided leases	...	...	...	...	...	...	94.39	9,133.40	7,223.46	...
Do.	...	Sundry claims	...	...	...	...	...	...	45.67	794.50	471.76	...
Nungarra	...	Voided leases	...	...	...	...	25.94	986.09	12,171.25	8,808.41	3.64	...
Do.	...	Sundry claims	...	...	...	...	46.67	1,455.98	3,601.90	2,212.33	...	...
Sandstone	887B	Lucky Dip	...	...	14.00	7.91	...	...	...	14.00	7.91	...
Do.	893B	Nous Verrons	...	...	307.00	225.11	...	...	...	307.00	225.11	...
Do.	(883B)	Nous Verrons	...	...	...	...	...	...	...	98.00	51.33	...
Do.	885B	Oroya East	...	17.77	448.00	357.24	...	17.77	508.15	860.92	...	...
Do.	...	Voided leases	...	...	...	...	4.75	3,185.47	687,306.27	441,118.57	11,754.22	...
Do.	...	Sundry claims	6.60	8.30	327.00	276.78	...	33.72	1,270.43	4,785.65	2,790.16	...	
Youanmi	(873B)	Three Mugs	...	...	...	...	...	...	...	75.00	9.66	...
Do.	514B	United	...	...	100.25	17.92	...	...	11.86	18,460.78	5,755.18	...
Do.	863B, 864B, (865B), (866B)	Youanmi G.Ms., Ltd.	...	...	1,857.00	983.45	...	...	...	56,125.75	38,674.05	1,658.83
Do.	...	Voided leases	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	8.00	16.24	36	115.06	283,509.75	132,261.45	2,949.72
			1.07	2.31	1,986.75	570.48	...
	<i>From District generally:—</i>												
	Sundry Parcels treated at:												
		State Battery, Black Range	202.00	15,375.74	59.53	...
		State Battery, Youanmi	582.55	3,583.04
		Various Works	37.00	5,664.78
		Reported by Banks and Gold Dealers	...	5.82	1,345.30	11.43
		Total	...	12.42	83.83	4,454.80	2,920.11	...	1,500.96	15,872.26	1,191,283.84	764,833.04	16,500.57

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

Murchison Goldfield.

CUE DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Barrambie ...	...	Voided leases ...	...	...	...	...	...	22.49	16,903.92	14,338.52	125.60
Do. ...	...	Sundry claims ...	...	...	...	...	...	70.50	35.81	...	...
Cuddingwarra	1860	Big Bell ...	...	...	15,894.00	2,431.95	...	...	64,448.36	10,954.08	85.29
Do. ...	...	Voided leases ...	...	...	...	...	10.59	124.53	35,855.75	43,796.59	15.42
Do. ...	...	Sundry claims ...	...	...	43.00	17.36	...	82.10	567.54	1,105.88	...
Cue	(2012)	Amythas ...	...	...	...	...	...	...	221.50	224.33	...
Do. ...	203, (1148)	(Cue Consolidated G.Ms., Ltd.)	...	...	...	...	...	...	23,427.50	18,382.10	...
Do. ...	203	Cue No. 1	...	...	...	...	...	...	7,781.75	12,961.68	20.40
Do. ...	(2017)	Hidden Treasure	...	...	...	2.73	...	...	79.50	41.02	...
Do. ...	(2019)	Kangaroo Dog	...	...	52.00	3.83	...	...	298.50	85.68	...
Do. ...	(1148)	(Light of Asia)	...	...	...	...	...	...	10,175.00	7,302.20	...
Do. ...	(1148), (1299), (1300), (1634), (1666), (1667)	(Light of Asia leases)	...	...	...	...	...	...	14,024.00	9,078.43	...
Do. ...	(1148), (1151), (1252), (1300), (1362), (1498), (1634), (1667), (1884), (1892), (1904), (1906)	(Light of Asia and Queen of the May leases)	...	...	...	...	...	...	23,043.00	18,341.27	...
Do. ...	(1148), (1151), (1252), (1362), (1498), (1884), (1892), (1904), (1906)	Mararoa G.M. Co., N.L.	...	...	...	92.87	...	...	11,387.05	11,513.68	2.88
Do. ...	(1151), (1252), (1362), (1391), (1498), (1689)	(Queen of the May leases)	...	...	...	...	...	...	6,926.00	6,974.06	...
Do. ...	...	Voided leases ...	...	...	...	...	34.72	535.34	182,622.62	129,312.60	43.35
Do. ...	...	Sundry claims ...	...	...	312.50	122.30	22.06	547.80	17,670.94	10,696.38	...
Eelya	...	Voided leases ...	...	...	...	...	...	8.78	971.00	1,778.94	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	101.86	595.15	630.47	...
Erroll's	...	Voided leases ...	...	...	...	...	...	20.25	14,098.50	8,902.24	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	227.00	92.86	...
Mindoolah	...	Voided leases ...	...	...	...	...	3.07	...	7,935.50	4,773.33	42.97
Do. ...	...	Sundry claims ...	...	...	...	...	...	9.81	1,017.00	1,130.39	...

Reedy's Find	(1932)	...	Culculli	...	...	40-00	167-84	...	...	...	260-00	1,486-62	...
Do.	1977	...	Emu	...	...	136-00	79-36	...	...	...	555-50	280-88	...
Do.	1981	...	Emu North	...	...	310-00	216-86	...	...	...	414-00	260-31	...
Do.	(1934)	...	Tuckanarra	...	...	...	...	...	...	...	69-50	231-25	...
Do.	2018	...	Turn of Tide	...	...	6-00	101-13	...	...	...	13-00	280-03	...
Do.	...	...	Voided leases	...	...	...	...	...	...	214-65	986-00	4,047-87	...
Do.	...	...	Sundry claims	...	4-71	13-50	23-68	...	169-59	87-00	397-80	367-88	...
Tuckabianna...	...	...	Voided leases	...	...	...	...	...	...	162-70	3,020-00	4,302-51	...
Do.	...	...	Sundry claims	...	...	74-50	42-38	...	23-44	102-14	385-75	244-50	...
Tuckanarra	1337	...	Nemesis	...	94-11	...	...	...	...	966-35	2,371-00	6,220-01	...
Do.	(2025)	...	We Two	...	...	37-30	80-98	...	...	...	37-30	80-98	...
Do.	...	...	Voided leases	...	...	...	...	...	14-65	2,095-42	15,584-10	14,405-28	172-77
Do.	...	...	Sundry claims	...	1-19	100-50	53-91	...	93-61	612-50	3,314-73	6,908-62	...
<i>From District generally :-</i>													
Sundry Parcels treated at :													
Cue No. 1 Works													
State Battery, Cue													
State Battery, Tuckanarra													
Triplicate Works													
Various Works													
Reported by Banks and Gold Dealers													
Total													
				37-71	95-30	17,019-30	4,022-08	...	1,204-20	5,701-26	475,200-28	385,760-50	508-68

MEEKATHARRA DISTRICT.

Abbott's	...	...	Voided leases	...	...	...	...	...	...	26-45	35,210-60	37,124-40	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	49	55-60	90-87	...
Burnakura	...	...	Voided leases	...	...	...	...	...	...	3,239-43	38,480-95	30,579-03	26-90
Do.	...	...	Sundry claims	...	...	...	...	...	12-51	81-11	144-50	118-98	...
Chesterfield	...	...	Voided leases	...	...	...	...	...	29-02	409-15	6,756-26	7,445-01	80
Do.	...	...	Sundry claims	...	...	...	...	...	...	41-63	435-60	487-80	...
Gabanintha	...	...	Voided leases	...	...	...	...	...	...	16-93	21,918-00	13,447-58	815-57
Do.	...	...	Sundry claims	...	...	...	...	...	13-05	74-38	1,063-50	715-19	...
Garden Gully	...	...	Voided leases	...	...	...	...	...	26-36	74-91	29,854-06	21,435-37	1,102-59
Do.	...	...	Sundry claims	...	...	...	...	...	...	5-38	294-35	373-03	...
Gum Creek	...	...	Voided leases	...	...	...	...	...	25-27	88-12	3,639-08	3,359-56	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	338-00	278-36	...
Holden's Find	1460N	...	Norma	...	...	...	...	...	...	...	213-75	167-26	...
Do.	1291N	...	Waterloo	...	...	480-00	199-58	...	...	...	14,256-00	4,939-69	...
Do.	...	...	Voided leases	...	...	...	...	...	...	18-00	1,273-25	987-62	...
Do.	...	...	Sundry claims	...	136-01	...	...	...	162-74	44-63	206-00	173-56	...
Jillawarra	...	...	Voided leases	...	...	...	...	...	...	1,134-68	1,499-55	2,801-53	...
Do.	...	...	Sundry claims	...	92	...	...	...	169-94	142-95	23-50	53-81	...
Meeka Pools	...	...	Voided leases	...	...	...	...	...	...	...	111-58	82-27	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	2-84	211-72	184-83	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

MURCHISON GOLDFIELD—continued.

MEEKATHARRA DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.						
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.		
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.		
Meekatharra...	597N ...	(Commodore) ...	...	...	...	...	...	...	...	...	...	...	...	...
Do. ...	597N, (915N), (1041N, 1365N)	(Commodore G.M. Co., N.L.) ...	...	...	...	...	...	...	...	498·00	1,268·71	...	...	...
Do. ...	1501N ...	Empire ...	...	...	113·25	110·46	...	...	...	113·25	110·46	...	...	...
Do. ...	477N ...	(Fenian) ...	...	...	...	...	...	...	...	8,831·75	18,289·22	...	...	...
Do. ...	477N, 814N ...	Fenian leases ...	...	...	5,851·00	3,512·17	...	...	...	313,464·94	254,585·68	...	...	...
Do. ...	1331N ...	Gwalia ...	...	...	604·50	189·08	...	...	132·98	4,223·25	9,609·20	...	...	...
Do. ...	1466N ...	Haveluck ...	...	...	163·25	280·70	...	...	...	401·50	586·00	...	...	...
Do. ...	555N ...	Ingliston ...	...	...	328·00	252·14	...	...	...	328·00	252·14	...	...	...
Do. ...	555N ...	(Ingliston) ...	...	...	...	...	...	...	...	1,202·49	2,332·27	...	...	...
Do. ...	475N ...	(Ingliston Consols Extended) ...	...	...	...	...	...	...	...	1,536·25	4,248·25	...	...	30
Do. ...	475N, 515N, 729N, 822N	Ingliston Consols Extended leases ...	...	...	26,271·00	13,060·56	...	...	...	327,926·22	178,584·87	...	...	...
Do. ...	1461N ...	Ingliston Extended ...	...	...	84·00	40·09	...	...	...	134·50	171·01	...	...	...
Do. ...	555N, (1239N) ...	(Ingliston leases) ...	...	...	15·00	12·53	...	...	...	21,324·85	19,947·12	...	...	...
Do. ...	1489N ...	Ingliston G.M. Co., N.L. ...	...	...	65·00	179·89	...	...	...	65·00	179·89	...	...	...
Do. ...	533N ...	Marmont ...	...	...	70·75	136·62	...	...	...	54,838·85	39,406·83	...	...	...
Do. ...	580N ...	(Marmont Extended) ...	...	...	...	...	...	...	...	43·00	38·03	...	...	...
Do. ...	580N, 888N ...	Marmont Extended leases ...	...	...	...	...	...	...	...	152·00	129·61	...	...	...
Do. ...	597N, (915N), (1041N), (1365N)	(New Commodore G.M. Co., N.L.) ...	...	...	...	...	...	...	...	127·10	76·78	...	...	...
Do. ...	(1517N) ...	Sinn Fein ...	...	...	95·00	51·21	...	...	...	95·00	51·21	...	...	...
Do. ...	...	Voided leases ...	...	...	...	...	...	3·88	465·44	284,246·70	142,159·69	2,451·42	...	...
Do. ...	...	Sundry claims ...	2·23	...	961·75	443·41	...	184·72	184·34	6,903·45	3,280·59	...	...	...
Mistletoe ...	(1514N) ...	Easingwold ...	...	...	...	...	...	4·15	...	...	...	...	...	...
Do. ...	1502N ...	Munarra ...	...	580·18	...	...	...	...	580·18	...	...	...	...	...
Do. ...	...	Sundry claims ...	16·94	12·30	...	...	...	93·09	63·65	...	...	...	...	...
Munara Gully ...	...	Voided leases ...	...	...	...	...	...	...	...	13,167·75	6,489·65	...	...	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	11·62	90·50	66·31	...	...	...
Nannine ...	166N ...	Nannine ...	...	...	...	112·12	...	...	218·15	214·00	630·52	...	...	...
Do. ...	(16N), (25N), 166N	(Nannine leases) ...	...	...	...	...	...	...	8·71	23,649·60	24,385·66	127·60	...	...
Do. ...	...	Voided leases ...	...	...	...	...	...	34·02	372·54	68,097·02	43,048·73	39·85	...	...
Do. ...	...	Sundry claims ...	...	3·60	55·25	52·31	...	21·29	414·92	2,442·45	1,959·14	...	...	...
Quinn's ...	...	Voided leases ...	...	...	...	...	...	7·30	1,186·50	18,931·16	8,886·79	90·70	...	...
Do. ...	...	Sundry claims ...	4·37	...	...	...	...	6·62	1,103·07	1,671·50	1,281·62	...	...	...
Ruby Well ...	...	Voided leases ...	...	...	...	...	...	...	...	7,443·00	3,988·36	...	...	...
Do. ...	...	Sundry claims ...	232·36	137·77	...	...	...	342·01	360·89	261·00	341·66	...	...	...

Stake Well ...	...	Voided leases ...	...	...	...	...	...	...	200.12	21,362.00	9,566.18	...
Do. ...	...	Sundry claims	...	...	...	27.00	32.31	...	31.79	260.50	289.51	...
Star of the East	...	Voided leases ...	...	...	...	...	...	...	...	27,244.00	20,305.40	...
Do. ...	...	Sundry claims	...	...	...	...	...	...	...	127.62	94.97	...
Yaloginda ...	(1470x)	Sirdar ...	...	...	...	...	...	...	...	32.00	6.62	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	1,591.82	25,744.02	13,249.73	8.68
Do. ...	...	Sundry claims	...	...	...	...	7.96	10.89	536.58	1,978.17	1,682.83	...
<i>From District generally:—</i>												
Sundry Parcels treated at:												
Ruby Well Battery ... 699.32												
State Battery, Meekatharra ... 14.00 11,073.16 19.00												
State Battery, Quinn's ... 618.79												
Tumbulgum Sands Syndicate Works ... 174.90												
Various Works ... 172.75 4,475.42 342.17												
Reported by Banks and Gold Dealers ... 8.12 ... 9,839.90 13.79												
Total ...			400.95	733.85	35,184.75	19,221.11	...	10,986.76	12,878.17	1,435,871.99	969,589.96	5,028.90

DAY DAWN DISTRICT.

Day Dawn ...	(555D)	Day Dawn, South	...	...	...	...	...	...	...	161.75	114.64	...
Do. ...	569D	Fingall South	...	...	...	171.00	133.96	...	...	171.00	133.96	...
Do. ...	557D	Great Fingall No. 2	...	...	...	210.00	105.75	...	...	266.00	227.09	...
Do. ...	1D, (2D), (86D), (87D), (99D), (119D), (129D), (158D), (159D), 170D, (185D), (191D), (209D), 210D, (211D), (212D), (213D), (224D), (225D), (249D), (424D), (453D), (455D), (467D)	Great Fingall Consolidated, Ltd.	...	...	...	173.00	151.93	...	...	1,865,432.35	1,185,313.15	169,210.20
Do. ...	(560D)	North Fingall	...	...	...	...	...	...	...	105.50	40.03	...
Do. ...	...	Voided leases	...	...	...	...	...	126.30	511.03	45,291.38	30,819.67	...
Do. ...	...	Sundry claims	...	...	19.87	324.50	116.80	19.87	259.13	3,204.58	2,236.63	24
Jasper Hill ...	553D	Neptune	...	...	...	500.00	140.44	...	...	500.00	140.44	...
Do. ...	...	Voided leases	...	...	...	...	...	4.90	1,210.23	15,350.75	9,133.56	...
Do. ...	...	Sundry claims	...	...	4.10	5.50	13.09	...	401.27	358.50	468.44	...
Lake Austin (Island) ...	568D	Boomerang	...	...	23.37	5.50	36.40	...	...	23.37	5.50	36.40
Do. ...	536D	Eureka	...	...	...	...	...	...	1,271.01	57.25	892.61	...
Do. ...	556D	Eureka North	...	...	...	54.25	19.06	...	...	133.25	38.37	...
Do. ...	...	Voided leases	...	...	...	...	...	590.52	1,568.02	29,774.37	45,386.70	...
Do. ...	...	Sundry claims	...	6.65	46.37	123.50	33.00	24.39	567.57	863.64	510.85	...
Mainland ...	...	Voided leases	...	...	...	...	...	...	...	2,706.26	7,272.13	23,129.51
Do. ...	...	Sundry claims	...	...	...	...	...	3.24	677.12	103.95	164.86	...
<i>From District generally:—</i>												
Sundry Parcels treated at:												
Various Works ... 16.61 940.75 1,537.30												
Reported by Banks and Gold Dealers ... 3.48 ... 77												
Total ...			26.52	73.84	1,567.25	750.43	...	2,346.49	9,215.10	1,969,992.65	1,300,324.98	169,210.44

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

MURCHISON GOLDFIELD—continued.

MOUNT MAGNET DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Lennonville ...	964M ...	(Empress) ...	...	...	...	...	...	1,649.00	7,361.81	...
Do. ...	964M ...	Empress ...	...	...	25.00	139.21	...	75.00	252.19	...
Do. ...	964M, (1078M) ...	(Empress leases) ...	...	...	...	...	...	4,813.00	3,171.33	...
	(1079M, (1115M), (1116M), (1117M))											
Do. ...	1197M ...	Galtee-Moore ...	...	...	607.50	246.19	...	1,274.50	549.78	...
Do. ...	(1204M) ...	Three Eights ...	...	...	7.50	15.79	...	7.50	15.79	...
Do. ...	...	Voided leases ...	...	...	...	...	3,196.79	133,616.23	112,658.54	458.82
Do. ...	...	Sundry claims ...	6.40	4.27	...	...	13.51	98.01	2,226.42	...
Mt. Magnet ...	1156M ...	Leap Year ...	...	...	106.00	73.07	...	1,327.75	1,032.83	...
Do. ...	(1195M) ...	Lone Hand ...	...	...	9.00	22.86	...	49.00	351.73	...
Do. ...	1013M ...	Mars ...	...	...	...	...	...	8,078.15	2,040.25	...
Do. ...	(1205M) ...	Mercury ...	...	...	24.00	3.40	...	24.00	3.40	...
Do. ...	1200M ...	Morning Star ...	...	...	74.50	51.97	...	200.75	127.39	...
Do. ...	1183M ...	Mount Zion ...	...	...	141.45	50.61	...	5,048.45	1,384.59	...
Do. ...	1201M ...	Neptune ...	...	...	119.25	149.88	...	119.25	149.88	...
Do. ...	1075M ...	New Havelock ...	...	...	360.00	88.70	...	15.77	1,921.00	872.20
Do. ...	(1190M) ...	Patagonia ...	...	...	...	...	...	102.50	19.25	...
Do. ...	(1202M) ...	Ready Money ...	...	...	...	...	25.61	...	...	...
Do. ...	1209M ...	Royal Consols ...	...	...	66.50	15.24	...	66.50	15.24	...
Do. ...	(1199M) ...	Saturn ...	...	...	...	...	1.10	104.00	36.99	...
Do. ...	1193M ...	Tame Cat ...	...	...	...	...	...	107.50	304.98	...
Do. ...	...	Voided leases ...	...	...	...	...	27.83	8,382.48	354,563.26	204,652.31
Do. ...	...	Sundry claims ...	...	10.28	633.25	265.93	1.82	1,191.40	21,315.72	12,676.42
Mt. Magnet, East	...	Voided leases ...	...	...	...	...	63.29	764.53	5,522.28	2,811.75
Do. ...	...	Sundry claims ...	...	...	...	...	...	37.22	214.50	144.10
Moyagee ...	1099M ...	Moyagee ...	...	...	195.50	164.43	...	...	2,497.00	4,247.23
Do. ...	...	Voided leases ...	...	...	...	...	...	5.08	2,053.15	2,416.74
Do. ...	...	Sundry claims ...	...	...	3.50	5.49	...	111.10	644.23	712.97
Paynesville ...	1196M ...	Elsie ...	...	200.54	...	...	...	358.89	10	18.13
Do. ...	1210M ...	L.P.S. ...	...	25.99	75	13.07	...	25.99	75	13.07	
Do. ...	...	Voided leases ...	...	...	...	...	...	152.90	19.75	26.62
Do. ...	...	Sundry claims ...	...	10.02	07	24.10	...	199.01	27.82	662.19
Youanmi ...	...	Sundry claims ...	...	...	...	...	...	...	33.00	44.58

From District generally :-

Sundry Parcels treated at:

Fremantle Trading Co., Ltd., Works ... ..	...	...	...	...	...	...	...	...	143.80	...
Long Reef Cyanide Works ... ..	...	...	...	69.30	...	...	...	...	69.30	...
Morning Star Battery ... ..	...	...	...	...	...	...	...	...	874.80	...
State Battery, Boogardie ... ..	...	...	...	...	...	...	92.51	15,747.31	...	...
Various Works ... ..	...	...	...	...	...	...	43.06	15,828.72	1.00	...
Reported by Banks and Gold Dealers	19.00	...	...	...	...	1,695.81	.35	...	...	...
Total	25.40	251.10	2,373.77	1,399.24	...	1,802.26	14,566.23	547,857.63	393,664.63	1,174.18

Yalgoo Goldfield.

Adavale ... ..	...	Sundry claims ... ..	...	...	...	...	...	10.00	12.56	...
Bilbertha ... ..	...	Voided leases ... ..	...	...	...	...	...	554.00	200.07	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	2.90	...	...	...
Carlaminda ... ..	...	Voided leases ... ..	...	...	...	...	...	947.32	524.72	3.30
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	114.00	71.96	...
Field's Find... 907 ... ..	...	Brown's Reward ... ..	...	763.75	440.23	...	...	1,073.25	1,301.42	...
Do. ... 902 ... ..	...	Field's Find Extended ... ..	...	...	...	...	10.38	8.00	23.74	...
Do. ... 968 ... ..	...	Hayes Gold Mine	5.08	32.00	22.95	...	5.08	32.00	22.95	...
Do. ... (922) ... ..	...	Sunflower ... ..	...	7.75	3.67	...	...	7.75	3.67	...
Do. ... ..	...	Voided leases ... ..	...	...	...	...	...	204.26	36,161.30	26,799.16
Do. ... ..	...	Sundry claims ... ..	...	14.75	6.97	...	5.77	163.59	448.00	457.66
Goodingnow... 919 ... ..	...	Blue Bell ... ..	...	175.00	206.88	...	...	251.50	279.10	...
Do. ... 878 ... ..	...	Carnation ... ..	...	43.00	29.45	...	...	2,769.00	4,562.80	...
Do. ... 606 ... ..	...	(Lake View) ... ..	...	...	...	...	...	163.00	185.46	...
Do. ... 606 ... ..	...	Lake View: Payne's Find Develop- ment Co., N.L. ... ..	...	276.00	348.42	...	15.58	9,530.00	9,640.97	...
Do. ... (613) ... ..	...	Orchid ... ..	...	162.50	163.20	...	...	3,435.75	5,411.08	...
Do. ... 849 ... ..	...	Princess Mary ... ..	...	25.50	18.26	...	...	397.50	384.15	...
Do. ... (607) ... ..	...	Sweet William ... ..	...	134.50	189.86	...	75.56	2,155.50	2,693.15	...
Do. ... (607) ... ..	...	(Sweet William) ... ..	...	...	...	...	2.16	4.85	81.59	...
Do. ... (607), (608), (662) ... ..	...	(Sweet William Consolidated Mines, N.L.) ... ..	...	...	...	...	7.68	907.46	1,564.84	...
Do. ... ..	...	Voided leases ... ..	...	...	...	146.70	171.75	7,789.50	7,554.68	...
Do. ... ..	...	Sundry claims ... ..	...	86.00	38.82	148.00	80.76	3,033.50	1,674.34	...
Gullewa ... 972 ... ..	...	Joyce Jenkins	78	18.00	9.16	...	78	18.00	9.16	...
Do. ... ..	...	Voided leases ... ..	...	...	...	...	...	23,056.50	15,128.82	...
Do. ... ..	...	Sundry claims ... ..	...	27.00	9.00	...	14.76	690.00	565.54	...
Kurkalucka ... ..	...	Sundry claims ... ..	...	...	...	...	...	8.80	4.01	...
Messenger's Patch 952 ... ..	...	Golden Monarch ... ..	...	4.50	.81	...	...	4.50	.81	...
Do. ... 880 ... ..	...	(Gnow's Nest) ... ..	...	...	...	...	...	10,938.00	9,827.20	158.06
Do. ... 880, 897 ... ..	...	Gnows Nest Gold Mine, Ltd. ... ..	...	3,073.00	2,707.59	164.83	...	3,073.00	2,707.59	164.83
Do. ... (912) ... ..	...	Monte Cristo ... ..	...	...	...	...	5.37	.06	76.40	...
Do. ... ..	...	Voided leases ... ..	...	...	...	...	315.99	587.20	305.89	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	463.12	315.11	438.55	280.85	...
Mt. Farmer ... ..	...	Voided leases ... ..	...	...	...	...	...	64.00	40.19	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	5.00	6.22	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

YALGOO GOLDFIELD—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Mt. Gibson ...	(722), (723)	Golden Harp leases ...	...	...	...	...	...	...	6.44	287.50	732.58	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	147.00	70.99	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	76.00	40.84	...
Ninghan ...	...	Voided leases ...	...	...	...	...	...	...	...	10.00	1.41	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	5.00	17.89	...
Noongal ...	953	Revival ...	...	...	430.00	192.15	...	...	...	477.00	219.52	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	15.86	3,086.95	1,847.66	...
Do. ...	...	Sundry claims ...	...	...	38.00	20.70	...	11.55	64.97	331.75	227.20	...
Nyounda ...	...	Voided leases ...	...	...	...	...	...	...	217.63	416.00	183.91	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	4.28	18.00	21.67	...
Pinyalling ...	...	Voided leases ...	...	...	...	...	...	...	1.36	2,281.60	902.03	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	2.59	160.50	132.57	...
Rothsay ...	(921)	O.K. ...	...	...	156.50	85.63	...	...	...	156.50	85.63	...
Do. ...	(894)	Rothsay ...	...	...	23.00	18.10	...	...	...	103.00	100.66	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	8,971.00	3,331.15	...
Do. ...	...	Sundry claims ...	...	...	152.50	89.89	...	...	...	192.00	123.62	...
Wodgingarra... Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	541.61	600.91	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	71.50	38.21	...
Warda Warra ...	970	Warda Central ...	...	...	15.50	14.88	...	...	...	15.50	14.88	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	10.00	25.54	...
Warriedar ...	961	Highland Chief ...	...	...	130.50	44.49	...	...	...	159.25	69.69	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	11,899.75	4,219.12	7.30
Do. ...	...	Sundry claims ...	...	1.04	438.60	158.42	...	...	2.84	1,276.85	553.42	...
Yalgoo ...	...	Voided leases ...	...	...	...	...	...	...	3.23	6,314.50	9,965.18	...
Do. ...	...	Sundry claims ...	...	97	...	...	...	...	18.74	850.50	513.97	...
Yuin ...	712, (735)	(Bullrush Gold Estates, N.L.) ...	...	...	...	...	...	...	...	23,690.00	7,302.83	130.13
Do. ...	712	Royal Standard: Bullrush Gold Es- tates, N.L.	...	...	4,733.00	2,208.56	...	...	...	10,977.00	4,928.21	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	127.12	31,381.50	14,957.04	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	4.70	279.50	59.20	...

From Goldfield generally :-

Sundry Parcels treated at:

Field's Find Extended Treatment Works	...	...	...	...	...	...	...	...	152.40	...
Godingnow (Payne's Find) State Battery	...	...	...	32.80	...	...	...	38.50	1,856.43	...
State Battery, Warriedar	...	...	...	638.92	...	...	...	...	3,187.19	...
Youanmi G. Ms., Ltd. Works (Warriedar Options)	...	...	...	...	...	...	...	...	310.93	26.67
Various Works	...	...	...	...	...	9.42	...	664.00	1,332.45	...
Reported by Banks and Gold Dealers	5.77	...	...	...	...	790.34	...	...	...	...
Total	5.77	7.87	10,960.85	7,699.81	164.83	1,574.90	1,861.47	213,566.55	150,529.68	490.29

Mount Margaret Goldfield.

MOUNT MORGANS DISTRICT.

Australia	...	Voided leases	...	...	...	...	...	1,911.63	15,913.69	23,305.76	1.76
United	...	Sundry claims	...	...	...	...	...	580.98	799.25	2,072.62	...
Do.	...	Sundry claims	...	...	...	...	...	...	11.00	5.40	...
Eucalyptus	...	Sundry claims	...	...	...	...	...	...	1,248.50	1,782.71	...
Federation Well	...	Voided leases	...	...	...	...	...	...	108.07	64.68	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	...
Korong	...	Voided leases	...	...	...	...	17.95	72.23	2,722.00	3,473.45	...
Do.	...	Sundry claims	...	...	...	...	...	34.97	279.28	232.89	...
Linden	344F, [998R]	Bindah	...	...	104.85	...	...	...	24,202.00	8,930.74	...
Do.	340F, [871R]	Democrat	...	...	66.00	221.46	...	...	736.50	1,357.69	...
Do.	346F, [1024R]	Great Carbine	...	...	62.50	7.58	...	...	136.50	41.07	...
Do.	(379F)	Old Kelly	...	...	26.00	14.54	...	...	156.00	265.21	...
Do.	341F, [903R], 343F, [985R]	Torquay leases	...	...	688.10	615.93	...	...	4,878.87	3,018.45	68
Do.	...	Voided leases	...	...	...	...	...	...	1,000.25	764.37	...
Do.	...	Sundry claims	...	...	84.00	54.75	...	...	1,045.75	718.88	...
Mt. Margaret	...	Voided leases	...	...	...	...	...	...	6,412.89	4,290.53	12.55
Do.	...	Sundry claims	...	...	60	4.35	...	16.61	366.10	289.21	...
Mt. Morgans...	6F	(Lilly of the Valley South: Westralia Mt. Morgans G.M. Co., Ltd.)	...	...	...	...	...	...	1,587.50	808.18	...
Do.	6F	(Lilly of the Valley South: Westralia Mt. Morgans Syndicate, Ltd.)	...	...	...	...	...	...	3,002.00	1,022.90	...
Do.	5F, (10F), (19F), (22F), (32F), (73F)	(Westralia Mt. Morgans G.M. Co., Ltd.)	...	...	...	...	...	...	575,148.00	294,758.28	5,552.63
Do.	7F, (20F), (21F)	(Westralia Mt. Morgans G.M. Co., Ltd.)	...	...	...	...	...	...	18,261.00	8,127.69	...
Do.	5F, 6F, 7F, (10F), (19F), (20F), (22F), (32F), 301F	Westralia Mt. Morgans Mines, N.L.	...	...	9,930.00	3,629.86	...	...	148,303.82	39,637.39	...
Do.	...	Voided leases	...	...	...	...	...	76.56	34,334.25	20,938.55	77.86
Do.	...	Sundry claims	...	...	20.19	73.98	...	6.61	22.66	1,382.29	1,693.47
Murrin Murrin	(372F)	Murrin Queen: Murrin Prop. G.M. Co., N.L.	...	...	...	...	...	...	1,323.50	547.80	...
Do.	...	Voided leases	...	...	...	...	...	10.43	222.93	127,382.72	100,615.29
Do.	...	Sundry claims	...	...	54.00	40.70	...	...	237.80	1,492.55	1,618.35
Redcastle	...	Voided leases	...	...	...	...	...	4.49	436.54	2,509.95	2,149.63
Do.	...	Sundry claims	...	...	...	...	...	...	103.58	139.00	163.01

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

MT. MARGARET GOLDFIELD—continued.

MT. MORGANS DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Yundamindera	357F	Big Stone ... ..	...	...	755.00	770.29	...	...	...	2,035.50	1,543.58	...
Do. ...	369F	Mahalah ... ..	...	...	...	...	...	...	...	58.50	7.56	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	...	...	333.50	348.41	...
Do. ...	...	Sundry claims ... ..	...	...	38.00	18.09	...	...	2.35	787.60	491.70	...
	<i>From District generally:—</i>											
	Sundry Parcels treated at:											
		Battlesville Battery ... ..	...	...	...	...	...	...	...	126.00	370.00	15.94
		Hainault Sulphide Plant, Kalgoorlie ... ..	...	...	...	...	...	...	...	127.21	83.91	...
		Mt. Morveh Cyanide Works ... ..	...	...	...	...	...	...	...	...	129.48	...
		State Battery, Linden ... ..	...	...	...	...	...	...	...	10.00	1,367.08	...
		Westralia-Mt. Morgans Works ... ..	...	...	...	...	...	...	...	...	153.10	...
		Various Works ... ..	...	...	...	...	...	...	...	788.50	3,010.07	84.03
		Reported by Banks and Gold Dealers ... ..	...	...	...	...	...	1,699.37	32.47	...	...	...
		Total ... ..	...	...	11,724.39	5,556.38	...	1,755.83	3,796.75	979,150.04	530,219.09	5,775.05

MOUNT MALCOLM DISTRICT.

Cardinia ...	1532c	Contact ... ..	...	10.70	...	...	...	11.99	19.51	2.50	50.37	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	...	1,568.29	1,628.24	3,550.42	...
Do. ...	...	Sundry claims ... ..	...	...	...	...	...	...	22.37	23.00	59.04	...
Diorite King...	(1545c)	Diorite King ... ..	...	...	...	...	...	...	...	71.00	102.67	...
Do. ...	1546c	Unexpected ... ..	...	15.04	117.50	179.34	...	...	15.04	117.50	179.34	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	...	819.15	34,470.53	31,460.33	24.05
Do. ...	...	Sundry claims ... ..	...	...	8.00	11.53	...	1.40	131.02	2,655.80	3,177.94	...
Dodger's Well	...	Voided leases ... ..	...	...	...	...	...	...	57.90	1,299.30	1,927.94	...
Do. ...	...	Sundry claims ... ..	...	...	...	...	...	...	3.37	798.75	665.13	...
Lake Darlot ...	1515c, [1210EM]...	New Discovery ... ..	...	...	214.00	39.31	...	...	...	214.00	39.31	...
Do. ...	1515c, [1207EM],	(New Discovery leases) ... ..	...	...	177.00	137.79	...	...	...	825.11	401.37	...
Do. ...	(1516c), ([1210EM])	Sundry claims ... ..	...	...	425.95	55.89	...	...	5.52	579.20	144.01	...
Leonora ...	198c	(Eastern) ... ..	...	...	...	...	...	...	...	302.00	321.72	...
Do. ...	1530c	Leonora Gold Blocks ... ..	...	...	103.50	79.05	...	...	5.15	452.50	447.04	...
Do. ...	1548c	Ping Pong ... ..	...	...	26.00	13.10	...	...	...	26.00	13.10	...

Do.	190c, 198c, 207c, 352c, 353c, 380c, 446c, 447c, (450c), (476c), 489c, 490c, 504c, (523c), 741c, 742c, 807c, 809c, 811c, 812c, (813c), (814c), 980c, (981c) 1082c, (1225c), (1226c), (1227c), (1228c), (1229c), (1230c), (1231c), (1232c), 1259c, (1291c), (1292c), 1341c, 1342c, (1343c), (1344c), (1345c), (1346c), (1347c)	Sons of Gwalia, Ltd. ...	...	...	13,281·00	18,533·12	1,925·95	...	...	2,695,994·67	1,285,595·96	79,254·07
Do.	198c, 1082c	(Sons of Gwalia South G.M. Co., N.L.)	...	...	...	...	...	...	...	631·00	903·61	...
Do.	198c, 1082c, (1257c), (1258c), 1259c, (1284c), (1285c), (1300c), (1301c)	(Sons of Gwalia South G.M.s., Ltd.) ...	...	...	...	...	...	...	...	98,239·00	51,593·99	8·66
Do.	198c, 1082c, 1259c	(Sons of Gwalia South G.M.s., Ltd.) ...	...	...	...	...	...	...	...	9,909·00	3,169·89	...
Do.	263c	(Trump) ...	...	...	...	...	...	...	...	562·50	2,393·40	...
Do.	263c	Trump: Gwalia Central G.M.s, Ltd.	...	...	...	61·29	...	...	...	1,541·00	3,220·24	...
Do.	263c, (774c), (793c)	(Trump leases) ...	...	...	...	...	...	...	...	21,794·45	16,002·07	...
Do.	...	Voided leases ...	...	...	...	...	...	...	1,847·42	138,291·75	65,756·85	10·71
Do.	...	Sundry claims ...	10·51	...	102·00	132·71	...	17·10	319·42	10,418·55	9,148·34	...
Mt. Malcolm...	...	Voided leases ...	...	...	...	...	...	...	47·07	62,301·78	47,425·54	...
Do.	...	Sundry claims ...	...	...	...	4·49	...	5·75	26·50	3,060·90	2,116·50	...
Mertondale ...	...	Voided leases ...	...	...	...	...	...	...	...	88,663·00	60,840·00	1,497·58
Do.	...	Sundry claims ...	...	...	...	...	...	1·45	63·04	1,092·46	1,538·97	...
Mt. Clifford ...	1544c	Bannockburn ...	...	...	46·00	27·60	...	...	...	75·50	265·58	...
Do.	1329c	Victory No. 1 ...	...	...	210·00	80·33	...	...	249·29	1,814·46	7,417·67	...
Do.	...	Voided leases ...	...	...	...	...	...	...	1,364·45	3,274·00	7,060·57	...
Do.	...	Sundry claims ...	11·26	...	14·00	12·18	...	13·21	268·03	1,020·50	1,613·62	...
Pig Well ...	1547c	Starlight ...	...	...	10·00	1·80	...	...	...	10·00	1·80	...
Do.	...	Voided leases ...	...	...	...	...	...	...	...	13,575·32	14,673·13	63·68
Do.	...	Sundry claims ...	...	...	...	...	...	...	34·61	2,738·40	1,160·33	...
Randwick ...	...	Voided leases ...	...	...	...	...	...	...	239·49	8,065·15	8,671·57	...
Do.	...	Sundry claims ...	...	...	...	...	...	66·57	159·37	1,282·14	944·20	...
Webster's Find	...	Voided leases ...	...	...	...	...	...	30·30	...	21,760·00	13,970·17	...
Do.	...	Sundry claims ...	...	...	...	...	...	36·37	15·73	1,397·80	939·58	...
Wilson's Creek	...	Voided leases ...	...	...	...	...	...	...	...	333·50	168·27	...
Do.	...	Sundry claims ...	...	...	...	...	...	...	4·24	5·00	19·04	...
Wilson's Patch	...	Voided leases ...	...	...	...	...	...	...	99·38	27,395·10	12,638·18	1·05
Do.	...	Sundry claims ...	...	...	...	...	...	...	1·50	814·00	1,086·36	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued

MT. MARGARET GOLDFIELD—continued.

MOUNT MALCOLM DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
<i>From District generally:—</i>												
Sundry Parcels treated at:												
		Fremantle Trading Company's Works ...	...	...	...	...	...	...	...	...	1.42	...
		State Battery, Leonora ...	...	...	...	884.10	...	...	...	95.50	11,254.44	98.14
		Various Works ...	...	...	...	...	...	...	...	371.50	7,149.72	20.12
		Reported by Banks and Gold Dealers ...	...	...	...	...	...	2,483.14	131.00	...	...	...
		Total ...	10.51	37.00	14,734.95	20,253.63	1,925.95	2,667.28	7,517.86	3,259,993.36	1,681,280.74	80,978.06

MOUNT MARGARET DISTRICT.

Burtville ...	2095r	Bell ...	...	...	...	...	...	...	...	12.00	12.15	...
Do. ...	(2123r)	Bond ...	...	...	...	...	...	...	...	507.50	877.00	...
Do. ...	(2139r)	Mikado ...	...	...	...	83.30	...	...	...	...	255.91	...
Do. ...	2138r	Nil Desperandum ...	...	...	70.50	196.34	...	...	...	196.00	1,065.36	...
Do. ...		Voided leases ...	...	...	...	...	2.29	413.80	66,281.68	102,790.13	275.27	...
Do. ...		Sundry claims ...	...	...	25.00	19.86	...	122.10	3,231.90	2,926.62	...	...
Duketon ...	(2114r)	Hematite ...	...	...	...	...	...	286.91	22.00	118.97	...	...
Do. ...		Voided leases ...	...	...	...	...	3.54	2,926.30	31,463.42	22,199.24	...	...
Do. ...		Sundry claims ...	...	...	...	75	...	65.43	238.50	367.12	...	...
Eagle's Nest... Do. ...		Voided leases ...	...	...	...	...	...	145.34	331.00	1,215.78	...	...
Do. ...		Sundry claims ...	21.96	29.00	16.99	...	4.00	332.54	139.50	126.41	...	...
Erlistoun ...	2113r	Baneygo North ...	...	...	36.00	14.42	...	...	...	587.00	182.55	...
Do. ...		Voided leases ...	...	...	...	...	...	11.66	27,012.07	18,461.35	...	...
Do. ...		Sundry claims ...	...	...	...	...	1,179.43	116.81	2,121.24	1,840.43	...	...
Euro ...		Voided leases ...	...	...	...	...	...	65.14	91,556.25	37,582.89	...	...
Do. ...		Sundry claims ...	...	...	...	68.49	...	46.52	259.50	344.56	...	...
Laverton ...	2083r	Beria Main Reef ...	...	...	48.00	10.60	...	...	...	1,159.50	171.68	...
Do. ...	715r, 806r, (1206r), (1207r), (1483r), (1523r), (1524r), (1525r), (1542r), (1544r), (1548r)	(Kalgoorlie and Boulder Firewood Co., Ltd.)	...	...	...	...	...	...	...	71,802.00	25,003.11	3,364.01
Do. ...	715r, 806r, (1206r), (1207r), (1483r), (1523r), (1524r), (1525r), (1542r), (1544r), (1548r)	(Lancefield G.M. Co., Ltd.)	...	...	...	...	...	...	102,179.78	39,402.81	...	...

Do.	715r	806r,	(Lancefield G.M. Co., Ltd.)	...	...	...	...	...	...	...	153,829.00	58,842.47	5,824.39
	(1206r),	(1207r),												
	(1483r),	(1523r),												
	(1524r),	(1525r),												
	(1542r),	(1544r),												
	(1548r)													
Do.	715r,	806r,	(Lancefield G.M. Co., Ltd.)	...	...	...	...	...	...	...	260,749.00	103,535.54	21,612.29
	(1206r),	(1207r),												
	(1483r),	(1523r),												
	(1524r),	(1525r),												
	(1542r),	(1544r),												
	(1548r)													
Do.	715r,	806r,	Lancefield Gold Mines, Ltd.	...	...	49.51	346.09	...	...	...	352,726.52	127,521.72	21,012.88
	(1206r),	(1523r),												
	(1524r),	(1525r),												
	(1542r),	(2050r),												
	(2051r)													
Do.	(2146r)	...	Lincolnshire Lass	...	...	10.00	11.91	...	...	...	48.00	77.07	...
Do.	(2142r)	...	Pinnacles	...	...	...	...	...	...	...	252.25	71.63	...
Do.	...	...	Voided leases	...	...	...	...	...	17.66	2,024.11	455,759.99	260,526.29	4,674.69
Do.	...	...	Sundry claims	...	9.21	35.37	60.97	77.77	...	204.58	1,393.91	4,973.84	4,689.83
Mt. Barnicoat	...	...	Voided leases	...	...	...	...	...	...	...	652.00	359.12	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	23.00	23.37	...
Quartz Hill	...	...	Voided leases	...	...	...	...	...	...	...	10.00	3.86	...
Red Hill	...	...	Sundry claims	...	...	...	...	...	...	...	27.00	13.76	...
<i>From District generally:—</i>														
Sundry Parcels treated at:														
			Brown Hill Consols Works, Kalgoorlie	...	...	...	...	...	...	...	...	13.70	...
			Mulga Queen Works	...	...	...	...	...	...	...	6.00	181.20	...
			State Battery, Laverton	...	...	...	105.84	...	...	...	77.50	2,429.92	...
			Various Works	...	...	...	...	...	...	...	151.00	9,603.44	...
			Reported by Banks and Gold Dealers	...	...	...	...	...	2,022.58	...	...	...	...
Total				...	9.21	57.33	328.98	952.36	...	3,434.08	7,950.57	1,628,385.94	822,836.99	56,763.53

North Coolgardie Goldfield.
MENZIES DISTRICT.

Comet Vale	5217z	...	(Gladstone)	...	...	...	...	...	...	...	10,879.50	8,678.16	95.29
Do.	5217z,	5333z,	Gladstone leases	...	...	...	1,301.36	...	...	...	64,875.00	49,536.57	1,410.36
	(5380z)												
Do.	5410z	...	Lake View	...	3.38	...	...	...	10.04	...	745.75	225.25	...
Do.	...	...	Voided leases	...	...	...	...	...	409.70	...	147,111.07	119,022.33	3,839.28
Do.	...	...	Sundry claims	...	...	...	...	...	34.99	...	727.40	541.59	...
Goongarrie	...	...	Voided leases	...	...	...	...	...	...	...	1,027.51	27,198.29	17,428.84
Do.	...	...	Sundry claims	...	79.69	57.67	81.00	...	33.72	589.57	1,200.27	1,367.93	...
Menzies	5423z	...	Lady Shenton	...	...	78.50	77.31	...	...	...	5,256.58	4,185.99	...
Do.	4931z,	4934z,	Menzies Consolidated G.Ms., Ltd.	...	...	16,291.00	7,947.81	...	...	...	501,038.00	263,000.92	78.67
	4935z,	4936z,											
	5074z,	5075z,											
	5260z,	5261z,											
	5315z												

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

NORTH COOLGARDIE GOLDFIELD—continued.

MENZIES DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Menzies ...	5484z ...	Warrior ...	...	...	188·00	107·11	...	...	...	357·00	232·75	...
Do. ...	...	Voided leases ...	...	...	...	...	...	45·42	1,049·04	373,305·96	423,936·52	11,263·06
Do. ...	...	Sundry claims ...	4·59	...	430·10	336·94	...	11·28	361·33	19,333·66	13,890·13	776·49
Mt. Ida ...	5467z ...	Forest Belle ...	...	...	253·00	98·15	...	...	...	1,318·00	984·49	...
Do. ...	5480z, 5481z ...	Unexpected leases ...	...	...	500·00	184·57	...	...	...	500·00	184·57	...
Do. ...	5481z ...	(Unexpected South) ...	...	...	...	...	...	...	...	36·00	29·45	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	77·07	56,564·37	67,244·74	106·63
Do. ...	...	Sundry claims ...	12·57	...	254·00	101·62	...	43·79	9·57	5,394·00	3,088·35	...
<i>From District generally:—</i>												
<i>Sundry Parcels treated at:</i>												
		Balkis Battery ...	...	...	...	...	...	...	...	65·75	4,648·28	...
		Boddington's Cyanide Works ...	...	...	...	473·25	...	...	...	...	1,069·35	...
		Crusoe Wedderburn Cyanide Works ...	...	...	...	...	...	...	...	...	1,497·89	...
		Fremantle Trading Co., Ltd., Works ...	...	...	...	...	...	...	...	...	212·98	...
		Gidney's Cyanide Works ...	...	...	...	...	...	...	...	...	906·97	585·27
		Lady Harriett Battery ...	...	...	...	205·49	...	...	...	279·50	3,868·35	30·00
		Menzies Mining and Exploration Corporation, Ltd., Works ...	...	...	...	...	...	...	...	639·50	732·04	...
		Mt. Ida State Battery ...	...	...	...	263·76	...	...	...	1,842·25	4,748·10	...
		Various Works ...	...	...	...	...	...	...	...	1,807·05	23,641·87	1,039·43
		Reported by Banks and Gold Dealers ...	...	...	...	...	...	968·65	195·48	...	...	...
		Total ...	17·16	83·07	18,052·27	11,178·37	...	1,103·80	3,764·30	1,220,474·90	1,014,904·41	19,224·48

ULARRING DISTRICT.

Davyhurst ...	...	Voided leases ...	...	...	...	...	...	2·93	138·99	155,644·73	123,063·43	5,403·14
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	30·12	5,972·15	3,194·28	...
Diemel's Find ...	...	Sundry claims ...	...	...	...	...	...	...	7·37	102·50	119·13	...
Mulline ...	(324v), (600v), (730v), (969v), (970v), (974v), (975v), (982v), (983v)	Riverina South G.M. Co., N.L. ...	...	...	...	...	...	...	...	8,397·25	7,445·18	528·04
Do. ...	(324v), (730v), (600v)	(Riverina South leases) ...	...	...	...	...	...	...	43·87	18,480·50	13,442·65	...

Do.	763v	...	Young Australian	...	...	...	...	...	...	...	601.25	733.86	...
Do.	763v	...	(Young Australian)	...	...	...	...	...	...	...	1,295.00	3,609.26	...
Do.	763v,	(938v),	(Young Australian leases)	...	...	...	...	...	...	...	2,672.25	5,763.88	...
	(939v)													
Do.	...	...	Voided leases	...	...	...	...	...	...	230.22	66,592.22	67,768.48	2.71
Do.	...	...	Sundry claims	...	...	6.29	88.25	91.47	...	41.82	7,107.32	5,018.65	.69
Mulwarrie	...	...	Voided leases	...	...	...	...	...	...	56.84	18,440.68	25,625.54	38.47
Do.	...	...	Sundry claims	...	...	...	...	...	...	21.45	2,099.07	1,888.49	...
Ularring	...	...	Voided leases	...	...	...	...	...	...	563.34	9,429.60	13,647.97	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	...	143.00	113.15	...
<i>From District generally:—</i>														
Sundry Parcels treated at:														
			Hannan's Central Battery, Kalgoorlie	...	...	...	...	...	...	...	18.40	4.66	...
			State Battery, Mulline	...	...	...	...	121.42	...	...	538.50	13,209.59	...
			State Battery, Mulwarrie	...	...	...	...	...	...	...	595.20	4,762.31	...
			Various Works	...	...	...	...	...	...	15.82	186.75	654.37	...
			Reported by Banks and Gold Dealers	...	...	...	...	...	19.24	.77	...	...	...
			Total	6.29	88.25	212.89	...	22.17	1,150.61	298,316.37	290,064.88	5,973.05

NIAGARA DISTRICT.

Desdemona	...	...	Voided leases	...	...	...	...	...	...	5.73	9,585.25	7,471.39	12.04
Do.	...	...	Sundry claims	...	...	...	...	...	...	8.99	1,331.70	634.19	...
Kookynie	780g	...	Cosmo	...	...	7.94	44.29	...	...	...	7.94	44.29	...
Do.	(779g)	...	Cosmo	...	6.96	13.63	23.21	...	...	6.96	88.13	59.30	...
Do.	757g	...	(Cosmopolitan, No. 2: Cosmopolitan Proprietary, Ltd.)	...	...	...	...	...	...	...	710.00	909.66	...
Do.	757g	...	Cosmopolitan, No. 2: Western Machinery Co., Ltd.	...	...	120.00	90.38	...	...	...	3,561.00	4,044.72	...
Do.	769g	...	(Two D's)	...	...	...	...	...	...	...	100.00	14.01	...
Do.	769g,	(770g),	Two D's leases	...	...	...	...	...	...	...	950.00	590.26	...
	(771g)													
Do.	...	...	Voided leases	...	...	...	...	...	...	257.33	729,921.81	383,551.35	5,375.97
Do.	...	...	Sundry claims	...	...	10.00	4.86	...	30.59	93.85	4,922.85	4,426.32	...
Niagara	...	...	Voided leases	...	...	...	...	...	...	104.54	84,472.50	51,887.97	...
Do.	...	...	Sundry claims	...	...	...	...	...	13.27	70.23	9,874.29	6,069.68	...
Tampa	...	...	Voided leases	...	...	...	...	...	...	28.60	49,271.87	22,173.80	174.24
Do.	...	...	Sundry claims	...	12.54	86.90	...	...	17.61	158.83	3,212.00	1,894.48	...
<i>From District generally:—</i>														
Sundry Parcels treated at:														
			Grafter Battery	...	...	...	...	...	...	...	98.00	448.91	...
			Hainault Sulphide Plant, Kalgoorlie	...	...	...	...	...	...	...	...	9.03	...
			Lubra Queen G.M. Co., N.L. Works	...	...	...	...	...	...	...	...	153.47	...
			State Battery, Niagara	...	...	...	...	...	...	...	671.50	8,945.91	...
			Various Works	...	...	...	...	...	...	...	451.00	6,356.43	41.17
			Reported by Banks and Gold Dealers	...	...	...	...	...	1,435.20	787.38	...	...	...
			Total	...	12.54	93.86	151.57	162.74	...	1,496.67	1,522.44	899,229.84	499,685.17	5,603.42

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued

NORTH COOLGARDIE GOLDFIELD—continued.

YERILLA DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Edjudina	(1060R)	Big Ben	...	...	17.00	10.59	...	...	...	120.00	73.52	...
Do.	1062R	Martin	...	...	38.50	32.22	...	...	...	65.00	54.34	...
Do.	1071R	Neta	...	...	...	...	...	...	...	156.75	102.56	...
Do.	(1010R), 1011R	(Neta leases)	...	...	...	...	...	...	...	407.00	340.01	...
Do.	...	Voided leases	...	...	...	...	...	...	18.44	32,083.20	41,658.25	37.79
Do.	...	Sundry claims	...	...	124.25	131.32	...	...	21.26	3,575.33	2,997.16	...
Eucalyptus	...	Voided leases	...	...	...	...	...	...	2,864.77	1,351.35	3,020.68	...
Do.	...	Sundry claims	...	...	...	...	...	...	367.50	362.50	381.82	...
Linden	998R, [344F]	Bindah	...	...	...	...	...	...	...	1,462.50	531.95	...
Do.	871R, [340F]	Democrat	...	...	...	...	...	9.01	...	2,245.25	5,026.30	...
Do.	1024R, [346F]	Great Carbine	...	...	...	...	...	...	...	67.75	20.30	...
Do.	903R, [341F] 985R [343F]	Torquay leases	...	...	...	...	...	...	...	325.68	107.45	...
Do.	903R, [341F] (904R), 985R [343F], (992R)	(Westralia United Goldfields Ltd.)	...	...	...	...	...	...	...	1,995.00	1,452.42	...
Do.	...	Voided leases	...	...	...	...	...	7.53	544.15	13,471.85	16,540.49	...
Do.	...	Sundry claims	...	...	...	...	...	77.81	35.11	6,493.25	4,798.42	...
Mt. Celia	...	Voided leases	...	...	...	...	...	...	...	14.00	5.39	...
Mt. Howe	...	Sundry claims	...	...	...	...	...	...	...	5.00	11.13	...
Mt. Remarkable	...	Voided leases	...	...	...	...	...	...	17.74	528.72	415.09	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	4.00	1.32	...
Pingin	...	Voided leases	...	...	...	...	...	...	46.99	14,637.80	10,306.68	...
Do.	...	Sundry claims	...	...	...	...	...	...	99.36	3,422.35	2,297.51	...
Yarri	(1058R)	Mt. Wallbrook Main Lode	...	...	...	...	...	...	...	116.00	73.06	...
Do.	1055R	Redbrook G.M.	...	...	184.00	153.78	...	...	...	607.25	412.92	...
Do.	...	Voided leases	...	...	...	...	...	6.30	87.08	36,822.75	19,124.10	2.00
Do.	...	Sundry claims	...	...	323.00	118.10	...	...	5.31	6,129.10	3,196.65	...
Yerilla	...	Voided leases	...	...	...	...	...	...	3,089.51	15,619.21	12,313.06	13.93
Do.	...	Sundry claims	...	...	...	...	...	19.30	15.88	2,401.00	1,338.07	...
Yilgangie	...	Voided leases	...	...	...	...	...	...	...	218.75	295.45	...
Do.	...	Sundry claims	...	...	...	...	...	121.67	29.83	25.50	46.17	...

Yundamindera	...	Voided leases	...	...	...	...	...	...	80.47	69,067.85	46,004.87	5.82
Do.	...	Sundry claims	...	...	...	...	...	...	85.22	3,151.25	2,740.75	...
<i>From District generally :-</i>												
Sundry Parcels treated at :												
		Battles Ville Battery	...	...	...	...	...	...	...	...	621.83	...
		Fremantle Trading Co., Ltd., Works	...	...	...	...	...	...	...	...	4.92	...
		Neta Battery	...	...	...	...	...	...	...	...	325.69	...
		State Battery, Linden	...	...	...	...	...	...	...	72.00	4,030.90	...
		State Battery, Yarri	...	...	...	...	...	...	...	231.50	4,412.89	3.50
		State Battery, Yerilla	...	...	...	...	...	2.17	...	72.00	1,257.22	...
		Various Works	...	...	...	...	...	...	...	786.35	5,277.20	...
		Reported by Banks and Gold Dealers	...	...	...	...	...	1,011.56	154.74	...	...	...
		Total	...	...	...	...	...	...	...	...	...	...
			...	...	686.75	446.01	...	1,246.34	7,572.37	218,114.79	191,618.54	63.04

Broad Arrow Goldfield.

Bardoc	1833w	Zoroastrian	...	...	5.00	15.43	...	...	23.25	22.45	106.77	...
Do.	...	Voided leases	...	...	...	...	...	...	1,863.68	73,236.55	51,823.64	203.60
Do.	...	Sundry claims	...	10.80	8.50	18.58	...	53.82	559.27	3,346.20	2,889.45	...
Black Flag	...	Voided leases	...	...	...	...	...	27.81	373.99	40,332.13	24,451.48	...
Do.	...	Sundry claims	...	17.68	8.85	...	...	704.19	180.49	2,181.08	2,063.02	...
Broad Arrow	(1900w)	Determination	...	...	...	...	...	...	26.79	72.00	253.91	...
Do.	1771w	North Duke	...	207.77	...	...	...	...	1,533.79	127.30	488.06	...
Do.	1799w	Oversight	...	...	116.65	141.86	...	...	1,214.31	912.65	2,269.49	...
Do.	1905w	Oversight South	...	...	11.50	18.88	...	...	...	19.40	36.24	...
Do.	1735w	Tara	...	9.43	62.60	57.40	...	...	3,174.28	571.50	1,623.03	...
Do.	...	Voided leases	...	...	...	...	...	54.85	2,313.89	117,765.21	97,605.59	15.85
Do.	...	Sundry claims	...	...	85.00	101.25	...	977.33	1,256.16	9,295.45	6,946.29	...
Canegrass	1895w	Diggers Luck	...	...	...	...	...	...	...	89.10	133.13	...
Do.	...	Sundry claims	...	116.48	...	...	...	...	116.48	...	...	...
Carnage	...	Voided leases	...	...	...	...	...	...	...	138.00	251.97	...
Do.	...	Sundry claims	...	...	32.50	12.06	...	...	...	73.50	38.38	...
Paddington	...	Voided leases	...	...	...	...	...	5,557.72	257.75	175,109.58	82,198.30	18.96
Do.	...	Sundry claims	...	...	73.44	49.60	...	1,714.16	2.13	10,391.36	6,658.42	...
Siberia	1399w, (1424w), (1429w), (1442w), (1655w)	Associated Northern Blocks (W.A.), Ltd.	...	...	91.50	54.73	...	...	...	247,585.84	91,053.70	1,664.70
Do.	1371w	Gimblet South	...	...	8.72	29.86	...	...	...	72,401.22	12,191.04	...
Do.	1399w	(Gimblet South Extended)	...	...	...	...	...	...	...	525.00	835.44	...
Do.	1399w, (1424w), (1429w), (1442w)	(Gimblet South Extended leases)	...	...	...	...	...	...	...	215.00	39.98	...
Do.	(1338w)	(Gimblet West)	...	...	...	...	...	...	...	680.50	482.83	...
Do.	1889w	Hazel Gold Mine	...	...	...	...	...	...	...	29.00	2.29	...
Do.	1289w	Lady Evelyn	...	...	184.00	235.55	...	...	...	890.00	1,162.28	...
Do.	1289w, (1308w)	Lady Evelyn leases	...	...	...	...	...	25.26	...	5,376.25	5,267.70	...
Do.	1916w	Ora Banda	...	...	39.00	55.53	...	...	...	39.00	55.53	...
Do.	1906w	Orinda	...	...	477.50	326.56	...	...	...	1,114.50	976.88	...
Do.	(1908w)	Paddy's Knob	...	...	120.00	43.39	...	...	...	213.50	111.37	...
Do.	1914w	Renown	...	373.59	7.50	12.25	...	...	373.59	7.50	12.25	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

BROAD ARROW GOLDFIELD—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Siberia	1375w	(Siberia Consols)	...	...	...	...	...	41.58	1,013.50	3,136.03	...
Do.	1375w	Siberia Consols	...	46.30	...	...	...	46.30	581.25	1,236.74	...
Do.	1375w, (1610w), (1720w)	(Siberia Consols G.M. Co., N.L.)	...	...	...	...	...	39.23	352.50	598.52	...
Do.	1336w	(Slippery Gimblet)	...	...	...	...	...	...	26,110.50	8,217.79	...
Do.	1336w, (1338w), (1419w)	Slippery Gimblet leases: Associated Northern Blocks, W.A., Ltd.	...	...	...	...	...	...	6,897.00	2,528.10	...
Do.	...	Voided leases	...	...	...	...	...	789.17	23,831.92	13,941.82	...
Do.	...	Sundry claims	12.72	135.04	215.50	269.33	139.21	734.33	13,839.79	9,238.04	...	
Smithfield	...	Voided leases	...	...	...	...	...	...	1,027.00	200.90	...
Do.	...	Sundry claims	...	...	...	...	...	23.79	49.50	149.47	...
<i>From Goldfields generally—</i>												
Sundry Parcels treated at:												
		Brown Hill Consols Works, Kalgoorlie	...	...	...	...	...	...	38.99	15.32	...
		Fremantle Trading Co., Ltd., Works	...	...	...	...	...	...	...	80.10	...
		Hannans Central Works, Kalgoorlie	...	...	...	...	...	...	8.70	15.47	...
		Hainault Sulphide Plant, Kalgoorlie	...	...	...	...	...	...	...	9.57	...
		Pole Works	...	...	...	...	...	...	...	356.07	...
		Regan's Carnage Battery	...	...	...	...	...	...	27.00	598.81	...
		State Battery, Ora Banda	...	...	05	16.51	...	...	47.05	1,679.93	...
		State Battery, Siberia	...	...	...	343.55	...	...	40.00	1,092.71	...
		Zoroastrian Works	...	...	...	...	...	...	116.50	1,082.23	...
		Various Works	...	...	...	...	...	2,271.17	16,622.68	31,760.91	278.85
		Reported by Banks and Gold Dealers	...	...	...	...	...	7,836.56	...	...	...
		Total	41.20	897.46	1,538.96	1,802.32	...	19,336.82	14,969.51	853,364.65	467,966.99	2,181.96

North-East Coolgardie Goldfield.

KANOWNNA DISTRICT.

Black Swan	...	Voided leases	...	...	...	...	...	...	160.00	141.76	...
Gambier	...	Voided leases	...	...	...	...	...	38.73	12,729.00	6,638.30	.07
Do.	...	Sundry claims	...	...	...	...	24.70	245.94	858.75	750.42	...
Gindalbi	...	Voided leases	...	...	...	...	...	19.94	43,613.28	39,438.75	38.31
Do.	...	Sundry claims	...	...	...	...	...	674.82	1,051.27	1,230.42	...
Gordon	1385x	Pride of the Morning	...	14.39	564.15	326.51	...	14.39	5,365.00	1,572.09	...
Do.	...	Voided leases	...	...	...	...	...	268.25	40,607.30	11,425.99	...
Do.	...	Sundry claims	...	...	...	...	...	54.65	630.50	577.80	...

Kanowna	(1439x)	Golden Crown and Cambrian	...	...	...	...	...	...	10-00	36-63	...
Do.	1389x	Golden Valley	...	...	58-00	167-84	...	...	5,072-13	3,137-35	...
Do.	1446x	Golden Valley East	...	...	543-00	303-21	...	...	611-00	331-59	...
Do.	1019x	(Kanowna)	...	...	...	...	5-84	691-94	9,588-50	14,544-42	...
Do.	1299x	(Kanowna Consol)	...	...	...	...	...	...	713-50	129-30	...
Do.	1299x	(Kanowna Consol)	...	...	...	...	...	...	339-00	207-36	...
Do.	1299x, (1300x)	(Kanowna Consol leases)	...	...	...	...	...	6-76	312-00	261-31	...
Do.	1299x, 1379x	Kanowna Consol leases	...	...	440-00	210-69	...	...	1,804-00	1,199-99	...
Do.	1019x	Kanowna Red Hill G.M. Co., N.L.	...	...	2,695-00	2,185-83	...	...	4,740-00	4,419-48	...
Do.	(18x), (19x)	(Lily Australis G.Ms., Ltd.)	...	...	...	...	...	...	197-00	119-18	...
Do.	(1440x)	New Reward	...	...	...	...	...	...	76-00	180-53	...
Do.	(3x), (14x), (15x), (18x), (19x), (60x), (81x), (938x), (974x), (1035x), (1103x), (1263x),	(North White Feather G.Ms., Ltd.)	...	...	...	...	...	...	147,974-75	74,343-01	159-19
Do.	(14x), (15x), (18x), (19x), (974x), (1035x), (1103x), (1263x), (1276x), (1278x)	(North White Feather G.Ms., Ltd.)	...	...	...	...	...	...	37,768-50	10,594-79	...
Do.	12x, 13x, (14x), (15x), (18x), (19x), (72x), (855x), (974x), (1035x), (1103x), (1263x), (1278x), 1438x	North White Feather G.Ms., Ltd.	...	...	989-00	554-50	...	...	55,555-27	25,059-97	...
Do.	(1445x)	Old Reward	...	...	24-10	30-23	...	...	78-10	93-23	...
Do.	1441x	Red Hill East	...	...	15-00	19-16	...	...	27-00	28-31	...
Do.	1442x	Red Hill West	...	...	120-00	175-17	...	...	120-00	175-17	...
Do.	12x, 13x, (14x), (15x), (855x), (1001x), (1012x), (1103x), (1107x), (1108x), (1109x)	(White Feather Main Reefs, Ltd.)	...	...	...	...	...	...	123,327-56	82,334-52	1,675-68
Do.	(9x), (10x), 12x, 13x, (72x), (83x), (201x), (855x), (1001x), (1012x), (1108x), (1249x)	(White Feather Main Reefs (1906) Ltd.)	...	...	...	...	...	20-45	24,393-00	9,138-31	...
Do.	...	Voided leases	8-47	3,701-82	246,449-24	137,565-01	647-37
Do.	...	Sundry claims	...	268-63	162-04	139-94	...	88-95	1,707-34	14,407-88	7,649-86	1-50
Mulgarrie	1246x	Palm	158-00	168-10	1,059-00	630-50	...
Do.	...	Voided leases	1,216-63	5,843-26	3,567-48	...
Do.	...	Sundry claims	13-29	1,184-00	596-64	...
Six-Mile	...	Voided leases	1,595-63	559-00	767-72	...
Do.	...	Sundry claims	31-44	141-50	103-37	...
<i>From District generally:—</i>												
Sundry Parcels treated at:												
Lady Pratt Works												
Old Cement Works—Martins												
Various Works												
Reported by Banks and Gold Dealers												
Total												
			28-70	283-02	5,768-29	4,281-18	...	104,481-67	11,170-40	946,134-33	587,457-38	2,522-12

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

NORTH-EAST COOLGARDIE GOLDFIELD—continued.

KURNALPI DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.						
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.		
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.		
Jubilee	...	Voided leases	...	...	...	...	...	...	...	...	...	...	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	18·87	...	46·00	28·91	...	...
Kurnalpi	(427K)	Agoriad Aur	...	...	...	...	...	...	...	129·35	86·00	164·55	...	...
Do.	...	Voided leases	...	...	...	...	...	...	371·18	2,971·29	2,839·01	2,613·52	6·27	...
Do.	...	Sundry claims	...	...	54·50	38·06	...	...	226·49	185·50	608·50	348·20	...	...
Mulgabbie	(430K)	Prince of Wales	...	...	...	...	...	...	...	1·04	...	...	...	...
Do.	428K	Try Again	...	...	...	...	...	...	...	519·35	...	92·34	...	...
Do.	...	Voided leases	...	...	...	...	...	...	...	606·79	84·65	7,290·69	4·95	...
Do.	...	Sundry claims	...	...	...	...	...	...	6·50	1,522·51	139·50	955·10	...	...
<i>From District generally :—</i>														
Sundry Parcels treated at :														
Success Battery			...	...	...	82·51	...	...	...	...	...	82·51	...	...
Various Works			...	...	...	...	...	...	...	...	56·50	193·15	...	...
Reported by Banks and Gold Dealers			...	...	...	...	...	...	11,375·71	19·62	...	...	...	...
Total			...	1·04	54·50	120·57	...	11,998·75	6,100·58	5,681·41	13,177·48	11·22	...	...

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Binduli	(5327E)	Nolan's	...	...	...	...	...	...	...	...	85·00	107·74	...	...
Do.	...	Voided leases	...	...	...	...	...	...	...	...	249·10	116·56	...	...
Do.	...	Sundry claims	...	...	59·09	27·81	...	...	...	...	455·65	481·88	...	...
Boorara	(3908E), (3910E), (3912E), (4033E), (4045E), (4327E)	(Golden Ridge G.M. Co., Ltd.)	...	...	...	...	...	...	...	...	239,600·10	132,893·92	408·36	...
Do.	(3908E)	Waterfall G.M.: Forward, Down, and Co., Ltd.	...	...	35·00	12·83	...	...	...	...	168·60	196·99	...	...
Do.	(3908E), (3910E), (4625E)	(Waterfall Gold Mine leases: Forward, Down, and Co., Ltd.)	...	...	...	...	...	...	...	...	5·40	55·98	...	...
Do.	(3908E), (3910E), (4625E)	(Waterfall Gold Mine leases)	...	...	...	...	...	...	...	...	6,671·50	4,097·17	...	...
Do.	(3908E), (3910E), (3912E), (4033E)	(Waterfall leases)	...	...	...	...	...	...	...	...	2,849·00	2,389·48	...	...
Do.	...	Voided leases	...	...	...	...	...	...	...	381·56	57,347·85	32,004·82	...	...
Do.	...	Sundry claims	...	...	...	...	...	...	49	53·46	615·16	550·25	...	...
Boulder	392E	(Acrobat: Paringa Consolidated Mines, Ltd.)	...	...	...	...	...	...	...	...	10·25	37·15	...	...

Do.	392E	Acrobat: Paringa Mines (1909), Ltd.	736-07	244-24	...	...	16,667-22	7,721-42	...	
Do.	38E, 71E, 72E, (101E)	Associated G.Ms. of W.A., Ltd.	60,376-84	22,081-83	773-00	...	8-49	2,082,030-28	1,109,606-19	33,709-05
Do.	49E, (4211E)	Associated Northern Blocks (W.A.), Ltd.	14-13	4,910-94	4,102-16	...	538-31	416,943-16	505,589-44	4,844-50
Do.	(682E), 902E, 923E, 986E, (1064E), 1124E, 1196E, 4075E	(Boulder Deep Levels, Ltd.)	...	...	...	...	...	3,043-00	1,778-10	26-71
Do.	902E, 923E, 986E, 1124E, 1196E, 4075E	(Boulder Deep Levels (1907), Ltd.)	...	...	...	...	...	787-50	210-30	...
Do.	281E	(Brookman Bros.: Boulder G.M. Co., Ltd.)	...	...	...	...	...	8,655-00	8,417-00	...
Do.	(4633E)	Brownhill Extended, Ltd.	...	...	...	...	...	456-83	66-92	...
Do.	24E, (888E), 949E, 352E	Central and West Boulder G.Ms., Ltd. (Chaffer's G.M. Co., Ltd.)	452-03	176-81	...	...	...	70,862-55	36,243-11	...
Do.	352E, 873E, 4334E	(Chaffer's G.M. Co., Ltd.)	...	...	...	...	...	4,256-00	1,299-03	161-50
Do.	352E, 873E, 4334E	(Chaffers G.M. Co., (1913) Ltd.)	...	...	...	...	...	111,111-00	44,796-77	...
Do.	1621E	(Croesus Proprietary G.M. Co.)	...	...	...	...	...	13,350-00	3,334-91	129-57
Do.	5347E	Croesus South	182-71	151-18	...	...	...	79-00	45-87	...
Do.	35E	Eureka	810-71	716-71	...	...	...	182-71	151-18	...
Do.	(4627E)	Garvagh	...	...	...	...	94-80	5,604-34	5,236-35	...
Do.	351E, 1001E, 1002E, 1085E, 1113E, 1219E, 1326E, 1397E	Golden Horseshoe Estates Co., Ltd.	90,126-00	52,406-83	28,312-02	...	...	982-00	866-20	...
Do.	750E	(Golden Link Consolidated G.Ms., Ltd.)	...	...	...	...	...	4,558,562-00	2,828,849-93	632,937-73
Do.	2325E, 2326E	(Golden Link Consolidated G.Ms., Ltd.)	...	...	...	...	...	10,729-00	6,096-80	...
Do.	750E, 1621E	(Golden Links, Ltd.)	...	...	...	...	...	1,525-00	733-48	...
Do.	873E	(Great Boulder Main Reefs, Ltd.)	...	...	...	...	...	87,115-02	43,504-60	19-06
Do.	66E	Great Boulder Perseverance G.M., Ltd.	46,932-72	54,165-51	8,843-41	...	...	143,292-39	119,541-14	761-98
Do.	16E, 51E, 61E, 102E, 280E, 1109E, 4366E	Great Boulder Proprietary G.Ms., Ltd.	105,382-66	65,445-64	8,155-00	...	...	3,306,942-88	1,841,159-00	203,821-43
Do.	902E, 1124E	(Great Boulder South G.M. Co., Ltd.)	...	...	...	...	...	3,583,366-76	3,127,508-36	353,072-10
Do.	3643E	(Hainault G.M., Ltd.)	...	...	...	...	...	437-00	122-11	...
Do.	6E	(Hannans Block 45, Ltd.)	...	...	...	...	...	517,345-70	184,570-02	113-30
Do.	131E, 245E, 269E, 743E, (794E), 969E	(Hannans Central G.Ms., Ltd.)	...	...	...	...	...	2,343-55	3,226-69	...
Do.	739E	(Hannan's Croesus G.M. Co., Ltd.)	...	...	...	...	...	6,098-00	3,360-33	...
Do.	1004E	(Hannan's North Croesus G.M. Co., Ltd.)	...	...	...	...	...	4,256-75	4,416-90	...
Do.	15E, 60E, 902E, 923E, 986E, 1116E, 1124E, 1196E, 4075E	(Hannan's Star Consolidated, Ltd.)	...	...	...	...	...	50-00	13-21	...
Do.	15E, 60E, 1116E	(Hannan's Star G.M. Co., Ltd.)	...	...	...	...	...	360-00	175-59	...
Do.	15E, 60E, 1116E	(Hannan's Star, Ltd.)	...	...	...	...	...	85,652-75	40,438-85	2,142-59
Do.	4317E, (4318E), (4442E)	(Idaho leases)	...	...	...	...	...	13,470-50	4,716-66	191-22
Do.	4317E	Idaho	217-30	85-16	201-00	...	...	4,847-57	128,727-26	63,546-75
Do.	946E, (4370E), (4531E)	(Ironsidess North leases)	...	...	...	...	...	217-30	85-16	...
Do.	946E	Ironsidess North	4-95	273-95	...	...	...	71,677-81	128,290-00	...
Do.	946E	(Ironsidess North G.M. Co., N.L.)	...	...	...	...	...	4-95	273-95	...
Do.	31E, 1357E, 1413E, 1507E, 4399E, 4445E, 4476E	Ivanhoe Gold Corporation, Ltd.	132,174-00	59,550-38	13,923-11	...	...	1,348-00	807-48	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

EAST COOLGARDIE GOLDFIELD—continued.

EAST COOLGARDIE DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons(2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons(2,240lbs.)	Fine ozs.	Fine ozs.
Boulder ...	1507E, (2899E), (3712E), (3713E)	(Ivanhoe Junction G.M. Co., N.L.) ...	...	...	...	...	...	...	1,764·00	121·43	...	
Do. ...	6E, 131E, 245E, 269E, (301E), 739E, 743E, 794E, 969E	(Kalgoorlie Amalgamated, Ltd.) ...	...	...	...	...	...	...	32,589·00	8,859·95	...	
Do. ...	6E, 131E, 245E ... 269E, (301E), 739E, 743E, (794E), 969E	(Kagoorlie Amalgamated (New), Ltd.)	...	...	...	...	...	...	27,145·00	6,265·27	...	
Do. ...	6E, 131E, 245E 269E, (301E), 739E, 743E, (794E), 969E	(Kalgoorlie Amalgamated (1909), Ltd.)	...	...	...	...	...	...	7,940·50	1,568·40	...	
Do. ...	1004E ...	(Kalgurli, Golden Eagle) ...	...	...	...	...	...	...	4,891·50	1,289·65	...	
Do. ...	1004E ...	(Kalgurli Golden Eagle : Golden Links)	...	...	...	...	...	...	193·00	31·63	...	
Do. ...	22E, 34E ...	(Kalgurli G.Ms., Ltd.)	...	...	...	...	...	...	1,683,548·41	1,072,090·59	188·24	
Do. ...	73E, (74E) ...	(Kalgoorlie Mint and Iron King Gold Estates, Ltd.)	...	...	...	...	...	...	3,020·00	1,762·00	...	
Do. ...	73E, (74E) ...	(Kalgoorlie Mint and Iron King G.Ms., Ltd.)	...	...	...	...	...	...	3,647·00	7,454·80	...	
Do. ...	15E, 25E, 32E, 60E, 352E, 873E, 902E, 923E, 986E, 1116E, 1124E, 1196E, 2325E, 2326E, 4075E, 4334E, (4432E), (4433E), (4434E), 4493E	Lake View and Star, Ltd. ...	...	...	23,859·06	21,657·51	836·58	...	...	1,720,720·61	605,663·19	55,520·14
Do. ...	25E, 32E, 2325E, 2326E	(Lake View Consols, Ltd.) ...	...	...	...	...	...	...	1,179,303·55	1,016,875·27	38,491·89	
Do. ...	5159E ...	Lake View South ...	...	...	152·71	51·51	...	...	...	336·81	148·11	...
Do. ...	5154E ...	Lucknow West ...	...	...	25·47	3·19	...	...	...	25·47	3·19	...
Do. ...	5346E ...	Main Ore Channel ...	...	...	34·93	4·59	...	...	...	34·93	4·59	...
Do. ...	(33E), 35E, (975E)	(New North Boulder G.Ms., Ltd.)	...	...	...	...	...	...	...	23,438·78	14,750·03	...
Do. ...	(33E), 35E, (975E)	(North Boulder G.M. Co., Ltd.)	...	...	...	...	...	...	...	33,549·15	47,532·52	...
Do. ...	(33E), 35E, (975E)	(North Boulder G.Ms., Ltd.)	...	...	...	...	...	...	...	4,542·50	4,256·55	·63
Do. ...	281E, 287E, 444E	(North Kalgurli Co., Ltd.)	...	...	...	...	...	43·99	...	104,116·49	60,229·47	7,202·47
Do. ...	281E, 287E, 444E	North Kalgurli (1912), Ltd.	...	...	1,497·94	1,209·85	...	...	...	33,792·97	16,894·67	...
Do. ...	5232E ...	Old Bank of England ...	...	...	208·08	243·12	...	...	...	925·96	885·19	...

Do.	73E, 410E, 448E, 532E, 578E, 698E, 944E, (1395E), (3031E), (4180E)	(Oroya Brownhill Co., Ltd.) ...	...	...	...	...	...	1,075,862-55	1,163,881-77	61,682-30
Do.	6E, 22E, 34E, 73E, 131E, 245E, 269E, (301E), 410E, 448E, 532E, 578E, 698E, 739E, 743E, 750E, (794E), 944E, 969E, 1004E, (1395E), 1621E, (3031E), (4180E)	Oroya Links, Ltd. ...	...	...	20,956-59	20,218-65	...	907,012-25	379,409-42	28,532-96
Do.	392E ...	(Paringa Mines (1909), Ltd.)...	...	...	...	...	...	26,890-74	12,599-54	...
Do.	1208E, 3612E, 3643E	South Kalgurli Consolidated, Ltd. ...	...	...	69,414-00	39,137-92	...	882,986-00	330,679-36	15,071-52
Do.	1208E, 3612E ...	(South Kalgurli G.Ms., Ltd.)	...	...	...	...	...	826,909-00	347,222-75	17,609-67
Do.	4537E ...	Union Jack ...	...	...	388-25	182-86	...	6,302-08	2,937-99	...
Do.	...	Voided leases ...	...	...	...	...	109-90	240,197-01	157,073-20	...
Do.	...	Sundry claims ...	...	...	163-42	57-57	24-58	2,289-93	1,379-42	...
Feysville	(4949E), (5152E)	Brittania G.Ms., N.L. ...	...	...	40-55	59-74	...	87-88	250-85	279-94
Do.	Block 48	Hampton Gold Mining Areas, Ltd.	...	...	...	...	...	...	17-10	66-95
		P.P.L. 53—McKenzie & Pty.	...	...	...	...	...	...	8-18	18-43
		P.P.L. 63 and 84—Golden Hope G.Ms., N.L.	...	...	2,660-00	1,338-95	69-60	...	2,928-30	1,534-72
		P.P.L. 175—Jubilee Central	...	...	...	...	...	...	29-00	7-70
		P.P.L. 207—Lancashire Lass	...	...	...	...	...	...	18-30	29-17
		P.P.L. 264—Marion	...	...	...	...	...	...	16-29	25-52
		P.P.L. 98—Red Indian	...	...	7-00	55-92	...	...	15-75	85-35
		P.P.L. 37—Ring Neck	...	...	...	...	...	15-36	4-40	58-25
		P.P.L. 306—Westralia	...	...	...	...	...	...	39-95	17-98
		P.P.L. 1—White Hope: Hopeful Syndicate, Ltd.	...	...	5,520-00	2,164-40	...	...	9,517-53	4,240-55
		Sundry claims	...	...	20-47	8-77	...	...	20-53	22-06
Do.	Block 48	(Hampton Plains Estate, Ltd.)	...	...	...	...	4,565-62	21-59	20,615-28	2,502-56
Do.	Block 50	(Hampton Plains Estate (1906) Ltd.)	...	...	...	...	...	...	85-00	108-82
Do.	Block 45	P.P.L. 252—Mount Martin	...	...	8,579-00	3,429-55	...	...	8,579-00	3,429-55
Do.	Block 45	Hampton Properties, Ltd.	...	...	...	...	...	52-75	69-75	80-52
Do.	Block 50	(Hampton Properties, Ltd.)	...	...	...	...	...	7-26	6,348-00	3,956-22
Do.	Block 50	Hampton Properties, Ltd.	...	...	...	...	...	106-23	689-36	591-14
		P.P.L. 138—Eva May Hampton	...	...	...	...	...	...	22-00	9-70
		P.P.L. 9 and 274—Hampton Cele- bration (W.A.), Ltd.	...	...	10,370-00	4,470-44	...	...	18,167-00	7,823-70
		P.P.L. 222—Hampton Jubilee	...	...	29-67	25-29	...	...	255-23	201-02
		P.P.Ls. 183 and 184—Melvina leases	...	...	...	...	...	...	170-00	44-00
		P.P.L. 23—Mutooroo Copper Cor- poration, N.L.	...	...	...	...	...	...	1,132-39	2,054-61
		P.P.L. 10—Pernatty Central Cop- per Mining Co., N.L.	...	...	...	...	...	...	125-11	42-56
		P.P.L. 129—Triumph	...	...	20-56	42-82	...	...	20-56	42-82
		P.P.L. 293—Union Jack	...	...	...	...	...	...	41-35	11-84
		Voided leases	...	...	...	...	...	22-86	310-45	114-30
		Sundry claims	...	1-51	38-85	43-84	...	12-13	379-60	264-50
Kalgoorlie	5348E ...	Big Genuine	...	...	71-00	71-20	...	...	71-00	71-20
Do.	(5166E) ...	Black Princess	...	...	...	...	...	...	86-96	23-35
Do.	(5247E) ...	Black's G.M.	...	...	...	...	...	...	39-79	7-40
Do.	5279E ...	Cassidy Hill	...	...	87-00	102-42	...	...	231-00	372-82
Do.	5251E ...	Central	...	...	8,541-00	3,356-02	...	...	14,896-00	5,716-35

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued

EAST COOLGARDIE GOLDFIELD—continued.

EAST COOLGARDIE DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Kalgoorlie ...	4546E, 4548E, (4551E)	Hannan's Reward, Ltd. ...	...	...	1,196·00	220·90	...	...	5·72	33,284·00	8,952·93	...
Do. ...	5358E ...	Invincible ...	...	...	9·00	6·57	...	...	...	9·00	6·57	...
Do. ...	4632E ...	North End ...	...	...	7·50	2·12	...	...	...	107·15	26·54	...
Do. ...	5333E ...	Paymaster ...	...	...	159·28	76·75	...	...	...	159·28	76·75	...
Do. ...	5368E ...	Rose of Diorite ...	...	...	170·00	88·33	...	...	...	170·00	88·33	...
Do. ...	5193E ...	Surprise, North ...	...	...	...	...	...	...	...	124·93	29·17	...
Do. ...	(4499E) ...	Williamstown ...	...	...	61·47	44·84	...	...	...	4,719·17	2,490·87	...
Do. ...	...	Voided leases ...	...	...	...	...	...	242·48	9,478·81	911,140·15	365,191·66	44,017·12
Do. ...	...	Sundry claims ...	...	90·05	4,811·77	3,104·93	...	207·69	425·55	40,412·79	15,356·49	...
Wombola ...	(4574E) ...	Creedon's Welcome ...	...	...	4·50	4·50	...	...	...	432·41	1,925·03	...
Do. ...	4600E ...	Daisy ...	...	...	23·00	32·36	...	...	...	353·55	1,782·83	...
Do. ...	4766E ...	Great Hope ...	...	...	731·40	3,006·78	...	...	...	1,144·38	6,265·62	...
Do. ...	4770E ...	Great Hope, North ...	...	...	428·00	520·65	...	...	...	1,741·24	2,438·25	...
Do. ...	(5243E) ...	Lass O'Gowrie ...	...	...	...	...	...	...	...	56·00	55·32	...
Do. ...	(5249E) ...	Mount Monger Proprietary East ...	...	...	1·70	20·25	...	...	...	21·20	45·44	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	1,867·91	5,520·43	5,176·66	...
Do. ...	...	Sundry claims ...	...	...	174·33	438·90	...	...	4·15	970·74	1,309·22	...
Do. ...	From District generally :—		...	...	...	...	...	...	...	...	...	...
	...	Sundry claims ...	...	...	83·84	86·41	...	10,907·93	431·95	5,291·84	1,646·53	...
	...	Sundry Parcels treated at :	...	...	...	...	...	...	...	...	...	...
	...	Adeline Works ...	...	...	...	...	...	42·64	35·12	127·90	20,900·12	...
	...	Associated Northern Blocks ...	...	...	...	...	...	...	...	...	287·41	...
	...	Bonnie Lass leases ...	...	...	...	...	...	...	...	55·00	1,297·73	...
	...	Brown Hill Consols Works ...	...	...	...	...	...	...	...	780·38	45,161·54	...
	...	Dunstan & Cumming's Works ...	...	...	...	...	...	...	...	...	9,244·56	1,644·00
	...	Fremantle Trading Co., Ltd. Works ...	...	...	...	1,384·68	102·77	...	...	...	12,644·63	8,028·22
	...	Great Boulder Perseverance Battery ...	...	...	...	...	...	...	...	...	7·18	...
	...	Hainault Sulphide Plant ...	...	...	...	1,189·90	...	...	...	35·66	3,902·54	728·06
	...	Hannan's Central Lakeside Works (A.W.A. Slimes Plant)	...	...	...	...	...	...	...	58·06	4,788·43	...
	...	Hannan's Reward Battery ...	...	...	...	100·25	...	...	...	...	100·25	...
	...	Hannan's Central Works ...	...	...	30·00	218·26	...	...	...	172·80	65,237·54	67·17
	...	Kalgurli Gold Mines, Ltd. ...	...	...	...	...	...	...	...	7·44	658·04	...
	...	Lone Hand Works ...	...	...	...	1,260·60	...	...	14·43	469·00	4,340·25	...
	...	North Kalgurli Battery ...	...	...	...	...	...	...	...	...	810·22	...
	...	Oroya Links Battery ...	...	...	27·71	235·86	...	...	...	28·59	420·14	...
	...	Various Works ...	...	...	...	...	...	...	...	...	75,908·77	1,968·67
	...	Reported by Banks and Gold Dealers ...	...	...	...	...	...	...	...	...	4·57	...
		Total ...	...	...	602,873·93	369,536·85	61,015·49	27,609·22	33,540·52	29,774,682·69	18,800,226·15	1,955,473·06

BULONG DISTRICT.

Balagundi l ...	...	Voided leases ...	...	...	...	...	...	2,408-98	1,110-68	1,473-73	12-92
Do. ...	...	Sundry claims ...	...	...	1-36	...	...	120-34	269-76	222-19	...
Bulong ...	1191y	Sweet Nell ...	...	...	63-64	212-32	...	...	74-84	269-50	...
Do. ...	1259y	Sunrise ...	...	...	17-18	66-65	...	...	17-18	66-65	...
Do. ...	...	Voided leases ...	...	...	...	...	...	107-54	8,433-70	99,606-01	82,419-97
Do. ...	...	Sundry claims ...	...	58-55	19-18	24-43	...	1,648-60	1,072-03	6,909-91	14,855-66
Hogan's Find	...	Voided leases ...	...	...	...	...	...	908-82	309-50	276-51	...
Majestic ...	Block 41	Hampton Gold Mining Areas, Ltd.—	...	...	...	...	...	...	...	...	...
Do. ...	P.P. L.275	Long Looked for	...	19-45	...	...	...	19-45	...	121-80	94-81
Do. ...	Block 41	(Hampton Properties, Ltd.)	...	...	...	...	...	...	...	41-00	22-66
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	1,007-70	333-30
Do. ...	...	Sundry claims ...	...	42-88	...	...	...	42-88	43-20	77-90	30-04
Mt. Monger ...	...	Voided leases ...	...	...	...	...	...	1,862-57	1,128-35	979-59	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	215-60	...	369-80	302-47
Randall's ...	...	Voided leases ...	...	...	...	...	...	...	60-04	31,820-04	10,645-98
Do. ...	...	Sundry claims ...	...	...	...	...	...	20-45	...	1,893-55	486-04
Sudden Jerk	...	Voided leases ...	...	...	...	...	...	...	63-91	14-25	53-67
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	15	10-23
Taurus ...	(1194y)	Ran Second ...	...	...	...	...	...	...	...	10-75	107-92
Do. ...	...	Voided leases ...	...	...	...	...	...	2-06	3-70	1,678-15	760-83
Do. ...	...	Sundry claims ...	...	...	...	...	...	112-69	...	276-00	411-01
Trans Find ...	1198y	Transville ...	...	...	321-92	384-86	...	...	...	321-92	384-86
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	4-50	31-63
Woodline ...	...	Voided leases ...	...	...	...	...	...	...	...	792-75	610-57
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	39-33	61-57
<i>From District generally :—</i>												
Sundry claims ...												
Sundry Parcels treated at:												
Various Works ...												
Reported by Banks and Gold Dealers ...												
Total ...												
			62-33	58-55	423-28	689-14	...	26,725-61	15,071-53	154,742-52	121,014-63	12-92

Coolgardie Goldfield.

COOLGARDIE DISTRICT.

Bonnievale ...	(4554)	Lorna ...	...	...	...	...	...	8-36	343-75	334-37	...
Do. ...	4600	Melba Maie ...	...	...	...	155-00	215-54	...	...	416-00	1,178-97
Do. ...	...	Voided leases ...	...	...	...	...	...	16-64	350,509-09	187,753-75	...
Do. ...	...	Sundry claims ...	...	23-84	31-50	56-04	...	79-92	2,045-18	2,006-41	...
Bulla Bulling	5179	Emerald Hill ...	...	...	25-00	6-77	...	...	...	25-00	6-77
Do. ...	5166	Surprise ...	...	...	113-93	293-33	...	...	...	113-93	293-33
Do. ...	5173	Surprise Deeps ...	...	...	25-50	21-94	...	...	...	25-50	21-94
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	612-38	346-15
Do. ...	...	Sundry claims ...	...	...	20-96	57-80	...	12-82	351-56	242-11	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued

COOLGARDIE GOLDFIELD—continued.

COOLGARDIE DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Burbanks ...	(5129) ...	Boomerang ...	...	...	38.50	48.96	...	...	...	38.50	48.96	...
Do. ...	(5152) ...	Burbanks Over ight ...	...	...	...	...	...	...	...	189.70	239.04	...
Do. ...	5188 ...	Burbanks Oversight G.M. Co., N.L.	...	...	170.00	155.73	...	...	...	170.00	155.73	...
Do. ...	...	Voided leases ...	...	...	...	...	...	13.36	342.96	407,534.11	301,032.55	521.06
Do. ...	...	Sundry claims ...	...	...	179.75	137.57	...	43.37	141.95	4,717.25	3,815.23	...
Cave Rocks ...	...	Voided leases ...	...	...	...	...	...	...	...	132.00	28.04	...
Coolgardie ...	5127 ...	Bayley's Reward ...	...	...	...	...	...	...	...	140.50	65.52	...
Do. ...	4559 ...	Cockshot ...	...	...	9.00	6.66	...	...	182.77	356.93	1,454.99	...
Do. ...	5137 ...	Coolgardie Redemption No. 1 South	...	...	...	...	...	...	...	47.00	5.19	...
Do. ...	4555 ...	(Dreadnought) ...	...	...	...	...	...	...	...	867.85	870.10	...
Do. ...	4555, 4561, (4563), (5065)	Dreadnought leases ...	...	...	124.04	70.79	...	...	...	962.18	1,028.24	...
Do. ...	5147, 5148 ...	Garden Gully leases ...	...	...	52.00	6.98	...	...	...	102.00	10.69	...
Do. ...	4567 ...	Griffiths Gold Mine ...	...	...	...	...	...	...	1.70	17,782.50	2,043.31	...
Do. ...	Block 59 ...	Hampton Gold Mining Areas, Ltd.	...	...	...	...	...	...	...	9.00	1.57	...
Do. ...	...	P.P.L. 119—Golden Eagle	...	...	65.00	138.45	...	...	...	169.84	267.95	...
Do. ...	Block 49 ...	Hampton Plains Estates, Ltd.	...	...	...	...	...	...	10.94	150.00	157.31	...
Do. ...	Block 53 ...	(Hampton Plains Estate, Ltd.)	...	...	...	...	...	...	358.42	67.00	112.49	...
Do. ...	Block 59 ...	(Hampton Plains Estate, Ltd.)	...	...	...	...	...	...	4.12	8,008.25	7,194.52	...
Do. ...	4556 ...	Lady Carmen ...	...	...	...	...	...	...	74.83	1,054.99	504.69	...
Do. ...	...	Voided leases ...	...	...	...	...	...	1,299.02	4,237.04	539,885.78	316,497.14	96
Do. ...	...	Sundry claims ...	29.34	...	765.61	351.70	...	105.73	2,078.63	37,109.56	14,686.68	...
Eundynie ...	...	Voided leases ...	...	...	...	...	...	...	...	29,812.50	14,966.76	1.75
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	117.00	31.11	...
Gibraltar ...	4586 ...	Carlton ...	...	...	16.00	4.33	...	...	15.28	852.00	663.78	...
Do. ...	4604 ...	Limerick ...	...	...	...	...	...	...	...	97.00	37.49	...
Do. ...	4580 ...	(Lloyd George) ...	...	...	...	...	...	...	...	341.75	289.27	...
Do. ...	4580, 4726, 4727	Lloyd George G.M. Co., N.L.	...	...	16,613.00	6,708.05	...	...	...	24,557.00	9,605.50	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	790.75	609.91	...
Do. ...	...	Sundry claims ...	...	...	7.00	20.95	...	...	48.55	636.45	438.62	...
Gnarlbine ...	...	Voided leases ...	...	...	...	...	...	...	10.94	1,899.75	1,049.90	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	1.31	189.75	99.26	...
Higginsville ...	...	Voided leases ...	...	...	...	...	...	...	287.26	32,578.00	14,938.44	134.79
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	16.52	772.90	515.40	...
Londonderry ...	...	Voided leases ...	...	...	...	...	...	...	46.25	27,102.85	18,537.59	...
Do. ...	...	Sundry claims ...	...	...	95.12	128.06	...	...	6.00	1,786.97	1,578.98	...

Mungari	...	...	Voided leases	...	...	...	...	...	17.71	735.00	331.78	...
Do.	...	...	Sundry claims	...	...	...	...	...	107.82	346.51	204.90	...
Paris	...	...	Voided leases	...	...	...	...	...	4.30	...	...	...
Red Hill	...	...	Voided leases	...	...	...	...	...	1,541.48	40,797.40	31,070.65	...
Do.	...	...	Sundry claims	...	...	...	...	...	34.62	160.42	287.90	...
Ryan's Find	(5120)	...	Undaunted	...	...	...	...	...	...	7.00	9.14	...
Do.	...	...	Voided leases	...	...	...	...	...	...	47.16	142.55	...
Do.	...	...	Sundry claims	...	...	...	...	...	44	87.69	226.64	...
St. Ives	4905	...	Brennan's Idough	...	...	590.75	309.93	...	12.18	993.25	874.43	...
Do.	4669	...	Coo-ee	...	...	126.00	113.75	...	...	233.50	401.57	...
Do.	4732	...	Ives Lake View Reward Junction	...	...	415.25	173.96	...	...	630.75	323.97	...
Do.	4720, 4721, 4722	Ives	Reward Gold Mines, N.L.	...	...	46.25	21.99	...	...	46.25	21.99	...
Do.	5194	...	Just in Time	...	19.31	...	...	...	31.79	...	...	...
Do.	4720, 4721, 4722	...	(Lake View Reward leases)	...	...	179.00	120.76	...	...	883.25	544.64	...
Do.	(5186)	...	New North Victory	...	...	32.00	14.83	...	...	32.00	14.83	...
Do.	5159	...	New Victory lease	...	...	...	...	...	...	82.75	42.21	...
Do.	(4638)	...	Victory North West	...	...	...	...	...	...	234.00	159.37	...
Do.	...	...	Voided leases	...	...	...	...	...	2.75	491.50	421.75	...
Do.	...	...	Sundry claims	...	...	261.75	97.68	...	...	655.92	236.58	...
Widgiemooltha	4028	...	Flinders	...	5.23	16.00	27.95	...	71.90	591.60	2,787.97	...	
Do.	5000	...	Great Reward	...	...	92.43	120.95	...	...	315.93	409.35	...
Do.	5192	...	Great Reward South	...	...	51.75	107.15	...	...	51.75	107.15	...
Do.	(5153)	...	Home Signal	...	...	...	...	...	...	56.50	115.14	...
Do.	...	...	Voided leases	...	...	...	...	9.42	795.21	8,815.33	3,800.74	17
Do.	...	...	Sundry claims	...	...	141.27	146.60	...	9.21	101.06	2,265.05	...
<i>From Districts generally :-</i>													
Sundry parcels treated at :													
Burbanks Main Lode Works													
Fremantle Trading Co., Ltd., Works													
Highgate Battery													
Imperial Battery													
Lady Robinson Cyanide Works													
State Battery Coolgardie													
State Battery, St. Ives													
Various Works													
Reported by Banks and Gold Dealers													
Total				19.31	58.41	20,468.36	9,852.09	...	9,106.97	11,215.72	1,560,493.58	979,636.28	891.44

KUNANALLING DISTRICT.

Balgarrie	...	...	Voided leases	...	...	...	...	10.94	75.48	5,142.25	4,825.96	1.38
Do.	...	...	Sundry claims	...	...	47.00	21.42	...	18.57	1,112.25	417.03	...
Carbine	33s	...	(Carbine)	...	...	...	...	...	10.85	2,401.00	1,164.53	...
Do.	33s, 710s, 711s, 807s, 863s, (890s)	...	Carbine leases	...	...	2,324.00	1,355.76	...	677.13	42,496.86	34,251.97	...
Do.	...	...	Voided leases	...	...	...	...	...	...	3,347.00	3,233.60	...
Do.	...	...	Sundry claims	...	...	...	...	...	...	73.00	55.69	...

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

KUNANALLING DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE	TOTAL FOR 1923.					TOTAL PRODUCTION.					
			Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	
Carnage ...	...	Voided leases ...	...	...	...	...	...	...	176.04	659.31	2,402.00	2,170.67	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	61.00	27.50	...	...
Cashman's (Siberia) ...	716s, [1289w] ...	Lady Evelyn ...	...	...	...	...	...	...	...	241.75	479.81	...	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	67.51	793.44	7,187.90	6,395.33	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	6.16	116.00	67.61	...
Chadwin ...	...	Voided leases ...	...	...	...	...	...	...	...	...	1,111.75	2,062.12	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	8.87	507.00	449.22	...
Dunnsville ...	...	Voided leases ...	...	...	...	...	...	...	...	181.12	17,407.10	7,982.23	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	43	121.27	297.19	301.14	...
Jourdie Hills ...	...	Voided leases ...	...	...	...	...	...	...	...	18.00	28,009.74	19,401.09	28.45
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	...	27.85	760.50	422.33	...
Kandana ...	...	Voided leases ...	...	...	...	...	...	...	...	...	465.00	68.12	...
Kintore ...	...	Voided leases ...	...	...	...	...	...	...	6.66	143.66	44,174.14	31,882.70	...
Do. ...	...	Sundry claims ...	...	...	11.00	3.82	...	...	100.30	78	1,241.70	1,163.14	...
Siberia ...	...	Voided leases ...	...	...	...	...	...	...	1.07	1,557.81	8,216.85	10,530.14	...
Do. ...	...	Sundry claims ...	...	...	...	...	...	...	30.91	...	223.00	349.86	...
25-Mile ...	696s ...	Blue Bell ...	...	...	27.00	9.15	...	...	...	...	27.00	9.15	...
Do. ...	696s ...	(Blue Bell) ...	...	...	...	...	...	...	...	8.05	697.00	429.47	...
Do. ...	696s, (727s) ...	Blue Bell leases ...	...	...	...	...	...	...	...	...	1,693.00	1,647.99	...
Do. ...	892s ...	Brittania ...	...	651.77	...	...	...	...	...	...	11.00	143.53	...
Do. ...	894s ...	Caledonia ...	...	...	52.00	108.34	...	...	...	810.29	52.00	108.34	...
Do. ...	845s ...	Sadie ...	...	...	40.00	63.55	...	...	...	...	2,045.00	1,901.44	...
Do. ...	645s ...	Star of Fremantle ...	...	...	...	58.58	...	...	32.67	...	5,301.00	3,829.58	...
Do. ...	(603s) ...	Sydney Mint ...	...	...	15.00	9.80	...	...	...	229.72	1,710.75	3,472.39	...
Do. ...	847s ...	Turn of the Tide ...	...	...	94.50	189.94	...	...	...	2.72	4,152.98	4,786.81	...
Do. ...	...	Voided leases ...	...	...	...	...	...	...	...	456.26	87,961.49	66,899.48	18.84
Do. ...	...	Sundry claims ...	...	96.33	179.58	515.45	...	...	13.22	231.44	7,069.53	4,540.62	...
From District generally:—													
Sundry Parcels treated at:													
		Blue Bell Battery ...	...	...	...	63.09	...	...	3.77	...	72.00	1,963.25	...
		Stanley Works ...	...	...	...	...	...	...	14.86	...	402.60	384.93	...
		Various Works ...	...	...	...	...	...	...	9.22	...	1,276.66	2,006.02	...
		Reported by Banks and Gold Dealers	...	...	...	...	...	...	264.19	1.10	...	...	...
		Total ...	...	748.10	2,790.08	2,398.90	...	...	731.79	6,039.88	279,466.99	219,824.79	48.67

Yilgarn Goldfield.

Blackbourne...		Voided leases ...							1,282 50	341 37	
Bullfinch ...	(3251)	Beechwood ...							30 00	5 24	
Do. ...	914, 915, 916, 926, 928, 942, 960	(Bullfinch leases)							1,027 52	10,958 88	
Do. ...	914, 915, 916, 928, 926, 930, 942, 960	(Bullfinch Proprietary (W.A.), Ltd. ...							477,968 42	166,223 11	27,833 41
Do. ...	914, 915, 916, 926, 928, 930, 942, 960	Bullfinch Proprietary (1919), Ltd. ...		36 67	36 05				56 97	67 10	
Do. ...	3249	Joke ...		41 00	16 03				41 00	16 03	
Do. ...	3256	Millenium ...							103 00	78 03	
Do. ...	(3236)	Who Can Tell ...		44 00	94 32				44 00	94 32	
Do. ...	(3237)	Who Can Tell North ...							87 50	175 98	
Do. ...		Voided leases ...						3 57	360 65	364 67	
Do. ...		Sundry claims ...		99 50	84 71				243 05	189 27	
Corinthian ...		Voided leases ...							134,508 00	29,324 83	
Do. ...		Sundry claims ...							104 50	77 35	
Ennuin ...		Voided leases ...							134 56	361 34	
Do. ...		Sundry claims ...							117 00	72 12	
Forrestonia ...	2909	Great Southern ...		133 00	31 34				915 00	214 16	
Do. ...		Voided leases ...							270 00	83 99	
Do. ...		Sundry claims ...		65 00	28 10				327 00	114 95	
Golden Valley ...	2994	Radio ...		795 00	2,625 76	7 43			2,441 50	7,609 71	7 43
Do. ...		Voided leases ...						18 05	7,935 24	8,289 07	2 00
Do. ...		Sundry claims ...		118 00	177 28			2 75	2,231 22	2,029 08	
Greenmount... Do. ...	3245	Jessie Graham ...		50 00	5 62				50 00	5 62	
Do. ...	550	Sunbeam ...							200 00	173 13	
Do. ...	550	(Sunbeam)					14 00		4,472 00	1,427 25	
Do. ...	550, (565)	(Sunbeam leases)							3,191 00	816 42	
Do. ...		Voided leases ...					31 99	21 62	115,887 50	28,843 86	944 50
Do. ...		Sundry claims ...						4 12	845 00	314 01	
Hope's Hill ...	2544	Colleen Bawn ...		10 00	103 29			15 26	389 20	1,754 15	
Do. ...		Voided leases ...						56 97	129,884 85	33,899 78	1 00
Do. ...		Sundry claims ...						25 38	1,622 50	506 06	
Kennyville ...	911, 3170, 3171	Edna May Battler G.M. Co., N.L. ...			101 26				5,850 00	1,397 64	
Do. ...	3267	Eveline G.M. ...		150 00	37 53				150 00	37 53	
Do. ...	911	(Trafalgar)							1,984 00	1,499 02	
Do. ...	(3164)	Wallace: New Trafalgar Gold Mining Co., N.L.							153 00	58 92	
Do. ...		Voided leases ...						18 76	23,860 13	12,030 17	59
Do. ...		Sundry claims ...		776 50	309 35			5 06	1,673 00	704 91	
Koolyanobbing ...		Voided leases ...							308 00	116 74	
Do. ...		Sundry claims ...							55 00	11 24	
Marvel Loch... Do. ...	3069	(Banker) ...							1,043 00	926 75	
Do. ...	923	Bohemian ...		287 00	280 58			19 66	4,740 00	4,585 73	
Do. ...	3217, 3222	Firelight leases ...		130 00	36 52				1,185 00	328 53	
Do. ...	3069, (3152), (3157), (3213)	Golden Butterfly G.M. Co., N.L.		416 00	625 15				4,911 00	3,148 65	

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

YILGARN GOLDFIELD—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Marvel Loch...	719	(Great Victoria) ... ..	...	...	...	...	...	...	1,356-00	281-53	...
Do. ...	719, 944, 945, 1227, 1228, 1606	Great Victoria leases ... ..	...	...	...	...	...	...	132,664-26	17,869-89	...
Do. ...	852	May Queen ... ..	...	...	24-00	184-97	...	4-07	870-50	4,383-08	...
Do. ...	(3255)	New Jacoletti: No Liability ... ..	...	...	50-00	23-90	...	...	248-00	109-56	...
Do. ...	(3247)	Pro Patri ... ..	...	3-95	24-00	15-90	...	3-95	54-00	28-22	...
Do. ...	(2998)	St. George ... ..	...	...	...	...	...	...	2,638-00	961-48	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	30-78	240,554-00	84,567-55	771-03
Do. ...	...	Sundry claims ... ..	...	...	477-25	301-49	...	7-72	77-53	10,426-74	5,426-73
Mt. Jackson...	...	Voided leases ... ..	...	...	...	...	...	114-88	37,186-03	27,676-47	2,305-28
Do. ...	...	Sundry claims ... ..	...	...	130-00	17-34	74	4-42	25-43	1,611-75	1,079-87
Mt. Rankin ...	...	Voided leases ... ..	...	...	...	...	...	3-84	5-20	496-00	122-17
Do. ...	...	Sundry claims ... ..	...	...	...	...	...	...	170-00	54-38	...
Parker's Range	2801	Scots Greys ... ..	...	...	145-00	45-77	...	...	1,101-00	406-59	...
Do. ...	724	(Spring Hill) ... ..	...	...	...	...	...	...	3,232-00	607-21	...
Do. ...	724, (760)	(Spring Hill leases) ... ..	...	...	...	...	...	...	8,910-00	2,215-59	...
Do. ...	724, 2633, (2793)	Spring Hill G.M. Co., N.L. ... ..	...	...	1,692-00	814-34	...	...	3,567-00	1,379-03	...
Do. ...	2951	White Horseshoe ... ..	...	...	689-00	448-53	...	...	2,940-50	2,535-51	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	105-14	13,686-25	10,013-04	...
Do. ...	...	Sundry claims ... ..	...	...	36-00	52-15	...	...	2,086-75	1,419-85	...
Southern Cross	3228, 3232 ...	Fraser's Central 1921 leases ... ..	...	...	294-00	93-88	...	...	869-00	269-57	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	2-13	211-22	433,160-20	211,594-62
Do. ...	...	Sundry claims ... ..	...	...	97-38	86-08	...	5-50	595-45	4,112-48	1,280-70
Westons ...	(2291), (2585), (2615)	Edna May Central G.Ms., N.L. ... ..	...	...	522-00	557-90	...	...	138,964-00	64,455-24	19-38
Do. ...	3257	Edna May Deep Levels G.M. Co., N.L. ... ..	...	...	20-97	342-21	...	...	80-97	548-31	...
Do. ...	(3260)	Les Trois ... ..	...	...	65-00	27-78	...	...	98-00	52-41	...
Do. ...	(2291)	(Myrtle Central) ... ..	...	...	...	...	...	...	751-00	243-96	...
Do. ...	3269	Myrtle Central ... ..	...	...	...	38-09	...	...	...	38-09	...
Do. ...	3226	Royal Flush ... ..	...	...	282-00	217-79	...	...	497-00	372-30	...
Do. ...	...	Voided leases ... ..	...	...	...	...	...	4-06	281,631-02	233,358-69	2-40
Do. ...	...	Sundry claims ... ..	...	...	55-00	88-90	...	52-91	1,285-75	1,280-81	...
From Goldfield generally:—												
Sundry parcels treated at:												
Glide Away Battery ... ..			...	...	...	30-33	...	...	...	200-17	...
Great Victoria Cyanide Works ... ..			...	...	...	...	...	...	...	5,847-54	...
Howlett's Battery ... ..			...	...	...	245-52	...	...	...	905-83	...
Never Never Works ... ..			...	...	...	14-06	...	...	...	1,629-53	...
Smith's Cyanide Works ... ..			...	...	...	26-16	...	...	...	26-16	...
Spring Hill Works ... ..			...	...	...	...	...	...	...	854-27	...

Sunbeam Battery ... ..	...	...	...	106-04	...	...	...	8-00	7,002-71	...
Violet Works ... ..	...	...	...	...	...	...	...	...	898-34	...
Various Works ... ..	...	...	...	...	...	...	...	118-28	26,087-03	36-54
Reported by Banks and Gold Dealers	...	...	...	...	...	22-05	3-53	...	...	...	
Total	8-95	7,755-27	8,372-02	8-17	91-65	1,475-35	2,258,057-29	1,037,460-74	32,288-71

Dundas Goldfield.

Buldanian ... ..	...	Voided leases ... ..	...	...	...	...	...	3-02	846-05	708-99	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	36-53	341-27	519-77	...
Dundas ... ..	...	Voided leases ... ..	...	...	...	...	...	...	4,543-23	2,208-48	...
Do. ... ..	...	Sundry claims ... ..	...	...	...	...	...	385-37	182-50	143-88	...
Killaloe ... ..	...	Voided leases ... ..	...	...	...	...	...	...	20-65	6-88	...
Norseman	903, 1138, 1253	Great Boulder Proprietary G.Ms., Ltd.	...	2,307-38	3,789-05	...	...	...	4,674-90	8,208-39	...
Do.	1306	Gloaming ... ..	...	111-50	172-04	...	...	90-62	111-50	172-04	...
Do.	(1295)	Hardy Junction Extended	...	19-75	24-10	...	...	...	129-25	149-87	...
Do.	1209	Hoffman's Gold Mine	...	126-50	73-64	...	...	...	1,534-90	934-69	...
Do.	1288	Mararoa No. 3	...	284-50	466-12	...	...	...	376-75	690-17	...
Do.	1290	Mararoa No. 2	...	...	...	...	...	...	186-50	189-75	...
Do.	1291	Mararoa No. 1	...	128-75	307-19	...	...	...	348-00	508-17	...
Do.	1261	Mararoa South Extended	...	...	...	...	...	...	377-00	70-32	...
Do.	1289	New Valkyrie	...	37-00	17-80	...	...	...	71-25	36-05	...
Do.	903	(O.K.)	...	...	...	...	...	21-23	1,147-25	1,293-01	...
Do.	903, 1138, 1253	(O.K. leases)	...	...	...	...	...	...	2,364-00	3,455-06	...
Do.	(1297)	O.K. North	...	...	...	...	...	...	18-50	14-21	...
Do.	1307	Recoup North	...	20-50	36-72	...	...	...	20-50	36-72	...
Do.	1281	Red, White, and Blue Extended No. 2	...	255-00	35-18	...	...	...	2,656-75	974-72	...
Do.	(1092)	(Sun)	...	...	...	...	...	142-26	655-50	737-49	...
Do.	(1092)	Sun	...	...	...	...	...	...	1,722-00	1,697-38	...
Do.	(1092), (1125)	(Sun leases)	...	...	...	...	...	...	337-00	692-34	...
Do.	1287	Supreme	...	77-25	61-13	...	...	...	199-50	191-75	...
Do.	(1286)	Thelma Joyce	...	...	...	...	...	...	8-00	220-52	...
Do.	(1299)	Victors	...	10-25	8-81	...	...	...	10-25	8-81	...
Do.	990	Viking No. 1	...	255-00	608-26	...	...	...	255-00	608-26	...
Do.	990	(Viking No. 1)	...	...	...	...	...	...	1,274-00	3,095-95	...
Do.	990, (1060)	(Viking No. 1 leases)	...	...	...	...	...	...	775-50	1,176-13	16-89
Do.	990, (1016), (1060), (1117), (1181), (1194), (1235)	(Viking No. 1 leases)	...	...	...	...	...	...	48,452-00	44,457-70	242-83
Do.	(1180)	Viking South	...	...	...	...	...	...	662-50	928-53	...
Do.	Voided leases	4-23	10,158-23	802,122-88	503,211-75	34,600-73
Do.	Sundry claims	1-03	114-66	371-25	348-55	997-63	3,056-56	20,773-71	11,959-70	...	59
Peninsula ... ..	...	Voided leases	...	...	...	...	...	17-61	7,807-14	4,833-88	...
<i>From Goldfield generally:—</i>												
<i>Sundry Parcels treated at:</i>												
<i>Rawlings, Bullen, and Rumble Works</i>												
<i>State Battery, Norseman</i>												
<i>Various Works</i>												
<i>Reported by Banks and Gold Dealers</i>												
Total	1-03	114-66	4,004-63	6,242-16	...	2,028-15	13,965-95	905,890-12	617,757-40	36,392-90

TABLE IV.—Production of Gold and Silver from all sources, etc.—continued.

Phillips River Goldfield.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1923.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.)	Fine ozs.	Fine ozs.
Kundip	147, 179	Fair Play leases	...	...	...	...	...	...	4,860.72	...	8,678.54	12.63
Do.	184	Gem	...	...	131.26	148.49	...	...	4,159.15	...	3,324.86	...
Do.	151	(Gem Consolidated)	...	...	...	...	...	...	777.50	...	616.30	...
Do.	151, 156	Gem Consolidated leases	...	...	...	...	...	...	6,315.76	...	5,690.35	8.00
Do.	M.L. 52 and 94	Harbour View Gold and Copper Co., Ltd.	...	...	20.00	9.53	...	...	1,602.89	...	1,836.05	360.11
Do.	M.L. 52 and 94...	(Harbour View leases)	...	...	...	...	...	...	3,619.25	379.86	1,560.86	61.41
Do.	M.L. 52, M.L. 94	(Harbour View leases)	...	...	...	...	...	...	3,403.50	...	2,227.62	1.88
Do.	98	Hillsborough	...	...	40.53	168.52	...	...	3,224.05	...	5,922.78	118.03
Do.	M.L. 370	North Harbour View	...	...	...	...	...	...	35.27	...	22.16	...
Do.	M.L. 52, M.L. 94	(Ravensthorpe G.M. Synd., N.L.)	...	...	...	...	...	...	1,124.00	...	433.94	164.98
Do.	...	Voided leases	...	...	...	...	...	113.28	176.31	37,704.03	25,448.75	3,070.20
Do.	...	Sundry claims	...	...	...	...	...	79.05	71.58	956.88	596.33	15.45
Mt. Desmond	M.L. 203	(British Flag)	...	...	...	...	...	...	...	...	7.76	...
Do.	M.L. 203	(British Flag: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	4.08	...
Do.	M.L. 208	(Desmond)	...	...	...	...	...	...	...	...	77	...
Do.	M.L. 208	Desmond	...	...	...	...	...	...	...	...	155.38	...
Do.	M.L. 208	(Desmond: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	219.59	14.55
Do.	M.L. 95	Elverdton	...	...	...	...	...	...	...	...	519.69	...
Do.	M.L. 95	(Elverdton: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	2,569.38	6,537.35
Do.	M.L. 95	(Elverdton: Phillips River Option Syndicate, N.L.)	...	...	...	...	...	...	...	...	9.63	...
Do.	M.L. 168	(Elverdton South: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	94	...
Do.	M.L. 109	(Mt. Desmond)	...	...	...	...	...	...	1.40	...	36.97	...
Do.	M.L. 109	(Mt. Desmond: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	228.19	180.06
Do.	M.L. 199	(P.L.P.)	...	...	...	...	...	...	...	...	13.69	7.41
Do.	M.L. 199	(P.L.P.: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	3.14	...
Do.	...	Voided leases	...	...	...	...	...	...	...	9.00	136.25	152.22
Do.	...	Sundry claims	...	...	...	...	...	...	...	...	32.81	51.01
Mt. Purchas...	...	Voided leases	...	...	...	...	...	...	4.38	346.05	293.13	...
Do.	...	Sundry claims	...	...	...	...	...	...	...	4.75	4.68	...
Ravensthorpe	M.L. 16	(Marion Martin)	...	...	...	...	...	...	...	...	20.09	...
Do.	M.L. 16	Marion Martin	...	...	...	...	...	...	...	...	240.70	...
Do.	M.L. 16	(Marion Martin: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	...	275.33	205.97
Do.	M.L. 15	(Mt. Cattlin)	...	...	...	...	...	...	...	49	200.00	85.50
Do.	M.L. 15	Mt. Cattlin	...	...	...	...	...	...	...	...	789.34	...

54

Do.	M.L. 15	(Mt. Cattlin: Mt. Cattlin Copper Mining Co., Ltd.)	...	...	...	...	...	...	...	1,496.92	52.92
Do.	M.L. 15	(Mt. Cattlin: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	387.33	...
Do.	M.L. 15	(Mt. Cattlin: Phillips River Gold & Copper Co., Ltd.)	...	...	...	...	...	...	...	3,077.08	3,814.45
Do.	...	Voided leases	...	...	...	...	...	141.31	21,716.76	18,765.65	310.73
Do.	...	Sundry claims	...	...	41.00	47.15	...	157.82	6.60	2,168.18	1,362.95
West River	...	Voided leases	...	...	...	...	...	...	...	10.34	31.06
Do.	...	Sundry claims	...	...	...	...	...	...	...	3.29	3.44
<i>From Goldfield generally:—</i>											
Sundry Parcels treated at:											
Gem Battery											
Phillips River Smelter											
Two Boys' Works											
Various Works											
Reported by Banks and Gold Dealers											
Total											
			232.79	374.58	...	472.20	781.93	92,227.74	87,739.70	15,688.17	

Donnybrook Goldfield.

Donnybrook	...	Voided leases	...	...	...	...	23.24	...	1,613.30	816.23	...
Do.	...	Sundry claims	...	...	...	...	...	...	40.00	2.29	...
Total			...	...	...	...	23.24	...	1,653.30	818.52	...

State generally.

Narra Tarra...	Loc. 833	Narra Tarra: Fremantle Trading Co., Ltd.	...	...	31.59	12,789.40	...	...	...	91.51	20,718.76
Coombana Ck.	...	Voided leases	...	...	...	...	...	53.66	...	...	...
<i>From State generally:—</i>											
Sundry Parcels treated at:											
Fremantle Trading Co., Ltd., Works											
Hainault Sulphide Plant, Kalgoorlie											
State Smelter, Ravensthorpe											
Various Works											
Sundry Specimens											
Reported by Banks and Gold Dealers											
Total											
			17.52	...	140.22	12,969.59	142.41	294.09	27.00	7,693.32	30,815.94

TOTAL OUTPUT OF GOLD BULLION ENTERED FOR EXPORT, AND RECEIVED AT THE PERTH BRANCH OF THE QUANTITY OBTAINED EACH YEAR FROM THE RESPECTIVE

Table with columns for Year, Kimberley, Pilbara, West Pilbara, and Ashburton. Each region has sub-columns for Export, Mint, and Total. Data spans from 1886 to 1923.

Table with columns for Year, b Yalgoo, c Mt. Margaret, e North Coolgardie, and f Broad Arrow. Each region has sub-columns for Export, Mint, and Total. Data spans from 1886 to 1923.

Table with columns for Year, g Dundas, h Phillips River, i Donnybrook, and State Generally. Each region has sub-columns for Export, Mint, and Total. Data spans from 1886 to 1923.

a Prior to 1st May, 1898, included with Pilbara. b Prior to 1st April, 1897, included with Murchison. c From 1st August, 1897. d Prior to 1st May, 1896, included with Coolgardie. e From 1st September, 1897. f Prior to 1893 included with Yilgarn. g Prior to 1902, included in State generally. h Abolished 4th March, 1903.

ROYAL MINT, FROM 1ST JANUARY, 1886, TO 31ST DECEMBER 1923, SHOWING, IN FINE OUNCES, THE GOLDFIELDS, AND THE TOTAL ANNUAL VALUE.

Table with columns for Year, b GASCOYNE, c PEAK HILL, c EAST MURCHISON, and MURCHISON. Each column contains sub-columns for Export, Mint, and Total, measured in fine ozs.

Table with columns for Year, e NORTH-EAST COOLGARDIE, f EAST COOLGARDIE, g COOLGARDIE, and YILGARN. Each column contains sub-columns for Export, Mint, and Total, measured in fine ozs.

GRAND TOTAL.

Table with columns for Year, Export, Mint, Total, and Value. The Value column is split into £ and s. d. units.

b Prior to March, 1899, included with Ashburton. c From 1st August, 1897. e Prior to 1st May, 1896, included with Coolgardie. g Declared 5th April, 1894, to which date included with Yilgarn.

TABLE VI.

COMPARATIVE RETURN OF GOLD BULLION ENTERED FOR EXPORT AND RECEIVED AT THE PERTH BRANCH OF THE ROYAL MINT, DURING THE YEARS 1921, 1922, AND 1923, SHOWING IN FINE OUNCES THE QUANTITY RECORDED EACH MONTH, AND ITS VALUE.

MONTHS AND QUARTERS.	1921.				1922.				1923.			
	EXPORT.	MINT.	TOTAL.	VALUE.	EXPORT.	MINT.	TOTAL.	VALUE.	EXPORT.	MINT.	TOTAL.	VALUE.
	fine ozs.	fine ozs.	fine ozs.	£ s. d.	fine ozs.	fine ozs.	fine ozs.	£ s. d.	fine ozs.	fine ozs.	fine ozs.	£ s. d.
JANUARY	523·90	50,934·68	51,458·58	218,582 3 1	329·92	37,851·30	38,181·22	162,183 10 3½	766·44	41,149·71	41,916·15	178,048 9 9
FEBRUARY	684·87	26,872·92	27,557·79	117,058 1 0½	926·19	41,194·66	42,120·85	178,917 19 11½	245·08	38,871·62	39,116·70	166,157 3 7½
MARCH	10·83	47,875·64	47,886·47	203,408 15 10½	180·55	42,662·44	42,842·99	181,985 9 1	331·55	35,689·00	36,020·55	153,005 11 5
<i>1st January to 31st March</i> ...	1,219·60	125,683·24	126,902·84	539,049 0 0	1,436·66	121,708·40	123,145·06	523,086 19 3½	1,343·07	115,710·33	117,053·40	497,211 4 9½
APRIL	670·94	46,602·38	47,273·32	200,804 6 0	1,237·24	45,157·08	46,394·32	197,070 10 10½	216·21	41,437·08	41,653·29	176,931 18 7
MAY	474·94	47,638·48	48,113·42	204,372 16 4½	271·67	39,454·59	39,726·26	168,746 8 6½	1,099·25	34,769·94	35,869·19	152,362 12 8½
JUNE	153·91	28,194·14	28,348·05	120,414 17 3	136·91	49,158·13	49,295·04	209,392 0 4½	161·24	44,502·99	44,664·23	189,721 11 9½
<i>1st January to 30th June</i> ...	2,519·39	248,118·24	250,637·63	1,064,640 19 7½	3,082·48	255,478·20	258,560·68	1,098,295 19 1½	2,819·77	236,420·34	239,240·11	1,016,227 7 10
JULY	1,641·31	44,917·02	46,558·33	197,767 4 3½	366·04	42,774·63	43,140·67	183,249 18 4½	1,061·58	40,283·93	41,345·51	175,624 11 3½
AUGUST	110·97	51,731·26	51,842·23	220,211 15 11	1,051·61	48,638·71	49,690·32	211,071 1 3	651·49	47,807·11	48,458·60	205,839 0 11½
SEPTEMBER	380·43	50,728·16	51,108·59	217,095 9 9½	...	46,398·21	46,398·21	197,087 1 5	...	46,272·38	46,272·38	196,552 11 6½
<i>1st January to 30th September</i> ...	4,652·10	395,494·68	400,146·78	1,699,715 9 7½	4,500·13	393,289·75	397,789·88	1,689,704 0 2	4,532·84	370,783·76	375,316·60	1,594,243 11 7½
OCTOBER	1,910·42	51,286·91	53,197·33	225,967 17 10½	216·07	49,092·82	49,308·89	209,450 17 0	767·13	49,956·62	50,723·75	215,460 15 10½
NOVEMBER	156·75	46,429·46	46,586·21	197,885 12 10	153·10	46,401·35	46,554·45	197,750 14 8	222·89	32,481·05	32,703·94	138,917 10 1½
DECEMBER	451·47	53,348·87	53,800·34	228,529 6 4½	450·86	44,142·20	44,593·06	189,419 5 7	410·96	45,356·16	45,767·12	194,406 7 4½
Total	7,170·74	546,559·92	553,730·66	2,352,098 6 8½	5,320·16	532,926·12	538,246·28	2,286,324 17 5	5,933·82	498,577·59	504,511·41	2,143,028 5 0½

TABLE VII.

MONTHLY RETURN OF GOLD, CONTAINED IN BULLION, FURNACE PRODUCTS, AND ORE, ENTERED FOR EXPORT DURING 1923.

MONTH.	UNITED KINGDOM.			VICTORIA.			NEW SOUTH WALES.			SOUTH AUSTRALIA.			TOTALS.			Minted Gold Exported*
	Bullion.	Furnace Products.	Ore.	Bullion.	Furnace Products.	Ore.	Bullion.	Furnace Products.	Ore.	Bullion.	Furnace Products.	Ore.	Bullion.	Furnace Products.	Ore.	
1923.	Fine ozs.	Estimated fine ozs.	Estimated fine ozs.	Fine ozs.	Estimated fine ozs.	Estimated fine ozs.	Fine ozs.	Estimated fine ozs.	Estimated fine ozs.	Fine ozs.	Estimated fine ozs.	Estimated fine ozs.	Fine ozs.	Estimated fine ozs.	Estimated fine ozs.	Fine ozs.
January	208·87	...	557·57	...	...	...	...	...	557·57	208·87	...
February	2·60	...	210·89	31·59	...	...	...	...	210·89	34·19	42·14
March	161·75	...	169·80	...	...	...	...	...	169·80	161·75	...
April	216·21	...	...	...	...	...	216·21	...	...
May	1,099·25	...	...	...	...	...	1,099·25	...	22·13
June	161·24	...	...	...	...	...	161·24	...	...
July	907·31	...	...	...	73·78	...	80·49	...	...	...	...	...	987·80	73·78	...
August	52·74	...	598·75	...	...	...	...	...	598·75	52·74	...
September
October	767·13	...	...	...	...	...	767·13	...	...
November	91·82	...	131·07	...	...	...	...	...	131·07	91·82	61·21
December	104·99	...	305·97	...	...	...	...	...	305·97	104·99	...
TOTALS	907·31	...	...	...	696·55	...	4,298·37	31·59	...	...	...	...	5,205·68	728·14	125·48

*When considering the total production of gold for this State, these amounts must be disregarded, having been already recorded in the total receipts of gold at the Mint.

TABLE IX.—Minerals other than Gold, etc.—continued.

Period.	SILVER LEAD ORE.		TUNGSTEN ORES.													
	Ashburton Gf.		WOLFRAM.				SHEBLITE.									
			State generally.		North Coolgardie Gf.		Broad Arrow Goldfield.		Coolgardie Gf.		Dundas Goldfield.		Total.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Q'nty.	Value.	Quantity.	Value.	Q'nty.	Value.	Quantity.	Value.		
tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£			
Previous to 1901																
1901	21.05	152														
1902	35.85	277														
1903																
1904																
1905																
1906																
1907																
1908	727.25	6,914														
1909	440.00	3,520			*5.00	90										
1910					†42.00	115										
1911					‡194.00	877										
1912																
1913	125.50	1,757			‡4.64	69										
1914	715.10	9,807														
1915	298.96	4,429			**25	27										
1916	67.83	554			20.00	117										
1917																
1918	237.48	3,461														
1919	214.76	3,116														
1920							273.06	829								
1921							134.25	113	3.35	175	45.71	101	41	10	318.77	980
1922															178.01	352
1923																
Total	2,983.78	33,987	265.89	1,295	407.31	943	3.35	175	85.71	155	.41	10	496.78	1,282		

Period.	COAL.		FIRECLAY.		GADOLINITE.		ASBESTOS.									
	Collie Mf.		Collie Mf.		Pilbara Gf.		Pilbara Gf.				West Pilbara Goldfield.		Total.			
					Marble Bar D.		Marble Bar D.		Nullagine D.							
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Q'nty.	Value.	Quantity.	Value.		
tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£			
Previous to 1901	176,254.10	82,547														
1901	117,835.80	68,561														
1902	140,883.90	86,188														
1903	133,426.62	69,128														
1904	138,550.04	67,174														
1905	127,864.06	55,312														
1906	149,755.27	57,998														
1907	142,372.54	55,158														
1908	175,247.92	75,694														
1909	214,301.98	90,965								40.00	1,600				40.00	1,600
1910	262,166.06	113,699								2.83	154				2.83	154
1911	249,899.15	111,154														
1912	295,078.91	135,857														
1913	313,817.96	153,614														
1914	319,210.32	148,684				1.00	112									
1915	286,666.35	137,859														
1916	301,525.97	147,823														
1917	326,550.07	191,822														
1918	337,039.24	204,319														
1919	401,713.18	270,355														
1920	462,020.78	350,346														
1921	468,816.65	407,117	677.80	646						32.00	1,900	124.50	5,386		156.50	7,286
1922	438,442.78	381,555								32.60	1,360	202.75	12,221		235.35	13,581
1923	420,713.98	368,949								2.50	250	179.18	7,350		181.68	7,600
Total	6,399,653.63	3,831,378	677.80	646	1.00	112	112.93	5,414	670.43	30,265	.85	17	784.21	35,696		

Period.	LIMESTONE.						DIAMONDS.		MAGNESITE.		ANTIMONY.		MANGANESE.			
	Murchison Gf.		Yalgarn Goldfield.		State generally.		Total.		Pilbara Gf.		East Coolgardie Goldfield.		West Pilbara Goldfield.		Peak Hill Goldfield.	
	Cue District.								Nullagine District.		Bulong District.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
tons.	£	tons.	£	tons.	£	tons.	£	carats.	£	tons.	£	tons.	£			
Previous to 1901																
1901			269.85	273	33,250.00	6,159	33,519.85	6,432								
1902			1,642.00	919	16,568.00	3,429	18,210.00	4,348								
1903			535.00	340	4,545.35	1,000	5,080.35	1,340								
1904			102.00	75	1,177.50	103	1,279.50	178								
1905					13,397.20	1,699	13,397.20	1,699								
1906					9,144.60	1,220	9,144.60	1,220								
1907					9,472.28	1,691	9,472.28	1,691								
1908	298.00	772			3,303.95	610	3,601.95	1,382								
1909																
1910																
1911																
1912																
1913																
1914																
1915																
1916																
1917																
1918																
1919																
1920																
1921																
1922																
1923																
Total	298.00	772	2,548.85	1,607	90,858.88	15,911	93,705.73	18,290	24	824.75	1,053	20.78	491	18.11	142	

* Produced within the West Kimberley Goldfield. † Tons 22.00, value £30, the produce of West Kimberley, and tons 20.00, value £85, the produce of Cue. ‡ The produce of Cue District. § Weight unknown. ** The produce of Yalgarn Goldfield.

NOTE.—As the collection of Statistics of Minerals other than Gold commenced during 1899, the total production from the different localities can only be approximately estimated by the Customs Records, the latest available returns of which are to be found in Table XXVIII., pages 74-9.

TABLE X.

QUANTITY AND VALUE OF BLACK TIN REPORTED TO THE MINES DEPARTMENT DURING 1923,
AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.				TOTALS TO DATE.			
			Quantity.			Value.	Quantity.			Value.
			Lode.	Stream.	Total.		Lode.	Stream.	Total.	
			tons.	tons.	tons.	£	tons.	tons.	tons.	£
PILBARA GOLDFIELD.										
MARBLE BAR DISTRICT.										
Cooglegong ...	...	Sundry claims ...	...	5.00	5.00	576	...	1,706.27	1,706.27	151,675
Mill's Find ...	...	Sundry claims ...	...	...	...	...	...	.85	.85	69
Moolyella ...	...	Voided leases ...	...	...	...	...	...	330.53	330.53	21,340
Do. ...	...	Sundry claims ...	...	19.00	19.00	2,344	...	2,834.21	2,834.21	260,030
Old Shaw ...	...	Voided leases ...	...	...	...	...	...	6.75	6.75	424
Do. ...	...	Sundry claims ...	...	...	...	...	...	214.04	214.04	14,525
Tabba Tabba ...	...	Sundry claims ...	...	40	40	40	...	116.02	116.02	13,005
Wodgina ...	M.Ls. 86, 87, 95	H.M. and Anchorite leases ...	...	...	...	...	...	5.00	5.00	500
Do. ...	M.L. 84	(Mount Cassiterite) ...	...	...	...	...	...	133.52	13.85	147.37
Do. ...	M.Ls. 84 (93), (148)	Mount Cassiterite leases ...	...	...	...	...	...	195.50	1.60	197.10
Do. ...	...	Voided leases ...	...	...	...	...	...	37.82	6.10	43.92
Do. ...	...	Sundry claims ...	...	...	...	...	...	5.78	48.20	53.98
		Totals ...	...	24.40	24.40	2,960	...	372.62	5,233.42	5,656.04
			...				...			511,141
MURCHISON GOLDFIELD.										
CUE DISTRICT.										
Poona ...	...	Sundry claims ...	...	...	...	...	...	1.52	1.52	118
Cuddingwarra ...	...	Sundry claims ...	...	...	...	...	...	3.20	3.20	242
		Totals ...	...	...	...	...	...	4.72	4.72	360
COOLGARDIE GOLDFIELD.										
COOLGARDIE DISTRICT.										
Bulla Bulling ...	...	Sundry claims ...	...	...	...	...	...	.15	.15	15
		Totals ...	...	...	...	...	...	.15	.15	15
GREENBUSHES MINERAL FIELD.										
Greenbushes ...	(472) ...	(Aqua) ...	...	...	...	...	...	1.50	1.50	128
Do. ...	511 ...	Champion ...	...	.62	.62	54	...	1.60	212.67	214.27
Do. ...	(510) ...	(Excelsior Extended) ...	...	...	...	...	...	.05	.05	5
Do. ...	(472) (497), (510)	Excelsior leases ...	...	...	...	...	...	119.85	119.85	17,930
Do. ...	(497) ...	(Excelsior Tin Mining Co., Ltd.) ...	...	...	...	...	...	4.05	4.05	281
Do. ...	(617) ...	Found at Last ...	...	...	...	...	...	.57	.57	130
Do. ...	515 ...	Kapanga ...	...	.20	.20	27	...	33.10	.96	34.06
Do. ...	(73), (233), (271), (504)	King Tin leases ...	...	...	...	...	...	6.52	119.54	126.06
Do. ...	(271) ...	(King Tin North) ...	...	...	...	...	...	1.84	1.84	112
Do. ...	(73) ...	(Nelson) ...	...	...	...	...	...	22.40	22.40	1,625
Do. ...	(73), (233) ...	(Nelson leases) ...	...	...	...	...	...	61.01	61.01	4,164
Do. ...	(504) ...	(Old Bunbury) ...	...	...	...	...	...	37.62	37.62	3,616
Do. ...	505 (519), 614	Scotia leases ...	...	4.05	4.05	365	...	60.17	60.17	6,107
Do. ...	580 ...	Southern Cross ...	...	...	...	...	...	7.95	7.95	1,988
Do. ...	(381), (435), (436), (472), (478)	(Westralia Gully Tin Co., Ltd.) ...	...	...	...	...	...	6.38	34.38	3,233
Do. ...	Locs. 289, 290	Clarke and Others ...	...	...	...	...	...	318.04	318.04	23,959
Do. ...	Loc. 290	McKay and Struthers ...	...	...	...	...	...	5.39	5.39	783
Do. ...	...	Voided leases ...	...	...	...	...	...	220.07	2,853.54	3,073.61
Do. ...	...	Sundry claims ...	...	23.15	23.15	2,578	...	71.10	6,574.52	6,645.62
		Totals ...	...	28.02	28.02	3,024	...	347.29	10,427.53	10,774.82
			...				...			918,293

TABLE XI.

QUANTITY AND VALUE OF TANTALITE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.				TOTAL TO DATE.			
			Quantity.			Value.	Quantity.			Value.
			Lode.	Stream.	Total.		Lode.	Stream.	Total.	
			tons.	tons.	tons.	£	tons.	tons.	tons.	£
PILBARA GOLDFIELD.										
MARBLE BAR DISTRICT.										
Wodgina ...	86, 87, 95 ...	H.M. and Anchorite leases ...	...	...	...	...	2.25	44.80	47.05	7,840
Do. ...	...	Sundry claims ...	...	...	...	...	...	51.50	51.50	6,124
		Totals ...	...	...	...	...	2.25	96.30	98.55	13,464
GREENBUSHES MINERAL FIELD.										
Greenbushes ...	(369) ...	Enterprise ...	...	...	...	...	...	3.19	3.19	1,804
		Totals ...	...	...	...	...	...	3.19	3.19	1,804

TABLE XII.

QUANTITY AND VALUE OF PYRITIC ORE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTAL TO DATE.	
			Quantity.	†Value.	Quantity.	†Value.
			tons.	£	tons.	£
MT. MARGARET GOLDFIELD.						
MT. MORGANS DISTRICT.						
Eulaminna ...	M.Ls. 4F, 5F, (11F), (12F) ...	West Australian Copper Co., Ltd. ...	...	...	...	61,687.98
Murrin Murrin...	M.L. 18F ...	Nangeroo: Nangeroo Mines, Ltd. ...	...	...	...	12,359.58
		Totals ...	...	...	...	74,047.56

† Represents the value of the sulphur only, the copper contents not having been treated.

TABLE XIII.

QUANTITY AND VALUE OF COPPER ORE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTAL TO DATE.		
			Quantity.		Value.	Quantity.		Value.
			Ore.	Metallic Copper.		Ore.	Metallic Copper.	
			tons.	tons.	£	tons.	tons.	£
WEST KIMBERLEY GOLDFIELD.								
Ber	...	Voided leases ...	...	...	...	13.19	2.78	200
Ya und ...	M.L. (1), [221H] ...	Yampi Sound Copper Mine ...	...	...	...	92.86	22.80	1,473
		Sundry claims ...	...	...	...	3.47	.36	36
		Totals ...	...	...	...	109.52	25.92	1,709
PILBARA GOLDFIELD.								
MARBLE BAR DISTRICT.								
Marble Bar ...	...	Voided Leases ...	...	...	...	11.00	1.64	90
Do. ...	...	Sundry claims ...	...	...	...	4.75	.48	25
North Pole ...	...	Voided leases ...	...	...	...	9.35	1.39	81
North Shaw ...	...	Voided leases ...	...	...	...	7.77	1.90	190
		Totals ...	...	...	...	32.87	5.41	386
NULLAGINE DISTRICT.								
Lionel ...	...	Sundry claims ...	...	...	...	9.00	4.75	360
McPhee's Creek	M.L. (14L) ...	Tambina ...	...	...	...	5.00	2.22	120
		Totals ...	...	...	...	14.00	6.97	480
WEST PILBARA GOLDFIELD.								
Croydon ...	...	Voided leases ...	...	...	...	604.00	108.65	7,333
Egna ...	...	Voided leases ...	...	...	...	542.00	104.15	6,643
Roebourne ...	M.L. 183 ...	(Carlow Castle: Roebourne Copper Mines, Ltd.) ...	...	...	...	69.00	7.80	780
Do. ...	M.L. 174 ...	Good Fortune ...	...	...	...	56.77	8.58	904
Do. ...	M.Ls. 174 (175) ...	(Good Fortune leases) ...	...	...	...	63.40	9.58	1,011
Do. ...	M.L. 184 ...	Good Luck ...	...	...	...	5.21	1.01	111
Do. ...	M.L. 167 ...	(Quod Est) ...	...	...	...	22.43	3.49	256
Do. ...	M.Ls. 167, 183 ...	Roebourne Copper Mines, Ltd. ...	...	...	...	122.45	18.50	1,855
Do. ...	M.Ls. 144 (192), (193) ...	Yannery and Whundo Copper Mining Co., Ltd. ...	...	...	...	404.50	87.14	8,116
Do. ...	M.L. 144 ...	(Yannery Hill Copper Mine) ...	...	...	...	469.25	113.81	9,961
Do. ...	...	Voided leases ...	...	...	...	2,729.28	515.83	44,459
Do. ...	...	Sundry claims ...	...	...	...	77.41	13.61	800
Whim Creek ...	M.L. 34 ...	(Balla Balla Copper Mines, Ltd.) ...	...	...	...	2,009.00	166.33	12,036
Do. ...	M.L. 34 ...	Mons Cupri: Whim Well Copper Mines, Ltd. ...	...	...	...	282.50	33.75	2,979
Do. ...	Loc. 71 ...	Pilbara Copper Fields, Ltd. ...	221.00	50.00	3,500	2,571.50	557.81	45,084
Do. ...	Loc. 71 ...	(Whim Well Copper Mines, Ltd.) ...	...	...	...	72,562.75	9,343.89	604,492
Do. ...	...	Voided leases ...	...	...	...	80.00	5.50	250
		Totals ...	221.00	50.00	3,500	82,621.45	11,099.43	747,070

TABLE XIII.—Quantity and Value of COPPER ORE, etc.—continued.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Quantity.		Value.	Quantity.		Value.
			Ore.	Metallic Copper.		Ore.	Metallic Copper.	
			tons.	tons.	£	tons.	tons.	£
ASHBURTON GOLDFIELD.								
Ashburton ...	...	Sundry claims ...	...	...	...	6.32	.79	94
Red Hill ...	...	Voided leases ...	...	...	...	175.50	33.85	2,128
Uaroo ...	...	Voided leases ...	...	...	...	169.25	62.49	4,188
		Totals ...				351.07	97.13	6,408
PEAK HILL GOLDFIELD.								
Peak Hill ...	M.L. (35P) ...	Burra Copper Mines, Ltd. ...	...	...	...	25.84	8.85	943
Do. ...	M.Ls. 37P, 38P	Sonia leases ...	...	...	...	135.04	47.26	4,807
Do. ...	M.L. 9P	Sons of Gwalia ...	...	...	...	458.49	169.89	15,680
Do. ...	M.Ls. (29P), (30P) (31P)	(Two Sisters leases) ...	...	...	...	64.04	30.93	1,466
Do. ...	M.L. (31P) ...	Two Sisters North... ..	...	...	...	115.76	31.40	3,594
Do. ...	...	Voided leases ...	...	...	...	153.91	43.02	3,885
Do. ...	...	Sundry claims ...	...	...	...	62.03	21.96	1,837
		Totals ...				1,015.11	353.31	32,212
EAST MURCHISON GOLDFIELD.								
LAWLERS DISTRICT.								
Kathleen Valley ...	M.L. (12) ...	Shepherd ...	...	...	...	6.77	1.32	69
Lawlers ...	M.L. (29) ...	Bungarra ...	...	...	...	157.44	23.85	2,837
Do. ...	...	Sundry claims ...	...	...	...	74.35	13.25	1,458
		Totals ...				238.56	38.42	4,364
MURCHISON GOLDFIELD.								
MEEKATHARRA DISTRICT.								
Gabanintha ...	...	Voided leases ...	...	...	...	920.56	119.84	9,381
Do. ...	...	Sundry claims ...	...	...	...	34.42	9.23	1,072
Holden's Find... ..	...	Sundry claims ...	...	...	...	6.72	1.11	111
Yaloginda ...	...	Sundry claims ...	...	...	...	6.76	1.41	150
		Totals ...				968.46	131.59	10,714
DAY DAWN DISTRICT.								
Day Dawn ...	...	Voided leases ...	...	...	...	26.95	5.17	305
Do. ...	...	Sundry claims ...	...	...	...	28.61	2.93	217
		Totals ...				55.56	8.10	522
YALGOO GOLDFIELD.								
Mount Gibson ...	...	Sundry claims ...	...	...	...	4.99	1.10	95
Twin Peaks ...	...	Sundry claims ...	...	...	...	19.50	3.49	227
Wadgingarra ...	M.L. (6) ...	Olive Queen ...	...	...	...	13.91	.98	91
		Totals ...				38.40	5.57	413
NORTHAMPTON MINERAL FIELD.								
Geraldine ...	M.Ls. (10), (11)	Geraldine leases ...	...	...	...	136.50	36.05	1,982
Narra Tarra ...	Loc. 833 ...	Narra Tarra : Fremantle Trading Co., Ltd.	9,626.29	883.21	59,143	10,624.95	1,091.96	72,578
		Totals ...	9,626.29	883.21	59,143	10,761.45	1,128.01	74,570
YANDANOOKA MINERAL FIELD.								
Arrino ...	...	Sundry claims ...	...	...	...	126.05	18.48	1,386
Yandanooka ...	Freehold Gd. ...	Muggawa Copper Mines ...	...	...	...	7.50	1.20	96
Do. ...	...	Voided leases ...	...	...	...	38.00	7.95	407
		Totals ...				171.55	27.63	1,889
MOUNT MARGARET GOLDFIELD.								
MOUNT MORGANS DISTRICT.								
Eulaminna ...	[10c, 11c], 4F, 5F (12c, 37c)	(Mt. Malcolm Copper Mine leases) ...	...	...	...	13,516.00	1,001.98	70,754
Do. ...	[10c, 11c], 4F, 5F	(Mt. Malcolm Copper Mine leases) ...	...	...	...	3,839.00	418.00	17,065
Do. ...	[10c, 11c], 4F, 5F (12c, 37c)	(Murrin Copper Mines, Ltd.) ...	...	...	...	19,165.00	798.50	45,817
Do. ...	4F, 5F(11F) (12F)	West Australian Copper Co., Ltd. ...	...	...	...	9,794.05	1,976.08	80,199
Mt. Margaret ...	G.M.L. (66P) ...	Mt. Morven ...	...	...	...	11.53	2.40	163
Murrin Murrin... ..	13F ...	Nangaroo : Nangaroo Mines, Ltd. ...	...	...	...	6.80	3.00	160
Do. ...	...	Voided leases ...	...	...	...	1,525.29	248.04	16,662
		Totals ...				47,857.87	4,448.00	230,820

TABLE XIII.—Quantity and Value of COPPER ORE, etc.—continued.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Quantity.		Value.	Quantity.		Value.
			Ore.	Metallic Copper.		Ore.	Metallic Copper.	
			tons.	tons.	£	tons.	tons.	£
MOUNT MARGARET GOLDFIELD—continued.								
MOUNT MARGARET DISTRICT.								
Burtville	M.L. (16r)	Dreadnought	...	...	...	2.85	.29	26
		Totals	...	...	...	2.85	.29	26
NORTH COOLGARDIE GOLDFIELD.								
MENZIES DISTRICT.								
Goongarrie	M.L. (13z)	Providence Copper Mining Syndicate, Ltd.	...	...	...	4.70	.42	33
Do.	...	Sundry claims	...	...	...	1.42	.40	18
		Totals	...	...	...	6.12	.82	51
EAST COOLGARDIE GOLDFIELD.								
EAST COOLGARDIE DISTRICT.								
Boorara	M.L. (100z)	Premier Copper Mine	...	...	...	50.67	6.22	330
		Totals	...	...	...	50.67	6.22	330
PHILLIPS RIVER GOLDFIELD.								
Kundip	G.M.Ls. 147, 179	Fair Play leases	...	...	...	180.09	131.30	11,975
Do.	G.M.L. 184	Gem	...	1.08	79	90.98	22.58	2,404
Do.	G.M.Ls. 151, 156	Gem Consolidated leases	...	...	...	48.00	76.75	8,327
Do.	M.Ls. 52, 94	Harbour View Gold and Copper Co., Ltd.	...	...	...	1,209.93	90.14	8,236
Do.	M.Ls. 52, 94	(Harbour View leases)	...	...	...	604.36	76.80	4,524
Do.	M.Ls. 52, 94	(Harbour View leases)	...	...	...	508.27	64.66	3,642
Do.	G.M.L. 98	Hillsborough	...	54	36	692.84	57.65	4,746
Do.	M.L. 370	North Harbour View	...	...	...	15.72	.99	124
Do.	M.Ls. 52, 94	(Ravensthorpe G.M. Syndicate, N.L.)	...	...	...	132.56	24.36	1,382
Do.	...	Voided leases	...	...	...	3,430.67	319.32	22,398
Do.	...	Sundry claims	...	1.79	19	111.12	17.40	1,372
Mt. Desmond	M.L. 203	British Flag: Phillips River Gold and Copper Co., Ltd.	...	...	...	19.90	3.64	250
Do.	M.L. 208	Desmond	...	...	...	1,392.85	164.82	16,993
Do.	M.L. 208	(Desmond: Phillips River Gold and Copper Co., Ltd.)	...	...	...	1,234.05	215.74	14,956
Do.	M.L. 95	Elverdton	...	...	...	7,418.57	675.84	67,229
Do.	M.L. 95	(Elverdton)	...	...	...	130.00	5.70	570
Do.	M.L. 95	(Elverdton: Phillips River Gold and Copper Co., Ltd.)	...	...	...	30,574.23	2,186.64	124,252
Do.	M.L. 95	(Elverdton: Phillips River Option Syndicate, N.L.)	...	...	...	2,946.02	401.43	22,657
Do.	M.L. (168)	(Elverton South)	...	...	...	18.48	2.39	119
Do.	M.L. (168)	Elverton South: Phillips River Gold and Copper Co., Ltd.	...	...	...	15.73	1.46	92
Do.	M.L. 109	(Mt. Desmond)	...	...	...	198.87	30.77	1,640
Do.	M.L. 109	Mt. Desmond: Phillips River Gold and Copper Co., Ltd.	...	...	...	1,762.22	216.76	18,128
Do.	M.L. 199	(P.L.P.)	...	...	...	208.66	33.69	2,277
Do.	M.L. 199	P.L.P.: Phillips River Gold and Copper Co., Ltd.	...	...	...	17.56	1.88	121
Do.	...	Voided leases	...	...	...	1,015.17	166.71	9,770
Do.	...	Sundry claims	...	...	...	140.25	25.17	1,901
Ravensthorpe	M.L. 16	Marion Martin	...	...	...	2,270.63	256.94	26,496
Do.	M.L. 16	(Marion Martin)	...	...	...	865.69	130.61	6,650
Do.	M.L. 16	(Marion Martin: Phillips River Gold and Copper Co., Ltd.)	...	...	...	2,855.36	375.44	28,506
Do.	M.L. 15	Mount Cattlin	...	...	...	2,178.01	142.64	15,296
Do.	M.L. 15	(Mount Cattlin)	...	...	...	281.56	31.35	1,716
Do.	M.L. 15	(Mount Cattlin: Mount Cattlin Copper Mining Co., Ltd.)	...	...	...	6,608.76	333.59	28,841
Do.	M.L. 15	(Mount Cattlin: Phillips River Gold and Copper Co., Ltd.)	...	...	...	1,263.76	80.26	7,646
Do.	M.L. 15	(Mount Cattlin: Phillips River Gold and Copper Co., Ltd.)	...	...	...	14,432.25	714.90	40,313
Do.	...	Voided leases	...	...	...	7,880.86	986.55	63,429
Do.	...	Sundry claims	...	...	...	1,153.67	132.58	11,438
West River	...	Voided leases	24.22	6.56	407	44.04	7.41	414
Do.	...	Sundry claims	...	...	...	150.69	25.84	2,061
Do.	...	From Goldfield generally	...	...	...	1,637.88	128.64	9,760
		Totals	26.01	8.44	541	95,690.26	8,361.84	587,651
STATE GENERALLY.								
...	...	Voided leases	...	...	...	5.11	1.54	56
...	...	Sundry claims	...	...	...	13.50	2.27	193
		Totals	...	...	...	18.61	3.81	249

TABLE XIV.

QUANTITY AND VALUE OF IRONSTONE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
WEST PILBARA GOLDFIELD.						
Whim Creek ...	(17), (18), (21)	Whim Well Copper Mines ... ..	...	...	100·00	300
		Totals ... ..	...	...	100·00	300
EAST COOLGARDIE GOLDFIELD.						
EAST COOLGARDIE DISTRICT.						
Boulder ...	(1490E)	Mt. Ferrum ... ..	...	...	450·00	247
		Totals ... ..	...	...	450·00	247
STATE GENERALLY.						
		Avon ... ..	...	...	22,223·00	16,241
		Clackline ... ..	...	...	18,253·50	8,789
		Coates' Paddock ... ..	...	...	4,712·00	3,277
		Greenbushes ... ..	...	...	7,481·00	4,629
		Koolan Island—Yampi Sound ... ..	...	...	10·50	12
		Werribee ... ..	...	...	4,600·00	3,200
		Totals ... ..	...	...	57,280·00	38,148

TABLE XV.

QUANTITY AND VALUE OF LEAD ORE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Lead Ore.	Metal therefrom.	Value.	Lead Ore.	Metal therefrom.	Value.
			tons.	tons.	£	tons.	tons.	£
NORTHAMPTON MINERAL FIELD.								
Geraldine ...	Loc. 1 ...	Geraldine Mine ... ..	...	...	...	774·59	257·13	5,189
Do. ...	M.L. (189) ...	Long Lode ... ..	...	...	...	38·00	11·62	86
Do. ...	M.Ls. 148, 150, 154, 158, 20PP	Surprise Leases	17,813·00	1,922·48	51,347	42,706·53	8,493·01	238,412
Do. ...	M.L. 156 ...	Surprise South ... ..	...	...	...	14·00	5·41	170
Do. ...	M.L. 153 ...	Three Sisters ... ..	...	...	...	6·25	3·94	112
Do. ...	M.L. 23PP ...	Wheal Ina	70·00	20·62	385	70·00	20·62	385
Do. ...	M.L. (19PP) ...	Wheal Lilly ... ..	...	...	...	44·75	30·79	742
Do. ...	Loc. 7 ...	Thring & Green ... ..	...	...	...	318·44	154·46	2,546
Do. ...	...	Voided leases ... ..	...	...	...	62·74	45·20	529
Do. ...	...	Sundry claims ... ..	...	...	...	327·04	175·65	3,408
Narra Tarra ...	Loc. 833 ...	Narra Tarra: Fremantle Trading Co., Ltd.	1,854·40	121·41	3,309	112,182·85	11,489·47	331,007
Do. ...	Locs. 118, 119 ...	Lauder & Raven (Tributers) ... ..	...	...	...	106·21	60·02	1,345
Do. ...	...	Sundry claims ... ..	...	...	...	238·16	34·18	442
Northampton ...	Loc. 1472 ...	Baddera: Fremantle Trading Co., Ltd.	...	...	...	129,264·56	13,888·33	317,631
Do. ...	Loc. 436 ...	Fortune Exploration Co., N.L. ... ..	...	...	...	123·38	51·17	1,316
Do. ...	Loc. 1146 ...	Wheal Ellen: Fremantle Trading Co., Ltd.	2,397·10	172·76	4,153	12,717·28	1,238·23	33,456
Do. ...	Loc. 436 ...	(Wheal of Fortune Extended Syndicate)	...	...	...	125·82	43·13	793
Do. ...	...	Voided leases ... ..	...	...	...	3,266·76	723·13	14,329
Do. ...	...	Sundry claims ... ..	...	...	...	222·12	132·14	2,679
Victoria ...	...	Voided Leases... ..	...	...	...	19·00	12·54	212
		Totals	21,634·50	2,287·27	59,194	302,628·48	36,870·22	954,739
WEST PILBARA GOLDFIELD.								
Roebourne ...	...	Sundry claims ... ..	...	...	...	2·57	1·36	39
Whim Creek ...	M.L. (172) ...	Cumstock ... ..	...	...	...	104·00	46·00	1,490
		Totals ... ..	...	...	...	106·57	47·36	1,529

TABLE XVI.

QUANTITY AND VALUE OF SILVER-LEAD ORE REPORTED TO THE MINES DEPARTMENT DURING 1923,
AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
ASHBURTON GOLDFIELD.						
Ashburton	M.L. (3)	Rainbow	...	...	56.90	420
Do.	...	Sundry claims	...	...	2.83	40
Uaroo	M.Ls. (43), (49), (84)	Uaroo Silver Lead Mines, Ltd.	...	...	2,824.05	33,518
Totals			...	...	2,883.78	33,987

TABLE XVII.

QUANTITY AND VALUE OF COAL REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
COLLIE MINERAL FIELD.						
Collie	197, etc.	Amalgamated Collieries of W.A., Ltd. (Cardiff Mine)	60,515.36	51,106	270,359.78	224,996
Do.	244, etc.	Amalgamated Collieries of W.A., Ltd. (Co-operative Mine)	104,016.05	91,888	394,036.40	337,233
Do.	85, etc.	Amalgamated Collieries of W.A., Ltd. (Proprietary Mine)	127,039.76	110,915	430,654.73	370,602
Do.	250, etc.	Amalgamated Collieries of W.A., Ltd. (Westralia Mine)	82,639.34	74,529	116,302.23	104,799
Do.	151, etc.	(Amalgamated Collieries of W.A., Ltd.: Scottish leases)	...	...	380.00	251
Do.	197, etc.	(Cardiff Coal Mining Co., Ltd.)	...	...	976,824.78	471,417
Do.	151, etc.	(Collie Boulder Coal Co., Ltd.)	...	...	71,512.70	26,139
Do.	244, etc.	(Collie Co-operative Collieries, Ltd.)	...	...	970,044.30	511,862
Do.	88 (part of)	(Collie Proprietary Coalfields of W.A., Ltd.)	...	...	477,781.55	242,918
Do.	85, etc.	(Collie Proprietary Coalfields of W.A., Ltd.)	...	...	580,392.15	289,246
Do.	260, etc.	Premier Coal Mining Co., Ltd.	46,503.47	40,511	327,062.01	227,423
Do.	15, etc.	(Scottish Collieries, Ltd.)	...	...	2,314.51	1,210
Do.	151, etc.	(Scottish Co-operative Collieries Co., Ltd.)	...	...	430,796.95	171,303
Do.	85, etc.	(The Proprietary Coal Mines of W.A., Ltd.)	...	...	693,045.34	413,755
Do.	88 (part of)	(The Proprietary Coal Mines of W.A., Ltd.)	...	...	109.00	54
Do.	250, etc.	(Westralia Coal Mining Co., Ltd.)	...	...	507,384.11	307,913
Do.	250, etc.	(Westralia Black Diamond Collieries, Ltd.)	...	...	125,083.24	117,827
		Voided leases	...	...	25,569.85	12,930
Totals			420,713.98	368,949	6,399,653.63	3,831,878

TABLE XVIII.

QUANTITY AND VALUE OF FIRECLAY REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
COLLIE MINERAL FIELD.						
Collie	87	Amalgamated Collieries of W.A., Ltd. (Proprietary lease)	...	...	677.80	646
Total			...	...	677.80	646

TABLE XIX.

QUANTITY AND VALUE OF LIMESTONE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
MURCHISON GOLDFIELD.						
CUE DISTRICT.						
Cuddingwarra ...	M.L. (3) ...	Linella ...	...	...	298·00	772
		Totals ...	...	...	298·00	772
YILGARN GOLDFIELD.						
Southern Cross ...	...	Voided leases ...	...	...	2,548·85	1,607
		Totals ...	...	...	2,548·85	1,607
STATE GENERALLY.						
Fremantle ...	...	...	...	...	90,858·88	15,911
		Totals ...	...	...	90,858·88	15,911

TABLE XX.

QUANTITY AND VALUE OF ASBESTOS REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
PILBARA GOLDFIELD.						
MARBLE BAR DISTRICT.						
Cooglegong ...	M.Ls. 274, 275 ...	Chrysotile No. 1 leases ...	3·00	150	70·10	3,660
Soanesville ...	...	Voided leases ...	...	...	42·83	1,754
		Totals ...	3·00	150	112·93	5,414
NULLAGINE DISTRICT.						
Lionel ...	M.L. 34L ...	Archem ...	...	...	3·00	90
Do. ...	M.Ls. (18L), (19L), (20L) ...	Barnett Bros., Ltd. ...	63·00	2,425	339·78	17,140
Do. ...	M.Ls. (21L), (22L) ...	Barnett Bros., Ltd. ...	...	...	25·00	2,000
Do. ...	M.L. (28L) ...	Barnett Bros., Ltd. ...	...	...	2·50	200
Do. ...	M.Ls. (18L), (19L), (20L) ...	(Barnett's Asbestos Nos. 1, 2, and 3)	...	...	163·00	5,793
Do. ...	M.Ls. 32L, 33L ...	Bullswool No. 2 and Junction leases ...	...	...	6·15	330
Do. ...	M.Ls. (21L), (22L) ...	(Nullagine Nos. 1 and 2)	...	...	7·00	526
Do. ...	M.L. (29L) ...	Toledo ...	4·00	120	20·50	816
Do. ...	...	Voided leases ...	...	...	4·00	100
Do. ...	...	Sundry claims ...	44·00	1,320	99·50	3,270
		Totals ...	111·00	3,865	670·43	30,265
WEST PILBARA GOLDFIELD.						
Roebourne ...	...	Sundry claims ...	·85	17	·85	17
		Totals ...	·85	17	·85	17

TABLE XXI.

QUANTITY AND VALUE OF GADOLINITE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
PILBARA GOLDFIELD.						
MARBLE BAR DISTRICT.						
Cooglegong ...	(M.L. 254) ...	Iverna ...	...	...	1·00	112
		Totals ...	...	...	1·00	112

TABLE XXII.

QUANTITY AND VALUE OF TUNGSTEN ORES REPORTED TO THE MINES DEPARTMENT DURING 1923, AND
TOTALS TO DATE.

SCHEELITE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Ore.	Contents Tungstic Trioxide.	Value.	Ore.	Contents Tungstic Trioxide.	Value.
			tons.	units.	£	tons.	units.	£
NORTH COOLGARDIE GOLDFIELD.								
MENZIES DISTRICT.								
Comet Vale ...	G.M.L. 5410z...	Lake View ...	...	...	...	380.84	338.39	818
Do. ...	...	Sundry claims ...	...	...	...	26.47	47.88	124
		Totals ...	...	...	...	407.31	385.77	942
BROAD ARROW GOLDFIELD.								
Ora Banda ...	...	Sundry claims ...	...	...	...	3.35	66.50	175
		Totals ...	...	...	...	3.35	66.50	175
COOLGARDIE GOLDFIELD.								
COOLGARDIE DISTRICT.								
Higginsville ...	...	Sundry claims ...	...	...	...	85.71	59.07	155
		Totals ...	...	...	...	85.71	59.07	155
DUNDAS GOLDFIELD.								
Norseman ...	...	Sundry claims ...	...	...	...	.41	3.98	10
		Totals ...	...	...	...	.41	3.98	10
WOLFRAM.								
LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Ore.	Metallic contents.	Value.	Ore.	Metallic contents.	Value.
			tons.	tons.	£	tons.	tons.	£
MURCHISON GOLDFIELD.								
CUE DISTRICT.								
Calli Spring ...	M.L. (11) ...	Socialist ...	...	...	...	194.00	6.11	877
Do. ...	...	Sundry claims ...	...	...	...	44.64	2.30	271
		Totals ...	...	...	...	238.64	8.41	1,148
YALGOO GOLDFIELD.								
Yalgoo ...	M.L. (36) ...	Yandanoo King North ...	...	...	...	.25	.12	27
		Totals ...	...	...	...	.25	.12	27
STATE GENERALLY.								
Derby ...	(146H) ...	Taylor's Wolfram Reward ...	...	...	...	27.00	2.00	120
		Totals ...	...	...	...	27.00	2.00	120

TABLE XXIII.

QUANTITY AND VALUE OF MAGNESITE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND
TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
			tons.	£	tons.	£
EAST COOLGARDIE GOLDFIELD.						
BULONG DISTRICT.						
Bulong	Sundry claims ...	...	...	824.75	1,053
		Totals ...	...	...	824.75	1,053

TABLE XXIV.

QUANTITY AND VALUE OF ANTIMONY REPORTED TO THE MINES DEPARTMENT DURING 1923, AND
TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.			TOTALS TO DATE.		
			Ore.	Metallic contents.	Value.	Ore.	Metallic contents.	Value.
			tons.	tons.	£	tons.	tons.	£
WEST PILBARA GOLDFIELD.								
Balla Balla ...	M.L. (185) ...	Star ...	...	...	...	20.78	11.58	491
		Totals ...	...	...	...	20.78	11.58	491

TABLE XXV.

QUANTITY AND VALUE OF GYPSUM REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
		STATE GENERALLY.	tons.	£	tons.	£
Koorda ...	M.L. 280H ...	White Cross ... ..	...	...	727·50	638
		Totals ... ..	...	...	727·50	638

TABLE XXVI.

QUANTITY AND VALUE OF DIAMONDS REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
		PILBARA GOLDFIELD.	carats.	£	carats.	£
		NULLAGINE DISTRICT.				
Nullagine ...	M.R.C. (6L) ...	Morgans, A. E. ... ..	...	...	...	24
		Totals ... ..	...	...	...	24

XXVII.

QUANTITY AND VALUE OF MANGANESE REPORTED TO THE MINES DEPARTMENT DURING 1923, AND TOTALS TO DATE.

LOCALITY.	NUMBER OF LEASE, CLAIM, OR AREA.	REGISTERED NAME OF COMPANY OR LEASE.	1923.		TOTALS TO DATE.	
			Quantity.	Value.	Quantity.	Value.
		PEAK HILL GOLDFIELD.	tons.	£	tons.	£
Horseshoe ...	(54P), (56P)	General Chemical Supply Co., Ltd. ... ..	...	...	18·11	142
		Totals ... ..	...	...	18·11	142

TABLE

RETURN OF ORE AND MINERALS OTHER THAN GOLD

YEAR.	COPPER.												
	COPPER ORE.										COPPER INGOT, MATTE, ETC.		Total Value of Copper Exported.
	West Pilbara Gf.		Northampton Mf.		Phillips River Gf.		State generally.		Total.		State generally.		
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£		
1850
1
2
3
4
5
6
7
8
9
1860
1
2
3
4
5
6
7
8
9
1870
1
2
3
4
5
6
7
8
9
1880
1
2
3
4
5
6
7
8
9
1890
1 ...	263	4,462	...	...	...	...	...	...	...	...	...	...	...
2 ...	†412	6,319	155	2,377	...	...	...	...	...	...	...	...	...
3 ...	50	606	...	...	...	...	...	...	...	...	...	...	...
4
5 ...	802	12,832	24	120	...	...	...	...	...	...	...	...	...
6 ...	6	100	...	...	...	...	...	...	...	...	...	...	...
7 ...	65	731	21	302	...	...	...	...	...	...	...	...	...
8 ...	281	3,334	75	932	...	...	...	...	...	...	...	...	...
9 ...	1,404	31,979	587	9,473	...	...	...	...	...	...	...	...	...
1900 ...	544	10,696	...	...	105	2,411	197	3,355	846	16,462	249	17,475	33,937
1 ...	1,058	26,464	1	10	1,205	22,107	397	6,322	2,661	54,903	880	55,866	110,769
2 ...	68	1,698	20	330	162	2,469	33	489	283	4,986	175	7,918	12,904
3 ...	4	180	25	460	302	3,538	15	349	346	4,527	1,075	33,288	37,815
4 ...	50	500	...	...	11	154	310	3,378	371	4,032	102	3,827	7,859
5	80	2,808	713	8,576	793	11,384	794	53,867	65,251
6 ...	112	323	...	...	...	...	224	2,930	336	6,162	343	30,367	36,529
7	3,727	61,493	3,727	61,493	1,602	141,883	203,376
8	2,503	29,272	2,503	29,272	479	27,819	57,091
9	6,959	59,541	6,959	59,541	833	45,100	104,641
1910	6,309	27,271	6,309	27,271	1,281	68,657	95,928
1	9,825	33,709	9,825	33,709	828	44,409	78,118
2	9,536	58,688	9,536	58,688	28	1,136	59,824
3	4,339	136,472	4,339	136,472	82	5,891	142,363
4	3,913	33,654	3,913	33,654	183	4,520	38,174
5	737	13,768	737	13,768	946	77,401	91,169
6	650	14,971	650	14,971	457	49,862	64,833
7	966	20,878	966	20,878	535	64,860	85,738
8	1,643	24,877	1,643	24,877	478	41,269	66,146
9	455	9,740	455	9,740	4	365	10,105
1920	1,511	22,467	1,511	22,467	137	2,698	25,165
1921	1,040	16,153	1,040	16,153	206	8,448	24,601
1922	352	5,519	352	5,519	660	14,860	20,379
1923	3,394	48,907	3,394	48,907	1,057	16,193	65,100
Total	76,128	928,143	13,414	817,979	1,746,122

† See Woodward's Mining Handbook, Perth : By Authority, 1895 ; page 123.

*† Weight not stated.

XXVIII.

ENTERED FOR EXPORT FROM 1850 TO 1923, INCLUSIVE.

TIN.											YEAR.
BLACK TIN (Dressed Tin ore).								TIN INGOT.		Total Value of Tin Exported.	
Pilbara Cf.		Greenbushes Mf.		†State generally.		Total.		Greenbushes Mf.			
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	£	
tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	£	
...	1850
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1860
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1870
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1880
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	...	5	300	...	...	5	300	...	...	300	1890
...	...	68	5,400	...	...	68	5,400	...	...	5,400	1
...	...	204	10,200	...	...	204	10,200	...	...	10,200	2
...	...	265	13,843	...	...	265	13,843	...	...	13,843	3
...	...	171	7,664	...	...	228	11,134	...	...	11,134	4
57	3,470	371	14,325	...	...	390	15,274	...	...	15,274	5
19	949	277	9,703	...	...	277	9,703	...	...	9,703	6
...	...	137	4,338	...	...	137	4,338	...	...	4,338	7
...	...	96	3,275	...	...	96	3,275	...	...	3,275	8
...	...	68	2,760	...	...	68	2,760	...	...	2,760	9
...	...	278	21,138	...	...	308	23,163	...	...	23,163	1900
...	...	102	8,032	...	...	470	38,178	142	18,872	57,050	1
368	30,146	68	4,895	...	...	507	39,495	97	12,607	52,102	2
439	34,600	31	2,870	...	...	279	22,568	141	16,830	39,398	3
248	19,698	25	1,868	...	...	292	22,856	235	29,277	52,133	4
267	20,988	24	1,389	379	20,797	467	27,118	129	16,155	43,273	5
64	4,932	119	8,177	666	51,748	973	76,778	†	1	76,779	6
188	16,853	444	46,254	624	64,005	1,397	138,634	45	8,746	147,380	7
329	28,375	...	...	1,424	151,414	1,424	151,414	78	14,725	166,139	8
...	1,093	83,294	1,093	83,594	†	1	83,595	9
...	698	62,989	698	62,989	...	...	62,989	1910
...	500	45,129	500	45,129	...	...	45,129	1
...	495	55,220	495	55,220	...	...	55,220	2
...	651	79,738	651	79,738	...	...	79,738	3
...	484	72,142	484	72,142	...	...	72,142	4
...	363	35,649	363	35,649	...	...	35,649	5
...	429	41,391	429	41,391	...	...	41,391	6
...	463	49,101	463	49,101	...	...	49,101	7
...	383	45,288	383	45,288	...	...	45,288	8
...	415	76,952	415	76,952	...	...	76,952	9
...	318	47,269	318	47,269	...	...	47,269	1920
...	243	49,449	243	49,449	...	...	49,449	1
...	67	6,485	67	6,485	...	...	6,485	2
...	110	10,930	110	10,930	...	...	10,930	3
...	131	15,095	131	15,095	...	...	15,095	4
...	14,698	1,392,852	867	117,214	1,510,066	Total

†Weight not stated.

†Probably the produce of Pilbara Goldfield and Greenbushes Mineral Field.

TABLE XXVIII.—Return of Ore and Minerals other than Gold

YEAR.	SILVER.		‡ LEAD.		‡ LEAD AND SILVER-LEAD.		PIG LEAD.		ZINC INGOTS AND CONCENTRATES.	
	State generally.		Northampton Mf.		State generally.		State generally.		State generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	ozs.	£	tons.	£	tons.	£	tons.	£	tons.	£
1850	...	...	5	55	...	...	...	...	...	...
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	‡	4	...	...	55	1,200	...	...
4	...	...	...	...	...	...	122	2,440	...	...
5	...	...	25	250	...	...	134	2,675	...	...
6	...	...	...	...	...	...	60	1,200	...	...
7	...	...	...	...	...	...	120	2,410	...	...
8	...	...	...	...	...	...	61	1,220	...	...
9	...	...	13	135	...	...	25	495	...	...
1860	...	...	98	985	...	...	...	...	...	...
1	...	...	79	790	...	...	...	...	...	...
2	...	...	9	90	...	...	...	...	...	...
3	...	...	230	2,300	...	...	...	...	...	...
4	...	...	80	800	...	...	...	...	...	...
5	...	...	703	8,436	...	...	...	...	...	...
6	...	...	273	3,282	...	...	...	...	...	...
7	...	...	902	10,824	...	...	‡3	50	...	...
8	...	...	1,100	13,206	...	...	...	...	...	...
9	...	...	699	8,394	...	...	...	...	...	...
1870	...	...	1,209	14,514	...	...	...	...	...	...
1	...	...	420	5,040	...	...	...	...	...	...
2	...	...	364	4,368	...	...	...	...	...	...
3	...	...	965	11,586	...	...	...	...	...	...
4	...	...	2,144	25,725	...	...	...	...	...	...
5	...	...	2,289	27,468	...	...	4	89	...	...
6	...	...	2,192	26,298	...	...	‡7	155	...	...
7	...	...	3,956	47,466	...	...	‡1	15	...	...
8	...	...	3,618	43,410	...	...	...	...	...	...
9	...	...	2,775	33,300	...	...	...	...	...	...
1880	...	...	1,921	15,368	...	...	‡5	89	...	...
1	...	...	1,401	11,204	...	...	‡1	20	...	...
2	...	...	1,794	14,348	...	...	...	...	...	...
3	...	...	1,038	7,266	...	...	...	...	...	...
4	...	...	696	4,872	...	...	...	...	...	...
5	...	...	465	3,255	...	...	...	...	...	...
6	...	...	611	4,277	...	...	...	...	...	...
7	...	...	471	4,710	...	...	‡6	120	...	...
8	...	...	532	5,320	...	...	‡2	40	...	...
9	...	...	250	2,500	...	...	...	...	...	...
1890	...	...	214	2,135	...	...	...	...	...	...
1	...	...	25	250	...	...	...	...	...	...
2	...	...	30	150	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	‡	4	...	...	‡1	11	...	...
8	...	...	5	33	...	...	...	...	...	...
9	...	...	16	96	...	...	77	1,077	...	...
1900	28,749	3,594	27	242	...	...	...	...	...	...
1	60,869	7,609	...	...	...	...	...	...	...	...
2	83,293	9,190	...	...	...	...	...	...	...	...
3	168,113	19,153	...	...	...	...	...	...	...	...
4	399,190	45,912	...	...	...	...	...	...	...	...
5	359,744	44,278	...	...	...	...	...	...	...	...
6	282,145	37,612	...	...	...	...	...	...	...	...
7	189,265	25,382	...	...	211	1,866	...	...	73	3,390
8	168,455	18,877	...	...	518	5,006	...	...	11	98
9	176,843	18,778	...	...	211	1,199	...	...	19	244
1910	176,139	18,777	248	1,433	...	...	...	...	12	147
1	169,043	18,333	1,549	15,002	...	...	...	...	12	189
2	165,371	19,725	1,868	22,270	...	...	...	...	14	217
3	188,020	23,420	3,169	59,002	...	...	...	...	...	...
4	193,057	23,227	3,554	46,285	...	...	...	...	22	379
5	222,159	24,295	...	...	2,883	39,032	13	302	7	143
6	173,012	22,258	...	...	428	12,033	3,523	74,930	14	630
7	222,075	38,339	...	...	22	593	4,661	139,940	...	...
8	109,830	22,711	...	...	282	3,045	5,489	163,880	...	...
9	223,332	55,342	...	...	248	3,704	1,780	48,462	...	...
1920	130,692	36,605	...	...	3,427	84,743	1,930	69,136	...	...
1921	116,151	18,658	...	...	...	...	2,156	48,863	...	...
1922	118,696	18,164	...	...	...	...	2,796	69,528	...	...
1923	109,005	16,036	...	...	3,172	43,416	20	609	...	...
Total	4,233,248	586,275	44,032	508,748	11,402	194,637	23,052	628,956	184	5,437

‡ Weight not stated.

‡ Estimated.

‡ Ore and Concentrates.

entered for EXPORT from 1850 to 1923, inclusive—continued.

TUNGSTEN ORE.				ARSENICAL ORE.		TANTALITE.		NON-METALLIC MINERALS.				YEAR.
WOLFRAM.		SCHEELITE.		State generally.		State generally.		GRAPHITE.		MAGNESITE.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	
...	1850
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1860
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1870
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1880
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1890
...	1
...	2
...	3
...	4
...	5
...	6
...	7
...	8
...	9
...	1900
...	1	6	...	...	1
...	2
...	3
...	18	5,729	...	...	...	4
...	5
...	6
...	4	140	...	...	...	...	...	...	...	7
...	8
...	9
...	1910
1	100	...	...	...	...	...	...	...	...	...	...	1
2	190	...	...	...	...	...	...	...	...	...	...	2
9	826	...	...	...	...	...	...	...	...	...	...	3
...	4
1	86	...	...	...	...	...	...	...	...	...	...	5
½	40	...	...	...	...	...	...	...	...	...	...	6
¼	25	...	...	...	...	...	...	...	...	...	...	7
1	128	3	438	11	19	47	9,375	21	284	688	1,196	8
...	...	½	42	57	707	17	2,513	18	158	42	50	9
...	...	5	720	679	2,564	...	...	5	75	62	225	1
...	...	6	772	...	...	...	...	...	...	...	...	2
...	...	2½	395	1,765	4,260	...	...	...	...	...	...	3
...	7	16	...	...	...	...	...	...	4
...	1,075	1,784	...	...	...	3	...	...	5
...	**	686	...	...	...	...	2	8	6
...	4½	688	...	...	...	...	7
15	1,441	21	2,507	...	10,036	...	18,780	...	696	806	1,526	Total

** Contained in Gold ore.

½ Weight not stated.

TABLE XXVIII.—Return of Ore and Minerals other than Gold

YEAR.	NON-METALLIC MINERALS—continued.						MINERALS NOT ELSEWHERE INCLUDED.		Total Value of Minerals other than Gold exported to Date.	YEAR.
	ASBESTOS.		COAL.		MICA.		Quantity.	Value.		
	State generally.		Collie River Mf.		State generally.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	tons.	£	tons.	£	tons.	£	tons.	£	£	
1850	55	1850
1	1
2	2
3	1,211	3
4	2,440	4
5	2,951	5
6	2,218	6
7	4,330	7
8	10,751	8
9	14,752	9
1860	9,006	1860
1	7,129	1
2	12,626	2
3	14,508	3
4	18,016	4
5	21,726	5
6	11,644	6
7	15,929	7
8	14,451	8
9	10,719	9
1870	14,604	1870
1	5,040	1
2	4,368	2
3	12,434	3
4	26,723	4
5	30,628	5
6	30,638	6
7	48,284	7
8	43,545	8
9	33,300	9
1880	15,577	1880
1	11,224	1
2	14,371	2
3	7,341	3
4	6,642	4
5	5,048	5
6	8,012	6
7	5,175	7
8	6,848	8
9	4,704	9
Carried forward	508,968	

entered for EXPORT from 1850 to 1923, inclusive—continued.

YEAR.	NON-METALLIC MINERALS—continued.						MINERALS NOT ELSEWHERE INCLUDED.		Total Value of Minerals other than Gold exported to Date.	YEAR.
	ASBESTOS.		COAL.		MICA.					
	State generally.		Collie River Mf.		State generally.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	tons.	£	tons	£	tons.	£	tons	£		
1890	Brought forward	...	...	...	...	...	...	508,968	1890	
1	7,671	1	
2	2†	25	...	14,912	2	
3	2†	4	...	22,714	3	
4	11,744	4	
5	2†	3	...	15,274	5	
6	22,658	6	
7	2†	209	...	4,438	7	
8	1	1	...	...	...	4,532	8	
9	...	1	798	772	2†	50	...	7,060	9	
1900	355	350	2†	3	5	66,611	1900	
1	971	969	...	...	...	95,261	1	
2	12	12	...	...	2	4	171,453	2
3	...	10	110	127	...	...	22	41	61,551	3
4	11	7	...	...	7	230	109,468	4
5	108	87	...	...	62	81	97,132	5
6	86	65	...	...	10	127	192,251	6
7	26	28	...	...	96	1,035	222,621	7
8	...	1,242	13	1,138	...	...	...	1,447	402,906	8
9	9,612	7,747	2†	10	42	2,750	176,827	9
1910	353	183	...	...	263	735	282,650	1910
1	85,647	93,781	...	...	...	...	200,106	1
2	3	2	...	...	1	100	197,439	2
3	48,876	38,400	...	...	14	407	212,509	3
4	40,063	29,344	...	...	...	8	336,155	4
5	6	6	...	...	5	17	182,996	5
6	42,602	30,721	...	...	9	635	218,495	6
7	54,228	39,125	...	...	...	115	265,043	7
8	54,416	38,244	4	323	12	713	343,167	8
9	1,667	1,513	2†	26	13	440	360,895	9
1920	26,167	19,288	...	...	...	116	244,050	1920
1	2,447	1,857	2†	10	14	97	377,416	1
2	37,590	28,387	...	...	5	116	293,771	2
3	31,951	29,359	...	...	...	223	243,512	3
4	23,238	24,424	...	...	...	257	226,996	4
5	69,708	76,924	1	514	17	116	...	5
6	78,788	104,665	18†	120	19	223	...	6
7	116,993	188,686	...	...	...	257	...	7
8	71,164	115,835	2	60	21	1,033	...	8
9	5,313	7,969	...	...	...	303	...	9
1921	43,729	73,256	...	...	...	...	...	1921
1922	1922
1923	1923
Total	...	20,336	848,499	953,283	...	1,357	...	11,049	6,201,252	Total

* Bunker Coal. † Weight not stated. ‡ 4 cwts. § Cobalt ore.

† Includes— Antimony ore, 25 tons = £630 N.E.I., 71 tons ... = 817 Total ... £1,447	‡ Includes— Iron ore, 9 tons ... = £7 Ores, N.E.I., 5 tons ... = 400 Total ... £407
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7 † Antimony ore. 12 † Bismuth.

12 † Includes— Bismuth, 1 ton ... = £37 Fireclay, 12 tons ... = 75 Manganese, 3 cwt. ... = 3 Total ... £115

13 † Molybdenite, 14 † cwts.

13 † Includes— Antimony, 12 tons ... = £258 Bismuth, 9cwt. ... = 24 Molybdenite, 14 tons ... = 158 Total ... £440

9 † Includes—

9 † Includes— Other Concentrates, 29 tons = £108 N.E.I., 234 tons ... = 627 Total ... £735

11 † Includes—

11 † Includes— Manganese, 2 tons ... = £4 N.E.I. ... = 4 Total ... £8
--

14 † Includes—

14 † Includes— Antimony, 27 tons ... = £580 Bismuth, 4 cwt. ... = 133 Total ... £713

17 † Includes—

17 † Includes— Bismuth, 1 cwt. ... = £15 Corundum, 1 ton ... = 1 Molybdenite, 7 tons ... = 100 Total ... £116

19 † Includes—

19 † Includes— Antimony, 2½ tons ... £45 Clay, 6 cwt. ... 6 Gadolinite, 1 ton ... 150 Iron Concentrates, 1 ton ... 17 Molybdenite, 10 cwt. ... 5 Total ... £223

20 † Includes—

20 † Includes— Barytes, 2 cwt. ... £18 Corundum, ½cwt. ... 2 Felspar, 1 ton ... 47 Jarosite, 12cwt. ... 5 Manganese, 16 tons ... 145 Pottery clay, 3½ tons ... 40 Total ... £257

21 † Includes—

21 † Includes— Barytes, 19 tons ... £73 Felspar, 60 tons ... 485 Gypsum, 2 tons ... 4 Molybdenite, 51 tons ... 505 Pottery clay, 1 ton ... 16 Total ... £1,083
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22 † Includes—

22 † Includes— Clay, 34 tons ... £94 Iron Ore, 2 tons ... 9 Manganese, 22 tons ... 200 Total ... £303

PART III.—ALL MINES.

TABLE XXIX.

MILLING AND CYANIDING PLANTS ERECTED IN THE RESPECTIVE GOLDFIELDS, DISTRICTS, AND MINERAL FIELDS ON THE 31ST DECEMBER, 1923, AND THE TOTAL VALUE OF MINING MACHINERY.

Mining Centre and Lease or Area.	Name of Mine, Company, or Works.	MILLING.								CYANIDING.			Value of all Mining Machinery.	
		Batteries.	Other Mills.							Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.		
			Number of Heads of Stampers.	Prospecting Mills.	Ball Mills.	Griffin Mills.	Huntington Mills.	Puddlers.	Other Crushers.					Flint Mills.	Grinding Pans.
PILBARA GOLDFIELD.														
MARBLE BAR DISTRICT.														
<i>Bamboo Creek.</i> G.M.L. 795	Bulletin	10	...	...	...	...	...	...	...	...	...	...	...	...
^	State Battery, Bamboo Creek	5	...	...	...	...	...	...	1	5	...	...	...	...
<i>Lalla Rookh.</i> R.C. 112	Lalla Rookh	10	...	...	...	...	...	...	...	5	...	...	...	...
<i>Marble Bar.</i> M.A. 87	Ironclad	10	...	...	...	...	...	...	...	...	...	...	...	...
G.M.L. 694	Jo Jo	5	...	...	...	1	...	...	...	1	...	...	...	...
^	State Battery, Marble Bar	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>North Shaw.</i> G.M.L. 820	McLeod's Reward	5	...	...	...	...	...	...	...	...	...	...	...	...
	Total	50	...	...	...	1	...	...	2	10	...	...	...	£16,714
NULLAGINE DISTRICT.														
<i>Eastern Creek.</i> M.A. 11L	Doherty's Reward	10	...	...	...	...	...	...	...	4	...	...	...	...
<i>Middle Creek.</i> G.M.L. 218L	Barton	10	...	...	...	...	...	...	1	6	...	...	...	...
^	State Battery, 20-Mile Sandy	5	...	...	...	...	...	...	1	6	...	...	...	...
	Total	25	...	...	...	...	...	...	2	16	...	...	...	£2,989
WEST PILBARA GOLDFIELD.														
<i>Pilbara.</i> (188)	Black Prince ... ..	...	1	...	...	...	...	...	...	...	...	...	...	...
<i>Station Peak.</i> M.A. 14	Pilgrim's Rest	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Weerianna.</i> M.A. 12	Porteminna	10	...	...	...	...	...	...	...	...	...	...	...	...
	Total	20	1	...	...	...	...	...	...	...	...	...	...	£2,281
PEAK HILL GOLDFIELD.														
<i>Mt. Egerton.</i> ^	State Battery, Mt. Egerton	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Peak Hill.</i> T.A. 6P	Wind Power Cyanide Works	...	...	...	...	...	...	...	...	4	...	...	...	...
^	State Battery, Peak Hill	5	...	...	...	...	...	...	1	...	...	...	...	...
	Total	10	...	...	...	...	...	...	1	4	...	...	...	£2,842
EAST MURCHISON GOLDFIELD.														
LAWLERS DISTRICT.														
<i>Kathleen Valley.</i> G.M.L. 382	Yellow Aster	5	...	...	...	...	...	...	...	4	...	...	...	...
<i>Lawlers.</i> 1212	Daisy Queen G.M. Co., N.L.	10	...	...	...	...	...	...	...	5	...	...	...	...
1171	Great Eastern	5	...	...	...	...	...	...	1	6	...	...	...	...
M.A. 11	Sands Retreatment Works	...	...	...	...	...	...	...	...	4	...	...	...	...
M.A. 30	Try It	5	...	...	...	...	...	...	...	4	...	...	...	...
58, etc.	Waroonga G.M. Co., Ltd.	10	...	...	...	...	...	...	1	4	...	...	...	...
<i>Sir Samuel.</i> ^	State Battery, Sir Samuel	5	...	...	...	...	...	...	...	...	...	...	...	...
	Total	40	...	...	...	...	...	...	2	23	...	...	...	£19,443
WILUNA DISTRICT.														
<i>Gum Creek.</i> (226J)	Alma May	5	...	...	...	...	...	...	...	4	...	...	...	...
<i>Mt. Keith.</i> ^	State Battery, Mt. Keith	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Wiluna.</i> ^	State Battery, Wiluna	10	...	...	...	...	...	...	1	...	3	1	...	...
6J, etc.	Wiluna Gold Mines	45	...	...	...	...	...	...	4	...	...	...	...	...
	Total	65	...	...	...	...	...	...	5	4	3	1	...	£22,954
BLACK RANGE DISTRICT.														
<i>Curran's Find.</i> Temp. Res. 299H	Red White and Blue	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Maninga.</i> Marley. 203B	Havilah G.M.	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Sandstone.</i> 893B	Nous Verrons	3	...	...	...	...	...	...	...	...	...	...	...	...
M.A. 13B	Yuanmi Gold Mines, Ltd.	20	...	...	...	...	...	...	...	...	...	...	...	...
<i>Yuanmi.</i> ^	State Battery, Black Range	10	...	...	...	...	...	...	...	6	...	...	...	...
863B, etc.	Yuanmi Gold Mines, Ltd.	20	...	1	...	...	...	...	1	6	3	...	...	...
^	State Battery, Yuanmi	5	...	...	...	...	...	...	...	2	...	...	...	...
	Total	73	...	1	...	...	...	...	1	2	14	3	...	£95,806

TABLE XXIX.—Milling and Cyaniding Plants erected in the respective Goldfields, Districts, etc.—continued.

Mining Centre and Lease or Area.	Name of Mine, Company, or Works.	MILLING.								CYANIDING.			Value of all Mining Machinery.	
		Batteries.	Other Mills.							Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.		
			Number of Heads of Stampers.	Prospecting Mills.	Ball Mills.	Griffin Mills.	Huntington Mills.	Puddlers.	Other Crushers.					Flint Mills.	Grinding Fans.
MURCHISON GOLDFIELD.														
CUE DISTRICT.														
<i>Cuddingwarra.</i> 1860 Cue. 208 (1889)	Big Bell	10	...	...	...	...	...	...	...	1	12	...	...	...
	Cue No. 1	20	...	...	...	...	...	...	...	1	4	...	...	...
	Gem of Cue Extended State Battery, Cue	15 5	...	...	...	...	...	...	...	...	5	...	...	...
<i>Reedy's Find.</i> 1977	Emu	5	...	...	...	...	...	...	...	...	2	...	...	...
<i>Tukanarra.</i> ^	State Battery, Tukanarra	10	...	...	...	...	...	...	...	...	...	...	...	...
	Total	65	...	...	...	...	...	...	...	2	23	...	...	£26,707
MEEKATHARRA DISTRICT.														
<i>Holden's Find.</i> 1291N	Waterloo	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Meekatharra.</i> 477N	Fenlan	15	...	...	...	...	...	...	...	4	...	6	1	...
	Ingliston G.M. Co., N.L. Ingliston Consols Extended Gold Mine	10 15	...	...	...	...	...	...	...	...	3	...	...	...
	Marmont	10	...	...	...	...	...	...	...	...	...	...	...	...
	State Battery, Meekatharra	5	...	...	...	...	...	...	...	...	5	...	...	...
<i>Nannine.</i> 106N	Nannine	10	...	...	...	...	...	...	...	2	3	...	...	...
	Total	70	...	...	...	...	...	...	...	9	8	6	1	£48,870
DAY DAWN DISTRICT.														
<i>Day Dawn.</i> 1D, etc. (188D)	Great Fingall Consolidated, Ltd.	40	...	...	...	...	...	2	...	1	14	8	...	...
	Murchison Associated	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Jasper Hill.</i> 553D	Neptune	10	...	...	...	...	...	...	...	1	...	...	...	...
<i>Lake Austin.</i> P.A. 371D	D. H. Powell	3	...	...	...	...	...	...	...	...	...	...	...	...
	Total	63	...	...	...	...	...	2	...	2	14	8	...	£4,850
MT. MAGNET DISTRICT.														
<i>Lennoxville.</i> 964M	Empress	5	...	...	...	...	...	...	...	1	3	...	...	...
	State Battery, Lennoxville ... ..	...	...	...	...	...	...	...	...	...	3	...	3	...
<i>Mt. Magnet.</i> 1156M	Leap Year	5	...	...	...	...	...	...	...	1	...	...	...	...
	Mars ... ..	...	...	1	...	...	...	...	...	...	3	...	...	...
	New Havelock	5	...	...	...	...	...	...	...	...	3	...	...	...
	State Battery, Boogardie	5	...	...	...	...	...	...	...	...	5	...	...	...
	J. S. Smith ... ..	...	1	...	...	...	...	...	...	...	...	...	...	...
	Total	20	1	1	...	...	...	...	...	2	22	...	3	£15,888
YALGOO GOLDFIELD.														
<i>Goodingnow.</i> <i>Gulliesea.</i> 972	State Battery, Payne's Find	5	...	...	...	...	...	...	...	...	5	...	...	...
<i>Noongal.</i> 953	Joyce Jenkins ... ..	...	3	...	...	...	...	...	...	...	...	...	...	...
<i>Nyanda.</i> 880	Revival	5	...	...	...	...	...	...	...	...	2	...	...	...
<i>Warriedar.</i> (708)	Gnow's Nest G.M., Ltd.	10	...	...	...	...	1	...	...	2	8	...	...	...
	Mug's Luck	10	...	...	...	...	...	...	...	...	5	2	5	...
	State Battery, Warriedar	5	...	...	...	...	...	...	...	...	5	...	...	...
<i>Yalgoo.</i> M.A. 17 P.A. 616	Ivanhoe	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Yush.</i> 712	Moxon ... ..	...	1	...	...	...	...	...	...	...	...	...	...	...
	Bullrush Gold Estates	20	...	...	...	...	...	...	...	5	...	...	...	...
	Total	60	4	...	...	...	...	1	...	7	20	2	5	£35,061
MT. MARGARET GOLDFIELD.														
MT. MORGANS DISTRICT.														
<i>Linden.</i> 344F	Bindah	5	...	...	...	...	...	...	...	...	3	...	...	...
	State Battery, Linden	10	...	...	...	...	...	...	...	...	5	...	...	...
	Torquay	5	...	...	...	...	...	...	...	...	4	2	...	...
<i>Mt. Margaret.</i> (314F)	Mt. Morven	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mt. Morgans.</i> (825F)	Millionaire	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Yundamundra.</i> 5F	Westralia Mt. Morgans Mines, N.L.	10	...	...	...	...	...	...	...	3	...	2	1	...
	Big Stone	5	...	...	...	...	...	...	...	...	3	...	...	...
	Total	45	...	...	...	...	...	...	...	3	15	4	1	£9,986

TABLE XXIX.—Milling and Cyaniding Plants erected in the respective Goldfields, Districts, etc.—continued.

Mining Centre and Lease or Area.	Name of Mine, Company, or Works.	MILLING.								CYANIDING.			Value of all Mining Machinery.	
		Batteries.	Other Mills.							Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.		
			Number of Heads of Stampers.	Prospecting Mills.	Ball Mills.	Griffin Mills.	Huntington Mills.	Puddlers.	Other Crushers.					Flint Mills.	Grinding Pans.
MT. MALCOLM DISTRICT.														
<i>Lake Darlot.</i>	State Battery, Lake Darlot	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Leonora.</i>	Chaffers G.M. Co. (1916), Ltd.	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>M.A. 10c</i>	Gwalia Central G.Ms., Ltd.	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>263c</i>	Leonora Gold Blocks	10	...	...	...	...	...	...	...	1	...	...	...	...
<i>1530c</i>	Sons of Gwalia, Ltd.	30	...	...	...	...	...	...	4	...	...	...	1	...
<i>190c, etc.</i>	State Battery, Leonora	10	...	...	...	...	...	...	...	5	...	...	...	...
<i>Mt. Chiford.</i>	Victory No. 1	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>1329c</i>	Starlight	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Pg Well.</i>	Total	85	...	...	...	...	...	...	4	...	6	...	1	£263,175
MT. MARGARET DISTRICT.														
<i>Duketon.</i>	Mulga Queen	10	...	...	...	...	...	...	...	4	...	...	...	...
<i>M.A. 22r</i>	Mary Mac G.M. Co., N.L.	10	...	...	...	...	...	...	...	4	3	1	...	...
<i>Laverton.</i>	State Battery, Laverton	10	...	...	...	...	...	...	...	...	5	...	...	...
<i>(1897r)</i>	Total	30	...	...	...	...	...	...	...	4	12	1	...	£5,200
NORTH COOLGARDIE GOLDFIELD.														
MENZIES DISTRICT.														
<i>Comet Vale.</i>	Gladsome	10	...	...	...	...	...	...	...	2	9	...	...	...
<i>5217z</i>	Lady Harriet	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>Menzies.</i>	Menzies Consolidated Gold Mines, Ltd.	20	...	...	...	...	...	...	...	9	14	4	1	...
<i>M.A. 65z</i>	Menzies Mining & Exploration Corp'n, Ltd.	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>4931z, etc.</i>	State Battery, Mt. Ida	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>(3100z, etc.)</i>	Unexpected South	5	...	...	...	...	...	...	...	1	...	...	...	...
<i>Mt. Ida.</i>	Total	55	...	...	...	...	...	...	...	12	23	4	1	£17,026
<i>5481z</i>														
ULLARRING DISTRICT.														
<i>Mulline.</i>	State Battery, Mulline	10	...	...	...	...	...	...	...	1	...	...	...	...
<i>M.A. 11u</i>	Young Australian	10	...	...	...	...	...	...	...	...	...	...	...	...
	Total	20	...	...	...	...	...	...	...	1	...	...	...	£2,539
NIAGARA DISTRICT.														
<i>Kookynie.</i>	Two D's. ... ..	...	...	1	...	...	...	...	...	3	...	10	...	...
<i>769c</i>	State Battery, Niagara	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>Niagara.</i>	Grafter	5	...	...	...	...	...	...	...	1	2	...	...	...
<i>Tampa.</i>	Total	15	...	1	...	...	...	...	...	4	2	10	...	£3,216
<i>M.A. 62c</i>														
YERILLA DISTRICT.														
<i>Edjudina.</i>	Neta	10	...	...	...	...	...	...	...	1	...	...	...	...
<i>1011r</i>	State Battery, Yarri	10	...	...	...	...	...	...	...	...	5	...	...	...
<i>Yarri.</i>	Total	20	...	...	...	...	...	...	...	1	5	...	...	£3,326
<i>M.A. 62c</i>														
BROAD ARROW GOLDFIELD.														
<i>Bardoc.</i>	Zoroastrian	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>1833w</i>	Associated Northern Blocks (W.A.), Ltd. ... ..	...	...	1	...	2	3	1	...	10	7	...	2	...
<i>Siberia.</i>	Gimblet South	10	...	...	...	...	...	...	...	...	...	...	...	...
<i>1399w, etc.</i>	Lady Evelyn	5	...	...	...	...	...	...	...	...	...	4	...	...
<i>1371w</i>	Pole	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>1289w</i>	State Battery, Ora Banda	5	...	...	...	...	...	...	...	...	5	...	...	...
<i>(1736w)</i>	State Battery, Siberia	5	...	...	...	...	...	...	...	...	...	...	...	...
<i>M.A. 62c</i>	Total	85	...	1	...	2	3	1	...	10	12	4	2	£63,526

TABLE XXIX.—Milling and Cyaniding Plants erected in the respective Goldfields, Districts, etc.—continued.

Mining Centre and Lease or Area.	Name of Mine, Company, or Works.	MILLING.								CYANIDING.			Value of all Mining Machinery.		
		Batteries.	Other Mills.							Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.			
			Number of Heads of Stampers.	Prospecting Mills.	Ball Mills.	Griffin Mills.	Huntington Mills.	Puddlers.	Other Crushers.					Flint Mills.	Grinding Fans.
NORTH-EAST COOLGARDIE GOLDFIELD.															
KANOWNA DISTRICT.															
<i>Gordon.</i> 1385X <i>Kanowna.</i> 1839X M.A. 19X 12X, etc. <i>Mulgarrrie.</i> 1426X	Pride of the Morning ... ..	...	...	...	...	1	...	...	...	...	...	...	...	...	...
	Golden Valley	5	...	...	...	...	...	...	...	...	...	...	...	...	...
	Martin's Battery	15	...	...	...	...	...	...	...	1	...	...	...	...	...
	North White Feather	20	...	...	...	...	...	...	...	...	...	...	...	...	...
	Palm ... ..	...	...	...	...	1	...	...	...	...	...	...	...	...	...
	Total	40	...	...	...	2	...	...	...	1	...	...	...	...	£8,750
KURNALPI DISTRICT.															
<i>Kurnalpi.</i> M.A. 5K <i>Mulgabbie.</i> M.A. 4K	Success Battery	5	...	...	...	...	...	...	...	...	2	...	...	...	...
	Simmons' Battery ... ..	...	1	...	...	...	...	...	...	...	...	...	...	...	...
	Total	5	1	...	...	...	...	...	...	...	2	...	...	...	£200
EAST COOLGARDIE GOLDFIELD.															
EAST COOLGARDIE DISTRICT.															
<i>Boulder.</i> 38E, etc. 35E 351E M.A. 71E 66E 16E, etc. 946E 31, etc. 15E, etc. 231E, etc. 6E, etc. 1208E, etc. <i>Hampton Plains.</i> Block 48, P.P.L. 86 Block 50, P.P.L. 9 Block 45, P.P.L. 252 Block 48, P.P.L. 1 <i>Kalgoorlie.</i> 796E 5251E 3643E M.A. 7E 4546, etc. 5387E L.C. 353E <i>Wombola.</i> 4766E 4770E	Associated Gold Mines of W.A., Ltd. ... ..	...	...	7	...	...	...	1	...	20	6	7	...	...	...
	Eureka ... ..	...	...	...	1	...	...	...	...	1	...	...	...	...	...
	Golden Horseshoe Estates Co., Ltd.	100	...	1	...	3	6	15	24	20	22	20	...	...	...
	Great Boulder No. 1, Ltd.	10	...	...	...	...	...	...	2	...	...	...	...	...	...
	Great Boulder Perseverance G.M. Co., Ltd. (in Liq.)	...	8	...	...	...	1	2	17	...	24	13	...	...	...
	Great Boulder Proprietary Gold Mines, Ltd. ... ..	...	1	6	13	...	2	9	20	...	23	7	...	...	...
	Ironsides North	10	...	...	...	...	...	...	1	2	...	...	...	...	...
	Ivanhoe Gold Corporation, Ltd.	100	...	...	...	...	3	2	25	32	13	3	...	...	...
	Lake View and Star, Ltd.	10	...	4	...	...	3	2	4	...	7	3	...	...	...
	North Kalgurli (1912), Ltd.	20	...	...	...	...	2	...	1	4	...	1	...	...	...
	Oroya Links, Ltd.	50	...	11	...	...	1	...	2	17	...	7	3	...	...
	South Kalgurli Consolidated, Ltd.	40	...	4	...	...	...	...	7	...	5	7	...	...	...
	Golden Hope G.Ms., N.L.	10	...	...	...	...	...	...	2	...	2	1	...	...	...
	Hampton Celebration (W.A., Ltd.)	10	...	...	...	...	...	...	1	1	2	2	...	...	...
	Mount Martin	10	...	...	...	...	...	...	...	6	2	1	...	...	...
	White Hope: Hopeful Synd., Ltd.	10	...	...	...	...	...	...	1	6	1	...	...	...	...
	Bonnie Lass (Raven's Battery)	10	...	...	...	...	...	...	...	...	...	...	...	...	...
	Central ... ..	...	...	...	1	...	...	...	...	...	3	...	...	...	...
	Hainault Sulphide Plant ... ..	...	1	...	...	...	...	...	1	7	...	...	...	...	...
	Hannans Central	20	...	...	...	...	1	1	...	8	4	2	...	...	...
	Hannans Reward, Ltd.	5	...	...	...	...	...	...	...	7	...	...	...	...	...
	Hidden Secret	5	...	1	...	...	...	...	...	7	...	...	...	...	...
	Lone Hand ... ..	...	...	...	1	...	...	...	...	1	...	...	...	...	...
	Great Hope ... ..	...	...	...	1	...	...	...	...	1	...	...	...	...	...
	Great Hope North	10	...	...	...	...	...	...	...	4	...	...	...	...	...
	Total	430	1	43	13	4	6	26	25	146	109	122	63	£1,142,651	
COOLGARDIE GOLDFIELD.															
COOLGARDIE DISTRICT.															
<i>Burbanks.</i> 13A, etc. M.A. 77 (2160) <i>Coolgardie.</i> 5135 5147 4567 M.A. 11 <i>Gibraltair.</i> 4580 4593 <i>St. Ives.</i> <i>Widgiemooltha.</i> M.A. 63 M.A. 280E	Burbanks Birthday G.Ms., Ltd. ... ..	...	...	...	...	...	...	...	1	...	9	...	...	...	...
	Burbanks Main Lode ... ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lady Robinson	10	...	...	...	...	...	...	...	...	...	...	...	...	...
	Coolgardie Redemption	10	...	...	...	...	...	...	...	...	...	...	...	...	...
	Garden Gully	5	...	...	...	...	...	...	...	...	...	...	...	...	...
	Griffiths Gold Mine	10	...	...	...	...	...	...	...	6	...	...	...	...	...
	New Bayley's Mine, Ltd. ... ..	...	...	...	...	...	...	...	...	1	4	...	...	...	...
	State Battery, Coolgardie	10	...	...	...	...	...	...	...	6	...	...	...	...	...
	Lloyd George	10	...	...	...	...	...	...	...	2	18	...	...	...	...
	Reform	5	...	...	...	...	...	...	...	5	...	...	...	...	...
	State Battery, [St. Ives]	5	...	...	...	...	...	...	...	5	...	...	...	...	...
	Highgate	3	...	...	...	...	...	...	...	...	...	...	...	...	...
	Imperial	5	...	...	...	...	...	...	...	...	...	...	...	...	...
	Total	73	...	...	...	...	...	1	...	3	50	4	...	...	£27,688
KUNANALLING DISTRICT.															
<i>Carbine.</i> 93E 25-Mile. 896E (871E) 845E 897E	Carbine	12	...	...	...	...	...	...	...	2	...	...	...	...	...
	Blue Bell	5	...	...	...	...	...	...	...	...	7	...	...	...	...
	Shanrock	5	...	...	...	...	...	...	...	...	...	...	...	...	...
	Star of Fremantle	10	...	...	...	...	...	...	...	...	2	...	...	...	...
	Nick of Time ... ..	...	...	...	...	...	...	...	...	1	...	...	...	...	...
	Total	32	...	...	...	...	...	...	...	3	9	...	...	...	£7,800

TABLE XXIX.—Milling and Cyaniding Plants erected in the respective Goldfields, Districts, etc.—continued.

GOLDFIELD.	DISTRICT.	MILLING.								CYANIDING.			Total Value of all Mining Machinery.	
		Batteries. Number of Heads of Stampers.	Other Mills.							Leaching Vats.	Agitating Vats.	Vacuum Filters and Presses.		
			Prospecting Mills.	Ball Mills.	Griffin Mills.	Huntington Mills.	Puddlers.	Other Crushers.	Flint Mills.					Grinding Pans.
GOLD MINING.													£	
KIMBERLEY	Marble Bar	50				1					10			16,714
PILBARA	Nullagine	25								16				2,989
WEST PILBARA		20	1											2,281
ASHBURTON														
GASCOYNE														
PEAK HILL		10								1	4			2,842
EAST MURCHISON	Lawlers	40								23				19,443
	Willuna	65								5	3	1		22,954
	Black Range	78		1						14	3			95,806
MURCHISON	Cue	65								23				26,707
	Meekatharra	70								9	6	1		4,887
	Day Dawn	68						2		14	8			4,850
YALGOO	Mt. Magnet	20	1	1						22		3		15,883
		60	4					1		7	2	5		35,061
		45								3	15	4	1	9,986
MT. MARGARET	Mt. Morgans	85								4	6	1		263,175
	Mt. Malcolm	30								4	12	1		5,200
	Menzies	55								12	23	4	1	17,026
NORTH COOLGARDIE	Ularring	20								1				2,539
	Niagara	15		1						4	2	10		3,216
	Yerilla	20								1	5			3,326
BROAD ARROW		35		1		2	3	1		10	12	4	2	68,526
N.E. COOLGARDIE	Kanowna	40				2				1				8,750
EAST COOLGARDIE	Kurnalpi	5	1								2			200
	East Coolgardie	430	1	43	13	4	6	26	25	146	109	122	63	1,142,651
	Bulong													
COOLGARDIE	Coolgardie	73						1		3	50	4		27,688
	Kunanalling	32								3	9			7,800
YILGARN		125				2			2	9	33	8	4	54,772
DUNDAS		17								3	10			10,336
PHILLIPS RIVER		50						1			2			9,800
STATE GENERALLY				1				1						30,100
Total, Gold Mining Machinery		1,638	8	48	13	11	9	33	32	236	448	179	82	£1,954,491
LEAD MINING.														
NORTHAMPTON, M.F.								5						39,370
Total, Lead Mining Machinery								5						£39,370
TIN MINING.														
PILBARA	Marble Bar					1		1						25,300
GREENBUSHES TINFIELD						1		4						16,341
Total, Tin Mining Machinery						2		5						£41,641
COPPER MINING.														
WEST PILBARA								5	2	1				60,000
MT. MARGARET	Mt. Morgans													4,250
PHILLIPS RIVER								10	2	2				71,250
Total, Copper Mining Machinery								15	4	3				£135,500
COAL MINING.														
COLLIE COALFIELD														115,126
Total, Coal Mining Machinery														£115,126
ASBESTOS MINING.														
PILBARA	Nullagine													2,750
Total, Asbestos Mining Machinery														£2,750
Total Machinery other than Gold Mining						2		25	4	3				£334,387
Total, all Mining Machinery		1,638	8	48	13	13	9	58	36	239	448	179	82	£2,288,878

APPENDIX.

ROYAL MINT, PERTH BRANCH.

Subject to the Regulations, any person may deposit gold at the Mint in his own name. Those who cannot attend personally for the purpose may send the gold by an agent, under Police escort, or by Post.

A circular can be obtained from the Deputy Master of the Mint giving all necessary information for intending depositors, Coining Regulations, etc., etc.

Forms for use in connection with gold sent to the Mint by post can be obtained at the Mint.

Charges for Assaying, Refining, and Coinage.

Gross Weight of Deposit in ounces.	Mint Charge.	Gross Weight of Deposit in ounces.	Mint Charge.	Gross Weight of Deposit in ounces.	Mint Charge.
Up to and including—	£ s. d.	Up to and including—	£ s. d.	Up to and including—	£ s. d.
24	0 5 0	400	4 3 4	1,300	10 4 2
30	0 6 3	410	4 5 5	1,400	10 16 8
40	0 8 4	420	4 7 6	1,500	11 9 2
50	0 10 5	430	4 9 7	1,600	12 1 8
60	0 12 6	440	4 11 8	1,700	12 14 2
70	0 14 7	450	4 13 9	1,800	13 6 8
80	0 16 8	460	4 15 10	1,900	13 19 2
90	0 18 9	470	4 17 11	2,000	14 11 8
100	1 0 10	480	5 0 0	2,100	15 4 2
110	1 2 11	490	5 2 1	2,200	15 16 8
120	1 5 0	500	5 4 2	2,300	16 9 2
130	1 7 1	520	5 6 8	2,400	17 1 8
140	1 9 2	540	5 9 2	2,500	17 14 2
150	1 11 3	560	5 11 8	2,600	18 6 8
160	1 13 4	580	5 14 2	2,700	18 19 2
170	1 15 5	600	5 16 8	2,800	19 11 8
180	1 17 6	620	5 19 2	2,900	20 4 2
190	1 19 7	640	6 1 8	3,000	20 16 8
200	2 1 8	660	6 4 2	3,100	21 9 2
210	2 3 9	680	6 6 8	3,200	22 1 8
220	2 5 10	700	6 9 2	3,300	22 14 2
230	2 7 11	720	6 11 8	3,400	23 6 8
240	2 10 0	740	6 14 2	3,500	23 19 2
250	2 12 1	760	6 16 8	3,600	24 11 8
260	2 14 2	780	6 19 2	3,700	25 4 2
270	2 16 3	800	7 1 8	3,800	25 16 8
280	2 18 4	820	7 4 2	3,900	26 9 2
290	3 0 5	840	7 6 8	4,000	27 1 8
300	3 2 6	860	7 9 2	4,100	27 14 2
310	3 4 7	880	7 11 8	4,200	28 6 8
320	3 6 8	900	7 14 2	4,300	28 19 2
330	3 8 9	920	7 16 8	4,400	29 11 8
340	3 10 10	940	7 19 2	4,500	30 4 2
350	3 12 11	960	8 1 8	4,600	30 16 8
360	3 15 0	980	8 4 2	4,700	31 9 2
370	3 17 1	1,000	8 6 8	4,800	32 1 8
380	3 19 2	1,100	8 19 2	4,900	32 14 2
390	4 1 3	1,200	9 11 8	5,000	33 6 8

For every additional 100ozs. the charge is increased by 12s. 6d.

NOTE.—Additional charges are collected when base metals in a deposit exceed 2 per cent. of its weight.

The following table illustrates the operation of these charges in case of gold of the value of £3 17s. 10½d. an ounce:—

Weight of Deposit.	Rate of Charge per ounce.	Amount of Charge.	Net Value of Deposit.
ozs.	d.	£ s. d.	£ s. d.
50	2.5	0 10 5	194 3 4
100	2.5	1 0 10	388 6 8
600	2.3	5 16 8	2,330 8 4
1,000	2.0	8 6 8	3,885 8 4
5,000	1.6	33 6 8	19,435 8 4
10,000	1.55	64 11 8	33,872 18 4

NOTE.—A proportion of silver in deposits of gold is paid for by the Mint as follows:—

In deposits under 1,000ozs. gross: all silver in excess of 8 per cent. of the weight of the deposit after melting.				
" from 1,000 " to 5,000	"	6	"	"
" " 5,000 " " 10,000	"	5	"	"
" " 10,000 " upwards	"	4	"	"

The rate at which payment for silver is made is liable to fluctuation.

RATES FOR CARRIAGE OF GOLD ON GOVERNMENT RAILWAYS.

	Distance not over—									
	10 miles	25 miles.	50 miles.	100 miles.	150 miles.	200 miles.	250 miles.	300 miles.	400 miles.	500 miles.
Bullion or unmanufactured Gold, per 100ozs.	s. d. 3 9	s. d. 4 6	s. d. 5 3	s. d. 6 9	s. d. 8 3	s. d. 9 9	s. d. 11 3	s. d. 12 9	s. d. 15 0	s. d. 17 3

1s. 6d. per 100ozs. for every additional 100 miles, or part thereof.

Consignments of Gold Bullion in lots exceeding in the aggregate 40,000 ozs. despatched on any one day will be allowed a reduction of 33½ per cent. with a minimum charge as for 40,000 ozs. Consignors may combine to make up the required quantity, but each consignment must be charged for separately.

To find the value per ounce of gold sent from a mine to the Mint.—Divide the standard gold by the weight before melting, and multiply the result by £3 17s. 10½d. For instance, supposing the Mint return to show:—

Weight before melting	..	..	..	..	..	..	..	Ozs.
Standard gold	..	..	..	..	..	..	..	47.41
								38.19

The calculation would be as follows:—

4741)3819.0(.805
3792.8
<hr/>
26200
23705
<hr/>
2495
<hr/>

.805 × £3 17s. 10½d. =
.805 × £3.894
.805
<hr/>
19470
311520
<hr/>
£3.134(670)
20
<hr/>
s. 2.680
12
<hr/>
d. 8.160 = £3 2s. 8d., value per ounce of gold as produced, at the mine.